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Mike: From the Center for Occupational Research and Development, welcome to Preparing Technicians for the Future of Work. I'm your host Mike Lesiecki. In each podcast we'll reach out to people who are actually on the front line of the future of work and hear what they have to say. That means interviews with industry, interviews with working technicians, forward thinkers in the field. We'll do some background research, and we'll curate that research to make sure you have the most up to date and relevant information. And in every episode, we'll suggest action that you can take. We want to inspire you to take that action. This podcast is brought to you by the Center for Occupational Research and Development, known as CORD, with financial support by a grant from the National Science Foundation's Advanced Technological Education program. Opinions expressed in the podcast do not necessarily represent those of the National Science Foundation. You can find out more about our project and our approach at "PreparingTechnicians.org."

Our guest today is Curt Yoose. He's an Agricultural faculty member at Ridgewater College. That's in Willmar, Minnesota. Welcome, Curt. Thanks for joining us today. As we get started, would you tell us a little bit more about yourself and your Ag program at Ridgewater?

Curt: Sure! I'd be happy to. My background is in Agronomics. And I was employed as a Crop Production Manager or an agronomist for a retail agronomy center in northwest Iowa in the middle 90s. And, if you know anything about precision agriculture and GPS, which is kind of the tool that drove precision agriculture, that became fully operational and utilized in agriculture in the middle 90s. And so that's kind of where I cut my teeth, was doing grid soil sampling, variable rate fertilizer recommendations and application, and then did some work with yield monitors as well. So, that's kind of my background.

Then was actually contacted by an instructor at Ridgewater College. And they were looking at starting a Precision Agriculture program and so, they reached out to me. They knew that I was working in the industry, and I'm originally from Southwest Wisconsin. So, they reached out to me. And started teaching here in the Fall of '98. And we've had coursework classes in Precision Agriculture since 1998. And then our Precision Agriculture degree became official in the fall of 2001. Actually, it was called "GPS/GIS Technology" when we started it and we've changed the name since to "Precision Agriculture."

And so, our program has five core courses that make up the Precision Ag component. They include things such as Electronic Components and Troubleshooting, and then there's some work in GIS—Geographical Information Systems). But then also, the rest of the degree is made up of Agronomic courses, Soil, Integrated Pest Management, Corn and Soybean Production, those sorts of classes that students need to have a background in—we feel anyways in our Advisory Committee—to be well rounded enough to understand how to be a good precision technician.

Mike: It sounds like a good and long-running program, Curt. In recent podcasts, we've been talking about robotics, automation, data sciences, but we've never really had a chance to talk about agriculture or precision agriculture. So today, we're going to be talking about robotics, automation, data sciences—no, I'm just joking about that, Curt.

Curt: [laughing]

Mike: But, you know, a lot of our listeners—well, let's put me in that group—may not have an exact definition in our minds of what "precision agriculture" is. What does that encompass? I imagine there's a variety of definitions. How would you define it?

Curt: Yeah, sure. So, let me kind of put it in this perspective because I answer that question a lot from prospective students. It really does depend. We can use a real broad definition, like: Using technology to make producers, growers, farmers more productive, more efficient, and lessen their impact on the environment, using technology to do those things. That would be a very broad definition.

But I think if you dig deeper, the way I explain it to students is there's really two tracks or two sides to precision agriculture. And the one side, especially if you're looking at technicians, would be the software and data side of precision agriculture. So, understanding GIS systems, and software programs, and data, and data management, prescriptions, prescription writing, and all the agronomic intricacies. If you're going to make up a variable rate prescription of fertilizer or seed, there's a lot of things that go into that. And that's kind of separate then from—or different than—a hardware or a component technician, where they're primarily looking at the electrical components of these systems, and understanding how to navigate within the systems, and calibrate the systems.

And so, the interesting part here is, if you're a hardware technician, you've got to understand what that hardware needs to do. So, you've got to understand kind of the software. If I make a prescription, can the hardware actually perform that prescription? And then vice versa, right? If you're writing a prescription, is it something that that controller is capable of handling?

So, right now that appears to be, at least when we have students go out on the job, there's really three places that they're going to become employed. One is for equipment dealers, working mostly with the hardware side of things. Or they're going to be employed at a cooperative or an agronomy retail location, working with the software side of things. And then, the third, we do have several—we call them our "farm operations students"—that come here. They know they're going to go home and farm and they'll take the coursework in precision agriculture so that they can put it to use on their farm. So... and I don't want to say they're mutually exclusive, like that's all we have because you will have an individual that works someplace that will do both. We've had several students that maybe they farm, but they sell equipment. We've had students, controllers, and the like. And then we've also had students that have started up their own consulting business, where they sell the equipment and then they help farmers with their yield data and those sorts of things. So...

