

# Sattin Hill Farm Course

## Module 6: No-Till Practices & Living Soil

### Introduction

In this module, Josh goes over what the term “no-till” means and why he practices no-till.

He also covers the principles behind creating and maintaining living soil, amendments and fertility, and how he prepares and flips a bed.

### What is No-Till?

Josh isn't a big fan of the term no-till, as it's defined by a negative. No-till (or no-tillage) is a broad term defined differently by different farmers, and it can encompass a lot of different techniques and approaches in farming. Tillage is best understood as soil disturbance which harms the biology and structure of the soil. The goal of no-till farming is to improve the soil over time instead of making it worse.

On the extreme end of the no-till spectrum, some would argue that even tools such as the broadfork or a tilter could not be used in a truly no-till approach. For those unfamiliar with these tools, a broadfork opens up the ground by wedging in tines from 9-12” into the soil. While there is some disturbance, the soil layers are not inverted when the tool is used correctly. Oxygen is reintroduced, causing microbial life to be reinvigorated, and compaction is loosened.

The tilter is a small drill-powered tool that functions as a “mini-tiller.” It only cultivates the top 1.5” of soil, helping to mix in soil amendments and creating a smooth consistency for direct seeding. There is minimal disturbance at the surface with this tool, but most of the topsoil below is left untouched.

Josh uses both the broadfork and the tilter in his system and encourages others not to be dogmatic about the no-till approach. Instead, zoom out and refocus on the big picture question: what will make the soil better over time? Josh has no problem with an initial till when breaking ground in a new growing space, but besides that one instance, he generally subscribes to the no-till approach. While there may be some damage to the soil biology from an initial till, if you are then adding compost regularly and refraining from deep tillage, you will lay a foundation for soil that only gets better with each passing year.

If you're converting from a tillage farm and want to go no-till, you can't just stop tilling and assume all of your problems will go away. You may even have new problems to deal with. As mentioned in the previous module, a good starting point would be to cover a portion of your farm with silage tarps. If farming is how you make a living for yourself and your family, you can't go all-in on a new experimental technique. Try going no-till on just a portion of your farm, and give yourself time to get used to it before converting the whole farm.

## Why Practice No-Till?

**Weed Control:** As mentioned in the previous module, weed control is a huge reason for going no-till. Whenever you expose bare soil, weed seeds will naturally grow. By preparing a plot and then covering it with silage tarps, all surface-level weed seeds will germinate, sprout, and die. Follow that with layering on wet cardboard and then six inches of compost, and you have an almost entirely weed-free growing space! By naturally killing off everything on the surface, covering it up, and no longer disturbing it, the weed seeds deep below never have the opportunity to germinate.

In contrast, coming through with a rototiller or a plow will bring those seeds up to the surface, where they can germinate and grow. On a traditional tillage farm, they come through with a plow, shape their beds, and then plant. Then a few weeks later, they have a flush of weeds, which necessitates cultivating for the rest of the season. This whole problem can be avoided by refraining from deep tillage.

**Carbon Sequestration:** While weed control is a practical benefit of the no-till approach, there are also significant benefits for the health of the soil. The goal is to keep carbon in the ground, commonly referred to as carbon sequestration. Tilling the ground breaks up all of the roots and plant material, which becomes oxidized and turns into CO<sub>2</sub>, escaping back into the atmosphere.

**Year-Round Production:** If you are practicing no-till and not relying on a tractor to prepare your beds, you can prepare beds and plant at any time of the year. Growing under polytunnels or protected culture would be required for winter production in extreme weather climates. However, eliminating the need for a tractor is a huge help in making year-round production feasible. When either tarps or tunnels protect beds, wet and muddy soil that can't be worked with a tractor is no longer an issue.

**Soil Health:** Soil health is the primary reason Josh has chosen to adopt the no-till approach. Josh does not use pesticides, herbicides, or insecticides on his farm. He made a decision early on in his farming career and has stuck with it. While he does occasionally lose a crop by forgoing the use of any chemicals, for him, the trade-off is worth it. It's impossible not to kill off beneficial things whenever you kill off a pest or a weed. This is why Josh has chosen to avoid it altogether.

