

Welcome, this is "The Ag Engineering Podcast," where we talk tools, tips, and techniques to improve the sustainability of your farm. I am your host, Andy Chamberlain, from the University of Vermont Extension, and this podcast is supported by Northeast SARE, providing grants and education to advance innovation in sustainable agriculture. We're trying to improve the industry by chatting with farmers and getting their input on tools, tips, or techniques that have changed the way they farm for good. Many of these practices affect multiple areas of the farm, whether it be environmentally, emotionally, physically, or financially, we share the knowledge to promote sustainable agriculture, lifestyle and business. Thanks for having a listen. Now, let's get started. Today's episode comes to you from Barnet, Vermont, where we meet with Heidi Choate and Evan Perkins of Small Ax Farm. Together, they've got 20 years agricultural experience, and 11 years in this business. They're growing on an acre of production, which includes about an 1/8 of an acre in both high tunnels and caterpillar tunnels. They sell primarily to a retail wholesale markets with 10% going to CSA or custom orders. Their sales this last year was about 115,000 gross, and they utilize about 2 1/2 FTEs. Heidi and Evan, welcome to the show.

Thanks for having us on.

Thanks.

So I just set the stage a little bit about your farm, but if you could just describe what you do in one sentence. What would you say?

We have a one acre no-till market garden on our off-grid homestead, and that's how we make our living.

Cool, well, today we wanted to talk about the no-till aspect of your farm. No-till is a popular topic right now, it seems to be brought up a lot at the trade shows and other podcasts, and defining it as tricky. So, how do you define no-till on your farm?

Well, we have been practicing no-till practices for 20 years. The first really good book we got on gardening, which I think was Ed Smith's "Vegetable Gardener's Bible." He's like, "This is how you should do it." And that's how we did it. And then we developed into a farm using similar practices. So, we've got a lot of experience with it. Our particular version of it is, we don't do intensive compost mulching or anything like that. So, we use probably a normal amount of compost that most farm would use. And we will only break the top inch of soil, basically, we do use a tilther. So, that's, in general, all we're doing, we're never inverting the soil layers. But because we're heavy on salad greens and radishes and things like that, that we need good seed beds and good germination. And so, for us, that means usually using the tilter to just provide a nice seed bed. And because we farm up north here, when soil comes out of the winter, it's not like a no-till farm in some place where it's warmer, where you can kind of keep that nice, loose soil on top, all year round. When soil comes out of the winter up here, after having snow, and it's gotten wet, and dry, and compacted, and then wet, and all that cycle, generally, especially in the springtime, that tilter is pretty necessary in our soil, just to kind of get some friability in that top layer. So, that's our version of no-till.

So at the beginning of the season, how are you renovating a bed?

Well, generally all the beds have, most of the farm is planted in some kind of green, or we'll leave whatever crop was on there, if it's providing good bed coverage over the winter. So, we try to over-winter stuff, all the beds with something in them. So it's pretty rare that a bed will be totally empty going over winter. And we don't cover crop because we operate in a really biointensive fashion. And we are just always, our philosophy is that the more land you have open, the more resources you're using. And it just makes more sense, and especially since it's hard to move resources around, just to farm the beds we have open, all the time. And so, we're just rotating crops through the beds. So because we don't have over-wintering cover crops or anything like that, in the springtime, pretty much everything will have died on the beds. And then if there is some living greenery there, because it snowed early and things didn't get killed off, we might rake it to rake some of that greenery off. But other than that, we'll usually for, if it's a crop that requires it, we'll use the tilther on it if we're planting greens or something like that. And we do use some other soil mulches, landscape fabric, and other things like that, pretty sparingly on the farm, And that might just go right over the bed, we might not do anything to it.

So generally speaking, going into the fall, it's crop residues that you're using for soil cover.

Yes, yep.

So you mentioned a little bit how you use the tilther to loosen things up. Are you broadforking your beds at all too, or not really?

