NEWS & IDEAS FOR LOCAL GROWERS

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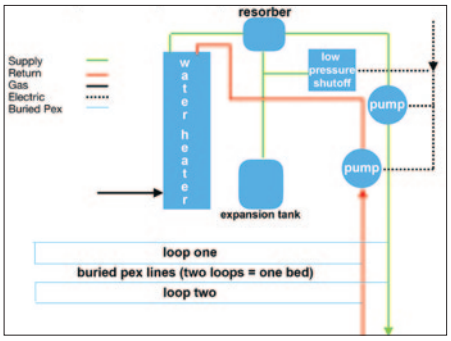


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# Simple ideas for better pack shed furniture

By Josh Volk

Like all of you, I'm always trying to make little improvements around the farm, and I'm never finding enough time to try all of my ideas. Last year I had the opportunity to rebuild the packing area at Cully Neighborhood Farm (CNF) and to also build three prototype pieces of furniture for a new packing shed at the North Willamette Research and Education Center (NWREC) for their small demonstration farm and to try out some of my ideas.

Both of these farms were looking to create functional packing sheds with limited budgets, small spaces, and for very diverse vegetable production on a small scale. An additional challenge, common to many small farms, was limited water at both sites (about 10 gpm and 55 psi) and no access to electricity. Both farms commonly have just one person working in the pack shed at a time, but might have three or more during peak times.

CNF has been using a simple, small pole structure, about 10x20' for much of the history of the farm. The structure has no walls, but a metal gable roof provides some protection from the sun and rain, and it's built in a relatively shady corner of the farm which also helps keep it cooler. The floor of the structure is just wood chips and soil that has been compacted over time. For years the farm had been relying on a simple hardware cloth covered spray table, an old bathtub propped up on a wooden frame for soaking greens, and a few folding tables covered with oilcloths. Of course the water and soil just drained onto the ground creating inevitable mud puddles to stand in, and the legs of the tables tended to sink into the soil over time, but it was a serviceable setup, and one that I see variations of on quite a few farms.

A spray table, wash tub, and packing table are the three basic pieces of pack shed furniture I see, and use, most commonly on small farms. They are simple, functional, and extremely versatile. For CNF we decided to use the poles of the structure and to build a fixed system that was similar to the layout the farm had been using for many years, but one that would be more ergonomic. That layout was pretty tried and true at that point, and using the existing poles meant not having to build legs which saved a little on cost and also opened up the space beneath the tables making it easier to put down more chips and to hoe out weeds when needed.

The very heavy cast iron tub still sits on its stand but we moved that to the back, because it is the least used piece. We also finally plumbed a simple tub drain with an integrated plug to drain the water away from the wash area into a trench behind the shed. This cost less than $20 in plumbing, keeps the working space dry, and saves time looking for the plug. We also used ¾" distribution tubing to plumb a fill hose that hangs above the tub. The fill hose has to be manually turned on and off, but we no longer have to drag a hose over and figure out how to prop it in the tank as it fills. It's also much safer from a food safety standpoint as the fill hose never touches the ground so the risk of contaminating the water is much lower. The fill hose is also flexible so we can use it to spray down and clean out the corners of the tub between uses. The return on investment (ROI) for something like that is hard to put a dollar number to, but we're definitely saving time filling the tub every day, and not

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## Better pack shed furniture

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standing in a mud puddle all afternoon is a big step up in quality of life.

For the spray table I replaced the hardware cloth top with a stepped, slatted bench. The center section is made from 4' lath, which I've been using as a wash surface for years and really like for its low price, ease of installation and maintenance, soft feel and compostable nature when it's life is over. Raw wood wears surprisingly well but it's a little controversial; some folks prize its natural anti-microbial nature, and others look at it as a porous, hard to clean and sanitize surface that probably won't be accepted by GAP or FSMA inspectors.

The lath bench has a number of subtle design features that I appreciate when I'm washing roots, or really anything on the table. There's a slight lip at the front edge to keep items from rolling onto my feet. I put a tall back splash on to keep things from rolling off the back. There's no lip on the sides, but there are stepped down benches where I can put totes flush up against the bench, dirty on one side, clean on the other, and then move the dirty product across the bench and slide it right off into the clean tote. The orientation of the lath helps with that, and the 4' length is just about an arm span so it's enough space to work with, but not so much that I have to travel much to get from the dirty side to the clean side.

For spraying I have two options. I have a hanging hose that will reach any corner of the bench and is great for cleaning the bench after I'm finished with a crop. It's short enough that it never touches the ground and I can flip it behind the bench and out of the way when I'm not using it, but it's still always within easy reach.

The author's spray table design. A slight lip at the front edge keeps produce from rolling off. Totes with dirty produce are placed on one side, clean on the other. The adjustable shower arm with high pressure shower head provides hands-free spraying. All photos courtesy of the author.

The second option is an adjustable shower arm extension with a high pressure, quick on-off shower head, the same type you might have in your shower at home. This

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allows me to position the head closer or farther from the bench top, depending on the crop, and to use both hands to move the produce across the table, even gently rubbing stubborn dirt with my hands or a brush if needed, without having to hold onto the sprayer. It's not always faster, but it definitely takes less water to do the same job and there's no fighting with the hose, or fatigue from pulling a sprayer trigger.

The final feature is a piece of metal roofing that sits below the table and directs the water and soil coming through the lath away from my feet and back to a section of gutter. The gutter then dumps the water in a trench outside of the packing shed. This keeps the floor much, much drier, which ultimately is safer and more comfortable.

Where the folding tables had been, I built fixed plywood tables for packing and distribution. These were made at a fairly low height which makes setting down totes, working with a scale on the table, and reaching into totes easy. If we have a task that requires a little extra height we just stack totes to raise the surface. Most of the actual sorting happens on the spray table, and the packing table is pretty much used for weighing the harvest and then setting up the CSA distribution.

The author's adjustable-height washing sink, with detail showing the stainless steel grate that can be added to use it as a spray table.

For NWREC's new pack shed I built the same three pieces of furniture but I took a slightly different approach. Their shed is similar in that it's a pole structure, but it has a poured concrete floor with a full length gutter drain on the low side. While it's still very small, it's a bit larger at 14x20'.

Instead of a separate wash tub and spray table I built NWREC a combined unit using a single basin, double drain-board stainless restaurant sink. The sink is 52" wide and 22" deep, so very similar in proportions to the spray table I built for CNF. I found a stainless grate that is designed to roll out over the sink basin, effectively turning it into a spray table, or it can be rolled back to expose the sink, allowing it to be used for soaking or dunking.

The sink is set up with a standard faucet, plumbed to accept a garden hose as its water source. I replaced the aerator with an adjustable spray head to allow it to be used similarly to the showerhead on the spray table at CNF. And it also has a pre-rinse sprayer (the official name for the hanging sprayers on restaurant sinks because they're designed for spraying off dishes before going into the tub of a sink or a sanitizer) which can be used to reach the corners, or for a more direct spray on the produce.

To make the sink appropriate for users of different sizes I mounted it on a hydraulic scissors lift cart. The cart raises easily with a foot pedal, and lowers with a hand lever, even when the sink is full of water. The cart also has wheels which allow it to be easily rolled out of the way when not in

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At left is the author's adjustable-height rolling table, with storage shelves over and under the table surface. Above are K-Ball nozzles used in the tote washer on the facing page. They can turn a piece of PVC pipe into a section of sprayer simply by drilling a hole in the pipes and clipping on a nozzle, available from US Plastic Corp.

## Better pack shed furniture

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use. The drain on the sink is set up to discharge to the side with the idea that it will be positioned over the gutter drain in the floor, but if needed it could be connected to a drain hose to move the water farther away.

There are no stepped down shelves on the sides of this set up, but simple dunnage racks placed on either side would function similarly. I have the full plans with construction details and lots of ideas for improving the design on my blog at joshvolk.com.

