This is the "Ag Engineering" podcast that rolls right into the details on tools, tips, and techniques that improve you, your farm and our world. I'm your host, Andy Chamberlain from the University of Vermont Extension, and this podcast is sponsored by Northeast SAREP. Thanks for listening. Today's episode comes to you from Portland, Oregon, where we meet with Josh Volk, who manages Slow Hand Farm. He's got an engineering mind and a DIY attitude and has written a couple books on things that can really improve the ergonomics and efficiencies of small scale farming. Let's jump right into this episode. If you could describe what you do in one sentence or a few, what would you say?

One sentence would be very challenging, but I'll keep it brief and say, I farm as kind of my grounding work and run a small urban CSA. And then the rest of my work is all centered around small scale farming, but it's a mix of consulting, teaching, writing and tool design.

And what's just a brief background to kinda help set the stage on the direction you go with technical agriculture?

Yeah, so my background is I have a degree in mechanical engineering, tool design, really general though, not agricultural-specific at all. And I wasn't involved in farms at all until a couple of years after I graduated from college, but I was always really interested in food and partly because I like to eat, and the environmental and social aspects of food production also. And so then I got involved in farming, went in apprentice with farms, was really interested in urban agriculture in particular, but basically, somebody recommended going and learning from farms that weren't in the urban corridor and then kind of taking that back. So that's what I did for about 10 plus years, worked in farms outside of the urban area, and then kind of brought it back to starting to work more in that urban context. And I've been really inside Portland, Oregon urban farming for the last five, six years at this point.

That's definitely a different experience set than what I've been exposed to out here in Vermont. Similar small scale agriculture, but urban farming on West Coast, I'm sure has some differences to Northeast.

Yes, many and I actually did... I farmed in Connecticut and I went to school in Massachusetts for a little bit, so I'm pretty familiar with the East Coast. I actually grew up in Philadelphia and there are a lot of differences and you have to keep those in mind, especially when you're thinking about like production methods and those kinds of things, but most of the tools and fundamentals are all really very much the same. So it's fun to see where the overlaps are and where they aren't, what the differences are. Yeah.

If you were to compare a small farm in Oregon to a small farm in Connecticut, what are a couple of those big changes? Would it be crops or climate or?

Yeah, there's two that jump out to me that I think about right away and the one is climate. So on the East Coast, it's hot and humid in the summer and it's cold and relatively dry in the winter and we are the opposite. So we are relatively warm and wet in the winter, and we're cool and dry in the summer. So we basically get no significant precipitation all summer long. And so we are completely reliant on irrigation for your market farm vegetable crops. It is possible to grow some things out here based on bank soil moisture, but that's not market farming crops necessarily, but we're also warm enough all through the winter that I've done year round growing here, with no frost protection other than light row cover. I

mean, good selection of crops, but that's a big difference. The second difference is the kind of scale of the geography. So out here on the West Coast, we tend to have these urban centers and then they're surrounded by some suburban sprawl development, but it get to rural very quickly, and there are very, very long, large distances and the farms get really, really enormous. So just the scale of kind the landscape, as opposed to the East Coast where you never get a farm that's anywhere near the size of the really big rural farms that you would get in Oregon or Washington or California, but you have a lot more basically villages. They're kind of small towns now, but villages much more frequently, and that's not really the case out here on the West Coast. And so for marketing and kind of, distribution, that changes the as well. And then the climate's, of course, changing the picture for kinda how you do the basics of production. It makes some things easier and it makes other things more difficult.

That's an interesting perspective, and it's always great to hear kinda the other side of the... The other side of the systems and things. Neat. Well, you said you wrote two books, so for those who haven't heard of your name or your books, what's a brief overview of them?