Mike: Sure. You know, Curt, when you talk with your industry, friends, or colleagues or advisory board members, do they give you any sense of what gaps they might see? Let's suppose they have workforce people coming to them, working for them? Do they say to you, "Oh, I wish they would have more of this or more of that?" Do you see gaps? Are they seeing gaps in the workforce that's coming to them?

Curt: They are. And I'm assuming you're interested in the technical skills. But I do need to say this, because it's actually... [cough] It's more prevalent, and we deal with it more, and that's on the soft skill side of things. Where employers call us and say, "Boy, they need *this*." And nine times out of ten, when they say that, they say, "Oh, no, you taught him good. They know how to do this and we'll put the finishing touches on that." But so, most of the time, the bigger gaps exists on the soft skill side of things.

But if we're looking at the technical skills, probably the biggest thing—and I don't know if you'd call it a gap, but it's the most in demand, or most requested, and that's troubleshooting. And now troubleshooting is a big topic. I understand. There's a lot of soft skills that go into troubleshooting. But there's also a lot of technical things. Like do they know how to use the various tools, like a multimeter? Do they understand basic circuitry? Do they understand how to read schematics and those sorts of things?

And this goes both ways. This goes on (not only on the equipment, you know, I defined precision agriculture with those two tracks, but both hardware troubleshooting and agronomic troubleshooting, right? Because if you've got a person out there that's working on the software side of things, and he's trying to help that grower improve his bottom line, his yields, and those sorts of things, well, he's got to be able to troubleshoot that field and then make recommendations based on are there fertility issues? Are there things that we can actually change? Or is this you've just got a field with poor soil type and we're not going to be able to do much in that area? Which, knowing that, then we can redistribute our resources, right? And that's a part of that troubleshooting. So, I would say troubleshooting is probably the biggest technical skill that they're looking for right now in the industry.

Mike: Certainly Precision Ag isn't alone in that desire, right? Across the manufacturing world, and other worlds as well.

Curt: Sure.

Mike: You know, Curt, our project has been focusing on cross-disciplinary skills. Things like IT, data science, GPS. Obviously, you've already mentioned GPS. What about something like cybersecurity? Does a Precision Ag Tech need some fundamentals of cybersecurity?

Curt: Yeah, definitely. And I think not necessarily understanding and being able to design systems around cybersecurity. But the Precision Ag Technician has to understand that the data that they are working with has value and so they need to protect that value. And that goes several ways. I mean, obviously they can't let it leak out to other people. But also, it gets deeper than that when we look at protecting that data integrity, validating that data. And I think that's more what a Precision Ag Technician has to worry about. Don't get me wrong, it can't leak! So yes, cybersecurity is crucial in this line of business. I would say more so with that software technician because they're sending files, and sending information, and they gotta protect that.

I've been to land auctions where the land gets bid up to a certain point and it kind of stalls out. And then the grower (or whoever) comes forth with my binder or whatever, and says, "Okay, here's all the yield maps. Here's all the Precision Ag type stuff that we've done on this farm over the last 10 years." And the bidding starts up again, right? Because they see value in that, and then they say, "Okay, wow. I got all these yield maps now that they'll give us. So, we can make some decisions based on that." So, that data has value. And yes, we need to keep it secure.

Mike: Okay, got a funny question for you, Curt. People imagine. That they're driving by. They see a tractor out in the field. Is there anybody in those tractors anymore? Or are they all autonomous? Run by GPS data from overhead? Or what's it like? Is anybody in those machines?

Curt: Oh, yeah. Yeah, today. You know, not saying that won't change. If you look down the road, that's probably going to be one of the biggest changes is autonomous vehicles and those sorts of things. But today, the majority of all that equipment does have somebody sitting in the seat. Now, that's not to say that they don't have autosteer systems in them, where the grower, when they start another pass—either automatically or they can push a button that will

autosteer that tractor as it goes through the field. And there are some systems out there and don't get me wrong, there are prototypes out there. Basically, every major manufacturer has a prototype autonomous vehicle that they've demo'd, and maybe even some farmers are using them. Just speaking locally here, I don't know of one that's actually being used every day on the farm. But who knows? If commodity prices continue to stay high.