Also on the blog are the designs, construction details and discussions for improvements of the packing table and tote washer I built for NWREC. The packing table uses a plastic folding table as the table top, which is hard wearing and easy to clean but much less expensive than stainless. The height of the table top is adjustable by moving pins in the supports on either side. This makes the table appropriate for tasks that require different heights, for example when a scale is being used often the table needs to be a bit lower. It also is a benefit to any farm that has users of very different heights. On most farms I've worked on there have been users ranging from less than 5' tall to well over 6' and they definitely have different requirements for good working heights.

The packing table incorporates a few more features that I've long wanted, including a large storage space under the table for packing materials

This is how bins slide through the washer. When in use, a tarp is put over the hoops to keep water from going everywhere.

like wax boxes, and a narrow shelf above for materials like pens, tape for labeling, and twist ties or rubber bands. The cart is again on wheels which means it can be moved anywhere, including over to the supply of packing materials and then back to the packing area, or even into a walk-in cooler.

The tote washer is really more of a rinser and is the one piece that really needs two users to work efficiently. The basic set up is track made from a couple of PVC pipe rails that you slide an upside-down tote along. The tote passes from the person feeding at one end, through a set of four sprayers set to rinse off every surface of the tote, and then to a person catching and restacking the rinsed totes. Over the area with the sprayers is a tarp that keeps the water from spraying everywhere, and below is a stock tank that catches the water coming off the totes and the tarp. A drain in the bottom of the stock tank allows the water to be drained away from the washing area. In practice I've found that the set-up is good for pre-rinsing and final rinsing of the totes, but that there's still a bit of manual scrubbing that needs to happen to get dirty totes really clean. The nice thing here is that the rails provide a good support surface for doing that scrubbing.

For small farms where only one person is washing the totes a modified version of this washer, with a foot or knee valve to turn the sprayers on only when needed, and a shorter rail area would probably work well for washing totes more ergonomically and for containing the wash water. An additional sanitizing spray would also be easy to incorporate.

At this point the NWREC pieces have seen almost no use. While the models are functional, many aspects are unproven and will undoubtedly be improved this season as they are used. The furniture at CNF has seen a full season of use and while there are small changes still to be made, it was a huge improvement over the previous set up and we appreciated the improvements every harvest day.

*Josh Volk farms in Portland, Oregon, and does consulting and education under the name Slow Hand Farm. He is the author of the book Compact Farms: 15 Proven Plans for Market Farms on 5 Acres or Less, available from Growing for Market. He can be found at SlowHandFarm.com.*

# Growing at Nature's Pace Organics

By Sam Hitchcock Tilton

How do you go about learning something totally new, like flower or vegetable growing? Most of us were not raised up as growers, but rather we were drawn to it from other professions: carpenters, teachers, and philosophy majors, for example. And there is a lot to learn. Too much to figure out all by yourself, I think.

A more approachable method is to work for established farmers, read books, and talk to everyone you can in order to get an idea of the methods growers are already using and what a stable farm looks like. And then to start by imitating those successful examples. That is how I got into vegetable growing, and if the proliferation of vegetable-growing books, Youtube videos, and Facebook groups is any indication, it is how a lot of us approach learning the trade of truck farmer.

Now I hope that you are more mentally agile and original than I, because I can fall into a rut. As a beginning grower I looked for the 'right' way to do it, the one successful model. Often times it seemed like "ten acres and an Allis G" was the right scale. And as a result of having been too focused on emulating the 'correct' techniques, I missed out on trying new methods. While there are as many ways to farm as there are farmers, there are certainly common approaches, techniques, and tools. But then there are also those growers who possess a curiosity and enthusiasm to try all sorts of things, even if it means totally reorienting their farm.

I met Jacob Bach through the Michigan State Extension on a visit to his farm with my professor. Over the two years since that first visit, I have come to see a kind of courage in the way he approaches farming; whole-heartedly trying machines and methods and moving in even opposite directions over the years as he develops his own style of growing. I have learned a great deal from the nuts and bolts of his techniques and been inspired by the breadth and depth of his approaches.

The moment I stepped foot on his farm I noticed the five Allis G's parked around his yard. I realized that this man enjoys machines. Whereas other growers preach the virtues of neatness and simplicity, machines in various states of disassembly lay in and around Jacob's sheds. But you don't get the feeling that this is junk sitting around, rather that there are many projects in progress or in plan.

As I say, the man has five Allis G's, and for someone growing on 6 acres, this has got to be the highest cultivating tractor to acreage ratio in the country. His G's are powered by three different sources: electric ("I'd convert them all to electric if batteries weren't so expensive"), the original Continental engine ("no one likes this engine, it is always breaking or not starting") and 13-horsepower Honda engines ("a reliable engine").

And it's not that Jacob collects these tractors for fun or show; each tractor has its own dedicated tools that save time by not having to switch implements – basket-weeder, seeder, tine-weeder, side-dresser, and all manner of other weeding tools. He likes to mechanically cultivate and had spent the time and resources setting himself up with the right tools

Jacob Bach, starting a batch of compost tea. Photos courtesy of the author.

for intensive cultivation. As a student of tillage, I was happy to observe all of these weeding tools in action when I visited Jacob in 2016. So I was stunned when I visited him this past summer, one year later, and saw his swarm of cultivating tractors sitting idle in their sheds during the heat of the season! Jacob had taken a U-turn from intense tillage and cultivation towards permanent cover crops, strip-tilling, and compost tea. This guy just doesn't stop trying new things. Permit me to use these precious pages to share with you some of the innovative projects and approaches that Jacob has been kind enough to share with me over the past two years.

Jacob and his wife Katie, owners of Nature's Pace Organics, moved to their 20-acre farm after two year-long internships in Pennsylvania and Michigan, and two years on rented land. In the years since, the size of their farm has expanded and contracted. Years 3, 4, and 5 saw the farm grow to 100 CSA members, 4 farmer's markets, renting 17 additional acres, wholesale contracts, and several employees. Jacob and Katie were also growing their family during this time! This is when Jacob went heavily into machinery and a more traditional approach towards growing vegetables: with more acres, employees, and intensive tillage.

Jacob and Katie's farming is very much driven by their values. And they have always aimed for the farm to be as self-sustaining as possible. To that end, at one point or another they have raised pigs and sheep, grown hay to make compost, and also bought a combine to grow and harvest their own cover crop seed! These are enterprises that have fallen away in recent years. At a certain point they reflected on their farm and thought "how small can we get and stay profitable?" As a result they dropped the CSA, wholesale, and all but one market. For the past two years they have sold once a week at a single year-round farmer's market in suburban Detroit, and this has greatly simplified their lives.

Along with their farm, Jacob and Katie's farming ethos continues to develop. Though they had always endeavored to farm using natural methods, after seven years of growing organic vegetables in a conventional way, they were becoming aware that despite all of the compost and cover crops, their soil was not as healthy as they wished. And moreover, instead of relying on the soil itself to feed their plants, they were relying on manures, composts, and fertilizers. As a result of this realization they have made some pretty striking changes to their farm in recent years.

When I visited them in 2016 most of the farm was in well-kept beds of vegetables with (mostly) weed-free bare soil in between the rows and beds, as one would expect. In one field Jacob had planted perennial clover into which he had strip-tilled

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rows of various vegetables. He was excited about the prospects of tilling less by using permanent cover crops and strip-tilling. He had also been getting interested in brewing compost tea. One of his interns that year was an acolyte of Elaine Ingham, the soil biology guru, and had read her books and taken an online course with her. Jacob let the intern run with his enthusiasm, obtaining the needed equipment to brew large batches of compost tea (costing $2,500) as well as building a laboratory space with a microscope so that the tea could be properly analyzed. That summer the intern spent a quarter of his paid time brewing, analyzing, and applying compost teas. Jacob did his best to learn from his microbial-minded colleague, spending hours peering through the microscope learning to identify the many different types of bacteria and fungi in order to determine when a batch had the biology needed to nurture a specific crop or soil-type.

