Phase 3: Increase Crop Diversity

Small Farm, Big Ideas
Solar Fresh Produce is a 3 acre CSA farm in Buffalo, MN operated by Sarah Lindblom since 2015. This season, I was able to build a caterpillar tunnel with a grant from the Mill City Farmer’s Market Next Stage Grant program.

Update from Phase 2
Managing temperature is much easier with the ends removed now that it is summer. The ends can be cut up the middle like a curtain, or cut off completely. Just make sure to leave plenty of extra plastic on each end in case it needs to be removed. Soil in the caterpillar tunnel is dry, so regular irrigation is a must. Straw mulch helps keep the soil cool and covered.

Why Crop Diversity?
Increase crop diversity is one of the soil health principles, and there are benefits to adding crop diversity in any growing space for both marketing and soil health reasons. Diverse crops help utilize different plant days-to-maturity to maximize yields from one area (for example cucumbers and radish or broccoli and lettuce) but also helps keep the ground covered to retain moisture. Diverse plant roots also provide more diverse food sources for soil microbes, attracting a wider ecosystem of beneficial insects, microbes and fungi. Mimicking the diversity of nature will lead to a more resilient system.

Caring for Tomato Plants
One of the main crops grown in covered areas is tomatoes—it can greatly reduce disease and weather pressure on this high value crop to grow them in a caterpillar tunnel. Because there is only one row of tomato plants in the tunnel to allow for diverse planting, it is important to maximize their potential using a few different methods including trellising, pruning, mulching, and irrigating.

While Farmer’s Friend LLC offers a trellising kit that can be used in the caterpillar tunnel, I decided to use the basket weave method to trellis. This involves pounding in t-posts at each end and in between every few tomatoes (I added a post between every three plants). As the tomatoes grow, twine can be used to weave between the posts holding up the plants on both sides. Frequent weaving (about once a week starting soon after planting depending on plant growth) will be helpful to keep fruits off the ground and easier to access when harvesting starts.

Light pruning of the tomatoes to one or two central leaders and also removing some leaves that are blocking light and air flow will help reduce disease and increase fruit production. Because of the tight quarters inside the tunnel, light pruning also helps access everything easier for harvesting and maintenance.
Once the tomato plants are established, a layer of mulch can help retain moisture, keep the soil temperature cooler, and improve food safety when it comes to harvest. I used straw mulch.

Because rain does not water plants inside the tunnel, frequent irrigation has helped keep plants growing healthy and at a good pace. Check moisture levels often and observe plant health. Keep in mind that different plants might have different moisture requirements when growing diverse crops in the tunnel. The irrigation system I have in place uses valves for each line of drip tape so I can choose which beds to water at any given time. Areas with denser planting (i.e. arugula next to basil) do not need as much irrigation. More control over the timing of irrigation helps prevent tomato splitting. It may also help to plant more drought tolerant crops to further reduce watering requirements. Crops can be fertilized as needed with compost tea or a side dressing of compost, but keep synthetic fertilizers limited to help plants function better on their own.

Adding Crop Diversity

The caterpillar tunnel is separated into six beds which allows for diverse plantings if desired. During the first summer of production, 2 of the six beds are planted with tomatoes (assorted cherry and heirloom slicing), one bed has basil and arugula, another bed has Tulsi and arugula, and a fifth bed has scallions that I attempted to companion plant with a failed summer squash planting (see Phase 5: Incorporating Livestock for more info on the failed summer squash).

