

Module 5: Preparing Soil & Creating Beds

Introduction

In this module, you will learn about Josh Sattin's preferred method for preparing soil and creating beds, called the deep compost mulch system.

We'll go over the pros and cons of this approach, as well as how Josh creates compost, builds beds and walkways, and how he incorporates mulch.

When it comes time to begin creating beds, you will need to work through all of the considerations in modules 1-4. Make sure you have spent time with those before this module. Creating permanent beds is something you want to get right the first time, as moving or adjusting them later will cost a lot of time and labor.

Soil Testing

When Josh took on the farm manager position at Raleigh City Farm he took soil samples before building beds there. After getting the results, they could make some informed decisions on what kind of amendments were needed for the soil. They learned that the pH was extraordinarily high and that they were low in sulfur. Adding sulfur would also correct the pH level, so that's what they did first. Soil amendments can take a long time to alter the levels in the soil, so the earlier you can get them taken care of, the better.

While soil testing is highly informative, remember that it's just one tool in a multifaceted approach to creating healthy, balanced, biologically diverse soil. It's also important to remember that a soil sample is only one snapshot of a specific place on your farm at a specific time. Getting multiple samples from multiple areas will give you the best overall window into your soil needs.

If you want to go more in-depth on soil testing and analysis, Josh recommends working with a professional agronomist. The other approach that Josh prefers is to learn how to let the plants inform you of what is needed in the soil, which will be gone over more later.

Tillage

To till, or not to till? Josh is a big proponent of no-till farming practices. However, he is not opposed to initial tillage on a farm when first building beds. Whether it's regrading a slope, installing drainage tile, or smoothing out a grow space, a lot of earthwork will often need to happen regardless. You just need to realize that this is a one-time occurrence, and there will need to be a season of building back up the soil biology. If you know that you will need to

incorporate amendments or compost into your soil to correct its composition, mixing them with the initial till is a good time to do so.

Time vs. Money

There are many ways to increase your soil biology, soil health, and organic matter. Planting cover crops or raising animals takes a significant amount of time. If you do not need to grow vegetables, these routes are worth looking into.

If you need to start growing sooner than later, investing some money into high-quality compost and/or soil amendments will help you achieve this. It's a faster approach, but it will likely cost you more to get started.

Deep Compost Mulch System

The deep compost mulch system is a term used by Josh Sattin and his friend Jesse Frost of Rough Draft Farmstead and the No-Till Podcast. It has also been called no-till, lasagna gardening, and no-dig. The no-dig term was primarily developed and spearheaded by the well-known organic gardener Charles Dowding.

Mulch is a term referring to anything used to cover the ground. It could be wood chips, plastic tarps, landscape fabric, or other materials. Covering the ground protects it from the elements, retains moisture, and suppresses weeds.

The compost itself serves as the mulch covering in the deep compost mulch system. Four to six inches of compost are layered onto the native ground, and the first crops are planted directly into this compost. In this scenario, the compost serves as the soil while also doubling as the mulch, holding in moisture and encouraging the soil biology.

Pros of Deep Mulch Compost

Weed Control: There are many pros to the deep compost mulch system. One of the main pros is weed control. While it's not 100% full proof in preventing weeds, it prevents most annual weed seeds from successfully germinating.

Quick Start-Up: Another pro is how quickly the deep compost mulch system allows you to start growing on your farm. With such a deep layer of compost, the plants will not be very affected by any imbalances in the native soil below.

If you have heavy compaction, start by making a pass with a broadfork to loosen and aerate. After layering on a deep layer of compost mulch, you will be able to plant right away. The roots of the crops you grow will continue loosening the soil over time.

Organic Material Boost: This system is also hugely beneficial for soils suffering from low organic material. Adding a high volume of compost like this will quickly raise your percentage of organic matter.

Aesthetics: While it may sound superficial, having pure black compost covering your garden beds creates a beautiful aesthetic. Having a nice-looking farm with dark, vibrant soil comes with many advantages. It is fantastic for marketing. Whether visitors are touring your farm or pictures you can post on social media or your website, it will increase interest and demand for your product.

It's a morale boost for you and your workers. It's a way to make you feel happy. Anything you can do to make it look more pleasant will make you feel happier. You'll feel more motivated to work and be productive.