I asked Jacob what interested him so much about compost tea and why he was willing to devote a fair share of his resources towards developing its use on his farm. He told me, "Healthy soil biology can be a biological shield around the plant. But each time I till I reset the soil biology and it has to start all over. So I want to reduce my tillage as much as possible and promote a healthy soil biology with compost tea. A functioning soil food web cycles nutrients in plant-available forms, so that the plant can take its nutrients from the soil organisms. The goal of tea is to get the soil food web established. I had been spending $3-4,000 per year on a custom blend of organic fertilizers that I would apply in the spring. But any fertilizer that ends in 'ate', like phosphate, is a salt, which kills soil life. This last season I did not buy any fertilizers and used only tea."

During fall of 2016 Jacob spent a lot of microscope time learning the role of the different organisms in the teas, how to identify them, and testing recipes. "I was brewing 24/7," he says of his enthusiasm. However, though he was learning a lot, he wanted to make sure that he was absolutely correct in identifying the different bacteria and fungi, so that he could be confident he would not be brewing any human pathogens in his tea. So he

arranged three days of private training with Dr. Ingham at her California institute last March so that he could study at the foot of the master. Upon returning in the spring he was ready to trust more of his farm's fertility to the soil biology, stimulated by compost tea.

In his hoophouses, Jacob has used the tea in the following way: first he takes a soil sample from each individual bed and looks at it under the microscope to see what the soil's organisms tell him. By counting the types of species present and their relative

At left is a strip-tilled field shortly after transplanting. Above is what the system looks like with established crops.

number Jacob can ascertain whether the soil is compacted and in which way he might want to influence the soil life. Next he broadforks the bed. He agrees with others that the broadfork is the best type of tillage – introducing air while not disturbing soil structure. It takes him about an hour to broadfork one 30 inch wide, 100 foot long bed and to tine-rake the surface afterwards. This might seem like a lot of time and hand-labor, but Jacob's goal in broadforking is never to have to do it again ever; his idea is that broadforking prepares the soil structure for the tea and resulting biological activity. Then later when the proper numbers of fungi have developed they will hold soil structure and facilitate water and air infiltration . . . that is unless any unwitting reporters walk on his beds. His solution for that problem is for the owners of any offending feet to broadfork a bed themselves. Such treatment soon cures those unwitting reporters of their careless steps.

Meanwhile, back in his compost tea lair, he will brew a tea specifically to address the problems that he saw in the soil sample and also to fit the proceeding crop. "Tomatoes like a 1 to 1 balance between bacteria and fungi, whereas brassicas prefer 0.3 to 1." Like a sorcerer-farmer, Jacob pulls from different feedstocks (oat straw, compost, vermicompost etc.) to brew teas with the desired balance of organisms. He is working towards having a palette of different composts to choose from, each with a specific fungal or bacterial balance and population.

The tea takes 24 hours to brew, aerated from below. Early in his farmer-barista career, Jacob had to constantly test each batch under the microscope while it was brewing, because the biology can change in mere minutes as one organism quickly flourishes or dies. But with greater experience he now knows mostly what to expect with his recipes and spends less time hunched over taking a microscopic census of tea samples. When the batch has the proper balance of organisms Jacob will apply it to the beds with a watering can, lightly rake it in, and plant immediately. When that crop is done, to avoid tillage, they will hand-pull the residue, rake the surface, and plant again.

"Well," I asked him, "does it work?" He replied, "We had been layering compost in our hoophouses for years, and tilling three to four times a season, but they still had terrible biology and there were certain beds that I would

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always have issues with. Also there would be beds with that dry hoophouse soil that never absorbed water like I would like. After two years of tea the problem beds have totally turned around and are producing bumper crops."

I am no soil scientist and I will not critique the veracity of Jacob's experience with compost tea, but I can say that the man is no dummy, and something good must be happening for him to devote precious resources to this endeavor and to cause that excited twinkle in his eye.

Jacob's field production, while on a different scale, has been similarly reoriented to reduce tillage and incorporate compost tea to stimulate a healthy soil food web. Jacob trialed strip-tilling into perennial cover crops for a few years get a grasp on the timings and types of vegetables suited to this culture. In 2016, he underseeded Dutch white clover into his conventionally-managed squash at the last cultivation. Through the end of the summer and into the fall the clover grew into a dense sward an acre in size. Through the previous years' trials Jacob had found that brassicas lent themselves best to being grown in the narrow strips he tilled into the clover because of their upright habit, which allows for easier between-row mowing of the clover.

This last season he grew an acre of brassicas in this way, with more space devoted to trials of celery, leek, onion, eggplant, chard, and beets. He found that winter squash was not suited to this culture, as its vines spread off into the clover, making mowing the clover impossible.

As he's developed the system up to this point, here is what he does: he plants a dense stand of Dutch white clover by underseeding it into an established long-season crop like squash or corn. Then he tills 18"-wide strips into the clover every 5 feet in the fall with a multivator, a two-headed rototiller that kills out the clover over the winter and leaves a clean strip in the spring. Then in the spring he runs a giant 2-shank sub-soiler through the tilled strips.

But, Jacob being Jacob, this is no ordinary sub-soiler, rather, it has been modified to apply compost tea in 4" intervals all the way down to the final tillage depth of 16". "Tilling the soil even once throws off the soil biology, from which it can't quickly recover on its own, so I add tea to help the soil rebalance." Into this tilled strip he will plant all manner of transplanted vegetables. He'll mow the clover between the planted strips as needed and run shallow sweeps (with his Allis G's) on either side of the row now and then to keep the clover from encroaching into the crop row too much.

One afternoon under dramatic grey clouds, we took in the view of his field: rows of dark-green kale marching off into the distance accented a sea of lush clover rippling in the wind like cresting waves in an undulating ocean. As the gusts whipped in our ears Jacob shared an interesting reflection on soil biology; his organic certification requires him to rotate his crops, but his experience with testing soil biology has shown him that certain crops prefer different types of soil biology (recall the tomato and brassica example from above). "What I wonder is, if I could really tune-in the soil biology of a given area for a specific crop, then wouldn't it be best to keep plants of that family growing there, instead of annually rotating in crops with different soil biological preferences?" I'll let you chew on that one.

Loosening soil before planting in fall-tilled strips with a two-shank subsoiler. Compost tea flows from the tank on the tractor bucket to the subsoiler shanks, applying compost tea every four inches, down to a depth of 16 inches, along the shanks.

When strip-tilling into clover in this manner Jacob cannot space his rows as tightly as in the clean-cultivated bed system. He admits that this reduced-tillage system requires more space and he can fit less on his acreage as a result. But, whether due to plant health, lower labor costs, or the good vibes of a healthy soil, revenue has continued to increase every year regardless of the changes of scale that he has made. At this point his family makes their living on six acres.

Though a promising technique, this method didn't seem to be suitable for every crop. "This strip-tilling is all well and good for larger transplanted vegetables," I told him, "but what about carrots, parsnips and such that require a finely-tilled seedbed and detailed weed control?" Jacob explained that for these more tender direct-seeded crops he grudgingly still keeps a patch of conventionally tilled soil, which he manages with his posse of Allis G's and their weeding tools. But he had an interesting take on this: "I think that if customers want to buy those vegetables that require more soil disturbance, like carrots, they should pay more for them – they should pay a tillage-tax for the damage that must be done to our soil in order to produce certain vegetables. As farmers it is our responsibility to steward our soil, but we shouldn't bear that cost alone."

While many growers stress the importance of creating ideal conditions for their plants to grow uninterrupted from seed to harvest, Jacob has a different perspective. "Totally perfect growing conditions and spoon-fed fertility are like giving the plants a bunch of candy. I believe, that like a good childhood needs a little struggle, it is the same with plants, and those that have grown in healthy soil and have struggled for their own nutrients offer more nutrition to us." There are easier ways to make a living than growing vegetables, and there are conventional ways to grow vegetables, but from what I have observed visiting with Jacob and his family, this is truly a farm trying to move at nature's pace.