Yes, I think with any, with most soil in a no-till system, you use it less and less and that's been our experience. And probably there was a bunch of years where we were using it more than we needed to. Our soil's just not really compacted, we don't walk on the beds, we don't run, we don't use, even walk behind tractors or anything like that, or BCS or anything like that. So, we do broadfork and we might crop-specific broadfork more often than just like, kind of just randomly broadforking 'cause we think the soil's compacted. But if we're gonna plant carrots, we're probably gonna broadfork just to make sure that everything's as loose as possible for them, which is pretty typical for most no-till farms.

No permanent raised-bed system? 30-inch bed top?

Yes.

Yeah. How would you make new beds?

Well, in general, all of our land is, we live on a hillside, which was overgrown pasture when we got here. Although, it was hayfield before that. So, because it was hayfield, it was rocked pretty well. There aren't a lot of big boulders, or big rocks, or anything like that. But it was, there's fairly large trees, they've been growing up for 25 years. So, anytime we're starting new beds, there's usually a tree involved somewhere, in pretty dense sod. So we generally will often cultivate with silage tarps, but we always use a tiller to break the beds open, just 'cause there's often like large rotted roots and things like that in there, that will just make it hard to work the soil, and then there will be some smaller rocks. So that first initial tillage allows us to kinda get in there, and get stuff out of the soil that's gonna make it hard to use

hand tools. If we were taking beds from like pasture that didn't have that stuff in it, we might not need, might never use the tiller.

Yeah, I think that's pretty common to,

Yeah.

Use a tiller to get established, get it started. So you mentioned how you work on a slope, and on a hill, and that's no joke. You are probably the steepest hillside farm and you're all, you're farming all on a hill, you don't have any flat space. But for those who haven't been on your farm, explain a little bit about how much hill you're working with.

Okay, so, I think on average we have about 15% grade, which means like every 10 feet that the slope is dropping a foot and a half. And then from our, we farm an acre, but it's not all together, we've got a block kinda down near the house towards the bottom of the hill, which is really not the bottom of the hill. It's just the bottom of our property, goes way downhill from there too. And so, we've got about a 1/4 acre down there and then we've got more like 2/3 of an acre at the top of the hill, and then a few other beds in other places. But from bottom to top, it's probably 175 feet of vertical, over a very short distance. So, we walk up and down the hill a lot and, which in most times, is great, keeps us fit, and then we swear sometimes when we...

Forgot that tool at the top of the hill or didn't close the greenhouse, yeah.

Yeah. Or slip in the mud on the way down in the spring time.

Because it's that steep, you're not utilizing wheeled equipment very much. You're not pushing a wheelbarrow around with compost, or trucks and tractors.

Yeah, so we don't own a tractor and we do use wheelbarrows, but they're often just a little bit less convenient because the hill it's, the hillside's steep and then there's just stuff to get around. So we're kind of back on the stone ages, we do use the wheel, but in a limited fashion. So, it may be like 14,000 BC or something like that.

Early wheel development.

Yes, exactly. They're not quite round. So, we do use wheeled stuff, but it's just less practical. One of our many lovely neighbors will loan us a tractor a couple times a year to move compost around. And we do that when it's dry, it's a four-wheel drive tractor. When it's dry, we can get the compost where it needs to be, at the ends of the bed rows. So, we'll pile compost a couple times a year or whenever we need, whenever it's dry, we'll move the compost where it needs to be, and then it's moved onto the beds with five gallon buckets. Or if the compost is fairly dry, we'll use grain scoops to move that onto the beds.

And on harvest days, we bring the truck to the top of the hill, and we just fill it, and bring it down and sort of up and back.

So you use the truck for primary...

For harvest.

Harvest.

Yeah, yeah.

Yeah and the truck works pretty well for harvest 'cause we only need to get it into one position near the fields, but it's not every day that we could bring a truck all the way around the beds, just because it gets really steep in certain spots.

