The Self-Sufficient Backyard

For The Independent Homesteader

Ron and Johanna Melchiore

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By Ron and Johanna Melchiore

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Introduction

We've lived a non-traditional life. I, Ron, thank my parents, family and friends who offered encouragement and acceptance to my chosen path. I am grateful to Johanna, my wife, who willingly embarked with me on the road to self-sufficiency early in my young off-grid homesteading career. Johanna thanks her parents for passing on the basic skills necessary to be successful with the alternative lifestyle.

My sincere thanks to local beekeeper Mario Swinkels who is a member of the Canadian Honey Council for taking time to read my bee chapter and making sure I covered the basics of bee keeping accurately.

I'd also like to thank a man I've spoken to via phone and email many times over the last 3 years but have not had the pleasure to meet in person. Rob Beckers is an electrical engineer and owner of Solacity who supplied much of our new off-grid electrical system. He happily read my off grid power chapter and offered a few tweaks and suggestions.

Many thanks to a local couple, Margaret and Kenny Booth, who allowed us to use several of their container garden pictures.

And finally, it has been a privilege to work with two professionals in the publishing business, Anne and Jason of S.C. Global Brother SRL. Their faith and trust in us was greatly appreciated. We couldn't have asked for two easier people to work with and together, we made a wonderful team. Both Anne and Jason made excellent suggestions to improve the overall book and we are thankful for their contributions.

Ron and Johanna Melchiore

Chapter 1 – 40 Years Homesteading

Where it all Began

Forty Years! That's how long I've been an off-grid homesteader. Sure, sounds like a long time but it's gone by in the blink of an eye. I've learned a lot over that span of years while at the same time racking up a pile of mistakes along the way. I overcame those errors and when I tally my homesteading successes and failures, the win column far exceeds the losses. I'd like to share my long journey towards self-sufficiency with you so if you embark on your own path to freedom, you too will wonder "Where in the world did the time go?"

Maine Homestead

My journey began with me spending 20 years in the forest of northern Maine. The first 5 of those years I was alone before I met my wife Johanna. Fortunately, she has been with me for much of this time and she shares the fervor for self-reliant living. Johanna has a great deal of experience and knowledge in many of the subjects and she will collaborate with me to add information from a woman's perspective. Our collective homesteading experience stems from living in cold climates so we write this book as 2 people who have dealt with harsh winters. Lots of snow and bitter cold. But just about everything we write will be of value regardless of which climate zone you live in.

There are many good books written on the subjects of homesteading, off-grid, prepping and the like. My intent with this book is not to reinvent the wheel. Rather I will pass on techniques and knowledge that have worked for us. But just as important to me, by the end of this book, I'd like to see my dear reader not only savvy but brimming with confidence that they too can accomplish whatever they set out to do.

Back during the last ice age, the 1970's, the back to the land movement was in full swing. In 1974, I graduated high school with a diploma in Industrial Electronics. I was mentally focused on becoming part of the 9 to 5 rat race. I still remember the first job I got as an electronics technician. I worked on a line utilizing microscopes to look at micro circuits while I tested them with an array of test equipment. What sticks in my mind to this day is no idle chatting with anybody else on the line was allowed and lunch was 12:00 on the dot with a 12:30 return. Not a minute later.

As you continue reading, you will discover I have a streak of renegade in me so that didn't go over well. But I lasted there for close to 2 years before moving on to my next electronics job. I liked electronics but these experiences were an eye opener for me. Surely there's more to life than simply working it away I thought to myself. The fact that you are reading this book with an interest in self-sufficiency tells me you can relate to that sentiment.

I'm a firm believer in the notion that events we experience growing up shape the future path we take through life. Yet I was born in the city of Philadelphia and grew up in the suburbs. So how the deuce did a city kid end up in the woods of northern Maine? That's a puzzler. Obviously, I zigged somewhere along the line when I might have zagged.

A supervisor in one of my electronics jobs suggested homesteading during one of our many conversations. That's really the first I had heard the term. As a young guy, I was physically active in local sports and played drums in a band with my friends, neither of which had anything to remotely do with homesteading. I'd have to do some research on this "homesteading."


Not Too Bad for a Newbie

Turns out homesteading is basically providing for yourself. Striving to be self-reliant for food, energy, shelter, medical care and all basic needs. With hopefully time left over to have some fun and enjoy life. My goal was to rely on myself as much as possible, regardless of what circumstance the world threw at me. To grow, raise and preserve my own food, provide my own source of power as well as heat and fuel for cooking (firewood), were all skills I put in my self-reliant tool kit. My mindset was one of being prepared for any calamity that might come along whether man made or natural.

There are any number of reasons why a person might explore this homesteading lifestyle: independence, pursuit of freedom, a new adventure, a change in life's direction, a desire to live more frugally, to ditch the 9 to 5 rat race, to live in a more environmentally friendly way, or perhaps a concern about how the world is taking shape. All valid reasons. For us, it's all of the above. Especially when I contrast the freedom I have now with the confinement and strict regimen of my first electronics job.

The Beginning - The First Homestead


Maine House

My early years in Maine were my first foray into this alternative lifestyle. I went from the hustle and bustle of suburbia where I was surrounded by humanity to the slower pace of country living with a much lower population density. Those were exciting times and a real education for me. In 1979, I purchased 120 acres of forest. There was a 4-acre overgrown potato field that would become my home for 20 years. I had no knowledge of carpentry but with the help of common sense, book research and manpower from a couple of friends one weekend, I built a 2 X 6 framed house that was generally pretty warm even on the coldest winter night. I say generally because it was a bit drafty if the wind blew hard.

I lived spartan. Spruce boards for my floor which shrunk so I had gaps that collected dirt daily, wood countertop with wooden shelves in the kitchen, no working refrigerator or freezer, an outdoor outhouse and hand pump outside for water. I modified an old refrigerator by installing a pipe that extended through the house roof into the freezer/refrigerator compartment which drew in cold air in the winter. In summer, my intent was to use ice I had made and stored in an ice house from the winter to chill my food. My off-grid electrical system was maxed out trying to run a car radio and tiny TV. Kerosene lamps provided light at night. I did laundry in dual tubs using a wash board for my “agitator” and I heated water on a wood stove for bathing in an old cast iron tub. Things changed a little years later when Johanna arrived on the scene. Eventually we had kitchen cabinets, vinyl and carpet for flooring and a small RV propane refrigerator. We moved up in the off-grid world!


Maine Kitchen

If you are experienced in homesteading and such, you know the lifestyle requires some effort. And if you are new to the idea of living a self-reliant life… well now you know. Some energy will need to be expended. And yet, you will find those hours of toil will bring some of the greatest joys and satisfaction one can experience in life. You’ll be tired at the end of the day but you’ll be brimming with pride over all the wonderful stuff you accomplished for the day. The return you get from your efforts will be commensurate with how involved you want to be. We all have our limitations and this book will be dedicated to suggesting methods and techniques that anybody can use regardless of one’s financial resources or physical capacity.

You might be questioning whether you have the skills and knowledge necessary to be a homesteader. I hope I don’t burst your bubble but I am nothing special. I have no great powers, super strength, superior intellect or amazing qualities. If you are looking for me to pull a rabbit out of my hat, you will be waiting for a long time. But I do have persistence and I have a penchant for giving everything I do my level best. Those two traits have served me well. As long as you have the desire, you do not need any special skills or knowledge. You will learn as you go, making your mistakes along the way. As you have success, you will build upon that success. Just as I did years ago.

If by chance you have some of those amazing qualities I mentioned in the last paragraph, then please know you have an advantage I didn't have when I started out. In addition to not possessing any of the aforementioned qualities, I knew nothing about homesteading, living off grid, self-sufficiency or self-reliance. I was a city/suburbs kid contemplating a completely foreign lifestyle compared to my upbringing. I was not born with a hoe in my hands.

Ron in Maine Kitchen

I've immersed myself in this lifestyle to the point it is now second nature. Even though I started out with a bare bone, spartan homestead set in the modern era, I utilized many of the old-time skills and techniques from yesteryear. Over time, I've incorporated some of the newer methods for doing things. But make no mistake, even though I've picked and chosen some of the modern ways of doing tasks, I still retain the practical knowledge of the old ways. Who knows when they might come in handy?

Before Johanna came along, I was quite capable of cooking a full turkey dinner, butchering, gardening, canning and preserving my food plus a myriad of other skills. There are multiple ways of accomplishing a task and I/we've tried many of them. We will sort this stuff out for you and tell you what works best for us. The information we provide may work well for you directly or you may have to adapt and modify to suit your particular situation. My advice is to try different methods and see what works for you. Take in all the information you can. Hone your skills. Everything will go in your "tool kit" for future use.

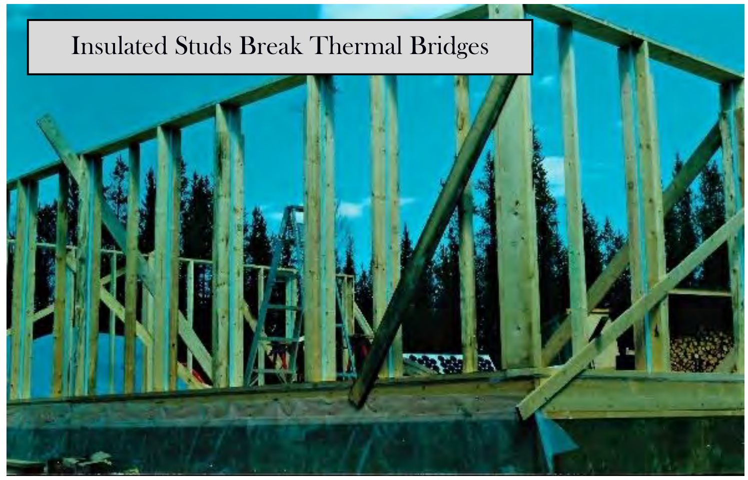
Time for a Change - A Move to the Wilderness

Float Plane Access to Hockley Lake

The Maine experience was a confidence booster and a nice change of pace but eventually there came a time when we were ready for a new adventure. We're not antisocial by any means but we enjoy the peace and quiet and don't feel the need to be constantly surrounded by people.

So, the obvious next stop was to go where there were no people. Northern Saskatchewan beckoned. Can you imagine living on a remote lake surrounded by virgin forest accessible only by float plane? We did that. We became modern pioneers much like those that traveled by wagon trains heading to the western United States and Canada to clear and settle a new land. What an honor and privilege it was to call the wilderness home for 17 years. When we lived there, we wouldn't see another human for 6 months at a time. Every 6 months, we came out for supplies, shopping, our mail and took care of any appointments.

I did a much better job constructing our home in the bush. I came up with a design I've never seen before. My design eliminated most of the thermal bridges from studs and with a fully taped vapor barrier, created a 10 inch thick wall that was super insulated. That house had no problem dealing with -57° F which was the coldest temperature we ever had to deal with. Not only that, but we had hot and cold running water with a shower, real kitchen with wall and base cabinets and countertop, color TV with satellite, Internet, 2 chest freezers, an electric refrigerator/freezer, lights like a normal house, and a moderate sized solar array with a wind turbine. We had come a long way from the spartan living of the Maine days!


Insulated Studs Break Thermal Bridges


Dining Area at Hockley Lake

Living 100 miles from civilization sure gives new meaning to relying on one's self. I respectfully suggest that the overall goal and encompassing prize for all of us is to simply become as self-reliant as possible. In my mind, we then automatically cover all the possible scenarios without having the need for a separate plan for every conceivable situation. A large part of being self-reliant is having the confidence, knowledge and skills to assess and adapt to situations as they develop. If you have the knowledge and confidence to rely on yourself regardless of what the world throws your way, you have upped your chances of coming out of it in reasonable shape.

Another word we might throw into the mix is self-sufficiency. As homesteaders, off gridders and preppers, it's important to understand, total self-sufficiency is unattainable. Mission impossible. There is no such thing. Knowing that complete self-sufficiency is impossible, we strive to be as self-sufficient as practical. Big difference. I wanted to be right up front with you. I want every reader who is dreaming of living a simpler life to be successful. And part of the success plan is to set realistic goals.


Garden, House and Outbuildings

Part of being realistic is knowing you can't raise 100 head of cattle on a ¼ acre homestead for example. The amount of land you have available will dictate how much you can do towards the goal of self-sufficiency. But don't despair. Whether you have a ¼ acre or 100 acres, we will throw many ideas your way and you can decide what makes sense for your own scenario.

Another important point I'd like to make. Life is short. Don't be afraid to zig in life. Take advantage of the opportunities presented and follow your dream. Ponder it, research it and do your homework. Then if convinced the chosen path is right for you, give it everything you have.

The Final Frontier - The Last Homestead

We are currently building our third and final homestead before we hit the checkout counter. We've taken all the things we've learned in the previous 40 years and are re-establishing ourselves from scratch again. It's another daunting task especially given our ages. But we have the health, energy and knowledge to make it happen.

Only Contractor We Could Afford

We are using a new building concept, at least it's new for us. We used ICF which is short for Insulated Concrete Forms. Because we live close to the ocean, we felt a concrete house will withstand anything mother nature cares to throw our way. We have the same modern conveniences as we had in the bush, but our off-grid electrical system is far bigger than we've ever had before. Each rung of the ladder we've climbed has been a big improvement from the previous rung. I kind of like the view from up here at the upper rung. What a change from when I first started.

It is our fervent hope you will find this book a source of inspiration and be thought provoking. We'll cover subjects in depth such as water, food preservation, off grid power and of course gardening. For those who own their property, you will be able to jump right in and start implementing some of the ideas. We also wrote a few special chapters for those dreaming of one day having their own homesteads.


Nova Scotia Home

We cover what to look for when shopping for a new property and points to consider when designing your first home. Whether complete beginner or advanced gardener, we are happy to share our experiences with you. But first, we need to think this all through, start at square one and come up with a game plan.

Chapter 2 – The Homestead Plan

You may be an apartment dweller or someone living in the city who is dreaming of one day breaking free to try your hand at a more self-reliant lifestyle. You have no land now but someday, some way you are passionate about making it happen. We want you to share in the good life. Not only will we encourage you, but the following few pages were written just for you to help give you a head start.

For those who own their own property and are ready to make the most of it, feel free to skip directly to the sub chapter titled *The Sketch.*

Ask yourself a few questions. Why am I considering homesteading? What do I want to accomplish? How self-sufficient do I want to try to be? Do I want to live off-grid? These questions will form the basis of your overall game plan and once you have the answers to those questions, you can formulate the next steps. Personally, we can't imagine any other lifestyle, but we realize that many of the aspects and concepts of off-grid living are foreign to the general population.

Living off the grid presents some challenges as well as rewards. It's just one of the many facets of becoming self-sufficient. You can strive to be self-sufficient and still remain tied to the grid though. In fact, there are situations where you can be tied to the electrical grid but you still have your own solar and/or wind power system for your needs. Any excess power you produce is sold back to the utility company whereas when it's cloudy or night time, the grid supplies your power needs. Kind of the best of both worlds. I'll have much more to say about this in the off-grid electrical chapter. But for now, this is a critical element that needs to be thought about in your planning because your location may preclude you from being able to set up a system like this.

More Questions

Let's do some more pondering together. The following questions are in no particular order. Answering them will further define exactly what you hope to accomplish with a property and how best to set everything up.


My First Garden in Maine

If your homestead is to be off-grid, will it be solar, wind, water powered or a combination of them? In essence - a hybrid system. Each of these avenues of energy production have certain requirements to be viable. For example, solar panels need a southern exposure without any obstructions that would shade them. Bear in mind these considerations when selecting your property.

Do you want animals? What kinds? Just a few hens or do you want a Noah's ark with two of everything including dairy and beef critters?

How big of a garden do you envision? Just a small salad patch, one big enough for fresh summer time eating or one big enough to provide you with food for a year? Any plans to grow extra to sell at farmers markets for supplemental income? What about an orchard. Do you want one?

What is your preference for a climate? A great deal can be accomplished regardless of what the climate is so this is more a comfort issue. If you head to the snow belt and regret that decision with the first heavy snow, that will take some of the joy out of the lifestyle.

How close to civilization do you want to be? Close to malls and shopping centers, out in the boonies or somewhere in between? Will you miss family if you make a move away from them?

You will be investing a great deal of time, effort and expense in your homestead so it needs to be in the right location. Do you want to be immersed in the mountains, desert, forests, coastline or near a lake? Do you want a stream or pond?

What I've tried to do with all these questions is to have you frame in your mind the ideal site that appeals to you. This is perhaps a lifetime investment for you. I know back in the 70's and 80's many a homesteader gave up their dreams by becoming disillusioned with the area they chose.

In a roundabout way, you now have a shopping list of suitable traits you are seeking when you go shopping for the perfect homestead spot. Based on the above answers, you can better define the size, location, function and attributes of the perfect property you are looking for.

Let me interject my thoughts on the one State or Province you should really consider. One of the great things about this lifestyle is the freedom it affords. I was blessed early in my younger days of homesteading to have winter thru hiked all 2100+ miles of the Appalachian Trail which led through 14 States. Then a few years later I bicycled across the northern tier of the United States from Washington State to Maine. And many times, we made the long drive across Canada from Saskatchewan to the East coast of the US. So, I've seen quite a bit of North America. I've formed a strong opinion on the perfect State/Province where you just have to consider settling and begin pursuing your homestead dream. And that State is: The State or Province that best fits your goals, dreams and sets your heart aglow. It's the place where you feel at peace. It's the place where watching a sunrise or sunset from your property makes your heart skip a beat and brings a smile along with complete contentment. For us, there came a time during every search when we instinctively knew we had found "home" and we are certain you will instinctively know too.


Ron Cutting Firewood with Proper Safety Gear

Sorry for the copout but I could not be so self-righteous as to declare one State or Province superior to another. Within each State there's such a variety of climate, geography and subtle characteristics that it would be foolhardy and unfair of me to ever suggest where you should settle. But Johanna and I are happy to give you pointers and things to consider.

We all have our reasons for considering a change of direction with our lives. I know I did! I wanted more out of life. The concept of being self-reliant and self-sufficient had great appeal. I wanted the satisfaction of raising my own food as well as heating and cooking with wood I cut myself. I sought the security of knowing that I was free from rising food costs or threats to the food supply. The prospect of independence from the power companies by generating energy from the wind, sun or both was empowering. I was a young, naive guy out for an adventure and what an adventure it has turned out to be. Once I made up my mind to make the change, I did it and never looked back. One of the best decisions of my life. I love the freedom of waking in the morning and deciding how I will spend my day.

To that end, I write this chapter as a reality check. It is a gentle prod for you to think everything through completely. It is so nice to fantasize about the simple little cabin in the woods surrounded by a lush garden with no cares in the world when you are stuck in a traffic jam or seated behind your desk at work. However, when it comes time to make your dream a reality, the path to success is often strewn with unanticipated pitfalls, any of which may seem insurmountable at the time unless you've thought ahead and have at least the seed of an alternative strategy in your mind.

When I first started out, I bought books on many homesteading topics and for years they were my reference library. It is our hope this book will become one of your go to resources. As humans, we can cram a lot of info into our craniums but it's impossible to store it all. Johanna and I still occasionally refer to a book or the Internet to look up some tidbit. Although the Internet is convenient for research, if for some reason technology breaks down, having a printed book to browse is still vital. Also, don't be afraid to talk to others who have lived the life. There are many people like us who are happy to chat and answer questions. Take advantage of that resource.

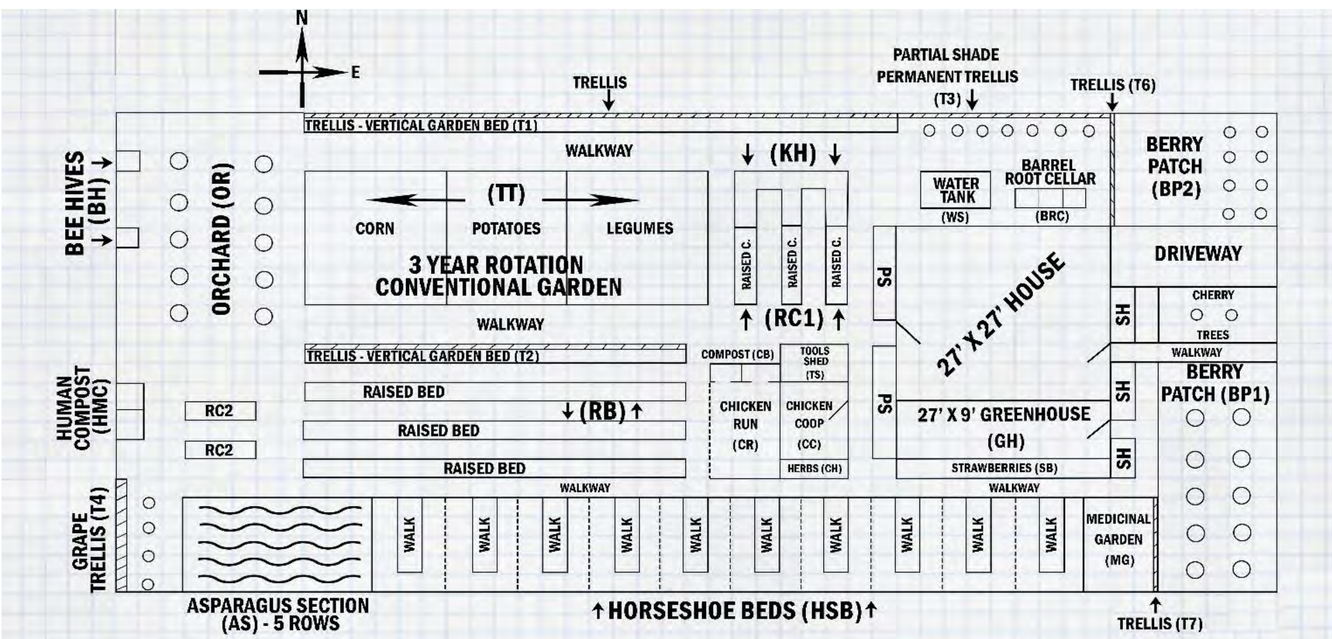
Understand that the lifestyle is not utopia but it is extremely satisfying to pursue self-reliance. Realize that you don't have to make an all or nothing clean break from your conventional life. Becoming a bit more self-sufficient can be done in stages. There's nothing wrong with living in suburbia and growing a small garden to help with your food needs. By the same token, there's nothing wrong with living so far remote that you only shop twice a year and need to grow the majority of your food as we did. And then there's everything in between.

Regardless of whether you own property currently or are dreaming of the day when you do, the plot sketch and accompanying chapters will get you well on your way.

The Sketch

So, you too have that yearning to try something different in your life. Let's assume you are a landowner who desires to be more self-sufficient but might be uncertain about how to proceed. As a template, Johanna and I will use a sketch of an imaginary ¼ acre rectangular piece of property.

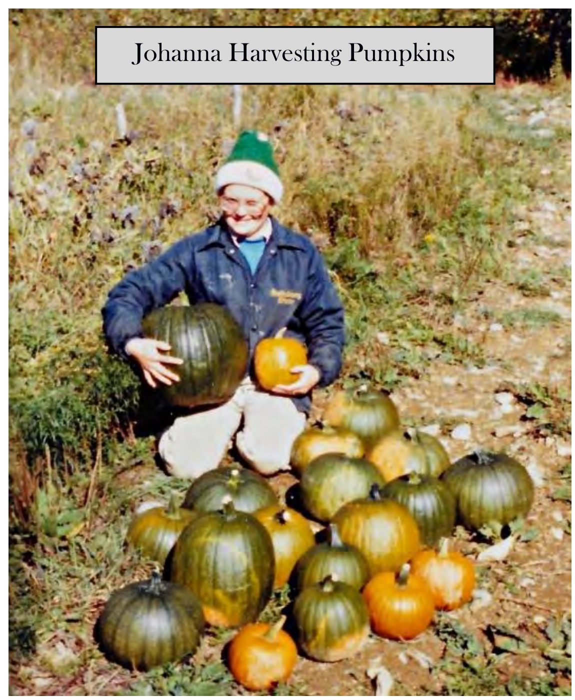
This sketch can be your guide. By using it you will get the benefit of our many years of doing this stuff which includes lots of blunders we made along the way. We thought we would arrange all the elements we feel are necessary on this plot plan in a configuration that we consider ideal. Consider it a layout we'd implement if given a cleared, perfectly oriented ¼ acre parcel of land. Our goal is to have maximum food production from the space we have available.


N
E
TRELLIS
PARTIAL SHADE
PERMANENT TRELLIS
(T3)
TRELLIS (T6)
TRELLIS - VERTICAL GARDEN BED (T1)
WALKWAY
(KH)
BEE HIVES
(BH)
ORCHARD (OR)
(TT)
CORN
POTATOES
LEGUMES
3 YEAR ROTATION
CONVENTIONAL GARDEN
RAISED C.
RAISED C.
RAISED C.
(RC1)
WATER
TANK
(WS)
BARREL
ROOT CELLAR
(BRC)
BERRY
PATCH
(BP2)
DRIVEWAY
PS
27' X 27' HOUSE
SH
CHERRY
TREES
WALKWAY
BERRY
PATCH (BP1)
WALKWAY
TRELLIS - VERTICAL GARDEN BED (T2)
COMPOST (CB)
TOOLS
SHED
(TS)
HUMAN
COMPOST
(HMC)
RC2
RC2
RAISED BED
(RB)
RAISED BED
RAISED BED
CHICKEN
RUN
(CR)
CHICKEN
COOP
(CC)
HERBS (CH)
PS
27' X 9' GREENHOUSE
(GH)
STRAWBERRIES (SB)
SH
SH
WALKWAY
WALKWAY
GRAPE
TRELLIS (T4)
WALK
WALK
WALK
WALK
WALK
WALK
WALK
WALK
WALK
WALK
MEDICINAL
GARDEN
(MG)
ASPARAGUS SECTION
(AS) - 5 ROWS
HORSESHOE BEDS (HSB)
TRELLIS (T7)

I need to make 2 caveats here. It is highly unlikely any of us will have a perfectly oriented, bare piece of prime gardening land, so most will have to adapt the layout and modify to suit their needs. When I say perfectly oriented, I am referring to the location of the parcel of land as it relates to southern exposure. Not only from a food growing perspective but from a solar energy perspective as well. Therefore, view this sketch as a good starting point for ideas as opposed to something written in stone.

Secondly, everyone will have their own ideas of what is the perfect layout. Developing a homestead layout is much like coming up with a house floor plan. Does the kitchen go here or is it better in this corner? Do we put the herb garden here or would it be better over there? To a degree, the overall arrangement is an individual choice. There's no right or wrong answer. As such there's a great deal of flexibility in the example plan. But after all our years of experience, we feel we can suggest things to do, how to do them and we'll give you our reasoning on why we laid things out the way we did.

Obviously, this is only a template for you since we can't know the exact shape and size of your property, where the house sits in relation to your property lines, what your climate is or how much you wish to grow. But this plan lets you take full advantage of whatever you have to work with. If you have anywhere near ¼ acre of land at your disposal, you should easily be able to grow a year's worth of vegetables, fruit and some meat for a family of 4. You may be asking "so how much can I grow on my plot of land?" I could go through an exercise to spell out in pounds what you can expect to grow, but it would be simply a guestimate with no real value.


Johanna Harvesting Pumpkins

For instance, if you don't like Cole crops, what is the point of me telling you that you can grow a gazillion pounds of cabbages and enough broccoli to sink a battleship? Most likely you will plant more of something else instead of Cole crops and maybe it's something we would have no desire to eat. Or let's say you raise chickens for meat. They can be raised and slaughtered in multiple cycles throughout the year or you may decide to just do one batch of no more than 6 birds. Obviously, anyone who raises multiple batches will be producing more meat. What you decide to do is purely your choice. If you live in a favorable climate, you can have succession plantings which allow you to double or triple yields from any given piece of land over the course of a growing season. However, maybe you decide not to do succession plantings of vegetables and instead opt for a planting of green manure. This will affect the amount of vegetables you harvest, but you're building up the soil. So, the point is I'd simply be winging it by trying to guess yields. But here's a fun stat. Johanna and I grow our years' worth of vegetables on roughly 2,040 square feet. That's less than 20% of our entire ¼ acre imaginary parcel. And we were able to accomplish that when we grew a garden in one of the harshest climates that can be had. In zone 0 of northern Saskatchewan, where we could have had a frost any month of the summer.

So, let's re-frame the question. The proper question is how much would you like to grow of each vegetable? Or how much chicken would you like to have in the freezer? Now we can tackle that question with more concrete information. You will have a starting point and then you can modify as needed for next year's garden. Our philosophy is we overdo whatever needs to be done. We over engineer the house or other structures we build, and we over do it when it comes to growing our food. We'd much rather grow more than we can use rather than come up short just as we'd much rather have a house that has excess structural integrity or insulation rather than not enough of either.

In the ensuing chapters, we will explain quantities we grow and what results we expect out of each item. We'll discuss how many eggs you can expect from each laying hen and then you can determine how many layers are appropriate for your needs. The bottom line is there is no question you can grow the desired quantities of vegetables, fruits and chicken for your family. We will also discuss things you can do to supplement and keep food costs down.

Sketch Details

Let's breakdown the plan sketch and I'll give you the reasoning for the location of each element. Refer to the related chapter for more detail. We put the basic house structure on the map and worked the rest of the elements around it.


Garden Trellises

First a word about trellises. Trellising is an important growing method as it maximizes the return for the least amount of space. In other words, trellises make the most efficient use of space when growing garden crops that can be trained to grow vertically such as peas, pole beans, winter squash, melons etc. Many materials can be used to fashion trellises: chicken wire, mesh netting, wooden lattice work, wood fencing or a solid wall of some sort. Trellises made of a solid structure create a little micro climate for plants set in front of them. Painting a solid structure white or lining with a reflective surface will help utilize any available light for better growth too. Any material used for the trellis needs to be compatible with what is being grown in front of it. By that I mean anything that climbs or that you will train to climb upwards needs to have a trellis with latticework or holes through which the vines can intertwine. Additionally, I positioned a couple of trellises to act as an edible landscape structure that create a delineation between adjoining sections, much like a fence.

Trellises (T1, T2) are located so the shading they create should not be an issue to other plants. Both T1 and T2 are permanent latticework fixtures remaining in place year-round.

Partial Shade Trellis (T3) is a solid wall type of trellis that is being used to not only define the property line, but to also create a microclimate for permanent plants more suitable to partial shade such as rhubarb, horseradish and mint. I would paint the wall white so it reflects light on to the plantings. Together with the orchard, grapes, raised beds and berry patches, the partial shade permanent trellis creates an edible barrier or fence as well as partial windbreak around the homestead perimeter.

The Grape Trellis (T4) is a dedicated area for growing some grape vines vertically; part of an edible landscape barrier/fence.

You will note the Greenhouse (GH) is attached to the south side of the house. That arrangement is the best utilization of available space. Because the greenhouse is attached to the house, it is well anchored, protected from north winds, can be used as a passive heating system to supplement home heat in winter if house windows are inside the greenhouse, and because one side, the north wall, is attached to the house, it's already insulated. The arrangement makes for easy access in winter and summer and the greenhouse becomes a more versatile season extender which allows potential growing in winter.

South Facing Attached Greenhouse

I chose to locate the Strawberry Bed (SB) directly in front of the greenhouse abutting the greenhouse wall (south side). They will benefit from the microclimate created there which enables them to get an early start in spring. They grow low to the ground and can take being buried in snow without damage. This is important since all snow will slide off the greenhouse which would damage normal shrubs and plants.

The Chicken Coop and Chicken Run (CC and CR) are conveniently located close to the home for easy monitoring, feeding and egg collection. The 8 X 12 foot was sized for a starter flock with room to expand or to temporarily house meat birds; the 10 X 15 run is enough room for a starter or expanded flock. The attached shed is for Tool Storage (TS) and is centrally located to the homestead, accessible along the main walkway.

There are 3 Main Walkways just wide enough for ease of travel when pushing a wheelbarrow; side shoots off main travel paths are narrower. I'd suggest 3 feet for main corridors out of the house and 2 feet for secondary paths.

The dual Compost Bins (CB) are located by the chickens. It's a convenient location for kitchen scrap disposal as well as chicken coop cleaning; centrally located to the garden area means the compost can be efficiently utilized throughout the homestead's gardens while at the same time making addition of fresh materials from anywhere on the homestead easy and convenient.

The Culinary Herbs (CH) is a 3 X 9 foot plot on the south side of the chicken house to take advantage of the microclimate created there. It's also handy to the house so the cook can easily run out and fetch fresh culinary herbs.

The Asparagus Section (AS) is a dedicated area that will always harbor these roots as they are perennials meaning they are a permanent planting that comes up each year. However, if asparagus is unwanted, that area can be used as a standard vegetable bed for other crops.

Water Storage Tank/s (WS) are positioned so they can utilize the roof area to catch and contain roof rainwater for irrigation. The tanks are located on the cooler, shaded north side of the house to deter the growth of algae. They are set up so either a bucket can be put under their faucet for filling or a hose can be


Patio Deck Container Gardening

attached to run water to various vegetable beds. If using buckets, you would manually lug the water to wherever it's needed.

The north side of the house is also the perfect place for a Barrel Root Cellar (BRC), if one is desired. It's a shaded, cool location that's conveniently close to the house for easy access.

The Raised Containers section (RC1), which is located close to the house, has flexible use. The area can harbor standard raised beds but it could also accommodate platforms with containers situated on top for an elevated container garden. The containers or raised beds would be a perfect solution for the elderly or disabled as they are easily accessible from the home and to water storage for irrigation. Or it can be an area dedicated to hay/straw bale gardening. All of these are good solutions for those not wishing or unable to stoop low to garden.

To squeak a little more growing space out of the plot, one could terminate 2 of the designated Raised Container (RC1) rows into 2 Keyhole Gardens (KH). In addition to this whole section being well suited for those less mobile, these beds are another way to recycle and compost the kitchen and garden waste as well as any excess gray water. This makes it a nice setup for our arid climate friends.

The Traditionally Tilled (TT) plot is broken into 3 sections; a large area for the growing and rotation of corn/potatoes/legumes. Each year the crops are rotated on a 3-year cycle. Corn does best when grown in blocks and does well after a planting of potatoes. There are certain vegetables such as corn and potatoes we would not consider growing in anything but a traditional tilled plot.

Horseshoe Beds (HSB) along the south property border are flexible and can be made into either raised beds, hay/straw bales or platforms with containers. In my opinion, a horseshoe configuration is the most efficient use of space, yet is easily accessible for working. By my calculations, at least 33% more space is available for planting than if raised beds with long access rows were built.

The Orchard (OR) is set on the NW corner of the homestead to act as a natural wind break and edible border. Ideally, the orchard should be behind a windbreak, but this sample sketch is for a bare piece of open land so the orchard trees in this example become the windbreak. Erecting a permanent solid fence on the property line around the orchard would be beneficial and effectively create that windbreak for the fruit trees. The trees are set in a group for best pollination.

Speaking of pollination, the Bee Hives (BH) were placed in the orchard so they would be near blossoming trees where the bees can do their thing. They are set in an area that will have the least amount of disturbance for the bees, be shaded in summer yet exposed to the sun in winter. The hives are also the furthest away from the house and people. The hive entrance faces south so the bee's natural flight pattern is away from the house and not towards the neighboring property. Any permanent border fence around the orchard would help protect the bees as well.

Berry Patches (BP1, BP2) are a mostly sunny/partially shaded area that would be suitable for any of the following: raspberries, blackberries, gooseberries, red and black currants, cherry trees, elderberry, huckleberry, kiwi, serviceberry, pawpaw, and strawberries all of which are partial shade tolerant plants. Berry Patch Trellis (T6) would be a good place to train black raspberries. The (T6) and (T7) trellises also provide privacy from passerby on the road. Since the berry patches are in the front yard visual to all, it makes sense to keep it neat, orderly and visually pleasing to neighbors and anybody passing. To that end, I would suggest setting all plants in neat rows with a strip of grass that would be mowed in between each row. The rows of fruiting plants should all be nicely mulched. I would make the front yard plants essentially permanent to avoid yearly tilling in the front yard. Yearly tilling draws attention to your gardening endeavors, makes the front yard less visually appealing as well as susceptible to erosion in a downpour. In regards to the neighbors, offering an occasional homemade fruit pie from your spare fruit can't hurt the cause either. Regarding spacing for the kinds of berries you choose to grow, check for the appropriate row spacing, but a reasonable distance would be 4' between rows. Less distance between rows of strawberries. Three feet would be good for them.

Human Manure Compost bins (HMC) are kept far from home; kept far from the well or homestead water source and kept as far as practical from the majority of edible plants. It is close to the orchard where its end product will be used to fertilize fruit trees.

Raised Containers (RC2) are located near the human compost bins. I did not want to waste the space but because safety was paramount, I situated raised containers here to minimize food contamination due to close proximity to human waste. Additionally, they are an efficient use of the small area.

Shade Tolerant beds (SH) on east side of house are good for fruits such as red and black currants, gooseberry, lingonberry or leafy vegetables such as lettuce and spinach. We realize that depending on the orientation of your house, these beds may be considered Partial Shade beds. But we wanted to include Shade Tolerant information in the event you have shaded areas on your property you wish to utilize.

Partial Shade beds (PS) can be used for more herbs, leafy vegetables or more fruiting plants.

Raised Beds (RB) are traditional raised beds perfectly suited for growing most vegetables but they are great for root crops such as beets, carrots, parsnips etc. These beds are also the beds that are properly oriented to take full advantage of the sun when covered with hoop houses in early spring. With the hoop houses, you can get an early jump on spring planting.

Medicinal Garden (MG) is located in the horseshoe bed directly next to Trellis T7. It's a square block on the sketch only to make labeling easier. This horseshoe bed can be a conventional bed, raised bed, raised containers or keyhole. The important thing is the path in the middle to give access to the entire bed.

Chapter 3 – Site Selection

When I first had the notion, I was going to be a homesteader, I was absolutely clueless! I was starting at ground zero, confused and inexperienced. I had no one I knew who could advise me and set me straight. All I knew when I started looking for a homestead site was I wanted to have some trees and the property needed to be a sizable chunk of land off by itself somewhere. How basic was that?

For someone just starting out with an existing bare property or for those who are still contemplating a self-reliant homesteading lifestyle, the transition can seem daunting. How do I get started and what do I tackle first? Where do I even start to search? This chapter is written primarily for those who one day hope to own a homestead of their own. It could be a small plot in the suburbs of a 1/4 acre or it could be several hundred acres. I've tried to cover all scenarios to help as many people as possible make their dream come true.

We are building our third homestead from scratch and we've had to go through the process of deciding where we would like to park ourselves three times. Technology has made things easier since we can go on the Internet and visit real estate sites, municipality websites, research climate statistics and the like. But in the late 1970's, phone books and the library were the tools I used. West Virginia and Maine were the 2 states I perused. I eventually settled on northern Maine. My property was located in unorganized territory on the border of a small town. This is where my education began. What an exciting time it was for a young guy!

Hopefully in your case, you now have your goals defined. You have a general idea of what the perfect homestead site will be with a diagram sketch of an optimal plot plan so let's go shopping for land. For those who own the land already and are ready to take their first steps towards independence, you will find a lot of the information that follows invaluable as well.

One Step at a Time

Let’s start logically and take it one step at a time. One of the first questions to address is, in what geographic region do you want to live off-grid or start becoming self-sufficient? Contacting multiple real estate agents in the area will be a good place to start to see what land is on the market. The MLS (multiple listing service) will be another great resource. We've also visited potential localities and inquired of the locals if they know of any property someone might be willing to sell. The last option we used was to study the land maps, pick actual properties that had appeal which were not for sale and with the help of municipal data bases, we wrote the owners via mail to inquire if they had an interest in selling. We had some good results from that so trying that avenue is worth a shot. When someone responded favorably to our request, we went to look at the property in person to see if it was what we wanted. Please don't buy something sight unseen. This is an important decision. Much like a foundation to a house is the most critical part of any structure, your land purchase will be the foundation on which you build your self-sufficient world.

Once you have a few places picked out in your area of choice, you need to ask a few more questions before you're ready to plunk your money down and sign a sales agreement. They are in no particular order.

Access to employment. Will you need to be close to an existing job or will you need to find a new source of income? Do you have a job skill that fits in with what industry is in the area? Don't laugh at me now, but when I initially went to live and build my first homestead, I figured I'd need very little money for the rest of my life and I'd live happily ever after on my little homestead. What a crazy notion. Granted, I lived a spartan life and needed much less money than the average person, but I still needed more money than anticipated. The main employment in the area was potato farming and logging. So, this electronics technician turned homesteader chose to become a logger. I adapted.

What dangers does the local area have? Deer with prevalent Lyme Disease, mosquito borne Zika or other? Be aware, every area has some issue or issues specific to that location. Forest fires, hurricanes, flooding, tornadoes and other potential natural disasters should be taken into account. No place is utopia so delve into what traits the local area has that might be of concern.

Are there dangerous animals in the area? You don't necessarily have to be afraid of them but you should be respectful of them. Bear? Cougar? Poisonous snakes? For us, bear have been the biggest problem. In Maine, bears were around but not often seen and they caused us no problem. The wilderness of northern Saskatchewan was different. Our greenhouse was trashed and we had a bear "mechanic" show up to rearrange our snowmobile and "work" on our Yamaha boat motor. The nice foam seat of the snowmobile was completely shredded. And don't get me started on the time a bear was bound and determined to climb through the bedroom window. No amount of banging and yelling deterred him. Suffice it to say, we've had some interesting animal experiences. Yet the chances of you encountering a similar experience are pretty slim. But one still needs to factor them into the decision-making process.

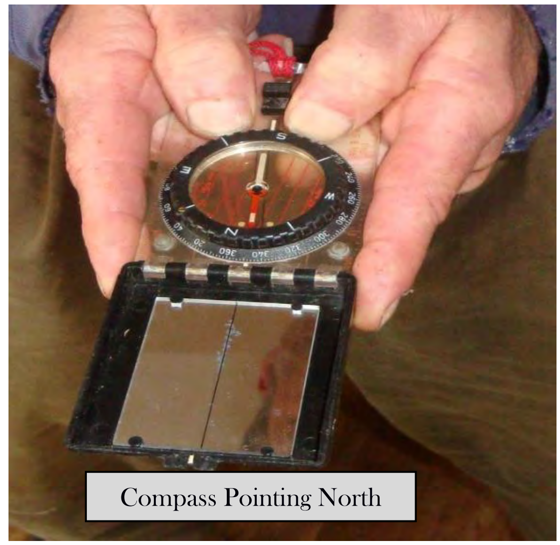
What is the proximity to shopping, resupply and medical care? In northern Maine, we lived within 20-40 minutes of shopping and medical care. In Saskatchewan, we shopped twice a year, once in the spring and once in the fall. Depending on the distance to supplies and shopping, meticulous list making might be required. Not necessarily a big deal though. In Saskatchewan, where our ability to shop was so infrequent, when we ran out of an item, it immediately went on a shopping list. Nothing was left to memory. If we missed buying something, the next shopping trip was half a year away. So, it was best not to forget a single item.

When we lived in the bush, medical care was always a dicey proposition. Float planes only fly in daylight with reasonable visibility. Plus, for about 6 weeks in the fall during freeze up and 6 weeks in the spring during break up, the lake wasn't safe for landing a plane. The only way in or out was by helicopter, an expensive mode of transportation. Distance to medical care may determine what your medical library looks like and whether to take a basic first aide course, first responders course, or something more comprehensive such as an EMT course. I took them all. Recently I took a wilderness first aide course too. Johanna has basic first aid. The more knowledge the better. Additionally, you might consider beefing up the medical kit if you are any distance to a doctor.

Does the property have clear title with warranty deed? You want to enjoy your homesteading experience. Wrangling in court over title or legal mumbo jumbo is the last thing you want to be doing.

Does the property face south to capture energy for your solar electric array or solar passive heating? I am always thinking in terms of future expansion. Any property needs to at least have the potential for an unobstructed view of the south. The best way to ascertain direction is with a compass. It need not be a fancy compass. Hold your compass level in front of you and rotate your body until the needle points north. Usually a red painted end will be the north end of the needle. Directly behind you is south. You can now reorient your body so that you are facing south. Double check the needle on the compass that behind you, the needle still points north. This method gets you in the ball park and will usually be within plus/minus 20 degrees in North America. Good enough for land shopping. When it comes time to orient your house, garden or solar array, you'll need to be more precise. Declination will need to be factored in at that time.

Your compass is actually pointing to a drifting target caused by the interaction of earth's solid iron core and a molten outer layer of iron moving at a different speed. That creates a magnetic field that is in a constant state of flux. If you remember the globes at school that rotate, true north is the top pivot point, the imaginary axis on which the world rotates. Depending on where you are on the earth's surface, magnetic north and true north will be different. That drifting magnetic field and the axis pivot point at the north pole are in different places. The difference between the two is referred to as declination. No need to bog down on the concept. There are many good books that can help you, perhaps a friend is good with a compass or as a last resort, a GPS with compass should take care of the declination automatically when it comes time to be more precise.


Compass Pointing North

Does the area have "Barky" the neighborhood dog that constantly barks at his shadow or is there industrial equipment running morning, noon and night within ear shot? Several times during our land shopping process we asked the land owner's permission to camp for a night or two on a prospective property. Spending a night at a property you are considering buying gives you a whole different perspective.


Well-Marked Property Line

If you can swing it, viewing a property during different seasons is valuable too. Is the ground prone to run off from winter storms or spring thaw? Is there standing water anywhere? Boggy ground at certain times of the year? Walking the land prior to purchase is strongly advised. If you can do this at different times of the year so much the better but if not at least do it once before buying. As you tramp around look for wet ground/low lying areas, high areas, rocky outcrops, drop offs/cliffs, pleasant views or unpleasant views as the case may be and try to envision the best place for everything: the house, barn, gardens, orchard and whatever else you plan on having. In other words, try to determine all the positives and negatives of the property.

Is the property surveyed? Lines well marked? It is inadvisable to build on or clear land unless you're absolutely certain you are working on your own property.

If considering wind power, is there a high spot or the potential to clear an area where a turbine and tower can be installed that gives unimpeded wind flow?

Is there enough soil for a garden? If not, this isn't a deal breaker because soil can be scavenged from other areas but if the area is a boulder field or ledge rock, establishing a garden of any size will be difficult. There are techniques we will discuss for this situation but it's not an optimal site.

What is the size of the property and is it large enough for everything you want to do? How about for future expansion? For example, do you want to plant an orchard? If you plan to raise animals, you'll need space to build a barn. If you plan to raise goats, sheep or a cow at the very least you'll need enough area for pasture, possibly a hay field for winter feed. Will the local zoning support having animals at your home? Any special ordinances you should be aware of? How about close neighbors who might object? Do you desire to grow your own grains for yourself or for animal feed? Speaking of animal feed, do you intend to establish pasture and hay fields? Will you buy all the feed? How will you deal with the waste stream generated by the animals? You will be amazed at the amount of manure generated by even a few animals. What predator animals are in your area that want to make a meal of your livestock and how will you deal with them?

Are there local ordinances that prohibit wind turbines, off-grid set ups, water catchment, beekeeping or other items you wish to incorporate in your homestead? Here in Nova Scotia, I downloaded and browsed the municipal bylaws. Then we went to the County office and chatted with the planning officer and building inspector. Doing so might ease your mind and you will get a better feel for how rigid your County Government is.

What's the local mill rate and what are the property taxes? How have taxes risen in the area historically? Are they going up 10%/year? 20% /year?

How close are you to a fire station? If you plan to have some type of homeowners insurance, be aware some (maybe all?) insurance companies will base their insurance premium on how near you live to the fire station.

Does the property have a good supply of firewood? Certainly, important if you plan to heat and cook with wood stoves.

Does the property have legal right of way? You definitely want to make sure you have full control of how you get to your home site. Also is there a right of way through the property you are looking at to another property beyond that's owned by someone else? If there is I would keep looking.

Does the property have a water source? If you are contemplating water power, is there adequate head and flow? Water is obviously a top priority for a homestead. We had no water worries living on a lake in Saskatchewan. We were confident we had water on our property in Nova Scotia too but we did not begin building and investing any more money until we confirmed we had a reliable water well. We also talked with some of the neighboring property owners in the area to find out what they were doing for water and what the quality of the water was.

Does the property have a spring that flows year-round that might be a water source or be used to make a spring house to keep items refrigerated?

Is there potential to dig an in-ground root cellar if desired?


Still Too Much Snow in Maine for Access

Depending on whether a driveway exists or not, you may need to build one. What costs are involved in road building to get into your property? Road building is an expensive proposition so make sure costs to build a driveway or road into your plot are factored in. Is access from a public road to your home site going to be a problem during the winter or mud season? Either way, being able to get to your homestead regardless of season will need to be considered. Keep in mind, large vehicles with construction supplies and concrete will need to be delivered. Even a water well drilling rig might need to utilize the road in to your property. Don't forget easy access for emergency vehicles such as fire trucks. I forgot that little detail when I moved to Maine. I had a driveway that was 4/10 of a mile long. When it got plugged with feet of snow neither an ambulance, fire truck, nor my vehicle could have reached my house site. Every winter when the snow came, I changed into a pack mule in order to lug in groceries and supplies. That got pretty old in a hurry. But it kept me in shape.

If you don't plan to be off grid, where are your power and utilities going to come from? What is a practical distance utilities can be run from the road? Do you need high speed, high bandwidth Internet service provided by a cable company? How about phone service? Is there potential for a land line? Is there a good cell phone signal? The reason I ask these questions is because we are building our off-grid home a long way from the power line. There is no option to run power lines or cable here. As well, this area is in a dead zone where cell service is completely unreliable.

These obstacles are not a big deal though. There are alternatives. And I'm not talking about tin cans and string for communication. One of those alternatives is an Internet satellite connection. We've relied on satellite for close to 19 years. In the beginning, it was absurdly slow. We were lucky to have 1 Mbps as a download speed. Over time, the speeds and bandwidth have increased and now we can do everything we need with our service. For phone, we rely on VOIP which is voice over Internet protocol.


Voice Over Internet Phone

No need to fret the technical jargon. Just know we have a real phone on the nearby desk which makes a connection to the Internet. There are phone companies that act as a transmission hub and our voice goes to the receiving party just as with a normal land line phone. We do have an added step because of the satellite connection. So our voice is bounced up to and back down from the satellite before ending up at the desired destination. The only drawback to the satellite part is a slight 1 second time delay. It takes time for a signal to move through the network, get beamed to a satellite, received and passed on. Because of this we sometimes talk over the person we're calling unless we remember to take the delay into account. We had this system when we lived in the bush and we have it at our new location too. Bottom line is we have had phone service at both of our remote locations and you can too regardless of where you live.

I'm not trying to bury you in minutia and I surely don't want to discourage you. There's lots to think about but it's pretty straight forward. Best to have all the information to make a good informed decision. This is a big step. I wish you the best in your shopping.

After you have purchased your property, it's time to set it up. The previous chapter has a sketch we created that can be used as a template which will be a great guide to help you. The rest of this book will revolve around that template but you can adapt as needed. You may have more than ¼ acre to work with so using the template as a guide, here are some more thoughts to ponder.

Homestead Layout

The layout of your homestead will to a large extent, depend on the answers to the above questions as well as the assets your property has to offer. If it is purely a chunk of land with no driveway or old buildings, I'd suggest walking it thoroughly to get a good idea of the lay of the land. Hopefully you did that to some extent before buying it, but now is the time to really assess your purchase and determine how best to convert the land into the garden of your dreams.

In your head, make mental notes or better yet, draw a map showing where the property lines are. It doesn't need to be to scale. Zoning regulations will require certain elements be set back from any property lines so you'll need to know where your lines are. It's imperative that you are browsing your own property and marked property lines will confirm that. If the lines are not well marked, a surveyor can delineate the property for you.

Surveyors are very costly. In the past, I've made deals with them to save money. I am comfortable with a chainsaw and ax. As a suggestion, you might be able to save a pile of money by having the surveyor put in corner pins and simply flag the lines for you. Then it would be your responsibility to clear and blaze them with an ax and paint. Ask the surveyor to show you the proper way to blaze and mark trees since there is a definite method. Leave the surveyors flagging up since that is proof of their work.

Indicate on your map where water in the form of ponds, streams and/or bog are located. Where are the low spots that might be prone to flooding? Are there any knolls and high ground? Where is it practical to clear the ground of trees and stumps for an orchard and garden? Or maybe there's already a nice clearing or relatively open spot for these areas as well as the house? If there's no existing driveway, don't forget to draw its proposed route on your map. In essence, you are trying to mentally map out where all the elements of your new homestead will go. Your rough map will simply show where the proposed house and driveway will go in relation to the property lines. It should indicate the likely spot for the garden and orchard, if you plan on having one.

A well laid out homestead is one that is practical and matches what is being envisioned. A good game plan will also allow for future, inevitable expansion such as when you are having so much fun you wish to make the garden or orchard bigger.

Ron Clearing the Homestead Site in Nova Scotia

Animals are no different than people in that they like to be outdoors. Map out where the barn and appropriate sized pens or pasture might be placed. Pasture and hay fields can be farther away from the house since these areas aren't usually visited daily.

Map out the route that a farm tractor, 4-wheeler or other conveyance will take to access all parts of the property. Note where fences would likely be placed as well as the best placement for gates.

So, you've come up with a long-term game plan for your perfect homestead; you've made the big purchase of property, the site has been mapped and now it's time for the nitty gritty. Here are some generalities for your consideration:

If at all possible, I would situate the house so that the living areas face south. Why? Admitting natural light to the living room, dining area and kitchen makes for a brighter home, helps combat SAD (seasonal affective disorder) and may mean needing artificial light for fewer hours in the day, a plus for any off-grid home. Having large picture windows that face south guarantee all of the above. Two other positives, in winter you will gain a great deal of heat from solar radiation on sunny days and come spring, you will have full sunny window sills for your garden seedlings. At the Maine homestead, the living room picture window faced west. A major mistake. The house was rather dark even on sunny days and our garden seedlings weren't the best. At our wilderness home in Saskatchewan, the house window sills were wide enough to put plant trays on. Two of those windows were large, south facing picture windows. The difference in the brightness of the living spaces was dramatic as was the quality of our seedlings.

Once you've determined the location of your house, placement of other items becomes a little easier. If either garden or orchard are far removed from the house, they are out of sight and out of mind, and you will likely not take care of them as well as you need to for good results. Therefore, I would definitely try to locate both of these, but especially the garden as close to the house as possible since you should be visiting it daily.

Any garden, orchard, hay field or field in which crops will be planted will need to have a sunny, well drained site with good soil. I would suggest keeping the best soil site for the garden since that will provide the bulk of the family's food.

With the orchard relatively close to the house, you can keep an eye out for bug infestations and spray accordingly. Ideally the orchard site should be protected from winds on the north and west sides, avoid frost pockets (remember cold air sinks) and most importantly be well drained. I learned that the hard way. My Maine orchard was in a wet spot and in spring, was often flooded. Shallow rooted berry plants didn't suffer much but my trees did. I suspect many of them died from drowning.

Solar panels will require a south facing, shade free area throughout the day. You would be amazed how much a tree or other shadow adversely affects solar charging.

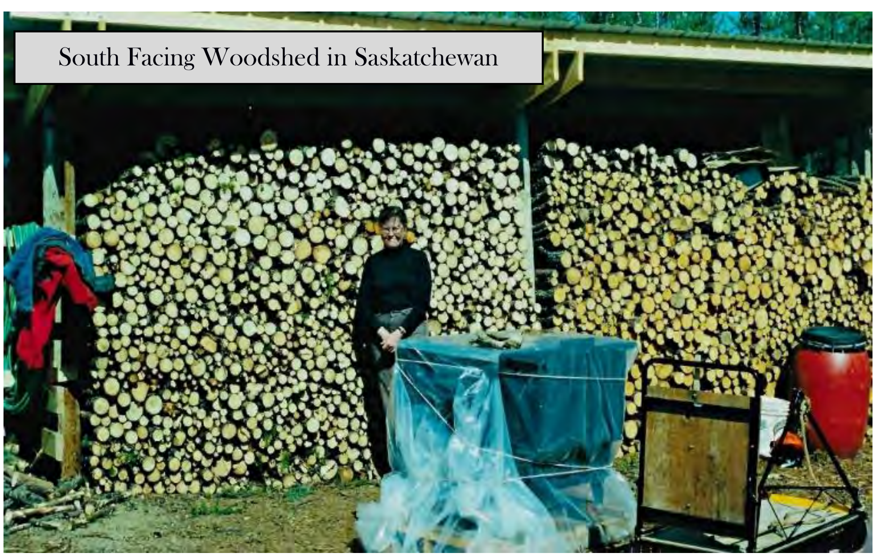
Likewise, a greenhouse (GH) should be south facing. As with the garden and orchard (OR), try to place this near the house for convenience. Proximity to a water source is a consideration too since you will have to water the plantings periodically.

If you are going to rely on a spring house for refrigeration, you'll want to have that somewhat handy to the house. If you plan to store food in a root cellar (BRC), will it be under the house or will it be a separate entity outside? If you have a hill to burrow into, that would be a good spot for an outside cellar. A cellar under the house is more convenient than one outside, but only if the ground is suitable to put a cellar under the house. If your water table is high, an under the house basement type cellar may not be the best choice due to flooding.

Depending on your desire for animals, give consideration to the location of the barn or chicken coop (CC) in relation to the house. You will be making many daily trips to the barn so you want it located close enough for easy access. You will be collecting eggs, feeding the animals and hauling water to them not just on fair weather days but through the snow and rain too.

Animals make copious quantities of waste byproducts that will need to be shoveled out and occasionally dealt with. I would want any outhouse, leach field or animal waste compost bins (CB) situated a safe distance from my well. I would defer to the local building codes for your area on what that distance needs to be but 100 feet is a good starting point. Safe drinking water is the priority here.

Bear in mind, a narrow, barely flowing meandering stream near the proposed home site can become a raging threat during spring runoff or an abnormal rain event. Site the buildings accordingly and have an escape plan if waters rise to dangerous levels.


South Facing Woodshed in Saskatchewan

By the same token, the opposite extreme can occur. That peaceful, wooded setting can become a raging forest fire during dry conditions so having a buffer between the buildings and the forest is a must as is an escape plan. Distance from the house to any outbuildings should be a safe span so that in the event either the house or an outbuilding was to catch fire, the whole homestead does not burn down.

Any woodshed should face south if possible so it can get sun and summer breezes to dry the wood in preparation for the heating season. Try to situate it close to the entrance most likely to be used for bringing in the wood. No point lugging firewood any further than necessary.

Finally, let me tell you about another mistake I made early on in my homesteading career. At my first homestead in Maine, I hired a bulldozer to reclaim an old woods road and overgrown potato field. The field was 4 acres in size and was destined to be my home site. This old potato field was a jungle of alder, young poplar, spruce and fir. The bulldozer dropped its blade and set to work dozing all the growth into one humongous pile in the center of the field. That seemed like a good idea at the time. But what actually occurred was that along with all the tree and root material, the dozer blade skimmed off the best top soil and put it in the pile too. Oops! My plan was to burn the woody material and quickly recover my field. What really happened is the woody mass was so full of dirt, it could never burn. It took me years to cut the debris into firewood and slowly work my way through the pile. Then it took more years to rebuild the soil into something I could work with.

What a colossal mistake! Instead of using the blade, a grubbing attachment called a root rake would have been more appropriate for the job. That implement would have been able to root out the trees while leaving most of the top soil behind. It would also have been able to roll the pile along as it pushed it into the center of my field thereby giving the soil a chance to drop off.

Here in Nova Scotia, an excavator with a "thumb" was used to recover the road and help with orchard and garden clearing. The thumb is a mechanical clamp that can be used to grasp a rock or tree and rip it out by the roots. So, the majority of soil is left where it belongs. The excavator with thumb is the best way I know to root around in the garden for boulders, break thick mats of sod, pull tree stumps and clear ground while leaving top soil behind. I hope our hard-learned lessons will prove of value to you.

Excavator Breaking Up Thick Mats of Sod, Roots and Boulders

Whether you live in a city apartment, have a small backyard or have 200 acres available to play with, Johanna and I will try to make relevant suggestions throughout our book to address as many situations as possible.

Chapter 4 – Road Building

Overgrown Driveway in Nova Scotia

Our Maine and Nova Scotia home sites had long roads which were viable years ago but were abandoned and had become overgrown with young forest. In many spots, there was no discernible path other than an animal trail through the forest. But if you know what to look for, it's pretty obvious there was an old road. One trick I use is to focus my gaze higher up in the forest canopy. The difference in tree height of the older growth forest versus newer growth in the abandoned road is usually pretty obvious. You will likely see a corridor through the forest that is delineated by taller, older trees that border the old road.

This trick also works well when I am searching for old property lines. First I look for a surveyor's marker and perhaps an old blaze or two which gives me a good sense of which way the property line is running. Then if I look a little higher, I can get a sense of where the line was cleared long ago. Even though there's lots of young growth I'm thrashing through, I can see the faint trace of an old corridor. If I'm lucky, as I follow that corridor, I'm finding an old blaze which is confirmation I've found an old line.

On the Maine homestead, I had roughly a 2100 foot (4/10 mile) long driveway. It was a woods road that led to a small 4-acre potato field. That field was the perfect place to put my new home nestled among the surrounding forest. I hired a local guy with a bulldozer to open the old road. The alder, spruce and fir trees, which I would eventually recover as firewood, were bull dozed off into the woods on either side of the road. Unfortunately, I also had to deal with a few sections of wet ground, each about 100 feet in length. It took dump truck load after dump truck load of gravel to fill in these short sections.

Maine Driveway

Dumping a Load of Bank Run Gravel in Maine

I bought "bank run gravel" from the local contractor. Bank run gravel is unprocessed, right out of the ground material containing small boulders, gravel and sand. In wet ground, you want some big material (boulders and rock) to form a good solid base. Then gravel on top to create a relatively smooth, drivable surface.

Here in Nova Scotia, we have roughly a mile long road of which the majority was overgrown with alder. In order to get to the proposed house site, I had to use a compass and GPS to flag out a new portion of road, about 600 feet, that continues from the end of the existing road to the homestead. This time, the contractor brought an excavator with the thumb attachment on the bucket to rip the alder and young spruce/fir out by the roots. It's time consuming pulling out trees but it does a good job without disturbing much of the road base. The excavator also has a blade which can push debris and dirt around.

Making a Road to the Nova Scotia Homestead

An excavator can also dig a few test holes to look for gravel which is what the operator did here. We were very lucky in that we had a high section of ground right along our driveway. When the contractor dug down 3 feet, he hit good quality bank run gravel. He was able to dig and fill a dump truck quickly and unload the material a short distance away. That saved us a lot of money for loads of gravel. It's always a good feeling when the property supplies the raw materials needed to solve a problem.

I would suggest flagging out the route of your drive from the town road to your homestead and then getting a number of written estimates for exactly how much cost is involved. You can pace it off to get a sense of the distance you're faced with. The land itself will dictate to a large extent how much road work will be needed and where the road will be located. Although a straight line from point A to point B (highway to house for example) is the easiest and cheapest, I like a gentle sweep in the road. It increases the length of the road which is a negative but that is outweighed in my mind by the fact it offers privacy and more security. Anybody driving down the highway can't get a straight-line view of your home. They cannot ascertain easily whether there is a car in the driveway signifying you may or may not be at home. Someone would have to drive most of the way in before making that determination. A gentle sweep also makes it easy for large delivery trucks to get in. Try to avoid sharp bends or gullies. We have a short, deep gully on our driveway here and delivery trucks sometimes bottom out with their bumper when they come in as well as when they go out.

Busting a brand-new road through the woods is an expensive proposition. You may have to cut trees down or pay a logger to do it for you. You may have to hire a bulldozer to clear the roadway. Then you will need to pay for load after load of gravel that will be hauled by a dump truck. If you are trying to convert a boggy area to a road, you will be astounded at how much gravel the area sucks up before you have a passable road. For spots with high spring run off or year-round flows, you may even need to purchase culverts. All these expenses need to be factored in when figuring the cost of homestead road building.

This is a good place to talk about money. Cost is a consideration in anything we do and I figure it might be for you as well. We are thrifty people and our philosophy is to live within our means. In 40 years, rarely have we taken out a bank loan. Staying out of debt and owning all our stuff has been our mantra. The few times that we have been indebted, we made it top priority to pay the loan off long before its term. We worked 7 days a week and paid extra on our monthly payments. Why make the bank any richer off our interest payments? Not only that but this is supposed to be a lifestyle that is based on freedom. Debt is anti-freedom. As long as we owed money to the bank, we weren't truly free. There's nothing like making the last payment long before it's due.

Because cost was paramount back in Maine when I was a young guy, when dealing with wet areas in my 4/10 mile long driveway, I opted to build a culvert on the cheap. With the help of a local guy, I dug a wide trench across the road. We dropped several cedar trees across the road at right angles to the road and positioned them parallel to each other in the trench. The trees in the trench didn't touch each other. I'm guessing the distance between trees was a gap of 12 inches. Depending on the diameter of the trees and the depth of my dug channel, I could have put another set of tree stems on top of the ones already in position to build up the height of the culvert if need be. Next we drove some stakes into the ground on the insides of the trench to hold those logs in position. That prevents the logs from rolling into the homemade culvert. We chose cedar because it is a great, rot resistant wood and the wet area the road passed through was conveniently located in a cedar stand. You may have other tree species available on your homestead and a little research will tell you if any of them have rot resistance.

In Need of a Culvert on Road to Nova Scotia Homestead

I built a top over the logs to box in the culvert using slabs that were generated by a portable sawmill which had cut the lumber for my home. By laying the slabs in a thick layer that was perpendicular to the logs, I created a surface that could be covered by loads of gravel thus creating a corridor from one side of the road to the other that allowed water to flow. That worked for a long time but ultimately, the wood started to rot. The slabs I used were spruce/fir which is a poor choice for a long term solution. A better option would have been to cut short cedar logs that spanned my culvert much like a corduroy road. Once the wood started to rot, my homemade, makeshift culvert started to collapse and I had to dig up the area again but this time I installed a steel culvert. But the homemade version is a trick to consider as a temporary solution if you are really low on funds. Although that wooden culvert lasted for many years, I would opt to do it right the very first time with a proper culvert if you can.

For those of you who live in snowy climes, snow plowing will need to be factored in when laying out your driveway. A gentle sweeping turn is much better than a short, abrupt change in direction. At the Maine homestead, I plowed snow with a large blade on a skidder and had the power and maneuverability to deal with any road condition. But for someone using a pickup truck or farm tractor to move snow, you'll be better off if you have direction changes that will allow you to keep your forward momentum going.

Don't forget to create pockets along the roadside where you can push accumulated snow well off the road and into the woods or field. Additionally, the width of the road should be wider for those in snowy areas. It is amazing how the snow bank will build on either side of the road from plowing over the course of a winter. Over time, it will be like driving down a tunnel. A wide road with some pockets for pushing snow off to the sides will be a godsend. Remember that once those banks freeze solid, it will be a real chore to break them up to wing them back, so it's best to wing the snow back as far as possible starting with the first snowstorm.

The last point of consideration is shade over your roadway. Our homestead in Maine had a long road that essentially wound its way through a forest and many large trees formed a shaded canopy in summer. Many sections never saw sunlight including the section of road that wound through the wet cedar stand. Conditions were always damp and the road surface was always wet. Over time, I thinned out the overstory of trees including the cedar trees which allowed sunlight in to dry the road bed. That made a huge difference in the road's ability to dry out especially in the spring or after rains.

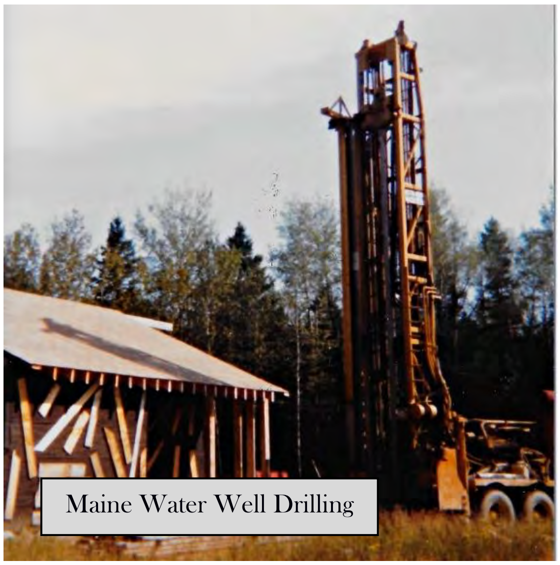
Every day, I took a walk down my woods road to fetch the mail. The lengthy drive had a number of turns and it was a lovely walk, one I treasured. On a warm summer day, with a sprinkling of sunlight on my shoulders as I strode down the drive, I knew I'd made the right decision to thin out and create an opening in the canopy to let the sun shine in. The bonus was it didn't take long for the driveway to dry out and rarely did I come home with mud caked footwear.

I'm parched! Let's search for our water supply.

Chapter 5 - Homestead Water

Drilled Wells and Hand Pumps

The life blood of any homestead is a reliable water source. It is vital for your homestead's success. Not only will your survival depend on a safe, adequate supply of water, but if you are considering animals, they too will rely on their daily drink. I personally would not do any construction until I was assured, I had a dependable water source.



Maine Water Well Drilling

There are any number of water sources a homestead could utilize. A spring, a drilled or dug well, even a river, lake or stream could be your source. Perhaps a cistern system that captures rain water or a holding tank system for water that is delivered to you by truck are other possibilities.

We are all striving to be self-reliant, so I would think long and hard about having a homestead that relies on a water delivery. Being dependent on someone to deliver water for my existence seems like a bad idea to me. Personally, I have experience with drilled wells, hand dug wells, machine dug wells and sucking water directly out of a lake. Each has advantages and disadvantages.

I would locate my well relatively close to the home, especially if you will be hand pumping and lugging buckets of water into the house. If you plan on a barn, a compromise might be in order. Locate the well within easy reach of both house and barn. Not only will it make bucketing water easier but if you ever plan to install a pump, your pipe and electrical runs from the well to your house will be shorter.

Maine Water Hand Pump

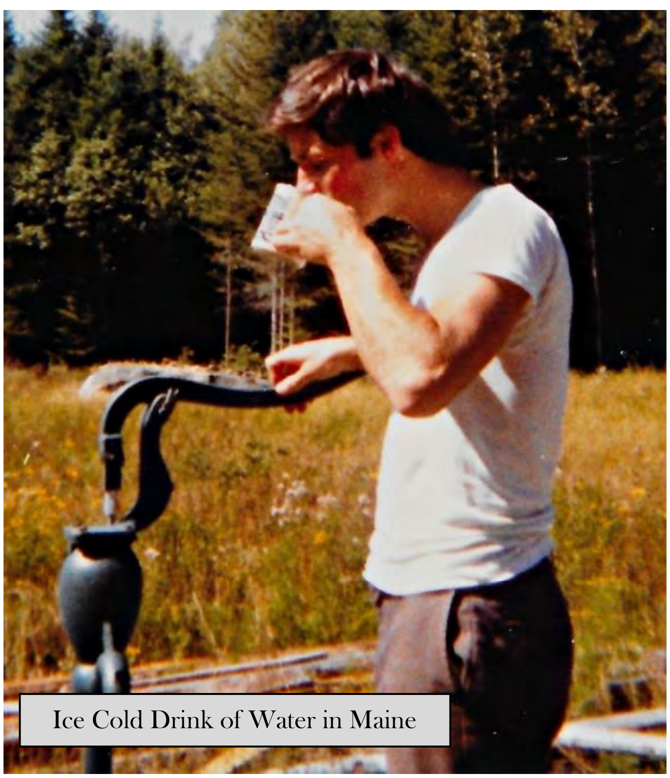
A drilled well relies on a heavy piece of equipment to bore a hole in the ground. There are different methods of drilling, rotary and percussion, and since I'm no expert, relying on the local well drilling company who has the expertise is best. They will have the experience to give you a good idea of how deep the well needs to go for a particular location as well as the water quality that can be expected. The important thing is that they drill deep enough so you have adequate water even in the driest season. The best time to dig or search for water is during a dry spell. The water table will have dropped and when you hit water, you will have increased your chances of having that precious liquid even in a drought.

My first water source was a drilled well back in my early homesteading years in Maine. I believe it went down several hundred feet but the water table was quite high with water generally being within 10 feet of the surface. To pump out water, I chose a new, deep well hand pump to install over the well casing. The casing is simply a piece of steel pipe that goes down a distance into the ground to protect the well from infiltration of surface contaminants. It keeps unclean surface water out of the potable water supply.

As long as you have access to the well casing, you can get access to water regardless of whether you have electric service or not. That's something to keep in mind if the power grid goes down. If you don't have a hand pump, there's another option in that event. There are slim catchment tubes called well buckets. They're made to be lowered down into the well casing via a rope. They open, fill with water and then when the rope is pulled to raise it, the bucket closes keeping the water trapped until released on the surface into your bucket. Of course, if you have well crocks and a dug well, a bucket tied to a rope that is tossed down the well will work in a pinch too. Lugging heavy buckets up by hand would get old in a hurry so if that process needed to be done for any duration, I'd build a small framework with a handle and windlass.

The hand pump I installed in Maine was the type often seen on old farmsteads. It was a reliable method of pumping water which worked perfectly right up to our move 20 years later. For many years, I hand pumped and then lugged buckets of water into the house as needed. Not that big a deal unless it was pouring rain or there was a raging snowstorm and -20°F temperatures. Ahhh, the good ol' days back in Maine.

A quick word about pumps. A myriad of different pumps exist for water systems. And they come in manual, mechanical or electric operation. A pump can either push water or lift water. A deep water hand pump pushes water whereas a shallow well pump lifts water. We've had both types. Each type has its application and use. Theoretically, you can only suck and lift water 33.9 feet high (vertical distance). Realistically, around 21 feet of lift is a more practical number. A pitcher pump (shallow well type of pump) relies on your water source being within that dimension. Your pump and situation might be able to improve somewhat on that lift number depending on how much suction the pump can generate and your elevation. Elevation refers to how high above sea level you are. Sometimes the only way to tell is to install the pump and see how it performs. There are other variables to calculate the lift but as far as I'm concerned, that's better left for scientists.


Ice Cold Drink of Water in Maine

When our deep well pump was initially installed, there was a small hole drilled in my suction line to allow water to drain out of the pump. If that hole hadn't been there, the water line would have remained filled with water right up to and including the pump head, and that water would have quickly frozen in the winter. That small hole allowed the water to drain back into the well. Then it was a simple matter of pumping a half dozen pump strokes to get the water flowing out again. Even with that hole, if I got too aggressive in my pumping and water slopped out the top and froze, I'd have to take a pot of warm water and pour it over the top of my pump to thaw it out so I could pump again. Warm water was sufficient. With very hot water, I risked cracking the cast iron pump housing from thermal shock.

Our hand pump required no power other than person power to pump the handle. The flow our hand pump produced was surprising. It didn't take long to fill a bucket. What a treat it was on a hot summer's day to pump ice cold drinking water from the depths of our well.

This setup was a simple, reliable way to get water to my homestead. But it sure would have been great if I could somehow have had water available in the house without having to run outside every time to pump a bucket. Even after I got married, we used that outside hand pump for our water. But there came a time when we decided to get really modern and have "running" water and I don't mean the kind I had to run outside to fetch either. I decided to install a manually operated hand pitcher pump by the kitchen sink.

The trick was how to run the pipe from the sink and tap into the well. It was a bit of work but this is how I did it. I dug a trench from the well casing and then under the house to where the kitchen sink was situated overhead. This water line would need to be properly insulated and buried. I dug about three feet down along the well casing to expose the casing. I needed to install an adapter below the frost line so I dug down to the appropriate depth. I needed enough room to get a drill with a hole cutter in there. There is a device called a Pitless adapter. The Pitless adapter makes it possible to tap into the side of an existing well casing in order to run another suction line down into the well. There are a couple readily available sizes, 1" and 1 ¼". Since my piston water pump had a 1 ¼" port and I already had 1 ¼" PVC pipe, I bought the Pitless adapter for this sized line. The advantage was I didn't need to use a reducer down to 1" and the bigger line has a little less flow restriction. Flow restriction would only be an issue on very long runs of pipe. Think of it as trying to suck soda out of a glass with a straw. The bigger the diameter of the straw, the easier it is to draw the soda out of the glass.

I bored my hole the required diameter for my adapter. This adapter has 2 pieces to it. One piece slides onto the other piece. It can only go together one way. One piece has a large threaded port with a big nut and at least one rubber seal. The trick is to lower the whole adapter down into the well casing and slip the threaded end through the drilled hole so the big nut can go on to attach the adapter. This was an operation that needed to be done right, lest I drop the assembly and it fall to the bottom of the well.


Plumbing the Pitless Adapter

You'll note the back half of the adapter has 2 smaller threaded ports. One end is closed off and the other is an opening that will allow water to flow through the adapter. The end that is blocked is for installation only. I needed a long enough piece of threaded pipe (galvanized or PVC, doesn't matter) that I could screw into that end. A piece of pipe threaded on both ends 6-8 feet in length was sufficient. If I had to do this over again, I would add fittings to make a "T" handle in case l lost my grip on the pipe and everything headed down to the bottom of the well. With the "T" handle wider than the well casing diameter, if I lost my grip, it would have stopped at the top of the well and I could avoid a disaster. Another good reason for making a "T" handle dedicated installer is if I ever need to access the Pitless adapter in the future, I can use the "T" pipe by reversing the installation procedure to separate the adapter again. The “T” handle can be made easy enough with a Tee fitting and a couple of threaded 6” nipples, one on each side of the Tee.

I slid the assembly down into the well casing. When I had the adapter aligned with the new hole I’d drilled through my well casing, I gingerly pushed it through the hole from the inside of the casing and then I was able to put the rubber washer and nut on from the outside to lock it in place. If there are 2 rubber washers, one should go on the inside and one should go on the outside of the casing essentially sandwiching the casing. I now had a sealed adapter going through the side of my well casing. I pulled up on the pipe, and the back part of the adapter slid up and off leaving the attached front part in place. I brought that to the surface and then connected my drop-down suction tube which went into the well water. I made sure the suction line was long enough to remain in water regardless of seasonal fluctuations or draw down. I also made sure I had a foot valve attached to the end of my suction line.

One very important point here, the suction line on a shallow well hand pump must have a foot valve attached to its end. That foot valve will remain submerged in the well water. A foot valve is simply a device that will allow water to flow one way only. You want to be able to draw water up into your suction line but prevent it from draining back out. If you lose suction and/or water doesn't seem to be staying in your water line, it's likely due to a leaking foot valve that is not sealing properly, probably due to a little dirt on the seal. I've taken foot valves apart and cleaned them so it's not always necessary to replace it. Having a spare foot valve is always handy though. That will be a recurring theme as we go along. Spare parts! They have come in handy over the years.

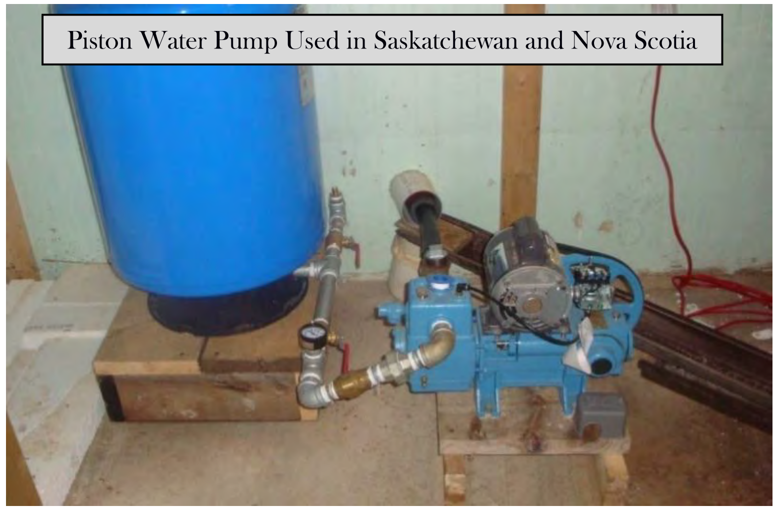
Continuing on, I slid the suction line/back half of the Pitless adapter back down the well using the installation pipe and repositioned the adapter back onto the first half. I could visually make sure they were mated and seated properly. After I was assured the 2 pieces of the Pitless adapter were seated properly, I unscrewed my pipe and removed it from the well.

Remodeled Maine Kitchen – Hand Pump at Sink

Once my water line was connected at the well casing to the Pitless adapter and the run was made up into the house and connected to the pitcher pump, it was a matter of priming the pump and pumping vigorously until enough suction could be generated to lift the water from the well, fill the water line and pitcher pump chamber and voila... running water... sort of. Its sure beat having to go outside to fetch buckets of water for cooking, cleaning and laundry. We became a two-water pump family. Progress!

Many times a pump needs to be primed. Every pump I’ve ever used for water had leather cups. The leather cups are what creates the vacuum to suck water. They are located in the pump chamber. Depending on the pump type and manufacturer, it should be pretty easy to disassemble the pump to access the leathers. Part of preparing a new pump or a pump that has not been used for a long time is to soak the leathers in water so that they swell and become soft and supple. The wet leather conforms to the pump chamber to make a tighter seal, hence better suction. I always inventory spare leathers and a pump rebuild kit.

Hand Dug Wells and Piston Pumps

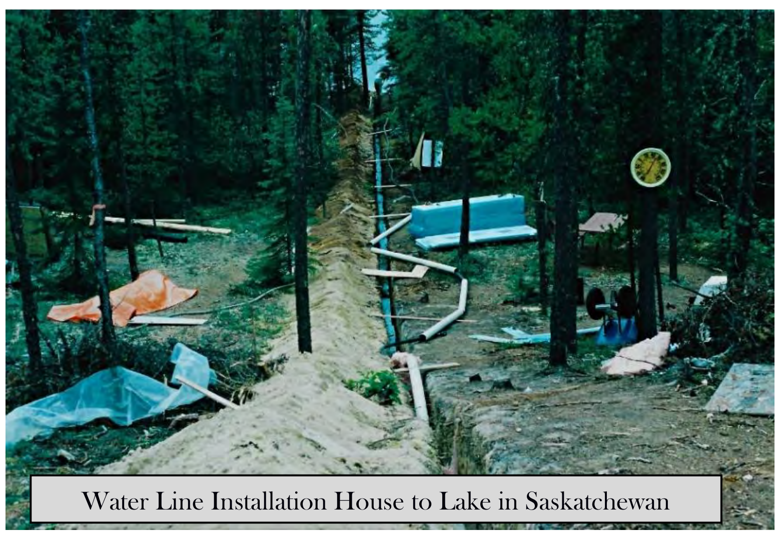


Piston Water Pump Used in Saskatchewan and Nova Scotia

Nineteen years ago, we made the big move to a remote off-grid location in the wilderness of northern Saskatchewan where we had a pristine lake from which to draw water. I utilized an electric pump to draw water out of the lake. The question I had to answer was: what system and pump do I incorporate to supply the new home with water. After a great deal of research, I chose a cast iron piston pump which ran off of 24VDC.

I was very satisfied with this pump. It was a great choice. The documentation stated that it has a vertical lift capacity of 25 feet but again, depending on the elevation, tubing size and joints, it will likely be somewhat less. I figured 21 feet was well within limits and as it turned out, our sand knoll where the house was built sat less than 20 vertical feet above the lake surface. The horizontal distance from the house to the lake was 200 feet which was of no consequence to the pump.

This pump can be rebuilt and I highly recommend buying a rebuild kit with multiple spare sets of leather cups. With proper care and maintenance, it should run a lifetime. After 17 years of use, I only had to change the leather suction cups once.



Water Line Installation House to Lake in Saskatchewan

The following describes how I set up our system. Before we built the house, we dug a root cellar underneath of where the structure would be located. The intent was not only to have a safe place to store our root crops and staples, but also to install the water pump and pressure tank there. We dug a trench from the house to the lake. This trench extended under the south knee wall of the house and intersected the root cellar. The trench was approximately 30 inches deep X 14 inches wide and 200 feet long. All dug by hand. Thank goodness we had sandy soil as it made for relatively easy digging. What was frustrating and brutal was extending this trench out into the lake so that we could draw water even if the winter ice thickness was 30 inches or more.

Preventing our water line from freezing in winter temperatures that can exceed -45°F was of paramount concern. To address this, on the ground surface, parallel to the trench, I connected multiple sections of 4-inch diameter PVC sewer pipe so that it was long enough to go from the house to the lake. Although I ordered insulating foam collars, the hardware store dropped the ball and didn't order the collars so I was forced to improvise. I wrapped the suction pipe in fiberglass insulation and then taped the insulation to keep it in place. I slid the insulated 1 ¼ inch PVC pipe into the 4-inch sewer pipe. Think of it as insulated tubing inside a larger protective pipe.

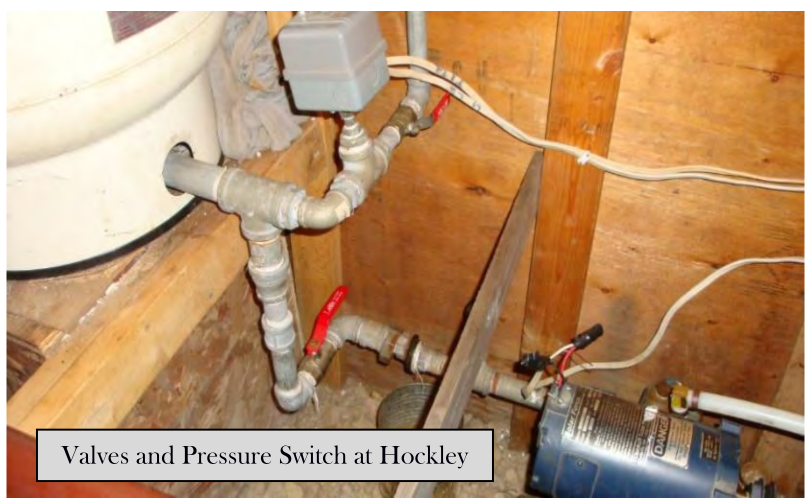
Next, I cut a strip of 1-inch Styrofoam blue board insulation the width of the trench and laid it on the trench bottom. Then the whole pipe assembly was gently laid in the trench. Prior to doing this, I made sure the grade was sloping all the way to the lake without any humps or rises in the bottom of the trench that might create a problem. Humps might be a place where an air bubble could occur or if trying to drain the line, a hump might not allow the pipe to drain completely. This entire assembly extended out into the lake. The other end was connected to the water pump under the house.

As with the case of the Maine water system, a critical component of this system was a foot valve. I connected the foot valve to the end of the pipe that lay in the lake. The purpose was to make sure the water line and thus the water pump were always filled with water and primed for use. Without the foot valve any water in the line would have drained right back into the lake.

Don't make the same mistake I made when I installed the foot valve. It was October and water temperature was already in the low 40's°F as was the air temperature that day. I had chest waders on as I wrestled with the foot valve while standing in the lake. For some reason, I had to take the valve apart while I was out in the lake and I dropped a retaining screw to the valve screen. Kerplunk! In order to retrieve the screw, I got out of the waders, stripped down and went frolicking in the surf. That was a miserable experience and was the closest I've ever come to hypothermia. I was a popsicle. Lesson learned the hard way.

To complete the installation of the pipe, I cut more Styrofoam blue board pieces, putting a vertical piece on each side of the line and a horizontal piece on top of it, essentially boxing in the 4" PVC pipe. I partially back filled the trench with the dirt. Next, I laid a piece of 2-inch-thick Styrofoam blue board 24 inches in width on top of the partially filled trench and then finished backfilling.

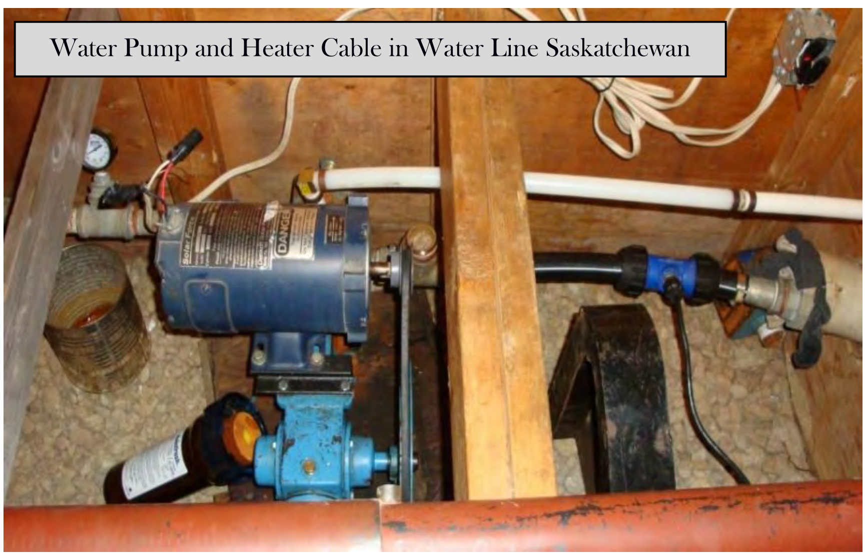
So, at this stage, I had my suction line with foot valve out in the lake. To finish the connections to the suction side of the pump located in the root cellar, I installed a coupler in the line. This was an easy way to disconnect the suction line if I ever wanted to take the pump out for maintenance. Then I put a Tee in the line so that I could insert a funnel and fill the water line with water for priming. Once the water line was filled, the Tee was capped with a plug. There was also a plug on the top of the water pump which I removed so I could pour water into the pump chamber to prime it.


Valves and Pressure Switch at Hockley

Now that my water line was connected from the pump to the lake, I had to finish plumbing the output side of the pump. Here's how I did that. On the output of the pump, I put another coupler. Then I installed a check valve (the check valve is another one-way valve), another Tee with a pressure gauge and then a shut off ball valve. The line out of the ball valve went to a pressure tank. Anywhere in the line to the pressure tank, preferably close to or on the pump, a heavy-duty pressure switch needs to be plumbed and wired in. The purpose of the pressure switch is to turn the pump off once the system is filled with water thus achieving adequate pressure. Then when water is used in the house and the pressure drops, the switch is activated, turning the pump on once again. The purpose of the ball valve was to isolate the pump from the rest of the house. If for some reason I needed to take the pump off to do maintenance, I could shut the valve and any water in the pressure tank or house wouldn't leak out meaning there was no need to drain the water from the house. The check valve will do the same thing but I felt safer having a ball valve to shut off.

Assuming the rest of the house is plumbed properly, once the pump motor is energized, the pump will come to life and you will love the steady rhythm of the piston pump as the system becomes filled with water.

Despite all the insulating I did, can you believe our water line still froze our first winter there? What misery that created. We had many feet of ice covering the lake that I had to bore through with an ice auger to access water. Then using a pot as a ladle, we filled many 5-gallon buckets with water. We utilized our snowmobile and tote sled to transport all the buckets filled with ice water to the house and then manually lugged each bucket inside. We did the bucket brigade routine for most of the winter whenever we needed water. We were sure glad to see spring and have an ice-free water line again.


Water Pump and Heater Cable in Water Line Saskatchewan

In the ensuing years, we mulched the water line with a thick blanket of chipped branches from the forest that we shredded with our chipper and we installed an in-line water heating cable. There are heating products specially made to keep water lines ice free. They can either go on the inside of the pipe (inline) or be attached to the outside of the pipe. Either way, at 200 feet in length, it took considerable power to run the heater cable. But with some experimentation, we determined this cable did not need to be plugged in all the time. A few minutes in the morning and a few minutes at night did the trick. Additionally, we made sure the pump ran a few times during the day to keep the water in the line on the move.

A couple of final notes. The power going to the pump was on a circuit breaker of its own. I also made sure I plumbed a small bypass line out of the pump's pressure relief valve to the outside. If by accident the pump started running while a shutoff valve was closed, it would have shot water out the pressure relief valve filling our root cellar with water, hence the need for the pressure relief bypass line. The pressure relief valve is a safety feature.

Although we thoroughly filtered our water from the lake before we ever drank it, we knew we would have more peace of mind if we could eliminate the possibility of any waterborne disease or bug. So we decided to hand dig a well. This meant we would have a safer water supply. As an additional advantage, since the well would be closer to the house, we could save considerable power because the heater cable would be shorter. For the well location, I selected a flat site 100 feet closer to the house which eliminated half the distance of our suction line.


Hand Dug Well in the Wilderness

That dug well was in pure sand. If you've ever been to the beach and dug a hole in the sand, you know it's not long before the hole fills with water and the sides collapse. I came up with a way to deal with that problem though.

We purchased and flew in a plastic PVC culvert 30 inches in diameter and a little over 6 feet in length. The culvert would be our well casing. We would ultimately stand that 6-foot culvert on its end and sink it in the ground. To do that required a hole in the sand at least 6 feet deep and 4 feet wide. With a shovel, I dug what I could until I hit water, about 3 feet down. Now the walls started caving in, so we stood the culvert on its end and set it in the hole. Then I got inside the 30-inch culvert and bucketed out sand and water for hours. I'd hand Johanna a bucket full of water and sand; she'd dump it out and return the empty bucket. We were a true bucket brigade. We kept this up until I was exhausted and my hands were numb from the cold water. Slowly but surely though, the culvert sank lower into the earth as I removed material from within the culvert.

After several rounds of the bucket detail, I eventually couldn't dig down any further. At this point, I tied a rope around the top of the culvert and hung heavy sand bags from the rope around the perimeter. We had a gas-powered water pump we used for our fire suppression sprinklers. I attached a hose and pressure nozzle to the pump and fired it up. By running a high-pressure jet of water around the inside base of my pipe, I was able, with the aid of all the attached weight, to slowly sink the culvert into place. Essentially, I used pressurized water to blast material from around the base of the culvert. The weight of the sand bags did all the hard work for me.

Two additional points to make. We did not want to contaminate our well by pumping the high pressure jet of water from the lake since we would then be filling our well with lake water. Although it's a cold, clear lake, there were always bacteria and parasites lurking. So, we drew from the well itself. Second, I insulated the outside of the well casing with Styrofoam blue board. The well casing itself had a lid. On top of the lid I put a thick layer of blue board, covered this with plastic and then a layer of chipper mulch. Each fall, I piled on a thick blanket of cut evergreen brush which acted as a trap for snow. The snow provided additional insulation. We never had our well freeze thanks to these protective measures.

Insulated Water Line and Well

The water line from the hand dug well to the house needed to be well insulated and buried in the trench. This time I made sure our supplier sent the proper foam insulating collars made for the size pipe I was using. The insulating foam comes in various sizes and thicknesses. I opted for ½" thick. I figured it was better to over-insulate than skimp. I insulated the entire run from the well right up to where the pipe entered into the root cellar. Then I put the entire insulated assembly into the 4-inch PVC solid sewer pipe. I laid that whole assembly in the trench and backfilled. So, in essence, I had an insulated piece of tubing inside of and protected by a larger 4-inch PVC pipe; the same setup as when it ran all the way to the lake. Now we had a safer water supply since we weren't drawing from the lake, and we had the freezing problem essentially solved. We were without running water for 11 days during the well digging/pipe installation ordeal, but it was worth it.

Machine Dug Wells

So far, I've discussed the experiences of our drilled well, sucking water directly from a lake and a hand dug well. Last up is our experience with a machine dug well here in Nova Scotia. We are both pretty skeptical people so when the excavator contractor asked if I could dowse for water, I said nah, not me. Back 40 years ago, when I was building the Maine homestead, a local older gentleman offered to witch for water on the Maine property and based on his recommendation, we drilled in the spot he indicated and had all kinds of water. I've always felt we could have bored anywhere on that property and hit water. But nonetheless, we had a high quality water source for our Maine homestead.

Nineteen years ago we had no worries about fresh water when we began homesteading on a lake in northern Saskatchewan. That lake was 4 miles long and 100 feet deep in places. But fast forward to now and we were again faced with the prospect of finding fresh water for our home site. The contractor said to take a bent coat hanger or a forked willow or alder stick, hold it a certain way which he demonstrated and walk slowly back and forth over the area. He seemed quite knowledgeable but then he added that he was never able to witch for water. Hmm, not exactly inspirational.

Nevertheless, I headed out to the woods to find a couple of properly forked limbs and began walking around. I slowly walked in a methodical grid pattern without registering any hits. It was frustrating. Those sticks are now somewhere out in the woods having been given the heave ho by yours truly.

A few days later I mentioned my dilemma to a man we had recently made friends with and he said he could witch for water and we could too. He cut a coat hanger apart and formed two divining rods. Then we went out to his front lawn. As he walked around, his rods were crossing as he passed over various locations, indicating water. I took a turn and they seemed to cross a few times for me but I wondered was the process really working or was it the breeze moving the rods? I didn't have a lot of faith. Johanna took a turn and she had a few indications too.

The next day we returned to our property for more work. I took my coat hanger rods out and gave them a try where I hoped we could have a well. After several minutes of walking a grid pattern, I had only one place where the rods crossed and I was not very hopeful. I placed a small branch among all the other debris on the ground to secretly mark the spot and then Johanna gave it a try. After a few minutes I returned and she was getting a cross of the rods in the same area as me. She had placed a marker 2 feet from where I had placed mine. Maybe this had promise after all.

We decided to dig a test hole with the big excavator. Three feet down, then five, then seven. Dry gravel and sand coming out of the hole by the bucketful. Now 9 feet deep. Still dry as a bone. This was discouraging. All I could envision was a dry hole and the homestead with no water. A couple more feet down and the soil started to look a little damp but maybe it was wishful thinking. More shovels and still nothing. Then the excavator stopped and we saw the operator pointing into the hole. My gawd, water was flowing up and filling the hole! What a wonderful sight! He partially filled the hole back in for the night so the walls wouldn't collapse.

Setting a Well Crock in Nova Scotia

The next morning the digging began in earnest. We needed to dig a large hole that would easily accommodate the well crocks. Well crocks are reinforced concrete rings that fit together when stacked atop each other in the well. They form the well casing and come in a few standard sizes. The ones the contractor ordered were 30" high X 36" wide. They have an interlocking lip that keeps them aligned as a crock is placed on top of the previous one. If a tight seal is desired, a sealing putty can be placed around the circumference of the crock to create a water tight seal. The seal is very important on the last crocks and serves the same purpose as a well casing so that surface water doesn't leach into our clean water. Surface water is undesirable because it can contain contaminants and bacteria.


Placing Gravel Around the Well Crocks in Nova Scotia

The excavator operator dug the hole as deep as he could go. That was essentially 17 feet down where he encountered bedrock. At that point, we had a strong flow of clear, clean water coming in from all directions. A dump truck's worth of clean, roughly 1-inch stone was brought in and bucketfuls of the material were carefully placed in the bottom of the hole by the excavator. Then the first crock was lowered to the bottom and a level was used to make sure the crock was sitting level. He carefully placed more stone around the crock. The purpose of the stone is to act as a course buffer and reservoir to allow water to easily collect and thereby fill the crock column. If we were to back fill with the material taken out of the hole we would be sealing off our well from the majority of the water source which defeats the purpose. Instead let that water infiltrate and become a reservoir around all that loose stone.


Installing the Hand Pitcher Pump in Nova Scotia

The excavator operator repeated the process several times, lowering in a crock and then placing clean 1-inch stone around the exterior of the crock. Once we had 3 crocks in place surrounded by clean stone, the dump truck and excavator went to our new quarry to fetch a load of clean bank run gravel to complete the remainder of the well. As each remaining crock was lowered into place, bank run gravel was used to backfill. We could have used the material that came out of the hole to backfill, but we were concerned there might be contamination from the top layer of forest duff and felt it was better to err on the side of caution. This was our drinking water after all. The area around the finished well was graded so that surface water would run away from the well.

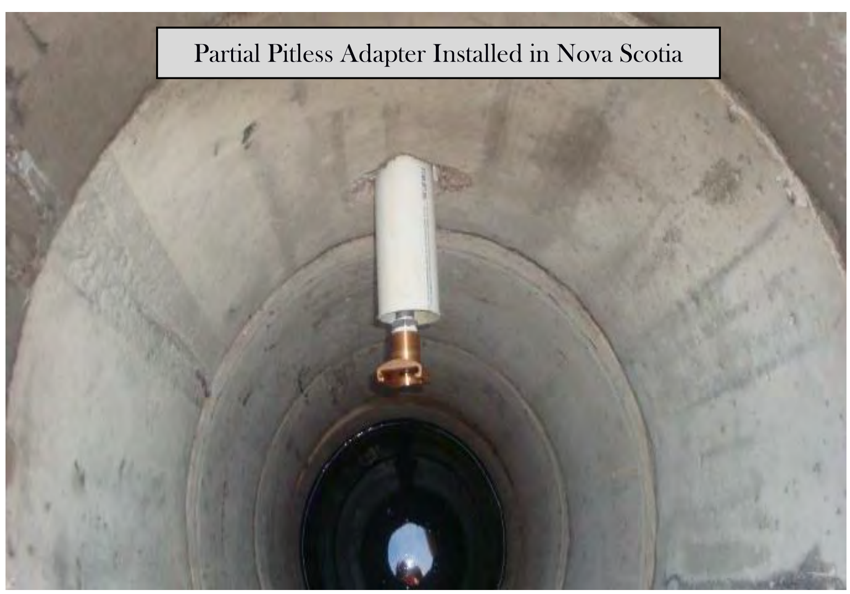
As a temporary water system, I installed a pitcher pump over the Nova Scotia well until I could get the line plumbed to the house. Plumbing from the well to the house was done the same way as in Maine, insulated PVC pipe and Pitless adapter.

I have to say I'm a bit shocked at how well the dowsing business worked. Quite magical. Although I am so relieved and pleased to see water, I will grow weary of hearing Johanna crow about how she wields great powers now that she knows she can witch for water!