*Sam Hitchcock Tilton is a former and aspiring vegetable grower who has visited with farmers around the world. He is currently studying for a Master's degree at Michigan State University, focusing on organic weed control and researching, testing, and building mechanical weeding machines. He has a passion for developing the finest popcorn strain and enjoys learning more and sharing his knowledge. He can be reached at rcvcfarm@gmail.com.*

# The advantages of growing pole beans instead of bush beans

By Liz Martin

A few years back we realized we hated picking beans. Not only do they take a disproportionate amount of time to harvest, but also it is backbreaking work. So we decided to try growing a bed of pole beans. We loved picking them standing up and we congratulated ourselves on how clever we were!

But when we got the long Fortex beans to market and stuck them in our quart boxes (more like stuck them out of our quart boxes) next to the slender little bush beans, we found that we couldn't get customers to try them. We heard over and over again that those beans looked like they would be tough. We told people how delicious pole beans are and were sometimes able to talk people into taking them home, but realized we were only hearing from the people who said it aloud. We were not even getting to the people walking past our booth thinking dismissive and derisive thoughts about our pole beans!

So the following year we decided to find pole beans that looked like regular green beans. We didn't want anything really long, or a bean with bumpy pods that made it look like the beans inside were too big. And we didn't want a flat-podded bean.

So in 2015 we trialed eight different kinds of green pole beans. Some of them were labeled "haricot vert." We liked Emerita and Blue Lake from Renee's Garden. Last year we grew Matilda and Cobra (Osborne Seed Company) and they were both fine as well.

Next challenge: a trellising system that could hold the plants up all season long and not sway in the wind. The design we initially used was okay, but it danced in the wind too much and there were spots where the Hortonova netting was drooping by the end of the season. Since the plants grow to eight feet tall and are quite leafy we needed a stronger trellis system.

Our farm has permanent beds that are 42 inches wide with sod paths. We find two rows of pole beans is too hard to harvest efficiently, so we plant the north row of the bed with pole beans and the south row to something else. We still grow Dragon's Tongue beans, which are bush beans, but only a small amount. So we may plant bush beans, edamame or some other crop on the south side of the row of pole beans.

We aim to plant our first seeding in the third week of May with plantings three and six weeks after. We expect to harvest a bed of pole beans all season, with production decreasing in the late summer and autumn. Normally, we wait to see what kind of germination we get and cultivate before we install the trellis. But trellising must begin by the time the beans start to reach for support. Don't wait or they will climb other beans, weeds, or whatever they can

Above left is how the pole beans for seed look in early June. After the bed was weeded, the trellis was installed over already-growing plants. Two pieces of Hortonova netting will lead both rows of beans to the top of the t-posts. Above right, by the middle of the summer the beans have formed a dense wall of foliage. All photos courtesy of the author.

find to grab onto!

We begin by pounding a ten foot t-post about one and a half feet into the ground every 15-20 feet. We then install yellow t-post insulators at the top of each post. Use only the short insulators because the extended ones will break under the weight of the beans. We run electric fence wire across the top of the posts in these insulators and wrap the wire around every other t-post to keep the trellis from sagging. We do not put the wire under tension and we typically use 17-gauge wire as it is easy to wrap around the posts. We finish by tying Hortonova netting to the wire and to the t-posts with 8-12 inch pieces of plastic hay string. We may try zipties this year.

Then we tie the netting to each t-post at the top, middle, and bottom, then tie the netting to the top wire every 4 feet. If the Hortonova hangs neatly at ground level we may leave it, especially if the plants are tall enough that they'll grab it right away. If the netting is short of the ground, the beans are too short, or it is really windy, we'll insert an 8 inch ground staple every 10 feet or so to hold the netting right where the plants will be

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## Pole beans

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looking for it.

This leaves us with about eight feet of vertical growing space for the beans. The bean harvesters vary in height from 5' 3" to 6' 4". Even the shorter harvester can reach the beans until the very end of the season. As the beans grow past the top of the netting, gravity brings the latest beans down within arm's reach.

The first couple pickings are just as annoying as picking bush beans, and perhaps even more so as the trellis is in the way. But after that, the primary harvest section gets higher off the ground every harvest! Pole beans do continue to have a few beans growing at every level, though. It's important not to let them develop mature seeds, or they will start putting their energy into the seeds instead of the pods. So look down as well as up when harvesting!

Typically we do not experience significant disease or insect problems on our pole beans (I hope I am not jinxing our future crops by writing that!). Though if you have pest or disease problems with bush beans, you are likely to have the same problems with pole beans. One benefit of pole beans is that the foliage dries faster so we are less likely to spread disease during harvesting. In order to minimize the spread of disease, we try not to pick beans when the leaves are wet, but sometimes this is unavoidable.

We like to leave the trellises in place all winter. Not only are we too tired and too busy in the autumn to remove them, but this helps them shed some of the dead vines over the winter. We have found we can use the netting for at least two years. In the spring when we are ready to move the trellises we take the netting down on a dry day and walk on it to remove as much of the dead vine material as possible. We are careful not to get the netting into a tangled mess! If you had problems with disease on the beans the previous year, you may want to use new trellis material as disease can over-winter on dead vines.

Overall, this method has been a big saver of our backs and our time. And now both our customers and we love pole beans!

## Pole beans for seed

We've been growing and saving seed for a few years to try and adapt crops to our farm that have been difficult for us to grow. We decided in 2017 to see if this could be a new income source for us as well as a new farming challenge. It must be hard for seed companies to find farmers to grow pole bean seeds (due to the infrastructure required, I guess) because two companies asked us to grow pole beans for them.

We realized that since pole beans grown for seed are only harvested in the fall rather than weekly, we shouldn't have any trouble growing two rows in each bed. Once we had this realization we decided we could have one set of t-posts down the middle of the bed between the two rows of beans and run Hortonova nets from each row of beans at a slant up to the wire at the top of the center of the bed. The trellises are shaped like an upside down V. This worked really well and had the happy bonus of being less post-pounding in the spring as well as requiring less t-posts.

We found we were able to cultivate inside the upside down Vs by sticking our arms and hoes through the netting. Despite the ability to cultivate inside of the trellising, next year we plan to try planting some of our pole beans

Above are some of the author's pole bean seeds after winnowing. They fetch anywhere from five to 25 dollars per pound sold to seed companies.

through plastic or biomulch. The actual planting will take a little longer, but not having to cultivate through the netting will make it worthwhile.

When growing beans for seed, we allow the pods to turn completely brown and get quite dry. We did not have disease problems last year, but if we did we would have discarded any diseased beans and vines. We harvested into apple-picking bags and dumped these into one-ton tote bags. Then we put the beans in our barn to dry further until we had time to deal with them. Next year we may put them in a room with fans and a dehumidifier for a few days.

Then came the threshing and winnowing. There are many ways to do this, but because we lack the specialized tools available for cleaning seed our methods were rudimentary. We spread a sheet of greenhouse plastic on the floor of the barn and dumped the pods onto it. We ran a few fans and when we had time we stomped the beans to break the pods (but not the beans!). Then we dumped the beans and pods through a screen and into a concrete mixing tray, to separate the beans from the broken up pods.

The final step was to pour the beans in front of box fans to winnow off the crushed pod pieces that didn't get separated by the screen. We placed two or even three box fans together to give a good strong air stream and get as much chaff off as possible with each pour. It can take a few pours to get really clean seed. Then we enjoyed marveling for a few minutes at the beauty of the glistening seeds that came out of those dusty old pods!

How did growing seed compare financially to growing fresh beans for market? It depends! For years we've used $400/100 foot bed as a bare minimum benchmark for each of our crops. The pole bean seed from one company earned us $280/bed (175 lbs. from 5 beds at $8/lb). Two varieties of seed for a second seed company earned us approximately $800/bed ($20/lb for one variety and $25/lb. for the other). All of the varieties yielded about 17-18 pounds of seed per 100-foot row.