Yeah.

So you can only do it when it's dry. But unless it's really rainy, we can usually bring the truck to the top of the hill on a harvest day. But we're harvesting from the top of the hill in March, so until May, usually, we're hand carrying stuff down.

Yeah, and we're hand carrying everything up, procro on your shoulder or all your seedling trays for paper pot, that are going up in that very top greenhouse, and you've got, 15 of them and yeah, you just,

Yeah, in our early days,

Get it up there. when we couldn't afford our amendments in the fall for the next springtime, we'd always be like hauling sacks of lime up as we could afford it in the springtime. And now, usually, we can stockpile that stuff up there in the fall. And so, we can apply in the springtime and it's already up there.

Yeah.

Yeah.

Have you figured out a list system, so you're never going uphill empty-handed?

It's our nature.

Yeah, I think it just eventually happens now.

Yeah, yeah, it's our nature to economize trips, and it's challenging with certain, some employees like that's, some people's brains they're just like, they're not think, that's not the way they think, they've got one task, they're gonna go do it. So, with certain employees, you realize about halfway through the summer, they're always gonna forget whatever they have at the top of the hill.

And there goes 20 minutes of income.

And that's probably something that, a specific challenge that we have that we could probably work on as employers, is just trying to figure out how do we train people properly so that they can think like that. And maybe it's a list or a loud speaker.

There's a lot of texting that's going on from the top of the hill to the bottom, it used to be yelling,

Yeah.

Just hollering back and forth, "What?"

Tin can and a string.

"Don't forget that." But now it's texting and that does help. So, we try to get our employees on board with that, so that we can all share lists that way, and that helps a bit.

So you use the cell phone primarily rather than a walkie-talkie or something?

Yeah, we thought we might wanna use the walkie-talkie, but I use the cell phone constantly for selling and for communicating with everyone else. So, it just made sense to just get Wunderlist and kind of share that amongst the employees and do it that way.

Yeah.

And I think it was kind of more of a financial thing early, like many years ago when we probably should have bought walkie-talkies, it was just one more expense and we've always, and then by the time that the farm was doing well enough that we could afford all those expenses, then the cellphone had kind of come into being.

Right, right.

Yeah.

It's a practical tool these day and age.

Indeed.

Yeah. I think another, there's one thing to know about our land too, is that we live on a south-facing slope and we live at about, on average, our fields go from about 1,400 to 1,600 feet. So, we're fairly high up. But because of that hillside, we don't get the extreme cold. And oftentimes, it'll be fairly warm here on really cold nights, but not always, only on still nights. So, we have a longer season because of our hillside and because it's south-facing, we do have one greenhouse with flat beds down near the house, and that's often a couple weeks behind the greenhouses that have that south-facing slope in them. So, there's actually a fairly dramatic difference and in production in the shoulder seasons, when you have

low-angle sun hitting flat ground, it's really diffuse. But on that hillside, you're maximizing every little bit of that low-angle sun.

That's a really unique observation that you'd think because you're such higher in elevation that your growing season would be later, but because you're on a south-facing slope, that kinda works to your advantage.

It does.

Facing the sun.

Yeah, all the things that we think we're experts on, on the farm, like if we were just to move just to the other side of the hill where it's north-facing, on our neighbor's land, we would have to refigure everything, all our planting dates, everything would be different. So it makes a fairly dramatic difference. Like our neighbors, our neighbors who have gardened here for years often can't believe like, "Wait a minute, you have that ready already?" And it's not that it's that much warmer here, but we're just not getting the extremes of cold as much.

Did you account for the angle of the sun when you were selecting this property?

