Sattin Hill Farm Course
Module 11: Nursery Management & Seed Propagation

Introduction

In this module, Josh covers the benefits of having a nursery, nursery set up, soil blocks, the timing of transplants, hardening off of transplants, and lots of other great tips.

The nursery is a crucial piece of infrastructure that often gets overlooked when first starting a small farm. A lot of your time will be spent in the nursery planting seeds and propagating starts, so having a strategically dedicated space should be a high priority when designing your farm.

Where To Put A Nursery?

Structure: Some growers will designate a portion of a larger greenhouse for their nursery space, while others have a completely separate structure. Both can work well. Others will use a garage, basement, or shop building with racks and grow lights. It really comes down to what makes the most sense in your context.

Placement on the Land: When determining where to place the nursery on your land, make sure it's easily accessible and in a central location on the farm. The goal is to reduce the travel distance between where the seedlings are grown and where they will be transplanted. In the principles of permaculture, this would be a zone zero or a zone one. You want to make sure the nursery is easily accessible so you have less deterrents to check on things consistently.

On Josh's farm, the nursery tunnel is the closest tunnel to his house, with the production tunnels being just beyond it. He planned it out that way because he knew he would be frequenting the nursery more often than any other part of the farm.

Indoors: Another option is to have the nursery indoors, using racks and grow lights. For the first few years of his farming career, Josh did this using racks for microgreens production and nursery starts. It takes up very little space and is inexpensive to start up. This can be done in a garage, a basement, or an outbuilding of some kind. As long as you can regulate the temperature to enable germination, the space should be suitable.

No Nursery: Another option is not to have a nursery at all. Some farmers decide to just purchase their starts from a commercial greenhouse or nursery and eliminate the need to start their own seeds. There is nothing wrong with this approach, and it can be a good option for farmers who are just starting out.

Why Do You Need A Nursery?

Protection From The Elements: The primary functions of a nursery are to create a space where temperatures for optimum germination can be maintained and where vulnerable young crops can be protected from wind and rain.

Germination Chambers: Some growers opt to use a germination chamber in the nursery, which is an excellent way of increasing consistent and successful germination. The most common germination chambers are DIY units made from modified standup freezers wired up with a two-stage controller and a Crock-Pot in the bottom. These germination chambers are especially helpful when it's hot and humid, and you need cooler temperatures for crops like lettuce or spinach to germinate well. They also come in handy when it's really cold and you need warmer temperatures for germination but don't want to incur the costs of heating your entire nursery space to 75° or higher.

Ventilation: Ventilation is also essential in the nursery. Having adequate airflow keeps down the moisture around the plants to prevent mold and disease. The wind generated by ventilation fans also helps strengthen the plants and prepare them for the heavier wind they'll experience when planted out in the field.

Additional Products: In addition to starting seeds and growing the seedlings for your farm, nurseries can also be a space to produce edible flowers, microgreens, or potted plants for selling.

Nursery Setup

Josh's nursery is a custom-built 16 'x 24' tunnel made by Rimol called "The Bobcat." One of his favorite features is the double-layered roof for added insulation. Having two layers of plastic on the roof, separated and inflated with a blower, creates a pocket of air, providing added insulation for the tunnel. The end walls are not insulated. Most of the heat escapes through the roof, so it's not as necessary to insulate the end walls.

The installation of the nursery tunnel was much more permanent than Josh's other caterpillar tunnels. The ground had to be leveled as it would for any other typical new construction.

One of Josh's favorite features is the sliding door on the end wall of his nursery. As often as he goes in and out, especially during the colder months, he has found the ease of use and premium feel to be well worth the upgrade.

Temperature Regulation: Josh's tunnel has two louvers on one end wall and two fans on the other end wall. When the thermostat is triggered, the louvers open up to let air in on one end, while the fans simultaneously kick in on the other side to suck the air out. This creates a cross breeze to ventilate the whole nursery. Josh has it set up in two zones. As the temperature starts rising, the first one will kick on, and then as it gets even warmer, the second one will kick on. This helps save on electricity by only running one when you need it and only two when you absolutely need it. In the shoulder seasons, it will often just be one fan running, and both will run in the summer. Being a smaller nursery, Josh hasn't found it necessary to have additional fans running for more airflow. Then ventilation fans on the end walls suffice.

Watering Wand: It's important to have a good watering wand. Josh uses the Wonder Water and likes how it makes a really fine mist, which is gentle on the crops. Just below the wand, he uses a Dram on/off valve. He's a huge fan of the Dram valves.

Misting System: He also has an automated sprinkler misting system, one row for each row of tables. The misters are made by VibroNet and purchased through Berry Hill Irrigation. It didn't come in a kit but was fairly simple to piece together. It's recommended to have misters every 3' for even coverage, which has worked out well for Josh.