*Liz Martin and Matthew Glenn run Muddy Fingers Farm, a certified organic vegetable farm in its 16th year of production. Muddy Fingers Farm is a three-acre, two-person farm that grows for CSA, farmers markets and local restaurants.*

# Rural online farmers market: a model for the future

By Thorsten Arnold

In the rural area of Grey Bruce in Ontario, Canada, many producers are facing difficulties accessing markets beyond our small and seasonally limited farmers markets. Together, we have established a cooperative approach that is designed around the barriers of our local farm and food businesses. My own role as business consultant and later General Manager provided me with a unique learning experience about the start-up of this coop and many strategic opportunities. This is why the article starts by analyzing market barriers, and then outlines how the coop strategically addresses some of these barriers in practical ways.

Every buyer of food is connected with farmers and other producers via a supply chain. Some of these are very short, as in the case of direct marketers of produce: the farmer takes the role of the post-harvest handler, sales person and distributor. Those direct marketing meat usually work with service providers for processing and packing and form a slightly longer food chain. The mainstream food supply chain trades in anonymous, standardized commodities and works through a long chain of processors.

Market data for the local food market remains patchy. In 2011, the estimated total local food market value was $4.8 billion or 1.9% of all food sales. A more recent study by the USDA estimates direct-to-consumer sales at $ 8.8 billion, and direct sales to retail and other intermediaries (distribution coops, restaurants and food hubs) at $11.5 billion in 2015. This $20 billion is almost a quadrupling since 2008– yet still a tiny fraction of the $400 billion total gross cash farm income or the $1,500 billion annual food expenditure in the US.

In recent years the market demand for unprocessed, directly marketed products seems to be stagnating across North America as larger farms take the lion share of this growth. Simon Huntley, owner of the software company Small Farm Central that serves hundreds of CSAs across North America, sees this in customer data: "The times of long waiting lists to become a CSA customer are over – across the board. Customer retention rates are down... farmers must face this new reality of local food supply growing faster than demand."

With more and more people attempting a small-farmer career, we are witnessing an increasing competition amongst small direct marketers. A common strategy that most farmers follow is: "work harder and market better". In a tight market space, we can only squeeze out one another with this strategy, while the mainstream food system could not care less. To avoid destructive competition among ecologically minded farms, we need to understand and address this problem – collectively, as a sector.

In my opinion, the economics of food supply chain and processing infrastructure hold the secret to understanding the barriers to local food. Our economic intuition is formed around competing with similar businesses in a marketplace. Food supply chain economics are fundamentally different. In food chains, the sales price covers costs and profits for several activities: production, processing, aggregation, distribution, and sales. Large scale can massively reduce costs of activities like grain elevators and mills, shipping harbors and food terminals, seed production, abattoirs, and retail. The shape of the supply chain, however, also determines how profits are shared in the interplay of negotiation power and ownership.

In integrated food chains, one business owns and operates all activities and only requires a positive overall profit. For direct marketers, this means that the sales price must cover the cost of production, processing, marketing and sales, plus some profit. In separated food chains, each activity is operated by a separate business that each must be profitable.

Today, it seems as if farmers have only two strategic options: farmers can either maintain full control over their entire food chain by staying small and selling minimally processed food directly, or get large. Then, they focus on one activity- production- and become globally competitive with an anonymous commodity.

But there are a number of intermediate strategies that I call third-path food chains. This includes joint sales, contract farming for a large proces-

sor, or regional branding based on standardized production practices. Whether these third-path food chains are financially viable depends on how well they manage scale, transaction and collaboration costs, and fair profit sharing.

Emerging third-path initiatives address these barriers as food hubs, non-profits, for-profit distributors, producer coops, and partnerships, farmers work together to carve out a new market niche and expand the market share for healthy, sustainably produced food.

## Online food marketplace

The online food market is a rapidly growing marketing opportunity that tripled in one year, from $16 billion in 2015 to $42 billion in 2016. Whether these benefit local food production remains contested: On one hand, local food producers can reach new customers with online sales by improving convenience services (a one-stop online shop, delivery) and a larger spatial reach. On the other hand, online shopping disconnects consumers from direct marketers. This anonymity may dissolve the social glue that incentivizes foodies to pay a premium price for a local quality product. Also, commitment to producers depends on the values of the owner of an online market: Many eCommerce initiatives are driven by the IT sector and their investors, with little understanding (or respect) for the needs of farmers, and profit expectations that are unrealistic.

Today, online food sales by retail giants offers their standard products online and with delivery. A new trend are meal kits as an easy path to from-scratch cooking: providers sell weekly subscriptions and customers receive shipments of recipes and ingredients in perfect volume ratios. With $5 billion in 2016, the market for meal kits has skyrocketed to half of the entire direct-to-consumer sales value. However, both retail and meal kit markets heavily draw on anonymous commodities and are hardly accessible for small and medium-scale farms.

To me, the question whether online markets benefit small farmers boils down to three questions: (1) how can small farmers access these markets, (2) how well our market advantages carry into cyberspace: our product quality, our stories attached to our food, our avoidance of monopolies, and our emotional relationships with our customers, and (3) how does the online market support small farms, e.g. through long-term commitment or access to financing and new infrastructure.

## Eat Local Grey Bruce

Eat Local Grey Bruce cooperative serves a region that spans 70 by 70 miles and is home to 170,000 people in 80,000 households. The traditional farming region has recently drawn retirees and health practitioners, as well as many that seek a second-career in a natural landscape. Our population is culturally and politically mixed, yet racially fairly homogenously white. Our coop offers an "online farmers market" of a variety of products from local producer members. Coop staff complements these local products with wholesale goods from neighbouring regions, and from natural and organic distributors.

The coop offers consumers a convenient and fully customizable one-stop shop and a cooling chain, which reduces the need for grocery trips and provides access to specialty products. Orders are aggregated in a central warehouse, packed into insulated bags, and delivered to homes and and cafes. With a company-owned Sprinter van, we deliver on two days.

Products are "mainly ecologically grown" and include organic dairy, yogurt, eggs & milk, a wide range of frozen and smoked meats, fish, produce in individual and bulk bags, in seasonal boxes, and as recipe-based kits. Local specialties like maple syrup and chocolates, roasted coffee and salsas, are complemented with hundreds of products from natural food distributors.

The coop also offers conventionally grown vegetables by a local Mennonite community. Pricing is considerably lower than naturally grown and organic options and the coop also offers bulk quantities (flats, bushels, etc.) that are popular for canning and preservation. At reduced price, a certified organic beef producer also sells meat from animals that were removed from certification.

The coop operates under the regulatory exemptions of a true farmers market. Without taking posession of products from our producer members, we charge a commission on consignment sales. In Ontario, this reduces food safety requirements on labelling, traceability and inspection.

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## Rural online market

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This opens the coop for early entrepreneurs like a 16-year-old sprout producer. At higher mark-up, the coop also resells from wholesale suppliers, using an inspected area for repackaging grains, nuts, and produce. The coop must cashflow these and carries the risk of spoilage and loss. Such sales are especially important during our long winters, when we also supplement with imported organic produce.

The coop was designed in a group business plan. This plan was put to a test in a large one-time sales event. Toward the end of the harvest season, 25 producers posted and sold products of a total value of $25,000 – twice the comfortable weekly sales value. The volunteered event was a full-blown success, and farmers were touched when a 10,000 square foot storage room filled and emptied over the course of two days.

Encouraged, they appointed a coop board and incorporated, piggybacking bylaws and policies from likeminded coops. In March, a fundraising campaign pre-sold 300 memberships and 30 bonds valued at $500 each, and an angel invested in a fuel-efficient reefer-equipped Sprinter van. We also secured cost-share grants for start-up capital and several interns. With this cash, the coop rented and equipped a warehouse and hired me as start-up manager.