Well, we started out looking for land with really no money and Heidi's got a college education, but we both came from working-class families. And so, we didn't have money and at that point you could get loans for land, but we had saved up I think about like \$15,000. And so, we had a pretty limited price range with which to buy land, but the bank was willing to loan us money 'cause Heidi had a good job, at least, at that point. And, so the steepness allowed us to buy the amount of land we wanted to buy and the quality of land. The quality, there's excellent soil here, the forest is really great. And we had decided that we wanted to live in a really rural area and we didn't wanna buy a small parcel of land in a rural area, and further start disintegrate that kinda web of that rural economy by breaking the land up into small pieces. So, we decided we were gonna like, "40 acres, that's our limit." "We're gonna buy nothing less than that." "And so we're just gonna wait until we can afford that." And buying steep land was one way we were able to afford it sooner because it had all the great qualities we wanted, it just wasn't flat.

And you were young and willing to,

Yeah.

Willing to deal with it.

Like when would that ever be a problem? Didn't occur to us.

Steep, whatever, it's clear.

Yeah.

We're gonna farm here.

Yeah.

And south.

Yeah.

And so, I think some things that are critical for us working on the hillside is we always gardened and farmed in a no-till fashion. We believed in it for, primarily, for environmental reasons and just for soil health, we could see the difference immediately. And because we did occasionally use tillers on beds in the first few years and we just like, we could see the difference. Like if you don't touch the soil, it just gets better and better. And if you till it, there's nothing wrong with tilling, but you do have to add more, you have to put more inputs into the soil over time. And then environmentally, that was kind of the whole thrust of our life, is to try to live a life that where we are living close to our environmental values. And so, fixing carbon in the soil, which happens in a no-till system, is the most important part for us. So we really believe in it in that way, but also in terms of practicality, like opening and tilling land like this would be probably fairly dangerous in terms of erosion over time and everything, every time you move soil, it's just falling downhill, it's falling downhill. And so, since we're rarely ever moving it, we don't have to manage erosion, we don't really have significant erosion. It's just not something we deal with for the most part. And so, because we have a south-facing hillside, we can have our beds at an east-west orientation, which is advantageous in the shoulder seasons, particularly for soaking up heat. And we manage the erosion that we have off of the top of the beds, so that when water comes down the hillside, it'll go into the pathways and drain out the ends. And we do have a couple larger swales or ditches above our two green, our two levels of greenhouses at the top of the hill, and that will really break up that water flow as well. So, we don't have mass water coming down across into our beds anyways. And the water that's, in an intense storm, that's draining off the bed, will erode soil from the bed down into the pathway below it. And then once, usually once a year, we'll take that soil that's below the bed and bring it back uphill, and we always move the soil uphill. So, that soil that does erode off the beds, isn't going anywhere, it's just going into the pathway below it. And then, usually, that's kind of like adding fertilizer, compost, everything in that time when we add the soil back up onto the bed, there's a lot that builds up in those pathways. Because we also, all of our crop residue actually gets composted right in our pathways, for the most part too. So, that's actually really advantageous every time we move that soil back onto the bed. I think one thing to note is that we farm on the steep hillside and we farmed through Irene. In that year, our town had, what's known around here as the May Flood, which was far worse than Irene in terms of damage, where we got about five inches in an hour. And we had almost no erosion during that, we had some damming up and breaking through, but it was, we were up and running like pretty much the next day, through those pretty massive events, which are more and more common. And then it's also, a lot of summers you'll get three inches in like 15 minutes, that happens pretty regularly and our farm weathers those things really well. So, that's how we've managed erosion on the hillside. I think there are also some other major advantages and say like this spring, for a lot of farmers, was really cold and they were really slow to get crops out. We really didn't notice any major difference in when we were getting out our first crops. One thing is we do a lot of season extension, so we just, we have the materials and the knowhow just to kind of warm things up as needed and cover