Well Disinfection

The last step of the process was to disinfect the well and have the water tested before drinking any of it. Testing the water was a priority. We could filter or boil the water to make sure we eliminated bacterial contamination but that does nothing if there is a chemical problem such as arsenic. Hence, we tested before drinking.

Although there may be differences in regulations between municipalities in Canada and the United States, you might find the following information of value.


Partial Pitless Adapter Installed in Nova Scotia

The following table is from Nova Scotia Environment and Labour titled Disinfection of Water Wells by Chlorination. This is what we used for guidance. Your area will have a similar chart. The bleach used should be approximately 5.2% Hypochlorite. What we are trying to do is roughly determine how many gallons of water are in the well so we can add an appropriate amount of bleach. If you have a standard diameter well of 6 inches and have a good idea of how many feet of water are in the column, the chart will tell you how much bleach to add to that amount of water. Same idea for a dug well.

Boring a Hole in Concrete Well Crock for Water Line

Depth of water in well		**Amount of unscented household bleach**[1]	
		Drilled Well	**Dug Well**
metres	feet	Casing Diameter 15 cm (6 inches)[2]	Casing Diameter 92 cm (36 inches)[2]
1	3	40 mL	1.5 L
3	10	120 mL	4.5 L
5	15	200 mL	7.5 L
10	30	400 mL	15.0 L
30	100	1.2 L	
50	150	2.0 L	
100	300	4.0 L	

We purchased a new shallow well pitcher pump to supply our water needs temporarily. We used it to pump the water out, then we bleached the well and pumped it out again. Finally, we sent a sample to the lab for evaluation. The first sample came back with bacteria contamination. The test is very sensitive and I should have been more careful to disinfect the pump and spout which is what I did for the second sample. The second sample was fine and to our delight, no chemicals or mineral problems were detected. We have a pure water source. Even a drilled well needs to be treated initially and back at our Maine homestead, our well driller used some bleach to do this. I deferred to the well drillers expertise on what quantity to use but essentially, once the bleach was in the well, I pumped water until I could no longer smell the bleach in the water. At that point, I did some extra pumping for good measure and then the well was considered safe at that point.

Regardless of what type of well you have, it needs to be covered to prevent access by rodents and insects that want to drop into the nice clean well water for a swim. Wind can also blow in debris so a tight seal is needed. For our dug well here, there's a concrete cover placed on top of the last crock to keep our well clean.

We could have opted to drill a well here in Nova Scotia as we did in Maine. The price was pretty comparable to the dug well depending on how deep the drilling would need to go. We chose to go with the dug well for a couple of reasons. First, the nature of the coastal geology is such that arsenic is a potential problem. It is even more prevalent in gold bearing areas which we are in. The deeper the well, the greater the chance of arsenic contamination. And second, the deeper we go with a drilled well, the more we take a chance on having a problem with salt water intrusion. Your area may have its own chemical concerns and pollutants to deal with and the water should be tested accordingly.

Before we move on to water filtration, let me mention another water pump option. Hydraulic rams. I have no experience with this type of pump since I've never had a situation where I could utilize the principle. These pumps can be purchased or built from PVC pipe and some miscellaneous valves and fittings. They work by taking a water source that has some elevation and using the weight of the falling water in conjunction with a couple of check valves. A pressure differential develops as the check valves cycle, which forces a little of that input water to the output side. This would be a good way to push water up to a storage tank for example if you had a nearby water source with a bit of an elevation drop.

Homestead Water Filtration

The drilled well in Maine was disinfected by the well driller and became a clean, potable water source. There was no need to worry about the safety and quality of our well water. In contrast, our Canadian homestead in the wilderness, which first used the lake as our water source, definitely needed a filtration system. Although the lake water was crystal clear and looked clean, let's face it, fish and birds poo. Animals such as beaver, moose and bear swam in the lake. In summer, the lake came to life with all kinds of waterfowl. The water was undoubtedly teaming with microbes and there were parasites such as tapeworms that we could actually see. Regardless of whether we drew direct from the lake as we did initially, or from our hand dug well as we did in subsequent years, we used filters in the system.

Canister Water Filter Used in Saskatchewan

Although it's tempting to drink out of a lake or stream, especially one far removed from society, doing so can prove life threatening when medical care is far away. The rule of thumb regardless of where one resides or what the water looks like is to assume it contains microorganisms and that it's unfit to drink without boiling or being properly treated. Safety is paramount!

The "local" (100 air miles away) hardware store carried a name brand filtration product so that's what we purchased. There are other brands so shop around for what's recommended locally. Our filtration was done in 2 steps. First I installed an overall house filter in the root cellar right after the pressure tank to catch the vast majority of sediment and bacteria. With this set up, our water got filtration before ever leaving the cellar and going to the rest of the house.

I installed shut off valves just before and after this filter. This allowed me to easily change filters when necessary. In our case, every 2-3 months, I'd swap a filter when Johanna complained that it was taking a long time to fill up her washer. These filters were washable and reusable, so I'd give the dirty filter a good scrubbing, let it dry and it would be ready for use the next time the filter needed changing. When it was time to change a filter, I shut the supply valve off (the valve before the filter) and then opened any tap in the house to drain the pressure. Then I closed the valve after the water filter. If that valve wasn't there, as soon as you removed the filter housing, all the water in the water lines would drain out of the filter and create a mess. This way the filtration unit has no pressure and won't leak when the housing is removed to access the filter.

Even with that overall house filter installed, we weren't comfortable drinking the water. It likely was quite safe but why take a chance. Because safety was paramount, I installed a second filter which was located under the kitchen sink. As with the whole house filter in the root cellar, I had shut off valves just before and after the filter housing.

At the kitchen sink, we had three faucets, hot and cold as well as a dedicated faucet for filtered water. Johanna used that for our drinking water as well as rinsing garden salad fixings in summer or any chore that required a higher level of clean, pure water.

Under Kitchen Sink Filter

That kitchen sink filter was ceramic and filtered down to 0.3 micron absolute. When it became clogged, the water flow slowed to a trickle and I knew it was time to take it out and give it a cleaning. An abrasive screen came with the filter for this purpose and inside of a few minutes, it was clean and ready to purify water again.

That was the simplest filtration system for our needs. Depending on how much water is run through the system, filters can be scaled in size and you can opt for reverse osmosis filters and ultra violet light filters or a combination. If you have water with high minerals, there are treatments for that as well. Everybody's water situation will be different but at least this gives you a better idea of choices regarding water quality.

Homestead Hot Water

This will be pretty short. If you need hot water, just take a pot of water and set it on a stove to heat. Once it is the desired temperature, pour it into your cast iron bath tub, adjust water temperature with a splash of cold water from a bucket and voila, hot water for a bath! After all, isn’t that what everyone does?

Of course, I say that with a bit of tongue and cheek. Running hot and cold water are taken for granted in this day and age and yet, it wasn’t that long ago that all of our homestead water was hand pumped and bucketed into the house. In Maine, we did that for 20 years until we “modernized.” Heating kettles of water on one of our wood stoves was how we always heated water for bathing and laundry. And when all else fails, say for example the power goes down, a pot of water heated on a wood or gas stove will get you some hot water too.

There are any number of ways to heat hot water for the home. Typically, a home has either an electric, gas or oil hot water tank. For anybody wishing to live off the grid, forget the electric powered water heater. It doesn’t make sense from an energy consumption perspective. It takes a lot of electrical power (watts) to raise the temperature of water adequately for daily use. That power could be put to better use elsewhere on the energy efficient homestead.

Having said that, if you are hooked to gas or electric utilities, you can save money and be more self-sufficient if you were to consider a system that preheats the water in solar panels made for this purpose. We have not had any need to do something like that since we use wood to heat our water. But the concept is simple enough. Before the cold-water supply gets to your gas or electric water heater, it is preheated by circulating through a solar panel usually mounted on a roof. There are many variations of pre-heaters with some using glycol (antifreeze) combined with heat exchangers. Pre-heaters can be home made as well.

Depending on the climate you live in, it may even make sense to set up a solar system solely for the purpose of heating your domestic hot water and have the gas or electric as a backup if the solar system needs to be shut off for maintenance or repairs. The sun's energy is free for the taking whether it produces electrical energy, is used for water heating, is used for food drying and yes, even for home heating.

I have built and lived in remote exploration camps that have used "on demand" propane water heaters and that's certainly an option to consider too. For an off-grid or energy efficient home, it's a more practical solution than an electric hot water tank. But it relies on a source of gas whether it be piped in from a utility company or from gas cylinders purchased/rented from the local propane company. Whether one relies on the electrical utility or the gas utility, a person is still dependent on others to supply a vital service.

For us, it made no sense to purchase cylinders of propane and then fly them into our wilderness homestead for heating water. Especially when we were surrounded by millions of acres of forest. Additionally, we would lose one of our self-reliant aspects by relying on the gas plant and float planes. So we opted for a method of heating our water that uses our wood resource. It's said that heating with wood warms you twice. Once when you cut it from the forest and stack it and then when it's burned in the wood stove. We've taken it a few steps further by not only cooking our meals with it but also by using it to heat our domestic hot water.


Cook Stove and Thermosiphon Hot Water Loop at Hockley

I discussed the hot water set up we had at the Maine homestead, the most basic system possible. For 20 years, we lugged in buckets of water by hand from a hand pump outside, poured the water into pots, set the pots on one of our wood stoves to heat and then we carried the hot water to the tub, sink or washer. This was great for building muscle and character. But yikes, there had to be a better way! And there is. A thermosiphon loop!

Our Saskatchewan homestead had a piston pump and pressure tank which drew from a hand dug well. That pump/pressure tank combination supplied pressurized water to the house. A wood cook stove in the kitchen set up with a thermosiphon loop and a storage tank provided our off-grid homestead's hot water. We have installed the same system here at our Nova Scotia site. Don't let the fancy term "thermosiphon loop" intimidate you. It's a simple concept. Just as hot air rises, hot water does as well. We utilize that principle by plumbing a standard home water heater set up next to our stove. It's roughly a 50-gallon tank. And that's all it's being used for, purely a storage tank. We set up plumbing from the tank to the stove's water jacket to take advantage of the flow of heated water. The water jacket is a container that sits on the inside of the stove's firebox. There are 2 threaded ports where pipes can be connected. As water is heated in the jacket, it starts to flow upward and into the top of the water tank and is then replaced by colder water coming out of the bottom of the tank.

This is a simple and efficient method of taking some of the heat from the wood stove and using it to raise the temperature of water for household use. It works great, and it's free. There is no need for any in-line pump since the water circulates on its own. The size of the tank is balanced with the size of the stove so we don't end up with a tank of boiling water, which would happen if we had a much smaller tank. But the water does get hot. Modern day water tanks are extremely well insulated so the water stays hot for days even if we have no fire in the stove.

There are many ways to plumb thermosiphon loop systems using copper tubing in fireboxes, around chimney pipes or on the exterior of a wood stove. If you understand the basic concepts, you should be able to utilize a wood stove to either fully heat or pre-heat water for your homestead. Regardless of how you use the wood stove to heat water, don't forget to install a pressure relief valve.

Although we chose a standard hot water heater as our storage tank, there are tanks made just for this purpose. Another name for them is range boilers, some of which are made of copper. Because both our water tank and stove jacket have ¾" pipe threads, I chose to use a combination of ¾" copper and galvanized iron pipe to make all of my connections. That would be the minimum pipe diameter I would ever use in a system. Some of our astute readers might wonder about connecting dissimilar metal pipes. Galvanic metal corrosion is the issue here. When 2 dissimilar metals are connected in the presence of an electrolyte, one can get some corrosion. All I can say is from my experience, it's not an issue. We use PEX plastic tubing for all our main plumbing throughout the house and I suspect that provided some isolation. I'd probably be singing a different tune if the house plumbing was all copper tubing with galvanized pipe connections to the hot water tank. The water tank has a sacrificial anode that will corrode and that also helps protect the water system. It's a good idea to check that anode by removing and replacing if necessary. The anode has always been located in the top of our water tanks. If in doubt, use a brass coupling between the copper and galvanized pipe since brass doesn't react with either metal. Something for you to keep in mind.

Hot Water Tank Plumbed to Wood Stove

I should mention that initially our Saskatchewan house water tank to stove connections were all galvanized iron pipe. But I found over time, the galvanized pipe coming out of the stove would fill with brown goo that needed to be cleaned once a year. Our whole house had filtered water so I really don't know what the brown sludge was. Nevertheless, that's when I decided to try copper pipe for my loop in and out of the water tank to the stove. The goo was never a problem again. Copper seems to be the best choice to plumb our system. I have 2 couplers in my copper plumbing so that if I need to remove the water tank, it is an easy job of disconnecting the couplers and the tank is free.

Let's take a look at our thermosiphon set up. You will note a number of things in the picture. The cold-water inlet to the tank and the hot water outlet each have a shut off valve. That way, I can shut the hot water off going to the house if need be or prevent cold water from going into the tank.

I also have a valve on the tank outlet that goes to the stove's water jacket. There are a number of very important points I'll make. As with any hot water system or potential steam arrangement, safety is paramount. It is critical that this valve remain fully open under normal circumstances. Tag it, tape it open or put a small wire tie on it so that it can't be inadvertently shut off. I want that valve there so that if my stove jacket or plumbing happens to spring a leak, I have a way to shut down the tank outlet and prevent the tank's contents from draining on to the floor. We did have a situation where the water jacket developed a leak and that valve came in handy.

Here's what happened. We found out the hard way that it is very important to have water in the system before making a fire in the cook stove. One winter, we had returned home from a vacation and I didn't have a chance to get the water up and running before Johanna started a fire in the wood cook stove. Because of that, our water jacket cracked. When I did fill the system with water, it was obvious something was amiss when water started coming out of the stove onto the kitchen floor. The moral of this story is the water jacket must have water in it before getting a fire to go.

Another critical component of the system is a minimum of one pressure relief valve. Two is better. If for some reason the water gets too hot, it has a place to vent and release some of that built up energy. To install a pressure relief valve, locate the port going directly into the tank's side and put the pressure relief valve there. The second relief valve should be located close to the outlet of the stove jacket. The water coming out of that port will be the hottest. A Tee inserted in line at that point with a pressure relief valve will keep you safe. Plumb both relief valves to the home's drainage line or a bucket. The second pressure relief valve up at the tank is simply a backup for safety.

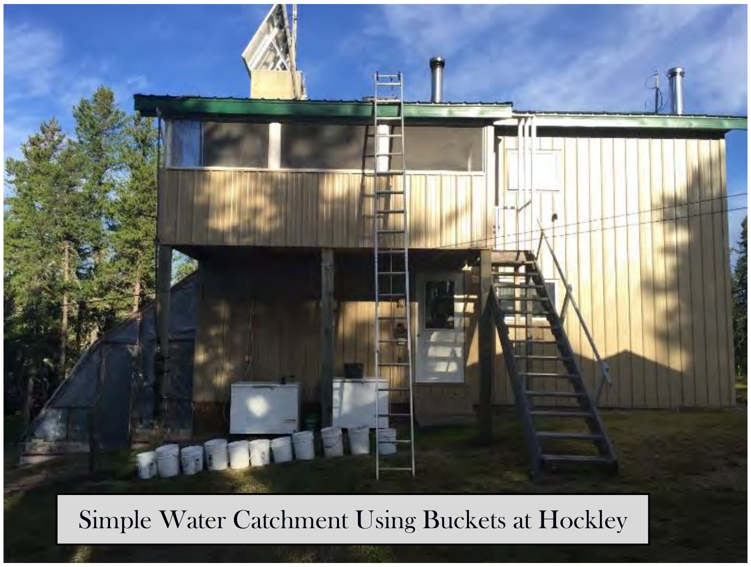
Unless Johanna is canning the entire day in summer or cooking the Thanksgiving turkey, rarely do we ever get water hot enough to open that pressure relief valve. We have enough experience to know when the system is building too much hot water and we just open a tap and let hot water run down the drain. It's a balance between the tank capacity, the amount of hot water taken out of the system on a daily basis and the duration and intensity of the wood fire. Only experience over time will tell you whether you need to modify your tank size.

The last 3 points I'd like to make are:
Make sure the water tank/range boiler is higher than the bottom port of your stove's water jacket. The idea is that you want the cold water in the tank to fall out of the bottom pipe and into the water jacket. If for example, you had the tank lower than the water jacket, you would be asking the water to flow uphill into the water jacket. Our tank's bottom port is 6 inches above the bottom port of the water jacket and it works just fine.

The next point is you'll notice I have a pressure gauge on the top of the tank on the cold-water inlet. Although I have a pressure gauge downstairs in the cellar near the water pump, this is a more convenient way for me to monitor with a quick glance, the status of our water system and pressure.

And finally, take note of the drain valve and nearby fire hose. The drain valve is handy for draining the tank for cleaning or if we go away for an extended period in the winter and have to drain all water out of the system so it doesn't freeze in an unheated house. The fire hose serves two purposes. I can run the hose outdoors to facilitate easier tank draining. And if the unthinkable were to happen, and the house catches fire, if we act fast, it might be possible to save the place by spraying the contents of the tank on the fire with the fire hose. It is our responsibility to think ahead and give ourselves a fighting chance. Please consider placing a fire extinguisher handy to your wood stoves too.

Rain Water Catchment (WS)



Simple Water Catchment Using Buckets at Hockley

The last water source we'll discuss is free water that falls from the sky in the form of rain. Rain water catchment systems (WS). This is another one of those topics that can be as simple or as complex as one wishes to make it. Yet, it need not be complicated. In essence, we're going to take water running off a large surface such as a roof top and store it in a container for later use. It's that simple.

Figure 623 gallons of water can be harvested from each 1000 square feet of surface area with a 1" rainfall. That's a lot of water. Here's the formula to calculate your rainfall potential.
Gallons of water = catchment area in square feet X rainfall in inches X 0.623

What you need to decide is what is the purpose for your collected water. Irrigation, drinking, supplemental for the house? We've always had a reliable water source for drinking so in the past, our reason for catching rain water was to supplement the garden moisture during any summer dry spell. To that end, we set 5 gallon buckets under the roof eaves to collect water and we also set up a gutter system to direct water to 55 gallon drums. Up until now, that has been sufficient for our needs. But we're going to have to expand our capacity this summer. We've been in Nova Scotia for 2 summers and there were long dry spells that occurred in both years. Although our well has not gone dry, it has been pretty low and we don't want to rely on it to keep our garden watered.

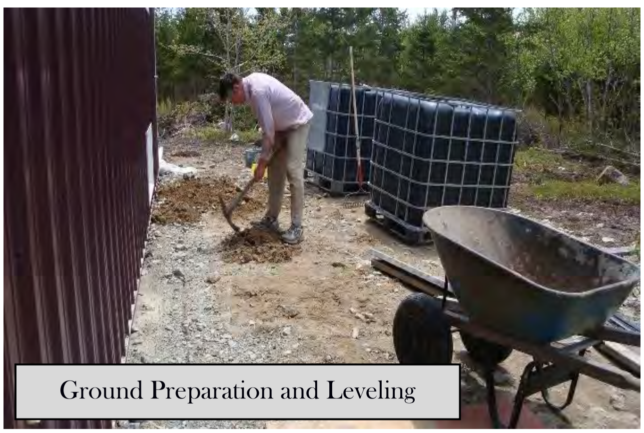
Fire Pump at Hockley Lake

In Saskatchewan, due to the threat of forest fires, we always had a fire pump and sprinklers set up along with firehose and nozzle. The pump sucked water out of the lake so we had virtually an unlimited supply of water for irrigation. When conditions warranted it, we'd start the fire pump and I'd water the garden with a firehose. It takes a gentle touch to water the garden with a 1½" hose made for dousing fires but I was able to do it. While the pump was running, Johanna was able to water the greenhouse and herb garden with a normal garden hose. Then when we had everything soaked, I'd fill up our rain barrels with the lake water and we were set for a while.

You may have a similar interest in utilizing rain water for your garden. It's also possible for you to use rain water for some household tasks including drinking water. There's no reason why you shouldn't be able to plumb a home with a separate system so rain water is used for clothes washing or filling your toilet. But best to check with your municipality on what is allowed. The level of filtering will need to be increased if you wish to use rain water for anything more than the garden. Maximum filtration will be necessary if it is to be used as a potable water source.

Maine House Water Pump and Rain Water Drum

Typically, a roof is used to catch the rain water. Most roof materials should be OK to use. But I'd be on alert for lead flashing, wooden roofs which might have been chemically treated or very old asphalt shingles which might contain asbestos.



Ground Preparation and Leveling

My interest in rain water catchment is in watering the garden so I'm actually pondering what size storage I'll need as a reservoir. There are commercially produced water storage tanks available of varying sizes. Some are as small as a 55-gallon drum while others store thousands of gallons. Storage tanks can be plastic, metal or concrete. These tanks can be set up above ground or below ground. You may have heard of the term "cistern" and that's another name for a water storage tank. When I think of a cistern, I have an image in my head of a large concrete holding tank that is either buried outside or sits in the basement.

There are also local sources for plastic drums and/or square containers that can be used individually or plumbed together to act as one big storage tank. Be sure any plastic containers are food grade. Bypass anything that ever-housed chemicals. As you shop for storage tanks, look for ones that are colored so as not to let any sunlight penetrate to the interior. That should prevent or at least deter the formation of algae. Because clear plastic will encourage algae growth, I'd suggest painting them a dark color or wrapping them in a material to keep sunlight away from the contents. Also look for tanks that have lids. Open tops let debris blow in but more importantly, they give mosquitoes a breeding ground. Any system should be closed but still vented to allow air to escape as the system fills with water.

Plumbed Tanks and Gutter

Our house is out in the open and our metal roof collects nothing but dust, occasional bird droppings, wood stove ash and bits of creosote during chimney cleaning. We have a hip roof all round but I will not collect any water from the roof where the chimney resides. If you have a wood stove, you know a bunch of soot and residue is flung on to the roof when it comes time to clean the chimney and that will surely be a source of bad contaminants that must not get into your water. Any water coming off our roof should be free of large bits of debris. I mounted a gutter on the eave where we catch the water to funnel into our system. The gutter transfers the water collected from the roof and diverts it to our storage tank. For those where leaves might be a problem, a leaf guard with screening that prevent leaves from going into your tanks should be installed.

Even with our “clean” roof, I still want to pre-filter all water going to the tanks. There’s a couple schools of thought on the pre-filter/water diverter. The water diverter is a clever concept that uses a small reservoir that specifically handles the first small amount of water off a roof surface. The idea is that this water will be the dirtiest and if it can be diverted before entering into the tanks, so much the better. But it’s an added expense and depending on whether there’s a downpour or a light rain, I can see it not working as planned. For example, if it lightly rains for a while, the diverter takes all that water and fills up. However, that light rain wasn’t hard enough to move all the accumulated bits of debris off the roof and down the gutter into the diverter. Now the diverter is full and a downpour occurs. The rest of the dirt runs past the diverter and right into the tank. Also, we live in a northern climate and if the diverter freezes, it likely will crack. Whether the diverter is manually drained or is self-draining, I’ve read reports that there’s still some maintenance to using a diverter.


Tank Plumbing

Since this is only water for the garden, I simply want to keep large debris from going into my tank. There are many filters that can be used for this purpose. A fine screen, mesh or even paint strainer bags are possibilities. I’ve found one of the best filters is an old pair of nylon stockings (nope, not mine). I just cut it to size. We used to tie a nylon stocking on the drain hose of our wringer/washer. The amount of lint and debris it caught was amazing. All of that junk was headed to our gray water leach field so it was best to catch it before it ever got there. We use a paint strainer bag on our washer drain hose currently.

So, at this point, we have water running off a roof that is collected in a gutter which takes water down to our water storage tank. Before it enters the tank it is filtered and now we need to have a means of utilizing that water. If your setup relies on smaller barrels daisy chained together, I would have the feed line to the garden hose or pump come out of the bottom of your last tank. If water enters through the top of the first barrel, as long as all the barrels following are piped together at the bottom in series, and all the bottoms of the barrels are the same height, water will seek its own level and all the individual tanks will act as one big tank. But that also assumes there is a way for the air in the tanks to be vented. As the tanks fill with water, the water is displacing air and by the same token, when you go to drain the tank, if it’s not vented properly, the flow out will be poor creating a vacuum.

I purchased 2 square 250 gallon tanks that have a surrounding metal cage. I see these advertised a lot. Various liquids are shipped in them. Some of these tanks are used in the transport of harsh chemicals which would not be good for our application. The outlets are on the side so they won't drain completely but that will allow any sediment to settle to the bottom and be an additional way of filtering water.

The local hardware store has PVC pipe components, bulkhead adapters and fittings and it didn't take me long to plumb the 2 tanks together for a 500 gallon system. I plumbed my tank output a little different than most. I opted for a 1" fitting with a 1" ball valve coming out of my last rain tank. I want to limit any restriction to flow, hence the 1" fitting. I may want to run a hose 150 feet to the garden and the bigger diameter at the outlet should help flow rate. I'll also go with ¾" diameter garden hose. The standard is ⅝" hose. Keep in mind, the higher the storage tanks, the more pressure or head there is. A couple feet of elevation may make the difference between success and failure when using a drip irrigation or soaker hose. For every 28 inches of elevation, you gain 1 psi but the tradeoff is water is heavy and any tank stand needs to account for that weight. We don't need a lot of pressure though. We want to water the garden, not wash it away.

I will also put a quick coupler on the tank outlet so that I can use our fire pump we brought with us from the bush to water the garden. I can sure water a garden in a hurry with that thing. For anybody living in a fire prone area, watering the garden is nice but in a fire emergency, having a small pump and sprinklers installed with your water storage tank might just save your place so that's an added benefit to having a tank-based water storage system.

The last thing we have to cipher out is how to deal with overflow once our tanks are full. You likely have gutters and downspouts installed on the house and any overflow from the tanks can be piped to go back with the rest of the roof water drainage. However, the overflow could be used to expand the collection system in the future by adding another tank or it could be diverted to a swale or holding pond so as not to waste it. Any holding pond can be natural or man-made. If the pond is lined with a waterproof membrane, it can store a good jag of water. If we lived in a really hot, dry climate, I would think hard about how best to utilize every drop of rain that falls. I'd capture 100% of the rainwater off the roof and store it either in tanks or, if there's overflow, in a pond. I'd also consider piping it direct to nearby garden beds. This is an idea I want to try for our garden this summer. I'm going to bury a 4" perforated septic pipe down the middle of our raised bed. I'll bury that pipe just so it's deep enough to have the perforations covered in dirt. Each end will be capped so that it retains the water for dispersal in the bed. At the end closest to the water source I'll insert a "Y" fitting. The opening to the "Y" will face up to the sky. Excess rainwater will be funneled into the "Y" to fill the PVC pipe for dispersal the length of the pipe. I have not tried this yet but since we have extra pipe, I plan to give this a shot. I think it would work. It would be much like a rigid soaker hose with large holes.

For this application, the longer the bed the better. That means a longer run of pipe and thus more capacity to disperse whatever overflow water is available. If I had multiple beds nearby, I'd consider branching off, much like laterals in a septic leach field, so there would be a run down each bed. A 4-inch pipe can hold a little over ½ gallon of water per foot. It might take a bit of experimenting to find the optimal depth of the perforated pipe. I'd need to find the balance between the pipe being buried so deep the dense soil can't absorb the water fast enough or having the perforations exposed too much so the water rushes out of the holes at the beginning of the pipe and never makes it to the end of the line. But the point is we are attempting to use that water and not waste it. In our experience, when things have been dry for awhile and a good rain falls, we think everything is soaked, but if we dig around and scuff the surface, it's disappointingly dry not too far down. It takes a lot of rain to really soak into parched ground so any water diverted into the garden even during a soaking rain will be of benefit.

And finally, for those in really dry, arid climates or those ecologically motivated individuals, I would try to find a way to utilize all the gray water the house produces. That's water from a shower/bath, washing machine and bathroom sink. The kitchen sink is a question mark depending on local code. But the other fixtures mentioned produce significant quantities of relatively clean water that can be reused for irrigating the garden or orchard. The use of bleach and any other harsh chemicals for clothes washing should be avoided. The house fixtures would need to be re-plumbed and there should be a valve setup in place that can easily divert water to the outside for irrigation in summer and yet reconnect to the septic system in winter or when not needed.

Our Wringer Washer

This is water that is best used as it's produced and goes directly to the garden to soak right in. I'm thinking this would be a good water source for the scheme I want to try above to utilize excess rainwater. Any gray water could be piped or poured right into that "Y" PVC pipe connection in the garden. I could collect buckets of the laundry water from our wringer washer for example. I don't necessarily need to do any house re-plumbing. Normally, the washer hose sends water into the utility sink. Instead, I could take the hose and fill buckets, walk them out and pour the contents right into my 4" PVC pipe irrigation setup. That would be much better than taking the buckets and pouring the contents directly onto the garden and watching half of it run off into the walkways. This way once it is in the pipe, the water remains until it leaches into the soil on its own accord.

Caution! I would not use this gray water directly on the plants. If you end up bucketing the water to the garden, at least gently pour it at the base of the plants. If you just dump the bucket out with a big splash, you risk splashing soil back up on the stem and leaves of plants which might induce soil borne molds and disease. That's true as well of bucketing any kind of water to the garden. We make sure not to splash soil back onto the plants. Recycling gray water is just another way of becoming a little more self-reliant.

Chapter 6 – House Floor Planning

Designing the floor plan of a house for a homestead, whether it be on or off the grid requires careful thought and consideration. Let's face it. You'll be engaging in activities most people have never dreamed of doing. Certainly modern houses aren't designed with activities such as butchering and food preservation in mind so you'll need to devise areas and work spaces for these activities. Johanna has definite ideas on how to lay out the house and I'll pass on her thoughts as well for your consideration before you start pounding nails.

If you've purchased property with an existing house but plan on doing some remodeling, you can incorporate many of the features I'll discuss. Doing so will make your homesteading life easier and more enjoyable. If you're building the house on your homestead from scratch, you have a wonderful opportunity to include features into your floor plan that are integral components of an efficient, smooth running homestead dwelling.

We've found that drawing various layouts on graph paper, studying them and rearranging them countless times until we hit on what we think is the perfect arrangement is much cheaper and easier than building, discovering the floor plan is lacking or unworkable and having to rip apart, redo and remodel.

Johanna designed the dwelling for the northern Saskatchewan homestead as well as the one for the Nova Scotia place, then it was up to me to figure out how to implement the designs. She finds it easiest to use graph paper for the general outline and then she cuts out numerous room components to scale. She can then lay those pieces on her floor plan in various positions without having to pencil in and erase countless times.

For example, she'll make each square of the graph paper equal 1 foot. Then she draws the outside walls of the proposed house as well as all the interior room walls. She'll take another piece of graph paper and cut templates to scale representing chairs, table, TV, bed, chest of drawers, kitchen cabinets etc. It's then a simple matter for her to lay the pieces of the puzzle on the graph paper floor plan and rearrange them until she has the most efficient use of floor space given our particular furniture and needs. It takes some time and can be frustrating fitting things in so sometimes it's best to take a break for a day and come back to it from a fresh perspective. Things will fall into place eventually. It may require changing building dimensions slightly to accommodate everything you'd like to accomplish. Plotting it all out on paper is a great way to visualize how your new home will look.

Dirty and Clean Areas

As I run through the various aspects of a well-designed floor plan, it may help to think of the homestead dwelling as having two main areas, the "dirty areas" and the "clean areas." As you might imagine, the clean places in the home would be the living room, dining area, bedrooms and perhaps a craft/sewing room. The entry way/mudroom, utility room, laundry and work spaces such as the kitchen and workshop are examples of the dirty places in the house. We are basically segregating work from living areas.

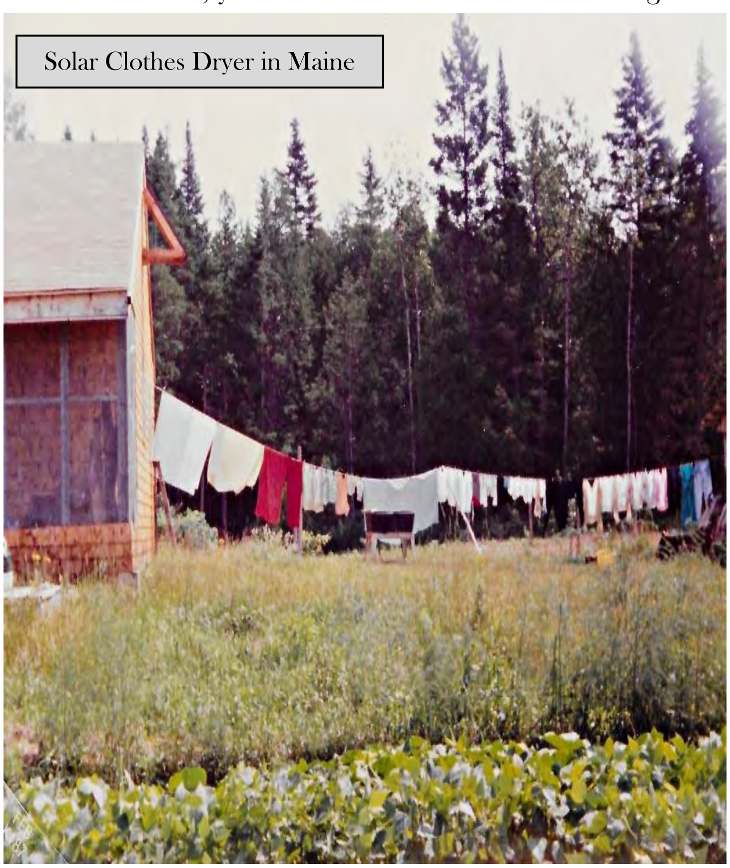
With that in mind, when you enter the house, I suggest you enter in what we call the mudroom/utility area. Seating by the door should be provided so everyone has a place to sit to remove dirty footwear as well as don said footwear before going out. If the seat by the door is a chest type design, it can serve double duty. Not only is it a place to sit for footwear removal, but if the lid is hinged, the chest is a great place to store such items as gloves, mitts and hats. If you have kids, this setup is certainly easier for them to access than shelves in a coat closet. If the chest interior is somewhat sectioned off so it can be organized, so much the better.

We're a 2-person family and yet we have several boot trays (a plastic mat with a lip on all 4 sides) situated beside the seat; a his and hers tray. We each have our indoor and outdoor sneakers, hiking boots as well as mud or logging boots. The trays are always full of footwear. The boot tray catches and confines the mud, dirt, snow and perhaps even bits of stuck on manure from the barn yard that eventually sloughs off the footwear. The tray is easily emptied of debris outside when necessary.

Storage for coats, hats, gloves and scarves should be located in the entry way area. A coat closet is beneficial for storage of items not in daily use such as winter coats in summer time. Pegs on a nearby wall give access to hung items that are used every day.

If you plan to heat with wood, I'd locate your wood box near the entrance. Simply enter through the door and dump your load into the box. Less mess will be created when you need to fill it since you won't be tramping through the house with dirty boots while carrying armloads of wood to your storage receptacle.

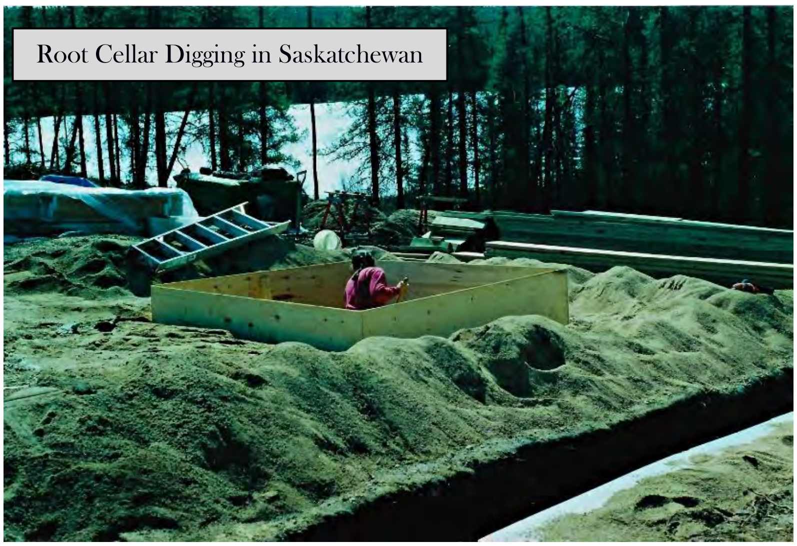
Close to the entry/mudroom/utility area, consider placing the laundry area and a bathroom. Why? For several reasons. Having a bathroom here means you can come in from working outside, sit by the door, remove your dirty footwear then traipse into the bathroom to at least wash dirty hands. If this bathroom has a tub or shower, you can even bathe before entering the "clean" zones of the house.


Solar Clothes Dryer in Maine

Locating the laundry area here means it's right where the dirty clothes are deposited waiting for wash day. Having the laundry area near the mud room door means you won't have to lug baskets of wet clothes through much of the house before reaching the exit. That's assuming you use a "solar clothes dryer," a clothesline, on a regular basis. I'll have more to say about appliances and off-grid electric systems in an upcoming chapter but for now, suffice it to say it doesn't make sense to power an electric clothes dryer in an off-grid home. They take a lot of energy to run. If you're committed to off-grid living, or even if you are hooked to the grid but wish to conserve energy, the outdoor clothes line can't be beat for drying clothes. The sun and breeze are free.

For both the Saskatchewan house as well as the Nova Scotia house Johanna tried to arrange the shower and sinks within close proximity to each other. This makes plumbing them much easier for the do-it- yourselfer. If you are paying a plumber to do the work, less labor hours will be required saving you a pile of money as the job is simpler than if you have plumbing going to the four corners of the house. Also, less pipe is required so cost for materials is kept to a minimum

Now is the time to decide if your root cellar, assuming you plan on having one, will be under the house or not, since that will have a bearing on the house foundation and construction. If the cellar is to be under the house, you'll need to determine how you'll access it. Here in Nova Scotia, I installed a bulkhead door on the outside of the house basement to gain access to the cellar. That way in the fall during harvest, buckets of potatoes, carrots, cabbage and the rest of the garden produce can go from garden to cellar without the need to tramp through the house and down the stair steps. Then when an item is needed, Johanna just heads down the interior stairs and retrieves produce through the winter.


Root Cellar Digging in Saskatchewan

In Saskatchewan, we had the root cellar under the house which was accessed only by a trap door in the floor. It's a viable way to do it but it does mean the access hatch needs to be easily accessible. It was a small root cellar and we used a step ladder as our means of getting in and out of it. Using a ladder made it harder to lug buckets of potatoes etc. down but it worked for us.

The way we are doing it now with the outside bulkhead door and interior steps is deluxe, not to mention safer. If you opt for interior steps or a trap door to access your root cellar, try to locate the trap door or steps so they are handy to the entry way door so you aren't walking through the entire house when bringing in produce from your gardens for storage. Our gardens are always wet and muddy in the fall so trust me this makes for a lot less mess if your root cellar access is handy to your entry way.

At the Maine homestead, my workshop was attached to the barn. This was convenient for my tool storage since most repairs I did took place outside, but it was inconvenient for me to do my woodworking. I enjoy making small items such as music boxes with hand tools. In the winter, I'd have to make a fire and warm up the shop before any work could take place so I seldom engaged in my hobby.

At our last homestead in Saskatchewan, the shop was in an enclosed room in the house with a door to open and shut. Enclosed so wood shavings and dust were contained. It was somewhat inconvenient having to run inside to fetch tools when I was working outside, but that was balanced out by the fact that I was more inclined to do wood working since my shop was located in the heated house. If you're able to locate the shop so that it's near the entrance, hoofing through the house to retrieve tools when working outside is kept to a minimum.

Now that we are starting from scratch again, I've made a compromise of sorts. We have a basement where I'll do my woodworking and we have a 40-foot sea can for storage outside where I'll have a work bench set up along with my mechanics tools. That way if I need a wrench or screwdriver when I'm working outside, I won't need to quietly sneak into the house, tiptoe down to the basement and grab a tool. In essence I won't need to go stealth and fly under Johanna's radar.


Baked Bread in Our Cook Stove

Homestead Kitchen

Speaking of Johanna, the kitchen is one of the most important rooms in the homestead dwelling, so be sure to give its layout careful consideration. The kitchen is her turf! If you plan to use a wood cook stove as we do, you'll need clearances on all sides per the manufacturer's specs. It's imperative that the stove and associated chimney are installed properly. Unlike an electric or gas range, the cook stove can't be set against a wall with cabinets butted up to either side. She treats it as the "island" in her kitchen and she has the cabinets, sink and countertop arranged around her island stove.

We use the wood stove to heat our domestic hot water. That requires having a large water tank behind the stove which is plumbed to the stove's water jacket. Water is heavy stuff. Combined with a heavy wood stove, consider bolstering the floor joists in that area by doubling up or increasing floor joists.

Adequate counter space is critical to any homestead kitchen. You'll be doing more than making peanut butter and jelly sandwiches and you'll need space to perform duties such as canning, butchering, cutting and wrapping meats and cooking from scratch. We've done our own butchering and an ample, well organized space is vital for this operation. Once Johanna completely clears the countertop of canisters and so forth, we each have our own work station. We work side by side. I cut and saw the carcass into manageable pieces, then I pass them to her for trimming, wrapping and labeling. Because we each have sufficient counter space, we are able to work assembly line fashion as if we're a well-oiled machine.


Johanna in Her Hockley Lake Kitchen


Hand Grain Mill Station

If you plan to have a grain mill so you can grind your own whole grain flours, be sure to incorporate an area for this in your kitchen layout. I built a 2X4 frame and utilized the scrap piece of Formica countertop that I cut out for the installation of the kitchen sink. That piece of Formica scrap is the perfect size to mount on top of the 2 X 4 framework. Then I mounted our hand powered grain mill on top of that. It's the ideal use for the Formica sink cutout and makes an easy to clean work surface. Johanna keeps buckets of whole grains underneath this assembly for easy access. Part of our grain inventory.

Lots of storage is important in the homestead kitchen too. A large pantry with shelves full of canned goodies Johanna works so hard to put by has been integral in all 3 of our kitchens. A year's supply of jarred food takes up a fair bit of space. Your pantry should be cool and dark if possible. In lieu of a pantry, basement storage would work but having some room in the kitchen for canned goods storage means fewer trips to the basement to fetch an item.

If you plan to buy and store staples such as flour and sugar in bulk 40-50 lbs. sacks as we do, be sure to take that into account when planning on how big to make your pantry. Items such as flour and sugar must be stored in a dry location or flour will mold and sugar will turn into a rock-solid mass. If the storage area is questionable, one can buy air tight 5-gallon pails with lids. Pour the sugar or flour into the buckets and then seal for longer term storage.

And then there's the space needed to store all your food preserving equipment. The boiling water bath canner, pressure canner and large kettles are bulky items that require a home when not in use. Same goes for a dehydrator, the meat saw, meat grinder and meat slicer if you plan to use these items. An apple parer corer, a butter churn and a pulp separator/squeezer round out our list of preserving equipment that requires storage. We solved our storage problem by incorporating a floor to ceiling cabinet in Johanna's kitchen at the last 2 homesteads. Conveniently, the cabinet also has room for storing dozens of empty canning jars.

Regarding the "clean areas" of the house, the living room, dining area and bedrooms can be arranged as you see fit. Incorporating big picture windows in the living room and dining area will admit lots of natural light particularly if you can orient the house so these windows face south. This will make for bright living areas even during the short days of winter and come spring, you will have a great space for your garden seedlings on the sills of the south facing picture windows.

Bear in mind that if you are planning to heat with wood, an open concept makes heating easier. At all 3 homesteads, the living room, dining area, kitchen and even her sewing room were essentially one big open space.

If you're in to vintage crafts such as quilting, sewing, spinning and weaving, or think you might like to be, consider including a room in your floor plan just for these activities. All of these are worthwhile homestead skills and hobbies, but each requires its own equipment and supplies that will need to be stored when not in use. Additionally, while some of these activities require little space to perform, others such as quilting on a frame or weaving on a floor loom take up enough floor space that the family might object if you set up shop in the living room.


Johanna's "Woman Cave"

If you are planning to have an off-grid electrical system, you will need to allocate space in your floor plan for a battery bank as well as all the electronics necessary to run the system. Batteries are heavy so the floor where they will be located will need extra reinforcement. Ventilation around the battery bank is essential too and will likely be dictated by the building codes in your area. Any off-grid electrical system requires more than a typical circuit breaker box. There are various electronic components and all of them need to be visible and accessible, so you should plan on allocating some wall space for the mounting of these gadgets. They too must conform to electrical codes.

Since we're ending this chapter on the topic of electrical systems, let's carry it through and chat all about off-grid power in the next segment. What's so great about off-grid power?

Chapter 7 – Off Grid Power

We've never had a power bill! For the last 40 years, most of our adult life, a wire from the power grid has never been connected to a home in which we've lived. All 3 of our homesteads have been far removed from the power lines. At least a mile distant and the cost to run in the electric line was prohibitive. Not that we ever seriously considered doing that. In Maine, my neighbor eventually ran electric to their place and at that time, I had a choice whether to continue the run down to our house. It still would have been terribly expensive and in the end, we chose to remain self-sufficient for our power needs. That's not to say we wouldn't have welcomed more power to the house.

Living off grid has many benefits and a few detractions. Although I tout we've never paid a power bill to a utility company, the upfront cost to produce power on a home scale is significant. But once we have a system installed, we are buffered from any future price increases. We have no worry that the utility will raise our rates. We also have an ultra-reliable source of power with no worries of outages from downed wires or deliberate damage/attacks to the grid. And although our batteries may get low and clouds may prevent charging, the electronics and solar panels that create the power have never failed us in all these years. All of it just keeps working. We have no fear of ever being disconnected or our power being rationed. And best of all, we get to choose where we want to live, even if it was 100 miles in the wilderness where access to the grid was impossible. How wonderful is that!

Satisfaction with an off-grid system hinges on whether it is sized properly. For anybody who has plans to design their own system, I urge you to have your design checked by a professional installer or a sales engineer from where you will be purchasing your system components. Have them double check your calculations and reasoning. Too much time and money will be spent on this and if things are not sized properly, you will either have spent more than was needed or you will be woefully underpowered. This chapter is not meant to be a complete design manual but its intent is to arm you with enough information so that you can understand off-grid power systems and be able to converse with an engineer or technician with more confidence; if the system goes down, you have a shot at diagnosing what the problem is. The following information I provide will get you started on a basic, off-grid system.

There are hybrid systems that incorporate multiple power sources such as wind and solar and there are setups called grid-tied where you can have the best of both worlds by being hooked to the typical power grid but still have solar panels and/or a wind turbine. Any excess power you produce is sold back to the utility. A setup like that is more involved and I mention it as something for you to look into. Grid-tied systems must be installed by a qualified electrician.

Even though I will walk you through a simple system design, consulting an electrician when it's time to hook up your components is strongly recommended, unless you are highly qualified to do wiring. Your safety is the most important consideration and a faulty installation can result in fire and injury. If you feel confident, you can at least mount the solar panels. Perhaps you can mount all the electronic components in advance before the electrician is called in to finish the installation. Ask the electrician what he/she requires. He/she will likely want a piece of heavy plywood mounted to the wall to which all the components will be attached. Anything you can do ahead of time to make the electrician's job easier will save you money. However, modifying or working with existing house wiring is best left to the pros. I don't want to hear about any shiny red fire engines with lights flashing and siren blaring that needed to be called when the 12VDC gizmo was wired to 120VAC and showed its' displeasure by going full flame on.


Maine Homestead with Small Solar Panels

Back in chapter 1, I alluded to the fact, that my first off-grid electrical system was so inadequate it was absolutely ridiculous. Here I was, an electronics technician quite familiar with wiring, Ohm's law and the use of multimeters, and yet I had no practical experience with how much power a car radio or any other electrical device took. Sure, I could relate to how much current an item took to run and what voltage I needed to supply to it, but how long would it play with a cheap car battery? Or how long would the battery take to recharge on a sunny winter day in Maine, with a single, low power solar panel? Although I knew car batteries were a bad choice, money was a limiting factor so I ended up rigging a half-baked power system that was next to useless. It was forever in the hole and was rarely fully charged. Not until I purchased the proper components, hooked them up and used them for a period of time at my locality, did I really understand what it took to build a real power system. "At my locality" is important. Location is a paramount consideration in how many panels and batteries are needed to power any home on a daily basis.

Years later, after Johanna arrived, I added a couple of small solar panels I built myself from scratch. I also bought 2 marine deep cycle batteries, put the kerosene lanterns in storage and added a few 12VDC lights. There, that should improve things.

Wrong! We still had a chronic power shortage. Very little improvement! Even with a cheap generator and battery charger, in 20 years of homesteading in Maine, our setup was never a satisfactory arrangement. But the entire experience was a terrific learning tool and one thing I learned was how much power our gadgets consume, what the capabilities of solar panels are and a lot about batteries.

Looking back, I marvel at what a stark contrast there was between my first off-grid system and what we have now. Back then, when I hooked up my first battery and panel, I was jumping up and down with glee if I got 2 amps output on a full sunny day. I quickly found out that was woefully inadequate even to power a small radio and tiny TV. When we installed a few more panels and the marine deep cycle batteries, we tripled our solar panel output to 6 amps on the best day. One would think that by tripling power output, the problem would be solved. But it's not that easy. Maine is a battleground between seasons and as a result we had long stretches of cloudy weather in both spring and fall. The battery bank was not big enough to give us the power storage needed to get through it. I'm guessing my first car battery was 50 pounds of weight. When I traded that battery in and bought the 2 marine batteries, I might have had 100 pounds of lead acid batteries. Keep that number in mind.

When we made the big move to the wilderness of Canada, I vowed we would end our power suffering by installing a large system. I put an 800-watt solar array on the roof which on the best day, gave us 24 amps of current, a quadrupling of our Maine output. And we flew in to the bush almost a ton, a little less than 2000 pounds of batteries. We modernized our home with more lights, satellite TV and more gadgets. We figured our system would easily power everything we had with some leftover. Nope, didn't quite work out that way.

One can make all kinds of calculations, look at solar insolation tables and study climate data. All of that will be a good starting point, but until the house is set up and utilized, one can't be certain everything will work as intended.

House Facing South (note solar panels, wind turbine and heavily mulched waterline)

There were periods during the year when we had all kinds of excess power. But winters in northern Canada are tough and at those latitudes, the days are short. I factored all that in though. We dealt with long stretches of clouds by having a large battery bank, plus as backup power, I wired in an autotransformer and a 6000-watt diesel generator to the inverter. So far, the plan was good. In practicality, any generator, let alone a diesel generator, is hard starting in the cold. Any temperature below 0°F and it was a real hassle to get the engine turning over and started. We counted on the generator getting us through the lean times of winter, but having trouble getting the generator to run due to frigid temperatures was a constant problem.

Ultimately, we decided to add a wind turbine and build a hybrid wind/solar setup. Wind turbines have their own set of problems which we'll discuss later. But unfortunately, the turbine wouldn't run when we really needed it.

Fast forward to today in Nova Scotia. We have all the appliances and gadgets of a modern house and are still getting used to this new system. We have a new battery bank that weighs almost 2000 pounds but now our solar array is capable of putting out 100 amps. We've quadrupled our output again compared to our wilderness home. And we have 50 times the current I started out with in Maine when 2 amps was my output. Now we're talking. Progress! We've come a long way from the days of kerosene lanterns and a tiny black and white TV.

At some point, we'll create a hybrid system with generator as backup. With weather getting so radical, having generator as backup for a prolonged cloudy spell can't hurt and although we've never had an inverter failure, as prepared homesteaders, it still is a good idea to have a plan B backup.

If you are considering either building an off-grid setup or are thinking about disconnecting from the grid, I'd like to help get the ball rolling. How complex do you want your energy system to be? A hybrid system of sun, wind or water or a single generating source? What is your budget? Contrary to popular belief, free energy from sun, wind or water is a fantasy. You'll quickly learn any alternative energy system isn't cheap. The more complex the system or the bigger it is, the more upfront expense there is. Granted the bigger your setup the more energy you generate and the more things you can run. But are all those gizmos really necessary? That is why determining what you want to power and what you can do without are so important.

Basic Electricity

Before we get too involved, I'd like to explain some electrical terms in the event you want to take a shot at a preliminary design of your own system or so you have a better understanding of what goes into system design. Feel free to bypass this basic electricity section and jump ahead to the battery section if electricity isn't shockingly stimulating for you.

If you've ever gone shopping for an appliance, it will usually have an energy rating. It uses "X" amount of energy in kWh/year. Most people have no need to understand what that means. All that is important when shopping for an appliance is making a comparison between several similar sized units by looking only at the tag and choosing the unit that uses the least amount of energy.

But if you want to design your system, you'll need a basic understanding of electricity. The 2 units of measure we will deal with now are voltage in Volts and current in Amps. The easiest way to think about this is to make an analogy with a water pump connected to a pipe. Much like a pump pushes water down the pipe, a battery provides the force to push amps down the wire. The bigger the water pump, the more water it can push, the bigger the voltage of the battery, the more amps it can push down the wire. The bigger the wire, the more current can be pushed through the wire, just as a bigger pipe allows more water to flow.

Voltage and current can be any numerical value. If you multiply voltage X current you will get power in Watts. So for example, you have a 12 V battery which is connected to a light bulb. That 12 volt battery is forcing 1 amp to flow through the wire to make the bulb light up. 12V X 1A = 12 watts. So the light bulb is consuming 12 watts of power. In this example, there are 2 more pieces to the puzzle I can add. Let's assume that the light bulb was on for exactly 1 hour. We can now say that the light bulb consumed 1 amp-hour (it drew 1 amp for 1 hour) or 12 watt-hours (it drew 12 watts for 1 hour) of juice. Watts is a measure of power drawn with watt hours a measure of power drawn over time, also known as energy.

Using Multimeter to Measure Voltage on New Batteries in Nova Scotia

It's nice to talk about volts and amps in theory but there may be a time when you need to measure voltage or current. A multimeter, a tool for measuring current, voltage and resistance, is a very handy tool to have around the homestead. I can't imagine not having my multimeter with me. You can buy a cheap analog meter with a moving needle or a cheap digital meter. I'd opt for the digital meter because it will be easier to interpret the numbers. When taking measurements with a multimeter, here's what's important. Voltage measurements are taken across a device and current measurements are taken in line or in series with a device. Rarely if ever will you need to take a current measurement, but if you do the leads of your multimeter would be inserted in series with the circuit so that it can measure the flow of current through the wire.

Much more practical is to take voltage measurements. What's the voltage at this AC outlet or what's our DC battery voltage? Which brings us to a couple more electrical terms. AC, alternating current and DC, direct current. All you really need to know is that a battery supplies direct current. And the electrical grid supplies alternating current. Just about all house appliances are made to run on 120VAC which is the power that runs in from the electric company. Getting back to the multimeter, there is a setting on the knob of the device to measure DC volts or AC volts. As long as you remember to set the multimeter properly depending on whether you intend to measure a DC voltage or an AC voltage, you will be fine.

The basic multimeter is capable of reading voltage, current and resistance. I haven't mentioned anything about resistance. Resistance quantifies how a material reduces the current flow through it and is measured in Ohm's. Going back to our water pipe analogy, the bigger the water pipe the less resistance and the more flow. The same is true for electricity, the bigger the wire the less resistance. Resistance or ohms is the third component that is correlated with voltage and current. They all work together. Ohm's Law deals with all 3 variables. Rarely will you have to measure resistance though. Typically you will use the ohmmeter setting to find short circuits or open circuits. A good example of this is an incandescent light bulb with a filament. If the bulb is good, the ohmmeter will read close to a short circuit, if the filament is broken, the ohmmeter will read nothing signifying the bulb is bad and there's an open circuit. Another example is perhaps you have a wire that doesn't seem to be working. You can do a continuity check. Your meter may have a continuity function with a buzzer. Place the red lead of the meter on one end of the wire and the black lead on the opposite side of the wire. It doesn't matter which end is which. If the wire is good, it will beep or you will get a reading on the meter. If there's no reading, then there's a break in the wire somewhere. The thing to remember is whenever you want to try reading resistance, the circuit or object must not have any power to it.

Batteries

There are 4 main components to a solar installation. Batteries, solar panels, controller and inverter. Let's look at these one at a time and break them down further.

Batteries are typically rated in amp hours. A battery is capable of producing a certain amount of energy for a given period of time before it becomes fully discharged. For example, let's assume I have a 100AH battery. Theoretically, that battery will be able to supply a load of 100 amps for an hour and then it's fully discharged. It can supply 50 amps for 2 hours before being fully discharged. You can see the progression of how this works. A 1-amp load could run for 100 hours.

Now let's assume I've run my load using my 100AH battery and now my battery is 100% discharged. In order to charge it back up, we need to have a charging source such as a solar array capable of putting energy back into the battery. If you have a solar array that only puts out 1 amp, then it will take 100 hours of full sun to recharge the battery. If your array puts out 50 amps, it will take 2 hours to recharge. One hundred amps and your battery is charged up in 1 hour. These are all basic concepts and really all you need to concern yourself with. I don't want to have your eyes glaze over and bog you down with complications such as efficiencies. Just know that nothing is 100% efficient so in reality in order to recharge the battery, it will actually take more time than what I stated. So, for example, if I drew 100AH (amp-hours) out of the battery, it might take 110AH of solar/wind power to recharge the battery because some of that energy from the sun is electrical energy while some is converted to heat. Don't worry about it, we'll add a fudge factor when we discuss solar panels.

The batteries are the means to store energy for later use. In Maine, I made the mistake of buying a car battery as my first storage and while it will work, it doesn't work well. The problem is with the design of a car battery. They are made to give a quick burst of current to turn the engine over for starting. They are not made to be drained completely and then recharged. Doing so shortens the life expectancy dramatically. What we want for our off-grid home is a battery that is made for deep cycling. Although marine deep cycle batteries are a step up, they still are a poor choice for off-grid. What you want is a true deep cycle battery made to take the punishment of being drained deeply and then recharged. There are some promising new battery technologies that are coming online but the best bang for the dollar in my opinion is still the old fashioned flooded lead acid battery.

If money is no object, then I would look at some of the newer technologies such as Lithium and lead/carbon. However, it's best to be seated when pricing these batteries. They are a significant investment. It will be worth doing the research and evaluating costs when it's time to install your system. Things change rapidly and there may be another form of battery that makes more sense. For both the Saskatchewan homestead and our new Nova Scotia place, we chose 2-volt cells for our 24 VDC off-grid system. It takes 12 individual 2 volt cells to make a 24 volt battery connected in series. Batteries also come in 6 volt and 12-volt packages.

Along with the flooded lead acid batteries, there are AGM (Absorbed Glass Mat) and Gel batteries. Those versions are sealed lead acid batteries with different life cycle characteristics and pricing. They are more expensive than flooded, but the big advantage they have compared to the flooded cell is that they are maintenance free. The flooded cell needs to be checked and over time, water needs to be added. Not a big deal really. Because they are maintenance free, they don't produce gas which is an advantage if batteries are located in the house. In Saskatchewan, we always had our flooded lead acid batteries in the house and I had them located in a ventilated room. Now our batteries are in the basement and in order to comply with code, I need to house them in a tight box that will be vented to the outside.

I planned ahead for this when we poured the concrete for our basement wall by putting in a vent pipe. That vent pipe will go to the battery box. A fan can be purchased specifically for this venting application. The fan is connected to the battery charger's auxiliary output. The purpose of the fan is to vent any gases the batteries produce while charging. Batteries only gas a lot when they are getting close to fully charged or when they are being equalized. The chargers these days are smart enough to know the relative state of the battery and they will automatically cycle the vent fan on when it is needed to discharge battery gas to the outside. The AGM and Gel sealed batteries don't have this concern.

Batteries can be connected in series or parallel. The rule is this: when batteries are connected in series, each battery voltage is added up to make the total bank voltage. Current in amps will be constant in a series connection. For batteries connected in parallel, the reverse is true. The voltage stays the same but the current capacity of each battery is added up. The best practice is to have all of your batteries be the same age and size. In other words, it will be a nightmare if you have batteries of varying age and/or different capacities. Please don't even try that. If you buy new batteries, they must all be the same amp hour capacity. If you find used batteries, at least make sure they are the same age and size. You should know that batteries can be hooked in a combination of series/parallel, but there really should be no need for a connection like that. Once you know the system voltage you wish to use, discuss the options with the battery dealer on how best to achieve that given voltage.

Typically, off-grid battery bank voltages are either 12V, 24V or 48V. Remember the water pipe analogy. The bigger the pipe, the more water can flow and the bigger the wire, the more current can be pushed through it. In a 12 V system, you need bigger wires to supply power to a large load. The higher the battery voltage, the smaller the wire diameter can be for that same sized load. So a 12 VDC off-grid system is fine for a very small system and 48V is best for a larger system. I favor 24VDC for the middle of the road.

Hockley Lake Batteries and Electronics

While we are on the subject of batteries, when selecting a battery, ask for the graph that shows life expectancy versus depth of discharge. This will tell you how many cycles the battery can handle before it needs to be scrapped. A cycle refers to any time the battery is discharged and then recharged. The more cycles and the deeper the discharge, the less life the battery will have. This is a really important point to understand. If you shallow cycle your batteries, you will get far more life out of them. We flew deep cycle batteries into our location in the wilderness and even though they were 17 years old, they were just as strong as when we purchased them. The secret was I would not let them discharge any more than 20% before I wanted to see them charged back up. I also made sure water levels were proper and terminals on top were periodically cleaned. These are expensive batteries and the little love and attention I gave them kept them going for a long time.

I suggest buying a good battery hydrometer which measures the specific gravity of the liquid in the batteries. That's the best way to really evaluate the state of charge of batteries. Relying on voltage is not a reliable method to determine battery health. Specific gravity measures the density of the liquid in the batteries. How much of the liquid is water and how much is acid. As the battery discharges, some of the acid is converted to sulphates by a chemical reaction that attaches it to the lead plates of the battery. When the battery is recharged, that sulphate then converts back to acid. The deeper the discharge, the more sulphate forms on the plates and over time, some of that sulphate remains on the plates. As soon as you get new batteries, number each battery with masking tape or a magic marker so that for the next 20 years or more, you will always know which battery is which. Make a sketch of the numbered batteries in a notebook and then record the specific gravity of each cell along with the date. In order to receive the best support from a battery manufacturer, it is best if you can prove to them you are a pro with batteries and this

New Batteries Numbered in Nova Scotia

is one way to do it. Each year, take specific gravity readings and continue recording these numbers through the years.

You will hear the term equalization in regards to batteries. Equalization is a forced charge into the battery with a higher voltage. That sulfate that collects on the plates during discharge sometimes doesn't all revert back to acid as it should. When you read specific gravity, the readings should all be very close to one another and should be close to the previous readings. If they are not, it's time to equalize and try to bring all the cells back in line with each other. By forcing current at a higher voltage, we are trying to clean the plates of sulfate and bring all cell specific gravities together again.

Solar Panels


Completed 3200-Watt Solar Array

Solar panels convert sunlight to electrical energy. They produce direct current (DC) voltage, a form of energy batteries can accept. There are different technologies with Monocrystalline and Polycrystalline being the common choices for panels. Both technologies work equally well these days so what you choose will come down to bang for the buck. What panels are on sale, what can be purchased to give you the most amount of power for a given space. The panels these days are very easy to wire since the connections can only go one way. Back in the old days, I had to make all connections in junction boxes; now the wires are all ready to connect together. A real good advancement.

The panels will need to be mounted either on a roof or ground mount. Just like a greenhouse, solar panels are best when the suns rays are directly beating down on the surface. But since the sun's angle changes through the year, unless you have a way to shift the angle each season, a compromise is in order. The rule of thumb is to set the panel angle to your latitude. There are some tweaks to that rule but to keep it simple, let's say panels should face due south with an angle set to your latitude. Here's a situation where we need to get our compass out and take declination into account. The panels must face south for maximum energy. Depending on your location the declination needs to be factored in to the compass reading to find due south.

A trick mentioned by my solar electronics dealer is to put a stick in the ground, mark the shadow every half hour starting at 10:00 to 2:00 and the shortest shadow is south.

Roof mounted panels were our choice in Saskatchewan. It was not a good choice but it was really our only option. We were in the middle of the forest and we needed to situate the panels as high as we could. The roof fit the bill. It was a great location as long as it didn't snow. Snow has a funny way of showing up in the winter when we need the power most. And northern Saskatchewan has a funny way of having winter show up in October and extend through April. A snow-covered metal roof on a 2-story building that is 100 miles from nowhere is a poor place to be, but I was up there countless times cleaning off those snow covered panels. To make the task as safe as possible, I mounted a wooden ladder affair to the roof to give me some footing and I always tied myself into a rope that was tethered to an anchor on the roof peak. I'll sum up by saying that snow covered panels are a major problem for roof mounted arrays. We now have a ground mounted array which is very easy to sweep off.

Charge Controllers

The charge controller is the component that goes in between your solar panels and the batteries. It is the regulator that senses when the batteries are full or they need more charging. Without some kind of regulator in the system, the solar panels will put all available power to the batteries whether the batteries need it or not. And if the batteries are completely full, there's a potential of damaging those expensive batteries by overcharging and generating heat. At the very least, the power is simply boiling the battery electrolyte away. Not only that, but your system voltage will rise to dangerous levels. You may damage other appliances and electronics that are connected to that high voltage. A charge controller is a must for the typical system for all these reasons.

There are 2 different types of charge controllers. PWM and MPPT. Instead of worrying about how the controllers actually work, I'd ask the distributor you are buying the solar panels from for their recommendation on the proper type of controller. The MPPT is the top choice if you confirm it will work with your panels. Both types have their use and more important is to know the theory on charging. A good charge controller will have 4 stages: bulk, absorb, float and equalization. The controllers are computer controlled but can be tweaked by the user if desired. But there are preprogrammed functions that monitor the voltages, current and time.

In the bulk charge, the controller allows the solar panels to put maximum power to the batteries. Once the controller senses that the batteries are getting full, it will drop to the next stage which is absorb. Now the controller is feeding the batteries a current that is regulated and it's the process of gently topping off the batteries to a full state of charge. Then finally, the charger goes to the float mode which is just enough of a current to trickle charge and maintain the batteries so they remain fully charged. The equalize state is the last stage and is only done when necessary. We discussed when that is needed in the battery chat.

Another consideration when buying a charge controller is to oversize it. For a little extra money, consider buying a controller that will handle double the capacity of your panels. That way, it will be very easy to upgrade and install more panels without having to buy a whole new charge controller. Or at least inquire whether the charge controller you buy can be connected to another controller if you decide to expand your array size. It might be wise at this point to also either install larger wire conductors that will handle more power in an upgrade or at least make sure the conduit that is used between panels and charge controller is large enough to make installing a second set of wires easy.

The wire that will connect the panels to the charge controller will be quite large and heavy. There are wire tables that help with choosing the right wire gauge given the distance the wire needs to be run. Here's the important consideration to keep in mind. The bigger the wire diameter: the lower the resistance, the lower the voltage loss and the more current the wire can carry. The converse is true. The smaller the wire: the higher the resistance, the higher the voltage drop (loss) and the less current the wire can carry. There will be a certain amount of loss in all wires due to resistance, but we want to limit it to a maximum of 5% but preferably less. No point generating lots of power from the panels and only half of it showing up at the charge controller. The distance between panels and controller, which is the wire run, will be part of the calculations. The longer the wire run of any wire diameter, the more resistance and the more loss. Just like our water hose analogy. Connect a length of garden hose to the faucet and there's lots of water pressure.

Connect 10 lengths of hose together and there's a lot less water pressure coming out. The moral here is to keep the runs as short as possible and use the right wire size to handle all the current the panels generate so 95% or more of the power makes it to the charge controller.

The Inverter

The inverter is a piece of electronics that takes our 24VDC battery voltage and converts it to 120VAC, so we can function like any typical house. In Saskatchewan, where we had a generator, the inverter also sensed when the generator was running, and then the inverter worked in reverse so it became a powerful charger to replenish our batteries. There are pure sine wave and modified sine wave inverters. Sine wave inverters used to be quite expensive. Nowadays, they have come way down in price and it makes the most sense to buy one of them in the power configuration you need. Sine wave power, which is alternating AC current, is what the utility company produces. So in essence, a radio or TV can't tell the difference between being connected to the utility company or an off-grid sine wave inverter. The 2 power sources are the same voltage and quality. Much like the charge controller, I suggest spending the extra money for a larger inverter since you will likely add more and larger loads over time and you will have everything in place to handle it. It will be able to handle simultaneous starting loads such as a refrigerator and freezer deciding to start at the same time. I'd go with a 4000-watt inverter if possible.

In addition to the 4 main components of a solar electric system, there are a host of other very important pieces. Some of those pieces include a combiner box that takes the output of various solar panels and neatly combines them all into a single run to the house, a disconnect so that the solar panels can be disconnected from the house electronics, a power center which makes it easy to professionally wire in the inverter and charge controller together and a battery main circuit breaker. A system monitor which is a sophisticated meter is very handy; I can tell at a glance what the state of my batteries is, what current is going in and out at any given time. I wouldn't want to be without one.

An Example Design

Now that we have a basic understanding of terms and components, we can start designing a very basic example system. The first step is to list everything in the house that consumes power, no matter how small and inconsequential it might be. Keep in mind, the inverter and controller will also consume some power and should be accounted for. You should be able to read a label on each item to find the power rating for the device. How long do you anticipate it running? The more accurate with this information, the better. For our example, let's say I have a refrigerator that has an energy star label of 240kWh/year, a 13-watt light bulb I plan to run for 5 hours/day and a TV that uses 82kWh/year. Let's say I like to watch TV with the refrigerator by my side so I can pull out a cold soda along with some sandwich fixings without having to get out of my chair; I turn the lights on during commercials to read solar design manuals.
Here's the calculations for the above scenario:

- 240kWh/365 days = .657kWh/day or 657-watt hours/day
- 13-watt X 5 hours/day = 65-watt hours/day
- 82kWh/365 days = .224kWh/day or 224-watt hours/day

In my example, those are the only 3 things I will power each day. (To keep this example simple, I have not included the power the inverter or controller uses.) So, I add up the numbers like this. 657+65+224= 946-watt hours/day.

I need a battery pack that can supply that amount of power each day. 946Wh / 24vdc = 39.4 AH. There's several things wrong with this conclusion. First, if I buy a 40AH (rounded up from 39.4) battery, I'll be draining it to stone cold dead every day and my battery life will be very short. Plus, I'm relying on the battery being fully charged every day so the next day, I can drain it completely again. What happens if the sun doesn't shine for the day? Or 2? Or 3? Now my soda is getting warm and I can't watch TV! We need a much bigger battery! That way we can shallow cycle it which makes for longer life and we have some spare power for the inevitable stretches of cloudy weather. For me personally, I don't want to drain my batteries more than 20%. We will use my number of 20% to continue the calculations, although up to 50% discharge is reasonable.

40AH / .20 = 200AH

So, a 200AH battery will give us a battery where we can drain it 20% daily and as long as it recharges daily, all is well with the world. But what about those cloudy days? I'll use 5 days of straight rain and/or clouds with no charging in our example. Our northern climates routinely see stretches like that in spring and fall.

200AH X 5 days=1000AH battery.

Now I can run my 3 appliances every day for at least 5 days, assuming I started out with a fully charged battery, and I'll only be 20% discharged after 5 days. Let me expound on a few more points. This example assumes no losses and 100% efficiency. There is no such thing. So by rights, we could add another 10% to the battery size to account for that. On the flip side, since my design parameter was a maximum depth of discharge of 20%, we really have some leeway on our batteries and if we went down to 30% on a rare occasion, no big deal. Some may say that only discharging 20% is ridiculous. I have the experience that tells me otherwise and my batteries will not be discharged more than 20% if I can help it. This example also included zero energy from our solar panels for 5 rainy, cloudy days. In reality, your panels will put something out during that time. It may not be a lot, but in 5 days, it will not be zero, so I did not factor that in as well. This was purely a worst-case scenario. You are free to set the number of days of clouds you expect and to discharge your batteries more. There is nothing set in concrete with this example. It simply illustrates how to go about making the necessary calculations.

The batteries are drained daily and we need a means to recharge them frequently. This is where the solar panels come in. They will produce energy to replace what has been taken out of the battery. Back to our example, if we take 40AH out of the battery daily, ideally, we put the 40 back in every day. If we have some cloudy days and take 40 out daily, we need a power source that has enough capacity to fully recharge the batteries when the sun finally comes out days later. Sizing an array is a balancing act between one that makes massive amounts of power that's wasted because the batteries are fully charged and an array too small where the panels can't produce enough to catch up with demand.

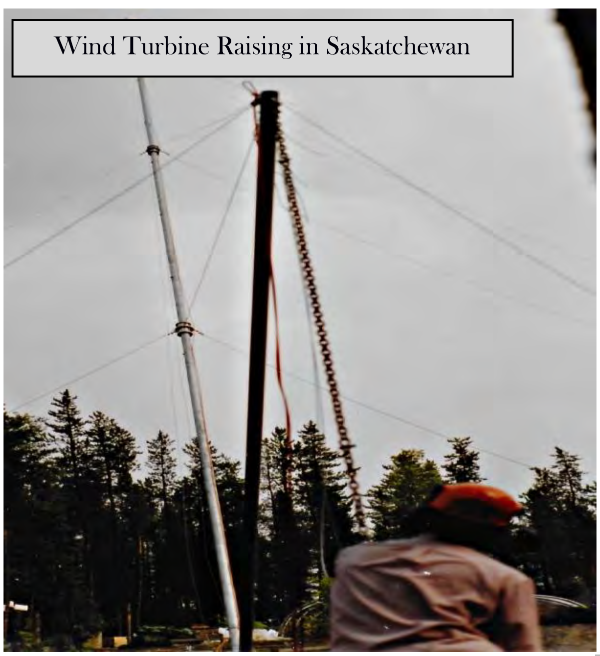
Assuming you have set the panels due north/south and the panels are set at the proper angle, we need to find out how much energy our chosen spot can produce. I also make the assumption the panels are in a clear, unshaded location the majority of the day. The panels need sunlight to produce power so any shade is a power killer. Climate has a great deal to do with the amount of sunlight reaching our panels. Insolation tables, measurements of average daily solar radiation for your location will be needed to pin down available power that can be produced. Plus, we need to factor in the fact that on the shorter solar days of the year in December and January we still need to provide enough power to recharge our batteries, otherwise we must find a supplemental source such as a wind, water turbine or generator.

Back when I tallied my 3 example appliances, I came up with a figure of 946-watt hours day. Let's round it up to 1000 WH/day. Based on insolation tables and this example, let's just say there are 5 good hours of average solar radiation each day through the year. That means that throughout the year, winter and summer, from sunup to sundown there is an average equivalent of 5 hours of prime sun each day. You would need to look up the insolation for your particular location to calculate your values.

1000 WH per day / 5 hours per day = 200 watts

One 200-watt panel should do it. But remember, we always have some losses due to inefficiencies. We need to add a fudge factor of at least 10%, better is 20%. So, let's make it 250 watts. But the short days of winter will still be a problem. With the cost of solar panels these days being relatively cheap, why not double it and get two 250-watt panels? That will speed up battery charging when a stretch of cloudy weather has taken the batteries down and it will supply enough juice to do a reasonable equalization charge for that 1000AH battery bank when that becomes necessary.

Phew! That was a lot of ciphering.


Wind Turbine Raising in Saskatchewan

Wind Turbines

I mentioned we added a wind turbine to our Saskatchewan homestead to create a hybrid system. I spent literally a few years in troubleshooting the two wind turbines we bought. Both were from the same manufacturer. I had the first turbine finally working when a freak wind storm destroyed it. So much for unfurling in the wind! The second replacement was bigger and supposed to be improved. I wrestled with that one and ultimately threw their junk controller away and wired in a real controller. Then it ran properly.

Winter, when the days were really short was when we needed to count on the turbine to pick up the slack. Unfortunately, every winter, when conditions were right, we would get ice fog which would form a thick ice rime on the turbine blades. We could have 30 mph winds and the blades would barely turn as a result. Talk about frustration. We hadn't seen the sun for a week, our batteries were below what I was comfortable with, it was too cold to get the generator to run easily and it was really windy outside but the turbine blades were iced up and wouldn't turn.

Turbines are mechanical devices that will need the occasional maintenance. Somehow, that turbine needs to be accessed, usually from a tilt-up tower or permanent tower.


Wind Turbine Being Raised at Hockley Lake

Anything mounted on the roof is small and certainly not on an optimal placement. Any tower is going to need at least 4, most likely 8 guy lines running in 4 different directions. Anchor points in the way of heavy concrete pads for these guy wires will need to be poured. For our ¼ acre sketch plot, the guy wires will be a major obstruction and hindrance for freely moving around on the plot. That's one reason I do not have a wind turbine in the sketch.

When we purchased solar panels for the wilderness home, they were about $5/watt. They are now well under $1/watt. In this day and age, it makes more sense to consider adding more solar panels and not worrying about a wind turbine. This is true not only from a practical standpoint but from an economical standpoint as well. A good wind turbine will cost considerably more than an equivalent amount of panels. Granted, a good turbine on a good windy site might have merit so I'm not totally ruling out turbines. Obviously a wind turbine makes power morning, noon and night as long as the wind blows. There may be some valid applications where wind power makes sense.


Gin Pole and Hand Winch

If you wish to have a wind turbine, you will need to locate it in an area that is ideally well above tree top or other obstructions. Figure at a minimum, the bottom tips of the turbine blades should be 30 feet above the tallest obstructions that are within 500 feet of it in all directions. Higher is better. You will need a tower that can pivot at the base and drop down so you can do maintenance if need be and a clear path for when the turbine is dropped down. In other words, the tower will drop down to the ground and there can't be any obstructions to impede where the tower and turbine rest near the ground.

A steel tower pointed skyward can be a source of real excitement during thunder storms. I am confident we were very lucky one summer. The inverter started to do some bizarre behavior during a lightning storm. Usually I powered the entire system down when a thunderstorm was threatening. By powering down, I was trying to protect our system from being toasted if we were struck by a bolt. But this particular storm didn't look so bad so I kept everything powered up. Lightning is odd stuff. I have no doubt a charge built up on our tower and affected the inverter. I'm thankful we had a lot of protection in place.

The protections we had in place were: our electronic system was grounded to an external ground rod, the house was grounded with lightning rods on the roof, chimneys were grounded to multiple ground rods, there was a lightning arrestor on the electronics in the house, there was a lightning arrestor at the base of the turbine tower and finally, I ran a heavy braided copper wire up to the top of the tower and splayed the individual wires out to form a fan shape to bleed voltage to a ground rod buried in the soil.

Living out in the bush was wonderful but that's about as close as I want to come to getting zapped. The consequences could have been catastrophic. The moral of this story is although there's no guarantee with lightning, having everything installed properly and over engineered is never a bad idea. Now you at least have a better sense of solar and wind power systems and can make some informed decisions on whether to join the off-grid crowd.

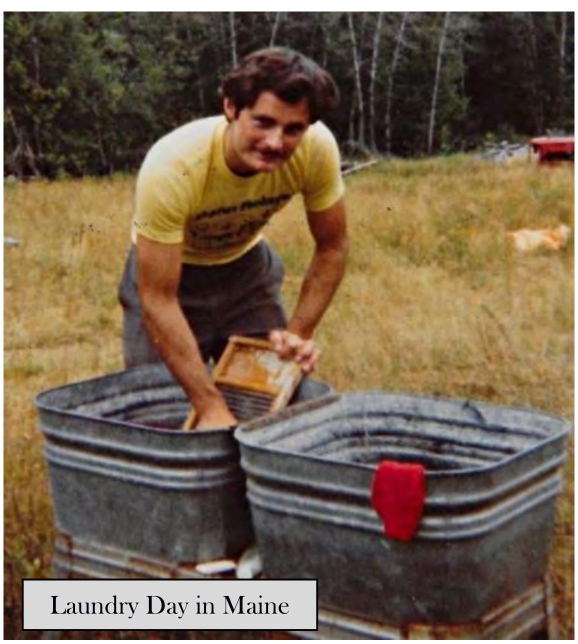
But before you take the plunge and unplug from the power grid, please take the time to fully develop your off-grid strategy. Formulate a game plan before you're faced with the reality of no water, lights, refrigeration or heat. Doing so will increase your chances of success significantly.

At the very least, you'll need to come up with an off-grid solution to the following. Without a doubt, there are as many solutions to each of these 6 issues as there are people who have unplugged and are living the dream.

1. water
2. power system
3. heating and cooking
4. waste disposal
5. food storage (as in frig/freezer)
6. laundry

Laundry Day While Living in a Tent

Most people take these 6 things for granted never pausing to think how much the grid plays into their availability. Access to water, light, heat and so forth are at their fingertips. When they turn on the faucet, water magically flows. When they flick on a light switch, the room is miraculously illuminated. If they're cold, crank up the thermostat. The house is always warm even when they are away from home for an extended period of time. No worries about frozen water pipes, no waking up to a cold house because no one got up during the night to shove wood in the wood stove. The toilet is always one flush away.



Laundry Day in Maine

Unless you think about how you'll meet these basic needs listed above and come up with a viable plan to implement, you'll decrease your chance of success when you unplug from the grid. Know that there are some things that are impractical for off-grid such as an electric water heater, electric heat, electric dryer and an electric stove/range. It would take a large system to power these and there are better alternatives. For example, an outdoor clothes line in summer and indoor wooden clothes racks for winter, instead of the dryer. A propane powered dryer is an alternative too. There are wood and gas-powered stoves to replace the electric range. Many factors need to be considered before taking the plunge and severing the cord that's tying you to the grid. How spartan a lifestyle are you willing to lead? Do you expect to continue with your current lifestyle, giving up as few conveniences as possible?

Just as important as how to power all the gadgets you have is how to select energy efficient appliances to do the job. Energy star rates appliances and you can use their information to guide your selections. Using energy efficient light bulbs is another means to conserve power consumption. Many of the devices manufactured these days have what are called phantom loads. Even though the appliance isn't running, it's still drawing and wasting power. By itself, that's a tiny amount of power being wasted, but when you add up all the gadgets in the house with phantom loads, the power wasted starts to add up over the course of weeks and months. Just something to keep in mind when shopping for devices. Things such as TV and computers can be plugged into outlet strips and then those things can be powered down at night when they aren't needed. Every little bit helps conserve power.

Our Singer Treadle Sewing Machine Uses No Electricity

Chapter 8 – The Orchard (OR)

Below is a table giving information on various fruits. We've included info on yields, spacing and where we recommend planting per the sketch. More details can be found in individual sub-sections. Johanna and I have teamed up on the orchard, garden and food preservation chapters so much of the following information is written by her from her wealth of knowledge and perspective.

Fruit Table

Fruit	Where grown	Spacing	Yield/ Plant or Square Ft.
Strawberries (100 plants)	SB (30 plants in 2 rows) BP1 (70 plants in 4 rows 35' long)	2' apart in rows 3'apart	Junebearing 1 quart per plant Everbearing ½# to 1# per plant
Blueberries (2 to 3 bushes per person)	BP1 (9 plants spaced 3'apart)	3' to 6' apart	Initially 7 oz. per bush. 3 to 4 quarts when mature
Raspberries (4 to 5 plants per person)	BP2 (16 plants 2' apart in 2 beds that will eventually fill in)	2' apart-canes from roots will fill bed or row	1 quart per plant
Blackberries (3 to 4 canes per person)	T6 (2 plants will eventually fill row)	4' apart-canes from roots will fill in row	1 quart per plant
Grapes (2 vines per person)	T4 and T7 (6 vines spaced 6' apart)	6' to 8' apart	10# to 15# per vine
Currants and Gooseberries	BP2 (6 plants in any combo-2 black currant, 2 red currants, 2 gooseberries)	5' apart	Currants-at least 5# per bush Gooseberries-4 quarts per bush
Saskatoons (also called Juneberry and Service berry)	T3 partial shade (3 bushes 6' apart)	6' apart	4# to 5# per bush
Rhubarb	T3 partial shade (2 plants 3' apart)	3' apart	4 to 12 stalks per plant

To us, establishing a successful orchard is more difficult by far than establishing a vegetable or herb garden. We are establishing our third orchard and hope to have better success than we've had in the past. We've always had good luck with the "small fruits" to the point where we've had enough to freeze for winter, make some jam, as well as eat our fill when they are fresh, but have had great difficulty with fruit trees. Not necessarily our fault. Hare and moose grazing along with mice girdling pretty much decimated our Saskatchewan fruit trees.

What nursery stock you decide to order is highly individualized and is governed by your food preferences, eating habits, how much room you have to plant things, the growing zone in which you reside, how much time you have to devote to food production, as well as what your intended goal is. We strongly suggest you contact your county extension agent for information on what fruits and their varieties are recommended for your location. This will at least give you a starting point for possibilities and you can do more research from there.

Your budget is another factor to consider. Fruit trees and other nursery stock are expensive. We are establishing an orchard here that includes the "small fruits:" raspberries, blackberries, blueberries, strawberries, currants, gooseberries and grapes. These are so named because fruit forms on small perennial plants versus trees. Our orchard also includes trees of pears, plums, cherries, apples and even a couple of hardy peach varieties. Due to budget constraints, we are acquiring our nursery stock over a 2 year period of time.

Growing Zones

When ordering nursery stock, be sure to order varieties that are hardy for your locale. All nursery catalogs state what growing zone each variety is hardy to so you can use that info when making selections. Growing zones have been established for both the USA and Canada. Gardeners can use them as guides to determine the climate and environmental conditions in their area thus enabling them to make educated guesses as to what plants will survive where they live. In the United States, the USDA plant hardiness zone map is the standard gardeners use. The map is based on the average yearly minimum winter temperature and is divided into 10°F zones with zone 1 being the harshest and 13 the mildest.

In Canada, Ag Canada developed their map based on the minimum winter temperature, length of frost free days, summer rainfall, maximum temperature, snow cover, January rainfall and maximum wind speed. The map has nine zones with 0 being the harshest and 8 the mildest. Both countries update their maps periodically based on the latest climate data.

In general the harsher the climate the fewer types of fruit can be grown. In severe climates such as where we resided in Saskatchewan, assorted berries and a few hardy tree varieties may be the only option. The flip side is if you live in a hot climate where you can grow pineapples, mangoes, citrus fruits and the like, you probably can't grow the colder climate fruits such as apples and pears. So count your blessings and make the most of what you can grow wherever you live.

Blossoming Apple Trees at Hockley Lake

You should remember all the maps and zones are guides. Areas may have microclimates created by natural land features or man-made features.

Microclimates are climates that differ from that of the surrounding area. Use microclimates created by windbreaks, buildings and bodies of water to your advantage when it comes to your orchard. Trees, bushes and tall hedges or buildings on the north side of a property give protection from cold winter winds. In fall, a nearby water body (pond, lake or ocean) may help delay the first frost as the water is a heat sink of stored heat from the summer sun. Conversely, in spring, that same water body will radiate cold for quite a spell and take much longer to heat up than the surrounding countryside. Lots of fog and late spring frosts are the result.

As we mentioned before, it is possible to create your own microclimate too. In Maine, where we were in zone 3, we planted grapes on the south side of our house. By doing so, we effectively increased our zone from 3 to 4 thus enabling us to raise grapes where none had been raised before, much to the amazement of the locals.

It's fine to buy nursery stock varieties that are hardy to a zone colder than yours but it's inadvisable to purchase something that is hardy to a zone more moderate than yours. For example, when we homesteaded in Maine and were in zone 3, we selected items that were hardy to zone 3, 2 or 1. If we opted for a tree species hardy to zone 4 or warmer we would have been taking a big gamble.

In northern Saskatchewan, we were in zone 0. We could find no nursery stock that was supposed to survive in this extreme climate so we made the best selections we could and ordered items that were hardy to the coldest zone we could find, zone 3, and planted those. We were able to grow raspberries, strawberries, saskatoons, red and black currants, gooseberries and sand cherries. We can only surmise that few people attempt to grow fruit in zone 0 so no nursery is aware just how hardy these plants are. Many of our fruit tree selections had hardy rootstock and survived fine but sadly mice girdling top killed all our trees above the graft.

Now we are in zone 5, which is almost like the "tropics." As a result, we're hoping to have better luck than we've ever had before with fruit trees. Nevertheless, we have chosen varieties that are hardy to zone 4 or less to increase our chances of success.

A word about where you order your nursery stock. I would avoid ordering from a nursery that's located in a zone warmer than where you live. The plants will be better adapted to your zone and will have a better chance of survival if they were raised in a colder zone or in the same zone as your own. For the Maine homestead, we could have bought plants from several southern nursery companies. Even though they had varieties that were supposedly hardy to our zone, the fact that they started life in zone 5, 6, 7 etc. certainly minimized their chances of surviving a northern Maine winter.

In addition to plant hardiness zones, we used other criteria when choosing our nursery plants, chiefly disease resistance. Because we want to keep our spray program to a minimum, we need varieties that have some resistance to things such as fire blight and scab. We also selected varieties based on their end use. For instance, we want some early "summer" apples which are good for sauce and fresh eating but which don't store well. We also want some "winter" apples which mature in late fall and will keep for

Poor Fruit Site Selection in Maine

months in the root cellar. For pears not only do we want disease resistance but we also want varieties that are good to eat fresh as well as to can. Lastly, we want our orchard to include some tried and true Heirloom varieties. All these factors played into our decisions when choosing our nursery stock.

Fruits generally grow best in full sun. The soil should be well drained so there are no water puddles after a bout of prolonged rain. I can't emphasize how important this is. Our orchard site in Maine was poorly drained and had standing water every spring. The shallow rooted small fruits survived but most of our fruit trees died as a result of poor drainage. If you have a hilly piece of property, avoid planting fruit trees in the low spots as cold air sinks creating a frost pocket. On the other hand, avoid planting on the crest of a hill too since the trees would be exposed to winds. Speaking of winds, if you live in a windy area, using a windbreak, be it buildings, tall hedges or other protection will be advantageous. You would be creating your own microclimate as I mentioned earlier. When it comes to properties that slope, be aware there are advantages to both north and south facing slopes. South facing slopes are warmer so fruits will flower earlier, but this makes them more prone to damage from spring frosts. Plants on north facing slopes will delay blooming because these areas are cooler.

Berry Planting (BP1, BP2, SB, T3, T4, T6, T7)


Bowl of Fresh Picked Strawberries

We love strawberries. In Saskatchewan, they were our most abundant cultivated fruit. One year we got a record 130 quarts! Two basic types of strawberries exist, June bearing and everbearing. June bearing strawberries yield all their fruit in a 3 week or so window and then are done for the season in contrast to the everbearing types which, once they start producing ripe berries, will continue to bear fruit right up until frost, at least in our location. We've grown both types and both are equally delicious. But if you're trying to optimize your return, everbearing varieties seem to make the most sense since you'll get fresh strawberries all summer long unless you live in a hot climate.

We start a new bed of strawberries in the spring, with plants spaced 2' apart in rows that are 3' apart. In the deep south, plant in the fall for a crop the following spring. When you plant, fan out the roots and be sure the crown is above the soil surface but not so high the roots are exposed.

Once the strawberries have established themselves, they will give you a crop year after year. Each summer, they will send out runners which will take over the garden if allowed. To keep the tenacious runners under control, Ron goes up and down the rows every few days and either pinches or cuts most of them off. He will allow some runners to fill in the rows more fully. The only other time he lets the runners grow is when, after many years, the plants seem to be producing less and the bed needs to be rejuvenated by a new planting. To do that he'll dig up half of the strawberry bed and replace it with young runners that have rooted. The following summer, he will replace the other half of the bed. This way, we always have half a bed that is producing for us and over the course of 2 years, the bed is replanted with new stock ready to give us strawberries for years to come. Strawberries are self-perpetuating this way and can give you plants for new beds for a long time. If over time, the strawberries become less productive, then replant the bed with brand new purchased stock and start over.

In the sketch, we situated a strawberry bed in front of the greenhouse (SB) simply because these are plants that can withstand the winter snow load when it slides off the greenhouse. Mulching in the fall helps protect the plants too. We figure about 30 plants will fit in this area in two staggered rows. For us that would not be enough so we would put the rest of the plants in the berry patch (BP1) that is just off the front walkway. For the 2 of us, we have 75 strawberry plants. For a family of 4, we would want at least 100 plants. June bearing varieties yield about 1 quart of berries per plant. Everbearing types yield ½ to 1# per plant. Keep in mind, as with the vegetables, these estimates are a guideline only. Different varieties and growing season will affect yields from year to year.

Blueberries like acid soil. For us that has never been a problem since our soils have always been acidic with a pH of 4.5 to 5. If you need to acidify your soil, add peat moss or sulfur both of which are available from garden centers. Blueberries come in highbush and lowbush varieties. Obviously with high bush varieties yields will be greater since the bush is bigger. They will also be easier to pick. Blueberries need more than one variety for pollination. A minimum of 2 varieties is required, 3 is better. Blueberries can be planted anywhere from 3' to 6' apart. The object of pruning, which usually begins at about year 3, is to be sure the bush has a good supply of young branches since fruit forms on wood that formed the previous season. By the time a branch is 6 years old, it's past its prime and should be pruned out letting new growth replace it. See food preserving chapter for ways to preserve blueberries.

Referring to the sketch, in the berry patch (BP1) which is just off the walkway, there should be enough room for not only the extra strawberries but 9 blueberry bushes spaced 3' apart. For a family of 4 that works out to a little over 2 bushes per person. By the third year each bush should produce about 7 ounces of fruit and the yield should steadily increase until years 6 to 8 at which time each bush should give 3 to 4 quarts. I would plant the blueberries to the north of the strawberries so the bushes don't shade the strawberries.

Raspberries are a bramble fruit that grow to a height of 5' to 8'. There are black raspberries, red raspberries, yellow raspberries which are a mutant of the reds, and purple raspberries which are a hybrid of red and black. We've grown reds and yellows and of the 2 the yellow was much sweeter. Raspberries are self-fertile so don't need more than one variety for pollination.

All the kinds of raspberries are easily propagated. Canes of red berries are upright and will send out new canes from roots of the mother plants which can be dug up and replanted elsewhere. Canes of black raspberries trail meaning the canes bend over and root themselves in the ground. These can be dug up and transplanted. We space our raspberry plants 2' apart in rows. To support the canes, we pound stakes in the 4 corners of the row and run wire around the stakes creating a "block" that's maybe 2' wide. A soil pH of 6 is about right.

Pruning method is determined by the type of raspberry. Summer bearing (regular canes) bear on second year canes (last year's canes) called flurocanes. Immediately after harvest, cut out the old bearing canes to make room for the new ones allowing 4 of the best new canes per foot of row and trimming out the other new canes. Everbearing types (primal canes) bear fruit on first year canes called primocanes. Cut canes that bore fruit to the ground in late fall or early spring. They produce a full crop that summer on the new canes.

If you don't want the trailing types to tip root and make new plants, you can snip the tip when the canes reach about 3' high. Black raspberries are usually summer bearing so prune as above, then "tip" them when they reach 3'. If you have porcupines where you live, be aware they love raspberry canes and will devour your patch unless you take precautions. Sadly, we learned this first hand and will need to put up an electric fence around the berry patch.

Raspberries are a soft, fragile fruit. Any that can't be eaten fresh mold readily, therefore surplus should be preserved by freezing, canning or making into jam. See food preserving chapter.

In the sketch, the berry patch (BP2) would be a good spot to plant raspberries. Each plant will give about 1 quart of fruit. Allow 4 to 5 plants per person.

Blackberries are a bramble fruit that produces new canes by suckering from its roots which easily fills up the row in a couple of years. We planted 2 new canes 4' apart figuring the row will fill in naturally. They bear fruit on second year canes which should be removed after the harvest. Blackberry canes can either be erect or trailing. When erect varieties reach 5' they should be pruned back 3" to 4" to stimulate branching. Next season, as soon as those canes are done bearing, they are cut at ground level. Trailing types can be pruned to 10' in length then arranged on a trellis. Just like the erect types, once the canes are done bearing, they are cut off at ground level.

We've never lived where we could grow blackberries before, but are looking forward to our first harvest of them from canes we planted last spring. Wild blackberries grow in profusion here so we see no reason why the cultivated type shouldn't thrive here as well.

The trellis T6 located just behind Berry Patch (BP2) would be a dandy place to grow blackberries. Starting with 2 canes should be adequate as the row will fill in with new plants that spread from the roots. Each plant should yield about 1 quart of fruit. If you allow 3 to 4 canes per person, you will likely have an ample harvest.

Currants are an often-overlooked fruit. Their cultivation may even be forbidden in some states due to the threat of white pine blister rust. Fortunately for us no such restrictions have ever applied. Both red and black currants are extremely hardy, much more so than any nursery catalog indicates. Ours survived actual temperatures of -57°F when we lived in Saskatchewan. In fact, the black currant is so tough it always started leafing out before the snow was completely gone.

Fruits of black currants are the size of large marbles. As they ripen, they go through color changes turning from green to purple to black, the color when they are fully ripe. They can be used to make a good jelly, but I prefer to make juice out of them. One black currant bush yields enough berries to make quarts and quarts of juice. One year I put up 28 quarts of juice from our one bush. Not bad considering the bush was only about hip height.

Black Currants at Hockley Lake

We planted our currants 5' apart in a location that got full sun. Full sun helps to prevent powdery mildew. Early spring is the time to prune currants. Cut out any branches that are damaged, not vigorous or more than three years old. The literature says to have 3 one-year old canes, 3 two-year-old canes and 3 three-year-old canes, but we generally have a few more than that in each age category, probably more like five to six canes in each age class.

While smaller in size, about that of a large pea, red currants also make a great juice as well as a fantastic jelly. Because both red and black currants are naturally high in pectin, addition of commercial pectin is not necessary in order for them to gel. In my experience, red currants seem to be prone to powdery mildew and if I'm not diligent with my spray program of sulfur, I lose out on the fruit. Interestingly our black currants have never been bothered with powdery mildew.

We've only ever purchased one red and one black bush, but have expanded our numbers of each through mound layering. This is easily done by selecting a branch close to the ground, gently scraping off some of the outer bark, applying some rooting hormone powder, bending the branch down until it touches the soil, piling more soil on top of it and weighting everything down with a rock. Eventually roots form where the bark was scraped off. Next I clip off the branch and plant in a new location. This will grow into a new bush.

Gooseberries are another little know and cultivated fruit. They are extremely hardy and do best in the northern half of the US but like currants may be banned in some states due to the threat of white pine blister rust. Gooseberries are a 3' to 4' tall shrub that should be planted about 5' apart. Pruning guidelines are the same as for currants. The fruit is roughly the size of a marble and contains enough natural pectin to gel on its own which is fortuitous since they make a great jam. When ripe the green berries turn dark purple. As with currants, they are easily propagated. In fact, in my experience they are even easier since if a branch merely touches the ground, it roots. Despite being armed with ½" thorns, hares or rabbits will gnaw on these branches if not protected by a fence of chicken wire.

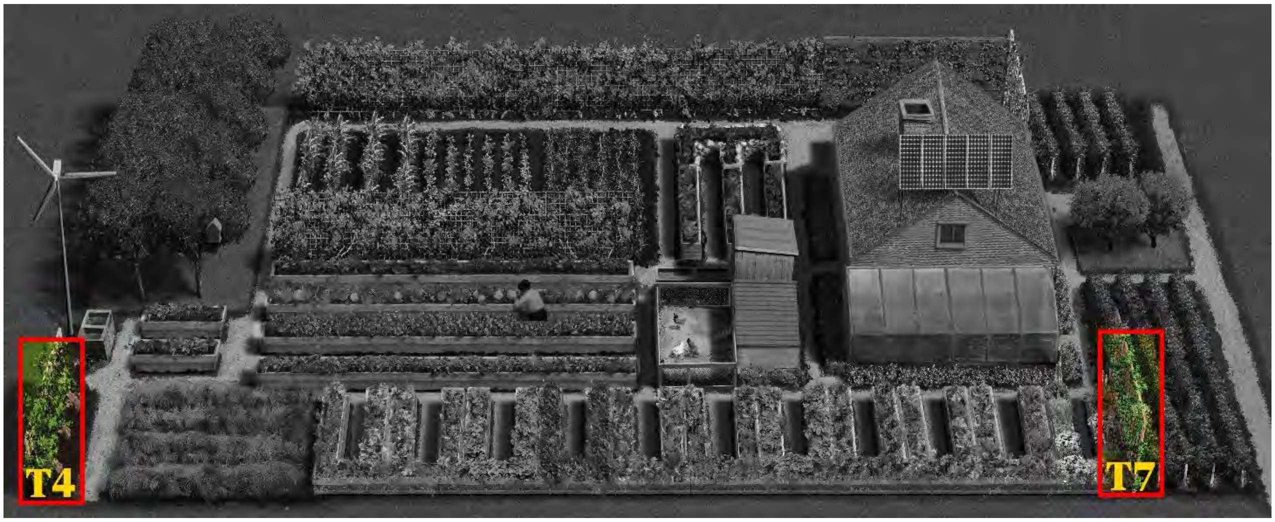
Both gooseberries and currants can be planted in the Berry Patch (BP2) One to 2 plants of each should be adequate. One gooseberry plant yields 4 to 5 quarts of fruit. While I never weighed the fruit, I'm sure our 1 black currant bush gave at least 5 pounds of fruit each year.

Saskatoons, also known as Juneberries or Serviceberries, are large shrubs native to the prairie provinces. But they are extremely hardy which is why we were able to grow them in our harsh environment when we lived in Saskatchewan. We planted ours 6' apart. We located these fruits in T3 on the sketch. We always pruned out old, damaged or less vigorous branches in early spring while the plants were dormant. We could be assured of a good crop if one, we had warm weather when the 6-8 foot tall bushes were blooming so the bees were out pollinating and two, we used netting to protect the berries against bird predation. Powdery mildew was a problem, but I controlled it with a spray program of sulfur.