And there again, that's one thing about the American farmer, you know, I said they were proud. And the second thing is, if they have money, most of them will spend money, if they can see a value. If it makes their job easier, more efficient, whatever. And so, you will see a lot of new technologies in this industry.

Mike: That makes sense.

Curt: Yep.

Mike: Speaking of new technologies... Of course, drones are all the rage today. Does a Precision Ag Tech use drones? They use data from drones? They fly drones? They do mission planning? They don't care about drones? What would you say about drones and precision ag?

Curt: So yeah, they're there. And actually, in our curriculum, and I know other like programs do work with drones. However, then I'll back up a step.

The initial purpose of drones was for remote sensing, right? Being able to take imagery and collect data that way. And drones can still serve that purpose.

The problem is they can't compete with satellites and even aircraft. And there's a couple of reasons for that. One is rural infrastructure bandwidth. Because most of the time with drones, you have to collect that data... now, if you're working locally, and you've got the software, not a problem. You can download that data. But because drones have (right now) a 400-foot height restriction, they have to take several hundred pictures of a field, and then all of those pictures have to be stitched together. And that takes space. Now, if you have to send that data...

We actually had a past graduate of our program donate a drone to us, because—for the reasons that I'm telling you—they said they couldn't compete in the marketplace. They were sending their data off to get stitched together. And they said they would start sending their files when they left work one night, and when they get back in the morning, only half the data was sent.

Mike: I see!

Curt: So, there's some issues there. Right now, I think that's holding drones back a little bit.

Now, another thing where there might be some more utility along with drones, other than the remote sensing side of things, we just acquired a spray drone. I think that has some utility to it. Now, is a spray drone going to compete with a ground rig with 120-foot boom on it?

Mike: Are you talking about spraying pesticides?

Curt: Sure. Yep. Pesticides, herbicides, insecticides, fungicides. Those sorts of things. They're not going to compete at that level. But there are some niche places.

Actually, I just got a phone call from some county administrators that want to look at and pursue right-of-way spraying and road ditch spraying and those sorts of things with drones. And so, we're going to get together and see if there's anything to that. So yeah, they're there. Again, it's going to take some money to pay for that technology.

Probably the biggest use right now of drones in agriculture is for crop scouts that are taking that drone out, going up 400 feet above that crop. They're kind of getting that bird's eye view of the field. And then they're saying, "Okay, I need to check these three spots in the field." Whereas they used to drive the whole field, you know, and it might take them an hour or greater. Now they could say, "Oh, okay, there only looks like there's three spots out here that need attention. Let me go look at those areas. And..."

And again, they're doing some things with stand counts and those sorts of things. So, there's a lot of companies that are doing that. And that works. There's some science there. But it just doesn't seem that they've caught on...

Mike: ...yet!

Curt: Yeah... Here's what I'm comparing it to... When drones first came out, they said within 10 years, they're just gonna be all over the place. And we haven't quite seen that yet. Right? So...

Mike: I like that term "crop scout." I never thought of a term like that. It just makes sense from the way you described it. I like it! Oh, by the way, with my pizza order next week, I'm gonna have my backyard sprayed by the drone delivery....

Curt: [laughing]

Mike: No, I'm just joking about that! Sorry...

Curt: Let's keep those separate. [laughing]

Mike: Oh, okay. Good idea! Hey, here's a question. Think about the existing workforce. I got Precision Ag Techs that graduates your program, or however they come into the workforce. They're out in the workforce. How do those folks keep up-to-date with all of these changes? How do they keep their software skills up-to-date? Their knowledge of modern electronics? How do they upskill out there in the workforce? Do they come back to the college? Do they take courses online? What do they do?

Curt: So, again, it kind of depends on where they have tracked—meaning if they went to a dealership, I would say most of those individuals—their upskilling comes from that industry. So, for instance, if they were to work for a John Deere dealership, John Deere is going to keep their tech's up to date. And then it's the same for Caterpillar, or Case, or whoever.

Earlier I had mentioned, kind of a third track where we have a lot of farm operations students who go out and use that technology. Those are the ones that are reaching back to us now. Because again, they maybe don't have that close tie with a dealership. I actually just attended a dealership training that was meant for farmers. So that does exist, but there seems to be some gaps out there for those folks where they would like to come back. A lot of them. Well, this particular one that I talked to, he was looking to update his skills in the troubleshooting side of things. Maybe not even update—just refresher, right?

Industry is huge in this. We partner with industry. And I know a lot of other colleges do that as well. And the industry is... I mean, that's who we're supplying these students to. And so, we need to make sure that we're meeting their demands. And they're the ones that are kind of leading things, so to speak, because they're the ones that are coming out with this new technology.