things. But also, that whatever little low-angle sun we got this springtime, was really aggressively warming our soils. And then everything also dries out a lot quicker on the hillside. So, we can plant, typically like the, if there isn't snow on the ground, we'll be planting like the 1st of April. And then, oftentimes, we'll go and like use a roof rake even or a shovel, and we'll shovel off a bed section if we see the weather window, it's like, "Oh, the soil could melt on Wednesday." We'll shovel it off on Monday, and then plant it Wednesday afternoon. And so, it's pretty typical for us to get crops in the ground really early, which actually is a significant advantage for us because yeah, a couple years ago, I remember we planted greens on like April 1st and then no one saw the ground again until the 15th. It snowed, but we had them under black silage tarp. And so, that was sticking up at points and we got a whole crop of greens that we wouldn't have gotten that was probably \$1,500, and that's 1% of our income, that we wouldn't have gotten just by being able to get in the ground early.

It's worth picking up the shovel in the snowstorm.

Oh, yeah.

Yep.

So no doubt farming on a hill poses many challenges, but it sounds like there's a lot of advantages there too.

Yes, I'm not sure they all equal out, but yeah, we've taken, I think, we're really home-settlers at heart, that's why we're here on this land doing this, is we wanted to build our own house, and build our own farm, and probably because we both enjoy the challenge of solving problems. And that's probably every farmer out there, like that's what attracts them to this. And so, yeah, we found advantages to it, and certainly there are climactic advantages and market advantages for us that we found. I think there's just a lot of tools we can't use and a lot of things that we can't do here, that are pretty standard for other farmers, that are good things to be able to do. Like get your compost right next to your beds, or be able to get in, drive to your fields in April, things like that.

You mentioned how you're not a big, how you use compost, but not as a mulch. Are you just using that as a soil amendment? Just how much are you adding? Just a sprinkle or are you adding a layer?

Yeah, we kind of have a standard of like every bed on the farm gets, at least, we do like, I don't know what it is in yardage, but we do like four or five, five gallon buckets per 45 foot row, which is our standard row length, 'cause that's also the row length of the paper pot chains. And that just happened to work out, but it's always been our standard row length because we decided on it randomly one day. I don't know why we didn't make them 50, but I think it was because like the way the hill was, we could only fit four 45 foot beds. We couldn't fit four 50 foot beds. So.

And then we double that for the heavy feeders too.

Yeah, so that's our standard, that's gonna be our standard application rate at about four or five gallon buckets for one of those per year. And because we're no-till, most of the carbon is coming from the

plant roots, which we leave in the ground. So, there's really a lot, we're building up organic matter over time, regardless of compost. And then, yeah, any crop that needs high tunnel crops or any heavy feeders we'll double or triple that just depending.

Are you incorporating that compost? Or just putting it on top and raking it smooth, planting into that?

It depends, I think if we're putting, sometimes we'll put it on in the fall, and in the fall we incorporate it because leaving it on top, you're gonna lose any nitrogen that's in the compost out of it. And we've generally made, for many years, we made our own compost and it was generally fairly high nitrogen compost. So, we would work it in that situation. But, in the summertime, if we were top dressing or planting a crop right in there, we tend to just, would leave it on the top. So, it really depends. Or the quality of the compost in terms of the seed bed. If we can plant right into it, we leave it on the top. But if it's a little chunky, we might wanna,

Tilther.

Yeah, use the tilther or before we had the tilter, a rake.

Yeah.

All right, you said you're buying in compost now, what type of compost is that? As in local person?

Yeah, well, we buy compost from Black Dirt Compost and from Vermont Compost, and they're fairly different composts and both are good for kind of different applications. And this was the first year we bought from Black Dirt Compost, so I don't know if their compost is always the same. Vermont Compost tends to always be the same in terms of its... But we are happy with both of them, they were just kind of different applications for different compost 'cause every compost maker makes a slightly different textured compost, and...

Certainly.