Saskatoons Grown at Hockley Lake

Saskatoons are a marble sized, blue colored fruit that are good eaten fresh, made into jam or frozen. In winter I would add some frozen ones to our other frozen berries to form homegrown berry compote that we had just about every winter day for breakfast. Additionally, they can be used much like blueberries in muffins, pies and crisps.

Grapes (T4, T7)



We were able to grow grapes in northern Maine (zone 3) by planting them in full sun on the south side of our house where we effectively were growing them in a zone 4 microclimate, and by selecting cold hardy varieties. Grapes can be classed as viniferas which need warm climates such as California, or labruscas which are winter hardy so labrusca type varieties are the best choice for us.

We are planting several varieties here in Nova Scotia to see which do the best, then we'll propagate those by cuttings. Grapes need a soil pH around 6 to 7. They are spaced 6' to 8' apart. Dig holes wide enough to thoroughly fan out roots and gradually fill hole tamping soil around each whorl of roots. Unless the nursery has pruned the grapes for you, all but 2 or 3 of the strongest vines should be removed. Eventually, as the grapes grow, they will need some sort of support such as 2 horizontal wires strung between posts.

Fruit is always borne on woody growth of the previous season. One goal of pruning is to keep fruit production as close to the main trunk as possible so nutrients and water don't have far to travel. Pruning should be done in late winter to minimize risk of the vines "bleeding" sap which attracts undesirable insects and fungi. The first year, you are trying to establish the main trunk. To do that, if there's more than 1 shoot, select the best one and trim the others back flush to the main trunk. Then cut that shoot back to 2 or 3 buds above where it started growing from the main trunk the previous spring. As this shoot grows, attach it to the support system you have chosen.

The next year the goal is to establish the lateral branches by cutting the main shoot back to a few inches below the bottom support wire. As the shoots grow from buds below the cut, tie the most vigorous shoots to the wires trimming out the weak ones by cutting them flush with the trunk.

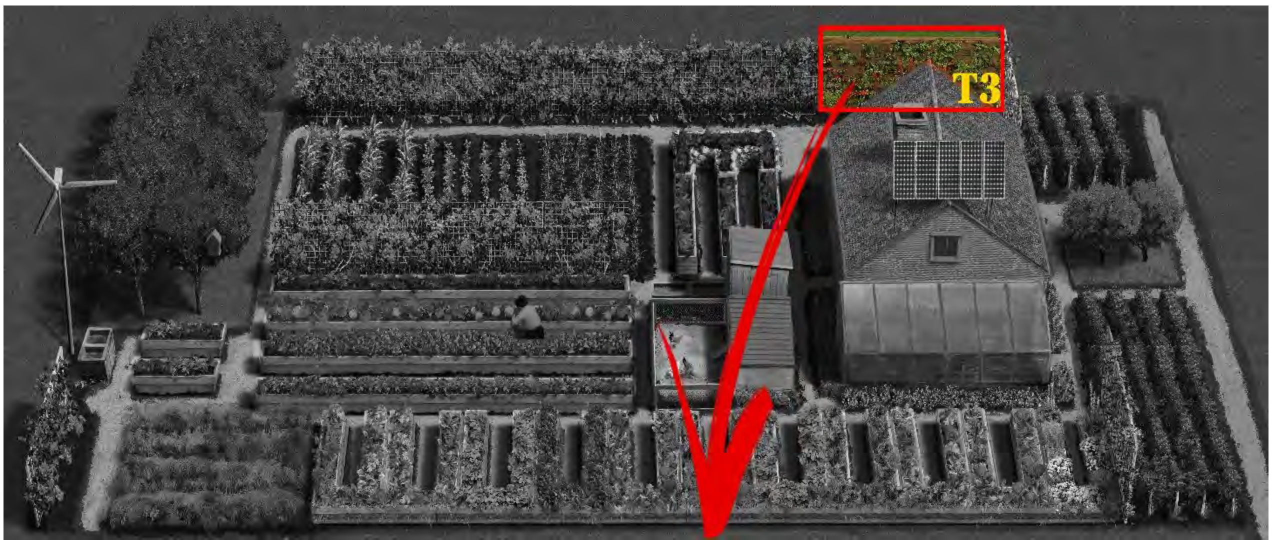
In the following years, the principle is to remove canes that bore fruit the previous season and to use some of the new canes that have developed to provide fruit for the coming season. So, in essence you're removing as much of the old cane as possible, while at the same time making way for the new wood that will bear fruit. When removing the old canes, leave 1 or 2 buds (called renewal spurs) at the base of the old cane to provide new canes for the following year.

One of the easiest ways to prune grapes is to utilize 2 horizontal wires and have 2 canes headed to the right of the main trunk (one on the top wire and one on the bottom wire) and 2 canes headed to the left of the main trunk. Remove all shoots between the wires. You're aiming for 4 canes (or maybe even 6 canes) with

5 to 10 buds on each and 4 (or 6) renewal spurs with 2 buds each. Grapes don't ripen after picking so judging when to pick is important. Look for the stem to brown and shrivel slightly. Taste the grapes to see if they are sweet. To harvest, use clippers to cut the cluster.

Generally, 3 grapevines per person are suggested. In the sketch, grape trellis T7 as well as T4 would accommodate a total of 6 vines with a spacing of 6' apart. Each vine could yield between 10 to 15 pounds of grapes. If you feel those 6 vines would not be enough, you could always plant grapes on trellis T6 if you were willing to forgo blackberries.

Rhubarb, a Vegetable or a Fruit? (T3)



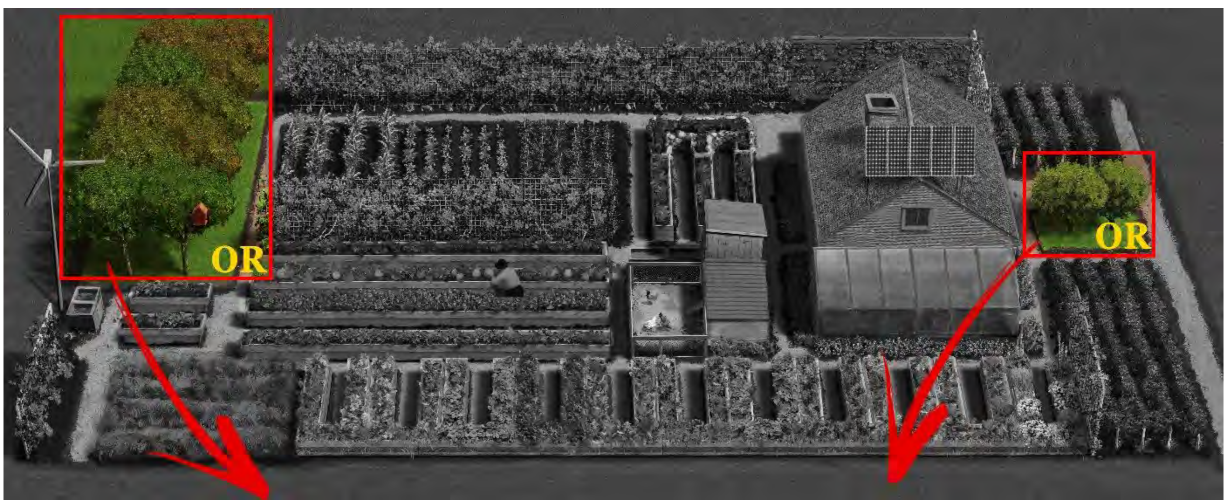
Botanically rhubarb is a vegetable, but since most of us use it as a fruit in sweetened desserts, I'll discuss it here. Rhubarb is a long-lived perennial that is one of the first edibles of each new gardening season. The first sign of emerging shoots is a harbinger of spring. Its harvest period runs 8 to 10 weeks. Only the stalk is edible as both the roots and leaves are poisonous to humans. Leaves can and should be relegated to the compost heap.

Rhubarb prefers cool weather. Since it needs a dormancy period brought on by its crowns freezing, areas where winter temperatures are above 40°F aren't good rhubarb climates. It can tolerate shade but prefers full sun. We usually plant it in front of a structure where we create a microclimate. Doing so means the plants will start producing earlier, which for us is always exciting as it means spring is finally here. On the sketch, the trellis T3 is a solid wall structure that not only acts as a privacy fence with the neighboring property but also acts to create a microclimate for the rhubarb planted in front of it. If the trellis wall is painted white, light would be reflected on to the plants.

A soil pH of 5 to 6.8 is acceptable. The soil must be well drained and well prepared with compost, rotted manure, bone meal and topsoil. The prepared hole should also be somewhat large, 18" in diameter and 18" deep, as by nature rhubarb is a large rangy plant. Plant the crowns 2" to 3" deep. Space them 3' apart. One crown is satisfactory to start with. You will be able to propagate more when the plants need dividing in about 5 years' time. Obtain your first crown by purchasing it or by getting one from a fellow gardener who is dividing his/her plants. Every 5 years, established plants need to be dug up and divided so they don't become crowded and stunted. Do this when the plant is dormant in the fall or early spring. Simply dig it up, chop it up so there are at least 2 buds or eyes on each piece and replant the "new" crowns in your prepared holes.

No stalks should be harvested the first year since the object is to establish a strong plant. The second year, a few stalks can be harvested, but by the third year harvest can begin in earnest by picking stalks that are between 12" and 24" in length. Never pick more than half the stalks as that can undermine next year's harvest. To pick, pull while twisting the stalk at the same time. When seed heads start forming, they should be cut off so energy goes to the root and not to seed production. Rhubarb can be used in pies, crisps/crumbles, in baked goods such as muffins and I even make a delicious juice with it. (see Food Preserving chapter) It's easy to freeze too by simply washing, chopping and throwing in a freezer bag. As far as yields are concerned, expect between 4 and 12 stalks per plant. Since the stalks can be up to 24" long, that translates to quite a bit of food from an otherwise undemanding plant.

Fruit Tree Planting (OR)



As I've previously mentioned, what tree fruits you can grow will depend on your climate. In really cold areas you are limited to apples or just crabapples. Generally speaking the more moderate the climate the more numerous the kinds of tree fruits you can grow but if you go too far south the cold fruits such as apples can't be grown. So, if you can grow oranges, apples are unlikely to grow.

Many fruit trees require a pollinator in order to bear fruit. Apples, pear and some varieties of plums need at least 2 different varieties to ensure pollination. When we homesteaded in Maine we planted several different varieties of pears. All died but one. This was a beautiful tree and it bloomed like crazy but sadly it never gave us any fruit since it never had a second variety for pollination. When it comes to plums, there are European plum varieties that pollinate each other and Japanese plum varieties that pollinate each other. But in general a European plum will not pollinate a Japanese plum.

Peaches and sour cherries (pie cherries) are self-pollinating and don't need a second variety for pollination. In regards to sweet cherries, some varieties are self-pollinating while others need a pollinator so pay attention to this when planning what varieties to buy. If hardiness is an issue for you, be aware sour cherries are more hardy than sweet cherries.

The orchard area on the sketch (OR) can accommodate 10 trees. Because apples are so versatile and can be stored for months in a root cellar, provided you have selected a storage variety and your cellar has the right storage parameters, we would suggest 4 apple trees. Personally, I would want a “summer” apple, 2 winter apples for long term storage and a fall ripening apple. If possible, I would try to select varieties that are all purpose meaning, they can be used for cooking, fresh eating as well as canning. I would have 2 pear trees, 2 peach trees and 2 plum trees. For pollination reasons, 2 plum trees are a must and they should both be either European or Japanese, not one of each. The orchard complements the cherry trees in the front yard next to the driveway. If you want sweet or sour cherries, bear in mind the sour are self-fertile so you can get by with 2 of the same variety whereas the sweet cherries may need a second variety for pollination which is why 2 cherries are planted together next to the driveway.

Another factor to consider when selecting fruit trees is their rootstock. Every fruit tree is made of 2 parts, the rootstock and the variety that is grafted on to it. There are many different rootstocks, each with their own characteristics that determine things such as hardiness, the age at which the tree will start to bear as well as the size of the tree; will it be a dwarf, semi-dwarf or a standard sized tree.

As a rule, standard rootstock produces trees that are extremely rugged and hardy because their roots go deep. They are more tolerant of poor soil conditions, are very long lived as in decades of life, and are more capable of thriving even if somewhat neglected. But the tradeoff is standard sized trees are large and take more space. Although they can be planted as close as 10 to 15 feet, a spacing of 20 to 25 feet is better, however pruning and thinning can keep a tree from getting out of control. Also be aware that standard trees take more years to begin bearing fruit.

Semi-dwarf trees are smaller so they can be planted closer together, something like 15 to 20 feet. They grow 50% to 85% of the size of a standard tree.

Generally, dwarf rootstock produces very small trees, less than half the size of a standard tree at maturity. This makes them easy to spray, prune and pick. They also take up very little space since you can plant them 5 to 10 feet apart thus they are a good choice for those with limited space. Dwarfs bear at a very early age, but they aren’t as long lived as other sizes of trees nor are they as hardy. Because the tree’s root system is shallow, they are more susceptible to poor soil conditions and must always be staked to give them support in heavy winds.

Assuming you have mail ordered your trees from a nursery, planting instructions will likely be included and we would suggest following their advice. If no such instructions are available, here’s some info you may find helpful. When the trees arrive, immediately open the package and be sure the roots are still damp. They will likely be surrounded by sawdust, wood shavings or shredded newspaper and this material should still be damp. Ideally you want to plant the trees immediately. If you can do this, soak the roots in a bucket of water for several hours, but no more than 12 hours, prior to planting. If you can’t plant them immediately, be sure to keep the roots damp and cool. You may even want to “heel them in” by digging a shallow trench and placing the trees in the trench so they are at an angle. Backfill with dirt and keep it moist. Plant as soon as you can. No matter when you do the planting, at no time should you allow any of the roots to dry out by being exposed to the sun or wind.

To plant, dig a hole that is big enough to accommodate the roots without them being curled around. Usually a 3’ X 2’ hole is big enough. Remove and discard all large rocks. We like to keep the topsoil separate from the subsoil so we can put the better quality topsoil around the roots and the subsoil on top of that. We also add some bone meal to the soil that will be around the roots, but we never add fertilizer or fresh manure to soil that will be in contact with the roots as those materials can burn the roots. Addition of lime to soil to achieve a pH of 6 to 6.5 may be necessary. We would not use wood ashes in this case to raise pH since ash may burn the roots if it's in direct contact with them.

When planting the tree, we keep it in a bucket of water until we have the hole ready then set the tree in the hole so the graft union, which looks like a bump or a bulge, is 2" to 4" above the soil level. Sometimes we make a little cone out of the soil in the hole and set the tree on the cone so it will be at the right level. Then we carefully spread the roots evenly around the hole packing the soil as we go so there are no air pockets. Halfway through backfilling we'll give the hole some water to settle in the soil then finish backfilling and end with a final watering. Leaving a ridge of soil around the edges of the hole to create a saucer to hold rain water is a good idea. When finished, we soak the soil with water and apply a layer of shredded wood chips as mulch being sure we don't get this right up against the bark because that would attract mice which will chew on the bark and girdle the tree. Because we have trouble with hares and rabbits gnawing on our trees, we protect them with a wire cage barrier. You may want to stake the young trees too to prevent them from being whipped around by the wind. This is especially true for dwarf trees since they have such shallow roots.

If the tree is a one-year whip, trim the leader back by ⅓ to compensate for any roots that were lost when the tree was dug up at the nursery. For 2-year-old trees, the goals of pruning are to remove dead or diseased wood and have a balanced framework of 3 to 5 branches that head off in different directions evenly distributed around the tree. That basic arrangement will form the foundation or scaffold system of main branches. Any branches whose angle is 45 degrees or less in relation to the trunk should be removed as they are more likely to break under heavy fruit loads.

In subsequent years, pruning is done to remove dead, damaged or diseased wood, any suckers that come up from the roots, water sprouts that grow straight upward from other branches and any branches that rub against each other or grow into the center of the tree. The object is to prune what is necessary to maintain a balanced framework, to keep the tree open enough for good air circulation and to keep the tree from getting too tall. The last is generally not begun until the tree starts bearing fruit.

Pruning is done when trees are dormant, usually in late winter or early spring. Sanitation of pruning equipment is important to prevent the spread of disease. Clippers should be dipped in a bleach water solution of 1 cup bleach to 9 cups water in between each and every cut even if cutting on the same tree. You can also wipe off your tools with rubbing alcohol in between cuts. When all pruning is complete, be sure to rinse off all tools with plain water and oil them to prevent rust and corrosion caused by the disinfecting solution.

Once a tree starts to bear, picking off some of the small developing fruit will allow the remainder to grow larger and prevent branches from breaking due to the weight from an overabundance of fruit. It may also balance the yield each year since if a tree bears heavily one year, the following year's crop might be light or non-existent.

Judging when a particular fruit is ready to pick takes practice. Apples are ripe when they easily come off the tree. If you have to yank and tear loose part of the branch, they aren't ripe. The color of the apple seeds is another indicator. White seeds indicate immaturity whereas dark seeds indicate ripeness. You can use color to indicate when cherries are getting close. Tasting for sweetness is another indicator. Cherries get sweeter and bigger the longer they hang on the tree, until they begin to soften that is. Like cherries, peaches will continue to grow and sweeten the longer they are left on the tree until they become "tree ripe." They only keep a few days if tree ripe but the flavor can't be beat. Avoid bruising by cupping the fruit in your hand and lifting up while slightly twisting at the same time. Pears should be picked before they are dead ripe, in other words when they are still green. Otherwise they will rot from the inside out. Pick when they turn from deep green to pale green and when the point where the pear attaches to the tree starts to swell. Keep cool and bring them to room temperature when you want to ripen them. All plums are green until they ripen and change color to that which is normal for the particular variety. Like peaches, they are best if left on the tree until they are tree ripe at which point, they are soft and sweeter than anything that can be bought.

How much you can expect from your fruit trees is quite variable and determined by your climate, growing conditions, how well you manage and take care of your orchard as well as the size and variety of your trees. The table below may be helpful.

	Height	Years to Bear	Yield	Weight of Bushel
Apple				
Standard	20'-30'	5 to 8	8-18 bushels	47#
Semi-dwarf	12'-15'	3 to 5	4-10 bushels	47#
Dwarf	7'-10'	2 to 4	1-6 bushels	47#
Peaches				
Standard	10'-15'	2 to 4	4-6 bushels	50#
Dwarf	5'-7'	2 to 3	1-2 bushels	50#
Pears				
Standard	15'-30'	4 to 6	2-8 bushels	58#
Dwarf	6'-8'	3 to 5	1-2 bushels	58#
Plums				
Standard	12'-25'	4 to 6	2-6 bushels	50# to 56#
Semi-dwarf	12'-15'	3 to 5	2-6 bushels	50# to 56#
Dwarf	5'-8'	3 to 5	1-2 bushels	50# to 56#
Cherries (Sweet)				
Standard	20'-30'	5 to 7	60-80 quarts	N/A
Semi-dwarf	15'-18'	5 to 7	30-50 quarts	N/A
Dwarf	12'-15'	4 to 7	15-20 quarts	N/A
Cherries (Sour)				
Standard	15'-20'	3 to 5	60-80 quarts	N/A
Semi-dwarf	12'-15'	3 to 5	20-60 quarts	N/A
Dwarf	6'-8'	3	15-20 quarts	N/A

Controlling Pest and Disease

Controlling diseases begins with selecting disease resistant varieties. Beyond that, it's much better to spray to prevent diseases than to spray after an outbreak. Fungal spores and bacteria are most active in warm, wet weather especially in spring and early summer so that's the time to be proactive.

Any spray program begins with the application of dormant oil to all parts of the tree when it's still dormant. This is probably the most important spray of the season as it suffocates mites and is effective against many pests including aphids, whiteflies and pear psylla. Temperatures should be above 40°F and buds should be starting to swell but shouldn't be green. In spring, spraying sulfur, an organic fungicide, will help control fungal diseases that run rampant during warm, wet weather, yet it won't affect bees or other beneficial insects. The product we use is called a Dormant Oil Spray Kit that includes a bottle of lime sulfur and a bottle of mineral oil, both of which are added to water in the amounts specified and then sprayed on the trees during the conditions given above.

As with the vegetable garden, copper and sulfur are 2 fungicides available to anyone wishing to raise their fruit organically. Many products are sold that contain these elements. Follow directions for application. Not only are the concentrations and mixing instructions important but so is the timing of application. For instance, spraying for fireblight, a bacterial disease that affects apples, pears and quinces, needs to happen when it's most active. This means spraying a fungicide during bloom. Some sources even say start spraying when buds show green tips, then every 4 to 5 days during bloom until the bloom period is over. Once again follow the directions on the product you are using.

Fireblight is our biggest worry as it can kill a tree within weeks. It begins on branch tips and blossoms then spreads to leaves and twigs where the leaves turn brown and shrivel. The wilted shoot tips are bent and look like a shepherd's crook. Prevention is truly worth a pound of cure but if fireblight strikes, to prevent its spread to healthy parts of the tree, prune off diseased wood and burn it. Disinfect tools between each cut.

Be aware just because a pesticide, insecticide or fungicide is organic in nature doesn't mean it's not toxic. In fact some organic pesticides may be even more toxic than their synthetic counterparts so read and follow directions explicitly taking all necessary precautions as outlined by the manufacturer. We found out the hard way how toxic copper is to young orchard leaves. We almost lost our orchard due to copper toxicity even though we followed directions. We have used several copper formulations, powder and granular, and this new granular stuff we tried was devastating to both orchard trees and potato vines. Copper will be used only as a last resort from here on out.

In the garden chapter we mention how plant debris on the soil surface can harbor unwanted pest and disease. That applies to an orchard as well. Therefore, because fallen leaves and fruit can foster diseases, it's imperative to clean up such debris from around each tree. Doing so prevents attracting mice and rabbits too. Additionally any fruit that rots on the tree should be removed and burned.

If you've managed to successfully get a fruit crop close to maturity, the next challenge may be to protect it from varmints such as rabbits, deer and birds. In the garden chapter, we discuss ways to deter marauding pests through physical barriers (fences and such), scare devices (reflective materials, scarecrows etc.) but we didn't mention protective netting sold by garden centers and in seed catalogs. This can be used to keep birds from eating ripe fruit on bushes, shrubs and trees providing the netting is suspended above the plants so birds can't access fruit through the holes in the netting. Obviously suspending netting above a full grown tree is difficult but you may be able to rig up something if your trees are dwarfs. Or you can do as some have done and build tall frameworks that support wire caging or the fabric-like netting.

In an organic orchard, various traps can be used to control pests. “Sticky apples,” red balls coated with a sticky compound such as Sticky Foot, Tanglefoot or Tangletrap are hung up in apple trees to catch apple maggot flies. They are attracted to the red balls thinking they are apples and then get stuck to the goo. Figure one ball is enough for a small tree with 6 to 8 balls enough for large trees. Apple maggots are particularly damaging to apples because they tunnel all through the flesh leaving behind small brown tunnels. I’ve cut open many an apple thinking it looked good on the outside only to discover the inside was riddled with brown tunnels from maggot damage. The entire apple was a waste. Pheromone traps are used to trap coddling moths which also attack apples, although their damage is not as extensive as that of apple maggots. Coddling moth damage is usually limited to the core which can be trimmed away. Nevertheless, controlling infestation is still desirable. Pheromone traps use naturally occurring chemicals the insects emit themselves to communicate with each other and to attract mates. Traps use man made pheromones to attract the males thus disrupting the mating cycle. Traps usually also include some sort of sticky board that the insects get stuck to. Traps can be used to not only catch the bugs, but can also be used to monitor and assess their population density to ascertain how severe the infestation is. This can be used to determine if more drastic measures other than trapping are required. Pheromone traps are sold in major garden centers, by Ag suppliers and on-line. Hang them in trees when they start to bloom.

And finally we would recommend taking precautions against mice damage during the winter months. Mice will gnaw on the bark, completely girdling the tree unless it is protected. We install plastic spiral tree guards to prevent mice damage during the winter and remove them in the spring and summer to allow air circulation around the trunk. To be most effective, the bottom of the guard should be buried an inch or 2 in the soil at the base of the tree. If you’re in snow country, the tree guard should be taller than the snow otherwise the mice will chew on the bark just above the guard.

Chapter 9 – Homestead Gardening

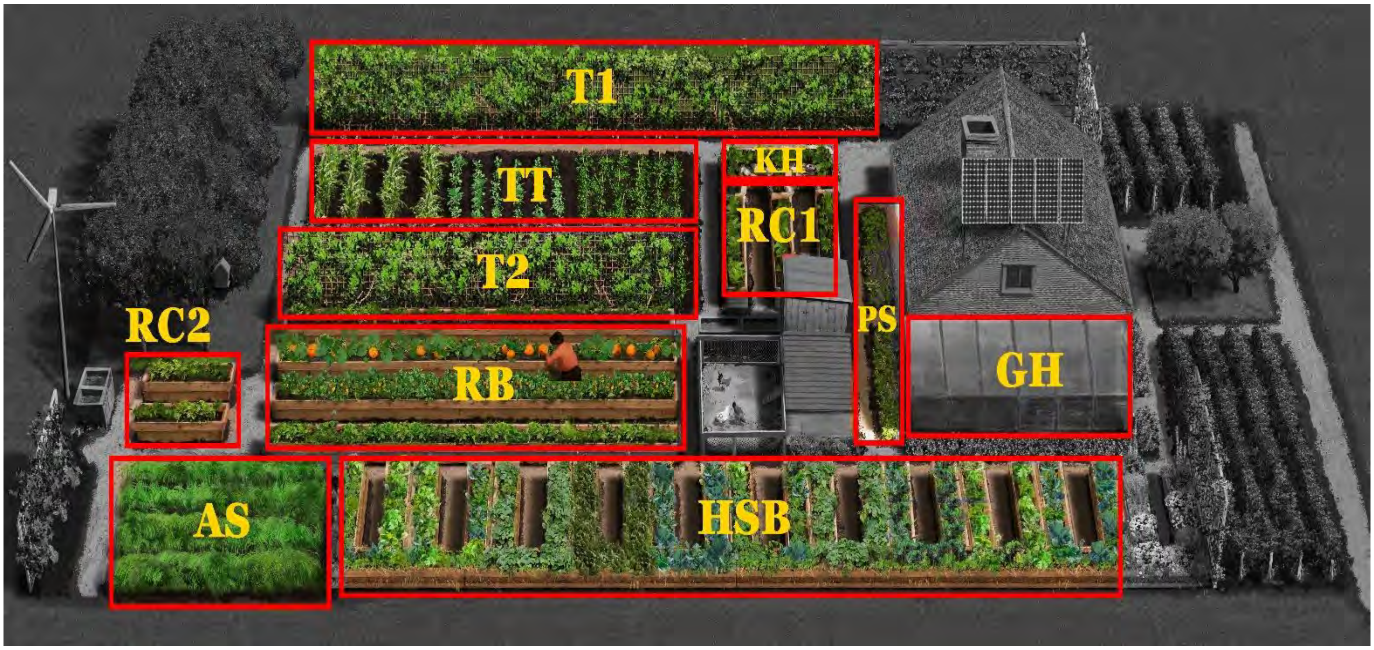


Table Legend:

- AS - asparagus bed
- RB - raised beds
- RC1 - raised containers section 1
- RC2 - raised containers section 2
- KH - keyhole garden
- TT - traditionally tilled
- T1 - trellis 1; T2 - trellis 2
- HSB - horseshoe beds
- GH - greenhouse
- PS - partial shade beds

Below is a list of vegetables with the possible locations on the sketch that they can be grown. As you can see, many items can be planted in more than one place. This gives you great flexibility and allows for crop rotation as well as succession plantings depending on what your climate allows. Info is also given on plant spacing as well as approximate yields. With this information, you should be able to determine how much you need/want to plant for your family. The easiest way to estimate the total amount you would need of an item is to determine how much you consume in a week or month and extrapolate that figure to encompass an entire year. As an example, if you go through 5# of potatoes a week, then you would need to grow at least 260# of potatoes for the year so you would need to plant at least 52 seed potatoes to harvest 260# of potatoes (see chart for yield of 5# of potatoes per plant). As another example, if you figure you need 50# of carrots for a year's supply given your family's usage, then you would need to plant the equivalent of 50' of row. Bear in mind yields are rough estimates and will vary considerably depending on the variety you've selected, your soil, climate and other growing conditions such as rainfall (or the lack of it) for any given year.

Vegetable	Where grown	Spacing	Yield/ Plant or Square Ft.
Asparagus	AS	18” to 24” apart in rows 3’ apart	1# per plant
Beans, snap (wax and green)	RB, RC1, RC2, KH	3” to 4” apart in rows 2’ apart	5# per 4’; 20 pods per plant
Beans, shell (Lima etc.)	RB, RC1, RC2, KH	3” to 4” apart in rows 2’ apart	2½# shelled beans per 10’ row
Beans, dry	TT	3” to 4” apart in rows 2’ apart	1# dry beans per 10’ row
Beans, pole varieties	T2, T1	6” apart in row in front of trellis	2 to 3 times amount of bush types (40 to 60 pods per plant)
Beets	RB, RC1, RC2, KH	3” in rows 6” apart	1# per foot
Broccoli	RB, HSB, KH	18” in all directions	4# to 6# per 10’ row
Brussels sprouts	RB, HSB, KH	18” in all directions	60 or more sprouts per stalk
Cauliflower	RB, HSB, KH	18” in all directions	9 oz. to 30 oz. Per head
Cabbage, early	RB, HSB, KH	18” in all directions	2# to 3# per head
Cabbage, late	RB, HSB, KH	24” in all directions	8# to 9# per head
Cabbage, red	RB, HSB, KH	18” in all directions	2# to 3# per head
Celery	RB, HSB, KH, RC1, RC2	9” in all directions	1# per plant
Celeriac	RB, HSB, KH, RC1, RC2	6” in all directions	7 oz. per root (14 oz. per foot of row)
Collards	RB, HSB, KH, RC1, RC2, PS, GH in winter	12” in row or bed	4# to 8# per 10’ row
Carrots	RB, KH, RC1, RC2	3” in rows 6” apart	1# per foot of row
Corn	TT	12” apart in rows 14” apart	1 to 2 ears per plant
Cucumbers	T1, T2	8” apart in row in front of trellis	10, 6 oz. Cucumbers per plant
Eggplant	RB, HSB, KH	18” to 24” in all directions	2 to 4 eggplants/ plant weighing 1# to 2# each
Endive/escarole	RB, HSB, KH, PS, SH, GH in winter	18” apart in all directions	4# per 10’ row
Kale	RB, KH, RC1, RC2, GH in winter	6” apart as I pick leaves when small	4# per 10’ row
Kohlrabi	RB, HSB, KH	9” apart in all directions	2 oz. per bulb
Leeks	RB, KH	3” to 4” apart in trench/row	1½# per foot of row
Lettuce	RB, HSB, KH, RC1, RC2, PS, SH, GH in winter	Leaf -9” apart. Others 12” apart in all directions	1 head per plant of 10 oz. to 1# each

Muskmelon	T1, T2, GH	6" to 12" apart in row in front of trellis	3 to 4 melons per vine weighing 2# to 6# each
Onions	RB, KH, RC1, RC2	4" apart in all directions	5# bulbs per 6' of row
Parsnips	RB, KH, RC1, RC2	6" apart in all directions	1# per foot of row
Peas (green, snow and edible pod)	T1, T2	1" to 2" apart in double rows 6" apart	2# to 6# per 10' of row
Peppers (hot)	GH, RB, HSB, KH, RC1, RC2	12" in all directions	6 to 8 fruits per plant
Peppers (bell)	GH, RB, HSB, KH, RC1, RC2	18" in all directions	3# to 4# per plant (6 to 10 fruits per plant)
Potato	TT	10" to 12" apart in rows 36" apart	Up to 5# per plant
Pumpkin	RB, KH, HSB, T1, T2 (fruit must be supported in a sling of netting or panty hose if grown vertically)	Hills of bush types -3'to 4' apart For trellis- seeds are 2' apart in front of trellis	2 to 5 fruits per plant weighing 6# to 20# each depending on variety
Radish, summer	RB, KH RC1, RC2, GH in winter	2" to 3" apart in carrot or parsnip furrows	2# to 3# per 10'
Radish, winter	RB, KH, RC1, RC2	5" to 6" apart in rows 6" apart	Up to 20# per 10'
Spinach	SH, PS, RB, KH, RC1, RC2, GH in winter	6" apart in all directions	½# per foot
Sweet potatoes	RB, GH	15" apart in rows 36" apart	4 tubers per slip (plant)
Rutabaga	PS, RB, KH, RC1, RC2	8" apart in rows 8" apart	15# per 10' of row
Turnip	PS, RB, KH, RC1, RC2	6" apart in rows 6" apart	1# greens per foot of row ½# roots per foot of row
Squash, summer	RB, KH, HSB	Hills spaced 3' to 4' apart	Up to 6# to 10# per plant
Squash, winter	RB, KH, HSB T1, T2 for vining types	Hills spaced 3' to 4' apart for bush types. Vining types 12" to 18" apart in front of trellis	Each plant yields 3 to 4 fruit 1# each
Tomatoes	GH, RB, KH, HSB	24" in all directions	Up to 10# per plant
Watermelons	GH, T1, T2 (if fruit is supported with a sling)	24" apart in front of a trellis; hills of bush varieties 3' apart	2 to 4 fruits per vine
Garlic	RB, KH, RC1, RC2	4" apart in all directions	5# per 10'
Witloof chicory (Belgian endive)	RB, KH, RC1, RC2	4" to 6" apart in all directions	Once forced in winter, each root will yield 2 cuttings of chicons

Your First Garden


Ron and His Mother with His First Garden Harvest

To our mind, planting, tending and harvesting a vegetable garden is one of the first steps to self-sufficiency, food security and independence from the globalization of the food supply. I've been gardening for 45 years so the whole process is second nature to me but for someone who has never gardened before the likely questions are how do I get started? Where do I begin? Let's take it logically and start at the beginning by developing a plan.

First figure out what your ultimate goal is; fresh produce for summer eating or production of enough vegetables to feed you and your family year round. Or maybe your objective is something in between. Obviously the more food you hope to grow the more room it will take. Realistically no one can hope to produce enough food for a year from 6 pots parked on their patio for instance. Yet with intensive gardening techniques such as inter-planting and succession planting in conjunction with raised beds, wide rows/beds you can maximize your return on whatever growing space you have available.

Second determine what resources are at your disposal. Do you only have a patio, balcony or deck for growing space? If so, container gardening would be the way to go. Perhaps you have access to the rooftop of your apartment building. This could be converted into a garden if growing beds are established up there. Maybe you have a back yard/front yard you want to convert from lawn to food production by creating edible landscapes. Hopefully you can see that with some ingenuity and creative thinking you can grow more than you thought possible given your space limitations. Or maybe you are like us and have ample space for a large spread. Even though we've never been plagued by a lack of space, we have always tried to maximize our return by working smarter and not harder. Succession planting and inter-cropping are two ways to accomplish this that I'll discuss later.

Another resource to take into consideration is time. Some time as well as effort is required to grow your own food. How much time you have or are willing to spend on the endeavor as well as how much effort you are willing to expend will dictate your garden plan and layout. The bigger the garden the more time it takes to plant, maintain, harvest and preserve. Granted there are techniques you can employ that save time and labor such as mulching to cut down on weeding, but gardening does take some time especially if you want to do it well.

For many gardeners, especially first timers, enthusiasm reigns supreme at the onset of the growing season but quickly wanes with the arrival of hot weather. If your over exuberance isn't held in check you may become frustrated and overwhelmed to the point of giving up when the area becomes unkept and overgrown with weeds due to neglect. In that instance, planting less could very likely mean more return, as you would have had the fortitude to keep plugging, reaping harvests along the way.

Intensive Gardening in the Wilderness

Regardless of your goals and resources, if you have no gardening experience, my advice is to start small, expect some failures, but don't be deterred. Look on them as learning experiences. After 45 years of gardening I'm still learning, still having failures or near failures and I continue to try new strategies. As a side note, if/when I have a shortfall of something, inevitably another item yields an overabundance so the two balance each other out. In other words one compensates for the other and we always have plenty to eat.

Starting small gives you a chance to grasp the basics without becoming overwhelmed. For example, some first time gardeners may ask "is that green growth I see newly sprouted carrots or am I looking at weeds?" By not biting off more than you can chew you'll have the chance to not only become familiar with what emerging vegetable plants look like, but also how they grow, what the plants look like as they grow, what their growth requirements are and lastly you can determine what each vegetable looks like when it's ready to be harvested.

Next up in your planning process is to take into account your likes and dislikes. For example, if no one in the household will touch a Brussels sprout with a ten foot pole why grow them? Now I'm all in favor of trying out new vegetables and am constantly trying something new but I only allocate a small space to it the first time around. That way if it doesn't grow well or neither of us like it, I haven't squandered a lot of growing area. But if it's something I know neither of us likes, turnips, rutabaga, collard greens, mustard greens, turnip greens or swiss chard for instance, I'm certainly not spending time, space and energy growing any of that stuff unless I need it for animal feed. Which by the way those items make great supplemental feed for animals. Conversely we have favorites such as corn, tomatoes, potatoes and peas and any garden we grow wouldn't be complete without them.

How much to plant is a real head scratcher for the first time gardener who has no experience to draw upon. Because everyone's goals and taste preferences are different, it's hard to offer up advice that applies to the masses so I'll just tell you what I do.


Bountiful Wilderness Garden Harvest

We are a household of two. Our goal is to grow a year's supply of food. If you have more mouths to feed you may have to increase the amounts. By the same token if you are not interested in getting involved in food preservation you'll need to decrease the amounts. Also bear in mind if you eat a great variety of vegetables as we do, you won't need to grow as much of each item as compared to someone who eats a limited variety of vegetables. Those folks will need to grow larger quantities of the few veggies they prefer. Furthermore my list may contain items you dislike. Ignore those and move on. On the other hand, maybe you'll find you need to grow more of something than I do because it's a favorite of yours. In essence every garden is as individualistic as the person growing it. My list reflects our personal likes. For what it's worth here are the amounts I usually shoot for each growing season at planting time.

- GREEN BEANS - the equivalent of 8 to 10 feet of row or about 32 seeds
- WAX BEANS - about half the amount of green beans
- LIMA TYPE BEANS - 30 to 40 feet of row (we grow a variety called Limelight, a rare variety of bean whose seed is hard to find but once you get your hands on it you can save your own seed as we do. This is not a true Lima but looks and taste just like one. What makes it so special is that for people like us in the northern climes with short, sometimes cool summers, we are able to get a crop. Real Lima beans are often a failure because we don't have enough hot weather to bring them to maturity.
- DRY BEANS such as kidney beans, black beans and beans for baking (Yellow Eye, Jacob's Cattle, Soldier bean and the like) - 100 feet of row for each variety I grow in any given year
- BROCCOLI - 12 to 15 plants for my spring planting and 6 to 10 plants for my fall plantings
- BRUSSELS SPROUTS - 6 to 8 plants
- CAULIFLOWER - 3 to 4 plants
- EARLY CABBAGE – 4 to 5 plants
- LATE STORAGE CABBAGE - 12 plants, more if I plan to make sauerkraut
- CORN - 5 or 6 rows about 14” apart with plants 12” apart in the row. Rows are 40-45 feet long. This works out to between 200 and 240 stalks. Usually half is an early ripening variety

and the other half ripens later. I have planted corn 12” apart in either direction and this worked but I found the whole plot a bit cramped. Try and see what works best for you. Either spacing is much closer than conventional row panting and will optimize the return for the area you plant.

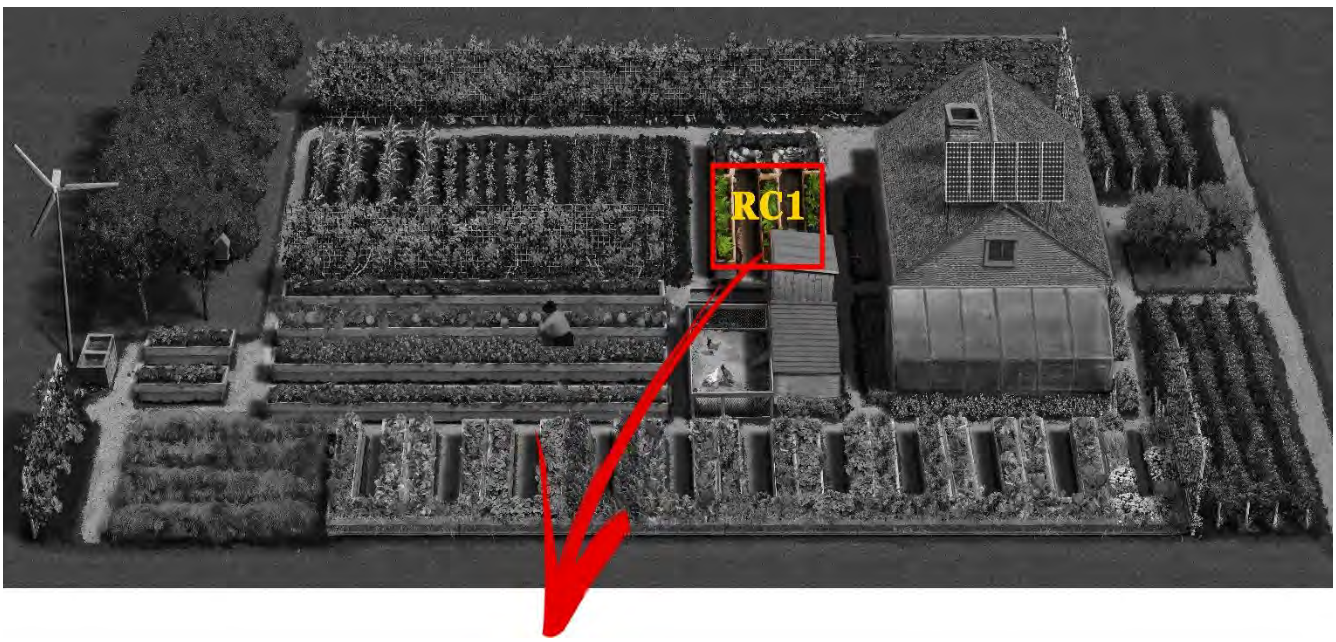
- CUCUMBER – 2 to 3 hills with 3 to 4 plants each
- LETTUCE – LEAF - 15 to 20 plants - possibly less if I treat it as what’s known as “cut and come again” by picking larger outer leaves and leaving smaller inner ones to grow. If I cut the whole plant off at ground level I may need more
- BIBB - 6 plants - more if I do succession plantings for a continuous harvest
- ROMAINE - 6 plants - more for succession plantings
- HEAD LETTUCE– 6 to 8 plants
- CANTALOUPE - 4 hills of 3 to 4 plants each
- PEAS - early variety - 20 TO 25 feet but rows are double rows with support fencing running between them later variety -20 to 25 feet but rows are double rows as above
- Snow pea - 5 to 10 feet also double rows
- Edible pod variety - about 4 feet also double rows
- PEPPERS - Hot variety - 6 to 12 plants
- Bell type - 15 to 20 plants
- POTATOES - 3 rows about 75 feet long. One row is a russet type, another is a red skin potato and the other is Yukon Gold. I plant a minimum of 5 pounds of each type
- PUMPKIN - between 2 and 4 hills that have 3 to 4 plants each
- SQUASH – zucchini - 1 hill of 3 to 4 plants
- YELLOW CROOKNECK – 1 hill of 3 to 4 seeds
- WINTER-BUTTERNUT and/or BUTTERCUP - 3 to 4 hills with 3 to 4 seeds each
- TOMATOES - cherry 3 to 4 plants
- early eating variety between 8 and 12 plants. Possibly as many as 20 plants
- BEEFSTAKE type - at least 12 plants
- PASTE type - a total of 24. some may be an early ripening variety and some may be a later ripening variety

These vegetables I generally grow in a raised bed that’s approximately 3 feet, no more than 4’ across. This is the maximum distance I can reach comfortably. I access half way across from one side of the bed then access the remainder from the other side of the bed. I plant the areas intensively with my seeds in rows that are about 6 inches apart. Where linear feet are specified, keep in mind the entire width of the bed is planted to that length.

- BEETS - a space about 3 linear feet in length
- CELERY - 24 to 30 plants
- CARROTS - 6 to 7 linear feet
- BELGIAN ENDIVE (otherwise known as WITLOOF CHICORY) - 2 linear feet
- ENDIVE/ESCAROLE – 3 to 4 plants
- KALE - 2 linear feet
- LEEKS - 24 plants

- ONIONS - between 400 and 500 sets. If I start onions from seed and have transplants, then 200 to 300 sets with the difference made up with transplants. I always grow 50 or so giant Spanish onions as well as 20 to 30 red onions either from sets or transplants
- GREEN ONIONS - grown from seed direct seeded - about 1 linear foot
- PICKLING ONIONS - also direct sown, about 2 linear feet
- PARSNIPS - 18 inches to 2 linear feet
- RADISH - summer type - I intercrop these with the carrots and parsnips, storage or winter type – 3 linear feet
- SPINACH - 6 to 7 feet in spring and more in fall wherever I have open space

Container Gardening (RC1)



Container gardening is a set up where plants are grown in every type of vessel from window boxes to hanging baskets to containers situated on patios, decks, doorsteps and yards. For someone with limited space or time they are a great way to grow some food. The containers can be purchased brand new from garden centers or seed catalogs or you can do as we do and scrounge for recycled receptacles from your home or neighborhood. I've used an old dented and cracked enamel canning kettle, leaky buckets no longer suitable for lugging water, old dish basins as well as pots that originally had nursery plants in them.

All have served me well provided I take a few things into consideration. First drains holes must be in the bottom of any container. Not a problem if the thing already has cracks and leaks but if the article is still intact, drill, poke or somehow make a few holes in the bottom. An acquaintance of ours uses large Rubbermaid containers that have holes drilled in the bottom. If you can put a thin layer of small stone or gravel in the bottom this will facilitate drainage. You want your soil to be damp but not a puddle of mud. Plants won't survive long with roots submerged in standing water. After heavy rains your containers may have standing water in them unless you have proper drainage.

Size of containers is important too. Too small or shallow and plants will not have adequate room to grow and will be stunted. A good depth of soil to shoot for is 6 to 12 inches. Vegetables such as radishes, lettuce and spinach require less depth than larger plants such as tomatoes, eggplants and peppers. Match the diameter of the pot to the plants it's destined to contain.

Some vegetables lend themselves to container gardening. Both hot and bell peppers, eggplants, tomatoes especially cherry tomatoes and the determinate types (these are usually more compact then indeterminate varieties), lettuces, bush cucumbers and summer squash (zucchini and yellow crookneck) are all candidates for container growing. Melons and winter squash are other possibilities. Cole crops also known as Brassicas (broccoli, cauliflower, cabbage and Brussels sprouts) should work well too.

Elevated Easy on Back Container Garden

Variety selection is critical for plants grown in containers. Seed catalogs offer versions of many vegetables that are suitable for container growing. When reading descriptions look for terms such as dwarf, bush, compact or ideal for containers or limited spaces.

Even though I've always had ample gardening space I have practiced container growing too. Every summer I grow a couple pots of cherry tomatoes and a pot or two of bush cucumbers in the greenhouse. I place these pots in the center walkway that runs between the 2 raised growing beds. Greenhouse space is at a premium so I'm always trying to get the most out of what area I have. I've also grown strawberries in hanging pots suspended from the greenhouse ceiling. I figured there was a lot of greenhouse territory above my head being wasted so why not try to capitalize on it.

In the fall we always bring in a couple of bell pepper plants and cherry tomato plants (Red Alert is the variety we grow) and even a few celery plants to continue growing through the winter. For the celery, we dig up a couple of mature plants retaining as much of the root ball as possible and pop them into a container, usually an old leaky bucket or a pot that once housed a nursery plant. Prior to bringing the plants inside, we water the transplants well and allow enough time for the plants to suck up the water to avoid wilting once they are brought into the warm house. When I need celery, I cut the outer stalks allowing the young center stalks to continue to grow.

We used to dig up the peppers and replant them in 14" square planter tubs we bought expressly for this purpose but in recent years, in spring when I transplant seedlings, I pop a few peppers into the tub at that time. Come fall all we have to do is bring the tub inside and we don't disturb the root system of the mature plant.

For the tomatoes, sometime in August we take cuttings from the adult plants being sure to select side shoots with a well-formed shape. Ron looks for leafy side shoots from the main trunk that also have at least one node where a sucker branch is emanating. Those nodes need to be covered with dirt and that's where roots will form to feed the plant. The cuttings are stuck in soil, watered and then we wait for them to take root.

Roughly half of the cuttings croak but the other half take root and are on their way to becoming viable, new plants. We select the best ones, plant them in a planter tub or two and by early December, we are picking ripe cherry tomatoes.

We've also grown lettuce in the winter in a planter tub situated on our south facing windowsills. Tom Thumb, a compact butterhead is perfect for containers. I can't say we get as much from our edible houseplants as from their outdoor counterparts but they produce enough to quell the desire for fresh, homegrown fare in the dead of winter. If we were to situate all the tubs under grow lights I'm sure we would get far more produce out of them. Being an off-grid household, we have to conserve power during the shortest days of the year. To that end, all tubs are placed in front of our south facing picture windows where the natural light is at its best.

For someone with disabilities, perhaps even a person confined to a wheelchair, or for older folks who find it difficult to bend over, stoop or squat down, container gardening is one answer. Containers can be elevated to a comfortable height by placing them on some sort of stand. Our acquaintance that uses Rubbermaid tubs has hers on a stand made of 2X4. Any sturdy platform, bench or table will do. You can make the most efficient use of space by being sure your containers are of similar shape and size. Purchased tubs such as Rubbermaid tubs would be a good choice but no doubt there many options available.


Elevated Easy on Back Container Garden

We've seen plastic barrels that have been modified with deformed slits around their circumference being used as a container/vertical growing setup. Great idea if you have plastic drums to modify. Ron came up with his own version using large hole hardware cloth, rubber mats and scrap 4-inch PVC sewer pipe. The soil filled grow tower sits in a hot water heater basin to catch excess water for recycling. We're using our grow tower to grow 38 strawberry plants in a small footprint. This is something new we're trying here in Nova Scotia.

So when developing your garden plan, give some thought as to what if anything you want to grow in containers and how you will incorporate those containers into your overall layout.

Let There Be Light

Adequate light is necessary for any plants grown outdoors no matter if they are grown in containers, in beds or long rows. Six hours of direct sun are the minimum while 8 to 10 hours are ideal. Some vegetables are better able to handle shady conditions than others and in fact benefit from these partially shaded areas in the heat of the summer. Salad greens such as lettuce, escarole and spinach prefer cooler temperatures and will bolt (go to seed) and become bitter in summer heat. By placing plants such as these in any shady areas

(PS and SH), not only are you utilizing a less than desirable area to produce some food, you are prolonging your harvest window for these veggies as they will remain succulent for a longer period of time due to the cooler, moderating effect of the shade.

Partial shade is defined as an area receiving at least 2 hours of direct sunlight per day. The rest of the time the spot is in shade or indirect light. Vegetables grown for leaves and roots don't require as much light as fruiting vegetables (such as tomatoes) so they are good candidates for shady areas but be aware some of them will take longer to grow and may not get as large as if they received more sun each day. When planning your garden layout, you may find the list below helpful to determine what vegetables will do best in shady areas.

- Beets
- Lettuce
- Kale
- Spinach
- Broccoli
- Chard
- Celery
- Cabbage
- Carrots
- Endive/Escarole

If shade isn't a problem where you live but heat and broiling sun are, you can create shady areas by planting the shade lovers in amongst tall, sun worshiping plants such as corn and tomatoes. In lieu of that you could set up shading devices over or beside your shade tolerant plants to cast a shadow. Window screen, snow fence, even cheese cloth are possible shade creating materials.

Edible Landscapes

As the name implies edible landscapes are those that produce food. For folks with limited land such as people with small urban or suburban lots this is a viable way to grow quite a bit of your food. If you want trees in your yard grow fruit trees, most likely the semi-dwarf type that don't grow very large. Instead of hedges consider the brambles-raspberries and blackberries. As an alternative to bushes you could plant blueberries. Looking for edging or border plants for along walkways? Try strawberries or vining plants such as melons and cucumbers, winter squash and pumpkins. If you've always wanted a trellis consider using it to grow vine crops vertically. Melons, cucumbers, and even winter squash can be trained to climb up the support structure thereby saving space. I've used this technique in the greenhouse to grow cantaloupes and cucumbers thereby conserving space and optimizing the return on the space I do have. And those hanging baskets for flowers that most homeowners suspend from their porches can contain edible plants such as strawberries, bush cucumbers or even dwarf tomatoes that cascade over the sides of the pot.

Let's not forget about window boxes. They can be used for root crops such as carrots, beets, turnips and rutabaga. In regards to the beets, I would recommend the variety called Cylindra which forms a long root much like a carrot instead of varieties that form fat round balls, I think you would get more yield this way. Lettuce, especially leaf lettuce and dwarf or compact versions of Bibb or Romaine, would work well in window boxes. So would radishes and green onions. The result being a window box brimming with all the fixings for a fresh salad. And finally, you can convert the grassy lawn in to an intensively managed vegetable patch that has raised beds, wide beds and rows where you practice succession planting and intercropping so you get the maximum amount out of what space you do have. By combining edible landscaping with container gardening you'll be able to raise an astonishing amount and variety of produce.

Choose Garden System

At some point you must decide on the basic layout of your garden. Will you employ conventional rows, wide beds, raised beds, containers, edible landscapes or a combination of the above. There is no right answer to this question. Each has advantages and disadvantages. Everyone's needs and goals are different so there's no one method that will suit everyone. My best advice is to try what you think will work best, see how it goes and modify your approach if need be.

As I eluded to earlier, the amount of space you have is a determining factor in the shape or style of your garden. Will you plant in conventional rows (like a farmer does), beds or containers? In our master plan in chapter 2, we've set up a variety of growing methods to maximize light and space. If I think back to when I started gardening as a teenager, we planted everything in rows. As I recall, the rows were about 3' apart since this was the width necessary to allow the tiller to pass down the rows for cultivation. Obviously this layout took up a lot of space, most of which was devoted to the path in between each row. Not only was this was a waste of good soil that we had worked hard to build up but every

Wide Rows and Efficient Use of Space – Rain Barrel in View
Saskatchewan

time we walked up and down the path we were compacting the soil. The same amount of food could have been raised in a much smaller area had we planted intensively in wide rows/beds and raised beds.

Now our garden is a combination of raised beds, wide rows/beds and a few conventional rows. I grow corn in a wide bed or block as described above. Beans and potatoes are grown in rows while most of everything else is grown in raised beds or block plantings of wide rows/beds. My raised beds are generally 3' to 4' across. Anything wider than that makes reaching to the center for weeding or thinning difficult.

To my mind the chief difference between a raised bed and a wide row/wide bed is that the wide row/bed is even with the soil level whereas the soil in a raised bed is mounded. A wide row is narrower than a wide bed. A wide row is usually a band of like plants perhaps 12 inches in width with closely spaced plants. An example would be 2 pea rows planted 6 inches apart with a support fence running down the center. Contrast this with a wide bed which is many feet wide.

In any method because plants are spaced close together they eventually shade the ground so weed growth is kept to a minimum, a plus for any gardener. Additionally, compost and other soil amendments are where they can be best utilized, in the growing bed, as opposed to in pathways where you walk. Yields from wide beds/wide rows and raised beds can be as much as four times that from conventional rows too.


Saved by our Hoop Houses

This is a boon for someone with limited space who needs to capitalize on every square inch of land. In Saskatchewan, where our growing season was very short, roughly 65 days, we used hoop house tunnels throughout most of the garden so we could get off to an earlier start than would have been possible without them. But we needed to come up with a system that produced as much food as possible from the areas that were protected. Raised beds in conjunction with wide row/beds were our solution. Our wide rows/beds ranged from 5' to 7' across. All were the entire length of the garden, 57', as was our 3 to 4' wide raised bed. Each vegetable took up a length of space in any given bed, then the next vegetable was planted right next to it and so forth down the line. This kept walkway space to a minimum as we didn't have a gazillion small beds for individual crops all of which had pathways in between. The paths we did have were narrow, about 18," which were just wide enough to walk down. As you can see from the sketch, in the raised bed area, **(RB)** we've implemented the same configuration in the imaginary ¼ acre homestead.


Intensively Planted Raised and Wide Bed Garden
Vegetables Consecutively Sown

This arrangement of long beds ensured Ron could get the tiller in to churn up the soil. We had loose, friable soil as a result that warmed up quickly in the spring which was also critical given our short season. Of course, the paths were too narrow for the tiller to pass but this didn't matter. As to be expected they became compacted from being walked upon. They were a visual reminder of one of the benefits of any bed growing system, that of avoiding walking on and compacting soil where plants will grow.

For a raised bed, usually some kind of frame is used to hold the soil in place, although this is not absolutely necessary. If some kind of structure is used however the growing bed height can be higher than is possible without it. It holds the soil in place without any danger of erosion. Wall height can vary from a few inches to a foot or more. In the garden, our raised bed is about 5" above soil level.

Raised Bed in Greenhouse

In the Saskatchewan greenhouse, because the ground sloped gradually, the back bed was about 12" deep whereas the front bed was 10" deep.

Dimensional lumber, so long as it's not pressure treated with harmful chemicals that can leach out into your soil, can be used to build the frames. That's what we've used in all the greenhouses we've built on each of our homesteads. In the garden however we simply used trees Ron cut down from our forest. This saved the expense of buying lumber. Masonry walls, cinder block, bricks or rocks can be used as side supports too, although most people opt for wooden frames as we do. I've used rocks to form the bed for my herb garden. They did the job and looked nice too since they added a bit of character.

The trees Ron cut were laid end to end down both sides of the proposed raised bed. Full length trees with 5-inch diameter on the large end. He pounded some sharpened stakes cut from the tree tops into the ground on the outsides of the logs so they didn't roll outward and then filled the interior with dirt. Voila! A raised bed. Alternatively, we've also shoveled out a shallow depression to sit the log in thus bypassing the need for stakes; this worked just as well.

Just like with my wide row/beds, I plant a myriad of vegetables in my raised bed. I grow my root crops: carrots, radish, parsnips, Belgian endive and beets in a raised bed. The extra soil depth means the roots have more room to grow without becoming forked and misshapen. Leeks go in my raised bed too since they are usually planted in a trench and soil is hilled up around them as they grow. If I have room in my raised bed for celery, I put it there. Otherwise I plant a block of it wherever I have the room to set my transplants out 6" apart in either direction. Onion plants and sets are great candidates for planting in raised beds too. Each item in my raised bed is planted in a block arrangement next to the other right on down the line. The raised bed arrangement in the sketch we developed lets you do this too.

Because the soil in raised beds dries out faster and warms up quicker than soil at grade, you can get your garden off to an earlier start. As such, they are the perfect spot to plant salad greens such as spinach, kale and lettuce for early salads. Because the soil is held in place by the retaining structure you've chosen, all the great additions you've added to your soil: compost, rotted manure, leaf mold, bone and/or blood meal will be right where your plants need it. Since soil in the beds are never walked upon they don't become compacted. They remain light and friable. Some folks find raised beds more user friendly, especially if they are several feet above grade, as their elevation may mean less bending over, squatting down or stooping. The keyhole gardening arrangement (KH) in the sketch is an example of that.

Regarding dimensions of any growing bed raised or otherwise, make it no wider than you can easily reach, although I admit our widest at 5' to 7' is an exception to this recommendation. You'll have to access the entire bed to weed, thin and plant. A good hoe makes weeding easier though. When reaching in from both sides, if you can't reach the middle, you'll have to step inside the bed and that defeats the whole purpose of the raised bed. Although I will say that the few times each season when I have to step into our widest bed our plants haven't been adversely affected. The dimensions I gave earlier work for us but are by no means written in stone. You'll have to determine what works for you.

The length of a raised bed is purely up to you. If it were me, I would try to configure the beds so that I have the most bed space with the least amount of walkways which is what we did with our Saskatchewan garden. Using graph paper and drawing various bed arrangements to scale would be an easy way to dope this out before beginning bed construction. Refer to our sketch in chapter 2 for suggested layout and dimensions.

The Shape Our Garden Takes

I grow Brassicas, otherwise known as Cole crops (broccoli, cauliflower, Brussels sprouts and cabbage), in a wide bed that is about 3 feet wide. I plant a center row of seedlings spaced between 18" and 24" apart (late cabbage is 24" apart and everything else is spaced 18" apart), then a row to either side of center at a distance of about 18." Transplants in the two outer rows are staggered in relation to those in the central row.

I've grown onions in either a raised bed or in a wide row depending on the room I have. Most years I have onions planted both ways - the sets are in a wide band that is 3 to 4 rows wide with the sets spaced 4 inches apart in either direction. Onion transplants go in the raised bed as do any onions I direct sow meaning I plant the seeds directly into the garden soil. I do this chiefly with seeds for my pickling onions and green onions (scallions).

I've grown green and wax beans in my raised bed too but have had problems with mildews due to poor air flow especially when I have cool nights with resulting heavy dew. So, for the most part I now plant these beans along with all my other beans in rows spaced 24" apart.

For me, I've had the best luck growing peas in double rows about 6" apart with a support structure running down the center of the closely spaced rows to give the peas something to grasp as they grow upward. I use pieces of chicken wire attached to stakes I pound into the ground but that's not the only option. In garden catalogs I've seen mesh sold for this purpose for example. By having a row growing on each side of my supportive framework I effectively double my harvest from the same linear feet of a single row.

We are big potato eaters having them in some form just about every day. Because of the quantity I grow, I find it best to plant them in conventional rows about 3' apart so I have sufficient soil to do a proper job of hilling up the plants as they grow. I've tried closer spacing, but it didn't work out too well. For me not only is proper hilling up problematic but my yields suffer too.

Corn is a favorite, one we look forward to with much anticipation. The space saving method we've come up with that works best for us is to plant corn in a block of 5 to 6 rows spaced roughly 14" apart and as long as possible. As far as we're concerned the more corn the better as there's no such thing as too much.

For the most part I grow the vines (pumpkin, squash, cucumber) in hills. The hills may be arranged such that they form a large block or they may be more in a line like a conventional row. Traditionally these are vigorous plants, and sprawl all over the place. This is especially true for winter squash and pumpkins. But bush varieties of the vegetables are available and they do save considerable space. The tradeoff however is that the bush types are usually hybrids so you can't save your own seed from them as I'll explain later.

I haven't mentioned tomatoes and peppers yet. For the most part those go in the greenhouse where we have raised beds although any overflow gets stuck in the garden wherever I have room. Raised beds are particularly effective in a greenhouse as the pathway in between acts as a cold sink. As you know cold air sinks and warm air rises. The fact that the walkway between the bed acts as a trough or sink for the cold air protects the tender plants in the growing bed.

Greenhouse space is at a premium so I'm always trying to squeeze as much in as possible. However I've learned the hard way there's such as thing as squeezing in too much. Eventually the small transplants grow into large, bushy plants with lots of branches and vines going everywhere. If things are too crowded, there's not enough air circulation and mildew and rot can set in. Therefore, the closest I space things is 24" for tomatoes, 12" for hot peppers and 18" for bell peppers.

Hopefully this gives you an idea of what form our garden takes. Now is the time to generate your own plan.

Plan the Layout

I highly recommend you work out a layout or diagram of your proposed garden on paper. Not only is this a fun project to do on a cold, blustery winter day but you won't be trying to figure out what goes where at planting time. You'll also be sure you have a place for everything with nothing being accidentally overlooked or forgotten. You can use the plot sketch as a guide or come up with your own version that suits your circumstances. I have a drawing of each garden I've ever planted. They are part of my record keeping and serve as future reference for what worked and what didn't. It helps me to figure out if I need to plant more or less of any given item as I have a paper copy of what I did and don't have to rely on memory. Having a written record of what was planted where also aids in crop rotation. It assures you won't have to worry about planting any given item in the same space as last season. I'll have more to say on crop rotation in a little bit.

Here's things I take into consideration when I come up with my garden plans. There are debates about whether beds or rows should be oriented east/west or north south. Maybe the best way to proceed is to let the lay of the land dictate what you do. For example, if you have sloping ground it's best to run the growing areas across the slope to prevent erosion. We've had gardens with the growing areas running in either orientation without any adverse effects. Just be aware if your rows or beds run north/south tall plants such as corn will cast shade to the area north of them. This is not necessarily a bad thing especially in areas of long hot summers since you can use the shady areas to grow plants such as lettuce that prefer cooler temperatures. You may even purposely plan to locate tall plants so they cast a shadow specifically for the production of items that prefer the shady spot created.

You may find locating the vining plants (pumpkins, winter squash, cucumbers, melons) on the outside edges so they can ramble all over the place a good idea. I use to do this when I was a teenager gardening in Maryland. However, I've spent my adult years gardening in the northern regions where the growing seasons are shorter and protection against late spring or early fall frosts is a must. So now I try to group plants that are susceptible to frost, such as the vines, together thus making protecting them an easier task. Those plants that can take the frost or threat of it are grouped together too but are separate from the tender plants. That way I don't have to try and protect my entire garden area when frost threatens. More on which plants are frost sensitive and which are not when I discuss planting dates.

Another factor you may want to take into consideration is that vegetables can be grouped into families. Those veggies within the same family generally have similar needs when it comes to soil preparation, protection against frost or insects, fertilizing, planting techniques and so forth. For example, the Cole crops, should have lime or wood ashes added to the soil prior to planting to minimize risk of root maggots and club foot. They are also heavy feeders requiring soil rich in nitrogen. Additionally, all Brassicas are plagued by little green cabbage worms which are easily controlled by spraying with BTK, an organic product. Having the Brassicas in the same location versus scattered all over the garden makes spraying easier.

If possible I like to group together items that will be in place until the last possible moment in the fall. Most of these are the frost tolerant long keepers destined to see us through the winter - cabbages, Brussels sprouts, carrots, parsnips, beets, leeks, Belgian endive. By keeping these in close proximity to each other, the rest of the garden can be easily cleaned up, tilled, perhaps planted with a winter cover crop and put to bed for the season. If these vegetables were scattered all over the place, fall garden maintenance and preparation for next spring would be much more difficult.

Crop Rotation (TT)

Crop rotation is important for many reasons. One of those reasons has to do with soilborne diseases. If the same plant goes in the same spot year after year, any disease that's specific to that plant is free to continue unabated by overwintering. However, by not planting the same item in the same location you've taken a proactive step to controlling the disease. You can counter fungal diseases and viruses such as scab and blight that affect potatoes, clubroot that affect Brassicas and wilts that affect tomatoes with this practice.

Likewise, insect pests are generally specific to certain vegetables. Part of their life cycle is to lay eggs for the following year then die. Next season, if you plant the same vegetable or its relative in the same area, when the eggs hatch, they will have easy access to an all they can eat buffet thus making their control that much more difficult. Rotating crops makes things a bit harder for the pests and easier for you.

Crops vary on what nutrients they take from soil. Growing the same vegetable or the same family of vegetables in the same area year after year risks developing a nutrient deficiency. By rotating crops you can prevent this from happening. Some plants can even be used to put nutrients back into the soil.

Here's an easy way to rotate without stressing over every little detail of the process. Simply follow the heavy feeding plants by the light feeders then the soil builders. I should note you can do this rotation over the course of three consecutive years or during the same season by succession planting. Once a heavy feeder is harvested, put a light feeder in its place. For example, once the spring planted spinach bolts and is yanked up, sow something from the light feeder list in its place. The following is a list of some vegetables categorized based on their nutrient needs.

HEAVY FEEDERS: All Cole Crops (broccoli, cabbage, cauliflower, Brussels sprouts), corn, leafy items such as spinach, kale, endive, escarole and lettuces, celery, vines such as pumpkins, winter and summer squash and cucumbers, tomatoes and eggplants.

LIGHT FEEDERS: Most roots such as carrots, parsnips, potatoes, garlic, onions, rutabagas and turnips, leeks, peppers

SOIL BUILDERS - (Sometimes referred to as legumes): beans of any sort, peas of all kinds, clover

You will note in the sketch the area that is set aside for the corn, potatoes and legumes (TT) is such that a 3 year or 3 crop rotation is possible.

As a side note, even though potatoes are light feeders compared to Brassicas, it's best not to plant potatoes where Brassicas were the previous year. They like soil that has had lime or wood ashes added to it which raises the pH of the soil whereas potatoes like a more acidic soil.

Hopefully the factors I've laid out will help you determine what system will work for you given your location, your resources and goals. Now let's get down to the dirt on garden soil.


Maine Homestead Garden

Soil Building and Preparation

Whether growing in containers, raised beds, wide rows/beds or conventional rows, good soil is key to food production. Soil nutrition is particularly important when food is grown intensively meaning plants are spaced closely together. Soil must be in top condition in order to meet their high nutrient demands.

Few people are blessed with the ideal garden soil called loam. We certainly never have been. When squeezed, loam forms a ball but it can be broken up easily. This good friable soil stays together when hand squeezed but is crumbly when broken apart. It retains nutrients and moisture yet excess water drains away. It's the perfect medium to grow a variety of vegetables.

In Saskatchewan our basic soil structure was sandy. As to be expected the soil felt grainy or gritty, dried out quickly which was great in the spring but not so great during dry spells and was prone to nutrients leaching out of it. If I tried to squeeze it into a ball, it would hold no shape and crumbled apart easily. Incorporation of organic matter was the solution to the problem.


Garden Clearing in Virgin Forest Hockley Lake

Here in Nova Scotia we have the opposite of sand, which is clay. When dry, clay soil is rock hard. When wet it is sticky and greasy. When squeezed it forms a sticky ball that's hard to break up. Clay soil is hard to dry out and if it's worked when it's too wet it will form hard lumps and clods which are difficult to break apart. I've noticed we have about a 3 - 4" layer of good topsoil and right under that is a 2" layer of gray, rock-like clay. This strata is prevalent no matter where I have dug. I have often thought if we could just transport the sandy soil from the Saskatchewan homestead and incorporate it into the clay soil here we'd have the perfect mix. Since that's impossible, to combat the clay soil we have begun incorporating copious quantities of organic matter into the garden. But before any soil building program could commence at either homestead, we first had to clear the land.


Ron Dropping Trees in Orchard/Garden in Nova Scotia

We've built 3 gardens on our 3 homesteads over the course of 40 years and not one of those gardens was easy to establish. The first one in Maine was an old field thick with young growth of alder and regenerating forest while the other 2 were completely forested. We simply were never lucky enough to plunk ourselves down at a ready-made garden site.

As you can imagine, it took a great deal of work to get our gardens in proper shape. The first order of business was clearing the garden areas of vegetation and trees. Ron will tell you, that's where he made his first big gardening mistake in Maine when he had the bulldozer essentially scrape off his layer of topsoil and deposit it in a huge heap that also contained uprooted trees and roots. It took him years to rebuild the soil using the techniques I will outline below.

In the wilderness of Saskatchewan, we didn't have the luxury of having a machine available so it was by pure effort that we cleared garden areas. Pure effort as in winch every tree out including the roots – one at a time, manually. Talk about work. However slowly but surely, we were able to winch the trees out and Ron was able to make the first pass with the rototiller. As soon as he started rototilling, it was evident that a thin layer of moss and decaying organic matter was all that covered our new garden spots. At most, 2 inches of top soil existed. We resided in what is known as the Precambrian Shield which is noted for its poor, thin soils, and our sandy knoll was no exception. Clearly a soil building program was needed.


Hard to Believe This Will be a Garden

Here in Nova Scotia, we were faced with another forest to clear. It was a young forest with a bole diameter of 6 inches or less. With a chainsaw, Ron cut the trees and I lugged the branches to various piles. Then we flagged out the garden areas and let the excavator rip the roots out. A bonus from this procedure was the excavator was able to dig around and get a lot of the boulders out as well. Sadly, the excavator didn't remove all the boulders and we dug them out by hand and wrestled them off to the side.

Hopefully you will have an easier time of things and have a cleared field or lawn in a back yard to work with. There are multiple ways to convert a lawn to garden. You can till it by making several passes with a rototiller to start breaking up the sod, you might use a shovel to dig and remove the sod in pieces or maybe you want to kill the lawn by placing a black plastic sheet over it. Our choice, since we have the tiller, would be to grind it up, rake all the clumps of sod out of it and then do a final till before planting. All the clumps that are raked out should be composted and eventually added back to the garden soil.


Can You Believe This Will Be a Productive Garden?

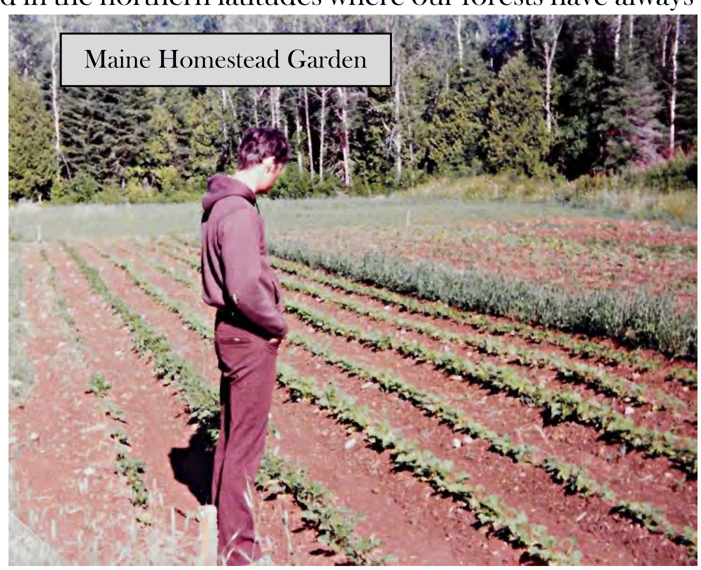
Ron did a double dig bed in Saskatchewan which was labor intensive but produced a wonderful bed for our asparagus and strawberries. He dug a wide trench about a foot deep and set that soil aside. Then with a tined fork, he worked the soil to loosen the bed further and mixed in organic matter. Then he moved over a few feet and started to dig again. Instead of setting that soil aside, it was placed in the first trench he dug. He repeated this process until he reached the far side of the garden. He loosened the soil with the spade and then all the soil that was set aside from his very first trench went to fill the last trench. Now we had a deeply dug bed of loosened soil with lots of added organic matter. It was a breeze to plant and maintain. Once the plants were in the ground, the rows were mulched.

Another option is to lay black plastic down on your garden area for a month or more until the lawn is fried. Then at that point, you can decide whether to dig/till it up into a conventional garden or to start piling on mulch and compost to create a no-till garden bed. There are many schools of thought on hand dig, till or no-till with pros and cons for each method. We favor breaking the soil up with either shovel or tiller to fluff, aerate, as well as to add nutrients and organic matter, which all of our gardens have desperately needed.


Preparing the New Berry and Asparagus Patch

At all our locations, after the garden sites were cleared we embarked on an arduous soil building campaign that included organic matter as a key component. Even if you don't have to go through the land clearing process that we did, your ground will benefit from the following soil building tips. Organic matter helps to correct soil structure and improve soil fertility. There are various sources of organic material some of which are easier to come by than others. Leaves, animal manure, cornstalks and other garden plant residue, compost, sawdust, seaweed and wood chips are some of the materials we've used. We've always used what we have easy access to so no cocoa bean hulls or shells for us, two items that are often given in any list of organic materials.

In my opinion, one of the miracle soil amendments is peat moss. Adding it to sandy soil will improve water holding capacity. Adding it to clay soil will improve drainage. Pretty amazing how it can work both ways. Garden centers sell peat moss but because we've lived in the northern latitudes where our forests have always had copious quantities of moss that is free for collecting, I use this as a peat moss substitute. I collect this naturally occurring resource figuring it has essentially the same positive attributes as peat moss.


Maine Homestead Garden

Regardless of what you use, your objective is soil that will hold moisture yet allow any excess to drain away. It should allow roots to spread easily, allow root crops such as beets, carrots and potatoes to grow down and outward and supply the necessary nutrients for growth of healthy plants.

Here's the "dirt" on how we've proceeded at each of our homesteads. In Maine the soil was rocky but the closest to loam when compared against our other homesteads. We used compost, animal manure from our barn animals, sawdust that was generated by our portable band sawmill and green manures to supplement the soil.

Green manures and cover crops are plants that are grown for the express purpose of plowing under or tilling into the soil. It's possible to turn them into the soil manually with a shovel too. They are one of the easiest way to improve the soil. Cover crops serve multiple purposes. They improve both soil texture and fertility. They help prevent erosion, facilitate microorganisms that break down the organic matter, and once broken down, they are a source of nutrients for garden plants. Another benefit is that they will out compete the weeds to a degree.

We've used rye, vetch, clover and buckwheat as green manures. Experiment with some of these cover crops. See what grows best in your climate. It won't hurt to mix and match. A simple way to work them into your garden plan is to classify them as the soil builders I talked about when I mentioned crop rotation. That way a portion of your garden is being spiffed up with these crops each year.

In Saskatchewan, we scraped up all organic matter and topsoil from the future sites of the house, storage shed and woodshed prior to building. Transporting this material by wheelbarrow, we dumped the contents onto the garden areas and tilled it in. This process continued each and every year except material was collected from the surrounding forest instead. Over the years, I collected wheelbarrow after wheelbarrow of forest duff and rotting log material from the surrounding area to improve our garden's soil. I bet I hauled a couple hundred wheelbarrows of organic matter to our garden through the years. We also employed the green manures I mentioned above as well as compost. Because of these efforts we ended up with dark loamy soil 8-10 inches deep. And it showed by the quantity and quality of produce we ended up with.

Here in Nova Scotia we are starting out with a slightly thicker layer of topsoil but the clay layer underneath it is problematic. Copious quantities of organic matter will be required to get the soil texture where it should be. To that end we are incorporating any organic matter we can get our hands on. Naturally occurring moss and leaves from our surrounding woods as well as wood chips that we are generating with our chipper. Currently we have huge piles of brush that resulted from the clearing of the land. Slowly but surely we are processing the brush into wood chips, some of which we are tilling into the soil and some of which will be used for mulch to curtail weeds. Eventually that mulch will be worked into the soil too. We are also using green manures and compost here just as we have elsewhere.

Testing your soil before adding any soil amendments is a good idea. The results will indicate just what is lacking, what the pH of the soil is and will dictate what to add for best results. Your county agricultural extension service can test your soil for you. Contact them for specifics. In lieu of that, you can buy a simple soil testing kit which gives an idea of the soil's pH (how acidic or alkaline the soil is). Kits also test for other nutrients such as nitrogen, potassium, and phosphorus just as the extension service test does. The "Big 3" as I refer to them are vital for proper plant growth. Other nutrients are necessary too but these are the most important. If the soil is lacking in nutrients or it is too alkaline or acidic, work will need to be done to correct any problems so plants can not only grow, but thrive.

Perhaps a brief explanation of pH is in order. You don't need to understand this to the degree a chemist would but you do need to realize its importance to plant growth. If the pH isn't optimum, a plant may not be able to make use of nutrients even though they are in the soil. A scale that runs from 0 to 14 is used to denote pH results. Zero is used to denote the most acidic and 14 the most alkaline with 7 being neutral. Most vegetables and fruits like a pH between 6 and 7 although there are some notable exceptions such as blueberries and cranberries which need acid soil. Potatoes also prefer slightly acid soil and should not be planted where you've spread lime or wood ashes. These amendments are used to raise soil pH from acidic levels to the more neutral range. How much you need to add will depend on the results of your soil test.

Our three gardens have all been in northern areas and have always had fairly acidic soils. With a pH of 4-4.5, the soil in its natural state is perfect for blueberries, cranberries and potatoes, but much too acidic for most vegetables. Sometimes we have used lime but since we've heated with wood all these years, the ash from our stoves has always been dusted on the gardens to neutralize the acid and sweeten the soil. Because we are constantly adding acidic organic matter each year, we spread wood ashes each year too.

For fertilizer, if you have animals, their manure will be a wonderful addition to your gardens. It will make a world of difference in growth. However because it is potent stuff it should never be applied immediately before planting as you risk burning seed and plants.   Best to spread it on the ground the fall before spring planting and till it in to make sure nutrients are incorporated into the ground and not lost to the air. Better yet is to compost the manure. See the compost Chapter for more info.

Organic Fertilizers

Soil fertility was a big issue at our last homestead in Saskatchewan as well as here in Nova Scotia. Soil tests showed the soil was deficient in everything at both places. As a result, rigorous soil building campaigns have been key to our successful gardens. The premise of the organic approach to gardening is to feed the soil which will then in turn feed the plants. In contrast, the non-organic approach uses chemical fertilizers to merely feed the plants while doing nothing to enhance the soil. We've always found the organic approach the best especially for anyone trying to live sustainably. To that end, here's what we did initially until we learned a lesson the hard way.

We made a big mistake in Saskatchewan. Our soil was terrible and we opted to fly in bags of "composted" manure since we had no animal manure at our disposal. In reality, we think the bags were attached to the rumps of the animals and as soon as the bags were filled, they were loaded onto the truck headed for the local garden store without being composted, which would have killed the weed seeds.

Then people like us purchased the stuff, spread it on their gardens and the hard-fought battle for weed control was underway. Through the manure we had introduced a number of weed species that were not native to our area. Unfortunately, they thrived. As fast as we weeded, a new batch would sprout. It was all we could do to keep them at bay. So, don't make that mistake if you can help it. Even though the bag may say "Composted Manure," it may not be.

To avoid the introduction of more weed seeds, we stopped using the bagged manure and switched to bone and blood meal. Blood Meal is a source of nitrogen and bone meal is a source of calcium and phosphorus. Additionally, we keep all our eggshells and crush them up and add them to the garden. There is debate on how useful crushed eggshells are for the garden but we do it. It doesn't hurt.

Of course, we make and use compost as outlined in the compost chapter. All the organic matter our gardens generate ends up back in the garden as a soil amendment in the form of compost.

We employed the same soil building methods for the soil in the greenhouse beds, herb garden and asparagus/strawberry patch.

At this point it might be helpful to mention that organic fertilizers take time to do their magic. Unlike chemical fertilizers that work pretty quickly, organic types take time to work. If you wait until a plant exhibits deficiency symptom, application of an organic fertilizer may not help because it takes too long to work. To that end it pays to be proactive and try to anticipate plant needs and apply fertilizer accordingly. In general, high nitrogen fertilizers, manure and blood meal for example, are prone to leaching out of soil and shouldn't be applied too early. On the other hand, many phosphorous fertilizers such as bone meal and rock dust take a long time to work. Here's a simple calendar I use to determine what to do and when for good soil care and improvement. This can be your guide for an annual program of soil maintenance too.

In the fall: Transport all plant remnants to the compost bins. Till in all remaining plant residue except diseased plants which should be removed and burned. Turn under any green manure crop and possibly plant a winter cover crop. Apply the following according to results of your soil test - lime, bone meal or other phosphorus fertilizer such as phosphate rock.

In spring: Turn under green manures at least 2 weeks prior to planting. A summer green manure can be planted at this time for tilling under later in the growing season. Apply nitrogen fertilizer such as blood meal and composted manures and potassium fertilizer such as wood ashes.

Be aware wood ashes have a very rapid release rate and can burn seeds and young tender plants so be sure they are well dispersed throughout soil prior to planting. They can be used as a side dressing later in the season (I have done this successfully with my Cole crops) providing you allow a margin of safety between the plant and the ashes. I once inadvertently burned some young bean plants by being too aggressive with the application of wood ashes.

Vegetable Seed Selection

Late winter is the time of the year to get seed and/or nursery stock on order whether you are getting started for the first time or you already have gardens established. A good use of the drab winter days is perusing seed and nursery catalogs and ordering seed for spring planting.

Some companies may offer a discount as an incentive to order early and avoid the last minute rush. Ordering early also ensures availability is not an issue due to shortages or outages of stock or seeds. Frustration is studying the catalogs, making selections, then placing the order only to discover said choice is sold out. Ordering early minimizes the chances of that happening.

What varieties and quantities of vegetable seeds to order is highly individualized and is governed by your food preferences, eating habits, how much room you have to plant things (do you need compact, dwarf or bush varieties that are space saving), how much time you have to devote to food production, as well as what your intended goal is as far as quantity is concerned. For example, do you merely want some fresh veggies for the table during the summer months or are you looking to grow and put by a year's supply?
Regarding selection of vegetable seeds, it's quite helpful to know how many frost free days your location has. Your county extension service is a good resource for this information. They can also give you the average date of the last spring frost and the average date of the first fall frost. Speaking to neighbors who garden is another valuable resource as is any weather data from the local weather service. Best of all is to keep records yourself so that over time you can determine what is true for your specific location as you may have a microclimate to take into consideration.

Microclimates exist that may be harsher or more moderate than what's expected for any particular area. For example, when we lived and homesteaded in northern Maine, we were in a low lying area and often got frost when the neighbors didn't. Water bodies and wind breaks create microclimates too. Trees, bushes and tall hedges on the north side of a property give protection from cold winter winds. In fall, a nearby water body (pond, lake or ocean) may help delay the first frost as the water is a heat sink of stored heat from the summer sun.

It is possible to create your own microclimate too. In Maine, we planted grapes on the south side of our house. By doing so we effectively planted the grapes in a protected environment which made it possible for us to grow them.


House Will Create a Microclimate for Garden

Seed catalogs give the number of days it takes for any given vegetable to mature. Sometimes the days are given as the number of days once transplanted out. In those cases, the days that elapse from the time the seed is planted indoors to when it's ready to set out are not included in the days to maturity.

There are a multitude of ways to extend your growing season in both spring and fall so you aren't limited to this theoretical number, but knowing the number of days is helpful when choosing which varieties to grow. Here's what I mean. If you have a short growing season, say 60 days, choosing a corn variety that takes 90 days to mature isn't the best choice.

Other criteria play a role in what veggie variety to buy. Is the variety bolt resistant once hot weather arrives? This characteristic is important for spinach and lettuce as they prefer cool weather. Does the variety have long term storage capabilities or is it meant for immediate use or short term storage only? Long term storage is a valuable asset in the winter keepers such as winter squash, potatoes, onions, carrots and beets particularly if your goal is vegetable independence and freedom from supermarket produce.

Whether a variety is disease resistant or disease prone is important too. If you're trying to raise food organically with a minimum use of sprays, resistance to various fungal diseases and wilts is an asset. How much space you have is another factor to consider. In northern Saskatchewan where my growing season was short, we used hoop tunnels over growing beds. Space was at a premium; the beds were intensely planted, so I opted for bush varieties of winter squash, pumpkins and cucumbers. In Maine, we didn't use hoop tunnels, but just planted these seeds in hills spaced several feet apart so I didn't need or use bush type varieties.

If you plan on saving your own seeds, you must select open pollinated varieties, not hybrids. The home gardener can't successfully save seed from hybrids. Well, you can, but the seeds will not produce anything like the original plant. Instead you will end up with something inferior compared to the original hybrid plant.

Catalog descriptions of size, shape and taste are helpful but do need to be taken with a grain of salt especially when it comes to taste. Sometimes it helps to pay attention to what characteristic they fail to mention as much as what they do say. Remember, they are trying to sell their seeds so any description will generally be a positive one. You will never read "this variety tastes lousy but sure does grow good."

When the ground is blanketed with snow and a cold wind is howling, there's nothing like sipping hot tea and perusing seed catalogs with their colorful pictures of succulent produce while dreamily envisioning your own garden's splendor. But if at all possible try to avoid the temptation of ordering one of everything in the catalog. This may take considerable willpower, but you'll be glad you thwarted your over exuberance come summer when you're battling the heat and bugs while weeding, thinning and cultivating your prized garden.

Let's Get the Garden Started!

Although it might seem like garden season is far away, unless you plan to buy your vegetable transplants from a nursery center, the time to get your garden started is when the snow is visible and the temperature is still dropping below freezing. Seeds for vegetables such as tomatoes, peppers, celery, cabbage and other Cole crops must be planted indoors so they have a jump start before they are transplanted out in the garden.

There are many reasons for starting your own transplants. Cost is one. A packet of seeds is cheap especially when you consider how many seeds it contains. Often a packet has enough seeds to last for several growing seasons if properly stored. Compare this to buying a pack of six plants that cost considerably more than the packet with dozens of seeds in it.

Variety is another. Garden centers usually carry popular varieties whose name is well known to the general population. But those varieties may not be the best for your particular geographic location or they may not be the best for whatever end use you have in mind. For example, because I make and can lots of sauce, I grow many paste tomatoes. I've tried many types of paste tomatoes over the years and have settled on Amish Paste as being one of the best. But this is not commonly available in any garden center I've ever visited so I must raise the seedlings myself if I want this variety in my garden.

Transporting pest and diseases to my garden is another reason for raising my own. One year I had to buy some pepper plants. Unbeknown to me they were infested with aphids. I was plagued with that problem the entire season.

Lastly growing my own transplants makes me more self-reliant. I'm not depending on others to raise seedlings for my garden. If your goal is self-sufficiency, learning how to raise healthy seedlings is an integral part of that goal.

Before any seeds can be planted, you must first prepare your starting soil mix. You can buy sterilized potting soil from any garden supply store but I opt for a homemade mix that uses my own garden soil. In the fall, before the ground freezes, I collect buckets of soil and store it inside until I need it the following spring.


Sterilizing Potting Soil for Seeds

Garden soil must first be sterilized before it can be used to start seeds otherwise your seedlings will be at high risk for damping off, a fungal disease that kills young seedlings. The tiny plants can be fine one day and keel over the next unless precautions are taken. Close inspection of an affected seedling reveals the stem has a pinched appearance right at the soil level. Before long the little plant succumbs to the disease. Once the plants grow and develop what are called true leaves they are at less risk for damping off. But getting them to that point is problematic unless you sterilize your soil.

To do this I first remove large pieces of debris such as twigs and pebbles from my stored garden soil. If there is an overwhelming amount of extraneous material the soil can be sifted, although I personally have never done this. Next, I add water so the soil is wet but not mud. Then I place the wet soil in an oven proof pan and cover it with foil. I heat this in the oven set at 275°F until the soil reaches 160°F. Using a meat thermometer inserted into the soil is helpful since too high a temperature creates salts that may be damaging to seedlings while too low a temp allows dangerous plant pathogens to survive.

Why wet the soil? First wet soil doesn't smell as bad as dry soil during the heating process. Second and most importantly, the steam generated from the wet soil is what helps to sterilize it.

Once the soil is sterilized, I cool it and keep it covered with the foil until ready to use. To use, I mix equal parts of perlite and vermiculite with the soil. So in essence my mixture is ⅓ sterilized garden soil, ⅓ perlite and ⅓ vermiculite. I place this mixture in my sanitized plant trays.

My plant flats are black plastic trays which I've purchased from a garden center. With care, they're reusable and in fact I've used the same flats for about 15 years.

To sanitize my plant trays, I first wash them with soapy water and rinse. Then I mix 1 Tablespoon of bleach with 1 gallon of water, rinse the trays with this mixture and air dry. They're now ready for my homemade potting soil mixture.

When I was new to gardening I followed timetables for starting seeds indoors outlined in garden books since I didn't know any better. Sometimes their recommendations were right on but sometimes they weren't. At least not for me and my locations. So I've deviated from the pros advice and come up with what works for me. For what it's worth, here's my time schedule for starting seeds indoors. Interestingly enough even though I'm in the northern latitudes, most of this schedule is appropriate for family members who garden in the mid-Atlantic region of the United States, so it might just work for you too. For information more specific to your locale, consult your county Ag/cooperative extension service.

Probably the biggest difference between my schedule and others is I start peppers, celery, onion seeds and leeks 12 weeks before setting out, not the recommended 6-8 weeks before. For me, these seeds take as long as 3 weeks to germinate and after that they grow very slowly. Perhaps if I had a heat germination mat on the bottom along with grow lights, things would progress more quickly. I have neither. By starting my plants so early, I compensate.

- **Early Feb** - all peppers
- **Mid Feb** - leaf lettuce to transplant into the greenhouse
- **Mid to late Feb** - Leeks, onion seeds, celery
- **Mid March** - broccoli, cauliflower, Brussels sprouts and early cabbage
- **Late March** - all tomatoes, Florence fennel
- **Early April** - red cabbage
- **Mid April to the third week of April** - all vines (melons, squash, pumpkins, cucumbers) fall storage cabbage, second planting of spring broccoli, assorted types of lettuces for transplanting to garden, herbs for tea
- **First week in May** - Corn
- **Mid May** - seeds for fall broccoli and cauliflower

- **Early June** - seeds for fall head lettuce
- **Late June** - seeds for fall leaf lettuce, seeds for beets and winter variety of radish
- **Early July** - summer radish for fall harvest
- **Mid to late July** - seeds for fall kale, seeds for fall lettuce for transplanting to greenhouse

Many methods and procedures exist for starting seedlings: jiffy pots, jiffy pellets, trays, trays with domes, cell plug trays, pots that fit in trays, trays with capillary watering mats and the list goes on. For a first time gardener the choices are overwhelming. Which system is best?

When making a decision, bear in mind what seeds require to germinate: moisture and heat. Light is generally not an important factor until a seed germinates. Then light becomes important. To meet a germinating seed's requirements here's what I do.

I fill my sanitized plant tray with my sterile soil mixture and plant my seeds. To plant most seeds, I make a shallow furrow with my finger or marker stick, about ¼ inch deep. After sprinkling my seeds in my furrow I cover them with soil and gently pat down the soil so the seed is in good contact with the mix. However some seeds are so fine and tiny they are best planted by merely sprinkling them over the surface and patting them in. Celery is an example of a vegetable that benefits from this technique. I plant many of my herb seeds this way too.

With the exception of corn and vine crops such as squash, pumpkins, melons and cucumbers, all plants I start indoors begin their life in plant trays. Because I use a single flat to start most of my vegetable seeds, I must use markers to label each item. For example, I grow several kinds of tomatoes as well as peppers. Seedlings tend to look alike so unless I label them it would be difficult to identify which is which. Markers are sold by seed catalogs for this purpose. Wooden popsicle sticks also work as do plastic strips cut from an empty bleach bottle that has been thoroughly rinsed out. Be sure to use a permanent marker to label your sticks otherwise the ink could be obliterated by repeated waterings. If you grow the same varieties each year, the marker sticks can be reused repeatedly.

Next I mist the soil with a squirt bottle filled with water. I've also used an empty spice bottle filled with water. The plastic shaker top is a perfect way to mimic a gentle "rain" that won't wash out newly planted seeds. Then I place a piece of plastic wrap loosely over the top of the tray to keep in moisture. (This is the purpose of domes that are sold with plant trays.) I put the planted seed tray in the warmest place I have, behind the wood stove, and wait for the seeds to pop. If necessary I mist or sprinkle the soil with my water filled shaker bottle to keep it damp.

Heating mats are sold that are effectively heating pads for plant trays. Placing a tray on top of the heat mat provides bottom heat that helps seeds to germinate. I get good results without any bottom heat. As a teenager, I never used a heating mat either to help germinate my vegetable seeds. I remember we had a hot water heater that was the size and shape of a washing machine and dad used to put the planted seed tray on top of the flat water heater since the top was nice and warm. That did help with seed germination.

Once the seeds germinate I move the tray to a sunny, preferably south facing window sill and remove the plastic cover. Plant grow lights are useful once seeds have germinated. However, I simply rely on natural light from sunny window sills which works fine.

Once the seeds in my flat have their second set of true leaves they are ready to be moved from the flat to individual pots. True leaves are not the first leaves that a seed produces. The first leaves are called seed leaves and are soon followed by the true leaves. So once the second set of them shows up it's time for the next step.

First I assemble all my pots and containers. I have some plastic pots I bought for this purpose. If I have a choice of round versus square I always opt for square as they fit in my plant trays the best. But I don't have nearly enough purchased pots so I supplement with plastic milk jug bottoms.

We are both big milk drinkers so naturally we generate many empty one-gallon jugs. I have come up with several uses for this waste product, one of which is to cut off the tops and utilize the bottoms as a plant pot for seedlings. All Cole crops, tomatoes and pepper seedlings eventually find their way to their own individual milk jug pot. Having a large pot ensures plenty of room for their roots to grow and assures I have the biggest, healthiest plants as possible come transplanting time. If you're in a short season area as we are, this is critical.

The fact that the jugs are translucent allows me to judge how much water to add to the pot. This is important. Because I want to be able to sit the jugs on all sunny window sills, I don't poke drainage holes in the bottom. If I did I'd have to worry about excess water leaking out. Being able to see through the jug, I can judge how much water to add without adding too much. To water all my seedlings, I use warm water. While hot water would undoubtably kill them, cold water is detrimental too as it's quite a shock to their roots.

So once I have my containers assembled, I fill them with my soil mix and they are ready to accept seedlings. To remove plants from the flat, I pry up the soil medium from the bottom to loosen up the tiny roots. I don't want to break any of these if I can help it. Then I gently tease the seedlings apart. I select the strongest for transplanting. I look not only at the green growth but at the roots too. If a big seedling has a puny or damaged root system I discard it.


Transplanting Seedlings


Transplanted Seedlings Waiting for Spring at Hockley Lake

Picking up the little plant by some of its leaves I gingerly pop it into the soil in its new home. I try not to pick it up by its stem as I don't want to crush that tender plant part. Then I give it a good drink of water and sit the pot on a sunny windowsill.

There might be some transplant shock but within a few days the little seedlings have recovered and are ready to be fed. I've used seaweed extract for this purpose as well as manure tea. The seaweed extract is a commercial product I bought that comes in powdered form. I mix up a stock solution per the package instructions then dilute as specified by the instructions.

To make manure tea, fill a burlap or loosely woven bag with fresh manure. Suspend it in a garbage can full of water and let it steep for several days. To use, dilute it until it is the color of weak tea. For those who aren't opposed to chemical fertilizers, any fertilizers meant for indoor houseplants could be used too.
Seeds for onion and leeks are planted in their own flat. They grow in these containers without being transplanted and when the time comes, they are planted directly in to the garden. I've found that by periodically trimming the green tops to about 2" in height, I get stronger plants. The trimmings make tasty additions to a spring salad.

If you have a short season, starting the vines and corn indoors will give you a jump start on a harvest and may even make the difference between getting a harvest or not getting one. Many pundits claim corn can not be successfully transplanted outside so therefore should not be started indoors. We've started corn indoors every year for almost 20 years and have had bountiful harvests as a result. It is the only way we could have grown corn in northern Saskatchewan.

The following is the method that works for us. Around 2 weeks prior to my setting out date, (no more than 3 weeks before) I get my corn seed started. I initially used peat pots thinking they would breakdown in the soil when I planted the corn pot but they didn't. They stayed intact. This meant the roots struggled to grow and break free of the peat pot resulting in stunted plants. Not good. So now I use individual plastic pots. I fill the pot with my soil mix, plant 2 to 3 seeds and water the pot. Ultimately I will select the best plant to grow and trim off the rejects at soil level. I have little disturbance to the roots come transplanting time since each transplant is in its own individual pot. The last couple of years though I've experimented with starting corn in a deep flat. This works providing I am careful when transplanting to the garden and the plants themselves haven't gotten overly large, which is why it's important not to start corn too early.

To start cucumber, squash and pumpkin inside, about 4-5 weeks prior to setting out I begin by pre-sprouting my seeds between damp paper towels. To do this, for each vegetable, I wet a separate paper towel. Then I place seeds on it and fold part of the wet towel over the seeds. I put the towel in a zip lock bag and put the bag in a warm place. I place them on top of our water heater. Each day I open the bag to admit fresh air and check on progress. Once the seeds sprout I set them in containers filled with my soil mix (I use the bottom half of a gallon milk jug).

By transplanting time, I like to have vine plants with a big enough root system so when I turn the pot upside down, the soil stays around the roots. That way when it's time to set them out, I can slip out the ball of soil and seedlings, set the root ball gently on the ground and bring topsoil up and around the soil ball to create my "hill." I've found this disturbs the roots as little as possible which is important for successful transplanting of the items.

Water all the seedlings as necessary. You want to keep the soil damp but not soggy. Fertilizing once a week is likely adequate but when it gets close to transplanting time stop fertilizing to prevent lots of lush, new growth. At this point it's time to start hardening the plants off in preparation for their imminent graduation to the great outdoors.

Ready to Plant

Hardening off is the process of getting the tender seedlings that have been growing in the protected environment of the house used to the vagaries of the weather outside. This begins by ceasing the fertilizing as I mentioned above about a week before starting to put them outside.

Next is to begin acclimating them to outside conditions of direct sunlight and winds. This is a gradual process. Start by putting your seedlings out in a sheltered spot for a couple of hours. Select a spot that has some indirect sunlight at first and is protected from strong winds that can dry out plants, break off stems and may even yank plants up by their roots. Each day gradually increase the time outdoors and increase the exposure to sun and winds. If you've done the process properly, in about a week's time the plants are hardened off to the point where they are ready to be set out into the garden. Failure to harden off seedlings results at the very least in severe transplant shock but most likely in plant death as the tender plants succumb to the harsh outdoor conditions of direct sunlight and winds.

Deciding when it's okay to plant either seeds or transplants is sometimes a gamble even for experienced gardeners. I'm always trying to push the envelope and get a jump on things in the spring. Sometimes I win and sometimes I lose. By in large the biggest factor in helping you decide when it's safe to plant is knowing your average frost free date. Remember though this is only a guide. Inevitably there are freak cold snaps that occur later then expected. If such an event is imminent and you've already set out frost susceptible seedlings, don't despair as there are things you can do to protect them which I'll talk about later.

In addition to the frost free date, pay attention to your weather forecast. Clouds act as an insulating layer and tend to keep frost at bay. Clear skies at night favor a precipitous drop in temperature. If it's 40°F outside at 8 PM and clear as a bell you would be well advised to take precautions against frost. Another tool you can use is the phase of the moon. Many times the last spring frost coincides with the full moon, especially if the night is clear. Be alert to frost danger which can extend to several days before or after the full moon.