Cons of Deep Mulch Compost

Availability: There are also some cons to the deep mulch compost system. The first would be the availability and quality of compost you have access to. Many farmers struggle with not having access to quality compost in their local area. This system may not work for your context if you can't find consistent, high-quality, local sources.

Cost: The other con to this system is the cost of the compost. You have to buy a lot of material to make this work. While it is an upfront expense, Josh believes there is no better investment than your soil. If coming up with cash is too much of a barrier, it goes back to the trading time versus money concept. Without the money to invest upfront, the alternative is planting cover crops and creating your compost. You can get there eventually, but the time investment will be higher.

Labor: The next con would be labor. While building these beds takes a lot of work, there are some ways to mechanize it if you have a front loader, compost spreader, or friend you can borrow one from. On a small scale like Josh is growing on, wheelbarrows and five-gallon buckets suffice. Regardless, it still requires a lot of energy to build beds this way. Organizing a group of friends and neighbors to help out for a "bed building day" is a great way to kick start your small farm.

While managing Raleigh City Farm, Josh would organize groups of 10-12 young and energetic volunteers to help build beds. They built a whole block of beds in just a couple of hours! Plus, it

was a fun community-building experience. Seeing the work get accomplished that fast was rewarding for everyone.

Erosion: When you layer a high volume of loose fluffy compost onto the ground, it's essential to factor in erosion risk. Until the crops have had a chance to get established and hold the soil together with their root systems, an extreme rain event could wash away a lot of high-value compost. Josh has experienced this before, and it was devastating.

One method of preventing this is to avoid building beds during rainy seasons and keep a close eye on the weather forecast. The other more fool-proof method is to grow under tunnels, which Josh has almost completely migrated to. With extreme weather events seemingly becoming more common, growing under tunnels can give farmers great peace of mind that their soil and crops will not be destroyed.

Keeping your compost pile covered with a tarp is protecting one of your most valuable assets on the farm. Heavy rainstorms can wash away this valuable material, so keeping it covered is a must.

Determining Quality Compost

When determining compost quality, you need to look at it, feel it, and smell it. While the dark color and consistency are a part of the criteria, the smell is even more important. If it smells like ammonia, manure, or any other unpleasant way, something is off. It should have a pleasing earthy smell, like after the rain. Josh has had experience with purchasing compost that wasn't finished. It smelled horrible and killed a lot of plants. Learn from his experience, and follow your nose!

Asking other local growers is a great place to start when trying to find a good source of quality local compost. Learning from their direct experience is helpful before you make your investment in a product.

If unfinished compost is all that is available to you, one option is to buy it and finish composting it yourself. This will require extra time and effort, like checking the temperature, watering it, and turning it. This is not the ideal scenario, but it may be worth considering if it's your only option.

Another thing to check for when purchasing compost is weed seed. If the facility you're buying from is not getting their compost hot enough, weed seed can survive and then find its way into your beds. Remember, the point of the deep compost mulch system is to smother weeds and reduce the need for cultivation. Compost with weed seed would defeat this purpose.

Residual pesticides and herbicides in materials used to make the compost are something to check for when purchasing your compost. Ask the facility where their sources come from to ensure it doesn't contain potential contaminants. It can take a long time to remediate contaminated fields and put them out of production for a significant period.

Some landscape companies also use biosolids from wastewater treatment facilities for their compost. While they will say it is safe to use, more research needs to take place on this. It's best to stay safe, especially when growing vegetables for market.

Compost with Leaf Mold

Compost is most commonly applied at a much lower rate than in the deep compost mulch system. It's typically spread over beds at just 1/2-1" thick and then incorporated into the topsoil with a tilther or a shallow till. When added in such small amounts, the compost adds fertility but not very much organic material.

In the deep compost mulch system, using 100% pure nutritional compost can be too nutrient-dense for optimal plant growth and even cause problems for your crops. Because of this, Josh recommends trying to find a mixture of compost and leaf mold (decomposed leaves). His local manufacturer developed a mix that's 50% compost and 50% leaf mold, which has worked out well on his farm.

Leaf mold is an excellent source of carbon and very nutrient-dense. Composting leaves on your property (if available) is a wonderful way to build up your soil. If you can't find a local source that sells a leaf mold/compost blend, you can always purchase them separately and mix them yourself by adding a 1:1 ratio to your beds.