Yeah, so the first one was "Compact Farms" and Storey publishing, which is actually out there on the East Coast in Massachusetts, they came to a friend of mine who then kind of passed it on to me, and it really was the book if I was gonna write a book, I would wanna write, and that was kind of, how do you do a small farm, a compact farm and make that work? And so I went around and I profiled 15 different farms that were all under five acres and said, here's the fundamentals, and those are farms all over the US, Hawaii, in the mainland US, Northeast, Northwest, Central and up into Canada. And then the follow-up book to that, which just came out this past August is "Build Your Own Farm Tools". And so that one kinda goes back to a bunch of tools that I've found useful over the years that either I modified or built from scratch, just with really simple tools around the farm, and the idea behind the book originally was really to highlight kinda the engineering principles, and what is an engineering arrow that somebody who hasn't been to engineering school wouldn't necessarily know, at least not in the academic sense and how can you apply those principles to these little tools? And so I really wanted to kinda get into that within this book. That ended up getting pushed into the appendices, but it's still there. And so mostly what the book is, is kind of these how-to on, I don't remember how many tools there are in the book, but it's probably about 15 tools, again, whereas... And I use the word tools loosely. So it's packing shed furniture and greenhouse furniture and drip tape irrigation systems and even crop planting systems, and that kinda thing. But then if you go to the back of the book and look at appendices, and somewhat within the descriptions of each tool, there's these explanations of this is why I'm doing it this way, and if you're gonna modify it, here's what you would wanna think about in terms of making a modification that makes sense. Or if you're just gonna go out and design your own thing, here are some of the principles that you really... Basic principles that you wanna keep in mind.

Yeah, let's get into the details a little bit. What are some of those principles that one should apply an engineering mindset to if they wanna build their own farm tools?

Oh, well, there's a long list and they're kind of all over the map, but a lot of what I'm talking about is things that people would recognize just from their own personal experience, but haven't necessarily put words to. And so then giving those engineering words, which then hopefully give people a little bit more clue. And I was just talking about this with one of my farm workers the other day and pointing out, like,

if you... And here's a principle that has to do with heat transfer. So I think about this all the time when I'm cooking. So if I have an aluminum pan and I stick it on the stove, or I have a cast iron pan and I stick it on the stove, if those two pans are the same temperature and I touch the cast iron pan, I will feel that it's hot and I'll be able to pull my hand away before I get burned. If the aluminum pan is exactly the same temperature as that cast iron pan, I will touch that pan and immediately, I'll be burned. And it's not that they're a different temperature, it's that they have a different capacity for transferring heat. And so, why am I talking about this? Why is this useful? I mean, if you've been in the kitchen for any amount of time, you've probably experienced this exact thing. And why you would think about these kinds of things is when you design any tool around the pack shed, for example, what is that surface gonna feel like both to you, who's working on that surface, maybe touching it or standing on it or whatever, but also to the vegetables that are going across it and everything else? So that's the kinda level of detail where it's like, oh, if I thought about this a little bit more, I might figure it out myself, but it's already in the engineering lexicon, and something that people every day, maybe aren't thinking about as immediately as an engineer would automatically pick up on that and be like, "Oh yeah, I gotta think about what the thermal transfer is that's going on here in this particular situation for a particular material. And then, select either a different material if I want something different or just design around that particular material." So there's a lot of material stuff in there where it's like, this material reacts this way, this other material reacts this other way. I'm a big fan of wood, so I talk a lot about the composite properties of wood in there, and any woodworker would understand grain and grain direction and have a general understanding of how that affects strength. But I've worked with a lot of people on the farms who are just starting, haven't had a lot of experience in woodworking, but they're building really simple things on the farm and they'll orient the grain in an incorrect direction and their piece will crack or break right away. And so it's like, okay, well, you gotta pay attention to the grain direction, and these are the reasons why it's strong this direction, but it's not necessarily strong this other direction. So there's two examples for you.

Yeah, that's a good one. So you've got a variety of tools that you build and teach on, what is the one that is most common?

Well, within the book, there's some ones that are super common on farms, and I might just have a slightly different take on them. And then there's probably only a couple in the book that are actually what I would consider my designs. One of the most useful ones is one that I picked up on that farm that I mentioned that I worked on in Connecticut, and it's not my design at all, but I've played with that design quite a bit, and it's one of the ones that I've now totted around for more than 20 years and probably built five or 10 different versions of it and I have passed off to lots of different people, and that's a drip winder. And so just a really simple tool for winding up drip tape. And it's not that complicated to design a drip winder, but what I really like about this particular design is that it's made out of really basic parts you can get at any hardware store, doesn't take very long to put together, and then you can basically make an unlimited number of spools and each individual spool itself, all it is, is a cut piece of plastic pipe. So they're really, really... The spool themselves are really, really inexpensive. Whereas most of the other designs that I see, the spool includes sides, and so you gotta have extra plywood or you gotta have something else to go on this, and so it just makes the spools themselves a little bit more complicated and thus harder to store, harder to put together, and in that way, less useful.