Yep. I think another thing that people, we often get asked about is hoop houses on a steep hillside. And so, our hoop houses are also across the hill, so they're kind of set up so that the ground, from end-to-end, is fairly level, because they're across the hill. But our 21-foot wide hoop houses, which is the widest we can have on our hillside, have a two-foot post extension on the south side, which is the downhill side. And because that ground is probably dropping closer to three feet, as opposed to two feet over that period of time, for our bigger hoop houses, we did excavate some dirt along the top row and move it to the bottom row. So, there's slightly terraced, they still slope downhill, but they're slightly terraced for the wider greenhouses. Unless we were to invest in a more expensive greenhouse system, that's kind of the most that our greenhouse supplier, he's like, "Yeah, don't probably extend your posts more than two feet." So, that's why we went with 21-feet wide. Also since we have to clear all the snow by hand the narrower the greenhouse, the better.

Right.

So that's kind of our unit when we buy a new hoop house, that's the width we do, 'cause we can practically fit it into the landscape. And there there's some real advantages with that, on the south wall, there's just like a lot of solar gain there. You never have to clear any snow off the south wall 'cause it's so tall. And then there's a lot of height inside the greenhouse that's just added by, if we were on flat ground, we would put that two feet on both sides, 'cause the higher the greenhouse, the better, we found. But in the beginning, when we didn't really know that, when we put up our first hoop house, the more height you have the more air mass seems to be better. As I mentioned before, we move the soil from the pathway below a bed, back up onto the bed about once a year, it might happen in the spring or the fall, anytime those beds are completely empty, we always did that with a shovel. So, our farm was only about 3/4, 1/2 to 3/4 of an acre when we were still using the shovel, and that was a lot of work, especially in the springtime, if you needed to do it in the springtime, like the pathways had filled in. We need to have those raised beds, so water can't flow continuously down the fields, it's always broken up by a pathway. And it was just a lot of work in April, when you need to get everything done. And then we also were digging pathways out. And so, a couple years ago, we bought a tool called the Tilly, which is, basically, it has a, it's a hand operated tool with a big lithium-ion battery and it has a hub motor that basically runs a wheel that's got a bunch of, essentially, co-linear hoes on it in a circle. They sell it in Johnny's, I believe, still, where we bought it. I think we bought it initially through Johnny's or we may have gone directly from the company. And that tool is really great because we can stand on the pathway above and run that tool at an angle and it will shoot all the dirt from the pathway uphill, onto the bed above it. And so, with that tool we could, in a day, do the whole farm, or less than a day probably, all the pathways in the farm. So, on that critical day in April, before we've planted crops in there or anything, we can just get it done. And even though we spend a lot of money on a tool that we don't use a ton, it's like that day that we have to use it, it really saves those few days, it makes a lot of difference.

Yeah, we used it to just reclaim all of our edge space as well, which is really, really handy. And it's so, so fast and easy to use. So, that's been super helpful as well.

Yeah, I think edge space with farming on a hillside because we can't like put everything together and when the greenhouses kinda have to be separate from the beds, we ended up with, we end up with quite a bit of edge space, which in a no-till system can be a challenge, 'cause you're... And so, we'll use that, the Tilly, to just cultivate along the edge and we can do that really quickly. We used to do it with a wheel hoe, but it's just faster with the Tilly. And then if you, if sod is encroaching, you can actually kind of break up sod with it a little bit. So without having to own a big tiller to do all the edge space, we can use that small, light hand tool to do it. And the battery is really big and lasts a long time, so that's never been an issue with us.

Yeah, it's really powerful. And we'll walk behind it as well, and occasionally do, just go straight down a pathway if it just needs a quick go over, and that's great too.

Yeah, and it works. You can shallowly, you can cultivate to like a 1/2 inch 'cause you can control the motor speed. So, it works well as a cultivator because a lot of other cultivators like that, they're just gonna sink right in and we don't want to do that in our system. If we're cultivating, we want it to be

shallow. So because you can control the hub motor speed, you can spin it at any speed and control how fast it's going and what depth it's going into the soil.