With that said, Josh still holds to the importance of not being dogmatic when farming. If you need to save a crop, and the only way to do that is by using some kind of organic pesticide or herbicide, do what you need to do—especially if your family is relying on that income.

Farms that prioritize the creation of living soil tend to have crops that not only look better, but also taste better. Living soil creates an environment where there is an ongoing relationship between the plants, the microbes, and the soil. Plants are growing and photosynthesizing while

their roots are putting carbon and sugars into the ground—feeding the microbes which feed them. The microbes convert nutrients and minerals into a form available for the plants to take up—the ultimate symbiotic relationship! You can see how soil devoid of this kind of microbial life would cause your crops to suffer.

For example, a lot of conventionally grown produce in grocery stores, like a head of broccoli, will look nice, but the flavor will be extremely flat. This is the product of crops grown with synthetic fertilizers in lifeless soil. Without a strong presence of microbial life in the soil, your crops will lack nutrients and flavor.

## Creating Living Soil

There are four principles when creating living soil: 1) keep the soil covered, 2) keep the soil planted, 3) disturb the soil as little as possible, and 4) create diversity as much as possible. Keeping these principles in mind as you make decisions on your farm about strategies, approaches, and tools will benefit your soil greatly.

**1 - Keep the Soil Covered:** The soil is your biggest asset on the farm, so it's essential to protect it and the biological life within. Growing in caterpillar tunnels as Josh does is one way to accomplish this. Tunnels protect your soil from heavy rains, wind, and extreme temperatures. When your beds aren't in production, covering them with silage tarps is also a fantastic way to protect your soil from erosion or drying out and killing off microbial life.

**2 - Keep the Soil Planted:** Another way to protect your soil is to keep it planted with either cash crops or cover crops. Anytime you have plants growing, you have photosynthesis taking place, feeding the soil and keeping it alive. Nature itself demonstrates this principle. Whenever you see bare dirt, native grasses will immediately begin growing to try and cover it.

**3 - Minimal Soil Disturbance:** Disturbing the soil as little as possible is at the heart of the no-till approach. Infinite interactions are happening with bacterial and fungal microorganisms in the soil, more than we can even understand. Our job is to allow nature to facilitate this biological activity and to get out of the way as much as possible. The less we disturb the soil, the better.

**4 - Create Diversity:** Creating diversity as much as possible is extremely important. This is a challenge for market gardens when growing multiple rows of one particular crop. This is not a phenomenon that takes place in nature. Nature is consistently full of diversity. Small-scale organic farmers can do to encourage more diversity. These include planting different varieties in neighboring beds, incorporating hedgerows of beneficial plants around the farm, and creating habitats for beneficial insects and birds. Wood chips create diversity in the soil, creating a habitat for mycelium and a plethora of fungal organisms.

## Replenishing the Soil

Every time a vegetable is harvested and exported from the farm, it takes all of the nutrients and minerals that the soil provided it with it. In light of this, it's of utmost importance for the farmer to constantly replenish the soil with those nutrients and minerals to ensure the soil does not become depleted. The soil is the primary engine on the farm, and it must be fueled and maintained.

When it comes to conventional fertilizers, they provide a plant with what it needs (artificially as it may be), but they will not replenish the soil with what it needs. This is why using natural fertilizers is so essential. The thing to remember about natural fertilizers is that they're not typically in a readily available form for the plant to take up and use. This is where microbiology comes into play. Living soil will turn all these natural fertilizers into a form that the plants can uptake, and that's why we need to focus on having living soil.

Anytime you can incorporate a local waste stream into your fertility program, it's a huge benefit. Josh Sattin's farm is located near chicken processing facilities, so he uses feather meal in his fertilizer blend. Feathers that would ordinarily be discarded from a processing facility are instead ground into a nitrogen-rich organic fertilizer. There are many different kinds of nitrogen-rich fertilizers to choose from. It just comes down to what is available in your local area. Asking your local farm store is a great place to start if you are looking for natural fertilizer substitutes.