Josh has his misters set to come on four times a day. However, he always likes to say, "there's no set it and forget it" when it comes to irrigation on a farm. Even when you have set your timers to come on at consistent times, there can always be new variables causing crops to get too saturated or dry out too quickly. You still need to regularly monitor your system to make sure it's working the way you need it to.

Tables: Josh built his greenhouse table tops out of pallets and made the legs from pieces of metal top rail piping. He chose metal legs to keep mice from crawling up them, which can be an issue with wooden legs. While there are many nicer greenhouse tables on the market to choose from, Josh has been content with his DIY tables. He recommends that whatever table style you choose, just make sure they don't have solid tops. It's crucial for water and air to be able to pass through the table for the health of the plants.

Having a workbench to do your potting is another great use of space in the nursery. Having a warm and protected space to work is really beneficial when it's early in the season, and you're doing the big push for spring plantings. You can also use space to store your soil mix, trays, and other potting supplies.

Nursery Size

When deciding how big your nursery should be, consider how many plants you will need to fit the space at your busiest planting time of the year, which for most farmers is the spring. If you're planning on growing crops like tomatoes, cucumbers, and peppers, you

will need more space to accommodate the plants getting potted up to larger pots as they mature. This requires considerable table space. Having a nursery that feels a little bigger than you need will serve you much better in the long run than a smaller one.

Pros of Soil Blocks

Soil Blocks vs. Trays: Josh is a big fan of soil blocks. He's been using them for the last two years now and has no plans of returning to growing his starts in trays. For those who aren't familiar, a soil block is simply a compressed block of potting mix for starting seeds in. They're an alternative to starting seeds in standard plastic 1020 trays. Though 1020s are the most commonly used method of seed starting by farmers and gardeners, they typically only last for a season or two before breaking and ending up in the landfill. They're commonly used because they are cheap and easily accessible.

There are now much sturdier trays on the market that are built to last, but Josh still prefers the soil blocks. Though they take a little more time to make with the soil block press, he's observed them grow stronger seedlings that experience less transplant shock when getting planted out.

Less Transplant Shock: Josh attributes some of this transplant stress to the pushing or pulling required when removing the soil plugs from the plastic trays. In contrast, soil blocks sit in a flat tray with no side walls confining or separating them. You simply pick them up and place them in the ground with little to no disturbance of the root system.

In his observations, Josh has noticed that since switching to soil blocks, transplants look healthy and strong from the moment they get planted. Previously there would be a week or so where the transplants would be slumped over and stressed after transplanting. Soil blocks seem to bypass this stress on the plants.

Avoid Root Spiraling: Soil blocks offer more flexibility with timing. When growing starts in trays, the root system will begin spiraling around in the base of the cell once the plant has outgrown the space. This gives the farmer a narrow window of opportunity to get the seedlings planted out. If they are left much longer past this point, the seedlings become root bound, and the plant becomes stressed and stunted.

Once the roots reach the edge of the block in a soil block, they are naturally "air pruned," which means that when the roots hit the air, they stop growing. This allows the plant to stay healthier for a longer period, giving the farmer more flexibility in their planting schedule.

Faster Transplanting: When Josh previously used cell trays, he would first stand at a table and pull out all the transplants. Then he would take that tray to the field to plant them all. Soil blocks have eliminated the step to loosen or pull all of the seedlings from the cells, which has allowed him to speed up his process of transplanting.

Less Trays: Another benefit of soil blocks is that you only need one kind of tray, regardless of what size soil blocks you are making. There are 128-cell trays, 72-cell trays, and others when using cell trays. Having just one kind of tray in your nursery is another layer of complexity that can be eliminated, further increasing your efficiency.

Watering: Soil blocks can be watered with an overhead misting system or bottom watered using a solid bottom tray under the perforated tray. This provides a lot of versatility for where and how you grow your seedlings, whether indoors with grow racks and bottom watering trays or in a greenhouse with an overhead irrigation system.

Cons of Soil Blocks

Moisture Retention: With a lot more open surface area on a soil block, there's a lot more airflow. While this is great for the health of the plant, it also causes the soil block to dry out very quickly. If they completely dry out, they can be tough to rehydrate.

Seeding: When seeding soil blocks, you really have to do them by hand because the soil blocks aren't always completely uniform in size and shape. This prevents you from effectively using tools like a drop seeder or a vacuum seeder. This can become quite a drawback on a larger scale, but for Josh, it isn’t a significant inconvenience.

Time Consuming: One of the main criticisms of soil blocks is that they are time-consuming to make. Josh would argue that while they take longer to make than filling a standard cell tray, the time saved by not having to pop out all of the starts from your cell trays makes up for it.