Since this is a podcast and people don't have the book right in front of them-

Yeah.

Describe a little bit of how it's built or how it works. Is it a hand tool? Does it go on a drill?

Yeah. Yeah. So what it is, is it's built out of, let's see, 1, 2, 3, 4, or five, it's built out of five pieces of metal plumbing pipe, and a few fittings, to put those together, and then there are two big plywood rounds that are about two feet in diameter. And then all that captures the piece of plastic pipe in the center, so that makes the center of the spool. And then it just sits up on a stand that kinda looks a little bit like a saw horse, kinda basic four-legged stand. And those pieces of pipe, the metal pipe are fashioned into a crank with a couple of elbows. And so basically, you're just hand-cranking this thing to wind the tape up. And you can, it's really so super easy to use, two people, one person will kinda guide the tape on, the other person cranks. Once you get used to it, it doesn't take long to get used to, you can crank up the spool at the same time that you're guiding the tape on, no problem. And you can get the tape pretty tight. And then once you have the spool full, so basically, you're out to the edges of the plywood, you unscrew the thing 'cause metal pipe nipples, they're called nipples when they're short, metal pipe nipples have threads on them, so you can just unthread them, take those two plywood sides apart, and then you kinda have to... This is the tricky part of it, you kinda have to carefully tie that bale of drip tape that you have all together tightly before you remove it so that it doesn't fall apart. But if you do that, and I've done it for many, many years and taught many people to do it, then you just have this tight bale of drip tape that you can store on its side, or anywhere in the barn, stack them up, and then the next year when you wanna put them back out, you just remount it on the winder, untie it and start spooling out the tape again. So really super, super simple. And it just makes everything really compact. And then we even roll up all the tape that we're gonna throw out. And then basically what we do is take a sharp knife or a saw and cut the tied drip tape to get that center back out 'cause we wanna retrieve the center. And that leaves us with a bunch, a tied up bale of short pieces of drip tape, as opposed to a lot of long pieces and they're nice in a compact form. I used to go to a landfill that hated drip tape. They would make us take it to a different place because it got all tangled up in their machinery. So if you cut it into these short pieces, then it's not a problem for their machinery.

Oh, that's considerate.

Yeah.

And allows you to dispose of it.

Exactly.

That's good timing. As I'm thinking about picking up the drip tape in the garden now this fall myself, the timing is right on for that, so.

We have been using it heavily recently, yes.

What do you think is kind of a quick win ergonomic improvement that a farmer could consider on their farm?

Yeah, so I'll give you an example of the wash table design, spray table design that I have in the book, and specifically, the ergonomic features of that table. The table is designed for one person to work at it. And basically, the things that make it really ergonomic are the height. So the working height is important and that may change depending on the height of the user. So you might be able to find an average height, but there's some ideas in the book also for how to change heights around. And then that spray table is four feet wide, and that's partly a function of the material availability. So four feet exactly isn't like the key number, but that's about my arm span. My arm span is about... And that's most people's arm span is somewhere in the four foot neighborhood. So I can kind of easily reach from one side of the table to the other side of the table without having to travel very much. And the table itself is also two-feet deep, which is about how far I can reach without bending over to the back of it, and then it's got a back splash on it. So it keeps all the product that I'm working on currently within arm's reach, and without me having to overextend as I'm doing that to hunch over, to bend over. And so that makes it really ergonomic. And then there are two low, sometimes they're called racks, the little kind of shelves on either end of it. So generally what I do is I have dirty on one side and clean on the other side, and those racks are set at a height so that my bins, whatever my harvest totes are, kind of sit flush with the top of the table. And that way I can dump stuff onto the table from one of them, and when I come in, I put that tote down, if I'm holding that with straight or fairly straight arms, I don't have to lift it up onto the table, I can just put it onto the rack without really having to bend over or having to lift the tote up too much. And then when I'm cleaning the stuff on the table, as it's clean, I'm just sliding it off the end of the table, and it's falling into the clean tote because the tote's not up above the surface of the table, it's just below the surface of the table. So, there's a number of things that I'm doing there, and basically, it's all around adjusting the height and the width and the reach of the space that I'm working in. The other feature of that table is it has a water diversion on the bottom so that the water and mud that's coming off of the table is getting diverted away from me. And that's another little ergonomic thing where, especially in the cold winter, but even really all through the summer, standing in a mud puddle is no fun or even standing on a wet concrete surface is really not as safe. And so just it doesn't have to be 100% of the water that's getting moved away, but if 95% of that water is getting moved away from you, it makes a big difference, especially if you're standing there for any length of time.