Regular deliveries started in July 1st and hit a weekly sale of $9,000 in October. But the combined $150,000 in start-up cash remained below the projected $220,000, such that the coop started under-financed and could never reach the break-even of $12,000 in weekly sales. We also made mistakes totalling to $15,000 in costs, plus the bankruptcy of our first software provider. In turn, we saved with unexpected community support: the installation of a refrigeration unit at cost saved us $10,000! But after nine months, funding for my position as start-up manager ran out. With sales fluctuating between $5,000 and $9,000 per week, the coop management transitioned to a volunteer board and reduced staff.

Since this transition, the board has learned all aspects of the operation. The highly dynamic first seasons require permanent adaptation and learning. Over time, core responsibilities crystallized: the supervision of products and staff; online store software; marketing and consumer outreach; weekly editing of newsletters; producer communication; treasury; financial analysis; food education; event organizing.

With volunteers, capacity remains a great impediment to growth or taking on new projects. Unfortunately, those local CSAs with best marketing skills and winter production capacity opted not to join the coop and remain competitors. With sales revenue hovering around break-even, payment to producer members lags 3 months behind – which producers currently tolerate.

Barriers remain, and software is never perfect. CSA farmers requested that we sell and deliver 20-week subscriptions – which currently cannot be automated. Why not integrated the online marketplace with designated CSA software? A flexible recurring order functionality (weekly & biweekly) would greatly improve customer retention. Meal kits currently remain one separate product but could add individual products into the editable shopping cart. And reporting functionalities could lower staff time and skill requirements.

Our vibrant community is not expecting high-tech software infrastructure or 60-min delivery, which only large online retailers can offer in metropolitan centers. Other barriers include our low rural income level and a cultural preference for cheap over quality, IT literacy, low population density, as well as long-standing ties between consumers and non-coop farmers, and low institutional support for ecological food. Despite that, many customers order $70 every week, and Eat Local has become a lifeline for individuals with limited mobility.

On the bright side, the coop has changed how many suppliers are doing their business. Suppliers stepped up labelling, packaging and grading; they adopted new varieties to fill niches. Meat producers have added cooking instructions and ideas to every meat cut. Vegetable producers develop seasonal kits for stir-fries and salads.

When farmers complained about our mark-up, they were asked to estimate their current marketing and sales costs – an eye opener for many. One enterprise dropped direct retailing entirely, in order to focus on wholesaling and online sales. Several producers work with a videographer for short video clips for the first time. Others upgraded their on-farm handling facility to meet wholesale regulations, e.g. for storage of frozen meat and vegetable handling. Many start to dream bigger, with visions of stronger consumer engagement or jointly distributing into Toronto two and a half hours away.

In summary, farmer members remain convinced of the business model because it meets their needs. But it is not certain whether our rural community can support the financial break-even demand of weekly sales averaging $12,000 – one third more than our current sales.

## Lessons from ELGB

The coop aims at increasing the market share for local food products by enhancing customer convenience. In my opinion, the Eat Local Grey Bruce experience highlights some basic truths:

Small-scale farmers truly benefit from collaborative marketing,

because it provides an efficient sales avenue, builds skills and social capital and enhances business practices at a viable pace. Many consumers like and support the idea of farmer-based marketing, even if not based on shiny advertisement and 60-min delivery. Reaching scale remains the most difficult challenge. There are no coordinated programs that allow us to simultaneously tackle supply, distribution and demand. In the absence of that, nobody is willing to provide capital that covers incurred losses during the first years.Access to processing infrastructure has become a main economic barrier for SMEs. Rural food supply chain infrastructure has eroded such that even low production costs cannot guarantee access to markets, because processing is too expensive. In this context, focusing on production alone may be a drop in the bucket and a waste of resources. The coop clearly demonstrates the fundamental challenge of scale and infrastructure in our food system: a rural abattoir that is large enough to slaughter at competitive costs, a vegetable processing facility that encourages wholesale-scale production, or an industrial kitchen for cooking prepared meals. So our small-scale farmers can only offer prices that reflect significant processing costs, which excludes us from wholesale markets and public sector procurement.

This highlights the desolate state of our food-related infrastructure. If we compare it with a road infrastructure that is entirely profit-driven, we would have a few toll highways that link harbours with grocery stores, plus a crude maze of trails that farmers chopped into the wood with chainsaws to bring their products to market on a donkey. In such context, even the best raw products cannot sell - they don't fit on the back of a donkey or this mode of transportation is just too expensive. For transportation, our society chose public investment into a coherent network of larger and smaller roads. For local food, such strategic infrastructure financing remains a dream and we need to work within severe limitations, e.g. through initiatives like Eat Local.

Finally, the coop also highlighted the need for social capital in our farming community. While small farmers superficially support each other, many farmers mentally seek competitive advantages over their neighbour and fear collaboration. This makes it hard to collectively tackle infrastructure barriers. Our small-scaled farming sector continues to struggle in formulating a collective vision that we can communicate to decision makers, like-minded nonprofits, and consumers. While Big Food advocates clearly and as a homogenous block. Decision makers naturally gravitate to this clear message over our disparate chattering that is difficult to make sense of.

Social capital means achieving unity in our diversity on basic political asks, especially around adequate food supply chain infrastructure and rural economic development. The coop has created a space to re-learn collaboration at board level and a space for dreaming together. I believe that, until the majority of small-scale farmers understand our need for collective bargaining, our sector will remain a treadmill where direct marketers compete each other out of the market without increasing our overall market shares. In short, we need to start working together.

*Thorsten Arnold was General Manager of the Eat Local Grey Bruce Co-operative from its inception until 2017 and continues to be involved in its development.*

# In-ground greenhouse heat is an efficient, DIY option

By Todd Coleman

Do you want to be able to heat your greenhouse with radiant heat? Are you interested in being able to heat your soil to extend your season or even grow through the winter? In this article we will examine how we built a hydronic radiant heat system for our greenhouse, and how you can do this at your farm.

Radiant heat in a hoophouse has many benefits over forced air heating methods. Perhaps most importantly, heating the soil puts the heat right where it is needed most, in the root zone and close to the above ground growth zone. When combined with floating row cover, a microclimate can be created and protection from very cold temperatures can be achieved.

Above ground forced air heating may heat the air, but because heat rises, it is difficult to heat the critical growth area. A high percentage of germination, even in the darkest days of winter, is also achievable when the soil is heated. We have had good success with sowing greens throughout the winter with our system and thus maintain successions providing a consistent harvest schedule.

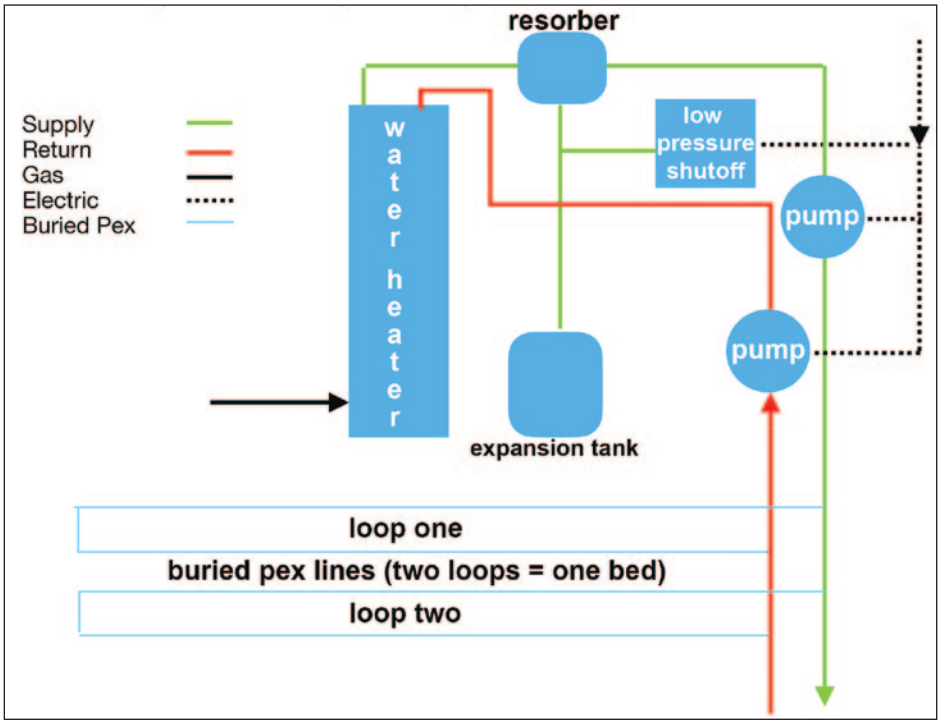


Diagram depicts basic components of the system and relationship to each other. The blue buried PEX lines represent one bed (not to scale).