Scalability: Another criticism is that the use of soil blocks would not be feasible for larger operations. However, Josh knows of farms committed to using soil blocks that have over two acres in production. For example, Daniel Mays at Frith Farm has two and a half acres in production and still prefers using soil blocks.

Tools & Supplies for Soil Blocks

Potting Mix: Make sure you buy a good quality potting mix. By purchasing a mix that already has high-quality organic fertility sources, you can bypass the need to add any additional fertility in the nursery, simplifying your process. This investment will have far-reaching ripple effects. Healthy transplants will lead to healthier crops that grow faster, have better yields, and make you more profit.

A high-quality potting mix will also block better when creating your soil blocks. The other thing to remember is that in addition to having healthy plants, the potting mix you use ultimately winds up in your beds. When you're trying to create living soil in your beds, these extra nutrients and minerals will also be contributing to that.

Josh uses Coast of Maine's Organic Seed Starting Mix, which he buys locally. He has also used Happy Frog, Tilth Soil, and Vermont Compost Company in the past. If you can find a regional or local supplier, that is ideal since they don't have to ship it as far.

Containers & Trays: Josh uses a heavy-duty rubber feed pan made for chickens and ducks to prepare his potty mix for soil blocking. A larger container would be helpful for doing a higher volume of soil blocks.

He uses the wide-mesh bottom trays from Johnny's Selected Seeds for his soil blocks. These trays work well for soil blocks, having ample airflow through the mesh bottom. This also helps facilitate air pruning. The other nice feature of these trays is the solid sidewalls that help keep in some of the moisture, which is especially helpful with the soil blocks prone to drying out quickly. They're not the most heavy-duty, but Josh hasn't had any break on him yet. There are other similar trays on the market that may even be cheaper, but the issue with them is that they lack solid sidewalls.

The Soil Blocker: There are essentially two types of soil blockers on the market: a hand-held blocker and a stand-up blocker. A hand-held soil blocker is a great tool if you aren't doing a high volume of soil blocks. It produces 2" soil blocks, which can be useful for some larger crops like kale, cucumbers, or squash. It's a much smaller investment and can be a great entry-level tool, especially when you're first starting out. With the hand-held soil blockers only making four or five blocks at a time, it can be very labor-intensive to produce a large amount of soil blocks.

Josh uses the stand-up 35 soil blocker from Johnny's. If you are doing any kind of significant production for profit, he recommends this as a necessary investment. It's close to $300 but built like a tank. With its ability to press 35 one-inch soil blocks simultaneously, it can fill a 1020 tray with three presses. One hundred five one-inch blocks will fit perfectly into each 1020 tray. Josh has found it to work quickly and consistently well. The stand-up model is also a much more ergonomic design in the way that it allows you to use your body weight to compress the soil.

How To Make Soil Blocks

After adding the potting mix to his container, Josh will add water to the mix to get it to the right consistency. It can be a little intimidating to know how much water to add when first starting out. This is understandable as there's not a set recipe. As a general rule, if the mix is too wet, the soil blocks will just fall apart. When this happens, you can just add a bit more potting mix. If the mix is too dry, the soil blocks won't hold their shape, and you will need to add a little more water.

A good rule of thumb: if you pick up a soil block and squeeze it, you should get a little bit of water to come out, like wringing out a sponge. If this is the case, you are now ready to start making soil blocks.

Once your mix is at the right consistency, place your container on the ground, grab your stand-up soil blocker, and push down into the mix with a twisting motion. After using your body weight to get more compression, lift the soil blocker up and over the tray, pull up the handle to release, and you have made your soil blocks. After a bit of practice, you will get your system dialed in and be able to move quite quickly.

How Much To Seed?

If you need 400 transplants, don't plant just 400. Plant 450 or 500. Always plant more than you need as an insurance policy, anticipating that you'll lose some starts, whether by mistakes or bad germination, or other variables. Always make sure you have more than enough. The goal is always to fill up your bed. As you get more experienced, you will be able to predict your variables with higher accuracy. Overplanting as a contingency is always a good idea.

What Goes On The Soil Blocks?

There are a few different options for covering the soil blocks after seeding. Some people will simply pinch the top of the soil block around the indentation where the seed goes. Others will sprinkle on a little more potting mix to lightly cover the seeds. Josh's preferred method is to cover the seeds with a thin layer of vermiculite. He only uses about two bags a year for this farm, and each bag is around $20. Vermiculite is great for moisture retention to increase germination.

Clean Your Soil Blocker

After you finish soil blocking, it's crucial to rinse out your soil blocker with water. If the potting mix is left to dry on the soil blocker, it can be challenging to clean it off. It also keeps it functioning smoothly the way it's designed to.