Preparing Soil with Silage Tarps

When the ground has been leveled, the soil has been tested and amended, and the drainage issues have been addressed, it is now time to build the beds.

The first step in Josh's process is to kill off any existing vegetation in the grow space by covering it up with silage tarps. Silage tarps are an amazing tool for a small-scale farmer. Having some on hand at your farm is highly recommended. They are reversible, with black on one side and white on the other, which can be used for different applications.

The beauty of the tarp system is that it saves a farmer from so much labor that would ordinarily be needed to clear a plot of ground for planting. The principle at work in the silage tarp system is called occultation. Occultation means to block something from the light. When a tarp is pulled over the soil's surface, any growing plant material dies and decomposes. Moisture is also

retained, encouraging soil biology and speeding up the decomposition process. In addition, any weed seed in the surface level of the soil is encouraged to germinate, sprout, and then die from the occultation.

If the ground is not already wet, Josh recommends watering it down or waiting for it to rain before pulling the tarp over with the black side facing up. With the black side up, it will absorb heat from the sun, which will, in turn, warm up the soil and encourage germination. If you have done an initial till to create a soil disturbance, any weed seeds on the surface will now germinate, grow, and die. After this process has taken place, you should have a weed-free surface to begin building beds on. Preparing your growing space ahead of time with silage tarps will save you a tremendous amount of time on weeding and cultivating by hand.

Make sure to purchase the correct size tarps that fit the size of your field blocks. Planning out the field block sizes to precisely match a specific tarp size (like Josh did) will serve you in the long run. Josh purchases 32' x 105' silage tarps from Farmer's Friend LLC, and then cuts them in half for two 16' wide tarps. These fit perfectly into his 100' x 14' caterpillar tunnels.

The amount of time it takes for a silage tarp to work is relative to the time of year, temperature, and moisture level. It's important not to rush the process when tarping, ultimately defeating the purpose. Checking regularly under the tarps is the best method. If you are tarping a pasture with native grasses, it may need to be left on for up to a year to decompose the organic material. However, on ground that has been tilled and prepared, weed seed can germinate and die within just two weeks (if the heat and moisture levels are sufficient).

Some grasses are more persistent and harder to kill, such as Bermuda grass. With rhizome roots that can grow and spread in the absence of light, they will often require being dug out by hand.

A question that often comes up regarding using silage tarps in this method is whether or not the microbiology in the soil gets damaged during the process. While there may be some detriment in the very top crust of the soil, the majority of the soil biology is just below that and remains uncompromised with adequate heat and moisture. Any microbial life on the very surface will also quickly rebound once the tarp is pulled and light and oxygen are reintroduced.

Josh has also used chickens to clear land in preparation for growing vegetables. They do a good job at clearing vegetation while also adding fertility, but they aren't as thorough as the silage tarp. You also have to consider food safety and allow for the appropriate time between when the chickens were last on the land and the time until harvest.

Building Permanent Beds

Bed and Pathway Dimensions: As mentioned in the previous module, Josh prefers a 30" bed. In his ideal scenario, he would opt for 18" pathways between beds, but due to the size constraints of his 14' wide caterpillar tunnels, he currently uses 12" pathways to maximize growing space. He likes the 18" pathway best as it allows for a harvest tote to fit comfortably, and also limits the risk of accidentally stepping on your crops while working. In addition, narrower pathways can completely disappear as larger crops (such as kale) mature and grow over the pathways. Despite this, maximizing space is the most important thing when growing in a limited space, so Josh makes it work with the 12" pathways in his tunnels.

In his 14' wide caterpillar tunnels, Josh can fit four 30" beds with 12" pathways between beds and 6" from the outer beds to the side edges of the tunnel. The tunnels are 100' long. To increase the varieties he can grow at one time and for ease of crop planning, Josh decided to split the 100' beds in half, with a 2' wide pathway separating them. He also accounted for one foot of space from the end of the beds and the end of the tunnel. This shrunk his beds to 48' and allowed him to fit a total of eight beds in his 100' tunnel.