Heating the mass of the soil also limits fluctuations in overall temperature as the soil maintains a more constant temperature throughout the day and night compared to overhead heating. Limiting swings in temperature provides a consistent growth rate and thus, we are better able to plan out our winter sales.

We use a hydronic system to radiantly heat two moveable hoophouses throughout the winter; one is 30' x 50' and the other is 18' x 50'. These hoophouses have polycarbonate ends and inflated double plastic over the top. For an overview on the growing methods used in these hoophouses please check out the previous article by Daisy Fair in the June/July 2017 issue of GFM.

Here we will take a closer look at

how the heating system and the distribution system work with the DIY farmer in mind. It may seem a bit complicated, but in truth this is a very simple system with very few moving parts and, in a pinch, most any plumber should be able to help you out. To be clear, there are many ways to set up a radiant system, and this is how we have done it.

In general, our setup works the same way as a radiant floor heating system works in a home; except that we use water in our heating lines and not glycol. A broken water line is an inconvenience that requires repair, where a broken glycol line in the soil is a hazmat situation!

On the other hand, because we don't have glycol, our water heater must always be functioning during freezing temperatures or we risk frozen lines and a frozen water heater, which could be a serious problem. To shut down the system during freezing temperatures, designing a good way to completely drain the lines is very important. We keep ours going throughout the winter, but if we did have to shut it down we would need an air compressor to blow the lines out. Having a drain valve, or multiple valves, at the lowest part(s) of the system is another option and would perhaps be much more convenient.

## The heating system

The heating system is comprised a water heater; which includes a gas inlet line and an exhaust pipe. We have a standard 75-gallon household gas hot water heater (not a boiler). We are only heating the soil to 40-60 degrees, so very high water temperature is generally not needed. We have a municipal natural gas line and electrical stubbed to our greenhouses, which, depending on your location, could be a significant cost. Using propane or

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The cart with the author's in-ground heat system. The water heater is the tall gray tank, the expansion tank is the short white one. The two red and black objects are the pumps. A heat shield protects the greenhouse plastic from the heat of combustion. A pipe directs the exhaust from burning natural gas out of the greenhouse, where byproducts of combustion could harm plants.

## In-ground greenhouse heat

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other heating oil and a tank is also an option if natural gas is not available. An electric hot water heater may also be an option, but in our area would likely not be worth the cost. When establishing a new location for a greenhouse, considering proximity to these utilities is likely worth while.

Our water heater is located inside one of our two heated greenhouses and it is on a moveable cart (because we have moveable greenhouses). The cart has rigid insulation around it to protect the water heater and the pumps from moisture and also to make it more efficient. Protecting the water heater, pumps, and expansion tank is a fairly critical measure, as dripping condensation, high humidity levels and/or irrigation water can corrode these components and significantly shorten their life.

A small expansion tank is also on the cart and plumbed to the supply line coming out of the water heater. This helps protect the system from thermal expansion as the water heats up. Without this expansion tank there would be a possibility that, as heated water expands in volume, pressure on pipes and fittings could create a failure.

Unfortunately, the gas to our greenhhouses is not metered separately so we don't have good numbers on how much gas we use throughout the season. In general, the hot water heater runs throughout the night when temperatures are below freezing, and it usually turns off during the day just after the sun hits the greenhouse.

### The distribution system

The distribution system is a "closed loop," meaning that there is a given amount of water that fills both the water heater and the cross-linked polyethylene (PEX) tubing and that water is constantly cycling from the water heater, through the buried lines and back again. There is no heat exchanger as there would be in a glycol based heating system, improving overall efficiency. It is important that there is no air in the lines and that pressure is maintained throughout the season. We have a pressure gauge, followed by a small valve, plumbed directly to the PEX mainline and also have a microbubble resorber that is essentially a one-way air valve to remove bubbles as the water cycles through the piping. This is mostly important to get the air out during initial setup after we reattach the system after moving the greenhouses.

Above is the author's distribution system. One-inch PEX header lines supply and return water to and from half-inch PEX distribution lines buried six inches in the ground. Opposite is the pressurization setup. A garden hose feeds the system, and a pressure gauge indicates when the system is pressurized. The two white lines are for supply and return of hot water.

The hot water that is created by the water heater is pumped directly to a one-inch PEX main supply line and then distributed via tees to 1/2 inch PEX tubing buried about 6 inches deep in the soil. Each bed has four buried 1/2 PEX lines that run the entire length of the bed and loop back at the end. This creates two loops of PEX tubing per bed. Each loop is connected on one end to the supply and on the other end to the return back to the water heater. This method of plumbing each loop to both the supply and the return allows the hot water to circulate through each loop, which helps maintain even temperature throughout both of the greenhouses.

To make the loop in the PEX at the end of each bed, we use two L fittings and a six-inch piece of PEX to connect the two full length pieces of PEX. This makes a squared off loop end. Two small Grundfos distribution pumps keep water cycling through the system (same as you would see in a residential radiant heat system). These are small red in-line pumps and they are located on the cart in a protected area. We have installed a switch so that if the pressure in the system drops below a certain level the distribution pumps will turn off. This protects the pumps in the event of a leak or blowout from running while dry (an issue we have dealt with in the past). These pumps are not cheap, so installing this switch from the get-go is well worth it.

There is a thermostat to set the temperature and a sensor for the thermostat that is buried in the soil of one of the beds. The sensor wire is inside PEX tubing to protect it and allow it to be long enough to be located in one of the beds. This thermostat is critical for setting the temperature and also for monitoring the temperature in the beds.


We have a standard garden hose attachment followed directly by a valve connected to the 1-inch PEX mainline to fill the system with water and also to add water as is needed to maintain pressure. Adding water to maintain pressure is usually only needed when we are initially pressurizing after moving the hoophouses. If pressure is not being maintained after the initial setup, this usually indicates a leak somewhere that should be addressed.

## Troubleshooting

Nearly all of the issues we have with the system have to do with moving our hoophouses and the need to detach the PEX mainlines and reattach them after moving. We monitor the pressure closely after reattaching the system and almost always have very small leaks due to fittings not being tight enough or leaking small amounts of water for whatever reason. Of course, this issue is easily avoidable in a non-moveable system or one that is plumbed permanently to both zones in a moveable system (something we are considering).

We have had a few issues with tools (digging forks) or T-posts (for trellising) hitting buried PEX tubing and creating a leak (i.e. human error). However, we have never had any issues with failure of the PEX tubing itself, or any of the crimped PEX fittings.

The system was initially installed with an on-demand hot water heater, but the harsh conditions in the greenhouse led to its premature failure. The tank-style hot water heater seems more up to the task (and is cheaper to replace if failure occurs).

I do believe there is the possibility of using a water heater located in a house or barn if it is in close proximity to the greenhouse. This also may enable the water heater to be used for multiple purposes (household hot water, packing shed hot water, etc.).

Also, make sure you check that the PEX tubing is holding pressure before burying. That way if you have a problem in the beginning you don't have to dig them up to troubleshoot the issue.

In short, heating the soil and growing throughout the winter even in harsh winter climates and high altitudes like ours in Utah can be done with some investment and a little ingenuity!

For more information on radiant heating, check out radiantec.com.