And whether you're just skimming across the surface or letting it dig down.

Exactly, yeah.

Like a mini tiller.

Yeah, and it's really easy to control, you can't really control that well with a tiller except by going faster, or slower, or pulling back on it. And with this, it's just a little trigger control and you can control all of that really easily. So it's been, I think it was around \$1,000 to buy it and the battery, and that is a tool that probably is a few year payback-type thing because all it's really, we're not growing additional crops because of it, but it's labor-saving. And so it takes it, it's paying back. It's probably paid itself back by now that we've owned it a few years, but it didn't pay for itself in the first year, like some of the tools that we've bought.

You mentioned a lot of its benefits are kinda bringing the footpath back up into the bed and cleaning up the edges of the bed, particularly 'cause you're on a hill. Do you think it would be just as effective for somebody on flat ground?

Yeah, if you need to maintain raised beds, it would work great, and as long as you have a system, if you have like wood chips in your pathways or something like that, it's probably not so practical, obviously. But, for maintaining raised beds, it works great. And I think for a lot of small-scale farmers, people use it as a cultivator exclusively, and I think it works really well as just like a power cultivator. And you can also add a wheel hoe to the back of it if you want to and use it that way. So, you can just basically, essentially, wheel hoe faster. But we've never used it for that, 'cause it's not really kind of, we don't use the wheel hoe a lot as part of our system.

I took a couple of pictures and a video clip of Evan demonstrating this, this fall, so I'll share that on our show notes on the website, as well as our YouTube channel, if you wanna see the Tilly in action.

Well, I think one thing is that because we're, for every farm it's about, like what all farmers do is just move things from one place to another, like that's primarily our job description is, put this here, take this there, put this here. And so, because we have a hillside, it's hard to move around, it's hard to, even wheelbarrows are pain to move stuff in and out of beds, and stuff like that. We, pretty early on, went to a system of composting all of our crop residue right in the pathway and just kind of like leaving that right down there as a mulch layer. And so, we'll tend to either rake that off with some dirt in it, so that it's not just a big layer of green, it's mixed with soil already. And so, if you mix a little soil into it, it tends to decompose really quickly, and we don't have disease problems or anything like that from it. We also use like a brush cutter to clear our greens beds and all those greens just go into the pathway below the bed, and they're mixed with soil because of that brush cutter and is kind of mixing them in. And then in the soil, all the roots are left in the soil, all the greens are gone from the top. And, so instead of making compost, hauling that out, turning it, doing all that, it's staying right there in those pathways. A lot of

that green matter is either, that carbon's going down into the soil from there or it is being reput back on the top of the bed at some point when we shovel the pathways up. So, that's one way we deal with the hillside and one less thing to move around, but keeping all that fertility in the beds where it belongs.

Are there other key elements to your sustainability practices that you'd like to share?

Well, I think we've always, our farming system works without fossil fuels, except for the fact that we have to deliver it. The scale of our farm really helps with that, and like we rarely go anywhere where we're not shopping for the family, or like this time of year, we'll deliver micro greens and we deliver up north next to some great areas for backcountry skiing. So, the skis are in the car or the mountain bikes in the car when we go out and deliver. It's pretty rare that we have a trip that's just delivery and we're not doing something else, so. But that's our big carbon use, but in terms of our farming system, it all works without fossil fuels. And we have some battery-operated tools that really help us be profitable, but they're not, none of 'em are a hundred percent necessary for our farming system.

And we're charging those batteries with the solar panel, so,

Yeah.

It's helpful.