Two beds did not get planted with summer crops and this would have been a good time to incorporate a buckwheat cover crop, however for various reasons the remaining two beds were treated with a combination of mulch, tarps, and irrigation to hydrate the soil in advance of fall planting and to keep weeds suppressed. I am planning out which crops to plant for the winter including spinach, radicchio, carrots, turnips, mustard greens, overwintering onions, and hopefully some cover crops. When choosing what to plant, it is helpful to balance which crops will grow well given the conditions and the value of the crops. Next season I will have a better idea of the mix of crops that might work best and can hopefully do some crop rotation within the tunnel (for example growing cucumbers instead of tomatoes).
Harvesting

Crops grow quickly in the caterpillar tunnel so it is important to harvest them as soon as they become mature, especially tomatoes. Arugula was the first crop I was able to harvest, and it was nice to free up some space for basil and tomatoes. Because of frequent irrigation the arugula was buttery and turgid. Succession plantings would help have a longer window of arugula availability. Basil was a close second after arugula and has been a great choice for growing in the tunnel, although needs a lot of watering. Tulsi (or Holy Basil) is growing abundantly and providing many harvests, and does not need as much moisture. Tulsi plants that have gone to seed are popular among the pollinators and honeybees.

While harvesting, keep in mind food safety and plant respiration. Use clean tools and harvest bins, do not set food on the ground (especially if it will be eaten fresh or raw), keep food out of direct sun while still in the field, wash produce thoroughly and soon after harvest, and be aware of your surroundings and monitor for food safety risks like signs of wild or domestic animals. If harvesting into a perforated crate, consider setting it on something to keep it off the ground (for example, a dedicated “ground crate” that is not used for food).
A Long View Approach

As I continue this project the focus on soil health has shifted my thinking from maximum output to sustainable long term production goals. While yield and production are very important to the financial sustainability of a farm, this should not take priority over the long term care of the soil which is arguably more important for a farm’s sustainability than yields (decreased disease, weed pressure, pest pressure, inputs, etc.).

Reducing tillage and other soil health practices requires a bit more planning ahead which can result in setbacks if prep takes longer than expected or planting windows get passed by. As I work these systems more the efficiency will increase over time along with the soil health. Thinking a few steps ahead (and even a few seasons ahead) is important in this system. Paying attention to the soil as a biotic community that we are part of (and not dominant over) will have long term benefits for yields, soil health and therefore human health. Small nudges in the right direction towards ecosystem balance and stability will have more rewards than the short term benefits of pesticides, artificial fertilizer, and other measures used to increase yields in the short term.

Increasing Diversity for Fall and Winter

To keep the soil covered and add crop diversity, I direct seeded spinach and a greens mix at the end of August (this timing could have been a little earlier to get crops established). Corvair (F1) and Bloomsdale longstanding spinach were seeded into 1/6th of the tunnel. I first spread a layer of topsoil, then made 3 rows about 6 inches apart and then irrigated with drip tape. The greens mix (a blend of garden seed including mustards, lettuce, kale, beets/chard, and cilantro) was relay planted with the basil, which was starting to slow down. This was then irrigated with drip tape as well.

Next Up

In Phase 4: Keep Living Roots in the Soil, see the germination results and harvest the spinach and greens mix, transplant winter greens into the tunnel, build endwalls, use season extending techniques within the caterpillar tunnel, see how the greens fare during the winter and do a pH test.
Earthworm Test
The third soil health test in the report card is the Earthworm Test. This is a test of biological activity and can also be an indicator of soil structure.

To complete this test you will need:
- Bucket or bucket lid to use as a stencil
- Tarp
- Shovel
- Soil Health Report Card to record data

Method:
Choose your location(s) and mark this in your records. You may want to test different areas of your fields. Place a bucket lid on the ground and dig in a circle around it. Once the outline is made, dig down about 1 ft. When digging, make sure to put all the soil from the hole on a tarp. The important thing is to keep the size of the hole consistent every time you do the test. Taking photos for reference might be helpful.

Count the earthworms in the soil sample on the tarp as accurately as possible. This is a good time to make other observations about soil structure, scent, biological activity, etc. Record the date, location, and number of earthworms in the soil health report card.

Analysis: My first earthworm test in the caterpillar tunnel yielded no earthworms! I am not sure if this is because I did the test too late in the season (early November) or if the biological activity is very low, or both. I speculate that occultation over the winter may have been problematic. Even though it worked well for weed suppression, it may have harmed the biological activity of the soil. I look forward to repeating this test next season to see if there are any changes.

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References