Marking the Corners: Standard wooden stakes from Home Depot work well for marking the corners of your beds. Once these are driven in, they will remain permanently installed and can be used repeatedly for pulling string lines to show the edges of your beds. When first installing your corner stakes, take your time to measure precisely.

Once a string line marks the edge of your bed, the first step in Josh's process is to broadfork the bed. This loosens and aerates the soil, making it more habitable for the soil biology soon to be introduced.

Choosing a Carbon Layer: After loosening, the next step is to put down a layer of carbon. For this, Josh prefers cardboard. It provides an excellent additional weed barrier and eventually breaks down. Wetting down the cardboard will help facilitate its decomposition and jump-start the biology. Cardboard is readily available (especially in more urban contexts) and is a great option for turning a material that may otherwise end up in a landfill back into the soil.

Another option for the carbon layer is straw or hay. The only issue with this option is the grass seeds. If straw or hay are more readily available in your context, covering it with a silage tarp would be recommended to kill off any unwanted germinating seed.

When finding your cardboard, look for the largest pieces possible. It will make it the quickest to layout and easier to make your beds. Make sure that the cardboard you're getting isn't glossy or painted. Also, make sure no tape or staples are present before laying it down. Slightly overlap the pieces so that no cracks are exposed. However, do not double up the cardboard or use extra thick material. It will take too long to break down into the soil and potentially create an anaerobic environment underneath the cardboard. A single layer is sufficient.

How to Layer Cardboard: Cardboard should be laid down everywhere—both over the beds and pathways. However, don't attempt to do an entire field block simultaneously. As Josh can attest to from experience, the wind will blow it all over the place, and you'll just be running around chasing cardboard. Also, wheelbarrows full of compost will damage the cardboard as they are rolled in. Two beds at a time works well.

Adding Deep Compost: Once the cardboard is positioned and wet down, it's time to add the compost. Josh layers on four to six inches of material which comes out to roughly two to two and a half yards per 48' bed. At \$30 a yard, that is about \$60-75 per bed. It is an excellent investment for what will yield a high return! Josh will get around \$600 per bed for his lettuce mix in just one rotation. However, the labor cost of moving in the material with a wheelbarrow is also a cost consideration.

Once the compost is evenly spread over the beds at 4-6", wood chips can be brought in to cover the pathways. Layer on the wood chips to be the same level as the compost. They will quickly compress and be lower than the beds, likely needing a second application. Having the wood chip pathways and the compost in the beds at the same level helps to hold everything in place.

First Plantings: In the deep compost mulch system, shallow-rooted crops like lettuce and other greens are recommended for the first planting. If you want to plant larger crops with more expansive root systems (like tomatoes), you can punch through the compost and the cardboard down into the native soil below. Carrots are also possible for a first planting, but they will likely be misshapen if the soil is too compacted. Greens are preferable for the first plantings.

Scaling Up: Is the deep compost mulch system feasible on a larger scale? Yes. Jared Smooth of Jared's Real Food in San Diego uses a similar approach on a larger scale; building his beds with straw and compost. He uses a front loader to bring the material to the side of the area where he is building beds and works from one side of the field to the other.

Daniel Mays of Frith Farm also uses this system on a larger scale. He'll line up three wheelbarrows and fill them all simultaneously with a front loader. The wheelbarrows are placed close to the beds, shortening the distance for the crew members helping with the task.

Wood Chips for Pathways

Weed Suppression: There are many benefits to using wood chips for pathways. The first and most apparent benefit is weed control. Josh is proud to report that he has never had to pull a weed from a pathway at Sattin Hill Farm! This is the result of all the preventative measures laid out in his process. From tarping, layering cardboard, and then layering on wood chips, the weeds have no chance to get established. He also continually adds wood chips as they decompose and become compressed. Anything you can do to reduce the time and energy you put into cultivating and weeding is always a win.

Moisture Retention: Another huge benefit of wood chips is their ability to retain moisture. Typically when you have raised beds, the outer edges of the beds will dry out faster because they're exposed to the wind and the air. By layering the wood chips at the same level as the soil, they will hold moisture and release it into your bed over time. The edges of your bed will not dry out as quickly as they would without the wood chips.