Exactly. I mean, you only want pruney hands and a wet waste for so long.

Right, right.

Especially in the shoulder or cold seasons.

Yeah.

If you were to generalize, what do you wish that the majority of farmers should do that they're missing?

Going back to that last example of the spray table, really just thinking, I mean, I think the number one thing is just thinking through workspaces and work environments more carefully to make really simple

changes that make it easier every day to do the tasks that you're doing. And that's really what the book is about to me, is, how do I step back for just a second, look at what I'm doing and say, what's the simple change that I can make that's just gonna make my life that little bit easier? And that's really going to... It doesn't even necessarily have to speed things up, but a lot of times, it's going to speed things up and it doesn't necessarily have to make it so that it's like this task feels easier when I do it five or 10 times, but if you're doing something 50 or 100 times, little teeny differences, they add up. And if you're doing that day after day after day, they start to make an enormous difference. And so I think, things like adjusting table heights, adjusting table reaches and widths, making paths that are clear paths to travel through, as opposed to having to kinda trip through a barn that's got too much stuff out in the pathways, lots and lots of thinking about how the individuals work and then how the individuals work as teams if it's more than one person working on something and how people can share that load and then how you can use mechanical advantage to make things easier, whether that's just shortening the distance that something has to travel or incorporating wheels or whatever it might be. So that's the thing that I see most farmers should be changing.

Yes. Speaking of wheels and moving things around, I see you also have a design for a cart. Could you explain a little bit about that?

Yeah, the cart is one of my designs that I would say is really my design work. And that's been through a number of iterations at this point, and it started out with the typical garden cart, that most farms have a garden cart somewhere, and that design is amazing. Whoever came up with that, kudos to them, 'cause that is a fantastic design in just how simple it is in terms of materials use, but it's not particularly ergonomic and people have done small things to it to make it a little bit more ergonomic, and it's not actually really designed for farms so much as it is kind of for around the homestead or something. And so we had one of those carts that had just been abused for many, many years, and that's one of the things I'm so impressed about, is that they last forever, but this one was finally dead, except for the wheels. I was able to replace the bearings and, of course, you can replace the tires and the wheels were still fine, and I salvaged the axle and chopped that off and then took a bunch of scrap metal that I had around the farm and welded something else together, and what I had always wanted with the garden cart was to widen it out so that the wheels were tracking in our pathways, 'cause the wheel tracks were always a little bit too narrow for our bed top width. And then, of course, when you tip it, when you tip a normal garden cart to carry it around, it's pretty low . And so it'll tend to drag if you have any kind of raised bed or any plants in the bed, certainly. So I wanted extra clearance and I disliked also having to lean over the sides of the cart in order to load it, and then kind of the way that it was balanced, that if you didn't load it just right, sometimes it would tip over backwards and those kinds of things. So, I was basically taking all these clues from that, and what I ended up with is a cart that has a deck with a height that is high enough that it clears the bed top, but it's low enough that when you're loading it, it's pretty much just about that height at the bottom of the tote. So you barely have to lift something in order to put it on, and there's no sides. The way I've designed it is mostly for flatter farms, that you don't really need the sides, you just need little cleats on the side to keep things from sliding off, and when you pick up the handle, it doesn't tip like the garden cart does. So that also eliminates the need for sides largely, but it means that you're also not leaning over as far to get down to that handle, to lift the handle up to drag it around. And I've seen some garden carts now that don't have the low handle, but ours always have low handles. So I've made a bunch of different versions of that, and some of them actually have