Yeah, and our farm's off-grid, so that kind of like forces you to live within your power and means. So, we have a solar power system and batteries and so that's how we pump our water, that's how we charge our batteries for our tools, run fans and that kind of stuff. So, we use very little energy on the farm just because we don't have it, and even an off-grid system, if we had a full-scale off-grid system, that has carbon costs as well. So having a smaller one that we could afford, it's all part of the picture in terms of environmental sustainability. And it makes us have to think about our energy usage and it would be awesome to load up the greenhouses with fans and ventilation, And we would get some crop improvement with that, but it's also a ton of energy you're using all day long, every day. So, yeah, that for us has been, and we wanted it that way, I mean, we didn't specifically look for land that had to be off-grid, but it was certainly something we were looking for in the beginning as a possibility because the land would be cheaper, and we're also not terribly self-disciplined people. We're really idealistic and we have, but it's really hard in that moment when things are hard, not just to flip the switch. And so, if you don't have it to flip or whatever.

Crank the heat.

Yeah. Or just fire up the tiller on the tractor and just plow all those weeds in and be done with it. Since we didn't have that option, we came up with another way and now that way is really profitable for us, because we've figured out how to do it. So yeah, I think being off-grid has helped us in how we think about things, and practically, we just use a lot less because of it.

What about irrigation, being off-grid and up a slope?

Yeah, so we have a drilled well that has good, high water-flow in it and so, we also live in Vermont, it rains a lot. So, that's really helpful. And yeah, we've always run the well with our solar power system, and generally we're running, we're irrigating, at the end of the day, when the batteries are full or, now our solar power system's big enough that we can kinda, if the sun's out at all, whatever energy's coming, it's just kind of canceling out and running that well pump. So that we just basically had to choose when we watered, and then we do definitely run the generator sometimes if it's like, if we need to water and it's been cloudy for days, then we'll run the generator. But we have a pretty small, efficient generator and that works well, so. And then there are possibilities for water collection and passive pumping, using a solar pump to get water to the top of the hill, but that's one infrastructure project that we haven't tackled yet, but...

For the most part, your solar system is big enough to,

It is.

Power the well pump and,

Yes.

Irrigate as anybody else would.

Yes, exactly, yep. Yeah, we've developed systems where we to use less water because of that in the beginning, 'cause it was a lot in the beginning, it was a lot harder. A couple times our farm outgrew our solar power just for like a year before we could afford, and then we had to kinda scramble like, "Okay, how are we gonna do this with less water?"

Drip or overhead irrigation?

We do primarily overhead, we do drip in the hoop houses for the longer term crops. And if we have like, there's a few crops that we'll do under plastic mulch or landscape fabric outside that we might drip. But mostly, for seed germination, because we're so greens heavy, the overhead is pretty necessary for planting 10 rows and you want consistent germination. So they don't take a lot of water, they just take water often.

And we flip the beds enough that moving all that drip tape is not,

Right, right.

Advantageous.

You can leave the overhead system set up.

It just is right there in the path, it's not even in the way, it's great.

Yeah, that's probably one of the big...

Number one, we flip a lot, it's almost constant.

Yeah. Yeah, so even though we're up in zone four, where many beds we're getting four, sometimes we'll get five beds on a crop, five crops on a bed, but we definitely average over three for every bed on the farm. So, that's a lot of bed flip, which means that's a lot of drip tape to move out of the way and put back on.

That is a lot of flipping.

Yeah.

Yeah, we're good at that.

You could almost look at it as if you're doing three crops, per season, per bed, like you're farming on three acres.

Yeah.

Yeah.

There you go.

It's all in how you think about it. Awesome, well, thanks for sharing your viewpoints. If people want to reach out with questions or follow along with what you're doing, how can they get a hold of you?

Well, we have an Instagram page, Small Ax Farm.

And we have a Facebook page and we have a website which is just smallaxfarm.com.

Sounds good, well, thanks for being on the show and I hope you have a great day.

Thanks.

Thank you for listening to today's episode, I hope you go ahead and subscribe, share this with a friend, or leave us a comment. And if you want more information, check out the show notes on our website at agengpodcast.com. That's A-G-E-N-G-P-O-D-C-A-S-T.com. Thanks for listening, I hope you have a great day.

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