Label Your Trays

After seeding your soil blocks, the other thing to remember is to label your trays. Josh uses painter's tape and labels each tray with the date. If he had a wider variety of crops, he'd also note the crop, but it isn't necessary for his context. Having the date of planting labeled on each tray helps you monitor how long something is taking to mature and lets you know if there are any issues you need to address.

Timing of Transplants

While there are general guidelines for how long transplants should remain in the nursery before they are ready to go in the field, these periods can fluctuate depending on the time of the year (when your nursery is outdoors). If you're starting seedlings in the

wintertime, they will take longer because of less heat and light, and vice versa, they will go considerably faster in the peak of summer.

During mid-season, crops like lettuce and beets will spend three to four weeks in the nursery from the time of seeding to the time they get transplanted. More than the exact number of days spent in the nursery, you want to focus on the transplants being strong enough to go out into the field and survive, but not too large to the point that they are starting to struggle inside their cell trays or soil blocks. As mentioned earlier, one of the best things about soil blocks is the broader window of time to get transplanting done before crops begin to suffer.

Hardening Off Transplants

In addition to getting the timing right, hardening off your plants before transplanting plays a significant role in keeping your crops healthy. When you take delicate seedlings from a completely protected space like a greenhouse and directly into the field where they can experience harsh sunlight and wind, there is a high likelihood they will be stressed and weakened. This can prolong transplant shock or even invite pest pressure and ultimately affect your yields.

The term “hardening off” refers to a transition period where you slowly acclimate nursery-protected crops to the harsher elements of the field environment. Josh likes to emphasize the importance of airflow in the nursery–as a way to acclimate the starts for the coming wind they will experience when planted out. The airflow will help strengthen the stems and roots of the plants. Easing the plants into the transition from grow lights to full sun is also important for preventing stress.

Hardening off can be as simple as setting up a table just outside of your nursery greenhouse (or garage if you're starting seeds on racks under grow lights). Transfer the trays seedlings to this table for a few hours the first day, and then incrementally increase that time each day until they're ready to be outside for the full day. At that point, they are ready to be planted out into the field. Typically a week or less is adequate for completing this process.

In Josh’s context, his starts go directly from a nursery tunnel to a production tunnel. The similar protected environments have made it so that he does not have to worry about hardening off his plants. However, if you are taking seedlings from any kind of nursery environment and planting them out into an open field, Josh strongly recommends taking the extra step of hardening off your plants to prevent crop failures.

Quality Seed

Buying high-quality seeds is just as important (if not more) than buying high-quality potting mix. Investing in quality seed can lead to better germination, less pest pressure, and higher yields.

One Seed Per Cell

When seeding your trays, only plant one seed per soil block or cell. Many gardeners will plant multiple seeds per cell to account for lost germination. Josh would argue that if you can dial in your system regarding temperature, moisture, and quality potting mix, over planting like this won't be necessary. Going back and thinning your trays to one plant per cell can be extremely time-consuming and disruptive to your seedlings' fragile root systems. Instead, focus on creating an environment where good germination can occur consistently and skip this step of thinning out. Planting a greater number of soil blocks than you will need is a better insurance policy than planting multiple seeds per cell.

Potting Up

Potting up is taking a small transplant, like one of Josh's soil blocks, and transferring it into a larger container for more room to mature. This is most common for crops like tomatoes and peppers. While there are four-inch soil blockers on the market, Josh has observed good results from using standard 3.5" pots for potting his soil blocks.

Many people ask if the soil blocks ever fall apart when being transferred or moved. The answer is no, they do not. The plant's root system fills the space in the soil block as it grows and holds it together quite nicely, both for transplanting and potting up.

Seed Storage

Keep your seeds sealed up as best you can, and ideally, keep them in the refrigerator. Josh made the mistake of not refrigerating his seeds for his first year of farming. Unfortunately, he watched the germination rates drop very quickly throughout the season.

Rodents in the Nursery

Josh had assumed that the metal legs on his nursery tables would be enough to prevent mice from eating his freshly planted seeds. He had no issues with crops like lettuce and beets with smaller seeds. However, with crops like squash that have bigger seeds, the mice still managed a way to get to his tables and devour the seeds. Josh solved this by

using humidity domes over his trays with the larger seeds and weighed them down a little as extra insurance. Sure enough, it worked to protect the seeds!

Once the plants had germinated, the mice were no longer a threat. The thing to remember with this technique is that the domes will prevent the trays from being watered by an overhead irrigation system, so that hand watering will be required.

Conclusion

Overall, Josh believes that investing in your nursery infrastructure and systems is a worthwhile expense and one that will save you time, lead to bigger yields, and ultimately lead to higher profits for your farm.