adjustable handle heights, but a lot of them have fixed handle heights, and in the book, I kinda talk about how do you figure out your handle height and what's the deck height and how that is designed and really can make it whatever width, so if you have a different width bed, you just make the thing a different width. And it's made out of a little bit stiffer material, and it actually turns out that the garden cart is pretty flexible. And when you're pushing it over with heavy loads over bumpy ground, it kind of gives and this thing actually ends up being a lot easier to move around, and that was a little bit of an unexpected benefit. So I actually designed it to be pulled, but it functionally ends up being really easy to push, and so we end up pushing around the farm quite a bit. And there's some other features on it. Like you can... It's basically just a bear frame, and then you put a flatbed on, just made out a piece of thin plywood, and then you can put all your harvested stuffs on there, but you can take that piece of plywood off super easily. We do it every single time we store the thing. So every day, we're taking that piece of plywood off and then putting it back on and it just has little cleats on the bottom to hold it in place, so it literally just drops in. And if you wanna... So then you're left with this metal frame, so if you want to add extra tools to it, which we've done in various forms, you can take that plywood deck off and mount a tool on it, and then it's almost like an oversized wheel hoe or we use it for bed-marking. You could mount flamers on it. You could do all kinds of things with it. You could have multiple decks. So if some of them are for your produce, your harvested stuff, but you have a totally different deck if you're moving compost or manure or something that you don't wanna have the same contact surface. So it's just a really versatile platform also. And if you're learning how to weld, it's a great first welding project.

And the plans to build that are in your book.

Yeah, the plans are all in the book with a bunch of notes on all those different things. And so it's a great starting point jumping off point, but definitely intended to modify it if you need to modify it, especially the width and handle height, those are the two things you should definitely consider modifying.

Between a flat deck and a wide wheel base and an ergonomic handle, it sure sounds a whole lot better than the wheelbarrow I'm using in the garden now.

Well, actually it's funny that you mention that 'cause wheelbarrows are totally different than two-wheel carts. They have their place too, right? 'Cause one of the things you'll realize with this cart if you build it is it's a big cart and actually, on our one little one-acre farm, it's almost too big. You need a little bit of space to turn it. And we also use a wheelbarrow. So the wheelbarrow has its place and the cart has its place. And then there's a suggestion in there and I've done this a number of times, that you can make a one... You can basically use the same design principles and really, a lot of the same design geometry and make a one-wheel version of this same cart with a flatbed and all that, which is great for... It's not as good a tool carrier, although you can use it for that too, but it is really great for, especially going through trellised crops or something like that, where you can't fit a cart over the full bed top.

Adding tools and stuff to that frame is just like opening the mind to the possibilities that you could do with this, opening the imagination.

Have you seen the tool called a weed master? I think it was called a weed master. It came out of somewhere in Scandinavia. I can't remember now what country. I wanna say, Finland, but that might

not be right, but that was actually one of the things that I was looking at when I was... It was kinda around the same time that I designed this cart. I can't remember if it was before or after, but certainly it was giving me ideas about, oh, tool mounting to use this cart with.

Yeah, neat. What's the cost to build a basic cart?

Well, material costs have gone up quite a bit just in the last year. So I don't have a current price and I will say the first two or three of these that I've built, I've built them completely just by going to the scrap metal yard and finding different types of metal that would work and going to the used bike store and getting two bike... It uses bicycle wheels instead of cartwheels, and there's some advantages to that and some disadvantages to that, but I've seen some people put them together with cartwheels. So you can do either one, but if you can get the wheels for free, it would be just be like 2 26-inch mountain bike, front wheels. And a lot of times, you can find those for free on the side of the road kinda thing, or depending on where you are. But even if you have to buy them, that's probably less than 100, $150 for a really decent set for this purpose. And then the metal itself, I don't know what metal prices are like right now, but you're trying actually not to make it too heavy, so you want relatively thinner-gauged stuff, which is gonna be a little bit lighter and that keeps the cost down, it's just made out of a plain steel, so it's nothing fancy and they're pretty standard pieces, some flat stock and some square tube and little bit of round tube. And I cannot remember, but I say it's maybe like 50 or 100 bucks worth of metal at the most. And if you found cut ends or you had a scrapyard that you could go to, you could get it for significantly less than that. And then a part of a piece of plywood basically, and just some wooden stakes would be the rest of the pieces that you need, a few screws, that's the whole thing. So I think in the book, I'd probably say something like $200 and I think, yeah, last time I built a prototype, but this was six or seven years ago, it was less than that. But it certainly isn't gonna be a lot more than that, even if you go out and buy everything brand new.