You may find this spring planting schedule useful:

5 Weeks before last spring frost:

- Peas
- Spinach
- Parsley
- Broccoli
- Cabbage
- Kale
- Brussels sprouts
- Chives

4 Weeks before last spring frost:

- Cauliflower
- Leaf lettuce (both plants and seeds)
- Onion sets
- Garlic
- Leeks

3 Weeks before last spring frost:

- Beets
- Carrots
- Radish
- Celery
- Celeriac
- Endive/Escarole
- Chard

On the frost date:

- Beans of any sort
- Corn
- Squash
- Tomatoes
- Florence fennel

After the frost date:

- Cucumbers
- Eggplant
- Peppers
- Melons
- Peanuts
- Pumpkins
- Winter and summer squash
- Sweet potatoes

Regarding terminology, when a vegetable is classed as a cool season crop, it generally refers to any plant that can be planted before the frost-free date. If a vegetable is referred to as a warm weather crop it is usually planted on the frost-free date or later.

Not every vegetable benefits from being started indoors. In fact, some can't realistically be sown inside. Peas, beans, carrots, beets, Belgian endive, spinach, kale, parsnips, turnips and rutabaga should all be directly seeded in the garden meaning their seed goes from the packet directly into the ground. Here's an easy to refer to list of what I start indoors and what I direct seed.

Start inside:
Celery
Peppers
Leeks
Onion seeds
Tomatoes
Broccoli
Cabbage
Brussels sprouts
Cauliflower
Corn (for earlier harvest)
Lettuces
Eggplant

For those with short seasons:
Cucumbers
Melons
Pumpkins
Summer and Winter Squash

Direct sow outside:
Peas
Beans
Carrots
Beets
Radish
Turnip
Rutabaga
Winter radishes
Corn
Lettuces
Belgian endive
Kale
Endive/escarole
Garlic
Parsnips
Onion sets

For those with long seasons:
Cucumber
Melons
Pumpkins
Summer and Winter Squash

A trick I've discovered to facilitate germination of seeds sown outdoors especially in sandy soils which dry out quickly, is to make a furrow the required depth (see the back of the seed packets for specifics), plant the seed, then cover with soil, but leave the furrow slightly depressed. These slight grooves or depressions catch water that may otherwise run away thus giving a germinating seed a critical substance it needs to emerge.

To aid in germination, I have found N-sulate garden covering works magic. The material slows evaporation of moisture which is particularly beneficial in soils that dry out quickly. In Saskatchewan where the soil was very sandy, my germination rate for fine seeds such as carrots was poor until I got the bright idea to put the N-sulate right on the soil surface. The fabric also heats up the soil which speeds germination, a plus for anyone in a short season area.

To set out transplants, I like to soak the soil in the tray or pot first. I allow some time for the plants to suck up some of this water prior to setting them in the ground. To plant, I make a hole with my trowel, set the plant at roughly the same level it was growing at in its tray or flat, press the soil gently around the roots (the exception is the vines I already talked about) and give it a good drink. Sometimes I give it a drink of fertilized water to get it off to a good start but I've used plain water too. If the ground is very dry at transplanting time, I may saturate the open hole, set the transplant into the hole and then prior to firming soil, give everything another drink. When planting large transplants such as tomatoes or peppers, after the plant is in the ground, I'll pull up some soil in a ridge around each plant to form a bowl. It functions the same way as the slight depression in seed furrows, namely to act as a reservoir for water so newly set out plants get off to a good start.

I learned the hard way that planting depth is important. For several years my onion transplants died after I set them out. Took me a while to figure out why. Turns out the problem was I was essentially burying the poor things and they didn't like that one bit. Once I smartened up my success rate soared. I now pay careful attention to the transition between the white and green portions on each onion plant. The seedling is set in the ground so that the transition zone is even with soil level.

I talked about starting corn inside but not how I set it out. My method is to use a bulb planter and basically drill a hole to set the corn plant in but a trowel works to make a hole too. Because corn benefits from being "hilled" up, I make a hole the depth of the bulb planter, probably, 3" to 4", set in my corn plant, give it a good drink, backfill, then pull soil around the transplant so its stalk is surrounded by a "hill" of dirt several inches high. Corn grows tall and this mound of soil helps to give it support from winds.

Instead of lugging a tape measure or yard stick out to the garden at planting time, I made myself a planting stick out of a lath strip 4' long. I marked the stick with a permanent magic marker in 6" increments, 6", 12", 18" etc. When planting it's a simple matter for me to place my stick on the ground and pop my transplants in at the proper interval, then move my stick down my row or bed until I reach the end. I also use this stick to plant my corn seed, seed potatoes and onion sets. Granted I could eye ball it, but this makes for more accurate spacing. I can also use it to measure off the distance between rows. I pound a stake in at either end of the potato rows then run string between them before planting any seed. This ensures my rows are straight and evenly spaced which makes my life easier when it's time to hill up the potatoes.

Succession Planting and Intercropping

Succession planting and intercropping are two practices that ensure you are getting the most out of your garden space. Both are intensive gardening techniques that in conjunction with raised bed and wide beds/rows ensure the most efficient use of space.

As the name implies, succession planting is two or more crops in succession. In other words, after one crop is harvested, another is planted in the same space. To be effective, you have to have a rough idea of maturity dates for vegetables you want to plant in succession, the expected length of your growing season and the first expected frost in the fall. The longer the growing season the more options you have. For example when I was a teen gardening in Maryland, I was able to plant a 60 day corn variety in the area vacated by the peas. We planted the peas around mid-March. They were done and out of the garden by June 1 and the 60 day corn went in their place. We were able to do this thanks to the blessedly long growing season. Incidentally this was a good succession too since the peas are a type of soil builder whereas the corn is a heavy feeder.

As another example, once the spring planted cabbage and broccoli were done, we planted beans in their place. Yet one more example of succession planting as well as following heavy feeders with soil builders.

However, once we headed to the northern latitudes of Maine and especially the extreme north of the bush of northern Saskatchewan, such successions were no longer possible. But we were able to put the principle in to practice a little. For example, once the spinach bolted, we followed it with something else, usually some peas with a short maturity date or a late planting of radishes. Depending on the year some of the peas didn't fully mature but we did get something out of the succession planting.

If you live in the southern states of the US, you are lucky. You'll have more options on what you can grow with succession than us as your growing season is longer. This translates to needing less ground to grow the same amount of food that we do. Because of our short season, we usually don't have many good growing days left after we harvest something and in fact many items such as beans and corn take the entire season for us to get a crop. So, count your blessings and make the most of your good fortune.

As I said earlier, to be successful with succession planting you must be familiar with maturity dates of various vegetables and you need to have transplants ready at the right stage of growth to put in spots as they open up and become available. It takes some thought and planning but the brain power you expend to figure out what will work will pay dividends. Here's a formula to aid you in your planning. It has been adapted from "The Seed Savers Handbook" by Nancy Bubel.

1. Take the days to maturity found on the seed packet
2. Add to that number 7 days for the seeds to germinate
3. Add to that number 14 days to allow for the fact the days will be getting shorter after the summer solstice (June 21)
4. Add to that another 14 days if the vegetable is frost tender (beans, corn, cukes, tomatoes, peppers and zucchini fall in this category). If the vegetable isn't frost sensitive there's no need to add 14 more days so skip this step.
5.If you will be growing transplants add 14 to 21 days to account for the time it takes to get the vegetable to a size that's ready to transplant. If your vegetable is one that is normally direct seeded there's no need to add this figure so skip this step.
6. Take the total number of days you have calculated and using a calendar count back from your expected frost date. That is the date you need to get the vegetable in the ground to get a crop before frost.

The following lists of vegetables with their susceptibility to frost may be a helpful guide.

Frost tender:

- Beans
- Corn
- Cucumbers
- Summer squash
- Peppers
- Tomatoes
- Pumpkin and winter squash vines
- Eggplant
- Sweet potatoes

Can survive light frost:

- Beets
- Cauliflower
- Endive
- Head and leaf lettuces
- Peas
- Onions
- Spinach
- Potato vines

Can survive heavy frost:

- Broccoli
- Brussels sprouts
- Cabbage
- Leeks
- Kale
- Carrots
- Radishes (summer and winter types)
- Turnips
- Rutabaga
- Belgian endive

If you have no experience ascertaining what is meant by heavy and light frost, these guidelines may be helpful.

- Light frost 28°F to 32°F
- Moderate frost 24°F to 28°F
- Hard freeze anything below 24°F

Most frost tolerant vegetables will be damaged or even killed by temperature below 24°F especially if these temps are sustained for any length of time.

By the way, the soil builders can be used in succession too. I have used them successfully in succession even in the short season areas where we've lived.


Intercropping Squash and Lettuce

Intercropping is another intensive garden practice that's invaluable for anyone wishing to get the most food out of whatever land they have. It involves growing at least two crops in close proximity to each other or even among each other. To achieve this I typically plant an early maturing vegetable with later maturing one. For example, for years I have never planted radishes by themselves. Instead I always seed carrots and radishes in the same furrows. The radishes germinate faster than the carrots so they in essence mark the carrot furrow. If I need to cultivate that area of my raised bed before the carrots emerge, thanks to the radishes, I can easily see where to run my cultivating tool without worrying about damaging the ungerminated carrots. Because radishes take only about 25 days to reach maturity they are harvested long before the carrots which take about 70 days. Hence, I get two crops out of the same ground.

I also sow radish and parsnip together. Parsnip takes a very long time to germinate, sometimes up to three weeks. By planting the quick germinating radish with the slow germinating parsnip I once again mark my furrow which facilitates cultivation.

Another example of pairing a quick maturing vegetable with a longer maturing one involves lettuce with pumpkin, squash and cucumbers. Leaf lettuce takes about 50 days. The vines all start out in "hills" spaced 8' to 12' apart for standard varieties and 4' to 6' apart for the bush types. In either case that's a lot of real estate sitting idle waiting for the vines to grow and spread into. To avoid letting this valuable area sit vacant I plant lettuces around and among the hills. By the time the vines are spreading and running, the lettuce has been harvested and I've gotten a lot of salads out of the area that would have been unproductive.

Some plants such as tomatoes and corn love the heat and are sun worshipers while others prefer cooler temperatures. Greens such as lettuce, spinach and endive fall into this category and will bolt (go to seed) in summer heat. Planting the cool loving vegetables, which coincidentally happen to be short, among the taller heat loving veggies is a perfect pairing. The taller vegetables provide shade for the shorter, cool loving greens. To facilitate planning your succession crops and intercropping, here's an abbreviated list of some quick maturing vegetables and the approximate number of days from planting to table. Check your seed packets or seed catalogs for info on other vegetables not listed.

Green beans - 50 days	Beets - 60 days
Kale - 60 days	Leaf lettuce - 45 days
Peas, early variety - 55 days	Bibb lettuce - 60 days
Radish - 25 days	Spinach - 50 days
Summer squash (zucchini, patty pan and yellow types) - 50 days	

If you have limited space or time, you can still reap a significant harvest. By judging every vegetable according to the space it takes up against its yield, you can choose vegetables that keep producing over a long period of time so you get a high yield from only a few plants. Tomatoes and peppers are examples of this. You can also choose vegetables that yield big harvest from little space. See the list below for more examples of these.

Bush and pole beans	Onions
Beets	Radish
Carrots	Bush summer squash
Lettuce	

While I'm on the subject of garden planting, here are a few more ideas for you. You can get some bumper crops with "cut and come again" vegetables. These are plants, usually the leafy ones, where more than 1 harvest is possible by picking off the outer leaves as opposed to whacking off the entire plant. Pick the outer most leaves leaving the center 4-6 small leaves to continue growing. Be careful not to damage the central growing stem. I've used this technique with leaf lettuce, kale, endive, New Zealand spinach, escarole, and celery and it works well. If you like chard it should work well with that too.

Finally let's not forget about vertical growing. Every year all my peas grow vertically up chicken wire fencing that I support with tall stakes I pound into the ground. I've trained vines such as melons and cucumbers to grow up a trellis. Pole beans are a natural for vertical growing as they are meant to grow up a pole by nature. As a kid I used sapling poles dad cut from the woods. He pounded them into the ground and then we planted the bean seeds around the poles. The beans grew up the pole without any encouragement from us. You can buy poles from garden centers for this purpose. In addition to saving space, vertical growing makes picking easier as there's less bending over and stooping. The sketch has areas devoted to vertical growing (T1 & T2).

Mulch and Fertilize

Mulch is merely a layer of material usually organic in nature but not always, that is spread on the soil surface. The advantages of mulch are many. Mulch cuts down on weed germination so you have less weeding to do. It keeps moisture in the soil thereby decreasing the need for irrigation. For anyone in a hot and/or dry region this is a major bonus. Another benefit for folks in these regions is that mulch helps keep the soil cool which is important for the cool weather crops such as broccoli and cauliflower. This aspect of mulch is a detriment in the north however, unless the soil is first allowed to warm up. I won't apply a mulch until about July 1 because of this. Additionally, June is slug month here in Nova Scotia and I'm afraid if I put mulch everywhere my slug control program would be hampered. Mulch not only protects against erosion from heavy rains, but also keeps vegetables from getting spattered by mud. In the case of tomatoes this may help prevent the spread of soil borne diseases. It also keeps low growing crops such as herbs and lettuce cleaner. For plants that sprawl on the ground, cucumbers, melons and the like, mulch helps protect them from rot and mildew that can occur if they're in direct contact with the soil.

Mulch can be used as frost protection. In Maine in spring, many a time we sprinkled a layer of straw over newly emerged bean and corn plants to protect them from frost. And finally if the mulch is organic in nature, it can eventually be worked into the soil to add organics to the soil.

Materials we've used for mulch include straw, seaweed, wood chips we generate with our chipper and sawdust. But that list is far from complete. Grass clippings, thick layers of newspaper, pine needles and leaves are other possibilities. Use what you have and what is the least expensive. Be aware though some caveats exist depending on what material you use for mulch. Leaves and pine needles tend to be acidic and lower the soil pH. To combat this, spread lime or wood ashes. Woody type mulches (wood chips and bark, sawdust) tie up nitrogen when they first decompose so additional nitrogen rich fertilizer may be needed to compensate.

Not all mulches are organic. Black plastic is one non-organic we have used in the melon patch in years past. Melons are heat loving plants. The black plastic warmed the soil and area around the plants providing the melons with the warmth they crave. We simply secured the edges of the plastic with soil so it wouldn't blow away, cut some holes in the plastic a few feet apart and set the transplants in the ground through the hole we cut. We no longer use the black plastic though. We found that a good layer of organic mulch around the plants is best.

Once the garden is planted, the main job will be to keep things, weeded, watered, fertilized and thinned. And finally harvested when they are ready. Weeding is a chore many find disagreeable but it's a necessity lest the weeds over take and choke out your crops. They also compete with the desirable plants for moisture and nutrients. As mentioned mulching helps with weed suppression thus minimizing the need for weeding. Sometimes mother nature provides ample moisture in the form of rain and sometimes not; in which case supplemental water will be required. We've always collected rain water in barrels set under the drip line of the roof eaves and then we bucket this water to where we need it to go. In Saskatchewan in the heat of the summer, we often had dry spells with little rain. With our sandy soil, supplemental water was a necessity to keep things growing or even from keeling over. Given our short season we could ill afford to lose any good growing weather so every 3 to 4 days we fired up the pump we used for fire suppression and Ron played "fireman" and watered the garden with a spray nozzle attached to the firehose. We found we were better off if we watered frequently to keep the soil damp than if we let the soil dry out completely. If that happened we had a devil of a time bringing the moisture back up to desirable levels.

Regarding fertilizing, at some point through the growing season many items need a shot in the arm, particularly the heavy feeders such as corn and the Cole crops. Side dressing, as this is called, is the application of fertilizer to a growing plant. You can use compost, compost tea, manure tea, composted manure, liquid seaweed extract, or a balanced commercial fertilizer such as 10-10-10. If you are growing your food organically be aware that most organic fertilizers take time to work. By the time you notice deficiency symptoms such as discolored leaves or veins in the leaves, it may be too late for organic fertilizers to do much good. We grow organically as much as possible but if I have to choose between not getting a crop due to a nutrient deficiency or using a quick acting non-organic fertilizer, the non-organic fertilizer will win every time. We also use foliar applications of fertilizer which can be purchased at anygarden center as a plant booster.

Thinning is the process of removing excess seedlings so the remainder can grow and prosper to their full potential. Many people, me included have difficulty sowing fine seeds thinly enough so no thinning is required. In fact, I often sow thickly so I'm sure I'll get a crop. Emerging seeds have lots of competition; slugs, flea beetles and even mice have plagued my tender, young sprouts. If I start out with an abundance of little plants, I can be assured there will be enough for us. But planting thickly also means I must at some point thin out the plants so the remainder aren't competing for water, nutrients and room to grow. It's a tedious task and one I usually do in stages as opposed to thinning to my final spacing all at once. The first time through I will glean nothing edible but after successive thinnings I generally get a little something for the table. Granted these tiny carrots give new meaning to the term "baby carrots" but they make great additions to our salads. Carrots, beets and spinach are vegetables I always spend time thinning.

Insects and Diseases

When I think about the myriad of diseases and insects that can plague any garden it's a miracle we harvest anything let alone enough to feed us through a year. We use organic controls almost exclusively and rarely have we had a vegetable fully succumb. Many organic practices help with prevention of diseases and insects. First, a healthy nutrient rich soil will produce strong healthy plants that are less prone to attack. Second is being diligent with garden clean up by either removing debris or tilling it in where it will decompose. Next is avoiding applying mulch if the soil is cold and wet as this promotes fungal diseases and mold. Believe it or not, practicing good hygiene by washing your hands after touching any diseased plants will help prevent the spread of the disease. The same applies for any tools that come in contact with sick plants. The tool should be disinfected in a bleach solution. Rotation is another defense as is selection of disease resistant varieties.

Even if you've done everything in your power to prevent problems, you will at some point have to deal with an insect infestation or a disease outbreak. Pay attention, be vigilant and observe closely for any signs of trouble. Once spotted take action immediately to keep things from getting out of control.
Cutworms are a common pest that strike transplants by chewing through the stem at ground level. Luckily these are easily controlled with collars put around plants when they are set out. Many people use paper collars around the stems of transplants setting the collars an inch or 2 in the ground. I've made collars from empty plastic milk jugs by cutting off the top and bottom of the jug. I'm left with a "ring" that is reusable for several years until it finally begins to disintegrate from UV exposure. These have worked well for me.

Sometimes a covering of Reemay or cheesecloth will prevent an insect infestation. If you're plagued by flea beetles, cucumber beetles, or root maggots this would be a remedy to try. We've covered young carrots with Reemay to prevent damage from root maggots. This was very effective for us. Before we started doing that, our mature carrots were filled with tunnels from the maggots. Large bugs such as Colorado potato beetles are easily picked off by hand. In Maine, we hand picked both the adults and immature beetles, collecting them in a can, then fed them to our hens. They loved them. Insects too small to hand pick such as aphids or whiteflies, which sometimes plague greenhouses, can be sprayed off with water or the plants can be sprayed with insecticidal soap. In a greenhouse, whiteflies can be trapped with sticky strips. The ones I've used are yellow pieces of stiff material that are covered with a very sticky substance that traps the pest when they fly or crawl on to it. They work great.

Corn ear worms are a common pest in corn. As a kid, I had to deal with them in Maryland and we have them here in Nova Scotia. The method I've successfully used to control them is half an eye dropper of mineral oil squirted in to the tip of the ear after it has been pollinated. Application of mineral oil too soon may interfere with pollination. When the tips of the silks start to turn brown, apply oil. Evidently, vegetable oil is just as good as mineral oil. And if a little BT or pyrethrum is added to the oil, it provides even more protection.

Slugs are a common pest particularly where conditions are wet and damp as they are here in Nova Scotia. Shallow trays of stale beer are effective traps. Using disposable aluminum pie plates filled with stale beer, I set the tray in a shallow depression I dug so the lip is at ground level, making it an invitation for all slugs to go for a swim. The slugs are attracted to the beer, crawl in and drown. I've used a mixture of yeast and sugar water in shallow trays and this worked too but it was a time-consuming task to continually mix up the concoction. I shifted tactics and now use rocks and small scraps of lumber as traps that I scatter throughout the garden. Each day, usually in the morning I go on "slug patrol." I overturn each trap and stab any hiding slugs with a stick. They roam at night and take refuge under the traps during the day. I eradicated 108 slugs this way last season.

As a last resort, there are organic insecticides that can be used for serious infestations. Bacillus thuringiensis, also called BT, BTK and Dipel works wonders on all caterpillars such as cabbage loopers, cabbage worms (which also attacks all the other Cole crops), corn ear worms, corn borers and gypsy moths. I use this stuff regularly on all my Cole crops. I buy the liquid form, dilute it per the directions on the bottle and spray on with a pressurized garden sprayer being sure to spray the underside of leaves. In Maine, my red currants were often infested with little green worms that devoured the leaves. A couple of treatments with Dipel took care of them in short order.

Diatomaceous earth is the dried skeletons of microscopic algae called diatoms. Their sharp edges abrade the outer layers of soft bodied insects eventually killing them. It's effective on root maggots, aphids and caterpillars, but fortunately earth worms aren't harmed. I use it for root maggot control for my carrots and winter radishes. To use, dust infested plants, especially under the leaves that have been dampened by a rain or irrigation so the powder sticks and doesn't blow away.

Pyrethrum, which comes from the flowers of certain chrysanthemums, is effective against soft bodied insects as well as certain beetles: squash bugs, Harlequin bugs and leafhoppers. This is potent stuff and should only be used when absolutely necessary. Because of its potency, we've steered clear of it but we've never had a serious infestation of any of the pests it kills. If we did, I'd likely change my practices and use it in desperation. If you want to try making your own, plant Chrysanthemum cinerariifolum and collect the white daisy-like flowers when they are in full bloom. Dry them then grind them up. Soak 1 cup of the powder in 2 quarts of very warm water for 3 hours. Add ½ cup of dish soap to help the liquid stick to plants and spray infected plants. This doesn't store so it needs to be used immediately. Planting chrysanthemums among garden plants may repel undesirable insects too.

Rotenone is an organic insecticide we have used through the years for serious infestation of potato bugs and flea beetles. Once again this is potent stuff so we only used it as a last resort when hand picking the potato bugs wasn't enough. In both Saskatchewan and now in Nova Scotia, flea beetles are a big problem in the spring and attack our Cole crop and vine crop transplants. If I didn't take steps, the pest would kill our seedlings. Rotenone does a good job but unfortunately is no longer available for purchase in Canada or the United States by backyard gardeners due to a change in government regulations. From now on, diatomaceous earth and Neem Oil are two options available to control flea beetles.

One of the best ways to address diseases in a home garden is prevention by planting disease resistant varieties. This practice is especially helpful when it comes to tomatoes which are susceptible to verticillium and fusarium wilts. As a kid, my Dad always told me to grow tomatoes that are VF resistant to avoid losing the whole crop to these wilts.

Another is to have good air flow around plants particularly in areas that are humid. Wet, humid conditions favor development and spread of diseases. For those planting intensively, the close spacing of plants may cause problems for certain vegetables. It has for us. Every time we've tried to plant beans closely together, I had issues with mildew. We've finally abandoned intensive culture of beans and have returned to traditional planting in rows. This has decreased our mildew problem significantly.

Roguing, or removal of infected or diseased plants can help prevent the spread of a disease. Do NOT put this sick plant in your compost. Burn it. And be sure to wash your hands before heading back to the garden and touching healthy plants lest you act as a vector spreading the contamination.

Rotation and cleaning up plant debris at the end of the season helps with disease control too but when all else fails there are 2 organic fungicides that can be used, sulfur and copper. We've bought both of these in powdered form and have applied them by mixing with water and spraying on. Sulfur powder can also be sprinkled on but you really need to apply to all plant parts which is hard to do when applying the powder. Spraying is more effective. However, the one drawback I've found is that the powder is hard to mix and keep suspended thus it clogs the spray nozzle.

Copper and sulfur can be used to combat powdery mildew, early and late blights, anthracnose, and fireblight, a disease that can kill apple and pear trees. Due to our bad experience with crystalline copper, sulfur would be the fungicide of choice for this. We've used a powered copper product in the past with no noticeable negative effects. In the future, if we were to use any copper product, it would only be applied to plants exhibiting fungal problems. If you were inclined to spray all plants as a preventive measure, I would highly recommend spraying a couple of plants only. Monitor for a few days and if no ill effects, then you should be safe. To be effective, any fungicide needs to be reapplied at 7 to 10 day intervals but follow product directions. I've recently read that vinegar can control powdery mildew by mixing 2 to 3 TBSP per gallon of water. I'll have to give this a try and see how it works.

Varmint Control

No matter where you live, there will be critters that want to feast on your garden just as much as you do. Keeping them at bay is a challenge but one worth the effort in my opinion. The best all round deterrent is a dog. We had a pet dog in Maine and our garden was seldom bothered by deer, rabbits or raccoons. In lieu of a dog you can use various barriers to keep out unwanted animals.

Rabbits have been the bane of my existence since I was a teen in Maryland. Back then I could stand at my bedroom window and watch rabbits come out of nowhere in the evenings to chew on our newly transplanted Cole crops. Fast forward 30 years and I could still watch the same thing happen in northern Saskatchewan. These were hares, a souped up version of a rabbit. The furry varmints were lawn mowers devouring everything in their paths. Chicken wire fencing is adequate to keep out rabbits and fairly easy to erect. Simply pound some stakes into the ground and attach chicken wire to the posts being sure the fencing is secure at ground level. Ron hoes up the soil at the base of the fence to make it rabbit proof. We used it in Saskatchewan and are using it here in Nova Scotia too. Instead of using staples to attach the fencing to the posts, we use pieces of wire inserted through the chicken wire and around the stakes then twist the ends together.

Deer are rampant in many parts of the United States as they are here in Nova Scotia. They can be kept at bay with electric fencing which is what we are using. Any fence whether electric or not will need to be tall as they can leap shorter fences. Groundhogs which like to burrow and dig can be kept out by extending wire fencing about 10 inches and bending it at a 90 degree angle outward away from the garden then burying this extension. Birds can be deterred with anything shiny and flashy such as disposable aluminum pie plates, tin can lids and the like. Suspend these from string above whatever you need to protect. Bird scare flash tape is a product I've used that acts on this principle. The tape is reflective mylar that's red on one side and silver on the other. It comes on a spool and you simply spool it out over and/or around what you want to protect. Any breeze sets all the shiny items in motion and they act as deterrents to animals. A family member uses a fake owl that's attached to a pole to keep birds away from ripening cherries. When they start turning red she gets out Mr. Owl, attaches it to the deer fence around her garden and the birds stay clear of the cherry trees.

While we're on the subject of birds, they can be advantageous as well. Why not make an automated 24-hour bio insect control system? Sounds like quite an engineering feat doesn't it? It's really quite simple though. Instead of using pesticides as the first line of defense, erect various bird houses and bat shelters on your property. With bird houses, we want to extend an invitation to any bird that makes insects the bulk of their diet to take up residence here. There are many birds that "fit that bill." Swallows, bluebirds, chickadees, bats, purple martins, sparrows and wrens are just a few of the bird species that will not only keep garden pests in check but help keep mosquitoes and biting flies at bay. They'll take turns getting rid of the pests for you. In Saskatchewan, we loved having night hawks, chickadees, warblers and swallows on insect patrol.

A bat can eat an astonishing 4,000 insects a night and a bluebird around 1000 bugs a day including cabbage worms, whiteflies, aphids, earwigs, grasshoppers, cucumber and potato beetles, caterpillars and grubs! We're talking some serious bug eating. The more the merrier as far as we're concerned.

You can do several things to attract birds to your site. Begin by putting out feeders with several types of seed, then erect bird houses that you've either built yourself or bought. Keep in mind, bird houses are built with certain dimensions depending on the species you want to entice and the locations where the boxes are placed will be critical as well. The size of the house opening and distance up from the ground are both important considerations to research for your local bird species. A bird bath may also help to attract some birds. Setting up a bat box on your place can encourage bats to set up housekeeping on your homestead. As symbiotic homesteaders, birds and bats can play a vital role in insect control. Between the two, insects are under attack day and night.

If you have the power to run a radio, you can use this to keep raccoons out of the corn patch when the ears are close to maturity. Put a plastic pail on its side, put the radio inside it to keep moisture off the radio and plug it in at night. Just be sure not to set this up too early or the raccoons will get accustomed to it. To be the most effective, wait until the corn is almost ready before setting this up.

Scarecrows may help to some degree but once again animals get used to seeing them and in time may realize there's nothing to be afraid of. I move mine around to different locations to combat this. If you're able to change the positions of arms or legs this may help too. My brother-in law uses these and he swears by them. If you can get your hands on a mannequin that would make a great scarecrow. The one thing to keep in mind is to not set up any of these things too early as critters are smart and they will eventually figure out there's nothing to be afraid of.

Unfortunately, porcupines are numerous at our location in Nova Scotia. To our dismay, we discovered they are voracious eaters of raspberries and they did some serious damage to our new raspberry plantings. We plan to use an electrified mesh fencing to keep them out of the berry patch that has not only raspberries but blackberries and strawberries as well.

Believe it or not mice were a serious problem in our Saskatchewan garden. Everything was fair game, newly emerged peas, mature peas (they would chew right through the pods to get to the peas), heads of broccoli, squash and melons. It took me a while to figure out what was causing the damage but once I did, I set all the mouse traps we had. Every day I checked my "trap line." One summer I trapped 120 of the vermin. And I'm sure there were plenty I didn't snag.

Season Extenders

For anyone seeking food self-sufficiency, anything you can do to prolong your growing season will mean more weeks of fresh eating. Even if your ultimate goal is just fresh eating for a couple of months of the year, with a few tricks you can extend the availability of your fresh home grown food by weeks, a month or even longer, thereby reducing the need for supermarket produce.

One simple, easy method to extend your season is through the use of a cold frame. A cold frame is a four sided frame usually made of boards, plywood or planks that is outfitted with a glass or plastic cover through which the sun can shine so you can take advantage of the greenhouse effect created by the glazing (the glass or plastic). There is no supplemental heat source. Heat for a cold frame comes from the sun and is stored in the soil. At night, heat is released back to the inside of the frame. The cover slows the loss of heat to the outside. The hinged lid is set at an angle and must be able to be opened so the frame can be ventilated on sunny days lest you fry any plants inside.

A cold frame can be any dimensions, but 3' deep is a user friendly size. A depth much more than 4' makes it difficult to reach to the back of the box. It can be any length you desire but you may want to take into account the size of whatever you'll be using for the lid (usually old windows, storm doors etc. that you have laying around).

Regarding the angle of the lid, the optimum design is one such that the sun's rays hit the covering at a 90 degree angle. Because the angle of the sun changes throughout the year, it's impossible to have an angle that is perfect for all times of the year. Most of us opt for the angle that is best for the spring since that is when transplants will be parked in there waiting to graduate to the great outdoors of the garden. To achieve that, we figure 9 inches for the front of the frame rising to about 14 inches at the back. Much as a cathedral ceiling in a house might be nice, it's not energy efficient. The same is true for a cold frame. Our cold frames are just high enough to handle the height of growing vegetables and the insertion of multiple standing gallon jugs of hot water. Anything more and it's wasted space that needs to be heated. Keeping the cold frames as compact as possible has allowed us to do some wonderful things in some mighty harsh climates.

Obviously the lid needs to be covered with something clear to admit light. The covering is called glazing. Glass or pieces of plastic can be used as can rigid sheets of greenhouse glazing materials. Be aware the rigid sheets are expensive though. I've used frames whose lids were covered with plastic as well as recycled old glass windows and both have served the purpose. Glass lids tend to be heavier than plastic, yet, unless you accidentally break the glass, are more durable since over time plastic will degrade especially if it hasn't been UV stabilized. By double glazing the lid you can improve your box's performance as the double glazing has a bit of an insulating effect. Double glazing refers to having two panes of glass or two layers of plastic with an insulating air space in between.

Probably the most important thing to consider when setting up a cold frame is where to put it. To be effective, the frame must face south. If you can position the frame on the south side of a building so much the better.

The cold frame can be used in many ways. To harden off transplants prior to setting outside, to start hardy spring plants, to grow the season's first salad greens, to grow transplants for fall planting or to overwinter hardy fall plants.

You can buy fancy kits to build a cold frame from seed and nursery catalogs. Or you can scrounge. Every frame I've ever used has been made from recycled lumber, old windows and such. The first frame I used even had "hinges" that were merely strips cut from an old leather belt. In a pinch you can quickly build a makeshift cold frame using hay or straw bales for the sides and cover the opening with an old window. In this case the lid will sit flat on the bales and not be angled so the contents will not be receiving the optimum amount of light but the set up is better than nothing.

However you decide to construct your cold frame, throwing some sort of an insulation cover over the lid at night will help keep in any heat on cold nights. Old blankets, quilts, sleeping bags and pieces of canvas are some of the things I've used through the years. You can also use pieces of rigid foam board type insulation you purchase for this purpose such as pieces of Styrofoam or Celotex. Whatever you do, don't use fiberglass. Shoveling some dirt around the outside walls of your box will help retain heat on cold nights too.

By insulating the insides of the box with some type of rigid foam as listed above and better yet extending that insulation down into the soil around the edges of the box, you can turn your cold frame into a grow frame. Doing so makes your box more versatile as now not only can it perform all the duties listed above but now you may be able to grow a substantial quantity of greens through the winter. This is especially true if you can tolerate the Asian greens such as Mizuna, Tatsoi and so forth. We've tried them and while tolerable, they are by no means our favorites. Unfortunately, the cold tolerant plants of broccoli, cabbage, endive, lettuce and spinach that we prefer are slow growers in the low light conditions of a northern winter. Remember most plants need a minimum of 6 hours of direct sunlight. Depending on your latitude, 6 hours may not be available in the dead of winter. With the arrival of February and the noticeably longer days, growth resumes with a vengeance and we're off to the races. In more southern latitudes where there is more daylight in winter, growth rates for these plants may be more favorable, so if you reside in the south, give them a try and see what happens.

Regarding Asian greens, a plethora exist. I've noticed seed catalogs now have a selection of these items for sale, so if you're interested in trying them, availability of seeds is not the problem it was years ago.

Taking it one step further is the hot bed. This is merely a cold frame with a supplemental heat source as well as insulated sides that extend to about 1 foot below the soil surface. The heat can come from an electric cable, an incandescent light bulb, a string of outdoor Christmas lights, a chicken brooder lamp, or from the traditional way, fresh manure.

This box does everything the above boxes do but it does it better. The heat helps promote seed germination especially if the heat is coming up from below and it also promotes steady growth of seedlings including any that are cold sensitive. Depending on where you live, a hot bed may enable you to raise some hardy vegetables in the dead of winter assuming you have enough hours of daylight.

Traditionally fresh manure is used as the heat source in a hot bed. Fresh poo gives off heat as it decomposes and since heat rises, if the manure is buried under the soil surface, the heat from decomposition will keep things warm. To set this up, first dig a hole 1½ to 2 feet deep. Fill the hole with fresh chicken or horse manure until it's about 8" from the soil surface. Wet the manure slightly to encourage decomposition. Next put on 8" of soil. Before long, just a few days in fact, things start cooking and your seeds and transplants will be toasty warm. A word of caution though. It's possible the manure may make the soil too hot once it gets going. As a result it could cook any seeds you plant. To avoid this, use a soil thermometer to gauge soil temp and don't plant any seed until soil temperature drops to 85°F. Soil thermometers are sold in garden centers and seed catalogs.

The manure method is an old fashioned way of providing heat to the box that is low cost and doesn't rely on electricity. This is a boon to anyone off-grid. But if you're looking for a more modern way to provide bottom heat, you can purchase soil heating cables and install them in your box. Once again garden centers and seed catalogs sell these things. Follow the manufacturer's instructions for installation but in a nutshell you will dig down about a foot inside your frame, place a 2" layer of vermiculite on the bottom to act as insulation, then lay the cord on top in a loop configuration. Put a thin 1" layer of soil on top of the cable then lay on a piece of hardware cloth to prevent nicking the cable with a trowel or other tool. Finally add at least 4", preferably more, of soil.

Other methods generally provide heat from overhead. Suspending lights or bulbs are examples of this. These methods work too. I can clearly recall my dad placing one of his shop lights containing an incandescent bulb in the frame on cold, early spring nights and all the transplants surviving just fine. Of course, we covered the lid of the frame to help keep in the heat too.

One low tech, off-grid solution we've come up with that works great is to fill empty 1-gallon milk jugs with hot water and place them in the frame. They essentially act like hot water bottles. I've used this technique in the early spring as well as late fall/early winter and it keeps the items inside my frame from freezing even when temperatures go down to below zero F. Depending on how cold it's supposed to be, I'll use between two and four jugs of hot water. Each night I'll cover the jugs and plants with a layer of a product called Reemay (more on that later) close the lid and cover that with a thick blanket. From experience I'm able to sleep worry free knowing all will be well come morning.

All three of these boxes require some attention to make them successful, namely that the lid must be opened, closed or partially open depending on weather conditions. Spring sun can heat up any of the above frames to dangerous levels pretty quickly so vigilance is required. An air temperature inside the box of more than 80°F is too hot and the cover has to be opened or your plants will croak. Putting a thermometer inside your box is helpful in gauging the internal air temperature.

Ideally the lid should be opened based on the weather conditions throughout the day. You should keep it closed until the outside temperature reaches 40°F at which time you can crack open the lid about 6". When the outside air temperature hits 60°F or above, open the lid completely. In mid-afternoon the cover should be closed because you want to retain the heat from the day to help the box stay warm through the night. If you leave for work early in the morning and arrive home at dusk, clearly this schedule is problematic. Fortunately, there are devices sold that are thermostatically controlled which can open and close the lid (provided it isn't too heavy for the device to move) depending on the ambient temperature in the box.

Since we are basically home most of the time, we opt for the low-tech way of doing things. We manually open and close the lid as needed and you can too if someone is home to do it. The lid can be cracked open with a stick, scrap piece of wood or anything else you can scrounge. You can even make a low tech but fancy prop by taking a scrap piece of 2X4 and cutting two or three notches into it. To use it, put the prop on the ground and rest the lid in one of the notches depending how open or closed you want your box to be.

Plant Protection

No matter where you live, you will likely want and need to provide some frost protection to individual plants or groups of plants once they are set out. One way to do this is through individual devices that can be purchased ready made or by utilizing items you scrounge from your neighborhood or homestead.

Garden centers and catalogs abound with devices designed to provide frost protection to newly set out seedlings. Clear, plastic domes called cloches and water filled tubes in a circular arrangement are examples of some of the items available for purchase. We've never used any of these ready-made gadgets finding them pretty pricey. At $6.00 a pop for the plastic cloches or $4.00 each for the water filled tubes, buying enough to cover our 3 dozen or more tomatoes would send us to the poor house. Therefore I can't speak as to the effectiveness of any of these items.

But we did improvise many years ago at our homestead in Maine where we used milk jugs as cloches. Cutting the bottom off 1 gallon jugs, we then placed them over tender transplants such as tomatoes and peppers. Using soil, we buried the side of the jugs slightly to prevent them blowing away. Because they acted like mini greenhouses we had to "vent" each jug daily by taking off the cap. Late afternoon each day we had to screw them back on for the night to help retain heat.

We found these helped a bit with frost protection but they had draw backs. First was the fact they often blew away even though we had secured them. Second the cap removal and replacement was time consuming and labor intensive given the amount of plants we had. Third the plastic jug had very little insulation value so our tender plants still suffered adversely in spite of being covered.

In Maine, whenever frost threatened, we also utilized every conceivable thing we could get our hands on to protect rows of beans, corn, squash and pumpkins (this was back in the days before we wised up and started growing things intensively in beds), tarps, old sheets, blankets, buckets turned upside down, you name it we used it. But all these were makeshift solutions often times giving less than satisfactory results. If a leaf or any plant part was touching the covering it was damaged and black death was the result. Surely there had to be a better way. And there is, that being row and bed covers that encompass the entire growing areas!
When we moved to the bush of northern Saskatchewan we knew gardening was going to be a challenge. We were above the 56th parallel where the season was short and fickle. Frost could occur any time during the summer and in fact our first summer there we were zapped by frost in July.

To combat this, in the garden, we set up hoop tunnels over the garden beds using pieces of PVC pipe inserted into anchor tubes of larger diameter PVC pipe that were permanently embedded in the ground. None of our tunnels were tall enough to walk through. They ranged in heights of 2', 3' and 4' tall. Taller vegetables such as corn were planted under the taller tunnels.

Hoop House Anchor Tubes and PVC Hoops

The arcs of tubing supported pieces of greenhouse plastic. To secure the plastic in place, I dug a shallow trench down one length of the growing bed and buried one side of the plastic in the trench using pieces of firewood as anchors. We found out the hard way that without those wood anchors, the wind would rip the buried side right out of the trench and send it flying.

Wires to Support N-sulate Fabric – PVC Hoops to Support Greenhouse Plastic

To secure the other edge of the plastic sheet, we used sand bags, which were movable. This allowed for that side to be rolled back on warm, sunny days, left in place during foul weather or one or both tunnel ends to be vented while the rest of the sheet remained in place. Care must be taken to either vent the tunnels or remove the plastic completely depending on weather conditions lest the plants fry. Even on an overcast day it can get surprisingly warm in the tunnels.

Setting up these hoop tunnels as early as possible meant we could start warming the soil for earlier planting and expect better germination of vegetables that I direct seeded such as carrots, peas, beans and potatoes. It also meant any tender vegetables that are susceptible to frost (corn, squash, tomatoes, peppers, pumpkins and cucumbers) could be planted earlier thus enabling us to begin harvesting at an earlier date too.

Because the plastic only gives 1 - 2 degrees of frost protection, we also used a garden blanket in conjunction with the plastic. We used to use Reemay, a spun bonded polyester product. Now we use a product called N-sulate. We like this product better than Reemay because it's more durable and has up to 6 degrees of frost protection. After transplanting, I inserted wire hoops over my plants to support the N-sulate. Having the N-sulate suspended above the plants created a dead air space which contributed to superior protection. Then the plastic was pulled across the PVC arcs and weighted down so in essence we had another dead air space between the plastic and the N-sulate.

We've transplanted the corn, had the temperature go down to 20°F at night and all the tender seedlings survived just fine with this set up. We've had it snow so much that the tunnels were bowing with its weight and still had 100% survival of tender plants. In our opinion that’s pretty amazing and it’s testimony as to the effectiveness of the arrangement. Even though we are in a much more moderate climate here in Nova Scotia, we will still use this set up since it will enable us to get a much earlier start in spring.

We store both the plastic sheets and N-sulate sheets once danger of frost is past. Doing so extends their lifespan as they aren’t exposed to the elements the entire season. Thus we are still using sheets of plastic that are almost 20 years old. The N-sulate’s lifespan isn’t quite as long but we are using pieces that are about 15 years old. In our experience that’s about as long as they last as they are disintegrating at that point.

For anyone in northern states or who live at latitude with short growing seasons, these techniques will go a long way to increasing your gardening yields and thereby your independence. Even those blessed with a more moderate climate will benefit as it means being able to plant earlier and extend your harvest which translates to fresh eating for more weeks out of the year.

If you built your raised beds (RB) using any kind of wood: lumber, logs or landscape ties for instance, you can easily set up tunnels over your beds. By using metal pipe or conduit straps/brackets that are attached to the bed’s wooden frame, you have a nifty way to insert the PVC tubing used to support the plastic. All you have to devise is a good way to secure your plastic. I would make one side stationary and the other side movable so you can vent your tunnel according to changing weather conditions. Like us, you could use heavy gauge stiff wire hoops (Ron bought a big coil of it and cut the hoops to size) which are easily stuck in the ground to support your garden blanket of choice, be it Reemay, N-sulate or some other fabric.

This whole set up is another reason to make your beds as long as possible. Doing so means you only have to set up one or more long tunnels as opposed to many short ones. It’s a more efficient use of the plastic and managing the tunnels is easier and less time consuming as you will have fewer ends to vent.

And one last tip. If a frosty night catches you unaware and your garden gets zapped, don't despair. If you take immediate action before the sun hits the frozen plants, you may be able to save them. Immediate action coming in the form of water from your hose. Spraying or misting them before the sun defrosts them will keep the frozen plant cells from bursting when the sun warms them. If no hose is available, you could try using a watering can or a plant sprayer.

While I've never tried the following, I see no reason it wouldn't work for the home gardener. If frost is expected, protect against it by providing a continous spray of water to plants via garden sprinklers. How many times have you seen on the news Florida citrus growers spraying their orchards with water when threatened by cold weather? If it works for them, it should work on a smaller scale assuming you have a water source and sprinklers.

The Solar Greenhouse (GH)

The epitome of garden extending devices is a greenhouse (GH). To be clear there are two basic types of greenhouses, the conventional and solar greenhouses. Conventional greenhouses are the kind sold in kits with clear walls all the way around. They are attractive but impractical for year round food production. They overheat on sunny days, lose heat rapidly after sundown and lose more heat than they gain on cloudy, windy or cold days. An additional negative is we find the kits to be expensive.

Solar greenhouses differ from conventional ones in that they are designed to both collect and retain heat thus reducing or eliminating the need for supplemental heat. Specifically, they are designed with year-round food production in mind. Because a solar greenhouse is a more versatile structure usable for a longer period of time, it ensures more return in the form of food from what limited real estate you have.

Entire books have been written about greenhouse design which is well beyond the scope of this book, but there are some basic principles that bear mentioning. The idea behind all the design features is to avoid having to use supplemental heat during cold spells.

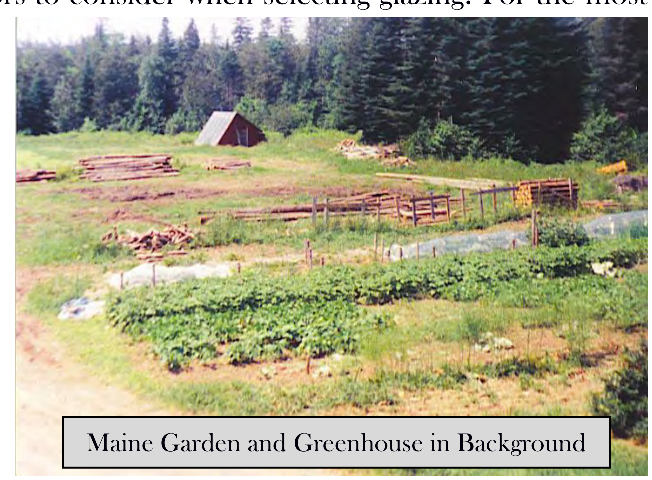
The solar greenhouse should be about twice as long (east to west that is) as it is wide. The long, south facing wall will have glazing. The remaining three walls should be insulated. This is a big difference as compared to the houses made from kits which are glazed on all sides. In a solar greenhouse, all cracks are caulked to prevent drafts. All interior surfaces should be painted white to reflect more light. The foundation is insulated with insulation extending to about 1 foot into the ground. The south wall should have two layers of glazing. Some sort of heat storage that will capture the sun's heat and radiate it back to the greenhouse at night should be included (water in containers is usually the storage medium of choice). Lastly some sort of insulating night blanket or curtain that can be put over the glazing at night to help retain heat is used. So there you have it. What could be simpler, right?

I have to say neither of our greenhouses was perfectly designed and met all the criteria I mentioned above. But we tried to incorporate as many of the design principles as we could. For example, the freestanding greenhouse we built on the Maine homestead had all walls except the south wall insulated. We used sawdust that was generated from our portable bandsaw mill in some of the walls as well as rigid foam blueboard for wall insulation. The south wall was double glazed with greenhouse plastic. This is plastic that has been UV stabilized to increase its lifespan. Without it, the plastic would likely be disintegrating before the first year is over. We had no insulation in the ground and no heat storage. I made a makeshift night curtain out of muslin and quilt batting. Whether it did any good or not is up for debate. But we were able to grow our tomatoes and peppers in there without worrying about them getting zapped by frost. Additionally, we learned a lot and gained some good experience.

By chance, I also discovered I could overwinter lettuce plants. I had some plants growing in there in the fall and when killing cold arrived I thought that was the end of them but I never bothered to yank them up. The following spring they started sending up new green growth so I gave them some water and they took off giving us very early salad greens that were welcome after a long winter's dearth.

As with cold frames and their cousins, the south wall of a solar greenhouse must be at an advantageous angle. It's impossible to have the perfect angle for all times of the year since the sun's angle changes. The simplest thing to do is to add 20 degrees to your latitude, call it good and use that figure as the angle for your south facing wall.

I should mention many materials exist for greenhouse glazing. Cost, availability of materials, thickness, durability and ease of installation are some of the factors to consider when selecting glazing. For the most part materials that come on rolls such as plastic or woven polyolefin are cheaper and easier to put up than the rigid sheets of material such as Lexan. My dream greenhouse would be glazed with this but unless I win the lottery, that isn't going to happen and since I don't play, I'm stuck using the cheaper alternatives. Woven materials are much tougher than plastic films, although the thicker the film, the more durable it is. We used a woven product as glazing on the Saskatchewan greenhouse and as a result, bears had to work hard to tear into our greenhouse in that wilderness environment. Regardless of what you opt for, any greenhouse glazing should be UV stabilized.



Maine Garden and Greenhouse in Background

Solar greenhouses come in many forms: freestanding like the one we had in Maine, attached, like the one we had in Saskatchewan, as well as pit greenhouses sometimes referred to as Walipini.

We wanted to build a pit type greenhouse here in Nova Scotia. Being on the coast, we live in an area prone to high winds and figured a pit type greenhouse would have a low profile to the wind. However we've determined our water table is too high. In spring, fall and during high rain events, the 4' to 5' hole would be filled with water. We'd have a great swimming pool but not a great greenhouse. So we've opted for an attached greenhouse like we had in the bush.

Our greenhouse in Saskatchewan was attached to the house. This saved on building and insulating the north wall as the north wall of the greenhouse was the south wall of our home. This is why we positioned the greenhouse (GH) in the sketch on the south side of the house. We double glazed the south wall using woven polyolefin as the outside layer and greenhouse plastic as the inside layer. We opted to double glaze the east wall too instead of insulating it as we wanted the rising sun to start heating up the house as soon as possible. The west wall was insulated and painted white.


Exterior View of Our Attached Greenhouse Hockley Lake

Milk Jugs as Heat Storage

I mickey moused the heat storage aspect of things by recycling our empty plastic gallon milk jugs. I filled these with water and placed them among my newly transplanted peppers, tomatoes and melons. I had at least 30 water filled milk jugs distributed throughout the greenhouse. During the day, the water absorbed heat, which was obvious when I felt the jugs. The next morning they were cold having given off their stored heat during the night. I know I didn't have near the amount of water for heat storage I should have had, but I think that what I did have helped considerably in spring.

At night, I also covered all the plants in the greenhouse with a double layer of Reemay, then removed it each morning. On really cold nights, Ron had "heater duty" meaning he put a kerosene heater in the greenhouse and put it on its lowest setting. He got very little sleep those nights as he was on alert for any malfunctions. Neither Ron nor the heater ever let me down. His efforts kept our plants from freezing. Good thing too since heading to a garden center for replacements wasn't an option given our remote location. If either of us misjudged and we lost plants to cold, we were out of luck. With no second chances, we had to get it right the first time.

Cold Frame in Greenhouse with Lettuce

The Saskatchewan greenhouse was home to tomatoes, peppers and melons through the summer, but before those plants were set out, I was able to pick the first salad fixings while two feet of snow were still on the ground. How? By placing one of our cold frames in the greenhouse in late March, I was able to plant lettuce seedlings raised indoors and direct seed radish and scallions in the cold frame. This greenhouse within a greenhouse meant I could keep things alive when night temperature dipped to -10°F or colder. It was much easier to create a favorable environment in the small cold frame than the entire greenhouse. In the hot bed section I outlined the procedure I used to protect these vegetables from the extreme climate. Namely that of filling empty gallon plastic milk jugs with hot water, sitting them in the frame, covering everything with some Reemay, closing the box lid and covering that with heavy blankets for the night.

If we had been hooked to the grid, I could have put an underground heater cable in the cold frame as I previously outlined and plugged it in at night. Since we were off-grid, I came up with an alternative solution and did the next best thing. The low tech hot water bottles worked surprisingly well provided I filled them with hot tap water each evening. Once the greenhouse warmed the next morning, I removed the blankets and either opened the lid or kept it closed depending on weather conditions.

Just like any of the frames or hoop tunnels, a greenhouse will overheat and needs to be ventilated. Even though the day may be cold, if it's sunny, a suprising amount of heat will be generated in the greenhouse. In Saskatchewan we took advantage of the heat by building the greenhouse so that we could open two of the downstairs windows and have passive heat from the greenhouse warm the house. But that alone was not enough ventilation. We had a hinged vent door at the peak of the west wall that could be easily opened and closed. The entry door was located on the opposite east wall. With both open, air freely circulated through the greenhouse.

If you are trying to be as self-sufficient as possible with your food supply, building a greenhouse that incorporates as many of the design principles I outlined earlier will go a long way to meeting your desire for fresh greens through the winter months, providing you give careful thought to which plants to grow and time their growth properly. For a fall and winter havest, plants must be started early enough to compensate for the decreasing hours of daylight. Here's some tips you may find helpful. Plants need to be established and fairly large by the time mid-October rolls around or Oct. 21 at the latest. After that date, the days are much shorter than the nights and growth slows. To achieve this, most fall crops should be sown in August. This schedule may work for some of you. Depending on climate and conditions in your region, optimum planting dates may be earlier or later. You'll have to experiment to see what works best.

Seed in August for maturity in fall/early winter:

- cabbage
- broccoli
- kale
- lettuces
- spinach
- collards
- endive/escarole

Seed in September:

- Chinese cabbage
- Asian greens
- radishes

Seed in October:

- more lettuces
- more radishes
- onions

Seed in February for spring and summer crops:

- spinach
- Cole crops
- tomatoes
- peppers
- eggplants

For best results, the cold tolerant plants would be your best bet with cabbage, Chinese cabbage, cauliflower, Brussels sprouts, broccoli, kale, mustard and collard greens reigning supreme. Endive, escarole, lettuce, Asian Greens and spinach are good choices too. But experiment and see what works best in your area.

A solar greenhouse should be able to produce salad greens through the winter. Leaf lettuce grows the fastest of any type of lettuce but even still, a fall sowing that will yield a winter crop will take twice as long to reach maturity than if sown in spring. Endive is a cool weather crop that can be used as a lettuce substitute. Onions won't form a bulb but they will form green tops for cutting. Asian greens I mentioned earlier are a great choice for winter growing in a solar greenhouse as they thrive in cool, low light conditions. Corn salad, otherwise known as mache is a green I hope to try in our greenhouse one of these days for winter greens. Taking about the same number of days to mature as lettuce, I would plant corn salad at the same time. Radishes, while not a green, still bear mentioning as they are the easiest and fastest growing greenhouse crop. Even still, you need to double the number of days from sowing to harvest if planted Oct. through Jan.

Early spring crops are the most productive in any region because the days are lengthening as the crop matures. Plants in the greenhouse are no exception and they really take off after Feb. 21 when the daylight approaches 12 hours. As a result spinach sown in Aug. may grow a little in the fall but rapidly grows in late winter/early spring.

In some parts of the country the greenhouse may sit unused through the summer months; but for people like us in the north or for people at elevation, the greenhouse is the perfect place to grow tomatoes, peppers and melons. Pollination of these items may be a problem though since bees don't usually find their way into the greenhouse. My solution is to become a bee myself. I hand pollinate these plants. Tomatoes are easy, simply give them a gentle shake and that sets the pollen in motion. But peppers and melons require a different technique. I use a little artist brush and go from flower to flower as if I were a bee.

Close inspection of melon, cucumber, squash and pumpkin will reveal two kinds of flowers, male and female. Female flowers have a slight bulge at their base which is a mini-fruit waiting to be fertilized. If it's not pollinated, it will fall off but once fertilized will begin growing into a viable piece of food. When I pollinate any of these items, I be sure to load my brush with pollen from male flowers before hitting the female ones. I have separate brushes for each vegetable variety so I'm not transporting pollen among different varieties. This is especially important if I'm saving seeds from any open pollinated items.

Seven Cash Cow Crops

If you are looking to generate some income from your homestead, the following 7 crops are suggestions on what we think are a good starting point for anyone interested in growing and selling garden produce. These crops are in demand and are easy to grow in the summer, but they are also good choices if one were set up to grow year-round either in a greenhouse or indoors with grow lights. They are in no particular order: microgreens, salad greens of which there are many varieties, arugula, spinach, white salad turnip which is much like a radish but can be cooked, Ginger which is perfect for partially shaded areas and basil.

We've suggested these particular plants as well because all are suitable for container gardening. But here's the thing. These are just suggestions to get you started. Your growing climate, tastes for certain vegetables and the local market will influence the choices you grow. Experiment and see what grows best in your area and consider making that your niche market for some income. Consider a rotation of a couple of different cash crops. For example, spinach favors cooler temperatures so this might be a good spring or fall crop. Ginger takes up to 10 months to fully mature but can be picked a little at a time even while growing. Whatever crop or crops you decide to plant for income, our advice is to become well versed in their growing habits and needs and become expert at growing those plants.

Guide to Common Garden Vegetables

Before I get to specific vegetables, please note I've given information on yields which is given only as a rough estimate. Yields can vary considerably depending on garden conditions in any given year, which can be quite variable, as well as variety grown.

<u>Asparagus</u> – Asparagus is a perennial that once established can continue producing for 25 years. It's one of the first fresh vegetables from the outside garden so therefore marks the beginning of a new season of fresh eating. Asparagus needs several months of cold weather, enough to freeze the soil and kill the tops to induce dormancy. An asparagus patch can be established using purchased 1 year old crowns which are quite expensive, or from seeds that will produce your own plants, a much more cost effective way of establishing an asparagus patch.

The drawback to starting with seeds is having to wait an extra year before harvesting begins. We've come up with a compromise. We buy some roots to get a patch started so we can start harvesting sooner while at the same time starting seeds. The bulk of our patch is grown from seeds, but the crowns we bought will at least give some spears to eat a year sooner than the seed grown plants. A pH of 6.5 to 6.8 is ideal. To plant, dig a trench at least 12" wide and at least that deep. Add compost, some rotted manure and bone meal to the trench. Set the crowns 18" to 24" apart in the trench so they are 6" below the soil surface. Make a cone of soil, sit the crown on top of it, fan out the roots and cover with 2" of soil. As the shoots grow, gradually add soil to the trench so eventually it's back to ground level. Mulch the area to keep it free of weeds. Plants should be untouched for 2 full seasons. Make the first harvest the third season after planting, but pick for only 2 weeks. The following year, you can pick for 4 weeks. Eventually the harvest window may be as long as 8 weeks in duration depending on how virorous the bed is.

Asparagus is a heavy feeder so application of a high nitrogen fertilizer is necessary. To harvest, break off spears that are 8"-10" tall. If the tips are open, that signals a spear that is tough and woody and is past its prime. After harvest is complete, let the stalks develop into feathery ferns. These feed the crowns so don't trim them off or mow them down. In fact, leave them alone until the following spring even though they look dead and brown. At that time they can be trimmed off at ground level. Asparagus can be frozen after blanching or canned, but we never have enough to do either. We love it and gorge ourselves on it when it's fresh.

Each crown will yield about 1 pound of stalks, roughly 12 to 15 spears. Each of us can easliy eat a pound even though a pound is supposed to serve 2 to 4 people. In the sketch, the asparagus section (AS) can accomodate 60 to 80 plants depending on spacing. If that is not enough, you could eliminate 1 or more horseshoe beds and expand the asparagus area. We probably have close to 75 crowns in our bed and we are a household of 2.

Allium Family - The allium family includes onions, garlic and leeks.

Garlic is hardy thus not damaged by frost or light freezing. In fact, for years we've planted garlic in the fall, mulched it with a thick layer of straw and had the shoots growing through the mulch when I removed it in the spring. Normally garlic is grown from cloves that are separated from the bulb. Plant root end down about 1" deep and 4" apart. Merely keep watered and weeded. Harvest when the tops begin to yellow and the cloves in the bulb are still tight. Use a fork to dig them up. Cure by drying in a sunny spot for a few days. Then snip off the dry top and trim roots close to the bulb. Store in a cool, dry place. The biggest cloves can be saved to plant next year. A single 10' row or the equivalent should yield about 5# of bulbs (or 50 to 70 cloves should yield about 6 - 10# of bulbs)

Leeks should be started inside unless you live in an area with a long season in which case they can be direct seeded into the garden. I start them indoors in February so they can be set out about a month before the last frost. I keep the green tops trimmed to about 2" until a week before I transplant. The best seedlings are those that are 4" tall. Seedlings can be 3" to 4" apart planted in rows. Soil is hilled up around them as they grow, but never so high it covers the point where the leaves branch out from the stems. Or seedlings can be grown in trenches that are 6" to 8" deep and 4" wide. I work compost into the bottom of the trench and the leeks are planted with the same spacing as if in rows. Begin to fill in the trench about 1" at a time, but do so gradually so plants don't rot. Fill until it's completely filled. Leeks are extremely hardy. I wait to harvest them until the ground starts to freeze. I dig them up and replant them in my greenhouse in trenches I dig there. Or they can be dug and replanted in tubs for storage in a cold, damp cellar. They don't store as long as onions so use leeks first. A foot long row may yield about 1½ pounds of leeks.

Onions are grown for their green stems (scallions or bunching onions) or their mature bulb. They come in white, red and yellow varieties. The yellow types store the best. Onions are sensitive to day length thus their ability to form a bulb is influenced by the length of the day. Onions for the north are called long day onions because they require 13 to 16 hours of light per day to form bulbs and are grown in the north where the summer days are long. Short day varieties require at least 12 hours of light each day and are grown in the southern states where the summer days are shorter.

Most people grow onions from sets but they can be grown from seeds too. In fact, more varieties are available if they are grown from seeds. Seeds can be direct sown in the garden for bunching onions but for bulbs for storage, seeds need to be started indoors fairly early. I start mine in February and keep them trimmed like leeks, to 2”. Set seedlings out up to 6 weeks before the last frost with a spacing of 4” in each direction. I learned the hard way to not plant these any deeper than they were in the flat. Sets can be poked in the gound just so the tip is exposed, with the root end down and with the same spacing as transplants.

Onions are shallow rooted therefore they need a steady supply of moisture. If seed heads appear at the top of stalks, break them off so energy goes to bulb production and not seeds. Onions can be harvested any time they are needed once they get to a usable size. For storing, allow them to grow until the tops fall over. Keep them in the ground another week to develop tough skins. When the leaves are shriveled and brown they are ready to dig and cure by leaving in a sunny, dry, airy location for about a week. Then bring them inside and keep in a warm dry spot for another month to finish curing. At that time, we cut off the dry tops and roots, brush off soil and loose skins, then bag up in old onion bags to be stored in a cool, dry place. Six linear feet of row yields about 5# of onion bulbs.

Beans - There are many types of beans: green beans (also called string or snap beans), wax beans, limas, kidney beans, plus a myriad of beans for drying (yellow eye, soldier, great northern, Jacob’s cattle etc.) to make delicious pots of soup and baked beans. Because all beans are a tender vegetable that can’t take frost, they shouldn’t be sown until all danger of frost is past. The seeds will also rot in cold soil. Wait until the soil is at least 60°F before planting, preferrably 70°F for lima beans. We’ve found that by laying N-sulate right on top of the ground, the soil warms much faster in the spring which is a godsend for those of us in short season areas. We even lay the sheet back on the ground after planting the seeds. Within a few days the seeds pop and we rarely lose any bean seed to rot. Once the seeds are up, we support the N-sulate on wire hoops essentially creating a greenhouse-like environment. Soaking seed an hour or two prior to planting will also speed germination. Sprinkling garden inoculant in the furrow with bean seeds causes the beans to form nitrogen fixing nodules on their roots that not only helps the beans to grow but also helps add nitrogen back to the soil. Garden inoculant is a nitrogen fixing bacteria that forms nitrogen fixing nodules on the roots of all legumes.

Green beans and limas come in both bush and pole versions. Pole types take a little longer to mature but they are easier to pick and save space since they are grown vertically. As a kid we usually had pole lima beans in the garden as well as bush limas. To plant pole beans, get your poles in the ground first and plant 5 or 6 seeds around each pole. To plant bush beans, space seeds about 3” apart. Other beans for shelling or drying can be planted 3” to 4” apart. Pole beans will shade other plants so either plant them on the north side of the garden to avoid shading other plants, or where you desire shade to protect certain cool weather loving plants from the blazing heat of the summer sun.

Snap beans generally bear for about 3 weeks. A continuous supply is possible through succession plantings. Lima beans are a challenge for northern gardeners as limas really like the heat. If you live in the north as we do and have had limited success growing limas, don’t despair. We’ve discovered a bean called Limelight which not only looks and tastes like a lima, but can be grown in short season areas. The only drawback is the seed is very rare. There may be more sources, but in Canada it’s available from Heritage Harvest Seeds.

The good news is it's an open pollinated variety so once you find the seeds you can save your own seeds from year to year which is exactly what we do.

Our biggest problem in raising beans has been powdery mildew which I control with sulfur. I also don't crowd the beans by trying to plant them close together to save space. Proper spacing allows for good air flow which helps mitigate mildew problems.

Harvest snap beans when the pods are large enough to make picking worthwhile but before the beans inside have begun to fill out the pod. Four feet of row may yield as much as 5# of beans; each plant may produce approximately 20 pods. Green shell beans are those that are picked and shelled when the beans are mature and fully formed but before they or the pods have begun to dry. A 10' row may give about 2½ pounds of shelled beans. Dry beans are left on the vines to dry and are picked when the pods are crispy. Once dry and brittle, we pick the pods, put them in an empty grain sack and whack them with a bat. This cracks open the pods and the dry beans pop out. A few pods may be stubborn and have to be shelled manually but that takes far less time than having to manually shell the entire crop. At this point, the dry beans have remnants of pods mixed with them which are easily removed by winnowing. The simplest way to do this is to pour the beans from one bucket to another on a windy day. The wind blows away the light bits of debris but the heavier beans fall straight into the waiting bucket. As with snap beans, figure roughly 20 pods per plant. If each pod has 5 to 6 beans in it, each plant yields about 100 to 120 individual dry beans. This translate to around 10# of dry beans per 100' of row.

When we lived in Maine, this was our chosen way to harvest kidney beans, yellow eye beans and other varieties of baking beans, but when we moved to northern Saskatchewan, we could only get these beans to the green shell stage due to our short season. As a result, we spent hours manually shelling beans which then had to be pressure canned. Snap beans can be frozen after blanching or canned.

<u>Beets</u> - Plant beets about a month before the last expected frost. Beets are fairly heat tolerant but are really a cool season vegetable. In areas with brutally hot summers, plant them in early spring or in fall so they miss the worst of the heat. They will tolerate partial shade. They are resistant to cold but can't take severe freezing. Beets are good candidates for raised beds.

Presoaking seed a few hours prior to planting may speed germination which is often spotty. Interestingly, one beet seed is actually a cluster of between 2 to 6 individual seeds. Thus, thinning is required to get proper spacing of about 3". Beets are a dual-purpose vegetable in that you can eat the greens as well as the root so you get twice the amount of vegetable from the same space. Fresh beet greens are a spring treat for some people, but not us. Mature beets can be "forced" in the winter providing fresh greens for salads when the outdoor garden is long put to bed (see Winter Gardening section for forcing roots). Beets are long keeping vegetables that are easily stored in a cold, moist environment. See carrots for ways to store beets.

Most beet varieties are round but we favor the cylindrical beets that are shaped more like carrots. Because the root grows lengthwise as opposed to widthwise, we feel we get more edible root from the same space. Slugs will eat emerging beet shoots so take precautions if necessary. If black corky areas appear on your beets, your soil is lacking in boron which can be corrected by a sprinkling of borax. Use 1½ teaspoons per square yard. A foot of row will yield about 1# of beets.

<u>Brassicas</u> - The brassica family of vegetables (sometimes called Cole crops) includes broccoli, Brussels sprouts, cabbage, cauliflower, Chinese cabbage, collards, kale, kohlrabi, rutabaga and turnip.

Without exception, all are cool weather crops and in areas of intense summer heat, most should be grown as either spring or fall crops to avoid the worst of the summer heat. Some are heavy feeders (especially broccoli and cabbage) requiring rich, fertile soil to get a good crop.

Broccoli is started indoors about 8 weeks before setting out. They can be transplanted out about a month before the last frost. Broccoli can take temperatures down to about 25°F. I space broccoli plants 18” apart in all directions. I do a center row with a row on either side of it where I stagger the plants in relation to the ones in the center. Spacing broccoli too closely results in small heads. Flea beetles and cut worms may plague newly set out transplants. When the heads start to form, cabbage worms become a problem but one that is easily dealt with by using Dipel (BT, BTK). Broccoli is a heavy feeder requiring fertile soil high in nitrogen. It also likes a less acidic soil so I always give a good dose of wood ashes (or lime) to where my broccoli will be planted. Harvest the head when the tiny florets are still closed and green. Yellow florets mean the head is past its prime. To harvest, cut the head close to the base of the head. Doing so will stimulate the growth of many more but smaller heads called side shoots which can be harvested too. I usually get several cuttings of side shoots, albeit smaller heads each time, thus increasing my yields from each plant as much as possible. Even though I’m in the north, I always have a spring and a fall planting of broccoli as it’s one of our favorite fresh vegetables. Broccoli freezes well after blanching. Figure roughly 4# to 6# of broccoli per 10’ of row.

Brussels sprouts are a long maturing vegetable, but they give big returns in exchange for the space they occupy, yielding 60 or more sprouts per stalk. They can withstand frost very well making them a welcome addition to northern gardens as we can be picking something fresh long after the first frosts arrive. However, they can’t take extreme heat. In areas with long, hot summers, grow these as a fall and even winter crop.

As with broccoli, Brussels sprouts are heavy feeders and will benefit from rich soil high in nitrogen. Addition of wood ashes to acidic soils is also beneficial. I start these the same time as broccoli and set them out the same time too, protecting them against cutworms.

Sprouts form at the bottom of the stalk first then work their way up. When the sprouts begin forming, start to remove some of the bottom leaves to give the sprouts room to grow; remove more leaves as sprouts form higher up, but always leave at least 2” of leaves at the top. Cabbage worms have been a problem no matter where we’ve gardened so we spray for them. You can start picking the sprouts anytime they are big enough (1 to 1½” in diameter) but they are much better after being zapped by frost. In fact cold weather will cause any loose leaved sprouts to firm up (warm weather causes them to be loose leaved and strong tasting). In short season areas, cutting off the top of the stalk 5 to 6 weeks before the first frost will stimulate the smaller sprouts at the top to get bigger. I’ve tried this trick and it does work. I keep Brussels sprouts in the garden long after the first frost, but when severe cold shows up, I dig up the plants keeping their root balls intact and replant them in trenches I’ve dug in the greenhouse. They also freeze well after blanching.

Cauliflower is the most finicky of all the Brassicas. Since we moved from Maine, I seldom get a head much bigger than a teacup but I refuse to give up and I keep trying for a real head. Unlike broccoli, cauliflower produces only one head. Heat impedes formation of heads so treat them as spring or fall crops. Start indoors and set out no earlier than 4 weeks before the last frost. They also like rich soil and lots of moisture so they can grow rapidly. If you can meet those 2 requirements and beat the heat (it needs to mature in cool weather) you will likely have better success than me. In areas with mild winters, seeds sown in late summer may yield a winter harvest. Protect transplants from cutworms and use Dipel to control cabbage worms. Cauliflower can be frozen after blanching but in our opinion is at its best served raw with dip or in salads. A large head of cauliflower may weigh up to 30 ounces which is almost 2#. A small head may weigh only 9 ounces.

Cabbage is one of our favorite brassica family vegetables. Even though a plant only produces one head, that head yields A LOT of cabbage making it a good plant for small gardens. Couple this with the fact it's a very versatile vegetable (it can be used raw in countless salads, in soups, side dishes and even entrees such as stuffed cabbage) it deserves a place in everyone's garden.

Countless varieties exist. They are typically grouped as early, mid-season or late cabbage. Some have smooth green or red leaves whereas some have crinkly leaves. These are known as savoy cabbages. Our preference is smooth leaved types. We grow several kinds of cabbage, an early variety for summer use, a late cabbage for root cellar storage and a red. All cabbages are hardy, can withstand temperatures down to 20°F and thus can be set out up to 5 weeks before the last spring frost. I start our seedlings 8 weeks prior to setting out. Try to time planting of fall storage cabbages to coincide with anticipated harvest dates for your area. All cabbages prefer cool weather. But if you have blazingly hot, dry summers, you may be able to grow cabbage as a winter crop.

Like the other Brassicas, cabbages are heavy feeders and require rich soil. They benefit from application of wood ashes or lime to the soil in advance of planting. They need adequate moisture to grow but when the head approaches maturity, excess moisture may cause it to split making it unfit for long term storage. I've found gently lifting up a mature head and giving it a twist to loosen or break some of its roots helps prevent a large uptake of water thus minimizing the risk of cracking from excess moisture.

Protect transplants from cutworms, use Dipel for cabbage worms and Diatomaceous earth for flea beetle infestations. Harvest any time heads have formed and are solid by severing the heads from the base of the plant with a knife. You may be able to coax a second cutting from early cabbages by leaving the plant in place. Eventually the stalk sprouts little buds. If you remove all but 1 or 2 of these sprouts they may develop into small heads by winter. Personally I've never bothered as I need the space for planting fall crops so I yank them up after harvesting the big head.

Solid heads store better than loose leafy ones. Supposedly cabbage can be stored 5 - 6 months in cold, moist conditions but the most I can keep it is 3 months. I have noticed red cabbage stores longer than green. This is a constant ocurrence from year to year. Cabbage can be stored in a root cellar by digging or pulling it up by the roots and either hanging it in the cellar from a rafter, placing heads on shelves, wrapping them individually in newspaper or by replanting it. We replant it in the greenhouse as described elsewhere. Try several methods and see what works for you. It can be blanched and frozen, made into freezer slaw or fermented into saurerkraut. In areas with mild winters, you can store it in the garden row with mulch for protection but be aware mice will find the heads and have a feast. If you can train a cat to guard the cabbages stored in the garden, you'll have it made. Cabbage yields are very dependent on variety. For early cabbages figure 2# to 3# per head. For the late storage types, figure 8# to 9# per head.

Because Chinese cabbage is extremely prone to bolting (going to seed) in warm weather and because it doesn't transplant well at all, its seed should be directly sown in the garden where you plan to grow it in July so it can be grown as a fall crop (or whenever is appropriate for your area so that it's planted about 12 weeks prior to your first frost). In mild winter areas grow this vegetable as a winter crop. It can withstand heavy frost and temperatures down to 20°F with little damage.

There are 2 types of Chinese cabbage, heading and non-heading. The non-heading produces bunches of leaves and includes bok choi and pak choi. They can be treated as a cut and come again crop. The heading type can either be round (wong bok types) or cylindrical (michihli).

In my experience, flea beetles love Chinese cabbage and I often lose the battle with them. If you're able to win the battle, thin the non-heading kinds to 9" apart and the heading types to 16" apart. Harvest when the plants reach a usable size. Store by pulling up the whole plant, removing the outer leaves and replanting the heads close together in a tub of moist soil in the root cellar. If kept in an area that is cold and damp it may keep for several months.

Neither of us are fond of mustard and collard greens which is unfortunate as they are powerhouses of nutrition, and since they are very hardy and able to withstand cold temperatures, they extend the fresh eating season. Both prefer cool weather and their flavor is improved by light frosts. Both can be direct sown or grown from transplants started indoors. Start seeds indoors about 8 weeks before setting out which can be done about 4 weeks before the last frost. In northern regions, planting collard seeds about a month before the last frost ensures the leaves will reach their prime as cool fall weather arrives. They can remain in the garden until killing frosts arrive. In the south where collards can stay in the garden all winter, plant in late summer/early fall for a winter/early spring crop. Pests that plague the other Brassicas will plague these greens too so take precautions as necessary. Both can be harvested all at once or individual leaves can be picked when they are young and tender. Per 10' of row, figure a yield 4# to 8#.

Kale is another nutrition powerhouse that is easy to grow and very hardy. Frost improves the flavor. In fact, it's still usable when the ground is frozen solid if protected by some straw mulch. I grow kale not so much for use as a side vegetable but because it can be used in recipes (soups and such) that call for spinach. I have better success growing kale than spinach so I freeze kale for use in recipes calling for spinach. Kale can be started indoors, but I've always direct seeded it whether I was growing it in Maryland or northern Saskatchewan. Pests that bother other Brassicas will attack kale too, flea beetles, cabbage worms etc so take precautions. Kale can be harvested by cutting the entire plant or by treating it as a cut and come again plant which is what I do. I pick the leaves when they are small, no more than 4" long and blanch them for the freezer. In the winter months, when I add it to soups, I chop up the kale when it's partially frozen before adding it to the pot so we aren't eating big leaves of it. Ten feet of row may produce 4# to 8# of kale.

Kohlrabi is one of the most unusual looking vegetables of the brassica family. Like the other brassicas, it prefers cool weather so it's a spring or fall vegetable and is susceptible to the same pests. It can be direct sown 6 weeks before last frost or started indoors 8 weeks prior to setting out. Transplant the seedlings 5 weeks before the last frost. For winter storage in the root cellar, sow seeds 10 weeks before first fall frost. Plants should be spaced 9" apart. The bulb of the plant is what you are after. This does not improve with size or age as it becomes tough and woody if allowed to grow larger than 2". It can be blanched and frozen or stored in a cold, damp cellar by packing it in damp sand or sawdust.

Turnip and Rutabaga are cool weather plants and do best when planting is timed so the roots develop in cool weather. Hot weather causes, tough, fibrous or pithy roots. Of the two, the rutabaga takes about a month longer to reach maturity and has better potential for long term storage. Seed for both is direct sown in the garden.

Turnips are a 2 bang for the buck vegetable as not only is the root edible but so are the leaves. In short season areas turnips are planted as an early spring crop 6 weeks before the last frost. In warmer regions, they are planted in fall 9 weeks before the first frost and carried over the winter, although they don't take heavy frosts very well. Harvest the roots when young at about 3" diameter. The leaves can be blanched and frozen as can the roots. The fall harvested roots will keep in cold, moist conditions in a root cellar.

Rutabagas are hardier than turnips so they can take frosts well and in fact are improved by it, but the roots shouldn't be allowed to freeze. Planting should be timed so the roots mature in the cool fall weather by sowing seed 15 weeks before the first fall frost. They should be thinned to stand 8" apart. Harvest when about 5" around and no longer than 6". They will store up to 6 months if kept cold and moist.

Many years ago, we grew turnips and rutabagas but didn't enjoy them enough to justify the growing space they occupied. But we did grow them for animal feed. They require no special equipment to raise or harvest making them perfect supplemental animal feed for a self-sufficient homesteader. When we do raise them, we plant them in a raised bed. Expect about 15# per 10' of row.

<u>Carrots</u> - Carrots are a dependable long term storage vegetable that take up little space yet give high returns. I plant a 6' to 7' long bed that's about 3' to 3 1/2' across and reap 60# to 70# each year!

Carrots come in all shapes and sizes. For heavy, clay soils the short, half-long varieties are best while light, sandy soils can accomodate the long, thin Imperator kinds. Because they are not heavy feeders, high amounts of nitrogen are not necessary and in fact too much nitrogen causes "hairy" roots, but working in a phosphorous source and some wood ashes are recommended. Carrots are direct seeded in the garden and can be sown up to 6 weeks before the last frost. The loose deep soil of raised beds is perfect for carrots. Carrots are a good succession crop; make successive planting 2 to 3 weeks apart. For long season areas, if you want carrots for winter storage, plant seeds 12 to 13 weeks before the first fall frost. I make one planting which provides carrots through the summer from repeated thinnings as well as my main harvest for winter storage. Carrot seed is fine therefore it's very easy to overplant, so lots of thinning will be required to get carrots spaced about 3" apart. They are very slow to germinate, sometimes as long as a month, so I usually plant some radishes in the carrot furrow. The radishes germinate quickly, grow quickly and are harvested long before they interfere with the carrots.

Harvest can begin as soon as the roots are big enough to use and in fact our first carrots are ones I've thinned out of the rows. Through the summer, whenever I need carrots, I simply pull up what I need. Come fall they can be left in the ground until it starts to freeze at which time the final harvest takes place. As long as carrots are kept in a cold, moist place they will last until May. To accomplish that many folks layer them in boxes filled with damp sand, moss or sawdust but that has never worked for me. I use extra large plastic food grade bags that I've perforated with a knife and keep the filled bags in a damp and cold place (a root cellar). The clear bag lets me see how the carrots are storing. In areas where winter temperatures rarely drop below 20°F, carrots can be stored in the garden row if mulched but be prepared for mice damage unless they are protected with hardware cloth prior to mulching.

<u>Celeriac</u> - Celeriac is grown for the knobby, gnarled root. It prefers well limed soil with constant moisture. Acidic soil causes poor growth which has likely been my problem. I start it indoors the same time I start my celery. I've been trying for 2 years to grow this vegetable in our new garden and have yet to get a root but I'm determined to keep trying. Transplants can be set out 2 to 3 weeks before the last frost 6" apart. Harvest can begin when the roots are 2" but are usually picked when they are 4". They are semi-hardy and a few light frosts won't hurt them, but harvest before serious cold arrives. Store like any other root in cold, moist conditions.

Celery - Some find celery a demanding vegetable to grow but I have little difficulty with it. It is a heavy feeder that demands abundant moisture. High amounts of compost, rotted manure, wood ashes and any organic matter are beneficial. In our case, celery can take up to 3 weeks to germinate and after that it grows slowly, so I start it mid-February which is earlier than most recommend, and set it out 3 weeks before the last frost, mid-May for us. Plant it so the root crown is level with the soil or just a little deeper than in its pot and 9" apart. Side dressing with a high nitrogen fertilizer every few weeks will be beneficial. My biggest problem with celery is brown checking, a nutrient deficiency caused by a lack of boron which is easily corrected with a sprinkling of borax. The stalk is sort of hollow and brown on the inside. I somtimes have problems with pink root too, a fungal disease that is best contolled with crop rotation and raising the heathiest plants possible so they aren't vulnerable to attack. I begin harvesting celery as soon as the outer stalks are a usable size. I've already talked about our celery houseplants and replanting in trenches in our greenhouse. Mature celery that's been dug up and replanted in tubs or boxes can be stored in a root cellar too provided it's cold and damp. Water the roots but not the stalks or leaves as that encourages rot. In mild winter areas you may be able to store celery in the garden row for a while by banking up soil on both sides of the plants. I blanch and freeze several bags to use in cooked dishes: soups, casseroles and stuffing. One bunch of mature celery weighs about 1 pound.

Cichorium Family - This family of vegetables includes Endive, escarole and witloof chicory. I talk about witloof chicory in the winter gardening section so suffice it to say I grow and store it like carrots (it's a good vegetable for the raised bed area) until I'm ready to force the roots in late December.

Endive and escarole are often confused with each other. Here's an easy way to keep them straight. Endive has frilly leaves and escarole has large, broad, lettuce-like leaves that almost form a head. Both are raised the same way. Their taste will be better if they are grown in cool weather, in fact in areas with mild winters, they can be grown as a winter crop. A few light frosts improve their flavor. Long days cause them to bolt and become bitter. I direct seed in mid-summer for a fall crop that I can dig up and store in the root cellar. I thin plants to 18" apart. Blanching 2 to 3 weeks prior to harvest will diminish the bitter taste these vegetables are known for. Blanching in this case means covering the plant to prevent exposure to sunlight. An easy way to blanch the plants is to invert a pot, bucket or tub over the plant. Some folks tie up the outer leaves but care must be taken that the center leaves are dry and remain dry lest they rot. For root cellar storage, dig up the plants and replant in tubs or boxes. Use as salad greens.

Corn - Corn is without question one of our favorite garden vegetables. When the first ears of the season are in the pot, we have to wipe the drool off our chins while we wait for it to cook. Well, almost.

Corn is categorized by its level of sweetness.

"Normal sugary" (SU) is standard sweet corn that contains varying levels of sugar. Once picked the sugar quickly turns to starch, which is why some folks have the corn water ready and boiling before they head out to pick it, but these types germinate better in cold soil.

"Sugary enhanced" (SE) corn has a higher sugar content and is therefore sweeter so they stay sweet for a longer period of time than standard. They don't require isolation from other types of corn and germinate in cold soil better than the supersweets. These types are generally preferred by growers.

"Supersweet" (SH2) varieties of corn have extremely high sugar content and convert their sugar to starch much slower than traditional varieties. Germination in cold soils is poor. The supersweets must be isolated from other types of corn to prevent cross pollination which results in tough, starchy kernels, but they can be grown with other varieties of supersweets.

"Synergistic" (SY) corn have different genetics on the same ear. They have 45% SH2 kernels for their high sugar content and 55% SE kernels for better cold soil emergence. They don't have to be isolated from other types of corn.

If space is very limited, you may decide growing corn is not worth your while since only a small portion of the plant is edible. You'll have to decide. But the dwarf varieties that grow only 3 - 4' tall help save room. The taller types can be used as supports (the poles) for pole beans and they can be interplanted with pumpkins or winter squash too.

Corn is a heavy feeder requiring soils high in nitrogen. Corn seed is likely to rot if planted in cold soils so wait until soil temperature reaches 50°F. Young plants are susceptible to frost and will need protection if threatened. Most people direct seed corn. We did for many years until we homesteaded in northern Saskatchewan where the season was very short. I've already outlined how we grew corn there so I won't repeat myself. Regardless of whether you direct seed or start inside, plants should be 12" apart and hilled up with soil.

Corn should be planted in blocks of at least 4 rows (I prefer 5 to 6 rows), not in long single or double rows. Because corn is wind pollinated, planting in blocks assures good pollination. If you grow any field corn for animal feed, be sure it's at least 40' away from the sweet corn for the table so the two don't cross pollinate, or stagger planting dates so they won't tassel (produce pollen) at the same time.

If smut, a fungal infection that produces mushroom-like growths, appears on any stalks burn them. Corn ear worms are a common pest but are easily controlled with ½ an eye dropper of mineral or vegetable oil squirted into each silk after pollination is complete. A spray program of BT will also control this problem.

Corn is ready to pick when the silk is dry and brown and the kernels spurt a milky fluid when poked with a fingernail. Grasp the ear, yank it downward while at the same time twisting, shuck it and whisk it into it's cooking pot ASAP then enjoy one of the best treats of the summer. Corn can be frozen after blanching or canned; our preference is frozen for best flavor. Yield depends on variety. Most of the varieties we grow produce only 1 ear per stalk. Some varieties, usually those with longer maturity dates, give 2 ears per stalk.

<u>Cucurbita Family</u> - This family includes summer and winter squash and pumpkins. All are typically planted in hills with 6 to 8 seeds per hill that are thinned to 2 to 3 plants. Vining types take up more room (hills are 6' to 8' apart) than bush types (3' to 4' between hills). A quick maturing vegetable such as lettuce can be interplanted between the hills for maximum utilization of space. All these plants are frost sensitive and should be protected if threatened or better yet, wait until all threat of frost is past before planting. These plants have male and female flowers. In order to get a crop, the female flower must be fertilized with pollen from male flowers. Bees and other insects normally do this for us but when we lived in northern Saskatchewan, we had a dearth of bees. My little squash and pumpkins withered and fell off the vines. It took us a while to figure out they weren't being pollinated. Once I started playing "bee" with a little artist brush, we resumed getting harvests. The two flowers are easy to tell apart. If you look closely at a female flower, you will see a miniature vegetable at the base of the flower. The males have none. I simply load up

my brush with pollen from a few boy flowers then gently dust it around inside the girl flowers. Presto! I've just pollinated.

Summer squash (zucchini, yellow crookneck, pattypan are examples) are quick maturing and prolific. One zucchini plant can produce 6 to 10# of vegetable over the course of the season, but they don't store for the long term. Bush types are good for small spaces. They can be grown from transplants as I've already described or direct seeded. If you direct seed, presprouting will help with germination. I've known people who let their zucchini get to the size of bats before picking them. Too bad, as they are at their best when they are small, young and tender, about 3" to 4" long for yellow crookneck, 6" to 7" for zucchini and 3" across for patty pan.

Pumpkins and winter squash which includes acorn, buttercup, butternut and Hubbard, are grown pretty much the same way as the summer squash but many of these have trailing vines that run all over the place, hence the need for a spacing of 8' to 10' between hills of pumpkins. But the bush varieties really do save a lot of space as many of them can be planted as close as 4' between hills. With the exception of acorn squash, these vegetables are long keepers if picked at the right time, cured and stored properly. They can withstand a few light frosts, but harvest before the first hard frost. The shells should be hard enough to resist easily denting by a thumbnail. Cut all pumpkin and squash leaving 3" to 4" of stem attached. Stemless ones are more likely to rot. To cure, set in a warm (75°F to 85°F), dry location for 1 to 2 weeks, then store in a dry location that is 50°F to 60°F. Acorn squash need no curing and should be kept in a cool (40°F), moist area. It should be used first as its storage life is shorter.

Squash borer is a common pest which causes plants to suddenly wilt. When signs of infestation occur, slit the stem and remove the borer, then cover damaged stem with soil. It will send out new roots. On any varieties that have long trailing vines, burying every 5th leaf node so it sends out new roots will keep the plant going in case it's attacked by borers. Altering planting dates or making a second planting after danger of infestation has passed is another avenue worth persuing. Pumpkins may produce between 2 and 5 pumpkins per plant. Depending on the type of winter squash, each plant may yield 3 to 4 squash that weigh around 1 pound each.

<u>Cucumis Family</u> - This family includes cucumbers and muskmelons also known as cantaloupe, as well as winter melons which includes honeydew and casaba. Both cucumber and melons are vines but bush varieties save space. All are susceptible to frost and should be planted after all threat is past or at least planted out with protection. They can be direct seeded or grown from transplants as I've already described. Like the cucurbitas, these too are grown in hills with more distance required between hills for the non-bush types. I've also grown some of these vertically to save space. As with the cucurbitas, most varieties of these vines have both male and female flowers so are easily pollinated by hand, which is good especially if these are grown in a greenhouse as we often do. Interestingly there are some varieties of cucumbers that have solely female flowers and are self-pollinating. I've grown these in the greenhouse a time or two and they did well for me.

Melons can be smooth skinned, netted or ribbed with flesh ranging in colors from white to green to every shade of yellow and orange. Melon varieties cross pollinate with each other so if you plan to save your own seeds, don't plant the crop near another variety of melon. However, melons and cucumbers will not cross with each other. Depending on variety, cantaloupes can range in size from 2# to 6#. Each plant usually gives 3 to 4 fruits. They are a heat loving plant requiring almost tropical conditions to grow. Melons are susceptible to rot so we make sure they are sitting on a nice bed of mulch and when ripening is at hand, we may even set each fruit atop an empty can turned upside down to keep them off the damp ground.

Cucumbers generally fall into 2 categories, slicers for fresh eating or picklers. While pickles can be made from slicers, pickling varieties are seldom good for fresh eating. If only one type can be grown, I'd go with the slicing type for their versatility. Cucumbers may yield up to 10 cucumbers per plant that weigh about 6 ounces each.

Cucumber beetles, squash borers and powdery mildew are some of the problems you may encounter when growing these vines. Treatments/remedies have already been discussed.

<u>Lettuce</u> – This is one of those "must have" vegetables in our garden. It takes up little space, can be treated as a cut and come vegetable so it yields big returns, can be grown in partial shade making use of areas less favorable for other vegetables and can be tucked into small spaces that have been vacated by other plants. Lettuce grows quickly becoming one of the first fresh foods from the garden in spring and it can be interplanted between hills of the vines which is otherwise wasted real estate until the vines start to spread.

There are heat and bolt resistant varieties but by in large, lettuce requires cool weather and moist conditions, otherwise it becomes bitter. We are able to grow lettuce all season long, but in areas with hot summers, grow it fall/winter and spring. Shading it will help extend the growing window. There are four main types each with increasing maturity dates: leaf, butterhead, romaine or cos and head lettuce. We grow varieties of all four. Head lettuce seems to be affected by heat more than the others. For early spring lettuce, seedlings can be transplanted to the garden 6 weeks before the last frost so start some seeds indoors about 6 weeks prior to your planned transplanting date. Lettuce is cold tolerant but night temperatures shouldn't go below 25°F. It can be direct seeded too. Use succession planting for continuous harvests relying on the bolt resistant varieties during warmer weather. Plant small amounts each time, but plant frequently so you have a steady supply without being inundated. About 8 weeks before the first fall frost you can go back to seeding the cool weather types. Space leaf lettuce 9" apart and the others 12" apart. You can pick the outer leaves of leaf lettuces allowing the central leaves to continue growing. Utilizing a cold frame, hot bed or greenhouse will extend the lettuce season in both spring and fall. Head lettuce stores the longest, 3 to 4 weeks followed by romaine at about 2 weeks, and finally leaf lettuce and butterhead which are the most perishable at a few days. Aphid and slugs are common pests.

<u>Potatoes</u> - Potatoes are classed as early, mid-season or late as well as by their color, red versus white for instance. Potatoes are grown from whole small potatoes or pieces of larger potatoes that are cut up. A piece or small potato the size of an egg is about right for a seed potato. Any cut piece should have several eyes. Allow the cut pieces to dry for a day so they will be less likely to rot when planted.

Soil for potatoes should be on the acidic side so don't add wood ash or lime the previous fall to the potato patch. But both phosphorus and potassium are needed for tuber development. Nitrogen is needed for foliage development but too much nitrogen will reduce the yield of the tubers.

Planting Potato Seed - First Garden in Nova Scotia

To plant we use conventional rows that are delineated by string strung between 2 stakes. We make a trench with a hoe and plant the seed 10" to 12" apart then cover with 3 " of soil. If you dig your trenches and allow the sun to heat up the soil for a few hours or more prior to planting, so much the better. After planting, to facilitate germination, we'll put a layer of N-sulate directly on the ground. We space the rows 3' apart so we have plenty of soil for the next step, hilling up. When the plants start to emerge, using a hoe, we pull soil up around the stem from both sides of the rows and repeat this procedure as the stems grow taller. Don't worry about burying the plant. In a few days, it'll bust out again. The hilling adds soil to the area where the potatoes form, protects them from a freeze in late fall and keeps the spuds from turning green. Any potatoes poking through the soil should be covered so they don't turn green due to sun exposure.

Mid-summer we always sacrifice a few hills for "new potatoes." We harvest some egg sized tubers, boil them, and add butter and salt for a real taste treat. The skin is so tender it comes off when I wash the spuds; the flavor of the cooked potatoes is unparalleled and completely different from that of mature potatoes.

Colorado potato beetles are a common pest. Hand pick the beetles and drop in a can of soapy water or use Diatomaceous earth or Neem Oil for heavy infestation. There are other organic deterents coming on the market so give them a try as well. If plants die down well before frost, suspect blight which can be controlled with sprayings of sulfur or judicious use of copper. Dig potatoes for storage when foliage dies back but they can be left in the ground to suck every last bit of energy from the vines as long as the ground doesn't freeze. Dig carefully avoiding any damage from nicks or bruising, brush off dirt (don't rinse off) and store in a cold, moist area such as a root cellar. If conditions are ideal, it's possible to harvest up to 5# of potatoes per plant.

<u>Tomatoes</u> - The most popular garden vegetable. They can be grown in containers, in greenhouses or in garden plots. Tomatoes can be either determinate, which are compact types that usually bear their crop all at once and don't require staking, or indeterminate which bear all season long until frost. These require staking. Within each class there are varieties of cherry tomatoes, slicers, as well as paste tomates. Paste tomatoes are meatier and have less water making them perfect for boiling down into sauces and paste.

"Rejects"

Tomatoes are heat loving plants and are frost tender. Because we grow most in the greenhouse, we can plant them out sooner and get a jump on the season. We also don't have to worry about any sneaky, early fall frosts. I always have extra plants which are set in the garden. Like most people, we start all of our tomatoes indoors 8 to 10 weeks before setting out which should be done on the frost free date or after all danger of frost is past. Adding bone meal to the hole at planting time may help prevent blossom end rot, a problem caused by a calcium deficiency. I space all my tomatoes 24" - 30" apart. If I'm doing 2 rows in my greenhouse bed, I will stagger the plants in each row in relation to each other. Leggy plants can be buried in a trench so the stem curves upward. Roots will eventually form along the buried stem. Cages are often used to support indeterminate tomatoes. We've found the pyramid shaped cages sold by garden supply centers to be inadequate and prefer to make circular cages out of wire remesh used for reinforcing concrete. The holes in the mesh are big enough to reach through for harvesting. If you choose to stake your tomatoes they will have to be pruned of suckers and tied to grow up the stake. Tie with twine or stout string. Pruned plants produce earlier, yield less fruit but take less space than caged tomatoes. To prune, allow the first 1 or 2 suckers to grow, but break off the remainder and continue to do this throughout the season.

Tomatoes are subject to fusarium and verticillium wilts. Select disease resistant varieties. Blight may be another problem particularly in the south. Harvest tomatoes when color change indicates ripeness. Tomatoes can well, can be made into various sauces (use the paste varieties for these), juices and can be frozen too. Green tomatoes, if mature, can be brought in when frost ends the season and allowed to ripen indoors giving more weeks of fresh eating. They will ripen in about 2 weeks at room temperature. If kept cooler, say 55°F, they will take up to a month to ripen.

So if you have lots of green mature tomatoes, do as we do. Keep the pink and some green ones at room temperature for the initial supply and keep the bulk of the harvest cool, gradually bringing loads of green ones to a warmer location. Sort through them every few days to remove any that are going bad. Storing them in shallow layers is best but we rarely have room for this so we fill either buckets or cardboard boxes. An even easier way is to pull up the plant and hang it in a shed or the basement. The plant should be dry of moisture when pulled so rot doesn't set in. See winter gardening section for other ideas on how to have fresh tomatoes through the winter. Depending on variety and type of tomato, a plant may produce up to 10# per plant. The paste tomato we grow, Amish paste, gives tomatoes that easily weigh 8 ounces each. Most are in the 10 to 12 ounce range with occasional 16 ounce beauties a possibility too.

<u>Parsnips</u> - Not the most popular vegetable which is unfortunate as they are one of the most frost resistant and can be left in the garden even in the coldest areas. They are long rooted and benefit from deep, loose soil making them ideal candidates for raised beds. In mild winter areas, plant in fall for a spring crop but for the rest of us, plant in the spring as early as the ground can be worked. Soaking seed overnight helps the slow germinating seeds to come up and marking the row with quick growing radish is helpful. We harvest parsnips after several hard frosts, just before the ground freezes hard and store them in a cold, moist place, the root cellar, using the same procedure as that of carrots. Use a spading fork to dig and loosen soil prior to pulling them up. Parsnip overwintered in the garden should be used the following spring before they send out new leaves and become tough and woody. A foot of row will generally produce 1 pound of parsnips.

<u>Peas</u> - Peas are a cool weather crop. In mild winter areas they are a fall/winter or very early spring crop. For folks in the north like us, we plant as early in spring as possible. Like beans, peas can fix nitrogen in the soil if they are treated with legume inoculant when they are planted. Bush varieties of peas require no staking, but the taller varieties do. This is more work but you get more return for the space they take up as the vines are taller and yield more pods. There are several types of peas: green peas, snow peas which are the flat pod type used in oriental stir fries and sugar snap peas whose pods are edible and are picked when the pods are round and fat. I plant all of these the same way, in double rows that are 4" to 6" apart with a supporting

fence of chicken wire running between them. Seeds are planted 1” deep. In our experience, newly sprouted peas can withstand frost.

Pick green shell peas when the pods are full but before the pods have started to yellow and shrivel. Don’t despair however if you miss some pods and they start to dry. Let these pods finish drying and then pick the dried peas for use in soups. Snow peas are picked when the pods are still flat, before the pea inside starts to enlarge whereas sugar snap peas are picked when the pods are full size and peas are large, but these are not shelled prior to cooking. You eat them pod and all making them a good choice for someone trying to maximize their return as there’s no waste from discarded pods. Since we grow open pollinated varieties, I leave about 2 feet of plants at the end of the rows to fully mature. Once they dry, in the fall, I pick and shell them and they become my seed for next year.

Radish - Radishes like cool weather. They come in all shapes and even in different colors. French breakfast is a variety that grows lengthwise so it yields more than varieties that form round balls. There are two categories of radishes, summer and winter. Summer radishes grow quickly, are often used to mark rows of slower germinating vegetables and become tough and woody if allowed to grow past their prime. Summer radishes can also be used as “trap” plants for root maggots that plague other root crops. Plant them ¼” deep and thin to 2” to 3” apart as soon as the soil can be worked. Harvest as soon as they are ready, when they are about 1” in diameter.

Winter radishes grow more slowly, are planted in early August for harvesting in cool fall weather and should be planted like summer radishes except they are thinned to about 5” to 6” apart. They are more fibrous than summer radishes but they are long keepers if stored like carrots. I grate them up for use in winter salads instead of slicing them. Winter radishes may yield as much as 20# per 10 feet of row. Summer radishes yield less, more like 2# to 3# per 10 feet of row.

Spinach - Spinach is a cool weather vegetable that is very sensitive to day length and heat. Long and/or hot days cause it to bolt. You would think living in the cool north we’d reap great crops of spinach. Not so. In northern Saskatchewan, each spring, by the time I was finally able to plant, it was already the third week of May and just a few weeks from the longest days of the year. Consequently it bolted before we ever got much out of the patch. Maybe putting plants among the taller vegetables so it was partially shaded would have helped.

There are 2 types of spinach, smooth leaves which is our preference and savoy which has crinkly leaves that trap dirt and are hard to clean. Spinach can be planted 6 weeks before the last frost. Plant the seeds ½” deep and thin to 6” apart. Spinach can be treated as a cut and come again plant or the whole plant can be cut. It can be frozen after blanching or canned.