### The Sattin Hill Fertility Program

Every bed flip at Josh's farm is prepared the same way. He first adds five five-gallon buckets of compost to each bed, all of which are standardized to 48' long and 30" wide. He then adds three and a half pounds of his fertilizer blend per bed, all of the ingredients found at his local farm store. Here is his recipe:

- 25% fish meal
- 25% alfalfa meal
- 25% feather meal
- 15% kelp
- 5% biochar
- 5% humic acid

Josh uses a cement mixer to mix up bulk batches of up to 150 pounds. He calculated the cost of his soil amendments to be about \$3.5-4 per bed. This is based on buying 50-pound bags of the different amendments and mixing them himself. Josh gets his compost for \$30 per yard and has calculated that it costs him about \$3.75 per bed for five five-gallon buckets worth of compost. He invests about \$7.50 per bed on fertility for both fertilizer and compost. This input cost is insignificant when considering the yield that can come from one bed.

With natural fertilizers, you're not just feeding what you're growing now; you're also feeding what you'll be growing in the future. There are many other approaches to providing organic fertility such as cover crops, compost teas and slurries, and Korean natural farming methods (KNF). Josh's program has yielded wonderful results for his context, so he chooses to stick with it.

## Flipping a Bed

Flipping a bed is the term used for preparing a bed for another planting. When a bed has been entirely harvested and is ready for flipping, we say that the bed has been cropped out. Here are the steps for flipping a bed at Sattin Hill Farm:

1. Remove all above-ground crop residue and take it to compost piles
2. Pull up and set aside the irrigation lines
3. Pull a string line the length of the bed from one corner stake to the other
4. Rake clean any remaining crop residue
5. Broadfork the bed
6. Add five buckets of compost and spread evenly with a rake
7. Add soil amendments and mix in with the tilter
8. Rake Smooth

**Leave the Roots:** In the no-till approach, the goal is to leave as much of the root matter from the previous crop still in the soil after the bed has been cropped out, decomposing and adding valuable organic material. Root crops come out in their entirety, although there is still a large amount of good root material that remains. For lettuce crops, you can twist the stock just above the soil, snapping it off and leaving the root mass in place. For bigger crops with woodier stalks like kale, tomatoes, and peppers, you can take a pair of loppers and cut just below the soil level to leave the root system in the ground.

Leaving the roots in the ground is very important to the whole system. Root systems do wonders for decompacting soil. As roots break down in the soil, they leave behind a network of tiny channels that allow air and water to pass through, invigorating soil life.

Another benefit of leaving plant roots in the ground is that the roots are still feeding the soil even after you terminate the crop. The microbes feed on the plant roots and multiply, making an even more robust environment for the next crop that will be planted there.

**Remove Irrigation:** Once the above-ground crop residue has been removed, it's time to pull the drip irrigation lines. Loosen the quick-fit connectors on the irrigation header. Go to the opposite side of the bed and completely pull all three lines together and set them aside until the next crop is planted. Make sure to keep soil out of the drip lines while moving them to prevent clogs.

**Pull String Lines:** On each side of the bed, tie your string lines from one corner stake to the other, creating a visual guide to separate the bed from the path. This ensures that your beds

stay straight and in the same place. Otherwise, they will shift over time, especially if you are on a slope like Josh's farm.

Use a lightweight, flexible metal leaf rake and quickly rake out any leaves or wood chips that may have crept into the bed. This takes very little time and ensures that the wood chips don't get mixed into your soil which would tie up nitrogen. This is also an excellent opportunity to pull up any weeds if they are discovered.

**Broadfork:** The next step is to broadfork, but this is optional. Josh recommends doing this step for the first season or two. Over time, the soil will naturally remain uncompacted, and the broadfork will no longer be needed. If the tines slip into the ground with little to no effort, you know that this tool is no longer needed. Some beds might be more compacted than others, so you must keep that in mind and assess each bed individually.

The broadfork is probably the gentlest way of helping de-compact the soil and open up channels for plant roots, oxygen, and moisture to pass through. To use it, put the broadfork in the ground, and then just rock and back and forth as you pull it back. Only pull back to about 45° to where you just begin to see the soil cracking open. You don't want to invert the soil layers and disturb things more than you need to. Just a light agitation to the soil is adequate. Using a broadfork too aggressively risks bringing up unwanted weed seed from the deeper soil, so the gentler, the better with this tool. Next, move back about 10-12 inches and repeat. Continue working backward until reaching the end of the bed.