Well, right. That was kinda my point, it's maybe a couple hundred dollar cart, or you could scrap it together if you can't, whatever, you buy everything. It's a few hundred dollars, it's not $1,000 investment.

Right. As long as you don't consider your labor.

Yes, that's true. Depending how good you are with the cutters and grinders and welders.

Right, right.

Yeah, if you know how to do that, then, sure. Fair enough. Fair enough.

I say that partly because I have toyed with the idea of, and I have done a few production rounds of these carts and when you count in the labor, particularly on the models that we've made, which have adjustable handles and break down flat, and so do a couple of extra fancy things, but they do end up being more in the... Well, I end up selling them. I think they cost us about 450 or $500 to produce. So it is more expensive when you consider the labor, but materials-wise, yeah, it's not expensive at all, especially if you're just scrapping it together.

Yep, no, that helps though if somebody was to pay somebody to weld it up for them that might be a couple hundred bucks in labor there too, so.

Yeah, and somebody could take the design and I actually have some ideas for this, but I just have never implemented them. Somebody could take that design, basic design geometry and probably figure out a way to do it in wood, and it wouldn't be as stiff, and it might be a little heavier, but it would probably have a lot of the same features.

Yeah, it'd probably be a little cheaper, a little easier to build a little more common tools, but might not last as long, might be lighter.

Yeah, it just depends on how you-

Yeah, it depends how good woodworker you are.

Exactly.

Well, you mentioned you wanted to talk about the appendices. Did you cover that or was there anything else that you wanted to mention.

Well, really the appendices are kind of the heart of the book for me in terms of, that's the background information. So that's the engineering stuff. I wanted to put together something where I was like, there's all these things that I learned in physics classes in high school and engineering classes in college that really are not that complicated. And most farmers, most farm... I've worked with a lot of farm apprentices over the years, so I see a lot of people kind of coming into farming and I've taught a lot of workshops and most people just don't have that background. There are a good number of people that do have that background, and for them, this might be more of just a refresher or maybe it's nothing new at all, but for anybody who hasn't sat in a physics class for a while or gone to engineering school, there's a bunch of stuff that's super, super basic, and I try and write it in very, very plain English. I was working with an editor who was not a technical editor at all, and she actually was kind of gratifying, was like, "Oh." A couple months after she had edited the book, sent me this note back and was was like, "There was somebody working outta my house and they were doing this thing and I totally understood it because I had read your book, and I wouldn't have otherwise." So it's that kind of stuff where it's like, this is basic knowledge that just comes in handy, because essentially, everything on the farm is a big engineering project. Like, how do you make water flow from one place to the other smoothly? How do you get power around the farm? I don't really go into electricity in the book, but that always, how do you move things? You make lots and lots of mechanical pieces, and that's really the meat of the book. Although I do go into some of the hydrodynamics as well, because there's discussion of irrigation systems.

Is there anything else that you wanna bring up? Well, if others want to follow along with you or see what's up, how can they do that?

I have a number of websites and they are all poorly maintained, but slowhandfarm.com. It's S-L-O-W-H-A-N-D-F-A-R-M.com is kinda the clearinghouse for all those. And that's probably the best place to start. And then I'm also on social media @slowhandfarm on Instagram and Facebook at Slow Hand Farm. So those are great starting points, and then you'll be able to find me in all the other places if you at those first.

Sounds good. Well, thanks for being on the show.

Yeah, thanks for having me.

Thanks for listening to today's episode. I hope you enjoyed it. If I can ask you or direct you to do one thing, that is to go to the website for this podcast, agengpodcast.com. That's A-G-E-N-G-P-O-D-C-A-S-T.com. There, you'll find the show notes, you'll find links to the farmer who we chatted with today, as well as photos or videos from the call, when I visited the farm. If you've got some feedback to share, my contact information's on there, or you can leave me a voicemail and you can do that right from the link in the description,` in the mobile app. You're listening to this too, so go ahead and do that. Thanks again for listening, and I hope you have a great day.