*Copper Moose Farm is a two-acre vegetable and cut-flower farm located in Park City, UT at 6,600 ft. They can be found at www.coppermoosefarm.com.*

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# The many decisions behind building a cut flower greenhouse

By Gretel Adams

This winter we put up a three-bay greenhouse, something larger and more permanent than anything we have built before. Each bay is 22' wide by 96' long, covering a total area of 66' by 96'. Instead of the same area covered with standalone tunnels, having gutter-connected bays that share the same ground posts covers a larger space more efficiently. It is heated by natural gas, and automated ridge vents plus roll-up sides provide excellent ventilation. The decision to build it was complex and took many meetings, as well as pro and con evaluations before finalizing.

## Costs versus profits

Most importantly we knew that we wanted to increase our season extension with heated greenhouse production for better employee retention by creating more winter hours. Plus, people are hungry for blooms in the spring, especially if winter has been dreary and long. We hadn't previously had many flowers before mid-March because of the way our fall blooms lined up with getting spring blooming crops in the ground. In zone 6a in Columbus, Ohio, we usually get frost in the middle of October. So in order for us to have flowers for Thanksgiving we use our heated greenhouse space for season extension in the fall as well as the spring.

This means our fall plants aren't coming out of the greenhouse until the end of November or sometimes December. That creates a crunch time in fall when we want crops to be going in, but we are also trying to hold onto flower sales later into the season. With this new space we knew it would alleviate some of that crunch.

To confirm it wasn't just our gut and desire to grow more driving us, we revisited our enterprise budgets for each crop we were thinking of increasing: ranunculus, anemones, stock, and snaps. We're always open for trials too, so there are a few test crops in there (poppies, fritillaria, early lisianthus, dusty in crates). Enterprise budgets are described in Richard Wiswall's *Organic Farmer's Business Handbook*, with downloadable templates that track inputs and outputs. They track labor and equipment rates, and with some data on harvest timing and processing, you can create a sheet that tells you the actual cost of production and profit per square foot for each crop. There is a lot of data being entered, so they take a long time to build, but they are worth it, letting you know which crops are most worth growing for your operation. What they showed us was that even with heating the houses and the upfront costs of infrastructure, the crops would generate revenue immediately, making it a high-impact expense.

## Location

In the location where this three-bay greenhouse stands now, there were two smaller tunnels in its place. The smaller tunnels were homemade structures we had purchased from a retiring grower that were used to grow herb plants. They were short arches, meaning that flowers could only be grown down the center aisle to have enough space to grow tall. Plus, there was no way to vent the sides, so even though we built two roof vents, it was sweltering in there during the summer, rendering those houses unusable even with shade cloth on them. We tore down these structures, sold one of them, and used the bows from the second one to build covered space for houseplant sales at our farm stand.

The dog surveys the future site of the greenhouse.

In our original setup, house one was unheated and had a place where

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we could plant in the ground. House two was originally used as an extension of our heated propagation house, which meant when we had overflow from the smaller propagation house, we would have to then move flats to fit everything into house two. I knew every time we touched those flats that the crop became less profitable, so our plan was to increase space for flats to avoid the plant shuffle from one house to another.

When we met with life mentors we've known since our pre-farmer days, their thought was, 'why go with the big fancy house if we knew we could make money from the regular Quonset style houses?' What swayed our decision was that since house two was originally heated, we already had gas, water, and electric to that house. That meant that we could have all heated space and cover more square footage more efficiently if we did a gutter connect instead of two separate Quonset houses.

The finished structure: three 22' by 96' gutter-connected bays add up to a total of 66' by 96' of heated greenhouse space. On the facing page, anemones are blooming in the greenhouse, flanked by ornithogalum in netted crates. All photos courtesy of the author.

## Suppliers and financing

There were many options for purchasing a gutter connect house like this, all with different bells and whistles, so we started getting quotes and talking to growers about which brands they were using, as well as attending trade shows to meet vendors. With prices ranging from $60,000-$120,000, we knew that we were going to need financing in order to make this large of a purchase. Let's talk about financing for a minute before I go on about the purchase.

When we first started borrowing money for the business, it was hard for me to come to terms with it because I was always raised not to have debt, but we learned through research and meetings with business professionals that there is a difference between personal and business debt. If you can borrow $1 and know you are going to make $1.50 on that investment, then it's acceptable for a business to take on good debt to attain growth, as long as your net is not going down as the business grows.

We chose to take advantage of low interest rates to fi-

nance this infrastructure while we are still young. But I think there is a stigma in the farming community, where the mentality of borrowing money is looked down upon by some. Having the data to know you are growing profitable crops is necessary in the decision-making process, and can be an important part of growing your business.

It may take a few years of growing and collecting data before you can reach a point where you are confident in making big money decisions. The fallacy that I held on to was that at some point it would become easier to make decisions about money because the business made more money. But unfortunately that wasn't the case, because the risks just got bigger as the business grew and we were making larger investments.

If it sounds scary, there are tools out there to help. We took a class through Cornell University online called Holistic Financial Planning, which has you compare goals and desired outcomes and provides a format for comparing pros and cons. This has been really helpful, along with gut feelings and confidence in yourself and your growing practices, which should increase the more years you have in your business.

Going to a bank to borrow money as a farmer can be difficult, especially with no off-farm income in the beginning. But having good records and showing them plans and enterprise budgets will help to show lenders you know what you are talking about. Also, using a bank like Farm Credit Services helps because they know how seasonal farm income works. We use Farm Credit for our yearly operating loan, our barn, and equipment loan. (Recently at a workshop, I learned some FC branches even provide payroll and other services, so definitely check them out!)



A lot of these loans are not set up with a monthly payment but instead you are just expected to pay either a lump sum each year, or have a percentage of it paid off by a certain date. This time we were able to refinance our house as collateral to put up this greenhouse, which is an increase in our monthly house payment, meaning it needed to be accounted for in winter cash flow (unlike our other loan payments with FCS).

We ended up going with Yoder's Produce Supply, an Amish company that instead of installing one brand of house, gathers components from multiple suppliers to give you the best price. We decided to have them put it up, which is the first time we've ever hired that out. That meant they could construct it while we were able to keep farming, dividing tubers, figuring out the soil steamer we had purchased, and starting other winter projects. It was the best decision we've made because they got it up in just a few weeks, and then it was up to us to figure out running all the utilities in the house, and hook up the gas, electric, and controls.

## Setting up the bays

The drainage under house two wasn't great, so we laid gravel down to increase drainage with a new layer of landscape fabric on top, which helped significantly with humidity in the house and with fungus gnats. Making that move though meant that the 3-bay house that we put up couldn't be used to plant in the ground in that section, so that bay of the greenhouse became the "seed house". So we dedicated our other propagation house to orchids, stock plants, as well as storage of all the plants we retail; whereas all the seed starting now happens back in the new seed house (which is really bay three).

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## Cut flower greenhouse

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We knew where house one was that we wanted to plant in the ground, so that became bay one. And we were undecided about the space that used to be in between the houses, so we decided to produce in crates this year before committing to putting down gravel or digging beds. So for now, bay two is crate production, which is why we have a lot of trial crate crops (anemones, dusty miller, fritillaria, freesia and snaps), as well as our regularly programmed lilies for bouquets.

During construction we had been accumulating crops planted in crates. We have another greenhouse that is heated and used to plant directly into the ground, but we had laid landscape fabric down and were using it for crate production while we waited to finish the new house. When we were ready, we had a massive move-in day with our crew at the end of January, using a hay wagon and tractor to get through the muddy mess while we moved crates around all day.

With our increased production in the new house, we have a national shipping program unfolding this spring with an online store available for florists and designers across the US. Last year we did a "soft opening," testing out shipping to a select few customers to work out some of the kinks, so we are really excited about what this season holds for us. We are building a Shopify store through the template that the ASCFG built. We'll be sure to update after this season to discuss the outcome of this new sales avenue.

*Gretel and Steve Adams of Sunny Meadows Flower Farm offer farmer consultations to help assist others in their decision-making processes. Check their website for more details about possible topics of discussion. Email sales@sunnymeadowsflowerfarm.com if you are a grower or designer interested in participating in the national shipping program being rolled out by The Columbus Flower Company.*