**Add Compost:** Garden carts are a great way to transport buckets of compost to the bed where they are needed. Once the buckets are next to the bed, space them out evenly the length of the bed. Five buckets to a 50' bed would be one bucket every 10'. Spacing the buckets like this provides a nice visual for evenly spreading the compost onto the beds. It also facilitates the task nicely when working with a crew, creating less margin for error and ensuring the compost is distributed evenly throughout the bed.

**Add Amendments & Tilth:** After the compost is spread evenly over the bed, sprinkle on the 3.5 pounds of the fertilizer blend. Once the blend is dusted over the length of the bed, it can be incorporated into the compost with a drill powered tilter. Though some in the no-till camp may be critical of the tilter (as it's essentially a mini tiller), Josh Sattin is a big fan of it. It only works the top 1.5" of soil and does an excellent job of incorporating the amendments, breaking up larger aggregates, and creating a smooth seedbed for good germination.

Josh uses the tilter sold by Johnny's Selected Seeds, which he has been pleased with. He emphasizes the importance of using a high-quality drill with large batteries when using the tilter. He uses a DeWalt 20-volt XR power drill with a high-power 6 amp battery. Lower amperage batteries are not up for the task when used with the tilter. Investing in a high-quality drill can also be put to use by the Quickcut Greens Harvester, making it an all-around good investment for the farm. Josh recommends buying one drill devoted to the farm and another for personal use.

A bed can be tilled in two passes by running the machine up one side, and back down the other. If you need to go a little deeper, slightly push down on the back edge as you're running it. Another trick is to slightly lean the tiller to the side, running along the edge of the bed. This will kick soil towards the middle of the bed and help it not bleed into the pathways. Conversely, you can lean it towards the middle to push soil outward if needed (i.e., your bed line has shifted a little, and you're attempting to correct it).

It's important to incorporate safety protocols for yourself and others when working with the tiller. After each use, make sure to take the string off of the trigger so it can't accidentally turn on. Also, carry it with the tines facing out when transporting it from one place to another.

**Rake Smooth:** The last step before the bed is ready to plant is raking it smooth with a landscape rake. Josh uses a 36-inch wide landscape rake from Lowes, slightly larger than a 30" bed. Johnny's Seeds sells a 30-inch bed preparation rake if preferred. The 36" wide landscape rake can be pulled at an angle while still covering the full width of the bed. With practice, the bed can be smoothed in one quick pass with this tool.

### **Conclusion:**

Your no-till bed is almost ready to be planted! The only thing left to do is add wood chips to the walkways. Josh recommends this take place every time you flip a bed. If the walkways need some wood chips, use this stage of the process to add them. The same method for adding compost can be applied to adding wood chips. Transport the wood chips in five five-gallon buckets via the garden cart. Space the five buckets evenly every ten feet along the bed, then spread them in the pathway.

After you direct seed the bed or plant your transplants, it's time to put the irrigation lines back in place, and you're done! You will have finished the complete no-till bed building process from start to finish. It's recommended to plant right away to create a canopy as soon as possible, covering the soil to protect it. The goal is to get the bed immediately flipped and planted directly after it was cropped out. The quicker the turnaround, the less time the bed will be uncovered and vulnerable.

If the previous crop had larger root systems (like kale or tomatoes), it will be hard to run a seeder through successfully. You can strategize and work around this by putting in transplants in such a way to work around the previous plants. For example, if the previous crop had two rows, plan out the crop to be one that requires three rows, avoiding the spots of the bed where the previous plants were.

When flipping a bed that was intensively planted with baby greens, it's best to finish it off with the Quickcut Greens Harvester at almost soil level, cutting the growth points of the plants. Then follow with a slightly deeper layer of compost than usual to ensure everything is smothered. Water heavily, then cover with a piece of landscape cloth for about a week (encouraging accelerated decomposition). Following these steps should ensure that the previous crop of baby

greens doesn't resprout as weeds in the next crop. It may take longer than one week under cover in the shoulder seasons. Make sure to factor in this one-week gap into your crop plan.

Do your best to prioritize the life in your soil, and keep those four main principles in mind:

1. Keep the soil covered
2. Keep the soil planted
3. Disturb the soil as little as possible
4. Create diversity as much as possible