Winter Gardening

When freezing temperatures arrive, most gardeners bag it until spring. But if you are savvy and resourceful, you don’t have to give your green thumb a complete vacation nor do you have to forego home grown fresh greens.


Starting Salad Sprouts

Most everyone has a sunny window sill, even apartment dwellers where they can park a few pots of herbs for winter. Parsley, thyme, and rosemary are good candidates for indoor growing as are basil and summer savory. I often dig up some of these from the herb garden and bring them in for the winter. I've discovered it pays to not skimp on the size of pot. These plants have been growing all season and have established root systems. They suffer if I try to squeeze them into a container that's too small. I am sure to provide some drainage in the bottom of the pot too. The roots won't like it if they are in standing water. To that end, I put some pebbles in the bottom of my container before adding my plant, then give them a good drink and bring them inside. Some transplant shock is to be expected but in a few days they should perk up. Once inside, I'm careful not to over water. I've done that a time or two and the plants died as a result. If you have no outside garden from which to dig up any herbs because you are in an apartment, you still have a viable option. In the spring, simply buy some herb plants from a garden center along with some plant pots and potting soil and you'll be on your way to your own indoor herb garden.

Sprouts are another great addition to our winter diets. They are easily grown, can be grown anywhere including in an apartment, and are a versatile lettuce substitute as they can be used on sandwiches, in wraps and in salads to help stretch other greens including lettuce. Just about any seeds can be used for sprouts: grains, beans, vegetables, lentils and peas. You can even buy mixes of several kinds of seeds for unique taste experiences. Mixes that include mustard seeds tend to be spicy whereas alfalfa and red clover tend to be mild. Recently I've started saving my own seeds specifically for sprouting. I follow the same procedure as if I were saving the seeds to plant in the garden. The sprouts in the photo were made from radish seed I saved. Since I wasn't sure how well this experiment would work, I only used 2 teaspoons of seeds which yielded almost 2 cups of sprouts!


Salad Sprouts

Devices for sprouting are available for purchase but are totally unnecessary. All you need is a wide mouth canning jar, a square of cheesecloth big enough to cover the opening of the jar and a rubber band. To make a quart jar of sprouts, I put 2 Tablespoons of seeds in the jar, add some room temperature water and let the seeds soak for 8 to 12 hours. Larger seeds need more soaking time than smaller ones. Next I put the cheesecloth over the top of the jar and secure it with the rubber band and turn it upside down to drain out the water. I rinse the seeds and drain again. Next I situate the jar so it's on its side but tilted so any excess water can drain out through the cheesecloth. I usually set the jar in a bowl so it catches any residual water. Then I put the jar in a dark place. I just sit it in a kitchen cabinet and shut the door. Sprouts should be rinsed at least twice a day to wash away any by-products of growth. More often is better but not necessary. To rinse, I simply run some water into the jar, swish it around, then drain through the cheesecloth and return the sprouts to their dark growing place.


Sprouts Rinsed and Ready

Depending on the seeds, sprouts may be ready in 2 to 3 days but 5 to 6 days is more realistic. You don't want your sprouts to start growing roots by letting them go too long. Once you determine the sprouts are ready to harvest, give them a few hours of direct sunlight so they produce some chlorophyll which increases their nutritional value and turns them a little green.

I have made sprouts this way every winter for years. But a few years ago I splurged and bought a set of 3 plastic screens of differing sizes that have threads so they screw on to the wide mouth canning jar. They make draining and rinsing a breeze.

We tried growing lettuce indoors on our south facing window sills in Saskatchewan but the amount of daylight in winter was inadequate, thus leading to spindly plants. If they had been grown under grow lights, they would have been much better. Leaf lettuce and compact versions of bibb lettuce would be good choices to try. Likely other greens may work too but we've never tried them.

I've already written about the "houseplants" we bring in every fall. They make a small, but significant contribution to our winter meals. Undoubtedly they would do better if they were parked under a grow light, a bulb that stimulates plant growth by emitting the spectrum of light that encourages photosynthesis. They attempt to provide the light spectrum given off by the sun or to provide a spectrum of light that's specific to the plants being grown. Some grow lights emit a white light, but others give off colored light. Different colors have differing wavelengths. Plants like certain wavelengths, chiefly that of red and blue, better than others so that's why some grow lights emit colored light. Many types of bulbs can be used as grow lights including incandescents, fluorescents, or LED's (light emitting diodes). We've used fluorescents, but both in Maine and Saskatchewan we've never had adequate power during the shortest days of the year which of course coincides with when grow lights are needed the most. In comparing fluorescents and LED's, the fluorescents are the cheaper of the two but the LED's are more energy efficient. Now that we have a bigger solar electric system, we'll have to give them a try in the near future.

Some seed catalogs carry grow lights as do garden supply and building centers. I've seen pictures of fancy set-ups that include not only the lights, but stands, tables or racks. We've merely suspended the lights from the ceiling above our plants. How close depends on the strength of the light but some rough guidelines are incandescents, 24" above, fluorescents, 12" above and LED's, 6" to 12" above. As the plants grow, raise the light if necessary to maintain proper distance.

Once again a set up like this would be ideal for anyone in an apartment. You could even keep stuff growing this way year round if you wanted to, then you could kiss supermarket lettuce good bye forever!


Sprouting a Tray of Salad Microgreens

Microgreens seem to be a current trend, possibly with good reason but there's really nothing special about them. They are regular vegetables that are harvested when very small, hence the name "microgreens." When I decided to give microgreens a try, I foolishly bought a package of seed labeled "Microgreens" thinking they were something unique. What a dummy! When I read the back of the package, I realized it contained seeds for items I already had.


Salad Microgreens Ready for First Cutting

Many vegetables can be grown for microgreens: lettuce, kale, chard, beets, spinach, arugula, radish, and mizuna. I've grown all these in the garden or greenhouse at one time or the other and in fact with the exception of arugula and mizuna, they are regulars. To grow microgreens, use the same procedure as starting any seeds inside, use a sterilized plant tray filled with sterile potting mix, plant seeds thickly, cover with soil, moisten using the shaker bottle trick, and cover with plastic wrap until germination. Once seedlings emerge, remove plastic and sit the tray on a sunny window sill or under a grow light. When 4 or more leaves appear, harvest with scissors by cutting at soil level. Rinse the greens well and spin dry with a salad spinner. The greens will regrow and can be cut several times. Eventually the soil will need to be relegated to the compost heap and fresh mix added to a clean tray along with new seeds.

Like sprouts and items cultivated under grow lights, microgreens are a boon to anyone who wants to be free from grocery store produce. Although we consume all of the microgreens we grow, they would be a perfect niche market crop to sell to local restaurants or farmers markets as they command a good price per pound. They can be grown by urban folks in high rises or by folks living in inaccessible, remote locations, in the winter or throughout the year. Between a compact cherry tomato plant, various salad greens grown under grow lights, some homegrown sprouts and micorgreens, you could be well on your way to year-round salad independence!

For those who are able to raise a garden, one method of cultivating greens for winter consumption is unfortunately often overlooked, that of "forcing roots." Basically, this is the process of encouraging roots to do what comes naturally, produce tender, green shoots. Roots of asparagus, rhubarb, beets, parsnips, dandelions and Witloof chicory can be forced. The procedure is simple. In fall, dig up the roots just before the ground freezes and replant them in any containers you can scavenge: busted buckets, leaky pails, old dish basins etc that have 6" to 8" of soil in them. Put the containers in a dark, warmish place (50°F to 65°F) and water the soil lightly. By the way, the quality of this soil isn't that important as the roots have all the stored energy they will need to send out shoots. For a dark place, use a closet, a basement that has light excluded or do as I've done and rig up a cover using a tomato cage to support an old blanket. In roughly 3 to 5 weeks, pale, succulent leaves will appear that are much more tender than their outdoor grown counterparts. Snip these off and with luck another bunch, albeit smaller in size, will grow. At that point the root is spent and ready for the compost pile.

If you decide to force asparagus and rhubarb, be aware they need a bout of cold to break their natural dormancy before they will sprout so after planting in your motley collection of tubs, sit the containers in a cold, unheated building for about 6 weeks, then bring them inside and proceed as above. Also be aware to successfully force these roots, they must be at least 3 years old and in the case of asparagus roots, the forcing process exhausts them so that they are no good for replanting in the garden, thus they are a loss. For that reason we've never tried forcing asparagus roots and instead enjoy them fully when they are in season. Rhubarb can be replanted after forcing, however. As usual, it's the red rhubarb stalks you want, don't eat the leaves as they are toxic and should be relegated to the compost pile.

Forcing Endive

We are inundated with "fresh" food in the late fall and early winter and don't really need any fresh greens until late December. For this reason, when I dig roots for forcing in the fall, instead of planting them in my containers, I store them in the root cellar as I would any root for long term winter storage until I really need the fresh shoots. At that time, usually mid to late December, I plant them as described above. One root I want to mention in particular is Witloof chicory, also called Belgian endive. Technically the roots are referred to as Witloof chicory and the shoots they produce are called Belgian endive but why stress technicalities. You can buy these shoots in the supermarket where the pale yellow, conical shaped heads are sold as chicons. They are pretty pricey in my opinion. To grow your own, you first have to grow the root. Plant the seeds in spring, thin to about 4" to 6" apart, keep them weeded and that's about it. When you dig the roots in the fall, trim off all the leaves and compost them. Then either store the roots until you are ready to force them or put them directly into your forcing containers when you dig them. Out of all the roots I've forced through the years, I think I've only ever had two perfectly shaped chicons. The rest of the shoots have been loose leaves that work just as well as anything that is picture perfect. Initially I grew Belgian endive thinking it would be a great lettuce substitute and put it on a sandwich. Yuck! We didn't like it. The leaves have a slightly bitter taste which we didn't care for. However, when mixed with other greens, sprouts, some red onion, shredded cabbage and carrots we have a very palatable winter salad that's all home grown.

Culinary Herbs (CH)


Herb Garden at Hockley Lake

Herbs are fun to grow, add delicious flavor to countless foods and don't take much space. They can have a dedicated spot in the garden, be grown in containers on a patio, porch steps, or wherever you have room to stick a plant container, or they can have their own separate area all to themselves, an herb garden (CH), which is what we do. For apartment dwellers with no land to grow anything, herbs make great indoor, edible plants. Herbs don't require particularly rich soil but they do need the soil to be well drained and not mucky. Poor soils tend to produce highly aromatic foliage whereas richer soils produce more foliage that is not as aromatic. If the soil has a heavy, clay type structure so it's poorly drained, addition of some sand and organic material will help. A pH close to the neutral range is best. If you're growing herbs in pots, be sure the pot has drainage holes in the bottom. I also put some pebbles in the bottom of the pot to help with drainage before I add any soil or herbs to the pot. Some herbs such as chives, parsley, lemon balm, mint and thyme can tolerate some shade but most prefer a sunny location.

If you are thinking about establishing an herb garden, once you have selected your bed's location, you may want to consider the growth habits of the herbs you plan to grow. Some herbs grow quite tall and should be located so they don't shade those that grow low to the ground. For example, thyme and chives are low growing perennials standing roughly 12" tall whereas the perennial rosemary can grow as tall as 3'. Dill is an annual that can grow 3' tall while the annual basil grows to 12" to 18" in height. Personally I like to group my perennial herbs together and keep the annual herbs together in a separate part of the herb bed. That way if a freak, late spring frost threatens, I can more easily protect the tender annual herbs.

With the exception of French Tarragon, which doesn't produce viable seeds, and the mint family, herbs can be grown from seeds. Any tarragon seeds that are sold come from Russian tarragon, an entirely different plant than French tarragon and different mints easily cross with each other so seeds for specific flavors of mint may not be true to type. For both of these herbs it's best to use cuttings from established plants or buy plants from a nursery.

Regarding mint, I should mention it is a very invasive plant and will quickly overrun any area where it's planted. I discovered just how fast and how much it spreads in Maine. I set a small plant in the herb garden and in a matter of a few years it was coming up everywhere and the roots had formed a mat so thick, I had to chop them out with a grubbing hoe. So don't make the same mistake. Plant mint where you won't care if it runs rampant. Or grow it in some kind of a pot to contain it.

Start herb seeds using the same techniques outlined in the garden chapter. Several are slow and erratic to germinate as well as slow to grow, so don't be discouraged. Some herbs are best direct seeded outside. Parsley, dill and mustard are 3 herbs I routinely direct seed. Now that I'm in a longer season area, I will likely resume direct seeding summer savory and marjoram too. With the exception of parsley, all these herbs are annuals. I'll continue to start basil inside along with stevia and lemongrass.

If you're lucky enough to have access to someone who has established herbs, you can obtain the perennial herbs for your garden from their plants by division or from cuttings. Herbs that are good for division are chives, garlic chives, oregano and thyme. To divide, simply dig up the parent plant, tear apart or cut the roots into several pieces and replant the individual new pieces. The best time to divide herbs is in the fall. I've done this with chives and garlic chives and it is very easy.

Good candidates for cuttings are lavender, mint, sage, thyme and oregano. Some plant cuttings such as mint and sage even form roots simply by sticking them in a glass of water. What could be easier! To propagate by cuttings, select a 3" to 6" piece of stem that is green and not woody. Cut it off above a leaf node. Peel off the lower leaves then dip it in rooting hormone which is a powder. Stick the dipped end in potting soil. Cover the pot with a plastic bag and keep out of direct sunlight. Water and ventilate the bag when necessary. In a few weeks new growth should appear at which time it can be exposed gradually to light.

Herbs can be classed as either annuals, biennials or perennials. Annuals live for only one year or growing season. Biennials bloom and bear seeds the year after they are planted, then die. Perennials survive the winter year after year and faithfully come up each spring. To a degree climate and growing zone determine which class an herb belongs to though. For example, rosemary is a perennial but only in warm season areas. North of the Mason-Dixon line it's generally treated as an annual. Sometimes protecting a tender perennial with mulch will get it through the winter. For instance, I was able to carry thyme through the winter when we lived in northern Maine by mulching it with a thick layer of straw in the fall. One year I forgot however, and it winter killed. Tender herbs can also be dug up, brought inside for the winter, then replanted outside after frost danger is past in the spring. Of course if your herbs are grown in pots outside during the summer, come fall it's a simple matter of bringing in the pot.

In Saskatchewan, due to our harsh climate the only perennial herbs I could count on were chives, chamomile and bergamot. All were indestructible and came up faithfully every spring. But I had to treat all other perennials as annuals and start them indoors every year, which was a royal pain since that was way more work, took extra time, and was always a struggle to find room for them on our overcrowded windowsills. No matter what mulch I used or how much of it, with temperatures of -40°F common in winter, my oregano, thyme and lemon balm always winter killed. To add insult to injury, the bergamot, which I grew for a tea herb, was not to our liking so it was really not all that desirable. It did however have beautiful pinkish-purple blooms so I kept it in the herb garden strictly for that reason. Now that we are in the more moderate climate of Nova Scotia, I look forward to the perennial herbs being once again, perennials.

Herbs can also be classified by how they will be used: culinary herbs, tea herbs or medicinal herbs. Below is a list of some common culinary and tea herbs along with their use and the types of plant they are. We have either grown these at some point in the past or grow these regularly every year. “A” stands for annual, “B” stands for biennial and “P” stands for perennial. A few medicinal herbs we grow are listed in the medicinal herbs section.

- **Anise Hyssop - (P)** a great tea herb with a subtle anise or licorice taste. This is not to be confused with Anise which is an entirely different plant. Anise hyssop makes beautiful purple flowers that attract honeybees.
- **Lemon balm - (P)** another great tea herb with a lemon taste. Initially I used too much when I made a cup of tea so that the tea tasted like lemon Pledge furniture polish. Once I figured out to not use more than a teaspoon of dry leaves per cup, we added this home-grown tea herb to our collection
- **Lemonella balm - (P)** similar to lemon balm and also good for tea.
- **Basil** (A) **-** a culinary herb used in Italian dishes as well as other dishes.
- **Bergamot (P)** also called bee balm as honeybees are attracted to the showy flowers. Can be used as tea herb, but we don’t care for it.
- **Caraway** (B) a culinary herb that makes caraway seeds the second year
- **Lemon catnip** (P) another lemon flavored tea herb
- **Chamomile** (P) tea herb that self sows and seems to come up in a different spot each year as a result. The little white daisy-like flowers are what is harvested
- **Chives** (P) - an extra hardy culinary herb that is a spring treat. Great on or in potatoes
- **Garlic chives** (P) as above but with a very tiny hint of garlic
- **Dill** (A) a culinary herb used for pickles, salads and dressings. Leaves and seeds can be used

- **Lemongrass** (A) unless you are in zone 11 in which case its a **(P)** - a wonderful lemon flavored tea herb
- **Marjoram** (A) a culinary herb used in many dishes
- **Mint** (P) a tea herb. Spearmint and peppermint are just 2 types of mint that are available.
- **Mustard, brown** (A) culinary herb whose seeds are used to make dijon type mustard
- **Mustard, white** (A) culinary herb whose seeds are used to make "French's" type mustard
- **Oregano** (P) culinary herb used in Italian dishes among others
- **Parsley** (B) culinary herb whose leaves are ready to pick the first season. I grow Italian flat leaf as well as moss curled parsley
- **Rosemary** (P) in zone 6 or higher otherwise an (A.) Mulch may help it survive the winter in colder zones. Digging it up and bringing it indoors for the winter is possible too.
- **Sage** (P) culinary herb that's a must in stuffing and homemade breakfast sausage
- **Summer savory** (A) culinary herb
- **Stevia** (A) unless in zone 9 then a **(P)** - tea herb that is naturally sweet. I add a small leaf to steep with other tea herbs and the little leaf sweetens the whole pot
- **Thyme** (P) my favorite culinary herb. I use it in soups, in roasted potatoes, stews, roasts and poultry dishes

As with vegetables, some herbs are hardier than others. Seeds for the following herbs can be planted before the last expected frost.

- **Borage** - 1-2 weeks before last frost
- **Caraway** - 1-3 weeks before last frost
- **Catnip** - 1 week before last frost
- **Chamomile** - as soon as ground can be worked
- **Chives including garlic chives** - as soon as ground can be worked
- **Dill** - can be planted as soon as ground can be worked
- **Parsley** - can be planted as soon as ground can be worked
- **Sage** - 2 weeks before last frost
- **Thyme** - 2-3 weeks before last frost
- **Lemon balm** - 2-3 weeks before last frost

Transplants for the following can be set out before the frost-free date.

- **Lemon balm** - 2-3 weeks before last frost
- **Sage** - 1-2 weeks before last frost
- **Thyme** - 1-2 weeks before last frost

Some herbs are quite frost sensitive and transplants of these shouldn't be set out until all danger is past.

These include:

- **Basil**
- **Marjoram**

- **Rosemary**
- **Summer savory** (seeds can be planted outside at the time of the last frost)

If you keep bees, you may want to consider growing certain herbs specifically for your honeybees. All herbs eventually develop flowers, but there are some in particular whose flowers the bees really like. Borage is one with its blue, star shaped flowers. Being an annual, borage must be planted each year, but in my experience it can self-sow so you may not need to buy and plant seeds each year. Other herbs that honeybees like include bergamot (also called bee balm), chives which have lovely purple flowers, anise hyssop with once again purple flowers, lemon balm, thyme, savory, rosemary, echinacea, sage and chamomile.

In most cases, leaves are the part of the plant that is desired. Herbs should be harvested just before they start to flower. For best flavor pick in the morning of a sunny day after the dew has dried. Harvest by cutting the stalks with clippers. Of course, they can be used fresh throughout the summer whenever you need them. For winter use they can be frozen in baggies or dried. See preserving chapter for details on drying. You can also dig up herbs, bring them in for the winter, then set them out next year. When I harvest annual herbs in the fall, I whack them off completely at ground level, but I always leave some of any perennial unharvested.

If the seeds the herb produces are the desired crop, you must wait until the plant blooms, then forms seeds. Some seeds may be located in pods, which is the case for mustard, while others form seeds in heads or clusters, as is the case with dill. However, the seeds grow, harvest them when they are mature and dry. I pick the entire seed head or stem instead of trying to pick off individual pods or seeds. Put what you've picked in a bucket or sack and whack/pound the plant material to separate the seeds from the pods or stems. Now you have a container full of seeds and plant debris mixed together. Winnow this stuff on a windy day by pouring it from one bucket or bowl to another. The heavier seeds fall into the container and the lighter chaff is blown away by the wind. If you don't want to wait for a windy day, you can use a fan to blow away the debris while you pour the material from one container to another.

When using tea herbs, I allow about 1 teaspoon of dried herb per cup of boiling water. For cooking purposes, figure you need 3 times the amount of fresh herb to equal the dry amount. Conversely, if using dry herbs, you need ⅓ of the amount called for of fresh herbs. When using dry herbs, I crush them up a bit before adding them to my dish since this helps to release more flavor.

Herbs are a great, non-calorie, sodium free way to add flavor to foods. I hope you decide to add culinary and tea herb culture to your self-sufficient homestead plan.

Medicinal Garden (MG)

A misconception exists that because herbs are “natural” they can be used without caution. On the contrary, just because medicinal herbs are “natural,” doesn’t mean they can be used indiscriminately. As is the case with prescription medications, herbal preparations work because they contain active chemical compounds that produce effects. Those effects could be positive or negative regardless of whether the compound was herbal or prescription in origin. Some herbs shouldn’t be used by pregnant or breastfeeding women. Some herbs are contraindicated in certain medical conditions. For example, wild lettuce should not be used by people who have glaucoma or enlarged prostates. Chemical compounds in herbs can also interact with each other and with other medications. If you take blood thinners, you shouldn’t use yarrow for instance.

Many herbs are poisonous if taken internally and are only meant to be used externally as salves and ointments. To further complicate matters, a given herb can have more than one name and can have numerous medicinal properties which means it can be used for more than one condition. So, the point is be sure you thoroughly research the use of any medicinal herb before you use it. Don’t rely on a single source for your information. We have several herbal books and cross reference each before proceeding with any preparation. You can also seek professional advice from a pharmacist and/or a doctor to avoid negative consequences.

While we will frequently use herbal remedies as a first line of defense, there comes a point when getting medical help from a pro is the only viable option. The trick is knowing when to seek professional help. Self-treating the occasional headache, tired, pulled muscles, cut or abrasion, the common cold as well as mild digestive upset are examples of conditions that are responsive to home treatments. Conversely, serious conditions such as cancer, heart arrythmias, glaucoma and the like need professional attention. Furthermore, diagnosing a condition takes expertise as many conditions have similar symptoms thereby mimicking each other. Before you can treat a condition, it’s critical to know what the condition is. So, in summary, use common sense, be realistic about what can be expected from herbal preparations and don't be afraid to seek help when you need it.

Having said that, herbal remedies have long been used to treat diseases and in fact numerous drugs have plant origins. Digitalis, a commonly prescribed heart drug, is derived from foxglove, quinine, used to treat malaria, comes from cinchona bark, morphine from the opium poppy and there are many others. Even common aspirin comes from salicylate which can be found in the bark of willow trees. So medicinal herbs have their place. Where the danger lies is in believing they are the only answer to every ailment known to plague mankind. On the other hand, there are many instances where traditional medicine has failed to help and herbal remedies were the answer.

As part of our reference library, we have several books that give details and specifics on herbal preparations as well as their uses and contraindications. If you are interested in using home grown herbal remedies, we would suggest you invest in some reliable references too. A quick thumb through any of our books suggests there is an overwhelming array of herbal plants that might be helpful for the different maladies that plague humans. As we already mentioned, to confuse the issue, in many instances an herb can be used for different ailments.

Familiarizing yourself with some terminology will make perusing herbal references easier since many will use these terms to describe the medicinal properties of herbs. The following list of definitions may be helpful.

Analgesic - substance that relieves pain
Anodyne - relieves pain and reduces nerve sensitivity
Antacid - neutralizes stomach acid
Antiemetic - prevents or eliminates nausea and vomiting
Antiphlogistic - counteracts inflammation
Antiseptic - inhibits growth of bacteria but doesn't necessarily kill them
Antispasmodic - relieves or prevents muscle spasms or cramps
Antitussive - prevents or helps a cough
Astringent - a topical application that causes a localized contraction of the skin or blood vessels
Cathartic - causes evacuation of bowels
Demulcent - soothes irritated mucous membranes
Diuretic - promotes secretion of urine
Emetic - causes vomiting
Emollient - substance used externally to soften skin
Expectorant - promotes ejection of mucous from lungs and trachea
Febrifuge - reduces fever
Poultice - plant material that is applied to skin to remedy certain conditions
Rubefacient - something that reddens skin due to increased circulation when rubbed on
Soporific - herbs that promote sleep
Vulnerary - herbs used to treat fresh cuts and wounds

Medicinal herbs can be obtained from the wild, can be purchased or can be grown in the garden. If you plan to forage for medicinal, arm yourself with a good field guide. No doubt there are other resources out there but our go to reference is the Peterson field guide to Medicinal Plants. It has color photos, descriptions of how to identify plants as well as their use. It is particularly good at pointing out plants that are very similar in appearance. This is especially important since some medicinal plants closely resemble other plants that are toxic. Plants we've gathered from the wild include plantain and balm of Gilead buds. Plantain is useful on insect bites and stings if it's pounded or chewed into a paste and applied directly to the affected area. I've used balm of Gilead buds collected from our woods to make a salve that is useful on cuts, scrapes and bruises. I boiled the buds in vegetable oil, strained out the bits then added beeswax to make a soft, spreadable salve. When foraging for medicinal plants, the same rule applies as when gathering wild edibles - never pick the area clean. Always leave some plant material to rejuvenate the area

In our medical arsenal we also have herbs we've purchased such as goldenseal, slippery elm bark and oil of cloves. Things we can't grow readily and/or things that don't grow wild in our area so we can't forage for them. In the short term, oil of cloves relieves toothache pain until you can get help from a dentist. It's available over the counter at a pharmacy. Because both goldenseal and slippery elm bark have numerous medicinal properties, we felt they were beneficial to have in our medicinal inventory. For example, slippery elm is useful in many poultice mixtures while goldenseal is beneficial as a wash for various skin problems. After doing your own research, you may decide you wish to include these items in your medicine chest too.

When it comes to growing herbs for medicine, the same guidelines apply as when growing any other plants; attention to soil preparation in terms of fertility and pH, although in truth most herbs are forgiving and don't require high levels of nutrients, mulching to help keep the foliage clean, minimize weed growth and to conserve moisture, and incorporation of compost to improve soil structure. Ironically poor soils produce the most aromatic foliage while more fertile soils produce more foliage but it's less aromatic. As with culinary herbs, medicinal herbs may be perennials, biennials or annuals. In late fall, just before the ground freezes, covering perennials with mulch will help them winter over.

The Latin name is particularly important when growing medicinal plants. This ensures you are getting seeds for the exact plant you want since many plants share a common name or have a very similar sounding common name. Using the Latin name avoids confusion and potential disaster.

Timing of harvest is important. As a general rule, if you are harvesting roots, collect them in the fall. Bark from trees should be picked in the late winter/early spring. Leaves and stems should be collected just before the plants starts to bloom. Flowers should be taken when they first open and seeds when they have just reached maturity. Thoroughly dry any of the plant parts prior to storage lest they mold. When picking annuals, harvest the entire plant. When harvesting perennials pick about 1/3 of the plant allowing enough time for some regrowth before winter arrives to avoid winter killing the plant.

We can't possibly cover all of the medicinal herbs and their uses but below is a list of the medicinal herbs we've grown. It may serve to get you started on your own medicinal herb patch. As always, we recommend you start small with a couple of medicinal herbs then expand your herb bed as your confidence grows and as needs arise. Just as with any vegetable garden, the herb garden whether culinary or medicinal will be as individualistic as the person growing it. So even though these are the herbs we opted to grow, it doesn't mean these may be the right choices for everyone. Assess your medical needs, research what herbs may be best and use that as a starting point to establish your own medicinal herb garden. In the list below "A" is an abbreviation for annual, "B" for biennial and "P" stands for perennial.


Comfrey

Comfrey (P) a medicinal herb reportedly good for bad bruises, swelling, sprains or fractures if a hot compress made from an infusion of comfrey is applied to the affected area. Comfrey is usually grown from cuttings but we've grown it from seeds. Once established, it is very hardy withstanding temperatures well below zero. It likes soil with a pH between 6 and 7. When it is well established, the comfrey patch can be easily expanded by division which is best done in early spring. The leaves are the desired plant part and are meant for external use only.


Echinacea

Echinacea (P) medicinal herb for use in the short term to enhance the immune system especially for colds. It can be grown from seeds, which is how we've grown it, or from division. An infusion can be made out of the leaves and reddish-purple petals. It's meant for short term use only.


Horehound

Horehound (P) medicinal herb whose leaves are used to make cough drops and cough syrup. It can be grown from seeds which is how we've established our plant. More than 1 plant really isn't necessary as a little goes a long way but if you wish, plants can be propagated by division. Horehound prefers a warm, sunny location but the soil need not be particularly rich in order to get a harvest. Large doses and long-term use should be avoided.


Mullein

Mullein (B) medicinal herb whose yellow flowers are used to make an infusion that may be used as a gargle to treat minor sore throats and coughs. It's an unusual plant in that in the second year, a striking yellow flower stalk grows from a base of fuzzy leaves. It is easily grown from seeds and will grow well in poor soil. The seeds are toxic so should not be used for medicinal purposes.


St. John's Wort

St John's wort (P) medicinal herb whose leaves and yellow flower tops are used to make an infusion that may be good for mood, sleep and as an antiviral. When taken internally, it may cause photosensitivity in susceptible individuals and as a result they may need to avoid bright sunlight. The fresh flowers can be crushed and soaked in olive oil for a few weeks which results in a reddish colored oil that could be used topically to reduce inflammation.

St. John's wort is another perennial herb that can be established from seeds. It prefers full sun to partial shade. As with all herbs the soil needs to be well drained. It will not tolerate alkaline soils (pH above 7).

There is interest these days in many different herbs besides the ones given above. Arnica, Yarrow and Wild Lettuce are just a few that we've noticed have been garnering attention. We have no experience growing or using any of these herbs. Please do your own research prior to self-medicating.

Arnica (P) a medicinal herb reportedly good as a topical application for inflammation, joint pain and aches.

Yarrow (P) medicinal herb purported to be good for treating minor wounds.
Wild Lettuce (A) thought to be a pain reliever as well as a treatment for asthma, insomnia and restlessness.


Arnica


Yarrow


Wild Lettuce

Keep in mind many medicinal herbs such as the three listed above are considered weeds and can be found growing wild. If you are considering foraging and harvesting wild plants for medicine, please remember we would recommend referring to a reputable field guide so you are certain of what you are harvesting. If you have no interest in foraging for wild plants or live where accessibility to wild plants is problematic, realize that since they grow wild, there's no reason you can't cultivate these plants in your own herb garden. Seeds for these are available for purchase. Again, please use the Latin name when making your seed selections and be aware that even though these are "natural" remedies, they work because they contain chemical compounds that produce effects. Sometimes those effects are contraindicated for people with certain pre-existing medical conditions. So, the point is to do your homework and perform your research thoroughly.

Finally let's not forget about 2 items that are common to every kitchen, dry mustard and cayenne pepper. Both are external analgesics, also known as counterirritants, that when applied to the skin, relieve pain. Mustard, either the white or brown variety, is an annual that is easily grown from seeds in any herb garden and can be used in heat producing poultices and plasters. Because the seeds are what you are after, you must let the plants bloom and go to seed before harvest. The seeds form in pods similar to that of radish. We generally wait and harvest the pods once they have turned dry and brittle but before they shatter and scatter their seeds all over the ground. Once you have shelled and winnowed the seeds, they are then ground up, mixed with an equal part of flour and then enough water is added to form a paste This is spread on a piece of fabric before it's applied to the affected area.

Cayenne pepper, another annual plant, can be used topically as a salve for joint inflammation. As with mustard it can blister the skin so applying it to a layer of fabric first before putting it on an affected body part is recommended. Check it frequently and keep it on only for the prescribed duration of time. Another word of caution. Be sure to keep cayenne away from the eyes, any open wounds or mucus membranes.

Herbal preparations can be made several ways depending on what part of the plant is used and what you plan to use the preparation for. An infusion, sometimes referred to as a tisane, is essentially a tea made from the leaves or flowers of an herb. It may contain one ingredient or several. To prepare, simply pour boiling water over the plant parts and steep for 10 to 20 minutes. As a general rule, figure using 1 teaspoon of dry herb or 3 teaspoons of fresh herb to 1 cup of boiling water. An infusion may be drunk, used externally as a wash, as a soak, a compress or massaged into the skin. Infusions can also be used aromatically by inhaling the fragrant steam. If the infusion is to be consumed, strain out the solids, sweeten if desired and drink warm. Mint tea and chamomile tea are examples of infusions.

A decoction is made from the tougher plant parts such as roots, seeds and bark. Like infusions they may contain one or more ingredients and can be consumed or used externally. To prepare a decoction, simmer the herb parts, usually 1 tablespoon of chopped up material to 1-1½ cup water, for 5 to 30 minutes. The finer the material the less time is necessary. The tougher and larger the pieces, the longer the material needs to simmer. Strain out the bits if drinking the decoction, sweeten if desired and drink warm. Horehound is one of many herbs that are prepared using the decoction method.

Both infusions and decoctions can be refrigerated, reheated then used 1 to 2 days later. Either can be made into syrups by heating them with sugar or honey. Horehound cough syrup is an example of this. First a decoction is made from the horehound which is then made into a syrup.

A tincture is a liquid form of an herb that is very concentrated and is usually made from herbs not commonly used for teas because of their unpleasant taste. They are made by adding 1 to 2 ounces of finely chopped or powdered herb to 1 quart of brandy, gin or vodka and steeping for several weeks or even a few months. They are administered by adding the specified number of drops, from an eye dropper to water and then drinking. Because the alcohol acts as a preservative, tinctures can keep unrefrigerated for as long as 2 years so long as all plant solids are strained out.

Vinegar can also be used to extract substances from plants but it lacks the power of alcohol. Herb vinegars such as tarragon vinegar are an example of this type of extraction.

Poultices and plasters are basically a mixture of herbs (either dry or fresh) that have been moistened with oil or water and then applied to an area of the body, most commonly the chest. If the mixture is a hot application it's called a poultice. If it's at room temperature it's usually called a plaster. Think mustard plaster for a chest cold for example. Because mustard, cayenne pepper and the like can cause blistering of the skin, poultices and plasters are best applied between pieces of fabric such as gauze, flannel or muslin so they can be easily lifted to check for skin irritation. This fabric "sandwich" also makes for easy removal. Many herbs are used to make poultices including slippery elm, mustard, flaxseed, cayenne pepper and comfrey.

A compress, also known as a fomentation, is made from a cloth (flannel, gauze, terry cloth for example) dipped in a liquid. The liquid can be either an infusion, a decoction or even plain warm water. A compress can be room temperature or warm. Many sore muscles and joints have been treated in our house using fomentations.

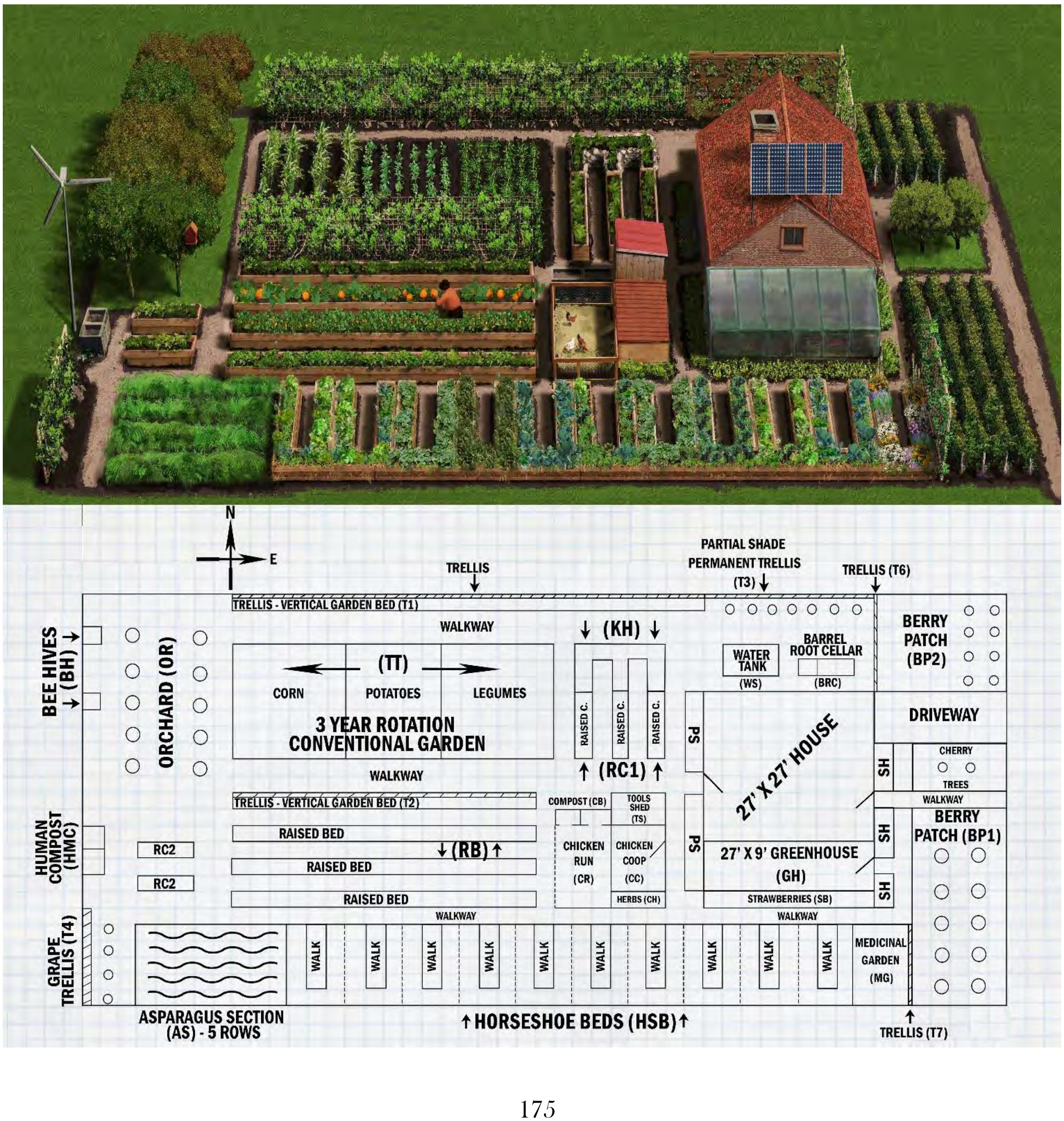
Salves and ointments are merely creams that begin with 1 or more herbs that are heated in an oil. Once the solids are strained out, beeswax is added to the warm oil to produce a solid but soft spreadable cream. The balm of Gilead salve I spoke of earlier is an example of this.

A liniment is an oil-based mixture without any added beeswax. They generally contain a heat producing element such as cayenne pepper or mustard that when rubbed into the skin increases blood flow to the affected area so it's healed through increased circulation.

Adding a few herbs to the medicine chest would be a wonderful addition to family security and self-reliance. But it's not enough just to have the plant available. Knowing when and how to utilize the plant for full effect is key. Remember that what works for you might not work for someone else. Because safety is paramount, research all herbal preparations thoroughly, be absolutely certain of the identity of any wild plants you forage and seek professional help if symptoms persist for more than a few days!

Chapter 10 – Easy on the Back Gardening

Johanna and I have utilized raised beds, conventional tilled gardens, containers and vertical gardening. Those types of growing methods have been covered specifically in the Garden chapter. But never have we had the need to consider other garden systems. Since we wanted to make sure to include some gardening ideas for those in drier climates, those who are getting older or those who would have difficulty with the more traditional gardening methods due to physical limitations, we include this chapter. There's no reason these impediments should interfere with your desire to be as self-sufficient as possible. So, this is a chapter devoted to you folks.



Referencing back to the layout sketch, you can see I used the south line of the property to make a series of beds (HSB) with narrow access paths to the middle of each bed. This was the most efficient use of space and gives a gardener the ability to reach the entire bed for cultivating. Instead of me dictating the type of garden you should have for this space, the shape is the most important aspect. You have the flexibility to choose whether the area will have raised containers, hay bales or simple raised beds shaped in the form of a horseshoe.

There are many ways to raise a garden and they are all variations on a central theme. Provide a nutrient rich medium that retains moisture so a seed or plant can thrive throughout the growing season. It's that simple. But for those with physical limitations the question is how to accomplish that while at the same time ensuring accessibility for the gardener. We can't possibly cover every type of garden system but here are a couple for your consideration, hay or straw bale beds and a keyhole garden.

Hay or Straw Bale Gardens

So why consider hay/straw bale gardening? If you have poor or no soil or live in an area where the ground is more rock than soil, this would be a great way to deal with that problem. If you are familiar with the concepts of gardening and composting, this is a method that combines the two. In essence, you are growing plants on a compost bed. An interesting concept. Because bales are typically positioned on their sides, they are automatically elevated about 18". Let's face it, we're all getting older and this is a nice way to create instant raised beds, especially if the bales are set up so at least 2 bales are in contact with each other on their long sides, thus creating a wide, elevated growing space. Obviously this set up will be easier on our backs from less stooping and bending. So too, this is also a way for anybody who is disabled or wheelchair bound to have a garden because the top of the bales are naturally raised. However, one drawback to hay/straw bales is the bales are cumbersome and heavy. Assistance will be required to get them in position.


Framework, Plastic and Bales

I have mixed thoughts on this method and I'll lay out the pros and cons. It is something we tried this summer in our own garden as an experiment. When I first heard about this method, the term used was "Hay" bale gardening and my immediate thought was yikes, that's an invitation for introducing a lot of weeds into a garden. For many years in Maine, every summer, I helped a couple of friends gather their hay bales, throw them on a truck and off load them into their barn. I have fond memories of those days. Not the hot days of sweating profusely as I wrestled a bale that weighed a proverbial ton from the ground up to the truck bed, but the treats afterwards as the wives always had sandwiches, cake, cookies and beverages. But I digress. The bales had a surprising range of weights from pretty light to dead weight. Your bales will probably be the same. They are bulky and you may need help putting them in a position to be useful even if you aren't physically limited.

When the hay/straw is freshly baled up, the 2 pieces of twine that hold the bale are strong to the point that rarely does one break when lugging the bales around. So too, rarely will a bale collapse and fall apart. Those balers do a great job of packing and making a dense bale. But if those bales get wet or are in the garden exposed to the elements, over time the twine will rot and break. At that point, as the bales compost further, they will have a tendency to bulge. That nice rectangular shape they had initially will start to fail. This is why positioning the bales so the long sides abut each other would be beneficial. In effect the bales act to support each other.

There's a big difference between hay and straw. Hay is made of grasses and legumes such as clover that are grown and harvested once they start to flower. If you wait too long, the plants start to lose nutritive value whereas if harvested too soon, you don't get the most value out of the field. So it's a judgment call on best time to harvest. Weather is an important consideration too. The process needs to be done in good, dry weather. There's always a rush to get the bales in and under cover before any rain shows up.


Preparing to Build a Hay Bale Garden

You may have noticed a field that was mowed and then a machine came along to fluff and windrow the hay into rows. That may happen multiple times to facilitate drying. The baler is the machine that will come along and scoop up the fluffed rows, pack the material into a rectangular or round bale, tie it up with a twine and leave it in the row for pickup.

In contrast, straw is the stalk remnant of grain production. When a farmer raises a grain such as wheat, the harvester gathers the seed head and the stalk that's left behind becomes straw. That makes great animal bedding but it has little food value unless you raise the grain yourself and are able to cut the stalks and throw stalk and attached seed head into the animal pen. Then the material doubles as feed and bedding since the animals work on the heads while the residual becomes a good bedding for them. Straw will be gathered and baled much like a hay bale so it's important to know the difference between the two. Whereas a good hay bale will have a nice greenish color to it, the straw bale will be a pale yellowish color. The straw bale should have much less weed seeds in it as compared to a bale of hay.

And that brings me to another consideration. The hay bale comes from a field of planted grasses and legumes of which the varieties will vary depending on your area and feed preference. But among those grasses are weeds that have come up along with the grass. Those weeds might have some nutritive value but they're weeds nonetheless. Something the farmer has accepted as part of hay growing. The animals fed the hay don't care. But a grain field such as wheat or oats is different. The farmer wants to get rid of competing weeds that would affect the yield of his/her crop. The farmer isn't interested in raising weeds so an herbicide will likely be sprayed on the crop at some point during growing. I am not a grower so I only point out the potential for chemicals on a grain field unless it is organically grown. In addition to herbicides which target weeds, it's possible insecticides and fungicides are used as well. It's quite possible in this day and age that hay is sprayed too, but that was not an issue for hay raised on my friend's fields 40 years ago. Depending on the chemicals used in spray programs, there is debate on toxicity, how fast the chemicals degrade and whether or not the levels build up in the soil over time if new bales are used each year in the same location. In my opinion, if you can find organically grown hay or straw, that would be best.

Another thought came to my mind almost immediately when I heard about this method and that concerns mold and mushrooms. In Maine, we had easy access to both hay and straw and always had some of each kicking around. If either gets wet after bailing or if either were bailed with a higher moisture content than desired, they can mold. Little mushrooms can also be found colonizing the bales. Moldy hay is no good for animal feed. Technically it's a sign the bales are starting the decomposition process which is fine, but I sure don't want to see mold growing on our vegetable plants. We both go out of our way to remove any moldy leaves or vegetable with mold growing on it from the garden. Mold has a way of generating spores to reproduce so it can spread throughout the garden simply by being blown around by the wind. A moldy leaf touching another leaf will spread it as well. Having said all that, molds are fungi and are a part of healthy soil. Like anything else, there are many beneficial fungi and then there's the troublesome fungi that cause problems such as blight and powdery mildew. I wouldn't want to make a blanket statement that all mold and/or mushrooms on hay bales is good or bad but I'd advise keeping careful watch over your plants. If they show signs of mold on leaves or stems, treat with an organic fungicide such as sulfur.

Don't think for a minute that you are failing as a gardener because of some plant disease or fungus problem. No matter where we've lived, we've had to evaluate and tackle plant problems and you will too. Weather plays a big part in what plant disease or pest shows up for the growing season. As a result the problems encountered in any given year may differ from previous years.

In Maine, we had access to hay and straw but always had the space to do the more conventional garden so we never tackled the hay/straw bale garden. In the Saskatchewan wilderness, our house and garden were built on a sand knoll and the soil was thin to non-existent. To build up the soil with this method would have required flying in dozens of bales a year. We would have had not only the cost of the bales, but also the cost of paying someone to haul bales 150 miles to the float plane base, plus the expense of over $1000 to fly a load of bales in on the Beaver. Even more if we'd chartered the Single Otter. That didn't make a bit of sense so we built the soil using the natural materials we had on site.

Here in Nova Scotia, there's a hay and straw shortage this year and I had a hard time finding bales. Cost was in the range of $4 to $6 per hay bale. We have a small SUV and the max we could fit in the car was 4 bales. It would be costly to have a bunch delivered to us. My point is the concept might be great but if you are in a location where hay and straw bales are unavailable or difficult to obtain, this method may be more trouble than it's worth.

Another concern we have is the amount of watering this system requires. I'll only point out that there's lots of exposed surface area around the bales which facilitates drying out. On the other hand, soil, with a good mulch applied, retains moisture. The raised hay/straw bale garden will need more water than a mulched, soil based raised bed and if water is an issue, this may or may not be the best choice.

We favor a natural growing medium. Soil is what plants and trees grow in naturally. A healthy soil has the bacteria, fungi, and nutritional requirements which all work together to allow a seedling to flourish. Granted, once the bales decompose, they become a nice composted medium. But to be successful with hay/straw bale gardening, the trick is to modify growing practices so that one can grow a plant while decomposition is taking place. In my research on the topic, there's a wide range of ways to do this and I'll tell you how I addressed those concerns to make my own version of a hay bale bed.

I alluded to the fact this is essentially growing plants on top of a compost pile. As the hay or straw composts further, it is becoming a prime soil which will be great to use either in place in subsequent years with more bales placed on top or redistributed into containers or segments of the garden that could use an infusion of prime compost. Even if you have compost bins elsewhere on your homestead, which you should, with the hay/straw bale method you are essentially composting in place while at the same time raising a crop.

Another benefit of this system is the flexibility you have for the location of your hay/straw bale garden. There's no need to turn soil over or have a plow or rototiller working the soil. Wherever you can throw down a few bales, that can be the garden. I've read of people suggesting bales can go on a porch or deck or even on an apartment patio. I'm not fond of either idea. Having wet bales on a deck will promote wood rot of your deck, even if one was to put a sheet of plastic underneath. If conditions are just right, a hay bale can spontaneously combust and catch fire. It's very low probability but something to be aware of especially if the hay bales are stacked before use on a porch. And on an apartment patio, because hay gardens need to be watered frequently, folks on the porch directly below might not be thrilled with the "rain" on a sunny day. But the judicious placement of your new hay bale garden can be adapted to each location. We made the Horseshoe Shaped Beds (HSB) in the sketch a flexible growing area that could be used for hay/straw bale, traditional raised beds or containers so this would be the area of choice for trying this method.

If you choose to use straw bales, they'll need to be conditioned to allow plants to grow. Without conditioning, the straw bales will take considerable time to decompose. They need help getting the process started. And that help comes from water and a nitrogen source. Nitrogen can come from any number of items: blood meal, urine, purchased bags of high nitrogen fertilizer, manure tea or chicken manure. Whichever you opt for, it needs to be added to the bales roughly 2 weeks in advance of planting.

To prep the bales, lay them on their sides in the garden location with the cut side up. If you look closely, you'll notice there's one side that will look like neatly cut tubes. Ideally that's the side you want facing up. That cut side will allow the water and nitrogen to penetrate the easiest into the bale's center. Water them until soaking wet and then sprinkle with ½ cup of high nitrogen fertilizer and/or lots of urine every other day for a week. Make sure to water the bales daily since water is critical to the process. The second week, decrease the amount of nitrogen fertilizer added every other day to ¼ cup. If you stick a hand in the bale, it should feel pretty hot which is a sign that things are working properly. You will know it's safe for planting once the heat dissipates and drops to barely warm. If we were going to use straw bales, we'd pick up the bales in the fall when the grain is being harvested and prep them in the fall for the upcoming spring planting. Then the bales have all winter to do their thing and will be soaking wet and ready to go in the spring.

Hay bales do not need this conditioning and are ready to plant. The bales inherently have a nitrogen source. Although I didn't have the time this year, I would still be tempted to water them and add some nitrogen to try to induce some heating though. I figure if I can get the bale heated, it might kill off some of the weed seeds.

The following applies to either straw or hay bales. The entire top surface of the bales can now get a couple inches of well composted manure, potting mix or quality soil prior to planting. That would create a bed for direct sowing of seed such as lettuce or spinach. For transplanting seedlings, wedge a hole open where you'd like to drop a plant, add a handful of compost first then drop the plant into the spot. Gently tamp down and move to the next spot. Once everything is planted, give plants some water. It won't hurt to add some fertilizer in the form of manure tea, seaweed fertilizer or even some diluted urine weekly especially if using the straw bales.

At the end of the season, assess whether you might get another year out of the bales depending on how much decomposition took place. I would think if the bales were initially set up so their long sides were against each other, they would sort of support each other and not fall down as readily. If you can get another year out of them, great. If not you have a couple of choices. Clean all the material up, throw it in the compost bin or mix it into another bed and then start the next year with new bales, or rake the old mass flat and stick the new bales on top of that. However, the only good reason I can think of to do the latter is to gain some additional height if mobility or health problem makes stooping difficult.

A couple of additional thoughts, if you have gophers, laying a piece of chicken wire or metal hardware cloth on the ground first will help. And for those where water is a scarce resource, be aware hay/straw bale gardening requires keeping the bales moist through daily watering so they don't dry out. Here's a solution I came up with for this. I built a square bed with 4 bales. I arranged the 4 bales in a square pattern such that a square hole in the middle was created. Incidentally, I chose to lay the bales flat (strings exposed) which worked fine. I figured out what the measured footprint of that arrangement was, then I built a box to that size using 2 X 10 planks; standard lumber, nothing pressure treated. Next I lined that box bottom with heavy plastic with the plastic coming up and over the sides of my 2 X10's thereby effectively creating a bathtub. That plastic protects the planks from rotting while at the same time captures and conserves water.

Finally I laid the bales in the box and filled the hole in the middle with layers of leaves, wood chips, manure and soil. I filled the central hole so the dirt formed a shallow, somewhat porous depression below the rest of the surrounding bales. Some vegetables can be planted in that dirt and the depression will act as a natural water catchment. It should hold moisture well yet allow it to dissipate to the surrounding bales. The wooden frame work is there to support the bales and keep them from collapsing too quickly plus it reduces the surface area thereby minimizing evaporation. Yes, setting up this arrangement is some extra work but in an arid climate, every little bit that can be done to conserve water helps. In general, we only watered every other day so I think it worked as planned. An added bonus is it's a nice compact growing arrangement. And if by chance there's a threat of a frost, it's easy to cover too.

Hay and Straw bales can be laid out in any configuration imaginable including end to end to create one long raised bed, although that would be the least desirable option in my opinion. I would certainly lay them out in such an arrangement that I have the most growing surface as possible given the square footage at my disposal. If that means placing them so their sides abut one another, that is what I'd do. You can stake plants, build a trellis or run wires or rope to a couple of posts so plants can climb vertically thereby getting more produce per square foot. This also applies to keyhole gardens.

A Keyhole Garden (KH)

Neither Johanna nor I spend time perusing the Internet looking for gardening ideas. We have our methods that work for us and we stick to them. But I was browsing online recently when I stumbled across keyhole gardening which happened to catch my eye. A keyhole garden is a concept from Africa that's designed to conserve a precious resource, water. We are just getting experience with our Nova Scotia climate and the last two summers have been dry. This style of garden bed has a lot of appeal and is something I'll keep in mind for the future.

The traditional keyhole garden is a circular shape 6 feet in diameter but I see no reason why it can't be horseshoe shaped to take advantage of space. The sides are raised and can be built from any handy materials, old fence, brick, stone, cinder block, flexible plastic sheets, you name it. You will again be growing vegetables on a compost pile but what's different about the keyhole garden concept is an indentation or walkway which allows access to the center of the circular or squarish growing bed where a central composting chamber is located. All kitchen scraps and vegetable waste can be tossed into this compost chamber along with buckets of gray water which help to keep the bed moist. Think of it as a compost pile within a compost pile. I like this concept better than the hay/straw bale garden since it is a permanent, no dig, self-sustaining growing bed. It has a growing surface set at a convenient minimum bend height, conserves water while making its own nutrients through the addition of compost material. It's accessible from the center as well as the perimeter for easy planting and cultivation. It's a perfect gardening system for those who reside in arid regions as well as those with limited time, space or mobility.

Referencing back to the drawing, you can see I terminated the raised container section (RC1) with two keyhole (KH) gardens joined together sharing a common bed. For those trying to maximize the return on every square inch of your homestead, you get a little more growing space out of this arrangement. It's a very efficient use of space so long as you can reach all of the surface area, which you can with this plan. I don't see a homestead or backyard having more than a couple of these since each bed relies on the constant addition of kitchen scraps and compostable materials. If you intensively grow the whole plot of land, you should have enough garden, kitchen and chicken waste to feed both of these chambers as well as the dual composting bins (CB) by the chicken run. If you have access to a steady stream of compostable materials, then by all means, more of these keyhole gardens can be set up. Please do not put human waste into any of these chambers. The human waste is treated differently and must be composted on its own in the chambers set aside for that. (HMC). The 2 keyhole pathways allow for access to the center composting bins and are the common path for the raised container beds as well.

Clem Rutter, Rochester, Kent, CC BY-SA 3.0 Traditional Keyhole Garden

I mentioned that the traditional keyhole bed is round but, in our case, we've modified it to a square shape to suit our needs. The only disadvantage of a squarish shape is the dispersion of water and plant nutrition from the composting chambers. This is not as efficient as with the circular bed, especially to the outside corners. Everything I write about our square bed applies to a round shape if that suits you better, especially if you have lots of room. I'd make our keyhole bed about 8 feet wide and 7 feet deep. There's no point in making it any larger since you need to be able to reach all points in the bed to plant and reaching in 3-3½ feet from any side is a reasonable distance for most people.

Mark around the perimeter where you will start laying the wall of the garden. I'm most concerned with the overall concept than I am with actual dimensions so there's lots of flexibility on height. Consider making the walls anywhere between 24"- 36" high. Obviously the higher the wall, the more user friendly for anyone who has problems with mobility but it increases the volume of fill materials needed which might be problematic.

After the walls are built, build 2 square cages out of hardware wire about 6" higher than the wall dimension and 16" in diameter. There's nothing critical about this dimension as these cages will be set in the middle of each keyhole bed and it's where all kitchen scraps and compostable material will be thrown. Waste gray water and roof catchment water can be dumped in here as well. Adding some earthworms so they can work their magic is beneficial too. Bear in mind a cage too small in diameter makes it hard to get a tool in to the cage to occasionally mix things up. Too large and it's wasted space. The compost and water that is continually being fed to this central basket will supply nutrients and moisture to the surrounding bed.

Anchor the cage in the center of the square bed which happens to be at the end of the access path, then start layering in garden debris, kitchen scraps, some stove ash, lawn clippings, compost and any other organic material that will hold the cage in place. You don't need to fill the cage completely. Just enough so that it stays put.

At this stage the idea is to build a large compost pile in the square beds. Start with a layer of course sticks or tree branches no bigger than 1" in diameter and no longer than a foot. As far as what to do next, well, there's no set rule. The idea is the same as any compost pile. Layering and mixing in all kinds of organic substances to encourage microbes and worms to breakdown the fibers and materials into a usable form for plants to utilize. Newspaper, cardboard, leaves, compost, straw, wood ashes, grass clippings, manure, spent garden debris, you get the idea. Water well between layers and just keep layering stuff in. The more variety, the better. It might take you a winter to gather all the materials to fill them. That's OK. Just keep filling the beds until you reach the top. At this point I would put a nice layer of manure, soil and compost to finish the top.

Be aware, over time, your garden will settle and will need additional manure and soil to bring it back up to the original levels. The fact that it is settling tells you things are happening in the pile and the compost heap is working. Matter is being broken down which is the objective.

On the sketch, I chose to combine this keyhole garden (KH) with raised containers (RC1) but there's no reason a single square or round keyhole garden can't be set up as the sole source of fresh vegetables. We hope these gardening suggestions will inspire people to pursue and enjoy the satisfaction that comes from growing their own food regardless of their physical capabilities. Happy gardening!

Chapter 11 – Seed saving

With garden seeds being relatively inexpensive especially when compared against their return, you may be wondering why anyone would want to fool with saving their own seeds. We can think of several reasons. First it takes self-sufficiency to the next level. There's something inherently satisfying about growing vegetables from seeds you've saved yourself. It makes you less dependent on seed suppliers and frees you from worry about shortages or escalating prices. Not to mention you aren't limited to the varieties the suppliers decide to offer. The varieties of several vegetables we grow are no longer offered in any of our catalogs. If we weren't saving the seeds ourselves, we wouldn't be able to raise those varieties any longer. And that would be very disappointing since they are tried and true and produce well for us year after year. Which brings me to another reason why saving seeds is important. That of being able to select seeds from produce that has characteristics we find desirable whether those traits be earliness, size, taste, tolerance to frost or disease resistance. We figure if we save seeds from what we deem the best specimens from each plant, we have a good chance of replicating that success in the future since the variety seems well adapted to our location and conditions.

So how to begin. Well, first any plant you wish to save seeds from must be open pollinated. This means it's not a hybrid. A hybrid is a cross of 2 different varieties of the same vegetable with the aim being to produce a new variety, a hybrid, that has the best qualities of both parent plants. An example would be crossing 2 different species of broccoli to get a new version of broccoli that is bigger, better, earlier, more bug resistant or whatever than either of the parent species of broccoli. This type of thing has been done for hundreds of years and is in fact a natural process that can occur in any garden as cross pollination readily occurs between members of the same plant species. The biggest drawback to hybrids is if you save seeds from them, you will not end up with seeds for the superior variety. The seeds will produce a vegetable that is not true to type as compared against the original, thus it will most likely not have the desired traits of the hybrid. Of course the other drawback is that growing only hybrid varieties makes you very dependent on the seed companies.

A hybrid should not be confused with GMO, genetically modified seeds. These seeds have been monkeyed with in a lab using high tech techniques that actually alter the genetics of the plant. They insert genetic material from unrelated plants or even from different organisms. In other words, they will take genetic material from an unrelated source and insert it into the DNA of a plant. Something nature would never do. There is much debate over health concerns as well as environmental safety of these fabricated seeds. Personally we steer clear of them.

And then there's "heirloom" varieties. What the heck are they? As the name implies, they have been passed down from one generation to the next and are therefore open pollinated. You can save seeds from any heirloom or open pollinated variety. Not all open pollinated varieties are necessarily heirlooms, but that doesn't really matter when it comes to seed saving.

We try to grow open pollinated varieties as much as possible. Some of those open pollinated varieties are considered heirlooms but not all of them. We do grow some hybrid vegetables and make no apology for doing so. Brussels sprouts is one vegetable that is a hybrid and so is corn. Many years ago we tried an open pollinated corn variety and it tasted terrible so we've stuck with hybrids ever since. Unfortunately, every few years we have to keep finding a new variety to grow as the suppliers cease carrying the one we grow. A further illustration of one of the drawbacks to growing hybrids.

To successfully save seeds requires being somewhat familiar with how plants are scientifically named. Scientific nomenclature is based on a 2 name or 2 part system. The first name is the genus and the second is the species. Plants of the same species will cross with one another but not if they are different species even though they are in the same genus. Here's what I mean. The Cucumis genus contains both cucumbers and melon. But they will not cross with each other because they are different species. Cucumbers are *Cucumis sativus* and melons are *Cucumis melo.* As you can see the second name, the species name, is different. Plants within the same species will cross with each other but plants from different species will not.

Another example is the Cucurbita genus. *Curcurbita pepo* includes pumpkins, all summer squashes, spaghetti squash and acorn squash. All of these can easily cross with each other. *Curcurbita maxima* includes Hubbard and buttercup squash. These 2-winter squash can cross with each other but it's unlikely they will cross with anything from the *C. pepo* group. If/when any crossing occurs within the same genus, the offspring of the crossing won't show up until the next season when those seeds are planted. In other words, they won't show up in the current growing season. Some gardening books and seed catalogs give the scientific name for vegetables which is helpful.

Because crossing occurs naturally within the same species, you need to pay attention to a few things when planting. To prevent cross pollination of different varieties of each vegetable species, you need to isolate the same species of each vegetable from each other by a distance of 100 yards or more or by planting 1 earlier and the other later so they are flowering at different times. Obviously, a separation of 100 yards or more is difficult in a home garden but adjusting planting time may not be. If you plan to save seeds from more than 1 variety of a particular veg that easily crosses, another strategy is to plant a single variety one year and save seed and then plant the other variety the following year and save that seed. Most seed are good for more than 1 year if properly stored, so viability isn't a concern. Then there's no worry about cross-pollination when only one variety is grown every other year.

You can also put some sort of protective barrier over seed bearing plants. Small pieces of cheesecloth, muslin or Reemay can be put over the blossoms before they open. We've never actually done this but to save seeds properly we probably should. One trick we do is to hand pollinate squash, peppers and cucumbers with a little artist brush instead of waiting for insects to do the job. I use separate brushes for each variety and pollinate each day going from male flowers to females flowers, the flowers that have a miniature vegetable at their base.

The next thing to be aware of is there are 3 basic types of plants, annuals, biennials and perennials. Annuals form seeds the year they are planted and are the easiest plants to save seeds from. When we began saving seeds, these were the types of plants we started with.

Perennials survive the winter and come up regularly each year. They produce seeds each year too but we've never bothered to save seeds from them since the plants come up each year. If we want more plants, they are easily propagated by division. In fact I cut off seed heads that form on the rhubarb, a perennial, because I want the energy going to the plant itself and not seed production.

Biennial vegetables, chiefly the roots and cabbage family, produce the edible portion the year they are planted but don't produce seeds until the second year. This means you must carry these plants over the winter and replant them in the garden the following spring at which time they will set about producing seeds.

While we've successfully carried beets, parsnips and carrots over the winter so we could plant the stored roots the following spring and get seeds, we've yet to be able to over winter celery or vegetables in the cabbage family and likely never will. That doesn't mean we won't try however once we get our root cellar built so we can properly store these vegetables. Below is a list of the 3 categories of vegetables.

Annuals
- any kind of beans
- broccoli
- cucumbers
- dill
- eggplant
- endive/escarole
- lettuce
- melons
- onions
- any kind of peas
- any kind of peppers
- pumpkins
- summer radish
- spinach
- any kind of squash
- tomatoes

Biennials
- beets
- Brussels sprouts
- cabbage
- Chinese cabbage
- caraway
- carrots
- cauliflower
- celery
- celeriac
- collards
- kale
- kohlrabi
- parsley
- parsnips
- rutabaga
- winter radish
- turnips

Perennials
- asparagus
- chives
- rhubarb

So now that you have open pollinated varieties growing in your garden, how do you go about saving their seeds? First is to determine what characteristics you find desirable. For us this includes such things as size, early ripening, disease resistance, long term storage potential, yield and slowness to bolt. But other desirable traits include flavor, ability to germinate in cold weather/cold soil and tolerance to drought or other unfavorable growing conditions. Save the seeds from the plants/vegetables that exhibit the traits you are seeking most.

Once you have selected the seed-bearing plants, you need to collect the seeds from them when they are fully ripe, or in some instances, when the vegetable is overripe, for best results. Save seed from the best fruits from multiple plants. In other words, don't save seed from just one tomato for next year's seed. The more plants you can save seed from, the more genetic diversity you have in your saved seed.

When I was new to seed saving and didn't know any better, I saved seed from green, immature hot and bell peppers. These seeds failed. Once I smartened up and saved seeds from fully ripe red peppers my success rate soared. To save seeds from peas, beans and any vegetable that forms seed heads with attached pods of seeds, allow them to stay on the plant until the pods are dry and brittle. Then collect the pods when they aren't wet from dew or rain. For peas and beans, we simply pick the dry pods off the vines and shell them manually. If we were saving a large quantity of seeds, we would thresh them as described in the food preserving chapter but for small quantities, manual shelling is satisfactory. For vegetables such as radishes, beets and carrots that form seed heads of small pods, we snip off the stalks then thresh and winnow them to remove the large chunks of stalk and pod debris. We do not try to pick off individual pods and we most certainly do not try to shell pods filled with tiny radish or beet seeds. I can't think of a quicker way to lose my sanity than by doing that.

For plants that bear seeds in edible flesh such as cucumbers, tomatoes and peppers, these should be slightly overripe before they are picked. So, the tomatoes should be quite soft, the cucumbers should be yellow and the pepper should be red and maybe even slightly shriveled. Pepper seed is easily extracted from the cut open peppers. Seeds for tomatoes and cucumber are scooped out and put in a small glass of water to ferment for a few days. Soaking in water makes separation from the pulp easier. It also allows the good, heavy seeds to sink to the bottom. The floaters, the lightweight seeds, and the pulp rise to the top making removal and discarding easier. For winter squash and pumpkin, I simply whack them open, scoop out the pulp and seeds, rinse off the pulp and dry the seeds.

Seed Drying Before Storing

Airtight Seed Storage

And that brings me to another important point. All seed should be dry before storage. We leave our seeds in small dishes that we've labeled with their contents for several weeks to air dry before packaging. Once dry, store in any air tight container such as small jars with lids, (baby food jars are good choices) or plastic pill containers. We've used paper seed packets like seed companies use but we store these in a plastic tub with a lid. Be sure to label each container with the variety it contains as well as the date. Different varieties of pepper, tomato, squash and pepper seed look alike so labeling avoids confusion in the future. Date is important so you can keep track of how old your seed inventory is. With proper storage, most seeds are good for several years. The exception is onion seed who's viability decreases significantly after two years. Store all seeds where they will be cool, around 40°F and dry.

Chapter 12 - Food Preservation

There are multiple ways to preserve food for long term storage: canning, freezing, drying, curing with salt/spices, brining, smoking and root cellaring. We've done all of them through the years discovering that particular techniques work better for certain foods than others.

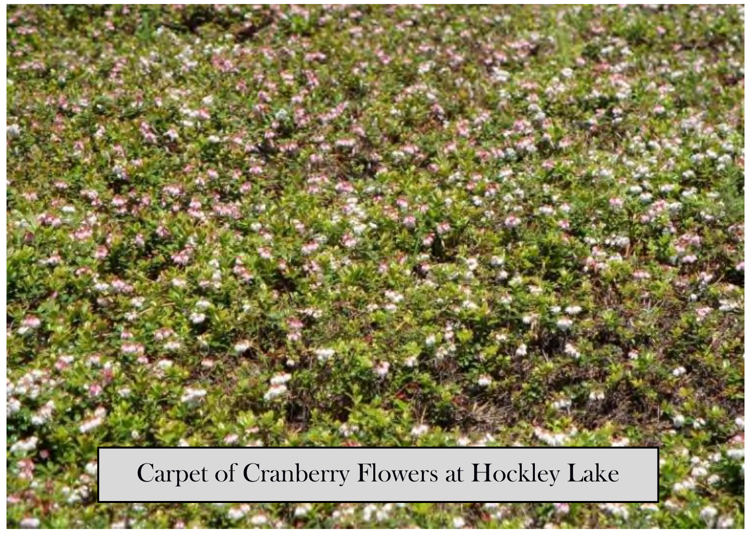
But before I get into the nitty gritty of how to do each method and what we've determined works best for us, I thought I'd take a minute to tell you what and how much of each vegetable and fruit we like to have stashed away at the end of our growing season. Remember we are a household of two, we want to have enough to feed us through an entire year and these items and amounts reflect our personal food preferences as well as what our growing zone allows. Sometimes we have a shortfall of something but that's usually balanced out by having a bumper crop of something else so we don't have to resort to the supermarket. Bear in mind the amounts given below do not include what we consumed fresh through the summer months. This list also helps to illustrate our chosen method of food preservation for various foods. The ziploc bags referenced below are the large 1 gallon size.

- **Green Beans** - 2 ziploc bags frozen
- **Wax Beans** -1 ziploc bag frozen
- **3 Bean Salad** - 8 pint jars
- **Limelight Bean** (a Lima type bean) - minimum 8 pint jars
- **Baking Beans** - 15 pounds (I grew these in Maine with no problem but was never able to get these beans to the dry stage in Saskatchewan due to our short, cool summers. The best I could do there was get them to what's known as the green shell stage and I canned all I could.
- **Broccoli** - 3 ziploc bags frozen
- **Cauliflower** - 1 ziploc bag frozen
- **Brussels sprouts** - 6 plants in root cellar
- **Cabbage** – 6 to 10 heads in root cellar depending on size
- **Sauerkraut** - 15# to 25#
- **Freezer slaw** - 8 pints frozen
- **Carrots** - 75# in root cellar
- **Corn** - 10 pints frozen in freezer
- **Belgian endive** - minimum of 6 roots in root cellar. Max of 25
- **Beets** - 5 to 6 pint jars of pickled beets; 3# in root cellar
- **Celery** - 2 to 3 ziploc bags frozen; 6 to 8 plants in root cellar, 1 to 2 in planter tubs as winter "house plants"
- **Kale** - 40 ounces frozen
- **Leeks** - 12 to 24 in root cellar
- **Onions** - 50# minimum. Possibly up to 100# in a good year
- **Potatoes** - 200#
- **Parsnips** - 5#
- **Peas** - 3 ziploc bags frozen
- **Pumpkins** - 6
- **Winter squash** - 12 to 15

- **Bell Peppers** - minimum 1 ziploc bag frozen, preferably 2 bags
- **Hot Peppers** - 7 pint jars pickled hot peppers
- **Spinach** - as much as possible. I never have enough. Minimum 40 ounces
- **Mixed vegetables** - 9 pint jars (I use these in soups)
- **Tomatoes** - cut up plain, minimum of 7 quart jars
- **Stewed tomatoes** - 9 pint jars
- **Tomato soup** - 7 quart jars
- **Vegetable juice cocktail** - 14 quart jars
- **Plain Tomato sauce** - 14 quart jars
- **Meatless spaghetti sauce** - 14 pint jars
- **Barbecue sauce** - 6 pint jars
- **Ketchup** - 6 pint jars
- **Taco sauce** - 6 pint jars
- **Winter radish** – 2# in root cellar
- **Refrigerator Dill pickles** - 1 gallon jar
- **Bread and Butter Refrigerator pickles** - 1 gallon jar
- **Sweet Relish** - 6 jelly jars
- **Dill Relish** - 6 jelly jars
- **Zucchini** in the form of a couple loaves of zucchini bread and some muffins in freezer
- **Dried Culinary herbs** - basil, sage, thyme, oregano, rosemary, marjoram, savory, parsley, dill and its seeds, mustard seeds
- **Dried Tea herbs** - lemon balm, anise hyssop, chamomile, mint, lemon grass, stevia

Here's some info on what fruits I put by and how much assuming I have access to them.

- **Wild blueberries** - 3 large ziploc bags frozen
- **Wild cranberries** - 3 large ziploc bags frozen
- **Applesauce** - 7 to 14 quart jars
- **Apples** - 50# in the root cellar
- **Apple slices** - 7 quart jars
- **Apple pie filling** - 7 quart jars
- **Apple cider** - 8 to 10 gallons, preferably 12 gallons canned
- **Vinegar** - 1 to 2 gallons of cider went to vinegar production
- **Juices: Wild blueberry** - 7 to 14 quart jars
  Wild cranberry - 21 to 28 quart jars
  Strawberry - 7 to 14 quart jars
  Black currant - 21 to 28 quart jars
  Red currant - 7 to 14 quart jars
  Rhubarb - 7 quart jars
- **Strawberries** - 20 to 30 pints frozen in syrup
- **Jams/jellies** - a batch of strawberry, blueberry, saskatoon, gooseberry, red currant, apple; each batch yielding 2 to 6 jelly jars depending on how much of any given fruit I have.

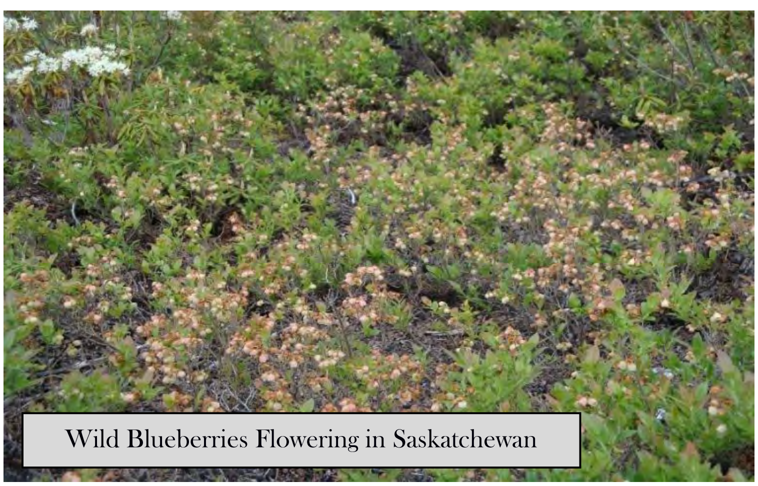


Carpet of Cranberry Flowers at Hockley Lake

Our garden in Saskatchewan, where we started growing intensively, was 57’ X 32’ for a total of 1,824 square feet. The greenhouse was 24’ X 9’ for a total of 216 square feet. From these areas, we produced all our vegetable needs for the year. We were in a harsh climate where everything was planted within a 3 week window and took the entire season to reach maturity by which time the snow was flying. We practiced succession planting as much as we could, but our climate limited what we could do. Most everyone reading this book will be in a more favorable climate, so if they practice succession planting, they'll need less space to get the same amount of food.

The type of fruits we’ve been able to raise over the years has been dictated by our location. In Maine, we had access to apples by the bucketful so I filled our larder with every apple product I could. I’ll do so again now that we are in Nova Scotia and have access to apples once more.

Our apple trees in Saskatchewan never gave us very much but our cultivated strawberries, currants, saskatoons and raspberries did. Strawberries did great and were our most abundant fruit. Consequently, I froze tubs of them each year. Wild blueberries and cranberries grew in more abundance than you can imagine. The landscape was a sea of blue during blueberry season and we took full advantage of nature’s bounty. I didn’t have access to either of these in Maine.



Wild Blueberries Flowering in Saskatchewan

Throughout this book, we’ve tried to convey methods we’ve discovered that make various homestead tasks easier as well as what has and hasn’t worked for us. When it comes to food preservation, specifically canning food at home, I’ve never taken short cuts or deviated from the directions in any way. Neither am I so rigid and set in my ways that I continue to do a procedure the way I’ve done it for years adopting the mentality “if it was good enough for my grandma, it’s good enough for me” when a newer recommendation comes out. No, I always explicitly follow the most up to date information available. The food scientists who are far more trained and knowledgeable than I are constantly learning more and making changes to recommendations. An example of this is home canned pumpkin. Years ago there were directions for canning pumpkin puree and that’s the way I did it. No longer. Pumpkin should be canned in chunks as the pureed form is too dense to be safely canned at home, so that’s now how I can it.

Freezing Fruits and Vegetables

To have a freezer or not to have a freezer, that is the question. At our homestead in Maine, without power to run a freezer, I was limited to drying, canning, curing, smoking and root cellaring as food preservation options. We could and did use outdoor winter temperatures below freezing to our advantage, but those temps didn’t show up until December which was no help whatsoever in July when I had broccoli coming out my ears. Now that I’m lucky enough to have several freezers, my life is easier since of all the preserving methods, freezing is one of the easiest. I still do lots of canning but what I put by in jars has changed through the years. I still can all sorts of tomato products and mixed vegetables for soups, all of which I’ll discuss later. But no longer do I have to scramble to can meat like I did in Maine when outside temperatures warmed in spring.

Having one chest freezer is a beautiful thing. Having two is heaven! We opted for chest freezers. Why a chest freezer and not an upright? Efficiency, that's why. Every time the door to an upright freezer is opened, cold air spills out. With the chest type the cold air stays put. I can also pack the freezer more tightly. I've had our chest freezer jammed so full I couldn't fit a piece of paper in the thing. That can't happen with an upright. Items would be falling out every time I opened the door. Truth be told, in our kitchen we also have a refrigerator with a freezer above and I’ve had that packed so tight, I probably should have worn steel toed sneakers whenever I opened it since many times, some frozen item dropped out before I could catch it.

The one draw back to chest freezers is accessibility to items buried on the bottom. Try as I might to think ahead, when I’m packing food in the thing, I always manage to bury something I wish I’d kept handy to the top. But there are some tricks I employ to make the hunt easier. I try to put all rigid containers on top of each other in stacks to use the space the most efficiently. They fit nicely together and are easy to take out and put back in when I’m searching for something. I also try to put all the zip lock bags of vegetables in a stack too. If possible I try to segregate the kinds of meat: chicken on the right, beef on the left, pork in the middle, for instance. Keeping a running inventory is a great way to keep track of what you have in the freezer at any given time. I’m very good about writing down what I put in, but unfortunately I’m not so good at remembering to record what I take out. That’s something I will try to improve upon now that our freezers are inside, down in the cool basement and I can keep the tally sheet and pencil taped to the freezer. That would have been impossible when we had our freezers outside under the porch like we did in Saskatchewan. Because the winters were long and cold there, we could leave the freezers unplugged from late October to mid April thus saving on power consumption.

Chest Freezer Outdoors to Utilize Winter Temps to Advantage

The size of freezer you buy is a personal choice governed by how much food you anticipate putting by and how much room you have to put the appliance. Our experience has been the more freezer space we have the more stuff we freeze. In other words, seldom do we have empty space as I’m constantly cycling stuff in and out of it. My motto is: create an empty space and we will fill it!

Because we live off-grid, we never have to worry about a power outage due to grid failure be it man-made or natural disaster. Being tied to the grid doesn't mean you need fear losing your freezer's contents every time the power goes out however. The first thing to do is keep the door shut to keep in the cold air. This will buy you time and prolong storage time. Items will stay frozen longer than you think especially if the freezer is full and you resist the temptation to open the door and see how things are doing. Think of the contents as being one big block of ice. Throwing heavy blankets and quilts over the freezer will help to keep the cold in too. Just remember to remove the blankets when power comes back on since some of the exterior may be part of the heat exchanger. When is it safe to refreeze something that has thawed? If the item still has ice crystals in it, it's generally safe to refreeze it. If it's completely thawed, cook it and eat it or cook it then refreeze it. For safety reasons never refreeze raw foods once completely thawed without cooking them first.

I admit having a freezer is a luxury. One some people off-grid do not have. I'm very thankful to have it. Could I live without it? Sure. I did for years in Maine. But having one certainly improves the quality of our meals, gives more variety to our diets and makes my life easier. Since our alternative energy systems in both Saskatchewan and now Nova Scotia have been big enough to power a freezer, why not take advantage of the convenience?

In addition to freezing peas, corn and beans which I had to always can when we lived in Maine, I'm able to freeze vegetables that don't can well such as broccoli and cauliflower. In Maine, we could only eat those through the summer months as I had no good way to preserve them. So too, I'm able to freeze bags and bags of all sorts of berries: strawberries, raspberries, blackberries, wild blueberries and cranberries. These fruits can be canned, but freezing produces a better product in our opinion. We like the taste and texture better and of course freezing is considerably less work for me.

Bags of chopped up frozen rhubarb for winter use wouldn't be possible without the freezer. Freezer slaw, a relatively new addition to our larder, wouldn't be possible without a freezer either. Why is that so important? When the fresh lettuce and cabbage are gone and we are hankering for some crunch in our winter diets, freezer slaw quells the craving. This was especially critical when we lived remote and only shopped twice a year. We needed to be as self-sufficient as our environment allowed.

The convenience of being able to freeze any baked goods I make is also a nice bonus to having a freezer. When we're inundated with zucchini in July, I can whomp up several loaves of zucchini bread or zucchini muffins and freeze them. Pulling out a loaf in January makes for a special treat.

So what's involved in freezing foods? We'll start with what equipment is necessary. Obviously one item you'll need is containers to pack the product in. There are many options here. The object of all methods is to prevent freezer "burn" which incidentally doesn't result from a burn at all but does result from moisture loss. It's caused by air reaching the frozen food and drying it out. You also want to preserve flavor, texture, color and nutritive value.

I've used ziploc plastic freezer bags, bags that close with twisties and rigid plastic freezer containers. Vacuum packaging systems are available for purchase but I have little experience with them. My sister has one though. She loves it and based on what I've seen when I visit her, I like it too and wouldn't mind having one. It seems to prevent ice crystals from forming in the food thereby improving texture in the long run. There's also less risk of freezer burn. All these factors contribute to a longer shelf life for food packaged with her vacuum system.

She buys sheets of plastic “bags” that come on a long roll. The sides of the roll are already sealed. Using the heat sealing element on the vacuum machine, she cuts the long strip of plastic to the size bag she wants then heat seals the bottom. After filling the bag she made, she sucks the air out of it with the machine and once again uses the heat sealing element to seal the bag. The plastic bags are reusable provided there’s enough of the bag left after cutting it open to reach into the machine for vacuuming and resealing. She uses her vacuum method for all her freezing be it fruits, vegetables or meats. No matter if the food is packed in a syrup, as most fruits are, or dry as most vegetables are, her system produces a leak proof bag.

For me, the ziploc bags are okay for items that are packed without a liquid; most vegetables and berries. Plastic bags that close with twisties are okay too. With either type, I have to be sure I remove as much air as possible prior to freezing. But if I’m freezing something that’s packed in a liquid, then I must use a rigid plastic container. For example these work great for strawberries in syrup, apple slices in syrup and any other fruit in a syrup too. I also use rigid containers for packaging corn as I want all the sweet liquid that’s exuded when I cut it from the cob prior to freezing. Squarish containers stack and pack better in the freezer thus they conserve space. Odd shaped containers take more room, although I have to say in the fall, when I’m running out of desirably shaped containers, I use round tubs if that’s all I have left. Some manufacturers of canning jars make their jars so they can be used to freeze stuff too. Be sure the label says can or freeze jars.

Keep in mind liquids expand when frozen, (usually syrups used for frozen fruits) so adequate space must be left at the top of the container to allow for expansion. Failure to do so results in the top popping off and sticky syrup leaking out in the freezer. I know. It’s happened to me. Loose packing vegetables are the exception and require no headspace be left. Things such as broccoli, Brussels sprouts, pepper strips and any other vegetable that has lots of space around the pieces fall in this category too.

In order to properly freeze vegetables you need to blanch them first. To do this requires a large kettle which has an insert or wire basket that fits inside the pot. You need to be able to get all the vegetables out of the boiling water at once when the designated time is up. You don’t want to be fishing errant peas out of the water with a slotted spoon. You can buy special blancher pots made for this job or use whatever you already have provided the wire basket fits inside of it.

You’ll also need a big bowl of very cold water to throw your blanched vegetables in once they come out of the boiling water. The purpose of this is to stop the cooking action in its tracks. I put a colander into my bowl of cold water to make extraction of the chilled veggies quick and easy so my cold water bowl is ready for the next batch coming out of the blancher pot.

Miscellaneous utensils common to every kitchen will be needed too: knives, cutting boards as well as a timer. I use a digital timer so I can accurately gauge the minutes. Most vegetables are only blanched for 2 to 3 minutes, peas are even less at 90 seconds, so a timer that can be set for such small increments is helpful.

The first thing to do is prepare your vegetable. Wash it, shell it, peel it, chop it, slice it or whatever is necessary to get it ready for blanching. Try to make all cut up pieces of equal size. Once prepared, you’re ready for the next step.

Scalding vegetables in boiling water, blanching, is a must for just about every vegetable prior to putting it in the freezer. Some notable exceptions are green peppers, hot peppers, diced mature onion bulbs and green onions which can be frozen successfully without blanching. The blanching process stops enzymes that adversely affect taste, texture and color. Blanching times vary with each vegetable as well as the size of the vegetable. For instance, large Brussels sprouts take longer to blanch than small ones.

To begin blanching, fill your kettle with water and heat to boiling. Once boiling, add your prepared vegetable to the wire basket and immerse it in the boiling water. Put the lid on the pot to facilitate a rapid return to boiling. For every gallon of water in your pot add no more than 1 pound of prepared vegetable. If the water takes more than a minute to return to a boil, too much has been added for the amount of water in the pot. Set your timer to the proper time once the water returns to a boil.

When the time is up, immediately remove the wire basket of blanched vegetables and pour them into the colander situated in the bowl of cold water. Return the basket to the kettle, return water to boiling and the pot is ready for the next load. Repeat as many times as necessary.

The vegetables must be thoroughly chilled to arrest the cooking process. Once chilled, remove the veggies from the cold water and drain well. Because each load will heat up the water in the bowl, you'll have to replace it with another batch of cold water. I often lay out the vegetables on a clean towel to absorb moisture. Then package according to your preferred method. One trick I employ to make easy extraction of a small quantity of vegetables from a large bag is to put the chilled product on cookie sheets, set the sheets in the freezer, then bag up the individual frozen pieces. Otherwise, the vegetable will end up being a frozen mass. This technique works great for many items: peas, broccoli, celery, Brussels sprouts to name a few. Incidentally the same trick works great for blueberries, cranberries, blackberries and raspberries. After packaging, label the package with its contents and freeze. I like to put the date on the package too so I can be sure to use the older stuff first.

For details on blanching times for each vegetable visit the website National Center For Home Food Preservation or pickup an up to date food preserving book. If processing times happen to change, going to the source with the most up to date information is best. I check periodically myself since food safety is paramount. By the way, don't feel you have to memorize the details for freezing fruits and vegetables or any of the processing times for canning. There's no need to be a walking encyclopedia, just refer to the directions for specifics on processing times, syrup concentrations etc. for the particular fruit or vegetable you're processing. After all these years, I have some processing times memorized, most I do not. Regardless, I look everything up just to double check.

Fruits take to freezing very well. Of all the fruits, blueberries, raspberries, cranberries, rhubarb and blackberries are the easiest to freeze. Simply wash, drain well (I dump them on a clean dry towel to suck up water), spread in a thin layer on a pan with a rim such as a jelly roll pan or cookie sheet and pop in the freezer. The rhubarb must be chopped up before spreading on the sheet. Once frozen, package and label. For me this means using a plastic freezer bag that either zips close or is closed by twisties. I try to squeeze out as much of the air as I can before closing the bag. What could be easier!

The process for other fruits is a little bit more involved. Obviously you'll need to prepare the fruit by washing, peeling, slicing, pitting, chopping or whatever is appropriate for the fruit and the desired end product. Because fruits such as apples, peaches, nectarines and pears oxidize and discolor when they are cut and exposed to the air, treatment with an antioxidant is necessary to prevent them from turning brown. Several options exist: Ascorbic acid (vitamin C), citric acid, commercial products with these as a base and lemon juice.

Lemon juice is commonly available but unfortunately it's the least effective of the bunch taking 6 times as much as compared to ascorbic acid which is otherwise known as vitamin C. Lemon juice also imparts flavor to the fruit while ascorbic acid does not. In the past, I've used lemon juice to treat fruit and it did a so so job.

Citric acid (a powder) can be purchased from any pharmacy which is where I've obtained it. It's more effective than lemon juice but not as powerful as ascorbic acid. It takes 3 times as much citric acid as ascorbic acid to do the job. It can alter the flavor of the fruit too. If you opt for citric acid, dissolve the amount specified for the fruit you are preserving in 2-3 Tablespoons of water first and add this to your fruit following the directions below for vitamin C (ascorbic acid).

Ascorbic acid (vitamin C) is the most effective antioxidant of the bunch. It also does not change the flavor of the fruit the way the other two do. It can be purchased from any pharmacy which is how I've obtained it. Like citric acid, ascorbic acid is a powder. To use, dissolve the amount specified in the directions for the fruit you are processing and proceed as follows:

- For wet packs with syrup - Add dissolved ascorbic acid (or citric acid) to cold syrup and stir.

- For wet packs with sugar - dissolve the specified amount of vitamin C (or citric acid) in 2-3 TBSP of water, sprinkle over fruit, then add sugar.

- For crushed fruits or purees - Add dissolved ascorbic acid (or citric acid) to prepared fruit and stir well.

- For dry pack (this means no sugar is added) - Sprinkle dissolved ascorbic acid (or citric acid) over fruit, stir gently being sure to coat each piece.

Let me give examples of dry pack versus wet pack. The berries I talked about back in the beginning, blueberries, raspberries, cranberries, rhubarb and blackberries are the few fruits that freeze well without any added sugar. This method is called the dry pack method. Nothing is added. Just the fruits and maybe some antioxidant if necessary depending on the specific fruit.

But many fruits have better texture and flavor when packed in some sugar or a sugar syrup. I once froze whole strawberries without any added sugar and I regretted it. Taste, color and texture suffered. Now I freeze sliced berries in a sugar syrup.

When some liquid is added to the fruit be it a sugar syrup, the fruit's own natural juice or water, the pack is called a wet pack. Headroom becomes important here as these products expand when frozen. To avoid the mess of popped lids and leaking contents, you need to allow for this expansion. A good rule of thumb is to allow ½" for pints and 1" for quarts. If you're using can or freeze jars, these headrooms are good for the wide mouth jars. If you're using the regular mouth jars allow ¾" for pints and 1½" for quarts.

There are different types of wet packs depending on the type of fruit you are putting up, what you desire for an end product, and its planned use. Once again the directions for each fruit will tell you which type of pack or choice of packs to use. I suggest you do like I've done and try different methods to see which way you prefer.

Here's a brief run down of the different kinds of wet packs.

- Wet pack with sugar - plain granulated table sugar is added to the prepared fruit and gently mixed in until juice from the fruit is drawn out and dissolves the sugar. Then it's packed and frozen. This is the way I process our strawberries for the freezer.

- Wet pack with sugar syrup - whole fruits or pieces of fruit are packed in containers then covered with a cold sugar syrup. The syrup can be of different concentrations. Your directions will tell you which to use for each fruit. Personally, I always use the least concentrated solution the directions specify.

Here's a chart of the different syrup concentrations:

Concentration	Sugar	Water	Yield
Very light (10%)	1/2 cup	4 cups	4 1/2 cups
Light (20%)	1 cup	4 cups	4 3/4 cups
Medium (30%)	1 3/4 cups	4 cups	5 cups
Heavy (40%)	2 3/4 cups	4 cups	5 1/3 cups
Very heavy	4 cups	4 cups	6 cups

You can use cold, warm or hot water to dissolve the sugar. If the water is hot or warm (the sugar will dissolve easier in these), be sure to chill the syrup before using. Use just enough to cover the fruit in the container, about ½ to ⅔ cup per pint container. To keep the fruit submerged (it tends to float) use a crumpled piece of parchment paper or wax paper placed on top of the fruit. Up to ¼ of the sugar can be replaced with corn syrup or mild honey if desired but avoid using brown sugar, maple syrup and the like as they will alter the flavor of your finished product.

- Wet pack with fruit juice or water - prepared fruit is covered with either water or juice extracted from some of the fruit pieces that have blemishes. Either liquid has ascorbic acid added to it per the directions. Keep the fruit from floating by the technique given above. This method is good for people on sugar restricted diets as no sugar has been added. If they want the fruit sweetened, they could use their artificial sweetener of choice to taste.

- Wet pack pureed - after pureeing by your method of choice (blender, food mill etc), fruit is packed in containers leaving headroom for expansion. Ascorbic acid may need to be added to prevent browning especially if the fruit puree is raw. In the case of applesauce which is cooked, I add no antioxidant at all. The result comes out just fine.

I always make gallons of various fruit juices each year but I always can them so I don't take up valuable freezer space with large containers. I'll talk about them when I get to the canning section. Suffice it to say though that homemade juices can be frozen if you want to.

Freezing Meats

First you need to acquire the meat. When we homesteaded in Maine, we raised most of our own meats, be it beef, pork, chicken, turkey and even lamb. I always felt raising our meat put us a step above the casual backyard gardener. It solidified our commitment to be as self- reliant as possible. While we relied on sacks of grain from the local feed store, we did raise as much supplemental animal feed as we could thereby increasing our self-sufficiency. Some things that could be easily and efficiently raised by hand without farm machinery were: field corn, sunflowers, extra cabbages, pumpkins and root crops such as potatoes, turnips and rutabagas; all items we grew to keep our dependence on store bought feed to a minimum. We tried growing grain for our own consumption as well as feed for livestock, but without proper equipment, the endeavor was a disappointment and not worth the effort in our opinion.

In Maine, where we didn't have a freezer other than a miniature compartment in a small, RV propane frig, we always butchered the large animals in late fall/early winter when it was cold enough to keep meat frozen outside. Once the packages were frozen, I packed them in a metal can I kept on the north side of the house. With below zero temperatures common in winter, our outdoor freezer worked great. No electricity or propane was required. The only drawback was once spring arrived, any remaining meat couldn't be kept frozen and had to be either consumed or canned. I recall many meat canning sessions in mid-March to preserve roasts, sausages and ground beef. More on that when I talk about canning.

Neither of us are trained meat cutters. Cutting up sides of beef or pork into usable pieces is a daunting task, especially if you've never done it before. The carcasses are gigantic jigsaw puzzles; the steaks and chops are in there somewhere, but where exactly? How do I begin?

Armed with pamphlets published by the USDA on butchering and slaughtering at home, we tackled the massive sides of meat. Each published pamphlet dealt with a different animal. We have the pamphlets on Beef and Pork which are wonderful reference tools. Fortunately, the pamphlets had lots of pictures in addition to written directions. Other books have proven invaluable over the years too. Each book will have a tip or picture that will help during the process. In our early years, we studied the books the day before butchering and then had them open by our side as reference when it came time to actually do the work. If you can get a copy of "The Complete Guide to Meat Curing" which was published by Morton Salt that will be a good book to have. Nowadays, there's also YouTube videos which we didn't have available back in our earlier days. Take advantage of that resource but remember, books will remain if technology and computers have a meltdown.

Eventually we always got the sides cut into manageable pieces. Ron used knives to slice through the meat and a manual meat saw to cut through bone. He passed the smaller pieces to me for final trimming, wrapping and labeling prior to freezing. Believe it or not, we actually ended up with roasts, steaks and chops that were shaped like what you buy in a supermarket!

In addition, we also ground meat for hamburger and various sausages. We made several types of sausage; breakfast and Italian sausage being two of our favorites. We also made Kielbasa, hot dogs, Vienna sausages, bologna and salami. The flavor of all these is excellent, but the texture is somewhat different than store bought. Fine by us. Our sausages were lean and nitrate free, making them healthier than their commercially made counterparts.

In Maine, we used manual meat grinders we cranked by hand to make ground beef and ground meat for sausages. These types of grinders are still being made. Our biceps got a good work out from grinding several hundred pounds of meat each fall. I say several hundred pounds because the meat was ground at least twice, first a coarse grind, then a fine grind. And if we stuffed the sausages into casings, we cranked the stuff through yet again. Although we still have the manual grinders that we can fall back on if need be, we've gotten lazy in our old age and now use a small electric meat grinder. The meat must be cut into small, 1" pieces, lest we burn up the motor (I did that with the first machine I bought) and the machine can't run nonstop for long lengths of time for the same reason. The grinder needs a period of time to cool down. To facilitate cooling down the machine, we'll stick the thing out on our enclosed, unheated porch so we can resume grinding in a timely manner. Our little machine also came with a sausage stuffing attachment. We've had the grinder for over 20 years, have ground up hundreds and hundreds of pounds of meat by now and it's still going strong.

Regarding our meat grinders, the blades can be taken out and sharpened. Ron uses his sharpening stones to do this. We can tell when the blade is dull because the meat doesn't feed through cleanly. It bogs down, and seems to clog the holes on the plate. The meat will also do this if it's not cold. Prior to grinding, any meat must be thoroughly chilled, better yet just partially frozen in order to feed cleanly through the holes on the plate.

Many bones are generated from the meat trimming process. To me, the bones are almost as valuable as the meat. I use them to make many gallons of soup stock that are incomparable to anything you can buy in a box or can from the store.

In Maine, during the summer months, the broilers we raised were our primary source of fresh meat. I purchased the chicks in May and by July they were ready for the chopping block. Over the course of several weeks we'd thin the flock and enjoy chicken prepared every conceivable way: roasted, stir fried, pan fried, grilled on the barbecue and baked in numerous ways so I could vary the seasonings. Chicken from the final butchering session had to either be used fresh, stuffed into the small freezer of the RV propane frig, assuming I had room, or canned. Canning the meat was considerably more work than throwing it in the freezer but I often didn't have any choice. I canned many pints of chicken pieces every summer. See the canning section for more info on this topic.

If you are interested in taking your goal of self-sufficiency to the next level by starting to do your own slaughtering, one of the best ways to get your feet wet is to start with fowl. They are small, easy to deal with and because they have feathers instead of a hide, aren't as cute and cuddly as a lamb or beef critter thereby making them easier to kill. Unfortunately, the reality of being a meat eater is that slaughtering has to first take place before the roast, chop, drumstick or meatloaf appears on the dinner table. Details of slaughtering chickens are in the chicken chapter.

Once the slaughtering process is over, you're ready for the next step. If you have a freezer your job will be considerably easier. I would leave some birds whole for roasting and cut and package some into pieces as described below. Whether you pull off the skin is up to you. All bony pieces should go into the soup kettle.

As we allude to in the chicken chapter, the first thing is to cut the neck off at the base and toss it in the soup pot along with the heart and liver. For chickens being left whole that's all that is necessary. They are ready to be packaged for the freezer. For the ones designated to be cut into pieces, it's time to begin the disjointing process. The pieces generated will be the exact same type of pieces you see in a supermarket: drumsticks, thighs, breasts and wings.

For this step a sharp boning knife is the tool of choice. A boning knife has a long, thin blade as opposed to a paring knife or a knife you'd use for chopping. If you don't have a boning knife, I'd recommend getting one especially if you plan on processing meat at home. But make it a good quality knife. Not some piece of junk from the local five and dime. Which brings me to a dissertation on good quality knives. If you are serious about doing your own meat processing, invest in good quality knives. These are the kind you see locked up when you go to any store selling kitchen equipment. They are expensive but they are worth their weight in gold. At the same time, you should also invest in a honing steel. A steel is a steel rod made for touching up the blade. It won't really sharpen a dull blade, but if used frequently, will keep a keen edge to your tools.

To begin the disjointing process, I lay the bird on its back and cut off the wings. I find the joint by wiggling the wing around and then cutting through the joint. Some wringing and twisting while cutting facilitates the process. The wings also go in the soup kettle. Since they are more bone than anything else there's little point in having them take up freezer space. Next, I remove the legs from the torso by once again wiggling around the leg and cutting through the joint while wringing and twisting at the same time. Finally, I separate the drumsticks from the thighs by cutting through the knee joints. Or you can leave these two pieces connected if you wish.

I usually remove the breast from the rib cage so in effect the breasts are boneless. If you want to leave the breast attached to the bone, you'll first have to separate the back side of the chicken from the rib cage. Once they are apart you can whack the two breasts apart down the center of the breast bone with a meat cleaver. Once again, I throw any remaining bony pieces in the soup pot. After all parts are free, I give them a final rinse. At this point they are ready for packaging, labeling, dating and freezing.

In northern Saskatchewan, logistics made raising our own meat impractical. When we moved to that fly-in location, we calculated the cost of flying in live animals, the cost of buying and flying in their feed, plus the cost of flying in building materials for a barn. It quickly became apparent raising our own animals didn't make economic sense. It was much more cost effective to buy and fly in a side of beef and a whole slaughtered pig and do all the cutting and wrapping ourselves, which is exactly what we did. Once again we used the cold to our advantage in winter, but when warmer weather arrived, thanks to our chest freezers, no longer did I have to can any meat come spring.