Fungi Producing: Biologically speaking, wood chips are also great because they add a lot of fungal life to the soil. The majority of the compost added to the beds will be bacterially dominated. By introducing the wood chips, you add a highly beneficial fungal element, bringing balance to the system. With wood chips for pathways, they no longer just serve as a place to walk but also an additional source of fertility and moisture. Josh is also convinced they are the least amount of maintenance!

Replenishing Wood Chips

After a bed has been flipped (finished, harvested, and prepared for the next planting), Josh assesses the pathways to see if any more wood chips are needed and then adds more at that point. After the initial installation of a bed, more chips will be needed between plantings, but over time as things get established, adding more wood chips will be required less frequently.

Local arborists and tree companies are a great source to acquire free wood chips. Most of these companies have to pay a fee for dropping their chips at a designated dump site and are often more than happy to dump chips at your property for free—especially when they have a job in your area.

While you can often get on a waiting list for wood chips to be dropped at your property for free (through services like Chip Drop), you'll usually have quicker results by reaching out directly and talking to the folks who work there. Developing a working relationship with a local tree trimmer is the best way to go. They will call you when they're in your area and ask if you are ready for another drop.

Another significant benefit that Josh believes is often overlooked about wood chips is the aesthetic appeal on your farm. That contrast between the dark soil and the lighter-colored wood chips makes things pop and keeps the farm looking nice and tidy! When your workspace looks nice, it makes you want to be more productive.

Cons of Wood Chips

One potentially negative aspect of having wood chips in your paths is that they can sometimes creep into your beds, especially if your beds are on a slope. For Josh, this has been only an occasional slight inconvenience, but not a very big deal in his opinion.

To help curb this from being a problem, he will quickly rake out whatever wood chips have crept into the bed just before replanting. Raking them back into the pathways only takes a minute and ensures they won't interfere with direct seeding or transplanting the next crop. Everything takes maintenance, but Josh has found that the wood chips are the least amount of maintenance of all the methods out there.

Another concern about having wood chips close to soil growing vegetables is that they could potentially tie up the nitrogen that would otherwise go towards nourishing the plants. There are no issues with nitrogen being tied up when they are only on the walkways or even on the surface in the growing space. This would only occur if wood chips were mixed directly into your production beds.

Alternatives to Wood Chip Pathways

Some people opt for using landscape fabric to suppress weeds in pathways. The problem with landscape fabric is that weeds will still find a way to pop up around the edges and through any holes. It will also degrade over time and need to be replaced. Josh has found that wood chips are easier to manage and more pleasing to work with. Using wood chips is also an opportunity to use an organic material rather than another plastic-based product on the farm.

Others will opt to leave their pathways as bare soil. This requires regular cultivation to manage the weeds that will continually try to grow. Running a wheel hoe or scuffle hoe down your walkways will need to be a regular part of your routine.

Another option to experiment with is living pathways. This involves growing specific grasses or low-growing ground cover in your pathways. There are many options, but they all take maintenance. Josh has found wood chips have the most benefits with the least maintenance.

Mulching the Beds

Many people inquire about whether or not to mulch the surface of the beds as well. In the deep compost mulch system, the compost/leaf mold blend serves as a mulch layer in and of itself. Its capacity to hold in moisture is far greater than the native soil. In short, additional mulch material is not needed for covering beds in this system.

However, many farmers will use landscape fabric over their beds, with holes in the fabric for the crops. Landscape fabric will lower the soil temperature slightly (if that is a benefit in your context) and will also protect plants from getting soil and muddy water splashed on them during heavy rains. This keeps crops cleaner and makes post-harvest washing a quicker process.

Conclusion

As previously mentioned, take time upfront as you're planning and setting up your systems to be as successful and efficient as possible moving forward. Following the steps outlined in this module will help you eliminate or significantly reduce the amount of cultivation and weed management needed on your farm.

Decide where your field blocks will go first, and then take care of any groundwork that needs to be done, whether tilling, adding amendments, digging drainage ditches, leveling the ground, or terracing. Then wet down the soil and cover it with a silage tarp. Wait until everything is killed off under the tarp, pull it off, measure out your beds, and install your corner stakes. Pull your string lines, then broad fork the beds. Lay down cardboard, wet it down, then layer on the compost and wood chips in the pathways, and BOOM—you have a market garden!

This method of building beds has worked out extremely well for Josh Sattin, and hopefully, it can yield the same results for you.