Mike: Sure. Sure. Industry driven.

Curt: Yep.

Mike: Cool. Curt, it's been interesting today, I learned a ton of things, right? I learned a new applications of drone technology. I was thinking of automation robotics, but what I really didn't quite pick up on is the autonomous nature of the machinery that's developing. And you see that coming. Everyone seems to be pushing that area. I thought that was interesting.

Curt: Yeah, I would say that autonomous systems, if we look down the road, I just can't...

So, here's the deal: agriculture is not unique in this aspect. But there is a huge, huge shortage, not only technicians, but just people even out there on the farms to run this equipment. And so, if these managers of these farming operations cannot find qualified people to do it, then technology is going to have to fill that void. And so, I just think the writing is on the wall. And I'm not saying it's bad, I don't want to come off as saying that. But I think that's the way it's going to go.

An area that's kind of similar to this is what we call custom applicators for these retail facilities like we talked about. Using drones to spray chemicals, crop protection products,... There is just such a huge demand for individuals to run those types of machines. And so yeah, I think we're gonna see that get automated more and more.

The other thing, I think, we mentioned data. You mentioned cybersecurity. That is just going to be more and more individuals that understand how to get real value out of the data, move the data around, everything and anything dealing with that data. It's just going to become more and more in the future.

Mike: Sure. Well, thank you for peering into your crystal ball there for a few minutes, Curt. Great talking to you and giving our listeners your perspective on this segment of the workforce.

And I think back, for example, as I mentioned, we've been interviewing folks in additive manufacturing, advanced manufacturing, biotechnology. Curt, the similarities are there. They need to know about many of the same things. And I guess that's one of the messages today, isn't it?

Curt: Yeah, it really is. We talked about troubleshooting. And you mentioned that sounds very similar. And it is! And so, you get back to—how do I say this?—I've been doing this for 23 years now. And we talk about emerging technologies, and all these new things. And you talked about keeping skills updated. And—don't get me wrong—I'm in the business of teaching technical skills, right? So, I believe in their value.

But the longer I do this, a lot of times the best thing we can do is give these students—these new employees, this next generation—a good foundation in some of those basic skills. And then try to inspire them (per their craft) to be lifelong learners. Try to infuse some passion in there. If they have those basic skills, and they're passionate about what they do and about making a difference, and helping those that they're serving, they're going to go a long way in this industry. And I would say—any industry!

Mike: Good message! In other words, give them a good preparation and then sit back and watch them grow.

Curt: [laughing]

Mike: Did you get that little joke there at the end?

Mike: Hopefully, I did! I did! I like that!

Mike: So, okay. Curt, thank you again for today. Just a pleasure talking to you.

Curt: Yes, you, too. I appreciate it.

Mike: Bye then.

Curt: Goodbye.

[music]

Mike: As we wrap up today, listeners, I'd like to ask you a favor. Right by the link to the Show Notes on the website, you'll see something called a Feedback Survey. Will you

take just a moment and complete that for us? Thanks! That would really help us improve the podcast.

Now today, you heard Curt talk about Precision Agriculture. I was struck when he mentioned both the hardware side of the technicians and the IT side (the software side) for these Precision Ag Technicians. And, of course, those skills intermingle as well.

Now we heard today about drones. They haven't taken over precision agriculture, but they're moving into their niches.

We heard a lot about sensors and other interesting technologies.

So, today I have a very specific action for follow up on your part. Number One: In the link to the Show Notes are resources to help people build precision-agricultural-related programs. So, if that's your interest, check out those resources.

And Number Two (this is for everyone): There's a link to a video in the Show Notes called the Future of Farming. And it's actually a pretty cool video. It's not very long. It talks about all of these new technologies. It's something you would show in class, whether your class is electronics, manufacturing, robotics, automation, biotechnology—all of those fields are impacting the future of farming. Show it to your students. Let them see the applications of the things that they're studying in class and the things that they're working on in the lab. So, that's your action for today.

Now, this podcast is produced by John Chamberlain at CORD. Thank you, John, for all of your excellent work. And the project is led by Principal Investigator Ann-Claire Anderson, also at CORD. Thank you, Ann-Claire. You can find our podcast at ***preparingtechnicians.org*** (that's all one word), or on Apple Podcasts, or Google Play. And a rating and review are always appreciated. And thank YOU, our listeners for ***Preparing Technicians for the Future of Work!***

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