If you don't want to get into raising and slaughtering bigger animals such as a pig and a beef cow, but you would like to process your own meat into sausages, ground beef, bacon etc. then you can do what we did in

Saskatchewan and buy sides of beef or pork. You'll have just as much meat to package for freezing as if you had raised the animal yourself. This is a much more economical way to buy your meat than from the supermarket. If you decide to pursue this, in addition to investing in good quality knives I mentioned earlier,

Butchering Tools

you'll also need a meat saw. This is a saw specifically designed to slice through bones. They are about 2 feet long and the teeth are angled sharply so they don't clog up with meat fibers, sinew and fat the way the shorter teeth of a hacksaw would. We received our meat saw as a Christmas present one year. We couldn't have received a better gift. Like us, you can use pamphlets published by the USDA to guide you on how to cut up the carcass. A down load from Iowa State University called "Dressing and Cutting Beef on the Farm" looks like a digital copy of the exact pamphlet we have in our homesteading reference library. Pictures of meat charts that are often found in cookbooks are helpful too since they illustrate what cuts come from where.

To package meats for the freezer, several options exist. Remember the object is to prevent "freezer burn" which means keeping air away from food so it doesn't dry out. You're after something that forms a moisture/vapor proof seal. The vacuum packaging system I mentioned above works great for meat. Another option is to use a combo of plastic wrap and foil. Wrap the meat in plastic first then foil using the drugstore wrapping technique. Or you can use butcher paper. Look for this in the grocery aisle that has aluminum foil, plastic freezer bags etc. or do like we do and get a commercial roll of the stuff from a bulk food store. But unlike us don't make this mistake. We accidentally bought a big roll of paper thinking it was the coated material we'd always used and had good success with in the past. It wasn't. The paper was uncoated, was like newspaper in that it soaked up any moisture from the meat, and little storage time elapsed before freezer burn became a problem.

There are 2 ways to securely wrap meat for the freezer. One is called the drug store wrap and is similar to wrapping Christmas presents with the ends of the paper folded and tucked up nice and neat. I find this only works well for blocky shaped pieces though. The other method is called the butcher wrap and is the method I prefer. I place the meat diagonally on a large piece of paper and bring the shorter corner over the meat. The left side edge and then the right side edge are folded in over the meat and then the entire package is flipped over until the other corner is reached. Tape the package, label it with what's inside, date it and throw it in the freezer.

To seal the paper wrapped meat bundles, special freezer tape is recommended. I've never had good luck with the stuff though. It doesn't stick very well for me. I've found packaging tape, the kind that comes on wide rolls, does a better job even though it's not meant to be used for this purpose. Under no circumstances would I use scotch tape, the kind used for wrapping Christmas presents. It will come unstuck, leaving the wrapped contents vulnerable to moisture loss and the dreaded freezer burn.

To facilitate freezing, set your freezer to the coldest setting and place packages in a single layer for 24 hours before stacking them. If possible, try not to add more than 3 pounds of food for every cubic foot of freezer space. Admittedly these are hard things to do when dealing with a side of beef or a whole pig but do the best you can. When adding large quantities of food to the freezer, more than we really should at one time, part way through the freezing process, we'll shift the packages around to promote faster freezing. This does seem to help. Once things are good and solid, it's safe to adjust the temperature control back to the normal setting and stack packages to conserve space.

Storage life varies for meat products. In simple terms, meats with more surface area (as in ground beef), meats with high fat content (such as bacon) and meats with lots of seasonings (such as sausages) have a shorter storage life when compared to roasts, chops and steaks.

Canning

Home canned food can be safe. Obviously. We've been eating it for most of our lives with no ill effects. But it can be deadly too if done incorrectly. Botulism kills. So, take no chances or short cuts when canning and always follow directions to the letter.

There are two types of home canning that are considered safe, boiling water bath canning and pressure canning. Open kettle canning is passé and no longer recommended. Which method to use is determined by the pH of the food. High acid foods, those with a pH less than 4.5, can be safely canned in a boiling water bath. Low acid foods, those with a pH of 4.5 or higher must be canned with a pressure canner. What is the difference between the two methods and what difference does it really make?

Water boils at 212°F at sea level. This is a high enough temperature to kill yeasts, molds and bacteria that can't live at 212°F. However, it is NOT a high enough temperature to destroy the spores of the bacteria Clostridium botulinum. The spores grow in low acid foods and produce a toxin (poison) that causes botulism which is deadly. The spores are destroyed at 240°F. The only way to achieve that temperature is through pressure, (240°F is the equivalent of 10-11 pounds pressure depending on the type of canner) hence the need for a pressure canner.

How will you know which method to use? Any reputable canning guide, such as USDA's Complete Guide to Home Canning, Putting Food By (my Bible of home food preservation) or Ball Blue Book, another good source, will tell you exactly which method to use but in a nut shell every meat and every vegetable except tomatoes are considered low acid foods and MUST be pressure canned to be safe. Fruits, jams, jellies and juices can be safely canned in a boiling water bath. There are some exceptions to this rule though. If low acid vegetables such as celery, onions and peppers are added to tomatoes to make stewed tomatoes or spaghetti sauce, then the product must be pressure canned because the low acid additions have changed the pH of the final combination. It's no longer acid enough to be canned by boiling water. Conversely, plain beets must be pressure canned while pickled beets can be canned by boiling water. The vinegar used to make pickled beets lowers the pH to the proper acid range so boiling water canning is adequate and safe. Once again, just follow the directions in a reputable canning guide and all will be well.

Canning Equipment

You'll need a boiling water bath canner. These are usually made of aluminum or enamelware and come with a lid and an internal rack. They are sold in hardware stores, farm stores as well as household sections of department stores, especially during the summer months. Usually any place that sells canning jars and other canning paraphernalia will sell a boiling water canning kettle. However, be careful. The kettle may hold quarts as advertised, but it may not be deep enough to properly process the quart jars. Here's what I mean. First, to be a boiling water canner, the pot must come with or be set up with a rack to hold the jars at least 1/2" off the bottom of the pot so boiling water can freely circulate around the jars. Next comes the height of the jars themselves followed by 1" to 2" of water that must cover the top of the jars. Usually the kettle will accommodate just that, so you may think you're good to go. You're not. What most pots fail to allow for is the necessary 1" to 2" extra for "boiling room" of the vigorously boiling water. And the water must boil vigorously to safely process the food unless the directions for the specific food you're canning state otherwise. If your pot is not tall enough, water will splash all over your stove or cooktop during processing even though it has the lid on it which by the way it should.


Canning Equipment

Low acid foods, (all meat, fish, poultry and seafood as well as most vegetables) MUST be canned with a pressure canner to be free of botulism risk. Any store that sells canning equipment usually sells pressure canners. There are 2 basic types, the dial gauge and the weighted gauge.

We have the dial gauge version and that is by far my preference, probably because that's the kind I used when I first learned how to can and it's the type I've used ever since. I once taught a canning class and had to use a weighted gauge model and did not like it one bit, but that's my bias coming through. The dial should be checked for accuracy at the beginning of each canning season. Your local cooperative extension service should be able to do this for you. You can make adjustments if the dial is off by 2 pounds but if it's off by more than 2 pounds, replace the dial. Order a new one from the manufacturer.

Weighted gauge types jiggle or rock during processing. The sound of the weight rocking and jiggling, usually 3 to 4 times a minute, indicates the canner is maintaining the correct pressure. Weighted gauge canners are supposed to be more accurate than dial gauge versions because every time they jiggle, they release steam. But they can't correct precisely for altitude. Ten pounds and 15 pounds are the only options available. So for example, if 12 pounds of pressure would be appropriate for your altitude, you will have to process your load at 15 pounds as the only other alternative is 10 pounds and that would be unsafe.

While it's possible to can food at home in metal cans, few people do as the cans are a one time use, expensive and require special sealing equipment. Mason canning jars with self-sealing lids are the container of choice.

They are reusable, we have some that are almost 40 years old, and are relatively inexpensive. They come in either regular or wide mouth. The wide mouth are easier to fill and empty but are a little more expensive than the regular. The lids are more expensive too. We have both kinds. I try to use the regular mouth for items that are easy to pack in the jar: fruit and vegetable juices, stewed tomatoes, plain cut tomatoes and sauces such as plain tomato, spaghetti, barbecue, taco and ketchup. As much as possible, I try to reserve my wide mouth jars for bulky items such as peach or pear halves. Back in the day when we had no way to power a freezer, I used wide mouth jars for most of my meat canning; chicken pieces, ground beef patties, meatballs and meat cubes were easier to pack in wide mouth jars and much easier to get out too.

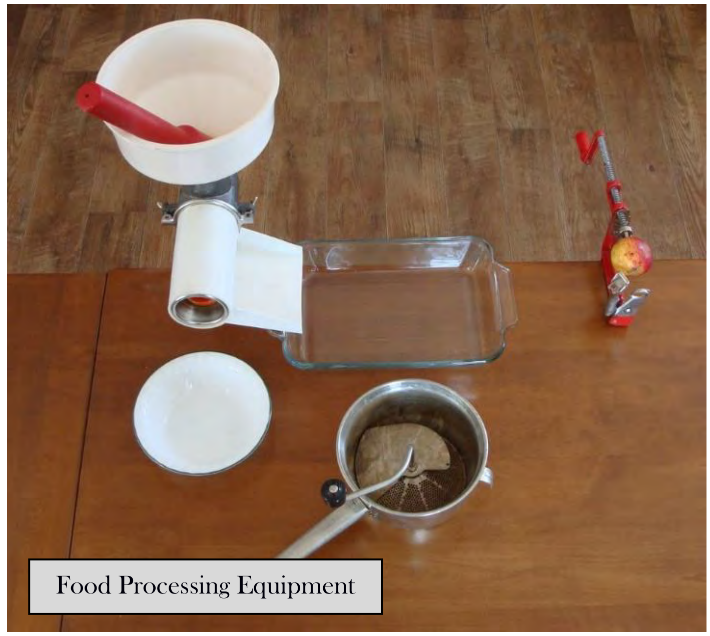
Jars are available in an assortment of sizes: ½ pint, pint, 1½ pint, quart and ½ gallon. I have an assortment of all sizes with the exception of the 1½ pint. Which size jar I use is dictated by what I'm canning as well as our family size and food preferences. I use the ½ pint size for jams, jellies and relishes. The ½ gallon and quart sizes are good for juice. Pickled onions and hot pepper go in pints while most tomato products, soup stock and sauerkraut go in quarts. Back in the Maine days when I had to can everything, chicken, beef, peas and corn went into pints. But your family size and food preferences may alter these suggestions.

In addition to official Mason type canning jars, pint and quart size mayonnaise glass jars (assuming you can find mayo packaged in glass jars and not plastic) can be used provided the 2 piece canning lids and rings fit properly AND provided you only use them for high acid foods that are processed in the boiling water bath. I've used glass mayo jars for years to can juices, applesauce and sauerkraut. Be aware they are not as durable as Mason jars and are therefore more apt to break. I've had that happen too and all the contents of the jar spill out into the canner during processing and be wasted. Very frustrating. They most definitely should not be used for any low acid food that has to be processed in a pressure canner. They are tempered less than Mason jars, can't take the pressure and will break. Most definitely do not attempt to use plastic mayo containers. Neither should any other commercial jar be used if the 2 piece canning lids can't be used because they don't fit. So forget about using maraschino cherry jars for instance. Whichever jars you use, prior to use, be sure to check the rims carefully for any nicks. The slightest imperfection in the jar rim can cause a seal failure.

A home canning jar, be it wide or regular mouth is designed to be closed with a 2 piece lid that consists of a reusable metal outer ring that screws on to the threads of the jar and a one time use lid. The lid has a rubbery gasket type strip around the outer edge of it and that's what forms the seal. If the gasket is damaged in any way the lid is no good and shouldn't be used. I stress the lid is to be used only once. If you look closely at a lid when you open a sealed jar you can see why. The rubbery gasket is depressed where the rim of the jar was embedded in it thus forming a seal. To try and reuse the now deformed lid would invite disaster from either no seal forming at all or a poor one forming that may let loose at a later date when it's sitting on your shelf.

In addition to common kitchen equipment such as cutting boards, knives, measuring cups and spoons, ladles and spoons, some specialized equipment makes home canning easier and more enjoyable. A jar lifter makes for safe removal of hot jars from both types of canners once processing is done. A wand-like lid lifter is a nifty magnetic tool for removing lids from the hot water pan they sit in. The wand has a small magnet in the end that attracts and holds on to the lid. A wide mouth canning funnel facilitates filling jars with minimal mess. Kitchen scales are handy too. Processing times are longer than blanching times and while keeping an eye on a clock is a way to keep track of elapsed time, it's easy to get distracted and forget to look at the clock. Using a timer means having an audible reminder that the time is up.

Some kind of squeezer is required to make purees and sauces such as applesauce or tomato sauce. Food mills, sieves and strainers are options. But for my money nothing beats the Victorio Strainer. What a time saver it is. No peeling or coring is necessary to make applesauce for instance. Simply wash the apples, quarter them, cook with some added water to prevent sticking and when soft, crank the mash through this magic gizmo. It separates the peels, cores and seeds from the luscious puree. The applesauce squirts out through a screen into my waiting pan and the waste comes out the tail end of the screen into a waiting scrap bowl. Whether it's apple sauce, tomato sauce or other puree, I always run the contents from the scrap bowl through the strainer one more time and recover as much goodness as possible.



Food Processing Equipment

Large kettles and pots are a must. I use 2 stainless steel kettles that are 12 to 16 quarts in size. Don't skimp on pot quality here. Spend the extra bucks to buy a pot with a heavy bottom, not some piece of junk that has a bottom the thickness of aluminum foil. You'll understand why the first time you scorch an entire batch of tomato sauce or ketchup you're boiling down.

Canning Foods – General Principles

As with freezing, appropriate headroom is important in canning too. This is the space between the underside of the lid and the top of the food or liquid. It allows for expansion of the food or the bubbling up of liquids during processing. If not enough headroom is left, some of the contents might be forced out of the jar during processing thus preventing a good seal. If too much headroom is left, food at the top may discolor. The right headroom for each item varies and is given in the specific directions. Generally more headroom is given to starchy foods such as corn, peas and shell beans because they swell.

Altitude affects the temperature at which water boils. We already know that at sea level, water boils at 212°F. But above 1000' it boils at a lower temperature. For instance at 5000' (think Denver and the "Mile High City"), water boils at 198°F. Obviously we have a problem if a temperature of 212°F or higher is required to kill dangerous food spoilers. To compensate for less actual heat, you add extra time if you're processing by boiling water bath. If you're canning by pressure, you add extra pressure to compensate. How much to add depends on your particular canner. Check the manufacturer's manual that came with your canner. Consult your canning guide for specifics on how much time or pressure to add for your altitude. If you don't know your altitude, contact your local cooperative extension service. They can also tell you how much time or pressure to add. The Soil and Water Conservation Service would be another organization to contact for information on your elevation above sea level.

You might wonder whether to sterilize jars prior to filling or not to sterilize. What should be done? Follow the specific directions for whatever you are canning, but here's some general guidelines. First, I always store any empty jars upside down until next canning season. That way I start off with clean jars which is important. If the food will be pressure canned, there's no need to sterilize jars. If the food will be processed in a boiling water canner for 10 minutes or more, there's no need to sterilize. If the food will be processed in a boiling water canner for less than 10 minutes, the jars should be sterilized. To sterilize jars, put jars in the canner pot, cover with 1" hot water, bring to a boil, boil 10 minutes. Keep in hot water till ready to fill. Then remove and fill one at a time. The hot water in the pot can then be used to process the filled jars.

To prevent breakage from thermal shock, all jars should be preheated prior to filling them up with hot food. I simply put my jars in my canner, add some water, sit the pot on the stove, heat everything up and keep it hot until I'm ready to start filling.

To use the 2-piece lid system, most lid manufacturers say to put lids in a small sauce pan of warm water and keep hot (do not boil the lids) until ready to use. Heating the lid makes the gasket more pliable so it forms a good seal. After filling jars and leaving the appropriate amount of headroom, remove air from the jars by inserting a plastic knife or spatula (not metal as that can make micro scratches in jars which can lead to weakened glass from repeated scratching) into the jar between food and jar side. Slowly turn the jar while at the same time moving the spatula up and down to allow air bubbles to escape. You may need to top up jars again to get the right headroom. Carefully wipe the jar rim with a clean cloth or paper towel. If any residue that slopped on to the rim during filling remains, the seal will fail. Remove a lid from the pan of warm water, place on top of jar and screw on the outer ring. How tight to screw on the lid is hard to describe. Too loose and liquid may escape during processing and the seal may fail. Too tight and the jar can't vent properly during processing. My method is to make the screw band fingertip tight. I hold the hot jar with a kitchen towel while I screw on the band. The band is now snug. This whole procedure is what canning directions mean when they say "adjust lids."

To use the boiling water bath canner, load up the canner with empty jars and either preheat or sterilize them depending on what you're canning. Prepare the food per the directions, adjust lids, load up the canner with filled jars being sure 1", preferably 2" of water cover the jars. The jars should be sitting in or on a rack so that they are at least ½" off the bottom of the kettle. Crank up the heat and start timing when the water commences a rapid and vigorous boil. If at any time during the processing the water stops boiling, you must start timing all over again from zero once the water resumes boiling. So save yourself the aggravation and keep the canner boiling. Once the prescribed processing time has elapsed, slide the canner off the burner (be careful, it's hot and heavy) take off the lid and carefully remove the jars with a jar lifter placing them on several layers of towels on the kitchen counter. Do not tighten any loose screw bands as you risk adversely affecting the seal. Let them sit undisturbed until cool. I let them sit until the next day. See below for what to do next.

For specific instructions for either type of pressure canner, consult the manual that comes with your model. In general these are some basic guidelines that apply to both types. First put 2" to 3" of water in the canner and place empty jars in it to preheat so you don't risk breaking a cold jar from thermal shock by filling it with hot food. Prepare the food per the directions for whatever you're canning. Then, after filling jars and adjusting lids, load up the canner with filled jars. Fasten the canner lid securely. Now vent the canner so all the air in the canner is replaced with steam. To do this, leave the weight off the vent port or petcock and heat the canner until steam flows freely from the opening. Let the steam flow for 10 minutes, then put on the weight. At this point the pressure inside the canner will start to rise. Start timing when the dial gauge indicates the correct pressure has been reached or when the weighted gauge jiggles and rocks per the manufacturer's instructions. Adjust the heat to maintain correct pressure. For me, since I do all my canning on a wood burning cook stove and the entire surface is one big heating element, this means simply moving my canner around on the cooktop until I find the “sweet spot.” For others you will have to fiddle with your stove’s temperature control.

I have memories of my Mom playing with the control knob on her electric stove to find just the right amount of heat to maintain an even pressure. Sudden and large pressure fluctuations can cause liquid losses from jars and should be avoided since this can prevent a perfect seal. If at any time during processing the pressure drops below what it should, you must bring it back up to the right pressure and start timing all over again from zero. This is to ensure a safe finished product. Do not leave the pressure canner unattended. I stay nearby and monitor the pressure closely making necessary temperature adjustments to maintain constant pressure. I’ve been known to sit in a kitchen chair, parked in front of our wood stove, reading a book while occasionally glancing at the dial and then getting up to put wood in the stove or move the canner around on the cooktop so I maintain constant, even pressure.

When the time is up, remove the canner from heat and allow it to cool and depressurize naturally. Don’t try to speed up the process by sitting the canner in cold water. Once depressurized, remove the weight, wait 10 minutes, then remove the canner lid. To avoid getting burned by steam, open the lid so it tilts away from you. Using the jar lifter, remove hot jars and place on several layers of towels on the kitchen counter. Do not tighten any loose screw bands. Let the jars sit undisturbed for at least 12 hours. I let them sit until the next day then proceed with the next day activities.

Activities for the next day are the same no matter if the jars were canned under pressure or with the boiling water bath. Remove the metal screw band, check to be sure jars are sealed, wipe the jar and the threads which are usually sticky, label, date and store in a cool, dark place. The screw bands have done their job and don’t need to be left on the jars and in fact it’s best to remove them so they don’t rust or get stuck on the jar.

To check for seals, the lid should be concave with a slight depression. As the jar cools, a vacuum is formed which sucks down the lid. When you press the lid in the center it should not move or pop back and forth. If it does, it’s not sealed. Refrigerate the contents and use it or you can reprocess the contents (using a new lid) if you’re doing another batch of the same thing. If the lid is not depressed (potentially a poor seal) but stays down when you push on it, then give this test a try. It’s more of a tell than the first. Once the screw band is off, lift the jar by the sealed-on lid. If the seal is weak, the weight of the jar will cause the seal to break and the jar will separate from the lid and fall. Be sure to protect the jar from breaking if you employ this test. You need not lift the jar very far off the counter to check the seal.

When you go to open a jar of home canned food, be sure the lid is still concave. Pry off the lid with a bottle opener listening for a sucking, popping sound. That’s what you want to hear. Look for any signs of spoilage: foul or off smells, foaming, gassiness which causes liquid to spurt out of the jar, mold on the food surface or underside of the lid and so forth. Take no chances. When in doubt, throw it out. Destroy it so no animal or human can eat it by mistake.

Canning Vegetables

With the exception of tomatoes, pickles and sauerkraut, all vegetables MUST be canned with a pressure canner to be safe. Follow the specific directions for whatever vegetables you are doing. Obviously, you will need to wash, peel, slice, chop, shell it as appropriate. Most vegetables can be packed either raw or hot, with hot generally being the preferred method. The hot pack is the way I can my vegetables. This essentially means putting the vegetable in a pot, adding water to it, bringing it all to a boil, boiling for the amount of time the recipe indicates, packing into jars leaving the correct headroom, adding the boiling liquid the vegetable was heated in, also leaving the right headroom, adjusting lids and processing at the pressure and time the directions state. To cold pack the vegetables, they are packed into jars without heating first, being sure to leave the right headroom. Boiling water is added also to the correct headroom. Adjust lids then process per the directions. Processing times may be slightly longer for vegetables packed raw.

If you are canning a mixed vegetable concoction, the rule of thumb is to choose the time required by the ingredient that has the longest processing time. I always do some pints of mixed vegetables each summer to use in soups during the winter. My mix usually contains peas, green beans, corn, and maybe a little zucchini. I look up the time for each of these vegetables and use the time that is the longest. In this particular example, I would use the time for corn as that processing time is the longest of all the ingredients.

As I stated earlier, when we homesteaded in Maine, I canned every vegetable I could since our off-grid electrical system was too small to power a freezer. But there are certain vegetables that don't can well. Broccoli, cauliflower, Brussels sprouts and cabbage, unless it's in the form of sauerkraut, are better if preserved in other ways. Broccoli and cauliflower are better if they are frozen. Cabbage is best if stored in a root cellar. Sauerkraut can be canned successfully or it can be stored in a cold root cellar. Brussels sprouts are best if either frozen or root cellared.

I discovered the joys of refrigerator pickles some years ago when we were homesteading in Saskatchewan and finally had a frig big enough to accommodate gallon jars of them. Our small propane powered refrigerator in Maine wasn't large enough to accommodate containers of refrigerator pickles, so I canned them back in those days. But now instead of canning pickles, I make both dill and bread and butter refrigerator pickles. Not only are they easier, the finished pickles are superior as far as texture is concerned since they haven't been cooked by the canning process. Of course, the one drawback to refrigerator pickles is you have to have enough frig space to store them. If you choose to make canned pickles or don't have the frig space for them, any canning guide will have various pickle recipes.

While I reveled in the ability to make refrigerator pickles when we homesteaded in Saskatchewan, I despaired over not being able to raise "dry beans." Unfortunately, due to the short growing season, dry beans never reached the dry stage. Instead I had to pick them at what's known as the green shell stage and can them. Lots more work. Not only from all the canning but also because we had to shell each pod individually which took hours. But they made great pots of baked beans and were wonderful additions to soups.

Canning Fruits

Most fruits if not all can be safely canned in a boiling water bath canner. Like vegetables though, some fruits are better frozen than canned so if you have the freezer space, I would freeze strawberries, raspberries, blackberries, blueberries and cranberries. I once canned surplus strawberries that we couldn't eat when we homesteaded in Maine where I couldn't power a freezer. The results were disappointing. If you have no other alternative either for any of these berries, follow the directions in your canning guide explicitly so you end up with a product that is not only safe but the best quality that it can be.

Fruit and berries for canning should be just-ripe. If over-ripe, they lose some of their acidity that makes them safe to can by boiling water bath. About the only fruit I've ever had in abundance to can on an annual basis is apples. In Maine, we tried to pick at least 1 barrel, preferably, 2 barrels of apples each fall from trees in old abandoned farmsteads. I canned every apple product my canning books gave instructions for: applesauce, apple slices, cinnamon apple rings, pie filling and jelly. I've described the procedure to make applesauce using my Victorio strainer, but I haven't told you about a nifty gizmo that clamps to the table and peels, cores and slices the apples all with a few cranks of the handle. My Mom bought me this time saving gadget years ago. I never used it in Saskatchewan because we didn't have access to large apples, but I can resume using it now that we're back in apple country. When preparing enough apples to fill 7 quart jars, any tool that can streamline the process is welcome and this thing fits the bill. The only problem is apples have to be positioned perfectly on the holder before starting to crank them through, otherwise instead of removing the core, you remove good flesh and are left with the core. Apples that are misshaped and not perfectly round are difficult to get properly positioned too.

When the opportunity presents itself, we buy plums, peaches, pears and nectarines directly from the orchard. By buying seconds that have slight imperfections by the bushel or case, we save significant dollars and I'm able to can enough to last us a year or two. If you don't have fruit trees or the ones you do have aren't bearing yet, you might consider doing the same thing.

Similar to freezing fruits, most all fruits are packed in a syrup when canned. The syrup helps to retain the color and texture of the fruit but it does not prevent food spoilage. The directions will tell you what concentration to use for each fruit. As always, I use the least concentrated syrup that's recommended. Figure on using ½ to ¾ cup of syrup per pint jar, double those amounts for quarts.

Here's a table of syrup concentrations. The proportions in this table are different than the syrup for freezing fruits. Prepare your syrup before starting fruit preparations and have it ready to go. To make the syrup, heat the water and sugar together until the sugar is dissolved. Some fruits are packed cold, some are packed hot, and others can be packed either way. The recipe in your canning guide will tell you what to do. If you're packing the fruit cold, pour the hot syrup over the fruit in the jar and leave the appropriate headroom, release air bubbles, adjust the lids and process. If using a hot pack, bring the syrup to a boil, add fruit and heat per the specific recipe directions, then pack hot fruit in jars, add boiling syrup leaving the specified headroom, release air bubbles, adjust lids and process per directions.

Concentration	**Water**	**Sugar**
Very light-10%	6 1/2 cups	3/4 cup
Light-20%	5 3/4 cups	1 1/2 cups
Medium-30%	5 1/4 cups	2 1/4 cups
Heavy-40%	5 cups	3 1/4 cups
Very Heavy-50%	4 1/4 cups	4 1/4 cups

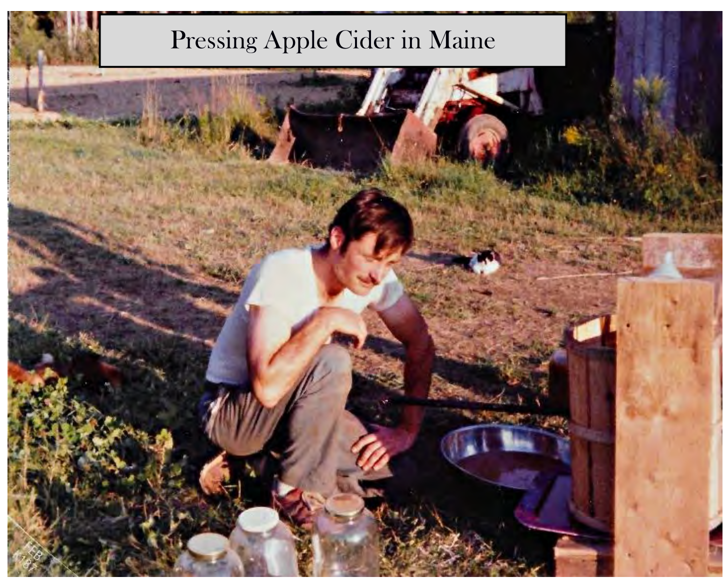
With the exception of berries, most fruit will discolor after it's cut. To prevent darkening, treatment with an antioxidant is necessary. You can get away without using any antioxidant on peaches though if you do the following. To facilitate skin removal, peaches are normally dunked in boiling water for 60 seconds then plunged in cold water to cool them off. Skin should slip right off. But before dunking them in the boiling water, slice them in half and remove the pit, then dunk them in the boiling water then the cold water. The brief exposure of the cut flesh to the boiling water retards browning without the addition of an antioxidant.

To treat other cut fruit (apples, apricots, pears, nectarines) to keep them from darkening, use ascorbic acid (vitamin C), citric acid or commercially available products made from these substances. Fruit Fresh is one such product that I know of. It's a combination of both. To use, follow the directions on the package. To use pure powdered ascorbic acid that can be obtained from any pharmacy, use 1 teaspoon per gallon of water. Keep halves, slices or quarters of the fruits in this solution until you are ready to proceed with canning them.

Canning Fruit Juices

Juices can be canned by the boiling water bath method. In Maine the only 2 juices I canned were high bush cranberry and apple cider. High bush cranberries grew wild and every fall, I collected as many as I could, at least two big 5 gallon pails worth. Due to time constraints, I usually didn't manage to get around to picking these until the end of October but fortunately they are hardy and could take the frosts which were occurring regularly by then.

After picking, I washed the fruit well, put it in a pot, added water to cover, brought it to a boil and cooked for 10 to 15 minutes, smashing it with a potato masher to help extract juice. High bush cranberries grow in clusters that are easily picked by the clump, stems and all but there's no need to pick each berry off the stem before cooking since the next step will strain them out. Once cooked, I dampened a large muslin bag I made that was the size of a pillowcase, dumped the pot contents into the bag, tied the opening with string then hung it up from a ceiling rafter to drip, collecting the juice in a large bowl set underneath the suspended bag. After the bag was squeezed of as much juice as we could get, I often simmered the cranberries a second time using half the amount of water I used the first time then once again hung up the bag to drain. The double cooking allowed us to extract as much juice as possible for our picking efforts. Once again, we always squeezed the bag to extract as much juice as possible. I mixed the second batch of juice with the first, added sugar to taste then canned it.


Pressing Apple Cider in Maine

In our Maine days, a fall ritual was making gallons and gallons of apple cider with the homemade cider press Ron built. We would set aside a day or two, usually in mid-October for cider making. After rinsing the apples, we ground them into small pieces using the hand cranked grinder Ron had made, (the smaller the pieces the greater the yield of juice from squeezing), then pressed the pomace with the scissor jack that was mounted in the hardwood frame he'd built that comprised the press. I always set aside a gallon or two of cider to convert to vinegar. The rest we drank fresh or I canned it. I liked to have at least eight to twelve gallons of cider canned for the winter.

Back in those days, I canned both these juices by the open kettle canning method which is NOT recommended anymore. If I were doing the juices today, I would use the boiling water bath procedure.

In Saskatchewan, even though we didn't have access to apples that were free for the taking, I was able to make a much greater variety of juices from our cultivated fruits as well as those that grew wild. One of the juices that added variety to our winter diets was strawberry. I suspect strawberry juice is something few people have ever heard of. I had never considered making it until I was inundated with berries one year and desperate for a way to utilize them. To make strawberry juice, I washed the berries, hulled them, cut or chopped them if necessary and measured. To each quart of prepared fruit, I added 1 cup water and cooked them till soft. I mashed the cooking fruit with a potato masher to facilitate extraction of as much flavor as possible. After straining in a muslin bag as described above, to each 4 quarts of strained juice, I added 4 Tbsp lemon juice and sugar to taste. At that point it was ready to can. I figured 8-9 quarts of prepared fruit yielded six quarts of juice.

Black currants were a fruit that thrived in our harsh environment in Saskatchewan. While they make a good jelly, I preferred to make juice out of them by following the same procedure that I used for strawberry juice. Our one black currant bush yielded enough berries to make gallons of juice.

Raking Blueberries

With the exclusion of our cultivated strawberries, by far our most prized and plentiful fruits in Saskatchewan grew wild, blueberries and cranberries. We were surrounded by acres and acres of blueberries, more than we could possibly use, although we certainly made the most of this resource by making gallons of blueberry juice each summer. Some we drank fresh but most I canned. By using the method, I outlined for strawberry juice, I put up at least 14 quarts of blueberry juice for each winter.

Cranberry juice was another favorite in Saskatchewan but this time we made it from the wild versions of berries that are typically cultivated, meaning the plants grow low to the ground, not on a tall bush. Every fall I made gallons for fresh drinking and I canned up to 28 quarts for the winter. Mixing equal parts of blueberry and cranberry juice for a winter time cran/blueberry cocktail was a special treat. I figured if that combo was good enough for Oceanspray it was good enough for us! To make and can cranberry juice, I measured washed berries and added an equal amount of water. I boiled the berries until they burst then strained them through my large bag which we squeezed for a greater yield. We added sugar to taste and the juice was ready to can.

All of the juices I canned in Saskatchewan ended up being strong flavored, almost like a concentrate, so I always diluted them with roughly equal parts of water prior to drinking. If you think about it, that was a blessing since we got double the amount of drinkable juice out of half the amount of jars and processing time.

Canning Jams, Jellies and Preserves

Often times people use the terms jam, jellies and preserves interchangeably when in reality they refer to different things. So, we are on the same page in our discussion, let me give a quick discussion of terminology and a commonly known example of each.

- **Jelly** - is made from fruit juice only and is crystal clear - almost jewel-like. (think apple jelly)
- **Jam** - is made from crushed fruit so it has chunks of fruit in it. (think strawberry jam)

- **Preserves** - are made from large pieces of fruit in a thick syrup. (think cherry preserves)
- **Conserve** - is basically jam with added raisin and nut
- **Marmalade** - a jelly with pieces of citrus fruit in it. (think orange marmalade)
- **Butters** - fruit puree with added sugar that's cooked till thick. (think apple butter)

For making jam, jelly etc. four key ingredients are required: fruit, pectin, sugar, and acid.

It goes without saying any fruit you use should be of high quality with no mold or rotten spots. It should also not be overripe as overripe fruit may adversely affect gelling. Slightly under ripe is okay as is just ripe fruit. If you want to be picky, you can strive for ¼ of the amount you're processing to be under-ripe and the remaining ¾ be just ripe. How you prepare your fruit after washing is determined by what you are making. For jelly you need to extract the juice; for jam, preserves and conserves you need to crush, peel, pit, chop the fruit or whatever the recipe says to do.

Pectin is the substance that is used as gelling agent in jams and jellies. Some fruits such apples, currants and gooseberries are naturally high in pectin and require no added pectin to gel. I've successfully made jams and jellies with all these fruits through the years with only 2 ingredients, sugar and the fruit or its juice.

Many other fruits are low pectin and need to have pectin added to them in order to set. Commercial pectin can be used to gel these fruits. You can also make your own homemade pectin. I did this when we homesteaded in Maine and had access to large quantities of apples. Making your own pectin is certainly one of the epitomes of being self-sufficient therefore if you are so inclined, this is how I did it. First I boiled apples in water to extract the pectin which just happens to be soluble in water. You can use unpeeled, (unpeeled because the peels have pectin) quartered apples or use peels and cores left from another canning operation such as making applesauce or canning apple slices, which is what I always did. In either case barely cover the apples with water and bring to a boil. Simmer for 30 to 40 minutes then strain. I poured it through a colander first to get rid of the big solid bits then poured the juice though a jelly bag.

You can use the pectin at this point by adding 1 cup of it to 1 cup of prepared, low pectin fruit along with ¾ cup sugar and 1 teaspoon of lemon juice. The lemon juice provides the necessary acid. Boil the whole mess to the "jelly stage" described below, then fill jars and process in a boiling water bath.

Or you can do what I did and boil the pectin to concentrate it. I followed the procedure above using 10 pounds of apples to start with which yielded about 3 quarts of juice. I boiled this until about 2 cups of a thick, almost ropy syrup remained. Because I was making this in the fall when apples were available, I canned it for use the following summer by putting it in ½ pint jelly jars and processing 5 minutes in a BW bath. Next summer when I wanted to make a low pectin jam such as strawberry, I used ½ cup of my homemade pectin to 4 cups of my low pectin fruit and boiled this for 2 or 3 minutes. Then I added 2 to 3 cups of sugar and 1 tsp lemon juice and boiled to the jelly stage. The only drawback in my opinion is the homemade pectin tends to give the finished product an apple taste but it did make it gel.

Commercial pectin comes in either liquid or powdered form. Certo and Sure Jell are two brand names I'm familiar with. I've used both and they work equally well. Each box comes with directions for how to make various jams and jellies. Follow the manufacturer's instructions for best results. Make no mistake, jams and jellies use a lot of sugar. Often more sugar than fruit. For example, raspberry jam made with regular pectin uses 5 cups of raspberries and 7 cups of sugar. But there are alternatives.

One of them is the “light” versions of commercial pectins (Certo and Sure Jell) that don’t call for as much sugar as regular versions. Raspberry jam made with the “light” pectin uses 6 cups of raspberries and 4½ cups sugar. I’ve used these low sugar pectins too and they work well but they still use quite a bit of sugar especially for someone who needs to restrict sugar for dietary reasons. Both the regular and light pectins require sugar to gel properly. Substituting artificial sweetener for the sugar will not work. To make sugar free jam and jelly requires what’s known as low methoxyl pectin.

The one low methoxyl pectin I’m familiar with is a brand called Pomona’s Universal pectin. For people who need or want to limit their sugar intake but still want jam or jelly on their morning toast, this product is the answer. You can make jams and jellies with lower amounts of sugar than the light commercial pectins. Raspberry jam made with Pomona’s pectin uses 4 cups raspberries and between ¾ cup to 2 cups sugar depending on how sweet you want it. And with this product, one can use artificial sweeteners such as stevia or Splenda. It can be used to make freezer jams too. Like the others, each box comes with directions, so follow the manufacturer’s instructions. I’ve used this product and it works as advertised. The main problem is availability. I discovered it through a food co-op I was part of at one time. I’ve never seen it in a store but supposedly it’s available in natural food stores such as Whole Foods, food co-ops, and the natural food sections of some supermarkets such as Wegmans.

In order for any pectin, other then the low methoxyl kind, to work its magic, sugar is required. This is white, granulated sugar, not superfine, not powdered sugar or any other kind. I’ve never tried using corn syrup or honey in place of some of the sugar so I have no idea how well either would work.

Some acid is required for fruit to gel. Acid content varies from one fruit to the next but is always highest in under ripe fruit. Hence the admonition earlier about using over ripe fruit. For fruits that don’t contain enough natural acid, lemon juice is called for in the recipe. Again simply follow the directions for best results.

Just in case you are curious as to which fruits are low pectin, high pectin, low acid, high acid, here’s a list to satisfy your curiosity.

High pectin fruits	**Low pectin fruits**
Apples-sour*	Apricots*
Apples-sweet	Blueberries
Cherries-sour*	Nectarines
Cherries-sweet	Peaches
Crabapples*	Pears
Cranberries*	Pineapple
Currants*(both red and black)	Raspberries*
Gooseberries*	Rhubarb
Grapefruit*, lemons*,limes*	Strawberries*
Grapes*	
Oranges*	

Plums*

*signifies high acid

To make jelly, you must first extract the juice from the fruit. Wash the fruit but you can leave on stems, skins and pits as the straining process will remove all that for you. Many fruit skins contain some pectin which is good so leaving the skins on means the natural pectin will be extracted too. Sometimes crushing may be all it takes to get the juice flowing, but usually the fruit is heated with some water. I've made apple jelly, currant jelly and chokecherry jelly and all have involved heating the fruit with a little water. Follow the specific instructions for juice extraction for whatever jelly you are making. Next is to strain the extracted juice. Jelly bags are made for this purpose. Dampen the bag with water before pouring your juice and fruit pulp through. For crystal clear jelly, which is what most strive for, let the contents of the bag drip without squeezing. I've never been interested in trying to win a blue ribbon at the county Ag fair with my jellies, so I squeeze the bag to increase my yield. This will make jelly that is slightly cloudy but I get more of it for my efforts. As far as amounts are concerned figure a pound of prepared fruit will yield 1 cup of juice. Most jellies call for a 1 to 1 ratio of sugar to juice. In other words for every cup of prepared juice add 1 cup sugar. Then boil to what's called the jelly stage. To judge when it's done use either a candy thermometer and cook to 220°F (at sea level) or use the sheet test. I use the sheet test but it calls for good judgment and I'm often asking for Ron's opinion on whether he thinks it's done or not. If you overcook jelly it's edible but it becomes rubbery and not very spreadable. One time when my Mom made apple jelly she over cooked it and the stuff was like a rubber ball. It tasted good and we ate it but we couldn't spread it around on our bread.

The sheet test for doneness involves dipping a cold metal spoon into the boiling jelly and holding it over the pot but out of the steam. Turn the spoon so the liquid runs off the side. If a couple of drops form then congeal and then slide off the edge of the spoon in a sheet, the jelly is done.

Our favorite jam is strawberry and we can go through 1 to 2 batches a year. Blueberry, raspberry and blackberry are favorites too. As is the case with most jams, these fruits are crushed before cooking. I use a potato masher for this, smashing small amounts at a time. If it were me, I wouldn't use a food processor to pulverize the fruit because you risk the pieces coming out too small. Follow the manufacturer's instructions for the specific jam you're making. Usually the directions say to boil 1 minute after adding the pectin. Personally, I've found this not long enough and if I don't cook it a little longer (as in about 1 minute more) it comes out too runny. The extra minute of cooking produces a perfect jam for me, but until you get experience, follow the directions to the letter. Quite probably I don't have enough under-ripe fruit in my batch. If you're using your homemade pectin, jam is done when it reaches 220°F (at sea level). The sheet test isn't supposed to work very well for jams, I guess because of the chunks of fruit, but I've used it as a way to check doneness.

Back when I was a kid and my Mom made jellies and jams she sealed the jars the way everybody else did, with melted paraffin wax. I did too in my younger days, but this is no longer recommended for good reason. The wax shrinks as it cools and sometimes it has air bubbles in it both of which result in a poor seal. Now processing the jars in a boiling water bath for a few minutes is recommended and that is what I do. Yet another example of changing canning practices in accordance with the latest recommendations. I always label my jars with the contents and date so there's no question as to what they contain and so I use my older stuff first.

So far all the jam instructions have been for cooked versions. But it's possible to make no cook jams too. Because they aren't cooked, they have more of a fresh taste. Since they aren't cooked and canned they must be stored in the frig and even then have a limited shelf life. For long term storage, they must be stored in the freezer. All the commercial pectins have directions for freezer jam, but because homemade pectin must be cooked in order to gel, you can't use it for freezer jams. Freezer jams are very easy to make. Basically smash up the fruit, add sugar, let that sit for a bit, add the pectin, stir, ladle into containers, cover with lids, let sit at room temperature for 24 hours by which time it should be set, then refrigerate or freeze. For more specific instructions follow the directions that come with the box of pectin.

I've been canning food at home for over 40 years. But not all my canning episodes have gone smoothly. I've had my share of near disasters such as the time I dropped the tongs into the firebox with a blazing fire going and had to fish them out with a long-handled barbecue fork. Or the time I was straining currant juice for jelly and knocked over the bowl spilling all my precious juice. Or the inevitable failed seals even though I was meticulous with all steps of canning. Many times canning carried on till late at night even though I had to go to work the next day. But I've never regretted all the hours I spent toiling away in the kitchen, slaving over the hot wood cook stove, preserving hundreds of jars for the winter. I've had satisfaction and peace of mind knowing I had a pantry full of jars filled with food I'd either grown or gathered from the wild. And you can too.

Canning Meats

As you know, when we homesteaded in Maine, we stored our frozen meat outside in a metal can during the winter months. But about mid-March I had to start paying careful attention to the weather. Once it began to warm, I couldn't keep the meat frozen anymore. It was time to fire up the pressure canner and can whatever was leftover. I canned sausages, meatballs, meat cubes for use in stews and casseroles, large chunks which I treated as roasts and ground beef patties which I used in sloppy joes, spaghetti sauce and casseroles.

If you are off-grid and don't have adequate power to run a freezer, are thinking about going off-grid but can only afford a small system and small freezer or have a freezer but it won't hold all the meat you need to put by, canning is one alternative way to preserve meat.

Meat MUST be canned in a pressure canner to be safe. There are NO exceptions to this rule. Beef, pork, poultry, lamb, fish and seafood have to be canned under pressure to be free from botulism risk.

Here's how I canned chicken at our Maine homestead where we were unable to power a freezer. After cutting off the necks and tossing them in the soup pot along with the hearts and liver, I decided what to keep aside for dinner that night, usually a whole bird for roasting. Homegrown chicken has a noticeably different and better taste than store bought birds and we looked forward to the meal with great anticipation.

Then I began the cutting up process in preparation for canning. It's the same process I described previously in the freezing section. It's impossible to cram a whole, uncut bird into a canning jar so it must be cut up into manageable pieces. These pieces are the exact same type of pieces you see in a supermarket: drumsticks, thighs and breasts.

I removed the legs from the torso and I also separated the drumsticks from the thighs by cutting through the knee joints so the separate pieces would fit in the pint canning jars. The entire leg was too tall for this.

I always removed the breast from the rib cage and the thighs from the bone so in effect these pieces were boneless. I threw all the bony pieces in the soup pot for stock as detailed in the Soup Stock section. After all parts were free they were given a final rinse. Now the canning process could begin. It was time to reference my canning book and pressure can as prescribed.

Since we are a household of two, I always packed the chicken in pints but for a larger family, quarts may be more convenient. Either way using the wide mouth jars makes filling the jar easier and makes extraction of its contents easier when it's time to use it.

Obviously home canned chicken isn't as versatile as frozen, so no fried chicken for instance, but our canned chicken still made for some good eating: chicken croquettes, pot pie, chicken in gravy or barbecue sauce were some of the ways we used our home canned chicken.

A side of beef yields a lot meat. More than the two of us could eat in the 5 months of freezing cold weather Maine had to offer when we homesteaded there. So come spring I had to can what was left when I couldn't rely on my outdoor freezer (metal trash can) any longer. All beef was precooked and packed hot into jars. I used the water I had cooked the meat in as packing liquid or sometimes just plain water. In either case the liquid was boiling before it was added to the jars. I always did an assortment of canned beef products so I could prepare different recipes with it. To can beef cubes, I cut the meat into 1" pieces, boiled them in plain water and packed them hot into jars then poured the boiling cooking water in the jars leaving the appropriate headroom. This was handy for making a stew, a casserole or maybe barbecued beef on a bun.

Ground beef patties were a versatile canned beef product too. Some patties were merely plain, unseasoned ground beef that I shaped into patties and browned. After packing into pints jars, I poured boiling water in the jar as packing liquid. I also prepared patties for Salisbury steak using our favorite recipe to make the patties. Once again I used plain boiling water as the packing liquid. Wide mouth jars were the only practical vessel for canning either of these patties as the regular mouth were too difficult to fill given the small opening. I used the plain patties in a variety of ways: to make chili, sloppy joes, casseroles, as well as spaghetti and meat sauce.

Canning meatballs was more of a rigmarole simply because making the meatballs themselves is more of a production. But the canning itself was no more difficult than that for the patties. I made meatballs according to our favorite recipe, browned them, packed them into jars and poured in boiling water as my packing liquid. When it came time to use my canned meatballs, most of the work was already done so it was a simple matter to make whatever sauce to go with them. Sweet and sour meatballs was a favorite as was spaghetti and meatballs.

All these beef products were canned using my pressure canner. All the usual rules of canning apply: attention to headroom, wiping jar rims prior to putting on lids and so forth. If you haven't already done so read the general info at the beginning of this chapter.

I seldom had much pork to can come warm spring weather thanks to being able to cure and smoke large cuts such as the hams, but if I had to, I did can pork cubes. I processed those the same way as the beef cubes and used them in much the same way too, in stews or in barbecue sauce.

But I often did have sausages left in the spring. We made all sorts of sausages at butchering time: kielbasa, hot dogs, Vienna sausages and Italian sausages. We stuffed these into casings using the stuffing cone on our meat grinder. This made them easy to can come spring if we had any leftovers when warm weather arrived. The only draw back to canning sausages was they had to be canned at 250°F which translates to about 15 pounds of pressure at sea level. That high a pressure always made me nervous. Follow whatever canning guide you use and you should be fine.

All soup stocks regardless of whether they are meat or vegetable MUST be pressure canned. Homemade soup stock can't be beat. The taste is superior and the fact we have the base for many meals from stuff some may view as waste is very satisfying. Nothing we could buy from the store be it in a box, can or cubes is its equal. Making our own stock from all bony pieces maximizes the return from the butchering operation and ensures we get the most out of every animal that has given its life to put food on our table. A lot of work and expense went into the production of that meat so we want to get everything we can out of our efforts. Stock making is yet another example of maximizing the return on our homesteading efforts.

No question picking through cooked bones to salvage meaty bits is a tedious process, one I don't particularly enjoy. But a lot of meat remains on those bones no matter how carefully I trim. You'll be amazed at just how much you'll accumulate. If you don't cook up the bones, you'll be wasting not only all the wonderful flavor harbored in the bones but all the meat that is attached to them. In some ways, I value the meaty bones from any animal the same as any meat. Even if you don't have the time or inclination to pick the meat off the cooked bones, merely boiling them up and then straining them will still yield precious and delicious stock without any added meat.

This is how we always made chicken stock when we butchered chickens. After every chicken butchering session we always had a big pile of bones: the wings, necks, backs, as well as the breast and thigh bones if we boned them. None of the bony pieces were ever wasted. They all went into the soup kettle as did the hearts and livers.

I covered all this with water, threw in some salt as well as fresh herbs from the herb garden which usually included thyme, sage, parsley and rosemary. Throw in some onions, carrots and celery for good measure and let the whole shebang simmer for a couple of hours. Then we strained the contents, allowed it to cool, then picked through all the bones salvaging all the tasty meaty bits. After skimming the fat off the broth, adding the retrieved meat back to the pot and bringing the broth back to a boil, it was ready to can. We always used quart jars for this as we found that was the perfect quantity for a soup meal for the two of us. At the end of chicken butchering season it was not uncommon for us to have added 28 quarts or more of homemade chicken stock to our larder. No matter if you only have the "waste" from 1 chicken or dozens, the resulting stock made from all bones, livers and hearts will yield a tasty soup.

Whenever we butchered a beef cow or a pig, be it one we raised or one we bought from a local farmer, we made stock from all those bones too. You can too even if you don't raise the animal yourself and are just cutting up a side of meat you bought. Once again much meat remains on the bones no matter how meticulously you trim. Because these animals are bigger than fowl, the amount of meaty stock you can glean is magnified. After cutting up a side of beef, we would end up with 5 or more kettles of bones (the kettle was 16 quarts in size) that yielded gallons of meaty beef stock. All we did was cover each pot full of bones with water, simmer for a few hours, strain, cool then pick all the meat off the bones. After skimming fat off the broth, the meat was added back to the stock, it was brought to a boil and it was ready to can in the pressure canner. It was not out of the question to can 50 quarts of beef stock after a butchering session. We handled pork bones in the same way.

You can make and can your own vegetable stock too using your own homegrown veggies. There are no real rules here regarding what to use; just remember the stock will have the flavor of whichever vegetables you throw in the pot. Carrots, celery, onions and leeks are always great choices but you can add turnips, potatoes, tomatoes etc. Then season any way that suits you. I always throw in some salt and thyme but those are our taste preferences. Now simply simmer everything for a couple of hours and strain. Nothing to pick through this time so it's really easy. Vegetable stock must be pressure canned to be safe.

Drying or Dehydrating

Drying or dehydrating is the process of removing moisture from foods so spoilage organisms can't grow. There are a variety of ways to do this: air drying outside, solar drying outside, an electric dehydrator, air drying inside or using the oven of a kitchen stove to name a few. My preferred drying methods are air drying and drying with my kitchen wood stove.

Other than air drying all my herbs, I've never dried much of our food except for the year Ron decided to winter thru hike all 2100 plus miles of the Appalachian Trail. In preparation for his 1990 trek, I dried most of the food he carried and ate during his hike. Using a homemade dehydrator he made that sat on the cooktop of the kitchen wood stove, I dried all sorts of veggies from the garden: onions, tomatoes, celery and carrots. I even dried chicken and ground beef from our own animals. I simply sliced or chopped things so they were of equal size, spread them on the trays and let the dehydrator do its thing. The meats I dried were cooked first. I browned the ground beef then spread it on the dehydrator trays. I baked or boiled the chicken then cut it up in small pieces prior to laying out on the trays. I concocted dried versions of dishes I normally made and packaged the dried ingredients in baggies. On the trail, he re-hydrated the day's meals prior to cooking. He found the home dried meals quite satisfying, but by journey's end he was thoroughly sick of dehydrated food and didn't want to see another dried morsel as long as he lived. Consequently, I haven't done much drying since.

The dehydrator Ron made sat on top of the kitchen wood stove and worked well as long as I was attentive and kept it situated off to the side away from the firebox. With any food that is being dried the object is to dry it, not cook it. Unless I was careful and changed the position of the dehydrator in accordance with how hot the stove's surface was, I risked cooking or even burning what I was trying to dry especially if it was on the bottom trays. So I had to be vigilant. Yet it was a bit of a balancing act because I didn't want the food to start molding either from too low a heat.

Judging when something is dry enough for storage takes some practice. I once dried some pears and put them away too soon thinking they were done only to have them mold. A hard lesson to learn since I had to throw out the entire batch. Most things should be crisp (but not cooked or burnt). In the case of leathers they should be, well, like leather and not crispy.

I air dry all my herbs be they culinary herbs or tea herbs. This is a low tech, energy free way to preserve them. After picking, I'll rinse them if they are muddy and spin them dry in my salad spinner. Then I make bunches and secure the ends with rubber bands. I open a paper clip, insert one of the ends through the coils of rubber band and use the other end of the paper clip for hanging the herb bundle. I hang the bundles from a wooden framed rack that has wires going back and forth from the sides of the frame. Suspending this rack from the ceiling behind my kitchen wood stove ensures the herbs are drying in a warm spot that has good air flow. Once the herbs are nice and crispy, I strip the leaves from the stalks and put them in glass jars with tight fitting lids so no moisture can enter.

I dried apples slices when we lived in Maine and had access to them. To prevent browning from oxidation they should be treated with any of the antioxidants I mentioned in the fruits section. I used lemon juice back then and the results were so so at best. Citric or Ascorbic acid would have done a better job. Nevertheless they were still tasty. I dried them to the point of being leathery not brittle.

Leather is something I've always dried in my wood stove oven at low temperature with the door ajar. If I were doing this in the oven of a gas or electric stove, I would put it on the lowest setting and crack open the oven door. The process may take several hours so expect your oven to be unavailable during that time. If you use a commercial electric dehydrator follow the manufacturer's operating instructions. It's my understanding some models come with trays for drying leather but spreading parchment paper on the tray facilitates removal of the finished leather since it doesn't stick to the paper. By the way, you can dry other fruits and vegetables in your stove's oven by placing stuff on trays, but I suspect that is not the most energy efficient way to do the job.

Drying Cranberry Leather

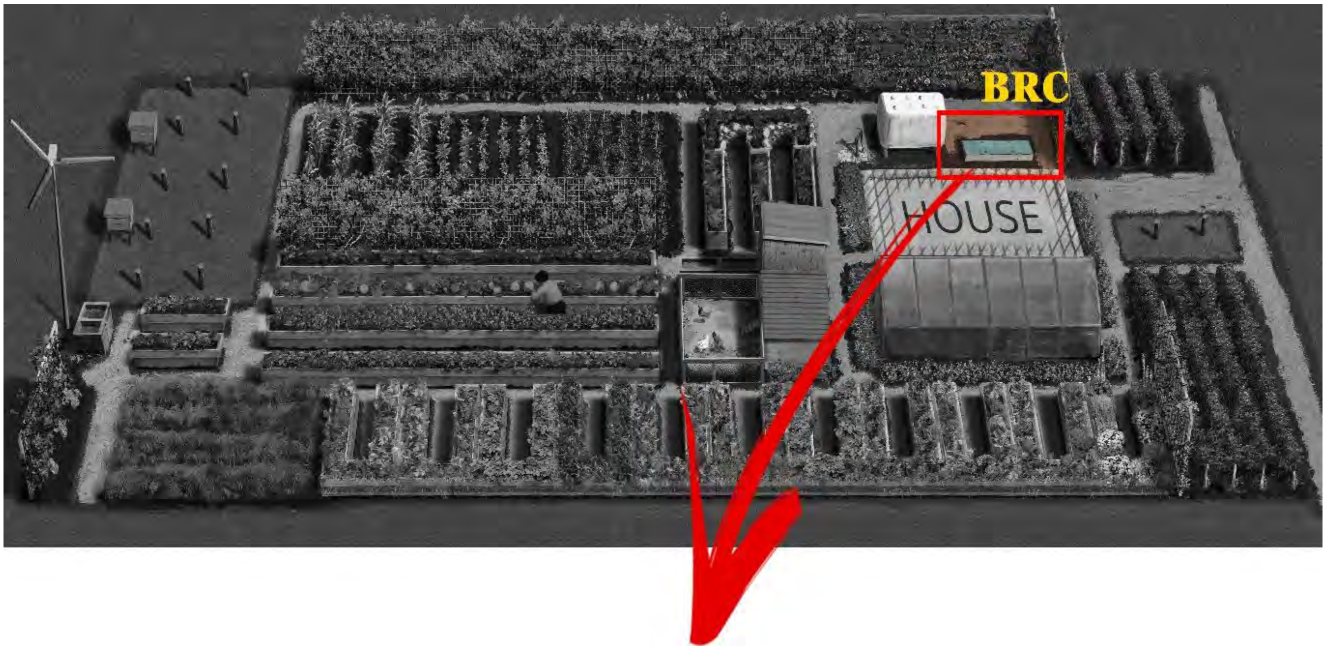
For Ron's hike I made apple leather by first making applesauce then I spread the puree ¼" thick on parchment lined jelly roll pans and dried it in my wood stove oven on low heat with the door slightly ajar. Part way through the drying process, I peeled off the pliable semi-dry leather, flipped it over and continued drying. To make doubly sure it was dry before I stored it, I put the sheet of leather, free of the parchment paper, on a wire cookie rack and let it air dry on top of my cook stove's warming oven for a few days.

I also made tomato leather and spaghetti sauce leather from our garden tomatoes. I began by making tomato sauce as if I were going to can it but kept cooking it down until it got quite thick, as thick as I dared take it on the stove top without it scorching. Then I proceeded as above. Spaghetti sauce leather was made the same way except I added seasonings to the plain sauce and then cooked it down. And last but not least, in Saskatchewan I made cranberry leather using our wild cranberries. I first made cranberry sauce using a little less water than the recipe called for, then pureed it and proceeded as above.

Bowl of Wild Cranberries in Saskatchewan

I'm not sure you'd call this dehydration in the usual sense but in Maine I grew lots of what we called "dry beans." Kidney beans, black beans and baking beans such as Yellow Eye and Jacobs Cattle were beans we grew and let dry on the plants until the vines and pods were brittle. Then we picked all the pods, put them in a grain sack and threshed them by whacking them with a bat. Because the pods were dry, they cracked open and the beans popped out saving lots of time shelling each pod individually. Once we whacked the pods, we carefully removed the busted and now empty pods, then winnowed what remained to separate the beans from any remaining bits of pod debris. To do this we merely poured the beans and debris from one bucket to another on a breezy day. The wind blew away all the detritus and we were left with debris free dry beans.

Root Cellaring (BRC)



Root cellaring is a time honored, low tech, low cost, energy free way to store food. Traditionally a root cellar is an underground storage space for vegetables and fruits. But the term can also include the entire range of creative produce saving methods from cellars dug into hillsides to buried trash cans, clamps and garden trenches. A dirt floored basement or a separate room insulated from the rest of a heated basement can also qualify as a root cellar. A root cellar can save time, money and supplies. No need to slave over a hot stove in the summer canning and freezing all your fruits and vegetables to get you through the winter; lower power bills from not running the kitchen stove; less outlay for canning lids or freezer bags are benefits too. This is not to say canning and freezing can be eliminated. Canned tomatoes or frozen peas in January are welcome menu additions but there's no need to rely solely on canned and frozen foods to get you through the lean months if you practice root cellaring. Some cash outlay initially will be necessary to build or create your cold storage area but the cost is a one-time expenditure and can be minimized.

The foods that store best in a root cellar are, well, the root vegetables: potatoes, carrots, beets, parsnip, turnip, winter radish and rutabaga. But with care and creativity, storing a much greater variety and diversity is possible. Cabbage, Brussels sprouts, celery, endive, escarole and Witloof chicory not to mention pumpkin, winter squash and sweet potatoes are some of the other vegetables that can be stashed away with this labor saving method of food storage.


Potato Storage before Proper Root Cellar was Built

There are some basic rules for storing food in any type of root cellar. First is timing your planting dates so the harvest coincides with cool fall weather. There's no point in having storage cabbage mature in

July for instance. For those with long growing seasons where you can have multiple harvests of each vegetable through the season, this is particularly pertinent. Use the info already provided in the garden chapter to determine your fall planting date. For those of us in the north where it may take the entire summer to get a crop of a vegetable with a long maturity date, dates for fall plantings are not as important. You'll have to experiment and see what timing works best for your locale.

Next is to time the harvest in accordance with the weather. Fortunately the harvest is staggered so you don't have to bring everything in at once. Begin with the tender vegetables that are frost sensitive, tomatoes, peppers, eggplant and the like, picking them before frost nips them. Next comes the hard shell vegetables of pumpkin and winter squash which should cure in the sun before being brought in but should be protected from heavy frosts. Last but not least are the roots which can be left in the ground until a hard freeze providing any parts that are protruding above ground are protected from freezing by mulch or by bringing up loose soil to cover the exposed tops. I like to leave these in the ground as long as possible for several reasons. First, the delay allows my storage area to get cold enough for good storage. Second, I figure the longer I can wait to pick the roots the longer I'll have them available during the storage season. Third, the vegetables themselves are cooling down which helps long term storage. Fourth, once the tops are killed by frost, the roots and tuber skins set which helps toughen them. And finally cold temperatures encourage the vegetables to store up carbohydrates rather than water which is more readily lost in storage thus leading to shrinkage. But I do have to be careful not to wait too long lest the ground freeze and I can't dig them.

Rodents such as mice will also find the roots and gnaw on them if I leave them in the ground too long. More than once, when digging carrots I've come across a hole perfectly shaped where once a carrot grew. So be realistic. Pay attention to the calendar and the weather forecast. In the south you may be able to delay harvesting your roots until December, in the mid-Atlantic states figure November and for the north make it October. When we lived in northern Saskatchewan we generally had our first snow in September. The first week of October was as far as I could take it. The ground was on its way to freezing solid by then whereas in northern Maine I could go until the end of October. Here in Nova Scotia I can push it to the first week of November but that's it.

Next try to harvest during dry weather so vegetables don't have lots of soil stuck to them because one thing you never want to do is wet or rinse any vegetables before stashing them in the root cellar. This will encourage rot. It's okay to gently brush off soil but stuff will keep better if it isn't cleaned too vigorously at the time of storage. The time to wash and scrub is when you go to use an item.

Also be gentle once an item is picked. In other words avoid tossing it in a bucket or doing anything to bruise the vegetable or fruit. Any damage is an invitation to spoilage. Scrutinize each item carefully when picking. Avoid storing anything that has nicks, dings, cracks or gouges as they are the perfect entry point for microorganisms that cause spoilage. Use any damaged items first. To avoid damaging produce when digging it, I use a spading fork instead of a shovel. The fork loosens the soil and facilitates digging and pulling up of roots. To dig the potatoes I use a special potato rake that has long tines that are bent at a 90 degree angle perfect for uprooting hills of tubers.

Root vegetables can and should go from the ground to cold storage without drying in the sun or warming up. But other long keeping vegetables need to cure before going into storage. Onions and garlic need a week in the sun to dry for storage and squash and pumpkins need up to 2 weeks of sun exposure to form hard rinds. If you're able to grow sweet potatoes where you live (lucky you), these will need to be cured for up to

2 weeks in quite warm conditions (80°F to 85°F) to toughen the skin and turn some of the starch to sugar before going in to storage.

As far as trimming goes, the only thing that should be trimmed at harvest time is the leafy tops of the root vegetables: carrots, beets, parsnips, Witloof chicory, turnip, winter radish and rutabaga. I've found trimming closely leaving as little as ¼" of leaves works best for me. Any remnants of leaves turn slimy and start to rot and if that is touching a sound root, the root starts to decay too. I have to be careful though not to nick the top of the root when I'm trimming so closely. Any knobby protuberances, forked roots or excess rootlets should be left alone because once again you don't want any breaks in the skin of your storage vegetables.

Once the harvest is put away, a race commences to use stuff before it spoils. One bad apple really does spoil the barrel (or one bad cabbage, carrot, pear or what have you) so keeping ahead of the rot is my holy grail. When determining what to use for dinner, I keep several factors in mind. One is to use the more perishable items first. See the chart below for info on that. Another is to use what is starting to go bad. A weekly sort through, two weeks at the most, is necessary to pull out anything that is starting to spoil not only to prevent rot from spreading to other pieces, but also so I can salvage the item before it becomes so far gone it's unusable. If there's only a slight bad spot that can be trimmed away fine, but if something is moldy, out in the compost it goes. Many times my menu is determined not so much by what we want to eat but by what needs to be prepared and consumed.

There are two schools of thought when it comes to "use first" produce. One is do you use the biggest specimens storing the small deformed runts (assuming they aren't damaged in any way) or do you store the prime pieces and use the "uglies" first. I probably do a mixture of both. Anything rotten and unsalvageable is tossed into the compost bin. Anything starting to go bad but that can be trimmed up so it's usable regardless of shape or size I'll use first and leave the rest for another day. But when it comes to potatoes, which are such good keepers for us, I use the big beauties first followed by the medium sized tubers and finally use the small runts last. The benefit to this routine is the small potatoes that make it through to spring are our seed for the new year.

There are three basic elements any root cellar needs to take into consideration to be successful: temperature, humidity and ventilation. The closer you come to meeting the ideal parameters of these conditions, the longer your vegetables will keep. Be aware ideal storage conditions vary for different fruits and vegetables. Below is a list of some common vegetables and fruits with their ideal storage conditions and their storage life expectancy. The closer you can come to meeting these individual conditions, the longer that specific food will keep. But don't be discouraged if you can't always meet these standards. You'll still be able to store stuff, just not for as long.

32°F to 40°F and 90% humidity (Cold and Very Moist)	Storage Life
Carrots	6 months
Beets	4 to 5 months
Parsnips	5 to 6 months
Turnip	4 to 5 months
Rutabaga	5 to 6 months

Celery	1 to 2 months
Chinese cabbage	3 to 4 months
Kohlrabi	5 to 6 months
Winter Radish	3 to 5 months
Leeks	2 to 4 months
Brussels sprouts	1 to 2 months
Horseradish	5 to 6 months
32°F to 40°F and 80% humidity (Cold and Moist)	
Potatoes	5 to 6 months
Cabbage	2 to 3 months
Cauliflower	2 to 4 weeks
Endive/Escarole	1 to 2 months
Apples	4 to 6 months
Pears	2 to 3 months
Grapes	1 to 2 months
Oranges and Grapefruit	1 to 2 months
35°F to 40°F and 60% humidity (Cool and Dry)	
Garlic	6 to 7 months
Onions	6 to 7 months
50°F to 60°F and 60% humidity (Warm and dry)	
Pumpkins	3 to 4 months
Winter squash	Up to 6 months
Sweet potatoes	till spring-up to 6 months
Green tomatoes	4 to 6 weeks

Here's some specifics on the three basic requirements for successful root cellaring. Temperature is far and above the most important thing you can do to increase storage longevity and should be the first item on your agenda when figuring where and how to store your winter keepers. As you can see from the list above, with the exception of the Warm and Dry group, most long keepers prefer cool to cold temperatures. In modern, well insulated homes this may take the most fiddling to arrange since the objective is to make houses as warm and energy efficient as possible. Keeping a thermometer in your storage area is a good idea. That's really the only way to keep accurate tabs on things.

Suffice it to say if you have a place you can keep the temperature between 32°F and 40°F, you've got it made. Most roots prefer a temperature just above freezing so any location that can do that, wherever that may be, (outside somewhere, under the house etc) is perfect. If the best you can achieve is 50°F your stuff will keep longer than if it was at room temperature but its shelf life will be shortened. We are currently building our third and final homestead and we were hoping to have the root cellar functional this fall, but it didn't happen. So my apples and root vegetables went downstairs where the temperature is 55°F to 60°F. Far from ideal but that was the best we could do. As soon as I had the room, I hustled as many of the carrots and apples into the frig as I could to prolong their storage life.

Any root storage system be it a typical root cellar dug into a handy hill, a cellar under the house or an outside garden row storage relies on the earth to provide cool temperatures. But the earth must be cool itself to perform this function. As a kid growing up in Maryland, we didn't have a root cellar, much as I wanted one. Instead we buried a galvanized metal trash can at an angle and used that to store our potatoes. This worked pretty well provided the ground and weather were cool enough when we filled the can with alternating layers of straw and potatoes. But one year, ground and weather and therefore the can were far too warm and the potatoes rotted. What a rank smelling mess. Plus, we lost our beautiful harvest. A hard lesson learned at a young age. We would have been better off to have brought the crop into the air-conditioned house than to have put them into the can to spoil. In the sketch, we placed the barrel root cellar (BRC) on the north side of the house where it would be shaded. A plastic barrel or metal trash can will work.

If you decide to section off part of your existing basement to create a "cold room," try to locate this room so it will have a basement window in it. The window can be opened to admit cold air at night which will cool off the room in preparation for the harvest. Once the room is sufficiently cooled simply close the window. Any time the temperature rises too much, just open the window for a spell to cool things off. Also keep in mind that this room will have a range of temperatures. Temperature will be cooler right on the cellar floor and slightly warmer the higher up one goes. If one had bins on the ground and some shelving units to place items on, various vegetables could be stored closer to their optimum temperatures.

Humidity is another factor to take into consideration. Again looking at the chart, you can see most root crops and leafy greens keep best if the humidity is high, 90% or so. This keeps these things from shriveling. There's more than one way to achieve this. If your root cellar is an insulated cold room you've sectioned off in your basement, you can sprinkle the floor inside the cellar room with water or you can put shallow pans of water in there to evaporate. A hygrometer measures humidity and would be useful if placed in your cellar room so you can assess and take action as necessary. Other ways to address the humidity issue for shrinkage prevention is to do what most people do and pack roots in crates or boxes filled with damp sand, moss or sawdust, arranging the vegetables in single layers with the packing material in between. We've tried all 3 packing materials with limited success. No matter which we used, we had problems with rot. For us, we've had the best results putting carrots, beets and parsnips in large food grade plastic bags that we perforated with a sharp knife. By using bags that hold about 10 pounds each, I can easily keep an eye out for spoilage. Because I have several separate bags I'm also not putting my whole crop at risk if a bag develops a problem. We would suggest trying several ways to determine which works best for your situation.

Fruits and vegetables continue to "breath" after they are harvested and are in storage. The cool/cold storage conditions slows their respiration but good air flow and ventilation is needed to remove excess humidity, odors and stagnant air. Most cellars or cold rooms have pipes built in to their design to address the need for ventilation, but an outside window can be rigged with an air-duct box such that it admits cold air while allowing warm, moist air to escape. Outside clamps (above ground pits) also are built with a means to ventilate the pile through the center, although these are not a user-friendly solution for anyone residing in snow country.

How you achieve these ideal conditions is up to you given your resources and situation. If you can dig and build a true in the ground root cellar and are so inclined by all means do so. But for those without the space, perfect location, funds or desire for this type of cellar don’t despair. Evaluate your surroundings with an eye to the conditions various vegetables require. Check the conditions (temperature and humidity) in your spare unheated rooms, unheated garages and sheds or the outside bulkhead entry to your basement, assuming you have one. Further possibilities include the buried trash can I mentioned earlier or utilizing coolers used for camping and picnics.

This fall because our root cellar wasn’t built, we used ice chest coolers set outside on the north side of the house, which is always shaded (we didn’t want the sun heating up the coolers). The coolers protected the contents from freezing until serious cold arrived at which time, we moved them down into the unfinished basement. This set up was far from ideal but was the best we could do. If you live where winters are mild, you can employ various outside storage techniques such as pits or clamps I mentioned earlier. You may be able to store the roots in the ground where they grew without pulling them. Obviously, this won’t work for us or anywhere else where the ground freezes. Although application of mulch will help to prevent the ground from freezing, it can only do so much. But if your climate permits this give it a shot and see how it works. I would definitely take steps to protect the roots from rodents though as your in the ground roots will be an all they can eat smörgåsbord. Another factor to consider is snow. If feet of snow blanket the ground where you live, you will have to dig to reach your root storage area so give that some thought too. It’s a major inconvenience but by the same token, the snow should act as an insulator to a degree.

There’s no need for all your vegetables to be stored in one central location so finding a hidey-hole here and hidey-hole there is perfectly fine. For example, in any modern home it will likely be easier to find spots for the stuff that like warm and dry conditions. So if you have an unheated garage or room that may be the perfect temperature for pumpkin and squash; store it there. Produce that requires cold and moist conditions can be stored elsewhere. The perfect spot for various produce might take some doing but with creative thinking, it can be done.

Below are solutions we’ve used through our homesteading career to meet the 3 basic elements of any good root cellar. Some of these solutions have worked better than others as you’ll see. Some were temporary fixes to get us by until we got set up properly.

At the Maine homestead, we hand dug a root cellar of sorts in the barn that was about four feet deep, three feet across and eight feet long. Maine gets feet of snow every winter. By digging this hole in the barn we eliminated the necessity of having to dig through copious amounts of snow every time I needed to access the root cellar. To cover the “hole” as we called it, we laid scrap lumber over the hole, then came a rigid sheet of foam insulation (Celotex or Styrofoam), followed by straw bales to the top using loose bits of straw to plug any gaps. Finally we threw some heavy blankets used by movers on top for good measure. Bins full of carrots, potatoes and other root crops stored beautifully with this arrangement. In May, when I emptied the hole of any remaining produce, what was left looked as if it had just been dug. But apples, cabbages and celery didn't fare so well. For all intents and purposes they didn't store at all since they rotted in short order.

I suspect part of the problem was lack of adequate ventilation. In actuality there wasn't any. Given the way we insulated it, the hole was pretty air tight. This kept stuff from freezing but didn't allow for any ventilation. I should also mention it was a royal pain every time I needed something from the hole. It meant having to remove all the loose straw, bales and foam insulation, get what I'd thought I'd need for a month (since I didn't want to go through this nonsense every week) then re-cover the hole as before. What a hassle! Another obvious disadvantage was not being able to sort through the produce as often as I should have. Perhaps if I'd been able to keep a closer eye on things, I wouldn't have lost the apples, cabbage and celery to rot.

Another drawback was the hole flooded in early spring during the thaw. If I was negligent and didn't get any remaining produce out of the hole in time, I had to fish the articles out of the ice water. I made that mistake only once learning my lesson the hard way, by bobbing for potatoes immersed in icy water with frozen fingers.

In Saskatchewan, before actual construction of the house began, we hand dug an 8 X 8 X 5 foot root cellar so it would be under the house and accessible through a trap door in the floor of Ron's shop. Fortunately the sandy, gravelly soil was relatively easy to dig. In addition to serving as winter storage for root crops, the root cellar was home to our water pump and pressure tank.

To be honest, the hole was not humid enough or cold enough in fall to function as a good root cellar. It served the purpose though as long as I took its limitations into account. When I pulled/dug the root crops: potatoes, carrots, beets, parsnips, storage radishes, and Witloof chicory, the first week in October, the cellar was around 50 degrees. Too warm to store my roots well, with the exception of the potatoes that is. Interestingly, they took the warm temperature in stride and stored just fine so they went directly from the garden to the cellar.

But the other roots required some special treatment until early December when the hole had cooled enough for good root storage. To get me through this interim period from October to December, I came up with a few tricks. The first was to load up the frig with bags of carrots.

Second, I put an ice chest on our screened in porch and put my root crops in it to protect them from freezing. Covering the chest with a blanket gave added protection. By the time the outside temperatures dipped to near 0°F, the root cellar was cold enough and I transferred the roots to the cellar. This worked great and saved me from rotting roots stored in a too warm cellar in October. When we homesteaded in Saskatchewan, another food storage strategy I came up with involved the greenhouse and cold frames. Remember the greenhouse within a greenhouse we set up in the spring using cold frames we put in the greenhouse? (see "The Solar Greenhouse" section of the garden chapter) Well, in fall, after we yanked up the tomatoes and peppers, we once again put the cold frames back in the greenhouse. By the first week of October, winter weather was at our doorstep and


Transplanted Leeks for Fall Storage

the garden was done. To extend our "fresh" eating season, I dug up mature cabbages, Brussels sprouts, broccoli, leeks and celery and replanted them in trenches I dug in the boxes. I packed the plants close together, saturated their intact root balls as well as the trench, and then backfilled.

With protection, (the same methods as we used in the spring), I could keep these vegetables alive and green for two more months. On nice days, I left the lids of the cold frames open. By early December, the snow was deep, we were getting serious cold, well below zero Farenheit, and I was tired of the hot water jug routine so I harvested whatever remained. As a side bonus, the cold frames were already in place for late March when the new gardening season commenced.

Storing Cabbage and Brussels Sprouts in Cold Frame in Fall

Here in Nova Scotia, we plan to have an insulated cold room sectioned off in our unfinished basement. When we built the basement walls, we installed two pipes through the outside wall for controlling ventilation in the cold room.

I should be able to cool the space down properly to receive the harvest in the fall, be able to monitor the temperature and humidity easily through the storage season and make modifications as necessary. Plus I'll be able to do a weekly inspection/sort of produce since the cold room is easily accessible from inside the house. Not to mention I can run downstairs to go "shopping" when the need arises.

I've mentioned we store our root crops dirt and all. We gently brush off clinging dirt with our hands when we're harvesting but we don't wash anything prior to storage as this encourages rot. I bring up a load of carrots and potatoes from the cellar when I need them, wash them at that time, let them air dry, then store a bag sized portion of carrots in the frig and the potatoes in my pantry. I put the potatoes in some sort of a container; a box or an old dish basin for example, and cover the receptacle with an old towel or cloth to keep out light. Light turns potatoes green which is not a good thing as they contain a poisonous compound known as Solanine. I could fetch the amount of items I need each day from the cellar since it will be conveniently in the basement, wash just enough for the meal, then cook it, but I find having small batches washed and ready to go more convenient. It's a more efficient use of my time and water too.

If you have your own hens, you'll likely want to put by some eggs to get you through their annual molt. We always did. The object is to keep the eggs cool and seal their pores to prevent moisture loss and prevent damage from the air. Waterglass is an old time method of preserving eggs that involves using sodium silicate in a solution with water. It works well enough for 3-6 months provided the eggs are kept in cold storage. Expect the whites to become thin. Rinse waterglassed eggs before cracking. It's been so long ago, I don't remember the specific ratio we used but 10 parts water to 1 part waterglass should do it.

In Maine we also kept the eggs in our root cellar hole after packing them in a box of sawdust. I packed them in layers with their small ends down. This worked pretty well, but occasionally I encountered a rotten egg. So I always cracked any egg into a small dish before adding it to my mixing bowl in case it was bad.

In Saskatchewan, since we only shopped twice a year, we flew in a case or more of eggs and stored them in the root cellar. They stored fine during the winter months. After our spring shopping trip, we stored them in the root cellar as well but after the cellar warmed up, I got the remaining eggs in the frig as soon as possible. Anymore, we don't bother with waterglass or packing in a sawdust. Now we keep our eggs downstairs where it's cool or in the frig. Out of habit, I still crack any egg into a small dish to check for freshness.

Curing, Smoking and Other Off-Grid Means of Food Storage

Curing, the process of adding copious quantities of salt or a combination of salt/sugar/spices to food, and smoking have been used for centuries to preserve food. The process can be used to preserve certain vegetables but the only vegetable I regularly salt cure is cabbage for sauerkraut. We always make our own which is a wonderful taste treat when cooked with a pork roast on a cold winter day.


Manual Food Shredder with Assorted Cones

To make sauerkraut, figure 5# of cabbage per gallon sized container. I make at least 15 pounds of sauerkraut at a time, usually more, so I begin by scalding a large container. I pour boiling water in my empty sauerkraut bucket, a bucket I have set aside as my designated kraut fermentation container. Then I wash the cabbages, slice them up remove the cores, weigh and shred them. I use a manual food chopper that has interchangeable cones which process foods into various sized pieces. I attach the coarse cone and crank the handle to shred the cabbage wedges. You could use an electric food processor or a traditional kraut board. Next I measure out the correct amount of salt for the amount of cabbage I have. Use only pickling salt here, not table salt. Proportions are very important. So for 25# of cabbage use 10 ounces of salt, for 10# of cabbage use 4 ounces of salt etc. Now I begin packing the bucket with layers of cabbage and salt tamping down each layer to get rid of trapped air and start the juices flowing. Top with a layer of salt. I put a piece of plastic wrap on next followed by a sterilized plate that I weigh down with a jar filled with water. The object is to keep cabbage below the brine. The bucket should be kept in a place where the temperature will be between 68°F and 72°F during fermentation which can take up to 4 weeks. A lower temperature will slow down fermentation and a higher temp may cause spoilage. I once lost 20# of kraut to spoilage because the temp was too warm, so don't make the same mistake.

By the second day, if there isn't enough liquid in the container to cover the cabbage make a brine by adding 1½ teaspoons of pickling salt to each cup of cold water and pour it in. Each day remove any scum that forms and replace the plastic wrap and put on a clean, sterile plate. Fermentation is occurring as long as bubbles continue to rise to the top of the brine. When the bubbling ceases, fermentation is complete. The sauerkraut should be clear, pale gold in color and should smell like sauerkraut. At this point, it must be kept cold, 38°F. If you have a root cellar that is consistently this temperature that would be a great place to store your container of sauerkraut. Otherwise, the sauerkraut must be canned.

Dry salting, the process of sprinkling on or rubbing salt on meat so the salt draws juices out from the meat is one type of curing. The other is brining where salt and water are mixed together, then the meat is added to the brine. We've employed both methods through the years. Our hams and bacon are dry cured and the corned beef and dry beef are brined. Both procedures cut down on the activities of the microorganisms that spoil food because the salt draws moisture out of the meat. The more concentrated the salt, the more storage power it has. Meat can either be left in the brine or dry salted until ready to use provided it's kept in a cool place, 38°F is ideal. That's exactly what we did with our corned beef when we homesteaded in Maine.

I have food grade buckets set aside for dry curing and brining meats. I never use them for anything else. When it's meat curing time come fall, I scald my buckets with boiling water prior to loading them up.

If you're familiar with the term country ham you'll have an idea what our home cured and smoked hams and bacon taste like. We became adept at their production in Maine. Once we had the hams and sides of bacon liberated from the main side of pork, we'd weigh the meat and combine curing salt, brown sugar, spices of ground cloves, black and red pepper (no nitrates!) in the correct proportions for the amount of meat we had. Then we smeared all surfaces with the curing mixture.

Next we'd put the pieces in the scalded bucket, cover it with a square of muslin and sit the bucket in a cool place, 36°F to 38°F is ideal. The meat shouldn't freeze but much above 38°F and the risk of spoilage increases. Sides of bacon usually cured for two to three days while the hams, because they are larger pieces, cured for up to a month, roughly 1½ days per pound. About the time we removed the bacon from the cure, we re-coated the hams with more curing mixture. We coated the hams a final time about half way through the curing time. Each time we rubbed the curing mixture on any of the meat pieces we made sure we poked the mix down into any cracks and crevices along the shank and muscle groups. When both the bacon and the hams were done curing, we washed the pieces in lukewarm water to remove any salt residue or grease, then they drained until dry. At that point they were ready for a trip to our homemade smoker.

Smoking is used primarily to flavor meat and give it the characteristic aroma we associate with bacon and the like, but it does have some preserving potential too. There are 2 types, cold smoking which takes place below 120°F and hot smoking which occurs above 120°F. Cold smoking is used to flavor meat while hot smoking is used to not only flavor the meat but cook it too. Smoking, if done for a long enough period of time, will dry out the meat and retard rancidity, both of which contribute to a longer shelf life provided the finished product is stored properly. Cold smoked meat is raw so should be treated like any raw meat product. All the meats we ever smoked be it hams, bacon or sausages were cold smoked and needed to be cooked prior to consumption.

Any meat or seafood can be smoked but we've only ever smoked hams, bacon, dried beef and sausages. If you decide to get in to the smoking act, you'll need a smoker. Commercial smokers are available and come with instructions for how to both cold and hot smoke. If you go this route follow the manufacturer's directions. We recently acquired one, but found our homemade "smokehouse" back in Maine that was made out of a 55 gallon drum did just as good a job. The drum was set on end atop some bricks or cinder blocks so it was raised slightly off the ground. A hole was cut in the bottom end of the barrel to accommodate the end of a metal rain gutter that ran from the barrel to a fire pit we dug in the ground some feet away. The pit was at a slightly lower elevation so the smoke could easily rise from the fire pit into the gutter pipe and travel to the smoker. The top of our homemade smoker was outfitted with 3 metal rebar rods that spanned from side to side. We suspended the meat from the rods so the pieces didn't touch each other.

Then we made a fire in the pit using hardwood. Maple and apple wood were two hardwoods we've had available so that's what we've used but you could use whatever hardwood is available where you live. Under no circumstances do you want to use softwood such as pine, fir or spruce as they emit a sooty smoke that taints the meat. Once the fire was going well, we covered the top of the fire pit with a piece of sheet metal, shoveling dirt around the edges to seal it but leaving a small section open so the fire could get some air. The top cover keeps the fire smoldering just enough to produce smoke, which is what you want.

How long you smoke anything is determined by the size of the piece and your personal tastes. Obviously large thick chunks such as hams will take longer than bacon or sausages. We smoked the bacon and sausages for a day, maybe two but the hams took longer since they were bigger. We never tried to keep our smoker going during the night but you certainly could if you wanted to get the process over with.

Once the smoking was complete, we put the finished products in muslin bags I had made for the purpose and suspended them in a cool, dry, well ventilated location that was safe from mice, rats, birds or other varmints. The curing and smoking adds much flavor and helps to preserve the meat, making it a boon for anyone living off-grid with limited refrigeration. When we homesteaded in Maine, I relied on the preserved hams after the weather warmed in the spring and I could no longer keep meat frozen outside.

Various dried sausages are a boon to anyone off-grid with limited refrigeration or freezer space too. In Maine we made Summer sausage, bologna and salami. Once we ground up the meat and added the seasonings, we stuffed the meat into muslin casings that I had sewn up. Their diameter was big enough to accommodate the wide mouth canning funnel. This made quick work of filling the muslin sleeve. We packed the sausage into the casing being sure there were no air pockets, then we tied off the tops with string and smoked them for 2-3 hours in our homemade smoker. The next step was to simmer the sausages in a big kettle of water until cooked. Finally, they were hung up where they would be cool and dry. I would cut off slices and fry them up in a skillet at meal time.

We've also preserved sausages by storing links and patties of breakfast sausage and Italian sausage in tins filled with melted tallow or lard. We laid the links and patties in the container and poured the melted fat all around them being sure no surface was left exposed and there were no air pockets. The fat kept out oxygen and pathogens and if the container was kept in a cool place, preserved our meat for a while.

Bear in mind all of the above methods to extend shelf life of perishable food has limitations and should not be viewed as a long-term replacement for a frig or freezer. No way would I try to carry any of these foods through a summer of blazing hot temperatures of 90°F for weeks on end. Nor are they a crutch for food that has been handled improperly through any of the steps outlined above. If your food was questionable at the start, it will not be improved and may become unsafe regardless of method of preservation.

In Maine, corned beef was one of our favorite ways to preserve beef for use after freezing temperatures were no longer with us. I relied on the corned beef to help fill the gap between the time when it was too warm to keep meat frozen outside anymore and the time when the chickens were ready for the chopping block. Essentially corning is the process of salt curing beef. Pieces of meat are rubbed with salt, allowed to sit in a sterilized bucket for 24 hours then covered with a brine that has some sugar and baking soda added to it. I always add some garlic cloves too for added flavor. Using more than just the brisket (the belly) I made 25-30 pounds of it by adding large roast sized chunks to the brine. The curing process takes 4-6 weeks. During curing, the bucket of meat must be kept cold, but not frozen, 38°F is just right. Once the curing process is done, it can simply be kept cold or left to freeze in its bucket of brine.

We let our corned beef freeze in its bucket on the porch once the curing process was over. Then when warm weather arrived, I'd place the bucket of corned beef in the barn root cellar hole where I could keep it cold until mid-May. In April and early May, this beef made for some great one pot meals with the addition of potatoes and carrots that were stored in the root cellar from the previous fall. When the root cellar hole warmed too much by mid-May, I canned whatever corned beef remained. At that time my canning books had instructions on how to can corned beef. Now I see it is not recommended, so I pass on the latest food safety information for you in this regard.

Even though I have a chest freezer now, I still make 25-30 pounds of corned beef whenever we cut up a side of beef. It makes for a quick, easy, delicious meal when cooked with cabbage, carrots and potatoes. What is commonly known as a New England Boiled dinner.

We made dried beef the same way as corned beef except we added more sugar to the brining solution. After the 4-6-week brining period was over, we removed the beef from the sugary brine and hung it up to dry in a cool place away from insects and varmints (mice and such). Once it was dry, we smoked it. The one drawback to this product is it gets tough when dried so it must be sliced thinly before cooking into creamed beef on toast. But it stored for a long time. If you cut the meat into strips, brine it and then slow cook or dehydrate you've essentially made a batch of jerky. This is the most basic jerky recipe which can be modified as desired with different spices and marinades based on preference.

Storage of Staples


Threshed Grain for Storage

No matter how self-sufficient you strive to be, there are food items most people can't produce on their homesteads. Sugar, oils, cocoa powder, molasses, whole grains to grind up fresh for flour, yeast and baking soda are some things that come to mind. Sugar cane grows best in the tropics and subtropics and cocoa grows in the tropics. For people like us in a northern growing zone, sugar cane and cocoa beans are virtually impossible to grow so they must be purchased.

We've always inventoried a substantial quantity of staple items. For the most part all of these items have a long shelf life (oils and nuts are the exception as they will go rancid over time) provided they are stored in a cool, dry location. A damp root cellar is NOT the storage place of choice for most of these foods. Most staples should be stored in air tight, rodent proof containers especially once the original packaging is opened. Glass jars and plastic food grade buckets with tight fitting lids are what we use. Below is a list of some staples we believe most people would and should have on hand along with their shelf life. Most staples will keep indefinitely and I've used many of these items past the times given below, but for best flavor and texture use within the recommended times given.

- Baking powder - 9 to 12 months
- Baking soda - 9 to 12 months
- Cocoa powder - 2 to 3 years

- Coconut - 6 months, longer if stored in frig or cold location
- Coffee - ground - a few months past expiration date
- Coffee - beans - up to 9 months
- Dry Milk - 2 to 10 years
- Flour - white - about 1 year
- Flour - whole wheat or other whole grain - up to 3 months. We inventory a large quantity of wheat berries for grinding into flour with our grain mill. This ensures our whole wheat flour is always fresh and free from rancidity. Storing any whole grain flour in the frig or freezer will lengthen shelf life to about 6 months.
- Pastas - dried types -1 to 2 years
- Nuts - 6 to 12 months
- Oils – olive - 6 months to 1 year; vegetable oils -1 year, 2 years if refrigerated
- Rice - white - 4 to 5 years; wild and brown - 6 to 8 months
- Shortening - 1 to 2 years
- Sugar - 2 years
- Tea - 18 months to 2 years
- Yeast - once opened, 4 months if refrigerated; 6 months if frozen but I've had it last in the freezer for a year or more.

With the exception of anything high in fat such as nuts, oils and coconut, most of the staples will be safe and edible past the aforementioned times but quality may suffer.

Even though we are a household of 2, we buy most of our staples in bulk. This is an economical way of purchasing plus I don't have to worry about running out of items on a frequent basis. This was especially important when we lived in the wilderness and only shopped twice a year. We perfected inventory control and shopping to the point we never ran out of anything during the 17 years we lived remote. Our system involved developing lists of everything we would need to survive. This included not only food but things such as matches, canning lids, toilet paper, cleaning supplies as well as various repair parts for pieces of equipment. Next we figured out the amount of each that we wanted to have on hand. We called that our "Stock." For some things such as sugar, flour and cocoa powder we included a fudge factor so if there was a world wide shortage we'd be alright at least for a little while. Sugar is a vital ingredient in cooking and preserving. And for Ron, he says cocoa is an essential building block of life. He's chocolate powered and without an occasional power nugget, he claims he'd be next to useless. So I guess it's pretty important to have a good supply of cocoa lest he shrivel away!

Before each flight to town, we took inventory assessing how much we had of each item and how much we needed to buy. Once home, I dated every staple purchased before putting it away so I was always sure I used the older stuff first. FIFO, first in, first out is the rule here. I still date all staples we purchase so I'm sure to use the older stuff first. What you choose to inventory and how much of it is a matter of choice and preference.

Making Apple Cider Vinegar

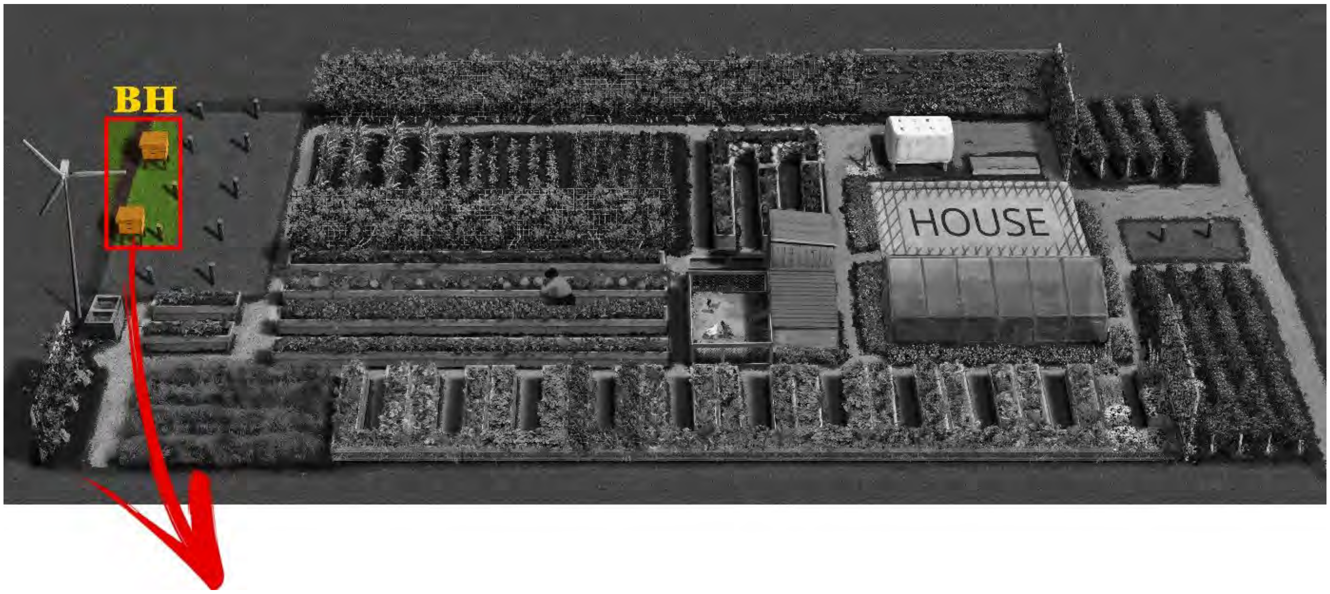
I've mentioned that we made cider vinegar from our own apple cider but I haven't explained how we did it. Each fall we set aside a couple of gallons of our freshly pressed, unpasteurized apple cider to make vinegar. The first time you make this is probably the trickiest since you likely won't have the starter called "mother." Mother is a thick, clear, jelly like substance that is made by the beneficial organisms that convert alcohol to acetic acid, the chemical name for vinegar. Sometimes you may see this stuff floating around in store bought vinegar. That's fine. It's not harmful.

The first time we made vinegar, I tried several methods. I added ¼ cup sugar to a couple gallon glass jugs filled with our fresh apple cider. To one of these jugs I added some yeast. I covered the jars with a square of muslin secured with a rubber band and sat the jugs behind my wood stove where they would be warm. The jug with the added yeast molded. Total loss. Eventually, the "mother" formed in the other jug and I ended up with a jug of vinegar. The process took a few months, but I was patient and left the jug undisturbed during this time. Once the cider was converted to vinegar, I carefully removed the "mother," put it in a small canning jar, covered it with some vinegar, put on the lid to prevent evaporation and stored this in my pantry until the following fall when it was time to make a new batch of vinegar. The next year I added the sugar and my "mother" (the starter) to my jug of fresh cider and had a new batch of vinegar in less time because I was able to add the starter which got things going faster. I never added yeast to another jug of cider again when making vinegar.

I've never used pasteurized cider, the kind you buy in the supermarket, to make vinegar. I have my doubts on whether it will work or not but I suppose you can try it and see what happens. Pasteurization is a heat process that kills dangerous pathogens but it also kills good beasts necessary for vinegar production.

The acid content of homemade vinegar is an unknown. As a result, if I'm canning a low acid vegetable such as pickled beets, I use commercial vinegar whose acid concentration is not variable. But I'd use my homemade vinegar for all other recipes: to make salads, salad dressings, refrigerator pickles, sweet and sour dishes and so forth.

Chapter 13 - Busy as Bees (BH)



As long time homesteaders, there's not much we haven't attempted to do in some fashion at one time or another but this is one topic of which we have no personal knowledge or experience. I've done my homework and we'll learn all about bees together. One of the most baffling things to me before I looked into this was the terminology. I don't know how some of the lingo such as "Supers" came into being but there's only a few major components to a hive and it's very easy to keep them straight. More and more people are taking up the hobby. Consequently there are lots of great resources such as beekeeper associations and clubs. That would be a wonderful place to start. I found out there are courses that can be taken too and who knows, you may know of a local beekeeper who can offer advice as well.

Obviously the two well known benefits to bees are honey production and plant pollination. The lesser known benefits are beeswax, bee pollen and propolis. Propolis is a resinous glue the bees make to seal small cracks in the hive. But it evidently has medicinal qualities too. Bee Pollen is also touted to have medicinal qualities and is a health food. Although it has tremendous benefits, it can be a problem for infants under 1 year old. The digestive system of infants is not fully developed and it's possible to get infant botulism from consuming honey.

For many people, raising honey bees would be very beneficial and a great step forward on the path to self-sufficiency. But because we've lived in some tough, harsh climates, keeping honey bees didn't seem to be a good fit for us. Keep in mind, when we lived in the bush, float plane was the only way in and out. I think the float plane pilots would have frowned upon flying in a package of bees as passengers or even hives. It would not have been pretty if the bees escaped while the plane was in the air regardless of how safe and well packaged they were. So bees weren't a good option for those years.

For a ¼ acre homestead, 1 to 2 hives is the recommended number to keep. The honey bees will help with your garden pollination which will improve yields and you'll get some honey to use and/or sell. There are many variables to account for the amount of honey produced per year. Figure anywhere between 20 to 60 pounds per hive on average with some years producing even more than that. That's a wide spread. Some of the factors that determine the honey yield are weather, strength of the colony, queen vitality, nectar availability, geographic location and size of the hive.

The type of flowers and the collected nectar will determine the color of the honey as well as its taste. Johanna and I favor a darker grade of maple syrup which has a stronger flavor. The same is true of honey. The lighter the color, the milder the flavor; the darker the color, the more pronounced the taste. Raw honey is unpasteurized and unfiltered. Many people choose to strain and filter their honey to remove pieces of wax and particles. There are different sizes of filtration; the finer the mesh, the clearer the honey will be.

Building the Hive

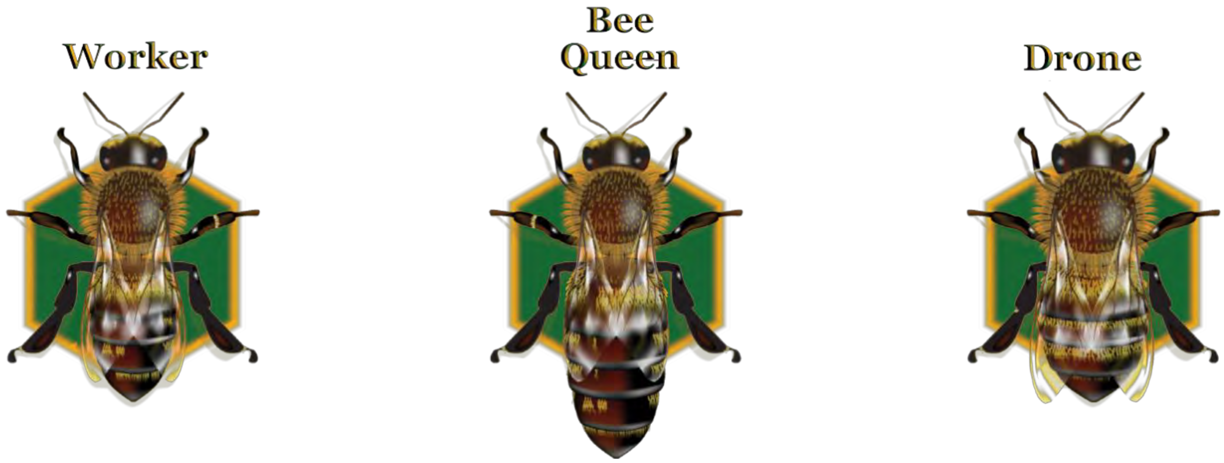
I'm technically oriented and I mistakenly thought that bees were complicated and difficult to raise. More and more people are taking up raising bees and now that I've looked into it, I can understand why. It's not complicated but there are many things that can go wrong. Bees are susceptible to diseases, viruses, fungus, predators and parasites. They take maintenance and care. It does take effort like anything else but beekeeping is pretty straightforward and that includes building the hives.

The hive is no different than a house. It has a foundation, a roof and multiple stories in between the two. I'm referring to the hives I've always seen in farmers fields. Those are Langstroth hives. But there are other types of hives that I came across when doing my research. One type I thought was quite interesting is the Top Bar which looks like a very cool way to make bee raising easier. I'd value the opinion of someone who has tried both hive methods and decided the Top Bar suited his/her needs better.

It's best to set the hive up on a raised platform. That way, it's at an easier working height and the rodents are kept at bay. If ants are a problem, a neat solution I came across was to build the stand with legs and then set each leg in a small, shallow tub of oil. Just enough oil in the bottom of the tub should do it. The foundation can be a solid board or it can be a screened board. The screened board provides ventilation while at the same time, if the hive gets an infestation of mites, any that drop off of the bees will drop through the screen and not be retained within the hive. Sticky sheets can also be set under the screen bottom to trap any mites while allowing the bees above to be safe.

Hive orientation needs to be considered here. Face the opening of the hive south to southeast which is where the sun will be. You can see on our master sketch that I located the hive (BH) in the orchard with the entrance facing south. I want to protect the hive with some shade during the day, keep the prevailing winds from blowing into the hive especially in the winter and provide a nearby source of food for them in the form of fruit blossoms in spring with the benefit to us of great pollination. When winter comes, the leaves are off the orchard trees allowing maximum sun to filter in to warm the hive. In addition, the orchard is furthest from the house which gives them some privacy and keeps conflicts with people and animals to a minimum. In my mind, it's also the optimal use of limited space if that is a consideration.

On top of the board or screen comes a brood chamber (Deep Super) which is a rectangular box with hanging frames. Deep super refers to the height of the box which is 9 ½". Usually the brood chamber contains 8 or 10 frames with 10 being the industry standard. This is where the queen bee will live and produce eggs. The hanging frames are where the bees will build comb in which honey and eggs are stored. Frames can be plastic or wood. One option is to buy open frames which means the bees will start from scratch to build combs. These are called foundationless frames. The comb they build will be in a hexagonal shape. Cell size can be adjusted by the bees for their needs. But another option is to buy your frames with a foundation. And there are options for what kind of foundation. Either beeswax or plastic foundations are available with a one size fits all hexagonal cell shape imprinted on it. The foundation gives the bees an easier start. But I have to tell you, there's debate among beekeepers as to the best hive type and whether to go with or without a foundation. Each has its merits and a beekeeper should have an open mind about it. But as a new beekeeper, it's suggested to start with a foundation, get experience and then potentially move to foundationless frames. There's not a clear-cut winner in the debate.



I should mention that each hive has 1 mating queen, lots of worker bees and some drones which are responsible for mating with the queen to produce fertile eggs. There are a number of varieties of honey bees with different characteristics. Some of those characteristics are how docile they are, how resistant to parasites, how cold tolerant, how likely they are to swarm and how much honey they produce. The typical races are Italian, Russian, German, Cordovan, Caucasian, Carniolan and Buckfast.

An entrance reducer is also typically installed at the bottom board to allow the bees entry and exit while keeping mice out. It also reduces the opening giving bees a chance to defend against marauding insects.

The brood chamber can be various sizes but is normally 20" X 16" X 9 ½" high. There are medium and shallow supers which refer to the height. Medium is 6 ⅝ "and shallow is 5 ⅞" As the hive expands and more bees are buzzing, another brooder can be set atop the first. The question becomes will it be a deep, medium or shallow brooder as the next level? And the answer comes down to weight and ease of working with the hive. The bigger the box, the more bees and honey can be produced in that piece of real estate but the more weight one has to contend with. That's also a consideration when choosing between an 8 or a 10-frame super. A 10 frame deep super fully laden with honey might weigh 80 pounds. Once the decision is made to go with an 8 or 10 frame hive, you are locked in to that size. If you pick an 8 frame, the rest of the hive will be built with 8 frame supers. One of the things I was quite surprised at is how easy it is to build a hive. Individual components are all modular and simply stack atop one another like building blocks.

On top of the top brooder is an exclusion screen. This screen has a mesh size that allows the workers to easily pass through but because the queen is larger, she can't pass through to access the rest of the hive chambers. So all the chambers above the brooding chambers are used for honey storage by the bees. The boxes above the exclusion screen are called Supers. But what was confusing to me at first is the term brooder or super. They are interchangeable terms really. It all depends on what the box is being used for. The way I'm keeping all this straight is a super can come in different heights. deep, medium and shallow. And depending on whether the super is used for raising new generations of bees or is used purely for the production of honey will determine if it is a brood super or honey super. A brood chamber is usually a deep super.

Another way to look at the organization of a hive is everything below the exclusion screen is for the bees survival and any super above is surplus honey for you.

Once the exclusion screen and a honey super are set atop one another, there's an inner top that's put on and then the cover goes on which is the roof that will keep the weather out. The inner top is there so that the bees don't "glue" the lid down. It makes accessing the bees for maintenance and checkups easier.

There's an interesting modification to a standard hive that I'd like to pass on. Johanna and I are the thrifty sort so when a friend suggested looking at a "hive in a jar," just the sound of that piqued my interest. Anyone who has done food canning over the years likely has an inventory of mason jars, some of which are sitting empty on the pantry shelf. Might as well put a few to work and save some money on buying a complete hive assembly as this might be a cheap way to try beekeeping.

To set this up, there are ready made kits available or one can start from scratch. The jars are set in a board that replaces the top super. A piece of plywood can be cut with holes the proper size to accommodate perhaps a dozen inverted jars. One of the nice features with this is the fact that one doesn't need an extractor. The capped honey is in a jar, ready to use. You dig it out of the jar, comb and all. It's all edible. It's also possible to heat the jar of honey in a water bath. The honey/wax combo melts, the wax floats to the top and after it cools, the wax can be lifted off.

I've seen beautiful jars filled with honey which is potentially confusing to people. Many people wonder how the bees filled the entire jar with honey and why it doesn't ooze out of the jars while they are inverted on the top of the hive. Those inverted jars sitting on the hive have comb with honey which is capped by the bees. At that point, there's no free honey that will leak out. The liquid honey shown in pictures that fills the void in the jars is surplus which has been added to the jars by the beekeeper to fill them further for storage or for sale.

In studying this, it seems to be a really cool idea that's best suited for more experienced beekeepers. It's certainly feasible for the beginner but having a standard hive and learning how it's structured and how bees work in the hive would be a great educational tool before venturing into the hive in a jar, unless you have the advice and help of an experienced beekeeper.

Equipment

We now have a better idea of how a hive is constructed but before we purchase bees, we need some additional equipment. One might be tempted to buy some sting proof body armor. The Medieval suit of armor worn by troops of the Middle Ages comes to mind. But one doesn't need to get that radical. Everybody it seems gets stung at some point raising bees although we can keep that to a minimum. I've been stung by wasps, yellow jackets and hornets over the years and those suckers hurt. I suspect a honey bee sting hurts as well. Just be aware some people can have an allergic reaction to a sting. And some people can have a severe reaction.

It doesn't matter if you've been stung before without incident. The body can develop an allergic reaction over time and each subsequent sting can make it worse. I don't mean to scare anybody since bad reactions are not that frequent and there are things beekeepers can do to mitigate the potential. Many beekeepers are comfortable wearing a veil but no gloves for instance. They bravely handle the frames and work around the hive with bare hands. And they get the occasional sting. But there are full beekeeping suits including veil and gloves. Make sure any entrances around the ankles and wrists are tight so a bee can't get in. Don't wear perfumes and scents so a bee can't mistake you for a mobile flower.

I would also strongly consider buying an Epi-pen and having an antihistamine such as Benadryl nearby. You may not be the allergic one. A visiting friend or other family member might get stung and have the reaction. It may not even be the fault of your honey bees. When we lived out in the bush, we had an Epi-pen as part of our medical kit. We were so far from medical help, having it on site gave us a chance of surviving any allergic reaction resulting from an insect sting or bite. If you do get stung, try flicking the stinger out. Use a scraper or a fingernail to get it out. If possible, try not to squeeze it since it might introduce more venom. Get it out as fast as possible.

A smoker is another vital piece of any beekeepers equipment. The smoke helps calm the bees. A slow, gentle approach is best when working with and handling bees. Everybody develops their own technique in using a smoker but it's a good idea to waft a bit of smoke their way when first approaching the hive. That means always having the smoker lit in advance and utilizing any breeze to your advantage. It does not take much smoke. A little bit will do the trick. Let the breeze carry the smoke towards the hive. Bees use a chemical called a pheromone to signal danger and that signal can spread and alert the rest of the hive in a hurry. Smoke masks that signal and the hive doesn't get the danger message. Smoke can also help herd the bees deeper into the hives or away from the area you wish to work. It's thought that the smoke triggers a fire response. The bees figure the hive might be on fire and they fill up on honey in case they need to get out of dodge and start a new hive somewhere. The honey gives them the energy to do that which also makes them more docile because they are full.

One of the many good uses for smoke is after a hive has been dismantled for inspection. Before the next super is placed on the stack, a little smoke judiciously used along the top of the box will move most of the bees so they aren't crushed when the next super is set.

Another time to use smoke is after you are stung. In the act of stinging, pheromone is released alerting the hive to danger. Bees will pick up on the fact that there is danger and may become more aggressive and sting again. If you smoke the area of the sting, it will confuse them. Be careful with the smoker since it can get hot. Keep in mind, there's a little fire in that can that is throwing out heat as well as smoke. The idea is to waft a little smoke their way, not cook them. You also don't want to impart a smoky barbecue flavor to the honey so minimal smoke to do the job is best.

Making a small fire in a smoker is no different than a campfire. A little fire starter tinder, some small kindling sticks and then some larger material that will smolder along. A cool smoke is what you're after, same idea as when you smoke meat.

There are several more items I'll mention that will help with bee keeping. A hive tool is an implement that is used to free up the supers. The bees glue the supers together with propolis and the hive tool aides in levering the supers apart. Additionally, they help lift the frames out of the hive. A feeder of some sort is needed to feed the bees in specific situations. There are different types of feeders each with some advantages and disadvantages. The jar feeder generally sits close to the entrance to the hive. Easy access to the bees but also easy access for ants and other uninvited diners. There's also a feeder that goes in the hive much like a frame. In fact it takes the place of a frame.

Potential Issues

There's much debate on when to feed and what the ratio of sugar to water should be. As long as the bees have lots of honey stored, they have their food supply. It's only after a long winter that they may need a sugar boost. In that event, a 1:1 ratio of white refined sugar to water is best. In the fall if they don't have enough honey stored, a 2:1 ratio is best. Two parts sugar to 1 part water, essentially a syrupy mix. Another situation where bees need to be fed is when establishing a new colony in the spring. In that event, a 1:1 ratio will be needed.

A light brush will help when you need to move bees out of the way. For example, say you want to inspect a frame which is crawling with bees. A brush can be used to gently sweep them off but a better way is to simply give the frame a quick downward shake and most of the bees will drop off. Repeat a few times and the frame should be pretty well bee free.

Marauding animals such as skunk and bear will wreak havoc if allowed. Although we never had bees when we lived in the wilderness, we can attest to the destructive nature of bears. Our chest freezer has indentations from a bear paw and our snowmobile foam rubber seat was destroyed not to mention other damage to the greenhouse through the years. I made nail boards to throw on the ground when we needed to leave our homestead unattended for any duration. Nail boards are just as they sound. I took scrap pieces of OSB or a section of plywood left over from the house construction and pounded nails in rows spaced every inch in each direction to form a grid pattern. I believe I used 8 penny common nails which left about 1 ¾ inch of nail spike exposed. I threw them on the ground in a random pattern around the greenhouse, outside freezers and the snowmobile. They worked well. But we had to be very cautious when returning home and remember they were all around lest we step on one. The first order of business was to pick them up once we returned home. If you use these boards as bear deterrents, you'll need to remember they are down around the hives in the event weeds grow and the boards become hidden.

Evidently skunks, possum and small mammals tempted to make a raid will be discouraged by nail boards as well, although the nails don't need to be as big. Anything that can be laid down to discourage an animal from roaming and parking itself by the hive entrance can be an asset.

In the wilderness, we used a second line of defense against bears that had mixed results. I put an electric fence around our entire homestead thinking that would keep them at bay. Wrong! I witnessed a bear jump it. I couldn't believe it. I had 3 strands of wire, with the closest being 5-6 inches off the ground and the top wire about 3 ½ feet, maybe a tad more, from the ground. I added a 4^{th} strand about 4 ½ feet after that bear hurdling. So make sure any electric fence around your hives is raised up. Keep the weeds and any grass from growing under and touching the bottom wire or it will bleed some of that energy away to ground especially when those weeds are wet. With all electric fencers, there are always 2 terminals, a hot and ground. That ground is very important and must be connected to a ground rod driven into the earth. An electric fence only works well when any animal completes the circuit between the ground and the hot lead.

Although the bees will glue the supers together, a bear will still be able to tear them apart if given a chance. In bear country, strapping the hives down makes a good deal of sense. That way, if a bear does get through the defenses you've put up, having the hive strapped down may frustrate it and save your hives.

How to Start a New Bee Colony

The first year of beekeeping is devoted to getting the hive established. The bees need to get down to the business of reproducing and gathering nectar. As a general rule, any honey that is produced the first year is for the bees. The objective is to build up the hive with more and more bees since the more bees in a hive, the more nectar can be gathered and transformed into honey. Getting the hive through the first winter is the priority. The second year the bees will have surplus honey in the upper supers.

To establish your first hive, you have a number of choices. Many years ago before my homesteading days, I was out walking in a field and saw a massive swarm of bees on a tree. I had no idea what was going on and certainly kept my distance. My only thought was can I outrun this swarm if it decides to turn on me. If I was a beekeeper, it would have been a dream come true to find that nearby swarm. Swarming is natures way of dividing a colony of bees to further the species. For a beekeeper who owns a beehive, if the bees swarm and leave the nest, the beekeeper just lost at least half his/her bees. That's never good so the trick is to avoid that potential loss before it happens.

There's a good reason why bees might swarm. Their home is becoming too crowded. They're running out of room. An experienced beekeeper will be able to judge that the bottom brood supers are full of capped comb with stores of honey and egg cells and another super is needed to let the colony expand. On really hot summer days, bees will group outside the hive at the entrance which is called "bearding." Sometimes the bearding is a precursor to a swarm. Most likely, any clustering on a really hot day around the entrance to the hive is the bees trying to regulate the interior temperature of the hive. Only experience will indicate whether normal bearding is going on to help regulate hive temperature or whether the bees are preparing to swarm.

Catching a swarm is supposed to be quite easy. But proper beekeeping clothing is still required. The bees are filled with honey and with no nest to defend, they are rather docile and can be literally scooped into a box or container. It's important to capture the queen as well. Leave the box open on the ground and try to capture the stragglers. They will migrate to the box on their own. If the colony leaves the box and goes back to the tree, it's a sign you didn't get the queen. Let them settle back down and try again.

The time to start a new bee colony is in the spring. A small package of bees can be purchased as a starter set. The package is usually a 3 pound box containing a queen and approximately 10,000 bees. There's a short procedure to installing the bees. When ready, usually late in the afternoon, spray the bees with a 1:1 sugar mixture to lightly coat them. That will act as a calming trick and they'll focus their attention on the snack provided. The queen will be in a separate screen cage in the box. There's a cover that needs to be lifted off the new box of bees. Under the cover is where you'll find the queen parked along with a metal feeder can. Remove the queen cage and then temporarily replace the cover again. Examine the queen and attendant bees to confirm all are healthy. On the end of the cage is a little cork plug. Remove that and that will expose a sugar plug. Don't remove the sugar plug. That would directly expose the queen to the colony and risk her being killed. The bees will remove it on their own in time.

There are so many ways to introduce a queen into the hive I quickly became overwhelmed. I found information on using a large rubber band, a modified paper clip, screen cage and more. It seems every beekeeper has their own method. The two methods that looked the easiest to me were to push the queen cage into the wax honeycomb on a warm day. Select one of the middle frames and push the cage in towards the top of the frame. Orient the candy end facing down to the hive foundation. Then snug the adjacent frame up to the queen cage for additional support if possible. Or you can use a rim board which is a narrow frame on top of a super to slightly raise it. It's a spacer rim. The rim board allows you to merely lay the queen cage on top of the frames without crushing it when you put on the lid.

All we're trying to do is introduce the queen into the hive without directly releasing her. Then bump the remaining bees to the bottom of their shipping box, remove the feeder can and dump all the bees into the brooder chamber. Set the now somewhat empty shipping box near the hive entrance so any remaining bees can migrate into the new hive. Replace the frames that were removed and cover the hive. They'll need a feeder at this point with the 1:1 sugar water which was mentioned above. Over the next few days, the worker bees will work on the sugar plug to release the queen. The time delay of a few days is for the rest of the hive to accept her since she is not from the same hive as the rest of the bees. Give the hive a week before disturbing it. Then take a peek, confirm the queen is out of her box and remove the cage.

Or another option is to buy a "nuc" or nucleus which is usually a set of 5 frames of honey comb, queen and brood eggs which can be set right into the hive. Either way, it seems a straightforward procedure for getting a new colony established. Over time as the hive expands, but not the first year, it's possible to split a healthy hive in two. That mimics nature, sort of a controlled swarm. The bees are divided into a new hive and then you have a choice to wait and hope the new colony makes a new queen or a new queen can be purchased and introduced to the new hive. But that's getting beyond what we should be focused on. And that's getting a couple of hives established and over wintered.

Harvesting Honey

Harvesting honey is usually done with an extractor. An extractor can be either manual with a crank handle or electric powered. Both work on the same principle, centrifugal force to propel the honey out to the walls of the extractor chamber. The honey frames are uncapped and then placed in the extractor. Having the comb in a warm environment makes the honey flow better when it comes time to extract. It thickens when cold. The honey collects at the bottom of the extractor where a spigot allows drainage into filters for further processing.

To uncap your frames, the easiest method is to use an electric hot knife made for the purpose. The knife heats up hot enough to slice the wax caps off in one pass. Another option is to use a scraper capping tool. Either way, in order to remove honey from cells, the wax caps need to be removed. The benefit to using an extractor is that it's quicker, easier and keeps the comb intact for the bees to reuse. It takes a great deal of time and energy for bees to make the wax comb so if it remains intact, the bees get off to a good start for next years production.

The other method of extraction is to crush the honey comb and put everything in a colander or strainer to drain. Again, warm honey will flow best. You will get less honey next year with this method because the bees have to take the time to rebuild the combs from scratch again. Regardless of which method is used, any wax can be rendered to use for candle making or to use as an ingredient in other products. To render the wax and remaining honey, you could use a solar heater or you could choose to use a double boiler. Set a pot of water on the stove to heat and then set in a smaller pot that contains the wax/honey. The wax will melt and float on top of the honey. Best to use a dedicated pot for this since the pot will be a chore to clean of hardened wax. Pour the liquefied honey/wax into a flat pan to cool and then lift off the wax. This is the same idea as if you made a fresh pot of soup stock from beef or pork bones. Once the soup cools, the fat congeals on the top and it's easy to lift off and separate from the soup stock.

Another option for some is to cut the honey comb into chunks and store it that way. It's safe to eat the wax and is considered the healthiest option since the honey is unfiltered and raw.

One use for beeswax I'd like to mention is for the wood workers out there. I enjoy wood working and there are many recipes for home made bees wax furniture polish. Other uses of beeswax include ointments and salves, lip balm and if that wooden drawer sticks, a rubbing of beeswax as a lubricant on the slide or runner will help make the drawer slide better.

Honey stores indefinitely. That assumes the honey has been harvested at the right time without introducing contaminants and is properly stored. It's best to store it in a dark, cool area in air tight containers. No need to refrigerate honey. Nor should you since that makes it crystallize. If the honey should crystallize, that's OK and normal. The honey is fine. We use honey and that occasionally happens. Johanna will put a clean dish rag in a pot of hot water and then she'll put the jar of honey in the pot on top of the dish rag, which protects the jar bottom and acts like a double boiler. Don't boil or overheat. Hot tap water may work as long as it doesn't cool too quickly. The honey will start to melt. Stirring it will help mix things up and facilitate liquefying. Since we use a wood stove for cooking, it has a large surface area and it's easy to set the pot off to the side where it can remain until the honey is thoroughly melted.

I learned a lot from this research and I hope I've armed you with enough information to give it a try. There are lots of resources with more information. Like anything else, experience will be your best teacher. Good Luck!

Chapter 14 – Introduction to Chickens

“It takes a tough man to make a tender chicken.” I’m dating myself but that was a slogan from Frank Perdue in his TV ads for Perdue chickens many years ago. I’ve modified that tagline to suit me better. “It takes a tough chicken to make a tender man.” I have a fondness for birds in general and have had some amazing experiences with wild birds, but I particularly like chickens. Back in our Maine days, we raised chickens, turkeys, pigs and beef cows for our nutritional needs. We will confine our discussion to chickens for the most part but much of what I write will apply to turkeys and other fowl.

As with any other facet of self-reliance, I suggest starting on a small scale. You’ll want to consider having chickens for both egg and meat production. Even if you have no interest in raising chickens for meat, the inevitable layer cull will need to be dealt with. We will deal with slaughtering and butchering later. But first things first. Make sure that zoning regulations will allow you to have some chickens. There really should be no reason in the world you can’t raise them on your property. They are unobtrusive and should cause no issues for neighbors if this is done right.

“Done right” is the key here. There are two big issues I can think of that could be a problem for your neighbors. Potentially, the neighbors will not be happy if your chickens are roaming around on their property. Surely the neighbors should have no objections to your chickens free roaming as long as they are confined to your own property.

The second issue would be roosters. I cannot know where your homes are located; suburbia, the country or remote so you should at least be aware that roosters crow. And they crow loudly, usually before you and your neighbors are ready to get out of bed. We’ve never had a rooster but we’ve heard the neighbor’s crowing loudly at a couple of our homestead locations. In my mind, there’s only one reason to have a rooster. That’s to fertilize eggs if you have plans to raise more chickens each year. But there are alternatives to the rooster that we’ll discuss. I’ve also heard the argument that hens are happier with a rooster around. Although I’ve never had that discussion with our hens, I have my doubts. They’ve always seemed quite content when I’ve been in their midst, as I balance on one leg, jerk my head spasmodically, and focus one of my cocked eyes back on their beady little eyes!

Chicken Breeds

Chickens are resilient birds and they come in lots of varieties. And just as a pet owner who might favor one dog breed over another, so too will chicken owners have a favorite chicken species that they have come to love. Although I wouldn’t limit myself to any particular breed, I’d start by inquiring what the local feed store or fellow homesteaders in the area recommend. Do you have a preference on white eggs versus brown? We’ve used both and cannot distinguish any taste difference between brown and white shelled eggs. However, there’s a major difference in taste between store bought versus fresh eggs. If you crack open a fresh egg you’ll notice two things. The fresh egg has a deeper orange yolk and the egg white is more viscous as compared to its store bought counterpart.

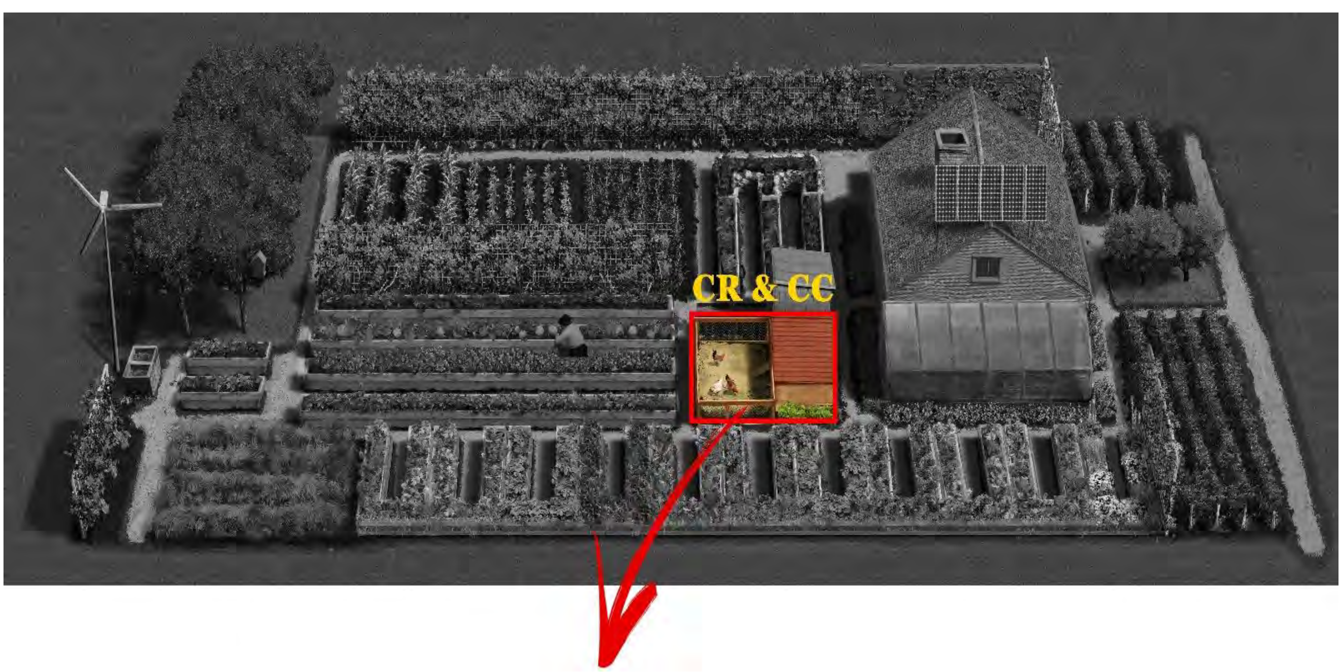
When we raised hens in Maine, we chose Rhode Island Reds which gave us large brown eggs. As the name suggests, their feathers are a reddish, brown color. They are prolific layers that are considered dual purpose birds, meaning they are good for both meat and eggs. Ours were raised for egg production and only became meat when they got too old to be worthwhile layers. Once they start laying eggs at roughly 20 weeks old, you

can figure you'll get 200-300 eggs per year per hen. That's a lot of eggs from one bird. They took well to Maine's long, cold winters and were quite docile, quiet and friendly.

If you prefer a white egg, the White Leghorn would be a good pick. Both breeds are common, good egg layers and will make great choices for the novice or pro. If you want something different, peruse the mail order catalog and make your selection. We stayed with the tried and true Rhode Island Reds, but bottom line is you can't go wrong with either of these 2 breeds.

For those concerned about the noise levels generated by a flock of hens, there are some breeds that are more docile than others. Docile does not equate to silent though. I believe chickens have their own personalities just like any animal. Even out of a flock of the same breed, there will be a few more vocal than the rest. Some of the other varieties noted for being docile and quiet in no particular order are: Buff Orpington, Delaware, Barred Plymouth Rock, Cochin, Australorp, Bantams and Wyandottes. This is by no means a comprehensive list. There are many more varieties and you can certainly mix and match especially if the flock is started from chicks of the same age. Although we only raised Rhode Island Reds as our layers, I can see having multiple breeds around the homestead since some will have a tendency to lay better in the winter. Plus, you may wish to have eggs of varying color and size and the variety of plumage color is always nice to brighten the day. If you really want that rooster around, especially to fertilize eggs, some breeds such as the Buff Orpington and Cochin have a more maternal instinct which can be used to your advantage.

The Chicken Coop and Run (CR and CC)



Chickens are like any other animal in that they need a house, food and water. We had a barn which housed the whole menagerie of animals we raised. Inside the barn, a pen was set up to separate the chickens from the other animals. Inside the chicken pen I built a nesting box on a platform. I had a small hinged door in the barn wall that led to an outdoor run. Spring, summer and fall, our chickens were able to go in and out of the barn as they desired during the day. At night we closed the hinged door to keep out predators such as fox and raccoons. Winter, the girls were locked up in the barn. They had no interest playing in 3 feet of snow.

Maine Barn

If you don't have a barn then you'll need to have a chicken coop (CC). A chicken coop provides protection from weather and predators. It's a place where they can have some quiet time to lay their eggs. It can be a simple building or a castle. What I mean by that is you can make it as simple or as intricate as you desire. No different than our homes. Some coops are set up with a hinged door behind the nesting boxes to make egg collection easier. If I had to build a coop, that would be a feature I'd strongly consider. We always walked into the chicken pen to feed, water and collect eggs. That meant the bottom of our shoes always had the potential to get bits of chicken manure stuck to them. Something we were always aware of before heading back into the house.

Your imagination is the limit when it comes to watering and feed setups. If you are handy, containers of various shapes and sizes and even PVC pipe can be utilized to make automatic water and feed stations. We went with a cheap commercial product from the feed store for our waterer and I had a couple of antique metal feeders from my great uncle that we hung from the ceiling for their feed. Although an easy solution is to put an open pan of water in their pen, don't do it. The chickens will certainly drink from it but they'll also wash their feet in that nice clean water. In other words, that water will get pretty nasty from a bird that feels the need to go wading.

Technically, chickens don't need a lot of room but we were always in favor of giving them lots of space. Our barn stall was 75 square feet which was perfect for the 6-8 hens we had at any one time. Plus it allowed for expansion if we wanted to increase the flock. We had friends that had smaller coops and more chickens in that smaller space and they did fine. Our outdoor run was about the same square footage. In some research I did, I found varying information on the recommended space allotted to laying hens. Information varied even between hatcheries. Some of it depends on whether they are confined to a coop all day or whether they also have an outdoor run or are free ranging. If the girls stay in the coop, 10 square feet per bird is good. If they have an outdoor run (CR- see sketch), then 4 square feet per bird is fine as long as the outdoor run gives them 10 square feet of room each. Those numbers are all well and good but it doesn't take into account those of us that live in northern climates where our hens are snowbound for 6 months of the year. Since they can't get out to play for perhaps 6 months, we allot 10 square feet of coop space per hen and call it good. We can safely add more hens if we wanted without cramping. When birds have more space, they are more content and healthier. For chicks raised for meat, 2 to 4 square feet per bird is OK.

We found the Rhode Island Reds rarely flew out of their outdoor pen so we didn't bother putting a layer of chicken wire over the top. We wanted to leave the top open on their run because that allowed us to throw in feed, threshed grain stalks or weeds for them to scratch through. This kept them occupied and provided an easy way to supplement their feed without going into the barn. If you have birds that fly the chicken coop, chicken wire will need to be installed on top of their run to keep them in.

The nesting box in their pen was the width of their pen with the bottom lined with a little hay or straw to make a nest. We would go in each morning to collect the eggs using a homemade ash splint basket. But depending on how you set things up, there's no reason you can't put a hinged door on the back side of the nesting box to make egg collection easier. You will need to keep a sharp eye out for eggs that have been deposited on the floor of your coop. Most chickens use the boxes but you'll occasionally have one that just has to be different. In the warm months, egg collection can be when it's convenient, but in winter, especially in very cold conditions, you'll want to collect the eggs as soon as you can lest the eggs freeze and crack. Inevitably there were occasions in winter when we didn't make it in time and an egg froze. Not a big deal. That would be an egg we would use in short order in some baked good. Johanna would thaw the egg, pull out her box of recipes and I'd get a cake out of it.

The last item that we had in our chicken pen was a stout wooden pole that was parallel to and a couple feet off the ground. I simply went out into the woods and cut a pole the proper length and about 2-3 inches in diameter. I beveled the ends to a 45-degree angle and in a corner, nailed each end cater-corner to the barn wall. This was where they slept at night. Each night, we could go in and most of the ladies would be perched on that pole. There were always 1 or 2 that liked to sleep on the top of the nesting boxes as well. Their natural instinct is to be on a perch.

We always separated the meat birds from the hens, with the broilers having their own pen in which to grow up. There was not as much space allotted to them as the hens. We didn't crowd them but we wanted them to eat, fatten up and not work off their meals by taking long strolls around their pen.

There are several options to keep the broilers and hens apart from each other. A section of the coop can be fenced off to keep the meat birds separate from the hens or you may have an attachment to the coop specifically built to house the meat birds. Another option is to house the broilers in a mobile fenced area called a "chicken tractor" that is either built on wheels or wooden skids. Wheeled is best! The chicken tractor allows someone to move the chickens to various areas of the homestead so they can scratch around in the soil while at the same time provides shelter from predators and weather no matter where they are currently situated. You can think of it as a controlled free range since you will occasionally move the contraption around to new locations on the homestead. This is great for the laying hens as well so long as you build the chicken tractor with nesting boxes and a perch. For meat birds, neither of those items is necessary.

Starting the Flock

There are a number of ways to secure some laying hens. Keep your ear out in your local area for anybody giving away or selling at a nominal cost a few chickens. Find out why they are getting rid of them. You only want healthy, relatively young birds that are still productive layers. The birds should look healthy, they should be active and curious, their eyes should be clear and the feathers should all be intact. The comb on top of the head and the wattles hanging below the neck should be a full, healthy red. If the birds you get are old and long past their prime, you will be the proud owner of a few pet chickens that require feeding with only chicken companionship and manure to show for it. If the new hens are mature adults bought from someone locally, it's recommended to quarantine the hens for 30 days in a separate area or cage. The idea is that you really don't know what the health of the newcomers is and it's best to be safe rather than sorry. But if these are baby chicks you've raised, presumably they are all healthy and you should be able to bypass the quarantine.

Bear in mind the term "pecking order." There is a definite pecking order which might create some friction when new chickens are introduced to an established flock. Yelling "bad chicken!" when an aggressive bird goes after another will have no effect. There will be some commotion until things are worked out between the hens. What you want to avoid is a chicken or chickens ganging up on a hen and drawing blood or worse, injuring the hen.

When it's time to have all the chickens get acquainted the first thing to do is make sure the new birds are roughly the same size as the older birds so they have a chance to defend themselves. I've read that introducing the newcomers to the coop at night after the main flock has settled in for the night is helpful. I think the easiest thing is to have them in separate runs for a few days. Split the coop with a temporary barrier of chicken wire. Feed and water both sections. The birds will be able to socialize and get accustomed to each other without going into battle. When it's time to let the guard down and bring the family together, let the newcomers out to the outdoor run or free range and after a few minutes let the old birds out. Provide some distractions with a few handfuls of scattered grain treats in their yard or a bunch of hay or greens to scratch around in.

There will probably be a few skirmishes which is normal. If one of the chickens becomes aggressive, and it could be one of the newcomers towards your older ladies, then you might end up having to segregate the aggressive chicken for a few days and then give it another try. Or isolate the hurt bird from the rest of the gang. Having a small partition where the aggressive bird or picked on bird resides but still be part of the flock might help get them accustomed to one another.

Instead of buying some mature birds of unknown quality locally, it's much better to purchase day old baby chicks from a mail order outfit. There are many reputable companies that specialize in hatching and selling various breeds of birds that are shipped via mail. Obviously if you do that, you must be available to pick them up as soon as they arrive at your local post office. The sooner they get into the brooder, the better. It's a stressful trip and an extra night sitting at the post office might make the difference between healthy chicks and dead or dying chicks. We never bought mail order chicks but I'm assuming any shipment will have some good instructions about the care of your new chicks. It's recommended to dip each chick's beak in water before you set it in the brooder. They need a good drink upon arrival and this should get them started.

Another option is to find a local animal feed store in your area. It is likely that once a year, usually in the spring time, they'll have a sale on various poultry. This is what we did for many years. The chicks will already be warm, active and healthy upon arrival. They'll already be drinking and eating so the feed store has done the first steps for you. When you pick up your chicks, you'll be able to pick up feed and equipment at the same time.

As far as meat birds go, we bought day old chicks specially for that purpose. If memory serves me right, they were a Cornish cross broiler. This is a chicken that has been bred for a body shape conducive to putting on weight in a hurry. You'll be amazed how fast they grow. Figure around 8 weeks of growing before they are ready to be butchered, but it really depends on at what weight you want to start the butchering process. Too young and you won't get maximum bang for your effort; wait too long and you'll be feeding the bird with diminishing return and little weight gain to show for it. There will be a few slower growing chickens in the mix so there's no reason the biggest birds can't be slaughtered first while allowing the others to grow a little more.

At 8 weeks of age they should be in a range of 6 to 8 pounds in weight. There might be a few heavier and a few lighter. Depending on your family's meat requirements, you can then start a new batch with mail order birds. Much like a succession planting in the garden, so too can meat birds be raised and grown on a rotating schedule of your choosing to give you all the chicken you desire.

When raising chickens, be aware they are susceptible to various diseases just like we humans are. We never had any disease problems and you may never have to deal with the issue either. Coccidiosis is a parasite and Marek's disease is a nervous system problem. Both of these diseases are frequently mentioned on the mail order sites as major concerns. Inquire from the hatchery whether they vaccinate. Vaccination is a personal decision. There's no guarantee that the vaccine will work since there are multiple strains of Marek's. There's some debate on whether to use medicated or non-medicated chick starter feed or whether to just go right to the normal growing mash. We used medicated chick starter. It was what the feed store recommended. If the chicks were vaccinated from the hatchery, then you can use non-medicated chick starter. When the chicks were old enough, we switched to normal chicken feed. The nutritional requirements of baby chicks, hens and meat birds differ. I would follow the directions from the hatchery in regards to what to feed them and when to switch to layer or growing mash. Then if you run into trouble with your chicks, you followed the hatcheries directions and might have a better chance at receiving further help.

Some of the other more common diseases that affect chickens are Avian Flu, Newcastle, Bronchitis, Fowl Pox and Croup. These are just a few of a long list of over 140 possible chicken diseases. Much more important to us than worrying about what disease our chickens could catch, was focusing on monitoring the hens and broilers, providing a clean, healthy environment for them in which to live and making sure we washed our hands after handling them or other animals so that we weren't responsible for spreading germs. We've lost chickens to old age but have never lost a chicken because of a disease. If we had we would have thoroughly burned the carcass.

Johanna and I are not chicken doctors and we wouldn't expect you to be either. If you find a sick bird, I'd immediately isolate it from the flock. Note the symptoms. Unless you can correctly diagnose the disease, all you can do is make your best guess and treat accordingly. Some problems can be treated with antibiotics. Some may respond to natural remedies such as apple cider vinegar, which incidentally is not a bad idea to add to their water as a normal routine. Use 2 tablespoons of vinegar/gallon of water. It helps with internal parasites. Food grade diatomaceous earth (NOT pool grade as that is dangerous for animals and humans if it's not used for its intended purpose) is great stuff for a garden and can be sprinkled lightly throughout the pen and chicken run, dusted on the birds if they have mites and lice and can even be dusted in their feed as a guard against intestinal parasites. To incorporate it into their feed, weigh the feed, calculate 2% of that weight, add that weight of diatomaceous earth to the feed and mix thoroughly. So for example, if your bag of feed weighs 50#, add 1# of diatomaceous earth. The one thing to know is to keep the dust in the air to a minimum. You don't want to breathe this stuff since over time, it might cause respiratory problems for you.

Several natural remedies exist for treatment of various problems. Cinnamon is supposed to be good for diarrhea. Chopped garlic is another wormer with antibiotic properties. Cayenne pepper is supposed to be good for respiratory problems, as a wormer and I've read where ½ teaspoon added to their feed or water can get them laying eggs again if for some reason they slow their production. Oregano, either oil, dried or fresh leaves, turmeric and black pepper round out the natural herbs and spices that have anti-bacterial properties and can be added in to their feed regimen.

We raised baby chicks a number of times. The proper way to do it is to have a brooder where temperature can easily be controlled. Chicks need a warm place and they will let you know in no uncertain terms when they are unhappy. You will hear the high shrill peeping of the clan. If you ever hear it, it's unmistakable and requires immediate attention. I wasn't fortunate enough to own a commercial brooder. Money was tight and we didn't have the power back then to plug in a heat source such as a light. So we did it the best way we could. I used a cardboard box with a towel over the top. This box was set near our wood heating stove. Good judgment is needed here. We don't want to set the house on fire by sitting the box too close to the stove but we wanted the chicks to be warm. My cardboard brooder box was set on a chair and I could easily gauge how warm it was by feeling the outside of the box, the side facing the stove. This worked out fine for us. There were only a couple times when the fire went out during the night that I had difficulty. The temperature in the house dropped below the chicks comfort level. The house was open concept, including the bedroom, which was nearby. The rooster of the house, me, heard the kids making a racket and I needed to get the wood stove fired up pronto. When we began to sweat because the house was so warm, we had it just right for the chicks. Contented peeps is an indication that all is well.

We solved the lack of a nighttime heat source by putting the chicks to bed with a hot water bottle. This was merely a rubber water bottle we bought from a drugstore then filled each night with warm water. Warm but not hot.

Early on, we learned a valuable lesson regarding chicks and a water tray. Chickens are not the most cerebral of animals and baby chicks aren't too far above amoeba on the intellectual scale. We left their feed tray and waterer in with them at night so they could snack, drink or start their breakfast before we awoke in the morning. One night, some of the chicks felt it was a good idea to sleep in their water. Their shrill peeping during the night told us something was amiss. We quickly warmed them up and from then on, we removed the water dish at night and set it back in first thing in the morning. As it turns out, they slept very well at night for us provided they were warm and dry. I attribute that to the fact we did not have a light source in the box and our house was not lit like a Christmas tree. We used the house lights judiciously plus their box was always covered with a towel come evening. So, when it got dark at night, it was nighty night for them. It's more natural this way.

Another option for a brooder is to use a light bulb as a heat source. Fire safety is paramount so my preference would be a plastic container in that situation. I would not use a cardboard box with an electric light fixture to supply heat and light for the chicks. If I'd had the power, this might have been my choice for a homemade brooder option. Then the brooder could have been placed anywhere in the house convenient to power. I could have regulated heat in the brooder by changing the wattage of the bulb or by raising/lowering the height of the light relative to the bottom of the container where the chicks were. But our hot water bottle did the trick. If you use a brooder with a light source that remains on, there will be periods of feeding throughout the night and the water should remain in place. They need access to water in that event. They'll seek a location in the brooder where the temperature is most comfortable and you can set the water tray away from them.

Regardless of what brooder method you choose, homemade or store bought, you should prepare to be vigilant with their water, food and bedding. They eat, sleep and poop not necessarily in that order. Check the bedding daily. If it starts looking nasty and if the box starts to really smell, it's time to make a bedding change. The frequency of that will be dependent on the number of chicks you have in the box and how big that box is.

Feed and Bedding

Let's talk about bedding. It's important to provide a clean, healthy living environment for your animals. In the chicken pen, a layer of bedding on the floor of the stall gave our hens the perfect medium to scratch around in and at the same time, catch all that wonderful manure that they deposited. When I first moved to Maine, I had a portable sawmill cut all the lumber for my new house. I had lumber, slabs and a big pile of sawdust. Sawdust was a good bedding for the grown hens. But it killed some of our meat birds when they were young. I made the mistake of assuming sawdust would be a fine bedding for our baby chicks once they were old enough to be moved from the house to their barn stall. It didn't take too long before we noticed a few dead birds that seemed to have a major case of constipation. I concluded the chicks were eating the sawdust as food. We immediately removed the sawdust and replaced it with courser material and some dirt and had no more problems. We had learned a valuable lesson.

Years later in Saskatchewan we bought a chipper. The machine makes a nice mulch and bedding from small trees and branches. If you can find a source of course, chipped branches, they would be great. Shredded paper, straw, or shavings from a wood working manufacturer are also great choices. For many years we threw a layer of straw down on the ground. When the bedding got nasty, we threw another layer of clean straw down. We repeated this process through fall and winter and then in the spring, it was time for house cleaning. We raked the old bedding into a pile, shoveled it into the wheelbarrow, wheeled it to the compost heap then mixed it in. We've also used old hay bales that were no good for feed as bedding, but that would be my last resort. The chickens will work it over pretty well but any weed seeds they miss will make it to the garden eventually. If the internal temperature of the compost pile gets warm enough, it should kill some of the weed seeds but if it doesn't, you'll be spreading weed seeds on your garden when you spread your compost.


Winnowing Threshed Grain

There were only two times in the year we let our hens out to forage. Spring before planting and fall after the harvest. Once the garden was planted, they were confined to their quarters. That garden is our food supply and chickens scratching around for our seeds or devouring the young seedlings would ruin our day. But when they are free ranging around the homestead, they should be encouraged to be in the garden, especially as soon as the soil is tilled. Weed seeds and over wintering bugs make tasty meals for them in the spring. And in the fall, there are lots of insects that had planned to spend their winter in the soil. The manure they drop is a bonus.

You should be aware that once each year, during the molt, egg production will slow or cease completely. It's a natural cycle chickens go through and it will vary in duration between chickens. The shorter, cooler days of fall trigger the molt and the birds start losing their feathers. Don't fret about that. They'll regrow and once the molt is over, they'll start laying eggs again. We never changed their feed during the molt and they were always fine.

In addition to the standard layer feed, any kitchen scraps were always tossed into their pen daily. There's no point throwing it direct into the compost bin when there is some nutritional value that can be gleaned by the chickens. It's just another great way of using waste to feed the chickens and let them process that waste into a super fertilizer in the form of droppings. What material they don't eat mixes in with their bedding and is churned up and ready to be composted when the time comes to clean the pen. We grew sunflowers and some field corn for animal feed. When the seeds turned black on the flower heads, we cut the head off and stripped the mature seeds by hand. We weren't fussy about cleaning the head completely. After we gathered the bulk of the seed, we stored the stripped heads in the barn. Each day, we'd toss in a couple of heads to the hens. There were always lots of seed left in the head, especially around the perimeter, for them to forage on.

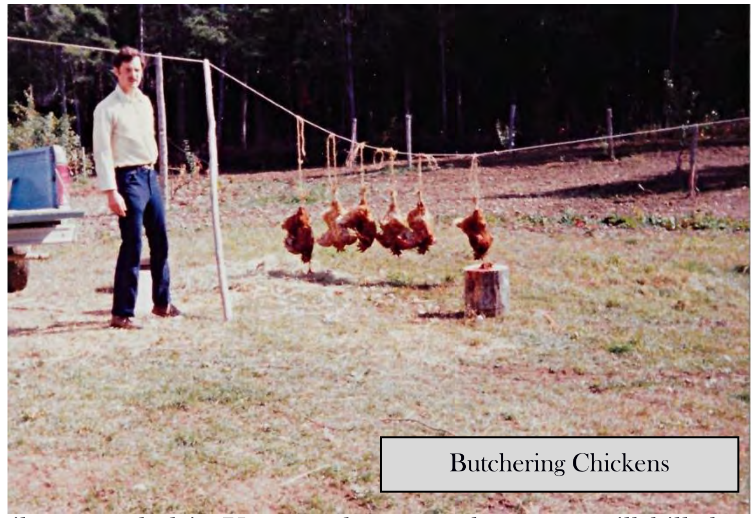
If you have spare land, you can try growing some grains to supplement their feed, or perhaps grow it all. We grew wheat, rye, barley and oats some years but we came to the conclusion it was easier and cheaper to buy a sack of threshed grain. Growing and threshing grain takes work and our yields weren't all that great. If you are lucky to have a farming neighbor in the area, check to see if he/she would sell you a few sacks of whatever grain is available in the fall during harvest. If you go to the trouble to grow your own grains, once you have threshed the grain (removed the seed kernel from the stalk), the hens will love you if you throw the stalks in their pen. There's always some grain that you missed and the chickens will scratch around and find it. At the same time, the stalks become fresh bedding.

Probably the most practical grain a small homesteader without equipment can grow is field corn. We always grew Mandan Bride, an open pollinated variety that had multicolored kernels. Planting, growing, harvesting and shucking field corn is relatively easy. The process is no different than raising corn on the cob for human consumption except the corn is allowed to mature and dry before harvesting. Where the deviation occurs is what happens after the cob has dried. The simplest thing to do is to shuck it and then throw a few ears into the chicken pen and let them peck off the kernels which is what we did. We threw the shucked material into their pen as well and let them work it over. Realize that corn is only part of a balanced diet and shouldn't be fed exclusively. If you had a grain mill, you could always grind up various grains along with the corn to make a more balanced meal. We bought the sacks of ground chicken feed from the local feed store letting the corn and various grains we grew be supplements and treats.

At harvest time, you have a choice on how best to store the field corn you grew. You can cut the stalks at their base, tie a bunch together pyramid fashion and store stalk and ear together outdoors in what's called a corn shock or you can pry the ears off the stalk and store the corn still in its husk, indoors, until it's needed. I wouldn't shuck any ears until they are fed to the hens. No need to make it super easy for the inevitable barn mice to have a feed.

Chicken Processing

And finally, we come to the time when the meat birds we raised were mature. What do we do now? It was always tough for me on "game day," the day when Johanna and I teamed up and slaughtered and butchered our meat birds. I had no qualms about considering our layers as pets since they weren't destined for the chopping block, but the meat birds were raised purely for food and we treated them as such.



Butchering Chickens

Here are the key points in regards to chicken slaughtering and butchering. The night before, withhold all food from the chickens. There's no need to waste the feed and we want to clean out their digestive systems. Allow them plenty of water though. On the big day, have everything prepared. Wear old clothing for this job. You will need at least one large kettle of scalding water possibly more depending on the number of chickens you will be doing that day. Having a second pot of hot water assures there will be no hitches should the first pot cool too fast or things take longer than expected. In our case, we heated the water on our wood stove and left it in the house, on the wood stove, until we needed it. You need a spot where you will kill the chickens and a way to hang the birds for proper draining. In our case, we had enough string nooses for the number of birds we planned to kill and enough nails on a barn beam or "S" hooks for hanging them from a rope we strung up. We placed a noose around the legs in preparation for hanging.

We had a clean, work station where we could gut the chickens and Johanna could cut them up further. Keep in mind, there are multiple ways of doing the killing itself. When I did it, I used a chopping block and a very sharp ax. It must be a well sharpened ax. This is not the time nor place to take whack after whack to sever the head. One whack has to do it. I had a block from a large log and I pounded 2 nails about an inch apart off to one side of the center. In as calm a manner as I could, I went in to fetch a chicken from its pen; I came out and Johanna immediately wrapped a noose around its legs. While she held the legs, I gently laid the chicken on the block and stuck its head between the 2 spaced nails. The nails were there to hold the neck in place while Johanna stretched the body slightly elongating the neck. In one swipe it was all over. The chicken will flop around involuntarily but it's over at that point. As soon as the head was off, the chicken was hung on the nail or line to drain. One important note here that pertains to slaughtering any animal. It's critical that the animals remain calm. Chasing them around the yard just before slaughter will have an adverse effect on the quality and taste of the meat. Chickens should be confined to their pen and when it's time to snag the first bird, slow movement in the pen will keep the rest of the flock from getting too excited. Corner a bird and like lightning, grab the legs, cradle the bird so it remains as calm as possible then get on with the task.

If ax and chopping block are uncomfortable for you, you can buy or make a cone that the bird goes in head first, upside down. That setup supports the bird while exposing the neck. Then with a very sharp knife, you would sever the neck artery and allow the bird to drain.

In all butchering, a couple of razor-sharp knives will make things so much easier for you. Since I work wood with hand tools, sharp carving knives and hand plane blades are a must. I sharpen Johanna's kitchen knives the same way as my blades. I use course, medium and fine sharpening stones to start with. If I take 8 swipes of the blade on one side, I take 8 swipes on the other side, working my way from course to fine stones. I'll check the sharpness using my fingernail. If I set the blade at a slight angle on a finger nail, it better dig in immediately. Then I angle the blade in the opposite direction and it should dig in that direction as well. That tells me my blade edge is fairly uniform and meeting at an edge. But there's probably a microscopic burr at this point. So I next take a piece of leather, apply some honing compound and I rub each side of the blade edge on the leather, slowly and steadily, as if I were using a barber's strop. Finally I take a piece of cardboard and strop the blade again on each side for a few passes to polish the blade to a keen edge. When I'm done, I can take a blade, shave my arm and the hairs will pop off. Now I'm ready to do some work!

Back to chicken butchering. After all the chickens were dead and hanging, we brought the hot water kettle out. The purpose of the scalding water is to facilitate the removal of the feathers. The first chicken came off the line and was dunked and swirled around in the scalding water for 5-10 seconds depending on how hot the water was. We held it by its feet when dunking. We quickly pulled it out of the water and attempted to remove some of the bigger feathers. They should slip out easily. If they didn't come off easily, we dunked the bird for another short spell. We didn't want to scald the bird and cook the skin, we merely wanted them in the hot water just long enough so the feathers could be removed easily. You'll have full hands of feathers so a rag to clean your hands will be handy. We kept plucking until all the feathers were off. We didn't worry about some small missed feathers. They were dealt with when we were ready to butcher them. Time was of the essence here since the water was cooling off. In rapid succession, we dunked and removed feathers from all the birds. Having that second pot of hot water waiting on the wood stove was vital in case the water cooled too much.

Most of us have bought and cooked a whole chicken or turkey. We've inserted stuffing in the cavities for that special feast. The idea here is to render our chickens to the same condition as the store-bought bird. As a suggestion, buy a whole chicken, study the layout and use it for this basic chicken anatomy class 101. Find the breastbone as a reference point. Study the backbone especially around the tail bone. Take a peek inside the cavity and note how clean it is. The process of getting your home-grown bird's appearance to match that of the store bought bird will be a learning experience. Unless you do this job often, it's like anything else, you won't be proficient. We do the best job we can and that's good enough. The more birds you do, the more confident you'll become and the next time you do this whether next week or next year, it will definitely be easier. Don't fret that you are making a mess of things. We surely did when starting out, but we improved with each bird we did.

Let's start by cutting off the feet. Until a few minutes ago, those feet were running around in an unsanitary pen with manure so they are the first to go. Find the first leg joint and work the knife in to sever the feet from the legs.

At the neck, gently cut the skin to expose the crop, trachea and esophagus. In many cases, you'll find, you will have more control if you hold the knife with the cutting edge facing up while you work. In other words, if you make an incision and work the knife with the blade up, you have much more control in your cut. If the blade is down, you are using downward pressure with little control. You should be able to make an incision and gently run the knife lifting up as you cut. If that knife is sharp, it will take little effort to make a precise cut, thus minimizing the risk of cutting through organs underneath. In essence, the knife is lifting the skin ahead of the cut.

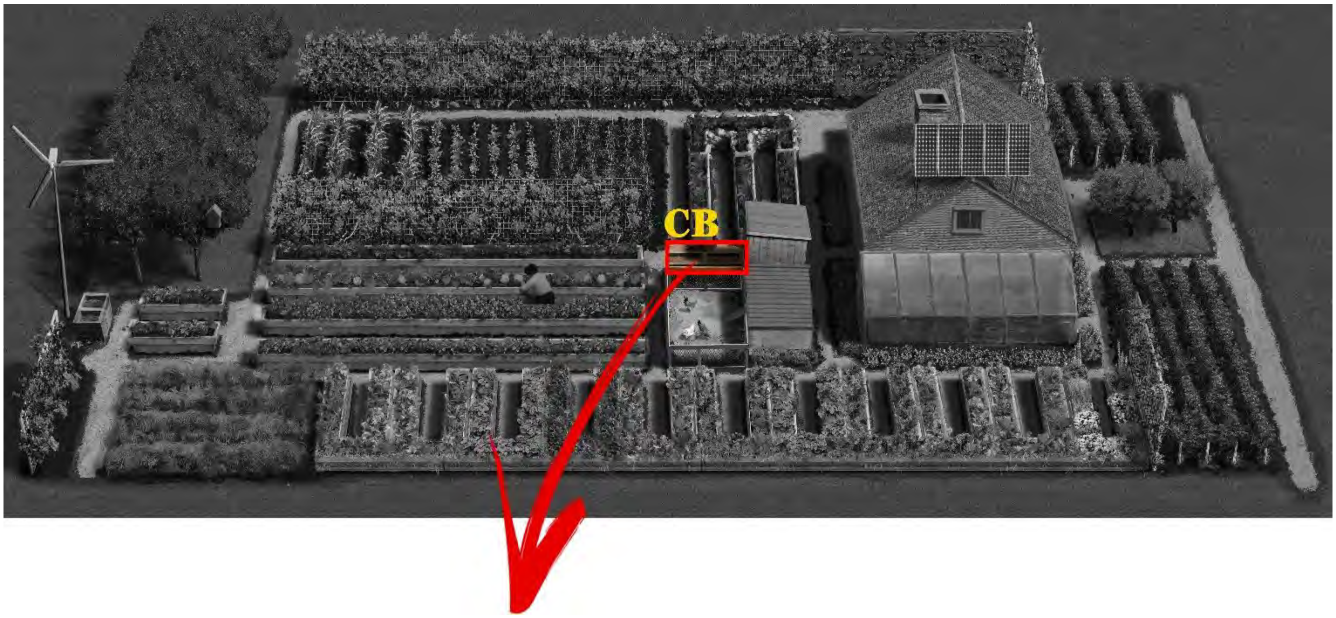
The trachea and esophagus are the 2 tubes running from the neck down into the body cavity. As soon as they are exposed, work your fingers in to loosen and separate those items from the neck. You want to use your fingers as much as possible because the knife might damage the crop. We'd like to avoid that if possible. Reach down at the base of the neck and loosen as much as you can. Then with your knife cut through and remove the trachea and esophagus along with the crop and neck skin at the base of the neck. Pull or cut the skin free as needed to expose the neck muscle/bone and everything at the top end will be clean. Cut the neck off and throw that in the soup pot.

On the other end what we're trying to do is cut around the tail piece and around the vent (anus) without cutting the intestine. Take your time and slowly work the knife down on each side of the tail and vent area; it's the fatty triangular piece on the bird's rump that also has the oil gland. If done right, it can be loosened free from the bird but still be connected by the intestine. You don't want to cut into the intestine. Now that the triangular flap is loose, you should see a small hole going into the abdominal cavity. Use the knife to carefully open the cavity up to the breastbone. Remember to have the knife edge facing up as you cut towards the breastbone. At this point what we are trying to do is create a hole big enough to reach in a hand. Work your hand into the cavity and loosen the guts as you extend your fingers towards the neck area. The guts should all pull out as one package. Keep working until the guts are free of the bird. The guts and the triangular tail/vent piece will be part of that. Set them aside for a minute. Use your fingers to scrape the abdominal cavity clean both along the spine and along the underside of the breast. As you dig around, the last thing that will need to be found are the lungs on the rib cage. They will be a pink color. There will be 2 lungs, one on each side. Dig in with your finger tips and remove them. Once you are satisfied the bird cavity is fully cleaned out, the last step is to rinse the bird well inside and out. Now it's ready for processing. Good job! The next one will be easier.

Before tossing the guts, remove the heart. If you desire, you can also remove the liver but be careful. You will notice the gall bladder which is a small sac attached to the liver. Cut that gall bladder off but give it a wide berth. It's better to lose a small piece of the liver than to cut the gall bladder and spill the bile. We never utilized the gizzard but that can be cut open, cleaned and used as well. We usually had a hog that the guts were fed to so nothing went to waste.

This entire butchering process is a reality that we as homesteaders and people interested in self-reliance need to cope with. If we buy meat from a store, we have no idea what conditions the animal was raised in, what feed it was given during its life and how it was treated at slaughter. When we raise an animal for meat production ourselves, we do know. Nevertheless we always were glad when butchering was over and we felt grateful to the chicken who gave its life so we could eat. For information on how to process your home-grown chicken for the freezer or for canning, see the Food Preservation chapter.

Chapter 15 – Composting (CB)



Composting is a wonderful way to recycle and reuse some of the waste stream we generate from our daily living. Composting is the process of taking organic matter and breaking it down into building blocks that plants can utilize to grow. The faster one can do that, the better. Decomposition occurs when microbes, bacteria and fungi all work together in a symbiotic relationship. Throw in some earthworms to do their magic and pretty soon, we're making soil from waste. Our job is to gather and recycle the materials and provide an environment conducive to all those microorganisms. Compost is indispensable for an organic garden. It creates a light, porous soil texture needed for plant growth and it's a top rate soil amendment that can convert clay or sandy soil into a rich, productive loam.

Nature takes care of creating a growing medium. Plants and trees die and decay; such is the cycle of life. That natural process continually adds nutrients back to the soil. Our task as gardeners is to mimic nature and add back the nutrients that are taken out when we grow a garden. I look at it this way. Consider the soil as a bank. If year after year, you continue to grow crops (withdraw from the bank), without making any deposits, the soil will eventually become completely depleted (the bank account goes to zero). It simply can't grow anything anymore. Unless deposits are put back into the bank, all the nutrients are gone. Addition of compost is analogous to depositing money in the bank.

Composting is a relatively simple process. Merely take a bunch of organic matter (plant waste and debris from the garden such as corn husks and stalks, plant stems, potato tops etc. that are generated through the summer), a nitrogen source (manure, urine or blood meal), some moisture (as in water), layer all this in a pile (CB) and voila decomposition gets under way with the result being a crumbly black substance that is worth its weight in gold to the serious gardener. Other sources of organic matter are: eggshells, coffee grounds, tea leaves, kitchen waste of vegetable and fruit peelings (do not use bones, fat or meat trimmings), wood shavings and saw dust (if you have a wood worker in the family you're in luck), pine needles and shredded brush and twigs. One cautionary note, do not use any diseased plant matter in your pile. Doing so will risk spreading the disease.

Log Cabin Style Compost Bins in Saskatchewan

There are numerous ways to get your pile going with the simplest being just to build an unconfined pile on the ground. But most people, us included, use some kind of structure for sides to keep the pile tidy. Multiple options exist for the wall of your compost bin: a circular or square bin made of wire fence, cinder blocks stacked atop one another, dimensioned lumber, snow fence type material and even poles stacked up log cabin style. We used this arrangement in Saskatchewan where I cut some small trees, limbed them, then Johanna built our log cabin-like compost bin. We always build two bins side by side which makes working the compost easier. We've also used dimensioned lumber and as a teen Johanna used spare cinder blocks her Dad had laying around. Each worked satisfactorily.

The next step is to assemble your ingredients as listed above. Begin by first putting down some coarse material such as brush to form a base. Then add about 6" of organic material, a 2" layer of manure or a sprinkling of another nitrogen source (see above) followed by a thin layer (about 1/4") of topsoil. You can also add a sprinkle of wood ashes or lime if you wish. This formula is not rigid. Just make sure some of each ingredient finds its way into the pile in layers and you should be fine. Dampen with enough water so everything is moist but not soggy. Build the layers as material becomes available until the pile is 3' to 4' tall. Then wait for the magic to begin.

Compost Bins next to Maine Garden

If you've done everything right in a few weeks your pile will begin to shrink. Don't despair. This is good. The microbes in the soil are doing their thing, decomposition. Two to three weeks after you build the pile you should turn it with a shovel or pitchfork. We always have a two-chamber compost pile going so it's a simple matter to flip the stuff from the new pile into the empty bin. When you turn a pile, ideally you want what was on the top to be on the bottom and what was on the outside edges to be in the center. Tossing it all into the next-door bin makes this easy. Giving the pile a second turning in about three more weeks is beneficial too. If you have a third bin for this final turning it makes the process easier but we didn't so we just tossed the material around in the second bin. One factor that effects the speed of decomposition is your climate. Cold slows down the process considerably. Freezing weather stops it completely until things thaw and warm up again. We figure a year to make compost in our climate. Depending on your climate, mix of ingredients and pile size, you may be able to get compost quicker.

If you're in a hurry you can speed up the decomposition process by shredding all material into small pieces. In lieu of a shredder you can chop up your larger pieces of garden waste such as pea and bean vines, tomato, potato and pepper plants by hacking them up with a spade. Johanna gathered the garden waste each fall and I put a layer into the compost bin. Then I got in the bin with a spade shovel and chopped. I added more materials and repeated the process. Johanna has used loppers to chop up standing corn stalks before adding them to our compost pile too.

More frequent turning, as often as every third day, is also required for a quick turn around. By inserting a vent pipe such as a piece of perforated drainage pipe into the center of the pile, aeration of the pile can be improved thus accelerating decomposition.

You never have to worry about compost burning plants or applying too much of it. Most often it's applied about 1" thick then worked into the soil prior to planting (one of the benefits of raised bed gardening is the compost is right where plants need it and not wasted in a garden path) but it can be used as a side dressing fertilizer part way through the growing season too.

If you are lucky enough to have a large pile of animal poo that can't be fully incorporated into the compost bin system, cover it with a layer of dirt or some organic material to help prevent nutrient losses to the air or through leaching. Black plastic would work too. The heat of decomposition should destroy pathogens and weed seeds. Well rotted manure is a soft crumbly, earth smelling material that will not burn plants and is safe to apply any time during the growing season.

Recycling Human Waste (HMC)

And finally, let's talk about the ultimate in recycling, that of recycling human waste. From day 1, we have utilized our urine as a fertilizer and as long as we breathe, we will continue to collect that resource. Recycling urine, which is high in nitrogen and a few other elements, is a wonderful way to utilize what comes out of our bodies as waste. In Maine, we had an outdoor outhouse, but used a portable camping toilet at night to collect and hold urine. Once a week, we emptied the holding tank compartment outside and gave it a good scrubbing. We never emptied the contents directly on to any plants, but instead used it as a side dressing around fruit trees, berry bushes and down the corn rows.


Maine Outhouse

When I first moved to Maine, I built the outhouse on a dirt mound. With door wide open, it was my throne to look out over my kingdom. Because the outhouse was situated atop a small hill, years later when the outhouse filled, I was able to dig an access hole and retrieve all those years worth of composted waste which we used on the ground around the orchard trees.

In Saskatchewan, we upgraded by moving the outhouse indoors. In the bathroom, I built a bench seat platform with a urine diverting toilet seat. We used a large plastic container to collect solids and the urine was diverted to a bucket underneath the bench seat. Access to both was by a hinged front door. I modified a one-gallon heavy plastic maple syrup jug to serve as a urinal. My urinal was a Ron original, patent pending, high tech affair which is unlikely ever to be duplicated due to its complexity! Just kidding. It was merely a plastic jug mounted on the bathroom wall with the drain tube emptying into the same urine bucket underneath the toilet. So, in other words, my urinal and the urine diverting toilet seat funneled into the same bucket which was emptied every 3rd day.

Both solids and liquids have high fertilizer value and we don't want to waste either of them. Roughly every 3 months in Saskatchewan, I took the tub of solids out to a dual bin compost pile. This dual bin compost pile (HMC) was completely separate from and unrelated to our garden compost pile. That's important. This human waste must be handled differently from standard animal manure and garden waste. I dumped the container of solid waste into the "fresh" material bin, spread it evenly, then completely covered it (1 ½ to 2 inches) with mulch. It would take a year to fill up one side. Once full, I left the material in that side of the bin to decompose for another year while the other side was being filled up. That made a 2-year rotation. Each year, we emptied out a bin.


"Patent Pending Urinal"

In our case, because we have a chipper, I used chipped brush to cover any new waste every time it was added and used a thick layer of it to top off the pile when the bin was full. We wanted to minimize leaching from rains and snow and in summer we did not want any exposed waste for flies. Before replacing the emptied tub back under the toilet, I would liberally sprinkle wood shavings or chips on the tub bottom which helped to prevent the fecal mass from sticking to the bottom of the container. It essentially made completely dumping out the contents much easier. We are doing the exact same procedure here at our last homestead.

After a year had passed, I dug out the finished compost from last year's bin and sprinkled it around the fruit trees, (never in the vegetable garden!), and immediately but lightly tilled it in. Again, the composted manure was never left exposed. Although the material had composted for a year and looked like a crumbly, rich soil amendment, I still treated it with respect. I wore long sleeve shirt, long pants, gloves and boots when handling the material. The wheelbarrow and shovel I used were thoroughly washed out and then set aside to sit in the sun for a week. A little bleach added to the rinsing water would be good as well.

You will note that I also located a couple of raised container tubs (RC2) in this area. I didn't want to waste the space but by the same token, I didn't want a ground level vegetable bed where leachate from the human waste might enter.

Here in Nova Scotia, we've incorporated a commercially available composting toilet into our bathroom that uses the same concept as the homemade Saskatchewan set up, namely that of keeping the liquid and solid waste separate. The commercial version diverts the urine into one container and the solids go to a plastic, removable container. We will handle the contents of both containers the same way as we did in Saskatchewan.

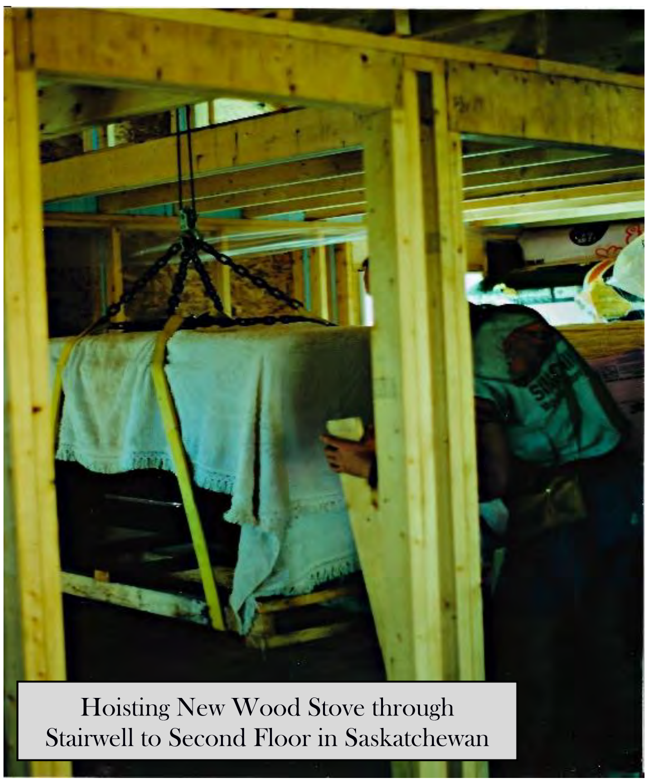
We have long winters with snow, and good spring rains. In the fall, once the garden has been completely harvested and tilled for the season, we have no concern pouring and spreading all the urine generated through the winter on the tilled garden. By the time spring rolls around and all the snow has melted, any urine from the preceding winter is quite diluted. Additionally, I always deeply till the garden again in the spring to fluff it up and make ready for the summer growing season. Once the garden is planted, most urine is dumped out in the orchard or on to the compost pile. A side dressing of diluted urine might be in order for something like corn.

Chapter - 16 You Can Do the Impossible

Throughout my many years of homesteading, I've had to be creative and overcome challenges mostly due to the lack of power equipment or help. I started homesteading alone and many times I had to struggle to accomplish a task that would have been easily completed had I had help. Once Johanna came on the scene, I had an extra set of hands which helped enormously but there's only so much she is able to do. This chapter is written not only to pass on some of the ways I was able to get things done, but also to offer encouragement that seemingly impossible chores can actually be done by a lone person. I won't say the doing is easy. Without help any task will take much longer, but it can be done.

Tools of the Trade

I'd be dead in the water if I didn't have simple tools and a basic understanding of mechanical principles. Here is a list of the tools and accessories I always want available to me that I keep in my tool shed (TS):



Hoisting New Wood Stove through Stairwell to Second Floor in Saskatchewan

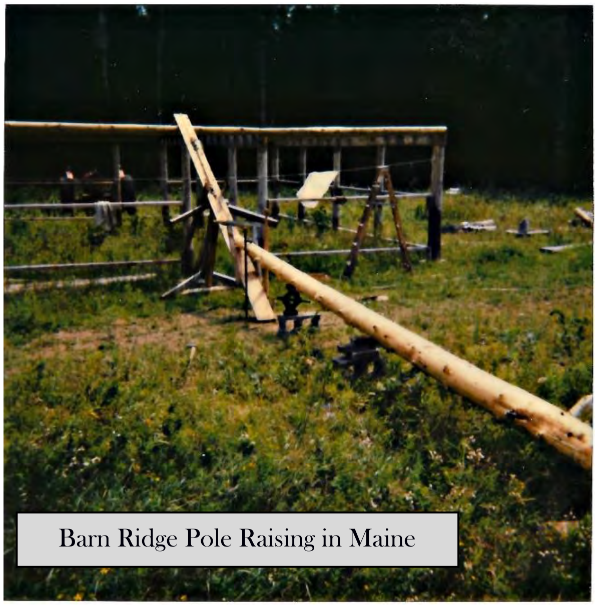
Heavy duty come-along also known as a hand winch, pry bars, various sized pulleys (single, double and triple sheave) to make a block and tackle, various sized ropes, chains of varying lengths with both grapple hook and choker hook, logging felling lever, logging peavey, nylon web sling tow straps, hydraulic bottle jack, scissors jack, heavy 4 wheeled dolly, handyman or hi-lift jack, snatch block, hand truck, steel wedges, sledge hammer, chainsaw, ax and wheelbarrow. It's amazing what can be accomplished with these tools.

The thing all these items have in common is they're based on the six different simple machines we learned about as kids in school. The lever, wheel and axle, wedge, screw, inclined plane and pulley. There are many fine books in the library and lots of material on the Internet for those who wish to learn the nitty gritty about each of these machines. There's a lot of math and theory too. But for the most part, we don't need to delve into the technical side. Instead, let me give you some real-world practical examples of how I have used many of these items.

Real World Examples

While in Maine, I logged professionally for 18 years and cut down thousands of trees. Using a felling lever or pounding in wedges makes dropping a tree exactly where it needs to go a cinch. As a result, rarely did I miss my target and have the tree fall in an undesirable location. You can accurately drop a tree wherever you desire if you assess the tree's lean and use wedges or a felling lever when cutting the tree. Slowly make your back cut and either start a wedge in or slip the felling lever in so if the tree decides to lean back into your cut, your chainsaw bar won't get pinched. If you get the chainsaw stuck, you will be adding new words to your logging vocabulary. So don't get the chainsaw bar pinched! Over the years, you may have seen a news report or video where the tree being cut down drops on top of the house. That's what you call a big "oops." Chalk that up to poor technique, bad judgment and not using proper tools to one's advantage.

Wheel and axle. This is an easy one. Over the years, I've probably moved a gazillion pounds of dirt, concrete and rocks in our wheelbarrow. While a wheelbarrow with a single wheel up front is a bit more maneuverable, I favor a double front wheel model for its stability.


Barn Ridge Pole Raising in Maine

Many years ago, when I built my barn in Maine, I had built the basic ground level structure and it was time to tackle the roof. I needed to get a ridge pole up to the second story and then into position to accept my roof rafters. The only problem was this was a freshly cut spruce tree 34 feet long x 12 inches at the butt. It was a big tree. I used an inclined plane and farm tractor to raise the ridge pole. Here's how. I placed a heavy plank from the ground up to the first floor of the barn at roughly a 45 degree angle which became my ramp. I oriented my ridge pole in relation to the barn so that the small end of the log was ready for a trip up the inclined plane. The idea was to slide the entire ridge pole up the ramp until it was firmly sitting on the top floor of the barn. I had a small farm tractor which I positioned on the opposite side of the barn. I threw a rope across the barn and attached one end of it to the tractor and the other to the small end of the log. I slowly moved the tractor forward in stages and used it to drag the ridge pole up the inclined plane by its small end. Periodically I ran around to the ramp to make sure the log was still centered on the ramp. Ultimately the 34 foot tree made it to the top floor of the barn. That's how one man, working alone, with only a simple tool, the inclined plane and a tractor can do the work of several people.

That was the easy part. Now I had to raise that ridge pole up about 5 feet and set it on 3 support posts to form the roof ridge. I used a handyman jack and blocking to raise one end up at a time and by working my way back and forth between ends, I was able to eventually get it to the proper height and slide it on to the support posts. My ridge pole was in place.


Using Straps to Lift Roof Sheathing in Nova Scotia

I've used towing straps to good advantage and recently used a couple during our home building in Nova Scotia. All the roof trusses were in place and I needed to sheathe the roof with ¾ inch OSB sheets. Those 4 X 8 sheets are heavy and I had a lot that needed to be moved from the ground up to the roof. No way was I lugging one of those sheets by hand while walking up an extension ladder to the roof, let alone a pile of them. I needed to come up with a solution and the towing straps were the answer. I favor the straps that have a loop in each end as they are useful as a handhold.

To get the OSB sheets up to the roof, I fashioned a sling from 2 straps which held a sheet of OSB. I used a third strap attached to the sling to pull the sheet up. The 3 straps were arranged in a “Y.” Johanna and I carried a piece from the lumber pile to the ladder. We stood the piece lengthwise on edge and looped the 2 ends of the “Y” under each of the 2 bottom corners. I scaled the ladder and using the ladder as a nearly vertical ramp along with brute force, I was able to pull the sheet of OSB up to the roof using the third strap. Then I disconnected the straps so we could repeat the process until I had all the sheets up on the roof.

Because each end of the strap has a loop, if you slip a free end of the strap through the loop on the other end, you make a choker strap. A choker strap is very useful since the strap cinches tight around whatever object you fasten it to. Maybe you have a boulder that needs to be dragged out of the garden. Using a strap as a choker, you can loop the strap around the boulder and snug it tight. Chances are now good that you can drag the boulder either by muscle power or with a machine such as a tractor or ATV.

If you have 2 straps, you can make a long one by slipping one strap end through the other strap’s loop and then back on itself, essentially making a choker through the strap loop. But be careful. If there is a lot of tension put on that junction, it will be a bear to separate the 2 straps when finished. Inserting a stout stick or pipe in the junction can help make disassembly easier.

To use a tree as an anchor point, around the base of the tree, you can position a chain or a strap fashioned as a choker strap. The strap won’t damage the tree the way a chain might. Using either is an easy way to make an anchor point for a come-along. If you use a tree as an anchor point for winching, pick the strongest tree and make sure you use the base of it to secure your device. If you were to anchor higher up, depending on the size of the tree, you run the risk of winching the tree over instead of pulling your load. In other words, the load will act as the anchor point and pull the tree over.

We own a stout, 2 ton capacity cast iron come-along that’s been an invaluable tool for us. There are good quality come-alongs and light duty gizmos, which I wouldn’t touch. Look at the cable. Is it less than ¼ inch diameter? If it is, I’d pass on it. Ours has a 5/16 cable and is made for some rugged work. Going back to the tree example in the previous paragraph, I used exactly that set up to clear the garden area of trees in northern Saskatchewan. Much like the pioneers of old, we were creating a brand-new homestead from virgin wilderness forest. We didn’t have draft horses or oxen to help clear the land. We did it all by hand with a chainsaw, manual tools and person power. Using the hand winch and chains, I mounted the come-along to the base of a tree in the garden and then ran my cable out to a nearby tree I wanted to remove. I connected my cable end to a choker chain that I placed as high as I could reach on the tree I wanted to pull out and then I used the winch and the leverage of the tree itself to topple it over. I continued to winch until tree and roots were

Hand Winching Stumps Out of Saskatchewan Garden out of the ground. A tedious process. Our winch has a pulley on it which allowed me to double my pulling power if need be.

This is an important point in the use of the come-along. If you anchor the come-along at one end and then feed the cable out to the object you are winching, that single line is carrying the entire load. As you try to winch it in, you are exerting full effort. But a good hand winch will usually have a pulley with a hook on it. If you run the pulley out to your load and connect the load to the pulley hook, then bring the cable end back and hook it to the winch, you have in effect 2 lines going to your load with each line carrying half the load. The effort you need to expend to pull the load is now half what it was with a single line.

Had I needed to change pulling direction when I was winching a tree, I could have employed a snatch block which is a pulley with a side plate that opens so the cable fits over the pulley without having to be threaded through the opening. Once the cable is over the pulley, close the side plate and I'm ready to winch. Anchor the snatch block to an object that will force the load to change to the desired direction. When the winch or come-along is engaged, the load will be pulled to the snatch block thus changing direction.

Johanna's new wood cook stove was delivered last year. At 450 pounds, it was all I and the driver could do to manhandle it through the front door. Actually, it was still hanging out the front door when the delivery driver made his escape and drove out of here at warp speed. But it was partially in and believe it or not, it was very easy from that point on for me to move the stove around the house. The stove was mounted to a pallet. I used a handyman jack to lift one end just high enough to slip a ¾ inch galvanized pipe under it. I simply rolled it forward a few feet and Johanna slipped another pipe under the front end. When I rolled it forward again, the first pipe became free and we just incrementally rolled it to its location. So when moving heavy objects, wood dowel rods or pieces of pipe make great rollers. When it was time to install the stove, I used my scissors jack and blocking to raise the stove high enough to slip a heavy duty dolly underneath so I could roll the stove around and get it properly positioned for installation.

One last example of this principle. I was alone out in the bush of northern Saskatchewan tending an exploration camp. The camp had a big diesel generator weighing probably 1000 pounds in a shed. This shed had one side open so the generator was accessible. Camp was going to be shut down and the generator needed to be airlifted by chopper to another location. I was asked to either move the generator outside or to take the roof off the building if that would be easier. I opted to move it out of the building. This was a case where I used a winch, jack, blocking and rollers in combination to ultimately get the generator out of the shed and ready for helicopter slinging.

Safety First!

None of this stuff is a big deal. I don't want to come across as a superhero. You can do these things too if you have the gear. These are just examples of some of the objects I've had to move around over the years which would have been impossible without simple machines. There's no doubt that somewhere along the lines, you too will be faced with moving a stove or other dead weight around on your homestead. It can be done! Give some thought on how best to move the object. Then give some thought on what can go wrong with your plan. Safety is paramount. Obviously don't stand under something you are raising up overhead. What will happen when winching a load and the cable snaps? Any cable can snap and come lashing back at you. When I was hand winching trees over, I always wore my logging helmet with visor down as well as work gloves. Handyman jacks are a valuable tool but they can slip or the handle can catch you off guard. As you jack a load up, stick some blocking underneath. Then if the jack slips or something goes wrong, at least it won't have so far to drop. Be slow and methodical and you'll be fine.

Chainsaws sure are handy. In Maine, I became a logger when I chose to selectively cut our woodlot. Initially I made a big mistake by going out without safety gear and caught a branch on my eye orbit as a result. No permanent damage but I was lucky I got a second chance. Please don't ever fire up the chainsaw without proper steel toed work boots, Kevlar chaps as well as helmet with ear and eye protection. Be aware that a nice solid looking tree could be rotten. Despite being properly notched that sucker could come right back at you. Therefore, always be alert and have your escape path clear.

I actually used a chainsaw to build the Maine house. I didn't have a skill saw or a generator. It's a bit of a trick but it's surprising how accurate one can be with lumber cuts when using a chainsaw. I was young and foolish as the picture shows. No safety gear at all. Bad!! I helped build a few log cabin camps and chainsaw is the only way to go. I can't imagine life without my chainsaw.

Carrying Beam and Floor Joists Built Alone

Building Main Carrying Beam and Floor Joists Nova Scotia

When I was building the floor for our new house, I needed to build and install 2 carrying beams, each 6" X 10" X 36 ft. Imagine trying to build that solo. But I did. And if I did, you can surely do something similar! The trick was to build my beam in stages with temporary supports and bracing. It was a tedious process but I was able to construct my carrying beam one piece at a time and overlap the seams with another piece of lumber which made the whole beam more stable. I accomplished a seemingly insurmountable task when I stopped wishing for the help of a "sky hook" and simply paused to think about how I could build this beam by myself.

Homestead Fuel Storage

I'll wrap this chapter up with some information on fuel storage. Over the years, I've found a lot of confusing information but nothing really definitive. Depending on the source, there were differing viewpoints on the subject.

So, I'll simply pass on to you what works for us. Because we lived at a fly in location only (via float plane) and we only shopped and resupplied twice a year, we needed to inventory a lot of things, including fuel. Here in Nova Scotia, it is still easier and gives us peace of mind to have an inventory of fuel on hand. Over the years, we've owned various fuel powered pieces of equipment including a small 6KW single cylinder diesel generator, small gas generators, gasoline powered chainsaws, brush cutter, rototiller, brush chipper, Honda water pump, ice auger, boat motor, ATV and snowmobile. All small to mid-sized engines. The three fuels we've inventoried are diesel, gasoline and a small quantity of kerosene. The kerosene was for a small kerosene heater used in the greenhouse in early spring.

I hate to make this so simple but... we do very little with our fuel as far as storage itself is concerned. I've heard and read the arguments that gasoline must be used within a certain period of time or it goes bad, gets stale, loses octane, won't run equipment well etc.

All of our equipment has run just fine on fuels stored for a year or more. I have no problem using one to three-year-old gasoline in any piece of equipment I have. Every piece of equipment has run like a top. Same applies to the diesel. I've tried gasoline additives and have found them to be of no value. However, I do randomly use a small quantity of gas line antifreeze (based on isopropyl alcohol), generally in the winter, for all of our gas-powered devices.

So let's get to the finer points. All gasoline is stored in RED 5 gallon plastic jerry cans. All plastic cans are sealed tight and are stored in a shed out of sunlight (TS). I think those are three important points. Airtight, out of the sun and plastic containers. In Saskatchewan especially, we had some radical temperature extremes and I think the plastic containers helped keep any condensation in check. We do the same thing here in Nova Scotia. All fuel is under cover.

When we lived in northern Saskatchewan, we flew in diesel by the 55 gallon drum or in YELLOW 5 gallon plastic jerry cans. I employed the same approach to diesel fuel storage as that of gasoline, air tight, out of the sun and stored in the storage shed. The exception to the diesel storage involved a stand I built that housed a 55 gallon drum resting on its side in a cradle. This setup was for diesel for more immediate use. The drum was positioned so the ¾" pipe bung was down. I had a filter housing with 10 micron filter and shut off valve attached to the bung via a ¾" nipple. Because I favor a filtration unit that has a clear bowl so I can visually see any water accumulation, that is what my filter housing had. The unit also had a small valve at the bottom of the bowl so I could bleed any water out. With any of our fuel storage, my biggest concern is fuel contamination, whether from dirt or water. To that end, all diesel was filtered through this setup before ever being used. We currently do not use diesel fuel but this is the setup I would install again if/when the need arises.


Diesel Set Up

Incidentally, if you ever find yourself wrestling with full 55-gallon drums, barrel levers are made to make standing a drum up on its end easier. In camps when there was no lever tool, I'd roll one end on a couple of scrap pieces of 2 X 4 and then manhandle the barrel from its side to standing on end. That couple of inches off the ground at that end made all the difference in the world. If you need to reposition a full drum in a cradle, use a monkey wrench on one of the barrel lips which will give you enough leverage to reposition a full drum in a cradle.

It's hard not to take note of the color specification for the storage containers. I've put the colors in capital letters as they are a very important component of proper fuel storage. I've worked in remote exploration camps where hundreds of drums of fuel are stored in berms along with many additional 5-gallon jerry cans of both diesel and gasoline. In theory, 55-gallon drums have a yellow or red band to signify what type of fuel it contains, but sometimes drums may not be color coded. Many times, the drums are sent out to be refilled, then are flown back in. At that point, it was a guessing game. Does the drum contain gas or diesel?

Save yourself some grief. You never want to take a stab at guessing what fuel you are putting into a gasoline powered piece of equipment or diesel engine. Yes, I have done the feel and sniff test. I've always been right, but all it takes is that one time to be wrong and it's lights out. Ask the guy in camp years ago how his diesel truck ran when he filled it with gas. Not terribly well.

A couple of final points. If you are storing significant quantities of fuel, regardless of whether it is legally required in your area or not, please consider storing it in a berm, something that will catch and contain any spill should it ever occur. There are commercial products made for this purpose. And finally, whenever possible, I fuel up equipment using a funnel with a fine paint filter to catch any course junk that might be lurking in the containers. It also does a decent job of catching water.

Chapter 17 – Parting Thoughts

Although we have devoted most of our life to this off-grid homesteading endeavor, you should know there's no such thing as a know it all expert on all subjects. We don't pretend to know it all. Homesteading is a continuous learning experience and we are constantly discovering new things. What we've tried to do is give you a whole range of options to accomplish a task. Understand there is no right or wrong way to do something and there's no one size fits all.

We have been honest and straightforward on what things we have not personally tried yet. But although we have not tried a particular method, we can fully understand the theory and realize it's more of an offshoot, a variation to something we have tried and are quite familiar with.

Understanding the rationale behind something is important. Let it be a guiding framework for you, but realize it's not set in concrete. There is flexibility and we encourage you to experiment and try different things to find what works best for your setting. That's part of the fun of building and gardening. It brings out the mad scientist in all of us. We all have that curiosity to ask "Why can't I do it this way, this makes sense to me." If you can't decide which to do, do them both. There's nothing like conducting an experiment to see what method works best. Each location we've lived in has had its unique climate and challenges and if we weren't willing to try new approaches we would have failed.


The Ultimate Goal - 100% Home Grown Meal

We've passed along a lot of information for you to ponder. We have no monopoly on knowledge and we happily share what we know. Perhaps one of our solutions is the answer to one of your dilemmas or will inspire you to devise your own unique solution. On the other hand, you may not agree with a method we've chosen to use but it's what we've found works best for us. And that's the name of the game. Feeling free to pick out pieces of the puzzle to apply in your own situation. Find solutions and techniques that work, adapt and modify so as time goes on, pretty soon, your confidence to expand will be like that newly planted seed in spring. You will flourish! Johanna and I sincerely wish you the best as you become more and more self-reliant and self-sufficient.

PROJECTS FROM 1900

THAT WILL HELP YOU IN THE NEXT CRISIS

Chris Cole

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Introduction

One of the biggest worries about people today, in advanced countries at least, is that they're quickly forgetting how to do things for themselves. Part of that is down to nanny state government regulations – in much of Europe it's against the law to do basic electrical work unless you're a qualified electrician, for example. In some countries you're not even allowed to fit a plug to a cable yourself, and that only involves a couple of screws. Putting up a new lamp in the bedroom? Forget it!

Bossy governments are a problem, but probably not the biggest one. That's just the modern attitude to the things we own. Technology is advancing faster than it's ever done, and most people want to have the latest model of everything- Our possessions get discarded just because there's a newer version available; we redecorate, and replace all our furniture, because a new fashion appears in the media.

This is not the way our ancestors lived. They only got rid of something when it was broken beyond repair. If it was still in working order, or could be fixed, they'd never dream of replacing it. As for furniture, why throw it out and buy new stuff just because the color was so last season? In fact, furniture was routinely inherited, and passed on through generation after generation.

A few generations ago, people didn't buy anything like as much stuff as we do now. There were various reasons for that. One is that things cost more. There was no huge international trade in cheap goods made in the Far East. On top of that, most people had less money to spare. We might complain about the cost of groceries, but as a percentage of family income it's the lowest it's ever been.

Finally, there was just a lot less to buy – and one reason for that was that people were used to doing things themselves. Most families made a lot of their own clothes. There were a lot more manual workers and tradesmen than there are now, so people had the practical skills to do repairs or improvements around the home.

DIY hasn't gone away – millions of people still upgrade, or even build, their own homes – and preppers are a lot more likely to do that than the general population, but it's a lot less common than it used to be. The average American, if they need work done on their home, hire a tradesman to do it. If they want furniture or clothes, they buy them from a store. Most of the things we buy are far beyond the reach of DIY anyway – who can build a cell phone at home?

A hundred and fifty years ago it was very different. Most families only owned a handful of things they couldn't make themselves – the most common examples were cast iron stoves, guns and tools. They *could* make just about everything else, and more often than not that's exactly what they did.

At the beginning of the 20th century a lot of rural Americans still lived in homes that they or their parents had built themselves. They put up barns and sheds on their own, or with help from neighbors. If their family expanded and they needed more space, they'd fell a few trees and start building an extension.

The USA in 1900 wasn't a backwards country. In fact, it had one of the most advanced economies in the world. The Industrial Revolution might have started in Britain, but by the Great Exhibition in 1851 the British were amazed at the variety and quality of things being made in the USA. Even so, if people could do something themselves they generally did. They didn't hesitate to take on big jobs, either – many turn of the century DIY projects were a lot more ambitious than putting up some new shelves in the den. In this book we'll look at some typical projects our not so distant ancestors were familiar with, and which can still improve our lives today.

The Smokehouse

Today bacon, ham and sausages come from the supermarket. At the beginning of the last century, most rural families made their own. Every fall they'd slaughter their pigs and make the preserved meat products that would see them through the winter.

For a lot of that meat, the preservation process included smoking – and that meant having access to a smokehouse.

Luckily, building a steakhouse was well within the abilities of the average 1900 rural American. If you could build your own house – and many of these people had done exactly that – a smokehouse wasn't going to be a challenge.

Thanks to that, most rural houses had one, and it was one of their most valuable assets.

At the turn of the 20th century nobody had a refrigerator at home – the first domestic model wasn't invented until 1913, and it was another couple of decades before they started to become affordable. The only way to keep food cool was with an ice box, and outside the big cities in the northeast, ice wasn't cheap.

Nowadays we can keep our bacon in the fridge, and we only buy the smoked kind because we prefer the taste. In 1900, people smoked bacon so it would stay safe to eat for more than a couple of days.

Meat can be preserved using just salt, but smoking reduces the amount of salt you need. Salt's cheap now, but not that long ago it was a lot more expensive, and that went double away from the coasts and big cities.

A way to preserve meat that used less salt was valuable. Of course, now we know that too much sodium is bad for you (although the safe limit is a lot higher than government guidance says it is) so using less salt is still a good idea, even if the stuff costs pennies now.

A smokehouse is just a small building that lets you hang up meat, fish or cheese and keep it surrounded by a lot of smoke for a long time. There are various ways to build one, but home ones usually used a design that used cold smoke.

Hot-smoking involves much higher temperatures, so the smokehouse has to be built of brick, but for cold smoking hardwood is fine. It's also cheaper and easier to work with, and this style of smokehouse is safer.

The Basics

This style of smokehouse is basically a wooden shed with an external fire pit to supply the smoke. Because smoke rises the fire needs to be lower than the floor of the smokehouse, so the best place to build one is on a slope. It can be at the top, or actually on the slope – as long as there's space for a fire a few feet lower down. Ideally look for a shady location – this will prevent the sun from warming it up, so that the only heat comes from the smoke and the inside stays cool when the fire isn't lit.

The first step of building the smokehouse is to dig out the fire system. Seen from above, this looks like the profile of a dumbbell – Two rectangular holes joined by a narrow trench. The lower hole is the firepit, and it's usually about 20 inches long, 16 inches wide and eight inches deep. The upper hole is about 16 inches square and two feet deep. Between them is a trench about six inches wide; this will hold a pipe to channel the smoke from the fire to the smokehouse. Because the upper hole is deeper than the lower one, you need enough of a slope to ensure that the pipe is angled upwards.

The Firebox

For obvious reasons the firebox needs to be heat resistant. It can have a stone slab as a base, but a poured concrete foundation is best. The sides are built with fire bricks, with a slab for a roof and, usually, an iron door at the front for lighting the fire and feeding it with wood. The pipe projects through the back wall of the firebox. That's obviously fine with old-style cast iron pipe, but less so with modern PVC. You'd need to line the first couple of feet of the tunnel with concrete or fire bricks to keep the pipe far enough away from the actual fire. Once the pipe is installed, backfill the trench.

At the top end of the pipe is an elbow joint, to bring it up above the foundation of the smokehouse. It's a very simple system; wood is burned in the firebox and the smoke, cooled to under 200°F as it moves up the pipe, escapes through the top end into the smokehouse.

The smokehouse itself is a small wooden structure on a heatproof foundation. The foundation is built by pouring a concrete base into the upper hole, then building a brick wall on it. This wall should have about five layers of bricks, which along with the concrete brings it up above ground level.

Now there's a low, square brick wall about 16 inches on a side. The actual smokehouse sits on top of this. It's built on a simple frame covered with boards, with a pitched roof and a small door at the front. Inside are wooden racks that meat can be hung from on hooks. Traditionally smokehouses are made from hardwoods, usually cut from fruit trees – cherry, apple, pear and apricot are all good. Most smokehouses are painted dark brown to hide any stains from escaping smoke. A small chimney fitted high in the back wall lets the smoke escape, and a thermometer is usually fitted in the door so the temperature can be monitored. Usually the roof is removable, so the contents can be checked without using the door. In total the smokehouse is usually about four feet high – three feet for the walls, and another foot for the roof.

Meat can be smoked for a few hours to give it a delicious traditional taste, but you'll get the most benefit from your smokehouse by leaving your food in it for days or even weeks. That will give time for water to evaporate, the heat from the smoke to cook it thoroughly and the smoke itself to penetrate deep inside and enhance the flavor.

A smokehouse is something that can be easily built in a weekend, and it's well worth the effort. You'll be able to turn cuts of meat into delicious, specialty hams and sausages. You can make your own traditional-style bacon, which is much tastier than the mass-produced kind. Best of all, you'll have an effective way to preserve food that doesn't rely on electricity, gas or any modern technology – it will keep working as long as you have access to wood and a bit of salt.

The Root Cellar

A smokehouse is great for meat, fish and cheese, but it isn't going to help you much with your stores of root vegetables. If you want to be self-sufficient you need to have a way to preserve the potatoes, beets, carrots and turnips you harvested in fall. Luckily, they're more robust than meat; as long as you keep them cool and dry, they'll keep you fed until you bring in the next crop.

The problem is that indoor temperatures are too warm for storage, and outdoors isn't stable enough – temperature changes between the seasons, and even between day and night, will quickly destroy your stores. One way around that is to store them in clamps, where the earth covering will insulate them, but clamps aren't exactly convenient; do you really want to start digging one up every time you need a dozen potatoes for dinner?

The solution is a root cellar. Partly underground, and with its upper walls and roof heavily insulated with soil, a root cellar maintains a much more stable temperature. Inside it's cool, the humidity is low, and the conditions are perfect for storing any kind of root vegetable. Even if you don't grow your own vegetables a root cellar makes a lot of sense. Look at what a few pounds of potatoes costs at the grocery store. Now compare that with the per-pound cost of buying them by the sack. Buy vegetables in bulk and you can save a lot of money over the course of a year; a root cellar will let you store them until you need them.

A century ago every rural home had a root cellar. They were first developed in 17th century England, brought to America by the early settlers, and quickly became an essential of pioneer life. They only started to fade away when refrigeration became available, but even so, many people still have one and use it regularly. Others are seeing the value of this old storage solution and building their own.

In 1900, building a root cellar was a common DIY project for anyone who didn't already have one. It took some work, but nothing that was out of the reach of the average homeowner, and that's just as true today. If you want a root cellar you can have one, and it won't cost you much – apart from some sweat.

Decisions to make

There's no one way to build a root cellar. Big, wealthy farms often had elaborated, stone-lined ones; on smallholdings, it would more likely have earth walls and a timber ceiling to support the soil overhead. Space and budget helped decide how a cellar should be built. So, did the local climate. In areas with warm summers and mild winters cellars need more insulation to keep the temperature down. Where the winters are cold, the problem is to stop the contents freezing or drying out.

There were late 19th solutions to these problems. In warm climates, a cellar that's dug deeper and has more earth around the upper walls and roof will stay cooler. Less heat from the sun and air makes its way into the interior. More of it what does get in will be soaked up by walls dug into the cooler sub-surface soil. Most of the sun's energy that hits the ground is absorbed by the top few inches of soil and re-radiated back into the air; even in the hottest deserts you'll find lower temperatures if you dig down a few feet. The same effect keeps a deep root cellar cool enough even when it's scorching outside.

Areas with cold winters create different challenges for a root cellar. Again, having more soil around it will help, but it probably won't be enough. More insulation was often added to retain heat – a layer of straw, for example.

The problem with insulating a root cellar to keep the heat in is that there isn't much heat inside to start with; that's the whole point of a root cellar. To keep the temperature above freezing some heat has to be applied. A modern solution is to keep a single lightbulb burning; that will generate enough heat to prevent freezing. Unfortunately, the light also encourages root vegetables to sprout. An older solution was to dig a pit in the floor of the cellar, fill it with compostable waste, and put a loose wooden cover over it. The heat created by the decomposing compost will rise into the cellar and maintain a cold, but non-freezing, temperature.

Choosing a location

There are a couple of factors to consider for a root cellar. If possible, it should be built on the north side of the house, where it will be in shadow when the sun is at its highest. That helps with keeping the inside temperature down. In areas that get a lot of snow, cellars were located somewhere that could be accessed even when everything else was buried – under a porch was one option. They were also placed away from low-lying areas that collect water when it rains; water collecting in the cellar would encourage rot in the food stored there.

The hard part of building a root cellar is digging out the pit. A lot of earth needs to get moved, so people didn't build a cellar bigger than they needed. On the up side there wasn't a problem disposing of the soil, because it would be reused to cover the top of the cellar. As well as the cellar itself steps had to be dug out to give access to it. The stairs would usually be built of timber or stone slabs, but cinder block is a good modern solution.

The construction of a root cellar depends on local conditions. A dirt floor is ideal, as it helps cool the interior and keep humidity constant. If the floor feels dry you can also sprinkle water on it, and it will slowly evaporate into the air. If the soil is very moist, planks or gravel will make walkways to stop it getting muddy.

Walls can be built from brick, stone or timber – most small farms used wood, as it was cheap and easy to obtain. Solid uprights and beams supported the heavy roof, while the walls were usually just boards to stop the sides collapsing. Some root cellars have bulkhead doors in the top, with internal steps, while others have steps down to a door in the wall. Doors are often insulated to help keep the inside temperature stable.

The interior of a root cellar usually has shelves to hold canned goods and boxes of produce, as well as wooden bins for bulk quantities of potatoes, turnips and other staples. Larger cellars could be divided into two sections, one with a drier atmosphere and one with a moist one.

Most homes now – even rural ones – don't have root cellars, but it's still a valuable thing to have. As well as giving you a simple, efficient way to store vegetables, there are also other uses for a strongly built, mostly underground space. It's an ideal storm shelter, for example, and if you add an air filtration system it will even work as a fallout shelter if there's a serious industrial accident or nuclear attack. Building a root shelter involves a bit of sweat, but it's a really worthwhile project for anyone who's serious about being prepared.

The Well

It's hard to beat the convenience of a modern water system – unlimited, clean water available at any time just by turning on a faucet – but it's a luxury our ancestors didn't have. Even well into the 20th century, many rural Americans weren't connected to the water supply. Unless they wanted to fetch their water from the nearest river – not usually the cleanest source – they only had one real option: Dig a well.

The principle behind a well couldn't be simpler. Below a certain depth, the *water table*, the ground is saturated with water. If you can dig a hole to below that depth the bottom of it will fill with water; then you can lift it out with a bucket or pump, and you have a water supply. Well water is untreated, but usually safer than water from a river or lake – you know there isn't going to be a dead sheep in it.

In some places the water table is only a foot or two below the surface, and you can get to the ground water by digging a fairly shallow pit. Other times you might have to go down anywhere from ten to thirty feet before you reach it, and then a few feet more to allow a good amount of water to collect in the bottom of the well. That's no problem with modern equipment; a mechanical auger can bore a deep well in an hour, then all you need to do is lower a pump hose down it and you're in business. At the start of the 20th century most wells were still dug, and operated, by hand.

Not everyone dug their own wells. Professional well diggers existed and could be highly paid. A lot of their perceived value was their ability to know the right place to dig. Many of them were dowsers – water diviners, who claimed to be able to find underground water using pendulums or hazel twigs. In reality, dowsing doesn't work – but that doesn't matter. The water table doesn't vary much over short distances, so if there's water ten feet down at one point on your property there will be water pretty close to ten feet down under all of it.

People who didn't want to pay a well digger would sometimes hire a dowser to show them where to sink a well, or they'd just pick a likely spot and start digging. The procedure was simple – just mark out a circle large enough for one man to work in, dig it out, then keep going down until they reached the water table. However, the details varied depending on the ground.

Firstly, you had to pick the right time of year. This makes a big difference. In most places, the water table is seasonal. It's important to sink a well when the water table is at its lowest. A well dug when the groundwater is *high* probably won't be usable all year round. It will be fine at the time of year it was dug, but as the water table recedes it will go dry. One dug at the right time will be as deep as it needs to be when the water is furthest from the surface; a rising water table will simply put more water in the well.

Seasonal variations in the water table depend on the local climate. Some areas have cold, dry winters and rainy summers; that means the water table will be higher in summer, so wells were dug in winter. That presented problems of its own. The top few feet of soil would often be frozen solid. Building a fire and keeping it burning for a couple of days would thaw it far enough down for the well to reach the deeper, unfrozen layers.

In other places, such as California, summers are relatively dry and most precipitation comes as winter rain or snow. That leads to water tables that are highest in late winter, and lowest in late summer and fall.

It's easiest to dig wells in sand or gravel, because a pick and shovel are all that's needed to excavate the hole. To avoid any risk of the sides caving in, destroying the well and potentially burying the digger, temporary wooden shoring would be used to support the soil.

Where the well had to be dug into bedrock, different methods had to be used. It's possible to dig through softer sedimentary rocks with a pick and crowbar, but it can be a low process; hard rocks will defeat normal digging tools. One option was to bore holes in the bottom of the hole, pack them with black powder cartridges – or, later, dynamite – and blast the rock. The rubble could then be cleared away, new holes bored, and the blasting repeated until the well was deep enough.

Not everyone has access to explosives, though, and there's also a risk of using too heavy a charge and collapsing the well. An alternative is percussion drilling. This process was invented in ancient China and used to sink shafts up to 3,000 feet into the bedrock. It's quite a simple principle; a heavy weight, usually with a sharp point, is dropped down the well to crush and shatter the rock; then it's pulled up in a rope and dropped again. When the bottom of the hole starts to get choked with rubble it's cleared out, then the weight is dropped again.

A percussion drilling rig could be built with a simple wooden tripod over the top of the hole, with a pulley hung from the top to take the rope. If a pulley wasn't available a steel ring or even a loop of rope would do, but it took more effort to lift the weight.

For the weight itself, the heavier the better. Even a shovel dropped blade-first onto soft rock would have an effect, but something bigger makes much faster progress. A sharpened log with a steel cone over the point was one option, or a blade improvised from an old plough or harrow. The main thing was that it had a strong, sharp point or edge, and enough weight behind it to drive it into the rock. The good thing about percussion drilling is that the deeper you go, the more force you can put into each blow of the weight – gravity does the work for you.

The tripod and rope would also be used to haul spoil out of the shaft. When enough rock had been broken up to start obstructing the weight it would be removed from the rope and replaced with a bucket. The broken rock would be loaded into the bucket and pulled up, the hole opened out with hand tools, then the weight went back on the rope and rock-breaking started again.

When the well shaft reaches the water table it will be pretty obvious, because the bottom of the shaft will start to fill with water. That didn't mean it was time to stop digging – it just meant it was time to get your galoshes on. The shaft doesn't just have to reach the water table; it has to penetrate down into it. How far? At least the height of a bucket, and then an extra few inches. The pool of water in the bottom of the well had to be deep enough that whatever method was used to lift the water could be submerged enough to actually work.

Once the well is deep enough it was time to start lining it. An unlined well will work for up to a couple of years, but it won't have a long life. Frost, erosion and seasonal expansion and contraction of the ground will gradually break down its walls. Soil will fall into the well and gradually raise the bottom; eventually it will raise it above the water table and the well will go dry. At that point it has to be dug out again, which can be dangerous if the walls are already becoming unstable.

To protect the work they'd done, well builders lined the shaft. Sometimes timber was used, but that was a short-term solution. In the humid atmosphere of a well shaft, and with one side in constant contact with damp soil, any wood will eventually deteriorate – and only high-quality hardwood will last more than a couple of years. Most wells were lined with brick or, when brick wasn't available (which was most of the time) with stone.

Lining a well could be tedious, because all the stone had to be lowered down the shaft, but it wasn't a difficult job. The lining didn't need a lot of structural strength, just enough to stop the walls eroding. Dry stone linings were occasionally built, relying on fitting the stones carefully together to hold them in place, but usually they were cemented in place. That helped seal the gaps between the stones and prevent things growing in there – birds and animals could even nest in a dry-stone lining, and that didn't exactly help keep the water clean.

The next step was to build a low wall around the top of the well. This was usually circular, made of brick or stone, and around three to four feet high. It had a couple of purposes. Firstly, it prevented dirt and debris being swept into the well by wind or rainwater. Secondly it reduced the risk of children (or clumsy water collectors) falling down the well. Usually the top of the wall was given a smooth, level cement surface.

Often, a roof was put over wells to keep debris out. Many traditional wells had two heavy timber supports mounted on, or even built into, the surrounding wall; a small pitched roof would be built on top of the supports. The same supports could also hold a windlass for raising and lowering buckets.

Many wells had a layer of fine gravel or sand at the bottom. With the walls sealed by cement, the only way groundwater can get into the well is through the bottom. That won't make it any less effective – as long as the bottom is open, simple pressure will equalize the water levels inside and outside the shaft – and it also gives you a way to filter the well water. A few inches of sand at the bottom will trap most debris and small creatures that might come up with the water, making it easier to purify.

Not many homes have their own well today, but if preparedness matters to you it's an excellent project. You probably don't want to give up the convenience of having clean water on tap – who would? – but modern water systems are vulnerable to disruption in any sort of crisis and having an operational well gives you a fallback option. It doesn't have any unwanted side-effects on the local water economy, either. Diverting streams for irrigation will bring water from some places but take it away from others. Building drainage ditches can transfer rainwater to places where, it turns out, it does a lot of damage. A well just opens a route to get at water that's already there, under the ground.

Even if you don't think a well is worth building now, knowing how it's done is vital survival knowledge. If the water supply does go down, and there's no prospect of it being restored in the near future, you can build a well *then*. Your emergency water supply should be enough to keep you going for weeks, and unless you're boring into bedrock without explosives a reasonably deep well can be dug and lined in a few days. By the time you've emptied the last barrel of stored water, you can have your own well delivering a steady supply.

The Hunting Bow

The bow is the oldest machine known to man. We know from cave paintings that our earliest ancestors hunted by throwing rocks, and later spears, at their prey. These are inefficient weapons, though. They can only be launched with as much energy as you can generate in a throwing motion.

Sometime in the late Stone Age, at least 13,000 years ago and perhaps as long as 71,000, the bow was invented. This was a huge advance in weaponry. It wasn't just an object that could be thrown; it was a machine that allowed energy to be input, stored, and then violently released. Now a hunter could exert sustained effort to tension the limbs of his weapon, take careful aim, then unleash all the energy instantly. Compared to a spear, a bow was more accurate, deadlier and had a much longer range.

By the time the first settlers arrived in the USA guns were already common in Europe, and the settlers brought plenty with them. What they found in the New World was a civilization that had never invented guns, and still relied on the bow. However, much to their dismay, they soon found that in skilled hands a bow was still a deadly weapon.

In fact, in skilled hands a bow was far superior to the guns of the day. A typical flintlock musket could fire three or four shots a minute and, expertly handled, might hit a man-sized target more often than not at a hundred yards. An English longbowman could reliably put quarter-pound war arrows into a one-foot circle at that range, was reasonably accurate to 250 yards, and was capable of losing a dozen arrows a minute. George Washington and the Duke of Wellington, the most successful generals of the flintlock age, both tried to find trained longbowmen to increase the firepower of their armies.

The native bows of North America didn't approach the terrifying power of the English war-bow, but they were still effective and hard-hitting weapons. Short and light enough to be used from horseback, they were also deadly accurate in the hands of warriors who'd been taught to use them as children, then hunted with them every day. A war party of archers on horseback was a real threat to a group of Americans armed with muskets.

By the end of the Civil War, guns had advanced far enough that they could outshoot bows in most respects – but bows didn't disappear. Anybody could make one, with a bit of practice, from natural materials. Arrows were even easier to make, and unlike rifle or shotgun ammunition they could be reused. Bows are also quiet to shoot. The boom of a shotgun will spook any game in the area, but a good archer can harvest two or three animals before the rest panic. That made them ideal for hunting, especially when money was tight.

The other big advantage of a bow was that, if you had some basic skills, you could make one yourself at basically zero cost. It takes a lot of tools and skills to make a reliable gun. You might see TV documentaries about craftsmen in the Khyber Pass who can make any gun to order using a few hand tools, but I've handled some of those guns and I would never risk firing one.

A bow is different. Some native designs featured elaborate laminates of horn, sinew, plant fibers and even fish skin, but they also used much simpler wooden weapons. A wooden self-bow – carved from a single stave of timber – can be made with nothing more than a knife if you need to.

Finding the wood

The first stage in making a bow is to select the wood – and if the bowmaker didn't get this right, the rest of the process was a waste of time. Bows can be made from of any appropriate-sized piece of timber but choose wrong and the result one that either shoots weakly, breaks after a couple of shots or quickly takes on a permanent curve and loses all its strength. On the other hand, good stave makes a powerful weapon that lasts for years.

Native Americans and pioneers were lucky, though. North America has some great bow woods and some of them are quite common. Ash, hickory and red oak all make tough bows; hazel, hornbeam, maple and acacia aren't quite as rugged, but more pleasant to shoot. Boxwood has a very fine grain and makes powerful bows. Yew makes the most powerful and fastest-shooting bows, but it's difficult to work with. It also needs care – the wood is poisonous and inhaling the dust can be lethal. Never try to work yew without a dust mask. The best of all is probably Osage orange. It makes bows that are almost as good as yew ones, but it's easier and safer to work with.

Saplings almost never make good bows. A better choice is a straight branch, four to six inches in diameter. The perfect material is a section between four and six feet long that's as straight, and as close to the same diameter all along its length, as possible.

Once the wood had been selected and cut, it needed to be seasoned. The best way to do that is to store it somewhere well aired, but protected from rain, for a year or two – under the eaves of a roof is good. People who needed a bow faster would peel the bark off and leave it in running water for a month, usually weighted down with rocks on a stream bed. After that it would be left for another month to dry slowly.

Whatever method was used, the wood seasoned faster if it was split into staves first. Unless they were made from boxwood, bow staves were never sawn; instead they were split with wedges or axes, so the splits followed the grain. Smaller branches would be split in half; bigger ones, above about five inches in diameter, were usually quartered.

Preparing the stave

Once the stave was seasoned it needed to be shaped down into a bow. You can make a bow with nothing but a sharp folding knife, but it takes a while and would usually be a rough job. A few simple tools made it a lot easier. These tools were commonly used to make bows:

- Pencil

- Tape measure
- Knife
- Drawknife
- Hand saw
- Ax
- Round, flat and triangle files
- Broken glass
- Coarse and fine sandpaper

Now the stave had to be prepared. If you look at the ends of the stave you'll see two different kinds of wood – the heartwood at the center of the branch, and the sapwood outside it. The back of the bow – the side that faces away from you – would be the inner ring of sapwood or the outside of the heartwood. The belly, facing towards you, came from the inside of the branch. If there was a lot of sapwood on your stave it would be shaved away to leave a single ring on the outside of the heartwood.

With the back ready, the bow's outline would be marked on it. To start, the stave would be measured and the center marked. That showed where to put the handle. A common mistake, even now, is to put the center of the handle in the center of the bow. That's wrong. The arrow pass needs to be very close to the center of the bow, and the handle was below that.

Traditionally there were two ways to make this work. Medieval English longbows were symmetrical and didn't have a handle. They were just shaped to bend into a perfect segment of a circle, with the arrow pass marked in the center. The bow could be used either way up, and the archer simply held it just below the arrow pass.

English longbows aren't easy to make, though. They have a deep D-shaped cross section and need to be *very* carefully shaped. Most American bows are flatbows, with a shallower rectangular cross section. That's much easier to work with, but it does need a handle.

The problem is, if the handle is in the center of the bow the arrow pass will be too far above it. When the bow is drawn the center of stress is at the arrow pass; if that's too far from the center of the *bow* the uneven stress on the limbs will probably break it. The solution is to put most of the handle below the center, and the arrow pass just above it.

With the handle marked, the tips would be marked next. A tight string laid down the center of the bow was used to mark the centerline, then marks would be made about half an inch each side of it at both ends. Straight lines were drawn to connect these marks to the corners of the handle, and that marked out the basic outline of the bow. The stave was cut down to that outline, and then the real shaping could start.

Shaping the limbs

The most important part of making a bow is shaping the limbs down so they bend evenly, giving the draw weight you want. The hard bit is getting an even bend; if the draw weight is too high you can just shave off more wood. But first, the handle was carved to fit the hand comfortably. This is an easy job, but doing it first meant that if it did get messed up the bow maker had avoided wasting work on the limbs.

To get the limbs right, a process called *tillering* was used. A tiller is a wooden frame with notches at the top to hold the bow, and a series of smaller notches down its length, usually about two inches apart, that can hold the string. The bow would be put onto the tiller and the string drawn back to the first notch. Then the bowmaker could step back, look at it and see how evenly it curved. If there were any straight bits some wood could be shaved from the back with a draw knife. For very fine shaving, the edge of a broken piece of glass gave more control.

Once the bow bent evenly at the first notch, the string would be pulled to the second notch. The shaving and bending process was repeated for each notch until the bow was fully drawn. Then the maker would draw it normally, to test the weight. If it was too heavy it would be slowly shaved with a drawknife or glass to bring the weight down. Finally, nocks were cut into each tip with a round file and the bow finished with wax or linseed oil.

The last stage was to make a string. Modern bowstrings are usually Dacron, Kevlar or Dyneema; traditionally, they were made from sinew or twisted plant fibers. A loop at each end fitted over the nocks, and the center was wrapped with fine cord to reduce wear from arrow.

Being able to make a bow is still a useful skill. In a survival situation, as long as you have a knife you can make an effective weapon. Just look for a dead branch that hasn't been rotting on the ground, and you have a seasoned stave to work with. Get fibers from crushed nettle stems to make a string, fletch some arrows with leaves or feathers, sharpen their tips and harden them in a fire, and you have a hunting and defensive weapon that's been used in America for many centuries.

Snowshoes

As the pioneers moved away from the original colonies and into the West, they encountered winters harsher than anything they'd seen before. It snows in Europe, but hundreds of miles from the coast in the US interior the temperatures were colder, and the snowfalls heavier, than most Europeans ever experience.

The problem was, even in the worst weather people still had to get out and about. Livestock had to be cared for, game hunted and food collected from stores.

Wading through deep snow could get exhausting in a hurry, and snowmobiles didn't exist in 1900. Luckily there was a slower, but cheaper, was to get around – snowshoes.

Snowshoes are simple. All they do is spread your weight over a larger area so you don't sink into the snow. Native Americans used them for centuries; the Plains Indians wore snowshoes on their winter buffalo hunts.

French settlers in what's now Canada and New England soon started using them, and before long almost everyone who headed outdoors in the cold American winters had a pair with them.

Snowshoes have mostly been replaced with cross-country skis, but they still have advantages. They're a lot shorter, for a start. It's much easier to strap a pair of snowshoes to your pack when you go hunting than a pair of skis.

They're also easier to make. Not many people can make a good pair of skis, but basic snowshoes aren't difficult. That's why they were the top choice at the turn of the century – any hunter or farmer could make his own.

What design?

Traditional snowshoes come in two basic shapes – oval and teardrop. The teardrop shape is easier to make, so that's what most DIY ones were. Both shapes have the same three basic parts, though:

- **Frame** This defines the snowshoe's shape, and acts as a base for the other parts. It's usually made as a wooden outer rim, with one or two crossbars to add strength.
- **Webbing** The webbing is what does the work of keeping you out of the snow. It's made of light material, usually woven into a mesh.
- **Binding** This holds the snowshoes to your normal shoes.

Making the frame

The best material for snowshoe frames is the trunk of a sapling. To make the outer rims people would cut saplings that would give a flexible pole at least eight feet long. Except in an emergency they would usually shape them to get the same diameter along the whole length; this made the snowshoes lighter, and it was also easier to get the shape right. The frames had to be strong enough to do the job, but any extra wood was just deadweight to carry around – and that gets tiring.

Once the poles were cut and shaped, usually to under an inch in diameter, they had to be soaked for at least twelve hours (a couple of days was even better). Next the wet wood would be heated over a fire, taking care not to burn it or let it dry out. This process softened the wood, so it could be easily bent into shape. To make teardrop snowshoes the wood was bent in stages until it formed a teardrop shape and the two ends could be pressed together. Then the inside of each end was cut flat, holes bored through the wood with a heated awl or piece of thick wire, and the ends tied together tightly with cords.

To fit the crossbars, holes were cut in the insides of the frame and the ends of the crossbars fitted into them. The tension of the webbing would hold them in place.

The webbing itself was usually made from thin strips of rawhide, woven into a net which was then tied tightly to the frame. The idea was to have a dense enough weave that it wouldn't sink into the snow. For each strand to sink it needed to have a certain amount of weight on it, and with enough strands there just wasn't enough weight to do that. The average snowshoe used over a hundred feet of rawhide in its lacing. It was important that the webbing was quite tight, though, or the weight wouldn't be transferred over its whole area.

Snowshoe bindings were usually simple leather straps fastened to the crossbars. There were usually three – one over the toes, one over the arch of the foot and one round the heel. Between them they held the snowshoes firmly in place; unlike skis they're not flexibly attached, or they flop around.

If you're going outdoors in the winter, snowshoes still make a lot of sense. They're light and can be strapped to a pack or slung over your shoulder on a strap, so you'll have them with you when you need them. They also don't need complicated tools or expensive materials to make – you can do a good job with nothing more than a knife and something to bore holes with. Saplings are free, and the rest is just rawhide and leather.

Snowshoes also work extremely well. With good, tight webbing they'll support a lot of weight even on dry powdery snow, and after some practice you can run amazingly fast in them. Walking in deep snow doesn't need to be an exhausting slog anymore; a few hours' work and, just like farmers and hunters more than a hundred years ago, you can get around on your home-made snowshoes.

Conclusion

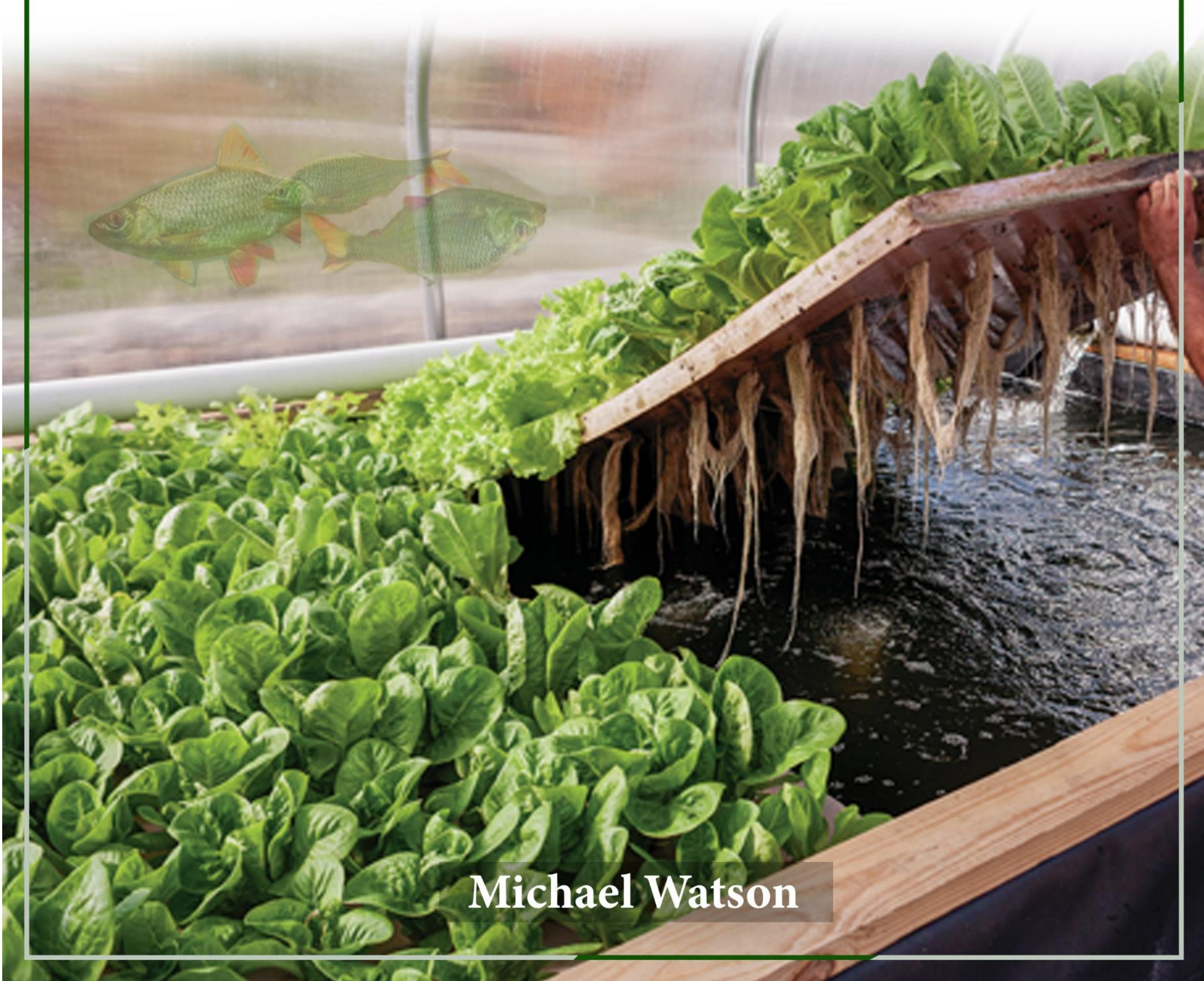
At the beginning of the 20th century DIY wasn't just a hobby or something you do to save some money on home improvements; especially in rural areas, it was a way of life for most people. Hiring someone to do a job was reserved for the rich and the few jobs people couldn't do themselves – everything else was a candidate for DIY.

Old-school DIY was often a communal activity. That can still be seen at events like Amish barn-raisings – people would help their neighbors, and in exchange their neighbors would help them. That made more manpower available for big jobs, and it also meant that people didn't need to master every single skill. As long as *somebody* knew how to do it, they could supervise the job.

Anyone who values being prepared probably has a bit of a DIY mindset already, but it's usually possible to do a lot more. One of the most useful ways to expand your DIY horizons is to learn about the lost ways of our ancestors in the 18th, 19th and early 20th centuries, to see what people did for themselves before the consumer society got into full swing. You'll find that, instead of trying to repair or replicate a modern solution to a problem, there's usually a simple and robust older one that will do the job just as well.

With Illustrations and Step by Step Instructions

The Aquaponic Gardner



HOW TO GROW YOUR OWN AQUAPONICS SYSTEM

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INTRODUCTION TO AQUAPONICS

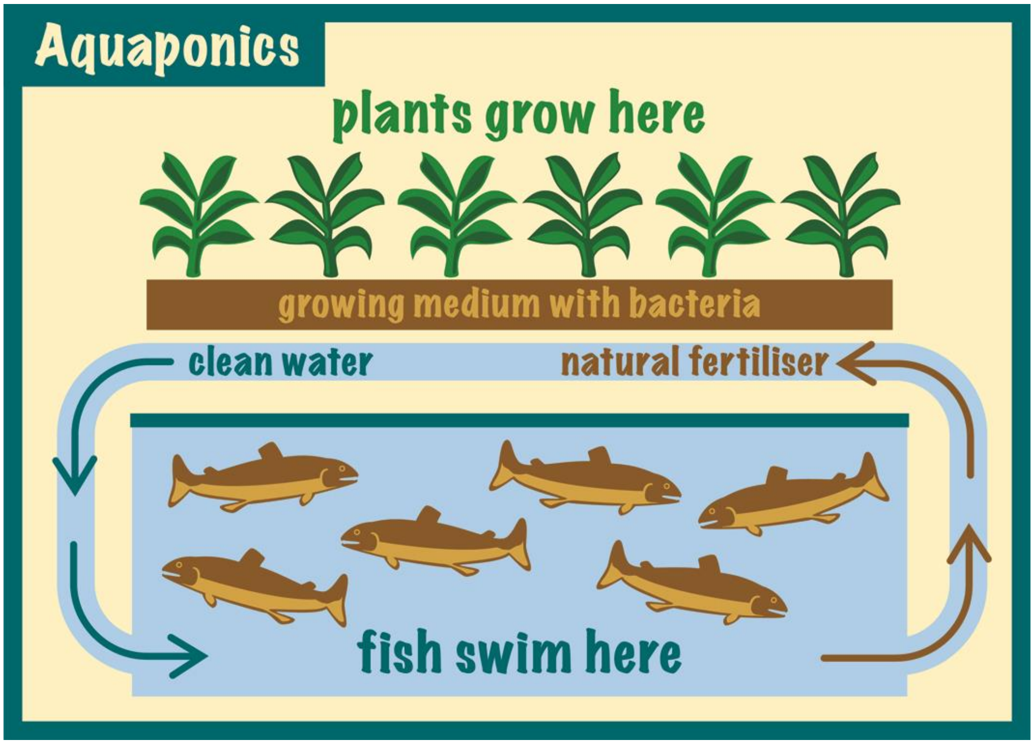


Figure 1: Aquaponics System

The word Aquaponics is typically used to describe an aquaculture system in which both fish and plants are raised and harvested, in a co-dependent environment. Fish waste is an ideal fertilizer for many edible plants, and fish food is exponentially cheaper than plant fertilizer.

A typical Aquaponics system is comprised of three major sub-systems: The Water System, the Plant system, and the Fish system. These three sub-systems work together to create a loop of self-supporting life that requires minimal input or investment to sustain. When setup strategically and cared for properly, this system can provide a steady food supply of both plants and fish.

Hydroponics is a word that often comes up when discussing Aquaponics. A Hydroponic system is composed of plants only. It is also a system in which plants are raised and harvested, but it requires the application of either natural or chemical food and fertilizers. When designed correctly, Aquaponics is generally accepted as a superior alternative to Hydroponics.

While requiring slightly more setup and initial effort, it allows for a more diverse harvest (both Fish and Plants) and is more affordable to maintain. With the excellent plant fertilizer produced from fish waste, maintaining an aquaponics system requires only fish food and general care. Overall it is a system that can provide a much greater return on investment than Hydroponics.

Developing a personal Aquaponics system can be both a fun hobby and a practical way to create an independent food source. If you have a desire to become self-sufficient in providing food to eat, Aquaponics is a great place to start.

When discussing Aquaponics, one important concept to consider is Life Cycle completion time. The phrase "Life Cycle" refers to the complete organic process of a typical Aquaponics system. An example of a typical Life Cycle is shown in figure 1 below.

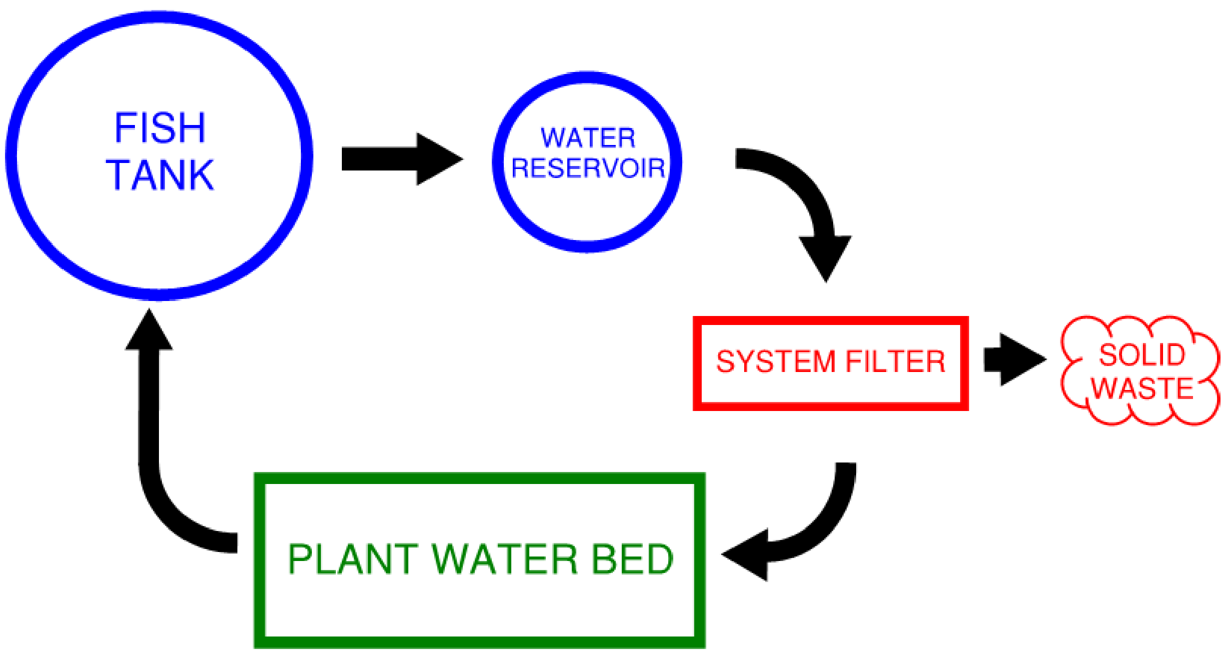


Figure 2: Typical Aquaponics Life Cycle

The completion time of this Life Cycle depends on a number of factors and will determine the frequency and volume of the harvest that can be achieved. How to optimize this life cycle for one's specific situation is discussed further in this guide.

Aquaponics is efficient not only with respect to plant food and nutrients, but also with respect to water use. Traditional gardening typically requires the repeated application of large amounts of water to supplement any rainfall. The water in an Aquaponics system is added one time, and then is repeatedly used by the Fish System and cleaned by the Plant System in an efficient, closed-loop process.

Aquaponics is also a system over which one has a large amount of control. While very dependent on the temperatures and climates present, an Aquaponics system is typically very condensed, which allows for easy control and manipulation of the system components, as needed.

Ultimately, this guide has been written with the goal of bringing this great concept of Aquaponics to a practical level that can be implemented in one's own back yard. The following section gives a brief but complete overview of what is included in this guide.

AQUAPONICS GUIDE OVERVIEW

The purpose of this guide is to provide all of the information needed to build a healthy, successful Aquaponics system. It is suggested that one first reads through this guide entirely before beginning to build an Aquaponics system. Doing this will provide a better overall view of the complete system and will help inform some of the initial decisions that need to be made about size and location.

As mentioned previously, a typical Aquaponics system is comprised of three major sub-systems. Each of these three systems is discussed in-depth in this guide, along with the initial support structure and the keys to starting and maintaining the completed system.

The support structure is the part of the Aquaponics system that can vary the most. There is a specific range of plant types to select from, and a specific list of fish species that would be best for the Aquaponics system, but there is an almost unlimited amount of options when selecting a support structure and overall system layout.

Whether it will be an Indoor or Outdoor system, a 2-fish or 20-fish system, and a parallel or stacked system are just a few of the considerations that must be made. The support structure sections in this guide will provide all of the information needed to help in determining which type of support structure will be best for one's specific situation. These sections will also provide setup instructions for a variety of different support structures.

Sections on the preparation, maintenance, and cycling of the Water system are included in this guide. These sections will give the reader all of the information, instructions, and tips needed to setup this portion of the Aquaponics system. Though the water is not one of the products that can be harvested, it is still a critical part of the system. The quality and health of the water are what both the fish and plan systems depend on for optimal success. Depending on the type of support structure selected, different considerations must be made for the water system. The type of water used in the initial setup of the system is also very important.

Sections on the selection, support, nutrition, and harvesting of the Plant system are also included. Like the water sections, these sections will provide all of the information and instructions needed to develop the Plant system portion of one's very own Aquaponics system. The plants will rely on the Fish waste for food and fertilization, so ensuring a good match between plant type and fish species is key. It is also important to consider the desired life-cycle completion time of one's specific Aquaponics system, and to select plants that grow at a rate that compliments this completion time.

Also included are sections on the selection, health, life-cycle, and harvesting of the Fish system. The fish system can be the most fun to plan for but can also be the most difficult to setup. It is very important to introduce the fish to the system as a final component, and to take steps to ensure they adjust well to the environment that has been created. These sections of this guide will provide all of the information and instructions needed to ensure the correct fish are selected and this transition goes smoothly.

Finally, separate sections on starting and maintaining the Aquaponics system are included in this guide. Information and instructions are included for the first week of running the system, the first harvest, and the first deep-clean. Even if an Aquaponics system has all of the correct components, if it is not started correctly it will quickly deteriorate. This guide will provide the information needed to ensure the Aquaponics system gets started correctly and maintains healthy life cycles. Information and instructions on common issues and preventative maintenance items are also included in this guide.

THE STRUCTURE

Choosing A Location

The most significant initial decision that must be made is whether this will be an indoor or outdoor system. Both are viable options, and both have desirable and undesirable factors.

An indoor system will allow for easy access when feeding the fish, maintaining the system, and harvesting. It will also ensure a consistent climate, giving a wider range of options for fish species selection.

If one enjoys looking at an aquaponics system or sharing it with visiting guests, this could also be an added bonus. Some undesirable factors in an indoor system may include any odors from the system, any potential mess from spilled water, and limited overall total size.

Depending on one's specific system an outdoor system will typically allow for a much larger overall total size of system. Locating one's system outdoors may result in limited selection of fish species, due to fluctuating temperatures. It may even result in having to shut down the system when the weather gets too cold to maintain fish and plant life. If one lives in a warmer climate, these issues may not apply.

There are additional factors to consider when choosing a location, besides indoor or outdoor. The plant system will require as much sunlight as possible. The more sunlight they can be exposed to, the more the growth of the plants, and ultimately the whole system life-cycle completion time, will be accelerated. However, the more sunlight the water system is exposed to, the more undesirable algae and bacteria will develop in the system.

If a classic parallel system is selected, it will be important to choose a location that has both sunny and shaded areas close to each other. Alternatively, a fully sunny area can be selected and a shade and dark for the water system can be constructed.

If a stacked system is selected, this will not be as much of an issue. Figure 2 below shows a schematic example of a stacked system.

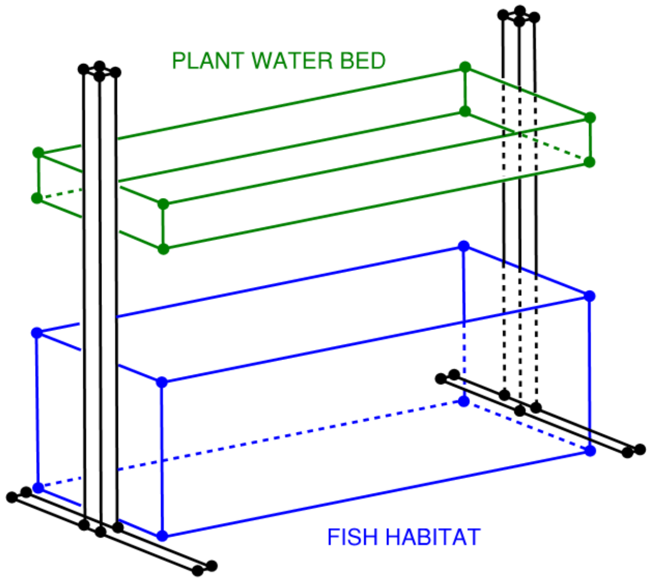


Figure 3: Stacked System Schematic

The classic parallel system is much more common, but in rare circumstances one may have materials already available that would perfectly suit a stacked system. Alternatively, a new exoskeleton frame could be constructed to accommodate a stacked system. As shown, a stacked system exposes the plants to direct sunlight, while providing shade for both the fish habitat location and the water system. While this stacked system requires more significant building and development, it does create a structure that is both sunlight-efficient and space efficient.

Finally, it needs to be determined whether or not the system will be located near a power source. A pump is needed to circulate the water throughout the system and carry the nutrients from the fish habitat location to the plant roots. There are a variety of pumps that can be selected, from solar-powered pumps to standard plug-in pumps to manual pumps. The "Water System" section of this guide gives a pump solution for every location, but it is important to consider all of the options before selecting a final location.

Building the Support System

Construction of the support system will include construction of each of the following main components

- *Fish Habitat*
- *Plant Water Bed*
- *Water Reservoir*

The first step in building each of these components is determining the desired overall scale of the complete Aquaponics system. For systems with 2 – 10 fish, there are a number of simple, pre-made containers that will work for each of the components, that are readily available and fairly affordable. For systems with 10 – 20+ fish, there are custom construction options for each component, based on the specific component needs. Each of these components is discussed in more detail below, with solution options for both small scale and large-scale systems.

The main factor when constructing the fish habitat is volume. The overall shape of the container is not as critical, as the fish can occupy varying depths of water. As a general rule, **1 gallon** of water is required for each **1 pound of fish**, in order to maintain a healthy environment. This translates to approximately **10 gallons** of water for each **8”-10” fish** present. Keep in mind that the sizing of the tank should be based on the final size of the fish before harvesting, not the initial size. The purpose of an Aquaponics system is to grow both the fish and the plants. For a small system, one affordable and easily accessible option is a 20-gallon or 30-gallon clear plastic tote, like the one shown in figure 3 below.

Figure 4: Example 30-gallon clear plastic tote

One of these totes could be large enough for 2 – 3 fish, or two of these totes could be used side-by-side in a system large enough for up to 6 fish.

For a medium-size system, another pre-made option for the fish habitat is traditional 55-gallon plastic barrels, like the one shown in figure 4 below.

Figure 5: Example 55-gallon plastic barrel

Two of these barrels would provide enough space for about 10 or 11 fish, depending on the size and species selected. Fish size and species selection is discussed further in the "Fish System" section of this guide.

For systems with over 10 fish, the most cost-effective option may be to construct a simple water-tight structure using a wooden frame and an industrial waterproof liner. Another option for a large system would be any large pre-made watertight container. As long as it is clean, smooth, and watertight, it may be a viable habitat for fish. Purchasing a container this large may be more expensive and not a better option than constructing one as noted previously. But if one has a container like this already present and not being used, it may be perfect for this Aquaponics system.

The main factor to consider when constructing the Plant Water Bed is surface area. The best container for the plant system will be a shallow container, to maximize the surface area while minimizing the water depth. The Plant Water Bed is actually comprised of 2 pieces – the flood table and the plant support. When selecting a flood table, once again a simple pre-made container may be the simplest and most affordable option. Figure 5 below shows an example of a shallow container that would work well.

Figure 6: Example Flood Table container

It is important to make sure that the flood table does not have any holes in the bottom. 2 holes will be added to the side of the flood table – one at each end, for the water to flow in/out of. This is covered in the construction steps below. But no holes should be added to the bottom, and the container should be able to hold water without leaking.

Alternatively, if one already has a large shallow container available that is capable of holding water, it may be well suited for the Aquaponics system Flood Table. The plant supports component of the Plant Water Bed can be created in a variety of ways, out of a variety of materials. A straight-forward option would be to place dowels across the flood table horizontally in both directions, to create a checkered surface as depicted in Figure 6 below. Another option would be to secure twine or thin rope across the container in the same fashion.

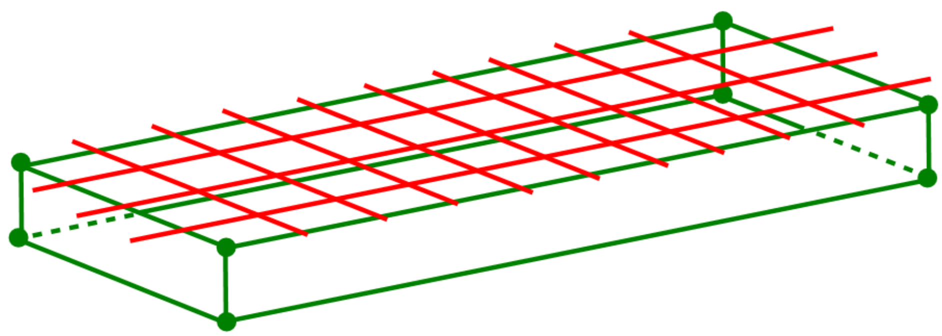


Figure 7: Plant Supports layout schematic

Selecting a large plastic or metal grate such as the one shown in Figure 7 below and placing it on top of the flood table would be an option as well. Ultimately, the goal is simply to have a structure capable of supporting the plant system. Each plant should be held upright, so that the roots can draw nutrients from the water, but the leaves to be harvested remain above water and the entire plant is not submerged in the water.

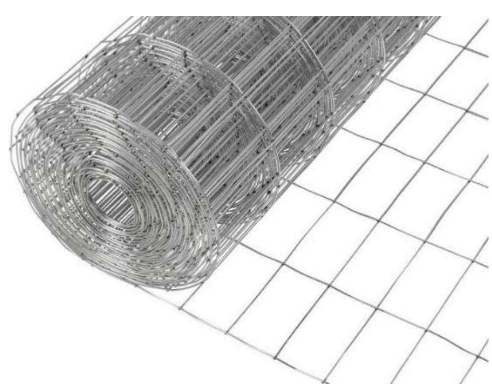


Figure 8: Alternative type of Plant Support

The Water Reservoir is the most flexible of the three components. The purpose of this reservoir is to contain the excess water that is to be cycled. This reservoir will allow for a “buffer” in the water level of the system. One can monitor the water level and add water when needed without disrupting the flow of the system. It also allows for an added filtering stage.

The volume of this reservoir should be approximately half of the volume of the rest of the Aquaponics system. Note that the Fish Habitat will be almost completely full, and the Plant Water Bed will be approximately half-full. An example is listed below.

- 30-gallon Fish Habitat (full)
- 12-gallon Plant Water Bed (half-full)
- **18-gallon Water Reservoir is needed (half of 30 plus 6)**

This Water Reservoir can be any shape or material. The only requirements are that it be watertight, and have at least one point of visibility, so one can monitor the water level and add water as needed.

Once the Fish Habitat, Plant Water Bed, and Water Reservoir are selected, construction of the support structure can begin.

Step 1 (Planning the Support Structure Layout)

Locate the Fish Habitat, Plant Water Bed, and Water Reservoir in the selected area of the Aquaponics system. Think through what layout will me most convenient for this specific system and space.

Arrange the three main components approximately in the formation shown in figure 1 of this guide, but do not anchor anything to the ground yet. The components will need to be moved around when attaching the hose sections and installing the pump.

Step 2 (Planning the required hose sections)

This step requires sections of 1/2” diameter flexible hose. This hose can be found at any local hardware store. An example of the hose needed is shown in Figure 8 below.

Figure 9: 1/2" Flexible Hose

Hose will be needed to make the following connections.

- Water Reservoir to Water Pump
- Water Pump to Plant Water Bed
- Plant Water Bed to Fish Habitat
- Fish Habitat to Water Reservoir

As mentioned above, the 3 main components of the system should be arranged so as to minimize these connection distances as much as possible. An example schematic of the Aquaponics system is shown in Figure 9 below. Note that the filter is not shown in the schematic below, as it is contained in the Plant Water Bed structure.

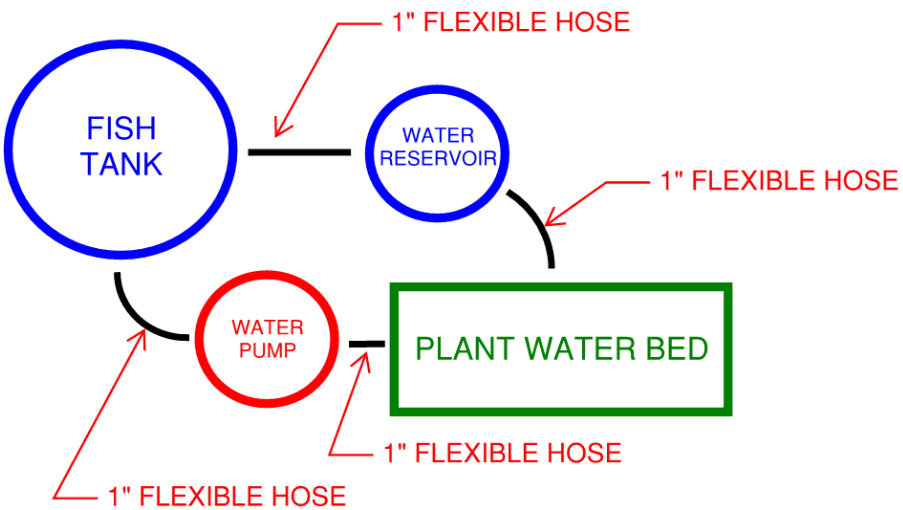


Figure 10: System Layout schematic example

Step 3 (Attaching the hose sections)

Once the final system layout has been confirmed, and sections of hose have been cut to the appropriate length, the hose sections can be attached to each of the three system components, and to the water pump. Attaching the hose to the components will require drilling 1/2" diameter holes and utilizing 1/2" "Uniseal" fittings like the one shown in Figure 10 below. Alternatively, a bulkhead type fitting could be used, but a Uniseal fitting is a much simpler option. This attachment can be found at any local hardware store.

Figure 11: Uniseal Fitting

For each of the three system components, two 1/2" holes should be drilled for the water inlet and outlet. The location of these holes will depend on the specific system layout, but they should be as far away from each other as possible, in order to ensure even flow and distribution.

The centerline of each 1/2" **inlet** hole should be located 1-1/4" from the bottom of the component. The centerline of each 1/2" **outlet** hole should be located 1-1/4" from the top of the component. The only exception to this rule is the outlet point of the Water Reservoir.

Depending on the shape of reservoir selected, the required location of the outlet point will vary.

The reservoir should be kept approximately half full at all times. The centerline of the 1/2" outlet should be located approximately 3" below the waterline, i.e. 3" below the halfway point of the Water Reservoir component selected.

Once attached, the (Hose - Uniseal fitting – Tank) setup should look similar to the schematic shown in Figure 11 below. This schematic is provided directly from the manufacturer as an aid in understanding the concept of the Uniseal fitting. The Uniseal fitting essentially provides the same end result that a bulkhead type fitting would provide, but in a much simpler fashion.

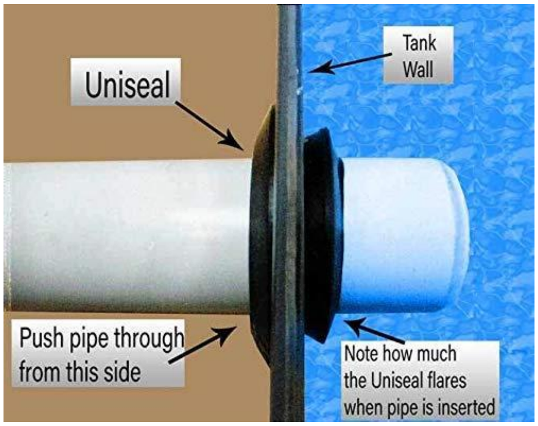


Figure 12: Uniseal complete schematic

The hose should be attached to the water pump inlet and outlet connections in accordance with the pump manufacturer's instructions. The pump sizing and selection process is discussed in more detail in the "Water System Structure Options" section below.

Step 4 (Anchoring the Components)

Once the component layout is finalized and the hose sections have been attached, the system should be anchored for stability. The anchoring process will vary significantly based on one's specific system location.

The surface type, size, and height will all contribute to the type of anchors that can be used. Ultimately, the goal is to secure and stabilize each of the 3 main components, to prevent issues from developing down the road.

Step 5 (Final Inspection, Water Test)

Once construction of the Support System has been completed, the final inspection and Water Test can begin. The "Water System Structure Options" section below gives more in-depth information on the specific requirements of the water system and on water preparation and maintenance.

Water should be added to the Plant System structure slowly, so that the water flows all the way through the system into the Water Reservoir.

Once the Water Reservoir is half full, completely covering the water outlet, the Water Pump can be turned on. The Water Pump should carry the water up to the Plant Water Bed inlet. From there the water should continue to flow out the hose connection point to the Fish Habitat. As long as the Fish Habitat is filled with water up to the hose connection point, water should flow back into the Water Reservoir.

If at any point in this process the water is not flowing as desired, the height or slope of each system component should be adjusted as needed.

Take care when adjusting the system, as the components can be quite heavy once full of water. Usually only slight adjustments to height or slope are needed to resolve flow issues. Make any changes slowly, one small adjustment at a time.

Once the system is circulating water to all 3 system components, take a close look at each hose connection point to ensure there are no water leaks present. Once this is completed and the system is running smoothly, the Support System is complete.

Water System Structure Options

The Water System is the structure that will probably take the most fine-tuning, in order to ensure smooth and complete water flow. Selecting components to hold the water following the directions above will not be too complicated.

The difficult part is implementing the water pump, hoses, and hose connections. While this process may be the most time-consuming, it is important not to rush through it. Constructing a sound Water System structure now will help decrease the amount of maintenance required down the road.

Step 1 (Determining Pump Size)

The size of pump required will depend both on the total size of the Aquaponics system and on the change in elevation present in the specific layout. The table below lists a few different recommended pumps for each size of Aquaponics system.

	Standard	Solar Powered
Small System (40 – 60 gallons), Small Elevation change (1-2 feet).	SEAFLO SFDP1-030-045-33	Aquatec 5503-AEE-B656
Small System (40 – 60 gallons), Large Elevation change (2-4 feet).	SEAFLO 42-Series Diaphragm Pump	Aquatec 5503-AEE-B656
Medium System (60 – 120 gallons), Small Elevation change (1-2 feet).	SEAFLO 42-Series Diaphragm Pump	Dankoff Solar Flowlight Booster Pump
Medium System (60 – 120 gallons), Large Elevation change (2-4 feet).	SEAFLO 52-Series Diaphragm Pump	Dankoff Solar Flowlight Booster Pump

In most cases, a standard pump that can be plugged in to a typical 120-volt outlet is preferred. A Solar Powered pump will be much more expensive, but may be required if there is no electricity available at the location selected for one's Aquaponics system. Additionally, there are some submersible pump options that may be considered. Submerged pumps are more difficult to monitor and are not recommended for an Aquaponics system, but may be considered if desired. An example of the technical details and overall dimensions provided by the manufacturer for one of the pumps is shown in Figure 12 below.

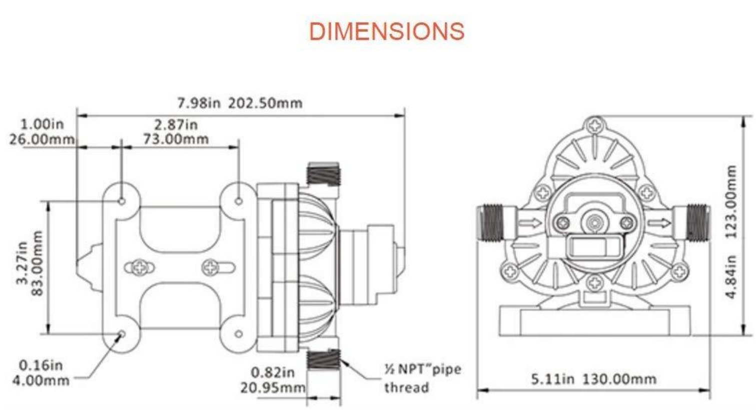


Figure 13: SEAFLO SFDP1-030-045-33 model information

Step 2 (Installing the Pump)

It is important to follow the manufacturer's instructions closely when setting up and installing the water pump. Depending on the pump selected, the pump may need to be anchored securely. Most water pumps create at least some amount of vibration, and it is important that the pump stays in position. Once the pump is setup and secured, follow the instructions from Step 5 in the previous section to cycle water through the system for the first time.

Protective Covering

The construction of a protective covering is not difficult, but it is essential. Of all the possible things that could negatively impact an Aquaponics system, direct sunlight on the water is the worst.

Nothing will kill both the Plant System and the Fish System faster than algae and bacteria growing in the water. If either the Fish Habitat or Water Reservoir are located in a sunny area, a protective covering should be used.

Step 1 (Selecting a Covering)

The material of the covering is not important, as long as it completely shields the water from the sunlight. It may be helpful to select coverings that are of light-weight material, to make adjusting and relocating them easier. Sheets of lumber or metal can be very effective shades, but can also be unnecessarily heavy. Dark cotton sheets, or even standard car windshield sun-shades, can do just as good of a job and are much easier to adjust and relocate.

Step 2 (Installing the Covering)

When adding the protective covering, be sure to check the coverage effectiveness at all times of day, as the sun moves across the sky. The covering may need to be adjusted throughout the day, or multiple coverings may be needed.

If the Aquaponics system is located inside, the shade material may only require minimal attachment. If an outdoor system is being considered, the shade material will need to be attached more securely to account for any breezes or other elements that may displace the material.

Ancillary Components

In addition to the three major components discussed above, there are additional ancillary components needed to support the Aquaponics system. The main component that needs to be addressed is the system filter. The Water Pump and Plant Supports could also be considered Ancillary Components as well.

The system filter plays the key role of filtering out the solid portions of waste from the Fish Habitat that cannot be absorbed or utilized by the Plant System. This filter is one of the few components that will require regular maintenance. A reusable filter is highly recommended.

If one prefers to minimize costs and does not mind the work of a weekly cleaning, a reusable filter is certainly the best option, even with the higher initial cost. If one prefers a more hassle-free solution, disposable filters may be a better option.

The most recommended option for a reusable filter are Matala sheets, also called Matala filters. These can be found at most Fish stores or Pet stores. Matala sheets do a great job of filtering out both large and small particles, while maintaining a smooth water flow through the filter.

Installing and using a Matala sheet as a system filter is very simple. Simply cut a Matala sheet down to the same size as the Water Bed Component, and fit it into the component near the water inlet end, as depicted in Figure 13 below. All plants should be located in the Water Bed beyond the filter.

The filter should be located approximately 6” from the edge of the Water Bed, to allow space for water circulation and filtration but still maximize the plant growth space available.

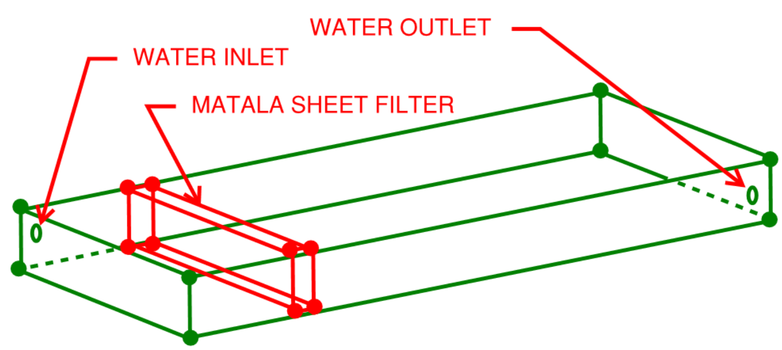


Figure 14: Matala sheet filter installation

If the Matala sheet is cut slightly oversize and wedged firmly into place, it may not require any additional securing. If it is not staying in place, a waterproof adhesive such as duct tape or silicone tape can be used to secure the Matala sheet to the edges of the Water Bed.

The system filter should be cleaned approximately once per week, depending on the environment surrounding one’s specific Aquaponics system. To clean the filter, simply remove the Matala sheet and rinse thoroughly under running water. Do not wash the filter with soap, as any residue left on the filter will introduce undesired chemicals into the Aquaponics system.

When cleaning the filter, pay attention to what specific foreign objects are being captured. There may be some unexpected things present, such as large leaves or other foreign objects. These may provide information about undesired objects in the surrounding area that are entering the Aquaponics system and need to be addressed.

THE WATER SYSTEM

Water Preparation

It is important to remember that the water in the system is living, just as much as the plants and fish. The Water system needs to be cared for and monitored, just like the Plant system and the Fish system. To start things off right, the water should be fully filtered. Starting with clean water in the empty system, and cycling the system for several minutes, should provide this.

There are four important factors to monitor when considering the Water System. These factors are:

- Oxygen Level
- pH Level (acidity)
- Temperature
- Nitrogen Level

These four factors may sound complicated, but they are actually relatively simple to monitor using basic water test kits. These water test kits are available at any fish/fish tank or swimming pool supplier. If there are issues with any of these factors, some water maintenance may be required. The section below gives detailed information on how to address each of these factors specifically.

Water Maintenance

If an adequately sized pump is selected, there should be some minor disturbances that make their way to the water surface of the Fish Habitat, and there should also be no issues with the Oxygen Level. Some signs that there is not enough oxygen in the water include fish crowding around the pump inlet or outlet, or fish consistently coming above the water surface (outside of feeding time).

The pH level of the water in the Fish Habitat should be between 6 and 7. One simple way to raise the pH level is by adding baking soda. To lower the pH level, consider adding natural components such as pieces of old wood, or some peat moss. When adding components to the Fish Habitat, take care to ensure they remain stabilized at the edge or bottom of the tank. Too much debris floating through the tank inlet/outlet will quickly cause a clog.

The required temperature level will vary depending on the species of fish selected for the Aquaponics system. The water temperature of the system will closely follow the temperature of the system's surrounding environment. The best way to change the temperature of the water in the system is to change the temperature of the surrounding environment. Since this is often not an option for outdoor systems, it is important to select a fish species that will thrive in the specific climate one's system is located in.

As long as the Plant System is active, healthy, and growing, the nitrogen level of the Water System should be well maintained. The Plant System plays a critical role in the health of the Fish System and overall Aquaponics water systems. It helps regulate the Nitrogen level, and consumes the food provided from the fish waste.

In addition to these four key factors, it is important to monitor the overall environment of the Aquaponics system, with respect to the water system. If a protective cover is used consistently and no additional foreign objects are introduced to the system, the water should stay clean and healthy as it is processed through the system.

However, it is inevitable that at some point the water quality will begin to deteriorate. If caught early enough, some simple maintenance as noted above can bring the water quality back up to a healthy level.

Water System Cycling

It is important to understand how the water moves through each step of the Aquaponics system, and what is happening to the water in each step. The water is the medium that allow the Fish System and Plant System to interact and support each other. Figure 14 below shows a basic schematic of what happens to the water at each stage of the Aquaponics system.

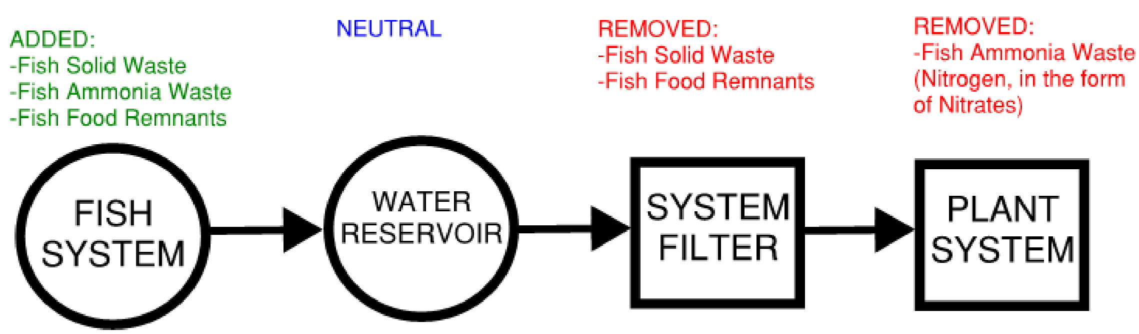


Figure 15: Water System Cycling process

As noted previously in this guide and depicted in the above figure, in the Fish Habitat fish waste is added to the water. This waste-filled water is carried into the water reservoir. As the water leaves the reservoir and passes through the pump into the Plant Water Bed, it continues to carry with it nutrients from the fish waste that will provide food for the plants.

The water passes through the system filter located at the entrance to the Plant System. This filter removes solid waste and debris, as these cannot be absorbed or used as nutrients by the Plant System. The ammonia-filled water then moves on, cycling through the Plant System.

The plants absorb nitrogen in the water through their roots. This is an essential step in lowering the water nitrogen level before it passes back to the Fish Habitat. Once the water has been filtered and cleaned by the Plant System, it passes back to the Fish System for the process to begin again.

The overall Aquaponics system structure should be observed from time to time, to ensure this Water System cycling process is continuing to flow smoothly, and that no clogs or back-ups are present. Undesired changes in system component heights or levels can create serious problems, but these problems are often easily fixed with a slight adjustment to the components.

The Water System is the “life blood” of the entire Aquaponics system, providing the Plant System the nutrients it needs and the Fish System the habitat it needs. If this first system can be started and maintained effectively, one’s Aquaponics system will be well on the road to success.

THE PLANT SYSTEM

Plant Selection

There are a number of factors to consider when beginning the plant selection process. The best starting point is to consider plants that are native to one's local region. If one is building an indoor Aquaponics system, it is possible to consider additional plant options that are not native to the region. However, even with the regulated temperature, there are other factors such as altitude and air quality content that may not be controlled. One should of course also consider what kind of plants they find appetizing or desirable. Most of the plants listed below can be found at one's local greenhouse. Alternatively, these plants could be started from seed outside of the Aquaponics system, and then transferred to the system once they have reached the transplanting stage.

Important factors to consider are rate of growth, amount of sunlight available, and whether the system is indoors our outdoors. There are many different options when selecting the plants for one's specific system, but this guide will discuss 3 general types of plants.

If the goal is to produce as much greenery or content as quickly as possible, Lettuce, Spinach or Watercress are good options. Watercress is the fastest growing but multiplies quickly and may soon overcrowd the Plant Water Bed. One may also tire quickly of eating Watercress. Lettuce or Spinach are good middle-ground options in the fast-growing category.

They will not produce quite as fast as Watercress, but most people find a wider variety of options available when preparing and eating Lettuce or Spinach. With these leafy plants, it is important to keep an eye out for small bugs and insects. They should not attract as many insects as a fruit-bearing plant would, but some bugs can destroy an entire leafy plant very quickly. Caterpillars are an especially infamous culprit to keep an eye out for, especially if the Aquaponics system is located outside.

If the focus is not on producing a quick harvest but rather on producing a quality harvest with fruit, Tomatoes can be a great option. There are many different types of tomato plants, but varieties that produce smaller fruit, such as cherry tomatoes or roma tomatoes, are usually the most successful. Again, one should consider the local region, and select plants that have been proven to do well there. As mentioned previously, it is important to note that any fruit-producing plants, especially tomatoes, will almost certainly attract some insects. This may not be as large of an issue if an outdoor

Aquaponics system is being constructed but should still be considered. If an indoor Aquaponics system is being considered, it may be best to plan for leafy plants only to keep from inviting too many insects into one's home.

Cucumbers can also be very successful growing in an Aquaponics system. These plants are excellent at regulating the nitrogen levels in the water, keeping things clean and healthy for the fish system. Cucumber plants do have large vine-like root systems that can reach to the water inlets/outlets or system filter and clog the system. One should monitor these root systems and trim them as necessary.

It is recommended that for the first life-cycle of one's Aquaponic system, a variety of different plants are selected. This will provide good information on what plants do well in the specific environment and climate present, as well as what plants one particularly enjoys seeing, caring for, harvesting and eating.

Plant Life

The goal of an Aquaponics system is to move the plant through its full individual life cycle as quickly as possible, in order to maximize harvest yield. As noted previously, the time of this life cycle will vary depending on the plant type selected, but it is still desirable to accelerate this process as much as possible.

One key factor to ensuring the plants are growing as fast as possible is maximizing sunlight. Depending on the location of one's specific Aquaponics system, this may occur naturally or steps may need to be taken to ensure this occurs. If an indoor Aquaponics system is selected, or an outdoor system as a somewhat shaded area, supplemental light may need to be provided. Consider adding a small fluorescent light, or a heat lamp if needed for the climate, to help accelerate the Plant System growth. The Fish System should provide enough food for the plants, if sized appropriately. The Water System will of course provide as much water as needed. The sunlight is the only key factor missing that one must take care to ensure is provided in large amounts.

Another important step in accelerating the growth of plants is strategic pruning and harvesting. Depending on the type of plants selected, strategic trimming and pruning should be executed as needed. It is important to make sure the main leaves or fruit-bearing branches are receiving as much of the nutrients as possible, and smaller or dying leaves or fruit-bearing branches are not robbing the plant of nutrients unnecessarily. Regular trimming or pruning is main factor within one's control, and the best thing one can do to accelerate the growth and life cycle of the Plant System.

Plant Support

Depending on the specific Aquaponics system setup, the plants are usually the part of the system that are seen the most. This means that they are also the most obvious to monitor and identify when support is needed. If one notices the plants starting to become wilted or dead, the first step should be to review the surrounding environment. Large changes in temperature, not enough sunlight, or a crowded growing area can all deplete plant health.

Other problems that can develop include plant-eating insects or plant diseases. If one finds that the Plant System is repeatedly struggling with the presence of plant-eating insects, it may be necessary to add a screen cover or netting cover to the Plant Water Bed.

As mentioned previously, all of the plants listed above can be purchased from one's local greenhouse or started from seed if desired. One's local greenhouse should be able to provide region-specific plant care tips and recommendations. If starting plants from seed, start with twice as many plants as needed for the Aquaponics system.

When ready to be transplanted, add 1-1/2 times as many plants to the Aquaponics system as actually needed. Transplants from seedlings are typically more fragile than plants purchased from a local greenhouse, and usually do not all survive. In the first few weeks following the transplant, remove any weak or dead plants as needed so that the appropriate quantity of plants are remaining in the Aquaponics system.

THE FISH SYSTEM

Fish Selection

This may be the most difficult of all the decisions one makes. The life cycle of the Fish system is by far the longest, and so, once selected, the species of fish will be set for the full life cycle of the Aquaponics system. Factors to consider when selecting fish type include

- Growth Time
- Hardiness
- Food Requirements
- Space Required
- Taste

Tilapia is the most common choice for an Aquaponics system. It most easily satisfies all of the criteria listed above. Tilapia are a very hardy fish – they can live in a water system that is anywhere between 60 degrees and 80 degrees. However, if the water temperature drops below 60 this can kill them, so they may not be the best choice for colder or winter climates. Tilapia typically grow the fastest of all the fish options, reaching the harvestable weight of 16 ounces in approximately 6 months. All species of fish considered will require minimal space, as the Aquaponics system typically drives this requirement.

Tilapia fall into this category, as they do well even in a crowded environment. Another advantage to Tilapia is the small amount of fish food required. While there is not a significant variance between fish species, the minimal amount of food required by Tilapia may be desirable if the goal is to keep system maintenance as low-cost as possible. Finally, Tilapia has a fairly mild flavor, and the taste is typically appealing to a wide range of palettes.

Yellow Perch is another species that satisfies all of the criteria listed above. It can do well in slightly cooler water, and also has a fairly short growth time. Yellow Perch typically reach harvestable weight in approximately 9 months. Yellow Perch are a hardy, slightly smaller fish. If one desires a larger quantity of fish in the Aquaponics system, while maintaining the 1 pound per gallon rule, Yellow Perch may be a great choice. Yellow Perch do not require much food – only slightly more than required by Tilapia. They do tend to have a slightly more distinct taste than Tilapia, so that may be important to keep in mind.

Catfish are a less traditional alternative, but still an option. Catfish are extremely hardy and can adapt to a variety of harsh environments and climates.

While they can survive in a wide range of temperatures, they do grow best in warmer water, between 70 and 85 degrees. They do require more food, and must be fed a food that is high-protein. They also have a longer growth time – they take approximately 18 months to reach a harvestable weight. They are also very sensitive to being touched or handled by humans, so a system with minimal maintenance and owner activity would be best. There are some who thoroughly enjoy the taste of Catfish, so that may be a desirable factor to consider.

Goldfish are a very non-traditional option, but worth mentioning. Typically, the dual purpose of the fish in an aquaponics system is to provide food, and to provide nutrients for the plants. If one wishes to provide nutrients for the plants only, and desires to have

fish present but not for harvesting and eating, Goldfish are an option. Goldfish are extremely hardy, and can survive in a variety of environments and climates, including crowded ones. They are also considered by some to be pleasant to look at and have present. If one's desire is to have fish present for plant food only, and never harvest/eat them, Goldfish may be a good option.

All of the fish listed above can often be found at one's local farm store. Alternatively, local Pet Stores or Aquarium Stores may carry some of these species. One's local farm store may also be able to suggest additional fish species that are available and would do well in the specific Aquaponics system environment created. Consult with the local stores, and consider the full range of temperatures and climates present in the Aquaponics system, before making a final fish species selection.

Fish Health

Of the three systems, monitoring the health of the fish can be the easiest. While not the most visible system, they are the most active and observable. There are a few key indicators that can be used to determine what, if any, changes are needed.

The main contributing factor to the fish health will always be the water quality. "The Water System" section of this guide gives detailed information and instructions on maintaining the water quality. Another significant factor that will contribute to the fish health is the food. It is important to keep the food type consistent, once a good food type has been identified. While it is tempting to select the cheapest fish food available, higher quality fish food is often worth the investment. Higher quality fish food typically contains more fiber and protein, which is very important.

One major thing to monitor for the Fish System is the fish activity. It is normal for the fish to move slowly outside of feeding time. But if they stop swimming altogether, are slow-moving during feedings, or are not eating at all, these are warning signs that the fish are not healthy. Ultimately, the best thing you can do for the Fish System to increase and maintain the health of the fish is to manage the stress. From water temperatures to climate changes to food types, fish thrive the most in a stable environment that is free from the stress of constant changes.

Fish Life Cycle

The fish life cycle will almost always be the controlling and limiting factor in an Aquaponics system. There are some who are proponents of Hydroponics over Aquaponics for this reason alone. However, while the fish life cycle is the longest, there are still steps that can be taken to accelerate this. As mentioned previously, the type of fish food used and the frequency of feedings plays a key role, as does the overall fish health. Ultimately, the best way to optimize fish growth and growth speed is to maintain the fish health by following the guidelines given in the previous section. Following these guidelines, ensuring the Fish Habitat is not overcrowded, and selecting a fish species with a short growth time are the key steps to having fish that are a harvestable weight as soon as possible.

It is recommended that all fish be harvested at the same time, or in a short of a time period as possible. It is not recommended to mix mature or near-mature fish with new young fish, as there is a high probability of the new young fish being eaten by the mature fish. The new batch of young fish should be added all together at the same time, into a system that has had two to three days to stabilizing after the deep cleaning.

STARTING THE SYSTEM

The First Week

It is important to monitor the new Aquaponic system closely during the first week. Ultimately, the goal is to have an Aquaponic system that is self-sustaining and requires minimal monitoring and upkeep. In order to develop a system that meets this goal, some adjustments during the first week may be required. Key things to monitor include

- Water Level and Cleanliness
- Filter Status
- Fish System Activity
- Plant System Health

If the water level in the water reservoir is consistently decreasing, double check all hose connection points to ensure there are no leaks present in the system. Add water as needed to maintain a full reservoir but try to determine what is causing the loss of water. A small decrease is expected, due to evaporation, but large amounts of water loss may indicate a leak.

If algae are accumulating on top of the water in either the Fish Habitat or the Water Reservoir, too much sun is reaching the water surface. Consider adding additional covering or taking other steps to ensure both water sources are completely in the shade. Too much algae will decrease the quality of the Fish Habitat environment and will also clog the filter in place unnecessarily.

The filter should be cleaned approximately once a week. It may need cleaned more often initially, when first starting up the system. After the first week, if the filter is becoming full and clogged after only a day or two, look into the environment surrounding the Aquaponics system to ensure no foreign materials are entering the system. Leaves, grass, dirt, and even dust can easily find their way into the system and quickly clog up the system filter. The filter is mainly intended to filter out only the contents present in the closed-loop Aquaponics system.

When feeding the fish during the first week, check and make sure there is healthy activity. It is important to make sure the fish are adjusting well to the new environment. It is not concerning if there is not much movement from the fish throughout the day, but there should be a healthy amount of activity during feedings.

The Plant System health will be the most obvious when monitor during the first week, as it is the most visible. It is important to ensure water is reaching the roots of all plants present in the system. As noted in the “Plant System” section , some minor trimming of smaller or wilting leaves may also be required, in addition to the regular main harvest.

The First Harvest

For many people, the most exciting part of owning an Aquaponics system is the harvest. Becoming familiar with one’s specific system, and when and how each harvest should occur, is something that will take both time and experience.

For the Plant System, it is important not to wait too long to harvest and trim. Allowing the plants to grow too large can create many problems including overcrowding, lack of nutrients, and even going to seed.

However, harvesting too early can result in damaging the health of the plants, or missing out on the largest or most efficient stage of growth and development. 6 weeks per harvest is a good starting point for the plant system, but this should be adjusted to accommodate the plant types present in one’s specific system. After the first few harvests, a familiarity with the life of both the Plant System and the whole Aquaponics system will develop.

For the Fish System, the harvest will not occur as frequently. The fish system harvest schedule will be the determining factor for the complete life cycle time of the Aquaponics system. Determining the appropriate harvest time will depend mostly on the optimal growth stages. If the purpose of the Aquaponics system is to generate as much food and sustenance as possible, the fish should be harvested as soon as either the growth begins to slow or the fish reach an acceptable harvest size – whichever occurs **last.** Similar to the plant system, after the first few harvests a familiarity should develop with the life of the Fish System.

One should not be discouraged if the first or even the second harvest are smaller than expected. Even the most experienced growers typically see a slightly reduced harvest following the first cycle. It takes time, first for one to become familiarized with the specific Aquaponics system, and second for the system to develop and the climate of each system to stabilize.

During the first few harvests of both the Plant System and the Fish System, it may be helpful to note dates, quantities, and conditions. Having a record to refer back to can come in very handy when planning for future life-cycles. One can make more informed decisions and plans about a specific Aquaponics system if there is information readily available regarding past harvest dates, quantities, and conditions.

The First Deep-Clean

Upon completion of the first complete life cycle of the Aquaponics system, a thorough deep-clean of the entire structure should be carried out before adding new fish and additional plants. The Flood Table and the Plant Supports should be removed and cleaned individually. Plant Support components may need to be repaired or replaced, if the structural integrity is becoming compromised.

The Fish Habitat should be thoroughly scrubbed, especially around the inlets and outlets. The water reservoir may not require too much cleaning, but the water pump should be thoroughly wiped down and dusted. If an inline pump has been selected, as recommended, take care not to spill too much water on the pump when cleaning each component.

Finally, the surrounding area should be cleaned as needed, and any loose debris should be removed. Although it has already been mentioned previously, it cannot be emphasized enough how important it is to keep the surrounding environment of an Aquaponics system clean. The concept of a healthy closed-loop system fails when anything from outside the system is added.

During this process, it is important to make sure the water pump is not run without water in the system, as this will damage the pump. If any soap or chemical cleaners are used, ensure all components are thoroughly rinsed and dried. Any soap or cleaner residue remaining that makes its way into the system can be very damaging to the health of both the fish life and plant life. The main goal of the cleaning process is to remove all algae and debris present and allow the Aquaponics system time to cycle water through all the components thoroughly.

Following any deep clean, the system should always be given two to three days to stabilize before adding new fish to the Fish System. Plants can be added immediately once the system is up and running again, but it is important to add the fish last, and only after two to three days. Almost all fish species are highly prone to shock, and the greatest chance of this occurring is always when they are being introduced to a new environment.

MAINTAINING THE SYSTEM

Common Issues

In an ideal scenario, the entire Aquaponics system would be constructed, setup, and started with no problems or issues along the way. Realistically, there are a number of minor common issues that may develop. A few of the most common issues include:

- Leaky Hose Connections
- Water Pump Failure
- Clogged Filter
- Struggling Plant Health
- Struggling Fish Health

If there is an opportunity for a leak, running water will always find it. In this Aquaponics system, the greatest opportunity for leaks is in the hose connections. If a leaky connection is identified, ensure the Uniseal fitting is fitted tightly, and the seal is free of debris or obstructions. Remove and reattach the connection if needed. In some cases, a completely new fitting may need to be installed.

If the water pump is not operating as expected, check to ensure that water is flowing through the system correctly while the pump is turned off. Refer to Figure 1, Figure 8, and the "THE STRUCTURE" section of this guide as needed.

Back-up of water flow can put an unnecessary load on the water pump, restricting its ability. If the system is setup for proper water flow, double check the filter to ensure no large clogs or blockage of water are present. Clean or replace the filter, if necessary.

If the plant health is struggling, check to make sure the plants are receiving enough sunlight throughout the day. It is also important to make sure that the plants are not exposed to a large swing in temperature or climate. Make sure all plants are receiving adequate water, but no plants are overly submerged.

If the fish health is struggling, check the instructions on the fish food being used to ensure the fish are not being over-fed or under-fed. It is also helpful take a sample of water from the fish habitat and inspect it, to see if debris or excessive algae are present.

Preventative Maintenance

There are a few steps that can be taken to ensure larger issues do not develop in the future.

The hose connections should be replaced approximately once a year, or once every 2 - 3 cleanings, whichever comes first.

The Water Pump should be removed from the system and cycled with clean and purified water approximately once every 3 months.

The temperature and climate of the overall Aquaponics system should be monitored, and steps should be taken as necessary to prevent overly large changes. Both the plant life and fish life depend on a stable and consistent environment.

The Plant System should be closely monitored for any damaging insects, and if found these should be removed immediately. This is especially important if leafy plants are selected.

CONCLUSION

In the introduction of this guide, it was recommended that one read through this text in its entirety before beginning construction of an Aquaponics system. After reading through this guide, there are a few main concepts that should come to mind.

First, the overall Supporting Structure of the Aquaponics system is comprised of 3 main components (Fish Habitat, Plant Water Bed, and Water Reservoir). These components can be items one already has available, one purchases pre-made, or one constructs to a custom size and shape.

There are of course additional ancillary components needed, and there are more specific details for each of these 3 components. But these 3 main components will drive the overall size and setup of one's specific Aquaponics system. There is flexibility in what each component is made from, and room for creativity. As long as each component serves the specific functions given above in this guide, it can be successfully incorporated into one's specific Aquaponics system setup.

Second, each individual system in the overall Aquaponics system (Fish System, Plant System, and Water System) should be developed and monitored both individually and in connection with all systems. For each system, there are specific items to look for when monitoring the health and development, but there are also general concepts to consider for the Aquaponics system as a whole. In the early stages and throughout the entire life of one's Aquaponics system, it is important to keep this information in mind.

Third and finally, the life of one's specific Aquaponics system, and that life's health and growth, will depend significantly on the local climate and environment. Whether the system is large or small, located indoors or outdoors, in a mild climate or fluctuating climate – these factors will all play a role in determining the overall resulting system, and ultimately, the harvests.

The final result of one's Aquaponics system should not be compared to other systems, but rather to the desired outcome of one's specific system. The goal is not to create an Aquaponics system that is mostly generic. The goal is to create an Aquaponics system that will fit one's specific space and environment available, and will meet one's specific desires. The directions and instructions given in this guide are not to ensure that all Aquaponics systems constructed end up similar overall. They are given to ensure that one's specific setup becomes a successful and thriving system.

Keeping these three main concepts in mind throughout the process will help keep things on track. After reading through this guide, take some time to envision the specific Aquaponics system desired, based on the available location, environment, and components. Take some notes and sketch up a rough layout. Then skim through this guide again to ensure that the key directions and instructions given can be implemented in the Aquaponics system being planned. If this is the first time one is constructing an Aquaponics system, there will undoubtedly be minor undesired surprises and hiccups that develop. Be sure to read through the "Common Issues" and "Preventative Maintenance" sections thoroughly, to anticipate these items and be prepared with solutions.

Owning an Aquaponics system does require an initial investment, but it can be a very rewarding experience. There is nothing like the feeling of sitting down to a meal made completely from plants and fish grown and harvested from one's very own Aquaponics system. This guide was written with the goal of providing directions and instructions for achieving that rewarding and sustainable experience.

Where Free Land Can be Found in the USA

Table of Contents

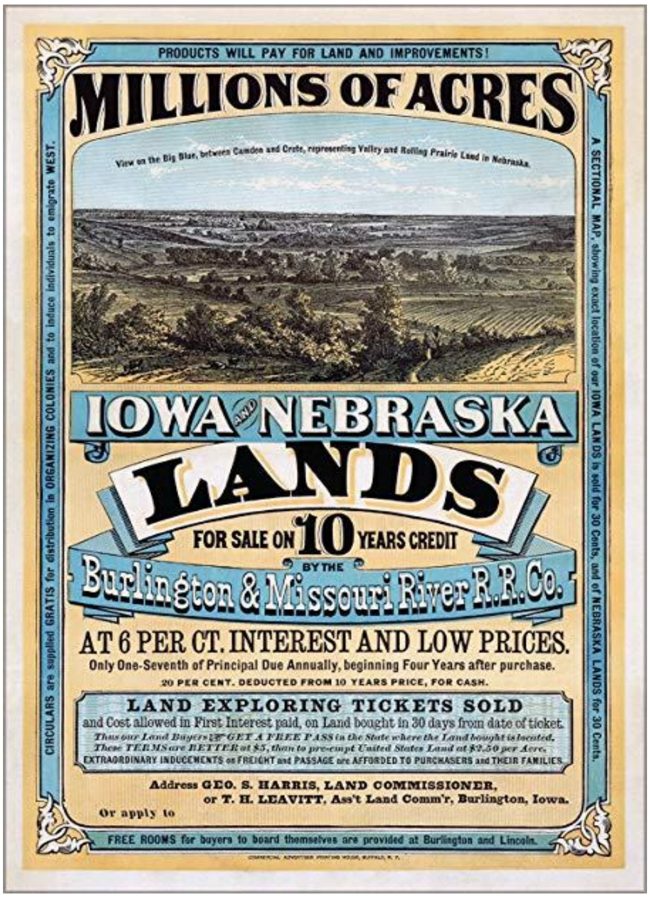
Anyone who has spent any time around the prepping and survival community knows that the goal of every prepper is self-sufficiency. But just what does that mean? How self-sufficient do you need to be, before you can consider yourself truly self-sufficient? How big a stockpile do you need?

Actually, there's more to it than having a stockpile; for no matter how big your stockpile grows, it will eventually run out. That's why experienced preppers tend to look towards growing their own food. Put another way, these experienced preppers aren't looking to their homes just being a survival retreat, but rather, being a homestead.

But just what is a homestead? There are many different definitions given to this word, depending on whether you are thinking in a legal sense, or in the sense of someone who is thinking of self-sufficiency.

That's really what we're talking about, and in that regard, a homestead is a small, subsistence level farm, allowing one to grow enough food for their own or their family's survival. It's not a commercial farm, but rather the true expression of self-sufficiency.

Once upon a time, early American settlers who were willing to move into the sparsely populated western territories of the United States were given the opportunity to scoop up a parcel of land and use it to make their own destiny.



Known as the Homestead Act of 1862, any adult citizen who had not fought against the United States in armed conflict could travel west and claim a 160 acre plot of land, so long as they were willing to make improvements to that land (usually building a home) and stay, working that land (usually farming) for at least five years.

Soldiers who fought in the civil war could count the time they served as time spent on the land, so they had even easier access to free land.

Of course, settling out west in the mid-19th century, even on free land, didn't come without hardships, but the Homestead Act fast tracked settlement of the western frontier and brought to life the homesteader spirit that is such a prevalent part of U.S. history.

It removed several huge barriers, most notably the cost of the land, which many poor people came up against when it came to carving out a place of their own. Homesteading gave them a way to make a living and feed and care for their loved ones – not to mention a legacy they could pass on to their children and grandchildren.

Homesteading Today

This seems like a complete and total pipe dream these days, doesn't it? Yet more and more experienced preppers are turning to homesteading. No, they aren't getting 160 acres of farmland and working it with a horse-drawn plow; but they are homesteading nevertheless. Actually, the modern homestead is much smaller, usually ranging one to two acres. Some people get by on even less.

I'm sure you've seen an article sometime about a family who grew all their own food in the backyard of their suburban home. That's homesteading and it can be done on as little as 1/5 of an acre. I had a neighbor once who farmed his backyard and about half of mine, growing all his own produce and even passing some on to me.

Modern gardening techniques make this possible. Granted, people who are doing this style of suburban homesteading aren't usually raising any livestock larger than chickens and rabbits. Nor are they typically growing their own grains. What they're doing is raising mostly vegetables, along with possibly a few fruit trees. Even so, they're successfully growing food to feed their families. In the case of a major disaster, the best of them are ready to expand their operations to the point of growing enough food to fully feed their own families.

If you want to be truly self-sufficient, having a place where you know you can care for your family, then homesteading is the way to go. If you can, get yourself a couple of acres and really set yourself up right. But if you can't; at least get a good-sized suburban lot and turn it into an urban homestead. Using raised beds and planting properly, you'll be surprised how much you can grow.

Two acres is considered enough to do a complete homestead, meaning that you are growing your own grains and have a little bit of livestock as well. But as we've already discussed, you can get by on much less, if you limit yourself to growing fruits and vegetables, as well as limiting your livestock to chickens and rabbits.

There are still places out there where you can get a plot of land for free or pretty close to it.

LAND FOR FREE

Don't assume that this list is by any means complete. These are a few places I was able to find, where land is available for free. Mostly, they are small communities which have land that is available, usually home lots.

While that may not be as big as what you want, you could do suburban homesteading. Take a look at the opportunities below and decide if any of them might be right for you and your family.

One thing to keep in mind is that such land is constantly coming available and then being snapped up by people like you and I, who want their own piece of the pie and are willing to work for it.

Just recently, a small town about 30 miles from where I live, gave away 90 lots and homes. I don't mention it, because the giveaway is already over. But you never know when such a giveaway might happen.

I don't know if they still are, but for a while the city of Detroit was giving away homes to anyone who wanted them. While those homes may not have worked out well for any sort of homesteading, it does serve to illustrate that these opportunities exist all over. So keep your eyes open for new opportunities.

When you find one of these places, you will have to pass through an application process. The city giving away the land will expect you to move in fairly quickly and start making improvements on your homestead. So be ready for that. While they will give you some months to move, they won't allow you to just sit on the land and not do anything with it.

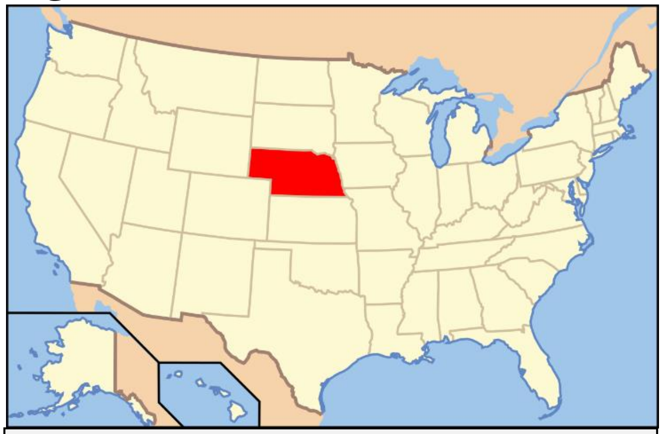
Besides, the whole idea is to take possession of the land and start building your homestead. You don't want to wait until a disaster strikes, in order to start homesteading.

Rather, the idea is to have your homestead in operation, so that when the disaster strikes and everyone else is in a panic, you're already self-sufficient and ready to go.

NEBRASKA

Nebraska is one of our nation's great farming states. In the northern part of the American Breadbasket, this state has produced a sizeable portion of not only our country's food, but the world's food for the last 100 years or more. With plentiful water and good farmland, Nebraska is a good place to live.

The only thing I could say against Nebraska, as a state for homesteading, is that your growing season will be a bit shorter than it would, if you were living farther south.



Wapcaplet [CC BY-SA 3.0]

To compensate for this, you'll probably want to build some greenhouses, which will allow you to start your growing season a few weeks earlier and end it a few weeks later, getting more from your farming efforts.

Beatrice, Nebraska

Unlike a lot of places you'll find on this list, Beatrice is not super rural – nor is it a very small community that needs an influx of new faces and businesses. The city uses their Homesteading Act of 2010 to keep lots in the city from becoming run down.

Like the Homesteading Act of old, people must build a home on the property within a year and stay for at least five years. While there aren't any lots currently available, it's worth checking regularly to see if any new ones come up.

Curtis, Nebraska

The small town of Curtis, NE offers free lots for the building of single family homes on paved streets with all utilities provided. With a population of under 900, Curtis claims to be a great place to raise a family or retire. Curtis also offers the unique opportunity to get a free lot on which to build a business, as well.

Ellwood, Nebraska

This small community has set aside a number of lots to be given away. While some are already gone, there are others which are still available as of this writing. The lots are 110 foot by 150 foot, which is a pretty good size. You must build a home that is at least 1400 square feet, with a two-car garage.

Loup City, Nebraska

This city offers two different programs, for those who are looking for free land to build a home. The Workforce Homes program offers free residential lots for those with qualifying income and assets.

In some cases, they might also offer up to $20,000 in down-payment assistance. The other program, which they call the Market Rate Homes, offers homes on a first-come, first-serve basis. Only a $1,000 deposit is required, which is refundable upon completion of construction.

IOWA

The climate in Iowa is going to be roughly like it is in Nebraska. There is plenty of water and good farmland to be had. But once again, you're going to either need to have your harvest in early or have greenhouses to extend your growing season.

Perry-Castaneda Library [CC BY-SA 3.0]

Manilla, Iowa

This small town is known for a low cost of living. Add that with the free land they are offering to build on, and you have a winning combination. You'll need to contact the city directly for information, as their website doesn't say a whole lot about the program.

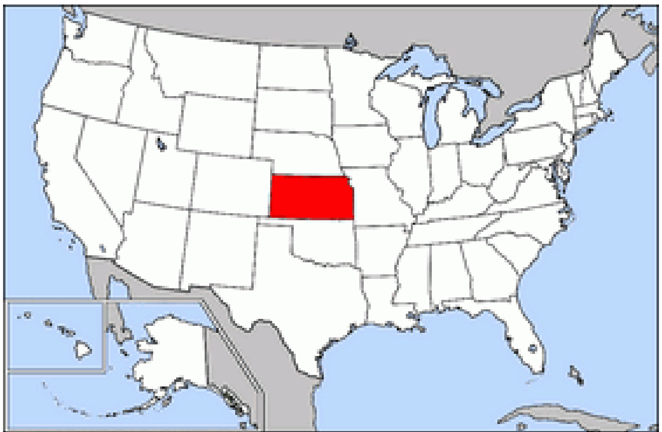
Marne, Iowa

The small farming community of Marne, Iowa has free lots that it will give away to people willing to either build a home or place a modular home there, assuming that home meets some basic requirements laid out by the city.

The lots are fairly small at approximately 80 ft by 120 ft, but they are free and you can't really beat that. Marne is located east of Omaha, NE and west of Des Moines, IA. It may be just the place if you're looking for a new place to put down roots.

KANSAS

The state of Kansas has to be just about the ideal state for growing anything. If you've ever driven though the state, it is 500 miles of nothing but farmland. So a homestead fits in just right. Your growing season will be a bit longer than in either Nebraska or Iowa, but you'll have a good winter as well, so that you can stay indoors and work on those projects that need to be done by the fire.



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Lincoln, Kansas

Among the picturesque hillsides of Lincoln, KS, you'll find several free lots to be had in their new subdivision. Along with the opportunity to snatch up a building lot for free, Lincoln boasts recent improvements to their school facilities, updated parks, and access to medical care right there in town.

Mankato, Kansas

Located in Jewell County, Mankato is giving away free lots for building. You'll have to have finances in place to build your new home, and an agreement with a contractor to get it started within 6 months, plus they require an interview with the city council. Homes have to adhere to some basic standards set out by the town.

Marquette, Kansas

The town of Marquette offers free lots on the western side of town for people to build homes on. The town prides itself on its great sense of community and the safe environment it provides for everyone, young and old.

Osborne, Kansas

While they boast about their fiber optic communications network that provides high speed internet access to the community, the town of Osborne also offers free land for both residential and commercial purposes.

You could build a home and a business without paying for land in this cozy little town, and the town itself may even be able to help you with financing your business through their revolving loan fund.

Plainville, KS

The town of Plainville, located in Rooks county, has free lots available for new construction homes on full foundations. The lots are 155 ft by 93 feet.

Along with the free land, they also offer their free land homeowners a property tax reduction to help making living there even more affordable. They'll give you a couple years to build your home – which must be at least 1,400 square feet – and get settled into it.

MINNESOTA


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Minnesota is going back north again, this time even farther than Nebraska or Iowa. While the state is known for having 1,000 lakes, it is also known for harsh winters. This is a place where you want to get your crops in early and watch the weather in the fall, so that you can get your harvest done on time.

Once again, greenhouses may very well be the way to go. Actually, if the water table allows for it, you might want a partially underground greenhouse, so that it the ground around it will help protect your greenhouse from the cold. Add in some additional solar collectors and your greenhouse, which is a passive solar building anyway, should stay warm enough to keep growing late into the season.

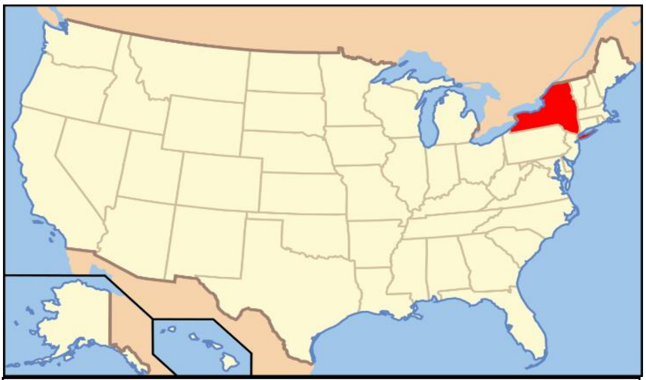
New Richland, Minnesota

With a population of about 1,200, the city of New Richland has a free land program that requires you to build a brand-new home on your free 86 ft by 133 ft lot. While the lot itself is free, you will be charged a fee to cover the development of the streets and utilities to the subdivision, the estimated cost of which is $14,000 which can be paid over several years.

Claremont, Minnesota

Claremont is open about the fact that their program is a copy of the one in New Richland. Hey, if someone has a good idea, why not copy it? They're offering free lots to those who qualify. But to qualify you must have a gross income of less than $84,200 for a family of two or $96,830 for a family of three. I don't think that will be much of a problem for most of us.

NEW YORK



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Ok, I'll have to admit, New York State isn't what most of us think of, when we think of homesteading. But have you ever spent any time in upstate New York? I have and its beautiful. Don't dismiss the idea, until you take a look at it.

Buffalo, New York

Buffalo is in the western end of the state on the eastern tip of Lake Erie. As such, they can have some really harsh winters. But you'll never have to worry about water and there are lots of woods to go hunting in. They have a slightly different program, where they are offering land for $1 as part of New York's Urban Homestead Program. Some of the land already has homes built on it, which would have to be brought up to code.

ALASKA

If there is ever a dream location for homesteading, it has to be Alaska, right? Oh, wait. It's really hard to farm in Alaska, because of all the cold and snow. Still, you could try to live by hunting and fishing, enjoying the great outdoors. Besides, if you're going to build a log cabin, doesn't Alaska seem like the place to do it?

Anderson, Alaska

If you're looking for peace and quiet, in a place where you can get away from it all, Anderson, Alaska is it. With a population of less than 300 you won't have to worry about the kids in the mall. For that matter, forget about the gas station, grocery store or public street lights too. But they do like homesteaders and you can get free homesteading land upon application. A $500 deposit is required, which is refunded once your building is complete.

CUYAHOGA NATIONAL PARK, OHIO

Of all the opportunities out there, this one might actually be the best. This is a really unique opportunity that will allow you to potentially farm a portion of the land in the Cuyahoga National Park.

This program, called the Countryside Initiative, started in an effort to rehabilitate the dilapidated farms that were already located on the land and turn them into working, productive farms again.

LAND FOR BUSINESSES

Most free land opportunities you see advertised are for homes and homesteads. But there are actually a lot of opportunities for those who are looking to open a business. One of the big concerns for many small communities is attracting jobs.

So they are much more likely to give away land to those who bring jobs into their community, than those who are just looking to build a home. Even towns that don't advertise free land can be talked into giving land to those who start businesses and hire people.

Flagler, Colorado

The town of Flagler, Colorado has set aside 480 acres they are giving away to businesses. How much of that land you can receive for free depends on how many jobs you bring into the area.

So, if you want to combine your homestead with a business opportunity, there's an ideal location for you, about 100 miles east of Denver.

Muskegon, Michigan

This is actually a large city which is giving away land. Muskegon has free land in their industrial park, which they are offering to businesses which want to come in and operate, as part of their Michigan Renaissance Zone. They are also open to tax incentives, as well as lower water and electricity rates.

OTHER FREE LAND OPPORTUNITIES

There are several more opportunities for you to build a home or plant your homestead on a free plot of land in the United States, assuming you're willing to abide by the regulations set out at various sites. While you'd still have to come up with the cash of financing to build a home or farmstead, it's maybe not as far away as you'd once imagined.

JUNK LAND

Almost all of the listings I've given above are municipalities who are giving away lots appropriate for building a house on or parking a mobile home on. They really aren't quite big enough for a true homestead, although if you plan your space carefully, you could still grow quite a bit.

But what if you want more? Land, as we all know, is extremely expensive to buy. Or is it? Is it possible to buy cheap land, which would be possible to use for a homestead?

There's a category of land known as "junk land". It's called that because it is not commercially viable for any real purpose. It's far enough out of town that it isn't practical for commercial, retail or residential use. It doesn't have utilities on it and it probably doesn't have water on it either. But… and again I say but… it's cheap. You can often buy this land, when you can find it, for less than $1,000 an acre.

The tricky part is finding the land. Most of the time, junk land isn't listed for sale. If the owner is thinking of selling it, it might have a "For Sale by Owner" sign on it, but that's about it. No real estate agent would bother listing it, because the commission on the sale isn't enough to make it worth their time.

The easiest way to find junk land is to advertise that you're looking for it. However, I'll warn you; if you advertise that you're looking for junk land, expect to get 100 phone calls from real estate agents who are going to try and sell you something for $20,000 an acre. They'll also try and convince you that what you're looking for doesn't exist, as part of their sales strategy.

But that doesn't mean that it doesn't exist. It does. Typically, it's land that someone inherited but never used. They never sold it, because it just wasn't worth the effort. But that doesn't mean that it isn't worth owning and won't work out as a homestead. Although I will say, you will have to do a lot of work to it, in order to make it a homestead; and then, when you do, it will be an off-grid homestead.

There are many things you have to consider, when looking at junk land:

- **Access** – You are going to have to make sure you have access from the roads to your land. This may mean signing a contract with some farmer or rancher, allowing you to use their private roads.
- **Water** – Your biggest need is going to be water and there probably won't be water on site. That either means drilling a well, harvesting rainwater or trucking water in. Be sure to have a plan for water, before deciding to buy any piece of junk land; and be sure to take into consideration how much water you'll need for growing your food.
- **Electricity** – There won't be electric power and to get electric power will probably require running miles of power lines, all of which you would have to pay for. It wouldn't hurt to check on that, but you will probably need to produce your own power via wind or solar.
- **Sewage** – You'll need to install a septic tank. Of all the problems you'll face, this is probably the most straight-forward. You might even be able to do it yourself, depending on the county's building code and regulations.

- **Flooding** – Make sure that you're not buying a piece of land in a 100-year flood plain. You just don't need the hassle.
- **Fencing** – If you're going to raise any sort of livestock, you're going to need to fence in your land or at least part of it. Running a fence around a couple of acres is a lot of work and can be pretty expensive.

None of these potential problems are serious enough that you shouldn't consider buying junk land; they're just things that need to be taken into consideration before making that decision. In some cases, it will be easy to overcome these problems; but in others, it won't.

For example, there's a lot of junk land available in West Texas for an excellent price. You can buy 10 acre lots for a song. But there is very little rainfall and the water table is very low.

So, if you're going to drill a well, it's going to have to be a deep one. The only other option is to truck in the water. Not an impossibility; but rather difficult nevertheless.

Junk land in the states listed above won't have this problem, as those are all states which have a reasonable amount of rainfall. As long as rainwater collection is still legal in those states, you could harvest enough rain water off your own land to take care of your needs.