Using sap testing to guide fertilizer application

Project evaluation farmer interview summary

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Introduction and methods

From 2022-2025, Palouse Conservation District worked with three producers to evaluate plant sap analysis as a nutrient diagnostic tool for winter wheat production compared to traditional tests as part of a WSARE-funded project. In November 2025 to January 2026, Ryan Boylan, Palouse Conservation District Research and Monitoring Program Manager, interviewed the three producers to gain information on the strategies they currently use to guide nutrient management; their experiences with and perspectives on the tradeoffs of plant sap testing relative to other strategies; their perspectives on the economic, agronomic, social, and other impacts of using plant sap testing; and feedback on project implementation for future projects.

Boylan audio recorded the interviews with permission, and then Arrowleaf Consulting analyzed the interview transcripts using an inductive coding methodology in ATLAS.ti software. This report summarizes the themes from the interviews.

Findings

This section summarizes each interview individually and then provides a summary of the primary themes that emerged across interviews by topic.

INTERVIEWEE 1

Background: They farm a variety of crops, including triticale, barley, peas, winter wheat, and spelt. They apply fertilizer in the fall and spring using a solution containing humic acid and other organic materials like kelp. They have previously used soil testing to inform their fertilizing decisions and would recommend soil testing to other farmers due to pH issues in their area.

Sap testing: Overall, they are skeptical of the usefulness of sap testing, citing issues with timing of getting results back and difficulty interpreting results. They found sap testing to be somewhat useful for testing weeds and suggested it would be more useful for perennial crops like apples or alfalfa because the timing of testing and fertilizing is not as urgent.

> "At *this point, I'm not sure I would continue to sap test because I don't understand the results and there doesn't seem to be an interpretation that I have confidence in.*"

> *"The problem with sap testing though too is that you have to take samples and the timing's so critical. That can be an issue, especially if you have a lot of acres because it's also a dynamic test and I could be wrong, but it seems to me that if you're only taking a sample from one spot, you're missing the big picture."*

> *"More than anything, sap sampling on especially commodity crops is a logistics issue of quantity, timing during the day, timing during the crop growth."*

Other interests: The farmer would be interested in exploring topics like nitrogen nitrification, the benefits of different water treatment methods, and precision weed spraying technology in future projects.

INTERVIEWEE 2

Background: The farmer primarily grows winter wheat, spring wheat, barley, and alfalfa, and is expanding into cattle. In the past, they would fertilize winter wheat in the fall and then top dress in the spring. They have adopted variable rate technology for the fall fertilizer application, using soil tests to vary the rate across different zones. They recommend soil testing, even though it is time consuming and there's a 10-day delay in getting results. They have tried tissue testing a few times but felt it was a ploy to get them to purchase more inputs. He also had to hire someone to do the tissue testing. He does not recommend others do tissue testing.

Sap testing: The farmer has extensively used sap testing as part of this project, conducting sap tests on different crops four times in the first year. They found the sap tests useful for identifying nutrient deficiencies, such as boron and zinc, which led them to increase those nutrients in their fertilizer program. However, they noted challenges in interpreting the sap test results. Overall, the farmer found the sap testing to be more useful than other nutrient management tools and plans to continue using it in the future.

> *"The sap tests have led us to find out what we're deficient in and trying to add stuff that's healthy for the plants to make up those deficiencies. And it's put me in connection with people that can understand what we're trying to do."*

Moving forward, the farmer recommends that other farmers conduct both soil testing and sap testing, ideally on the same day, to get a fuller picture of their nutrient status.

> *"Especially if you want to top dress in the spring. I would soil test in the fall. I would sap test in the spring and soil test. I wouldn't do all the zones. I'd take your middle zone and then go from there."*

Other interests: They suggested a potential future project for Palouse Conservation District could be to test for pesticide and nutrient levels in riparian areas with long-term buffers as a way to demonstrate the effectiveness of those practices.

INTERVIEWEE 3:

Background: The farmer grows winter wheat, canola, garbanzo beans, lentils, spring wheat, barley, peas, alfalfa, and Timothy hay. Rather than following a strict crop rotation, they aim for a five-year rotation of winter wheat, pulse crops, winter wheat, spring grain, and spring canola, though this varies based on weed pressure management needs. The farmer employs multiple fertilization strategies for winter wheat, with the primary method involving fertilization at seeding time between mid-September and October 1st using banded application. Additional methods include chisel application and fall stream-on fertilizer applications.

The farm was over-fertilizing on knobs, and this over application was reducing yields substantially. Through variable rate technology implementing seven fertility zones based on topographic positioning and thereby reducing fertilizer rates in marginal ground, the farmer achieved potential savings of $40,000-$50,000 annually.

Sap testing: The farmer said the most challenging aspects of sap testing were timing and interpretation of results. Their key takeaway was that considerable work remains to develop accurate calibration curves for sap testing, which requires substantial effort to build for an entire region. When asked about broader adoption, they recommended other farmers pursue sap testing as it provides information useful for years to come and makes farmers better stewards of their operations.

Other interests: The farmer expressed interest in “growing” their own fertilizer and cycling nutrients, as well as exploring organic production methods. The farmer emphasized that growing their own fertilizer represents the frontier of innovation they are most interested in pursuing.

> *Growing our own fertilizer and cycling nutrients, and it's like, how can we take FLOURISH and some of the organic stuff that's been going on and utilize some of that information to conventional or organic, grow our own fertilizer, maybe find a value added... In my eyes, there should be a premium for conventional crops grown without fertilizer or grown where you could say, "This is not synthetic fertilizer. This is grown in a more biological system, or it's grown with minute amounts of fertilizer, some of the regenerative stuff."*

Theme summary tables

TABLE 1 | *Interview themes related to soil and tissue testing*

Theme	Quotes
Helps determine fertility needs	"We actually do [use soil tests to help make decisions]. Like this year…especially with our starter and our foliar feeds…we'll work on that next spring to see what we need to put on as far as foliar feeding."
	"One of the things that we've changed [after soil and tissue testing] is we've backed off on [phosphorus] a little bit because we've added so much more humic acids and sugars to a lot of the blends. Cool. And that really helps with availability. It helps hold things up in the profile better. So we've done that. We add a lot more micronutrients. I mean, I won't put down fertilizer without zinc and boron anymore."
	"I think soil tests are really important to have because it's important to know what's going on with your soil."
Expensive	"I pulled all the tests when I bought a little rod and I went out and poked holes in the ground, hired my son to go pull holes in the ground and it takes a lot of time and it's expensive. Yeah, it is expensive. And it'd take 10 days or something to get the results back, so you had to plan ahead."
	"Benefits? They sold me more fertilizer. To me, to be honest, that's what I decided it was. It was just a ploy to get me to buy more fertilizer and hire the plane to put it down."
Difficult to interpret; interpreter conflict of interest	"I think that it's problematic that we've directly correlated what's in the soil to what our plants are doing. I think that's where tissue or a sap test is important. Where I see problems is the correlation. What is the relationship? How do they correlate so that you can make better decisions?"
	"You're capturing something, but do we actually understand what it is that we're capturing?"
	"Well, since I couldn't do it myself, I have to hire somebody to come and do it, and then it's a biased opinion."
	"I don't understand it well enough, and I'm not sure that there's a hierarchy there because soil testing's voodoo, but it tells you something. Tissue testing is maybe less voodoo, but interpretation is really difficult."
Too many variables	"I'm getting more confident in our tissue tests, but they're still not ... They're not great because timing and different years."
	"Just like with a soil test, the tissue test is going to be variable across the field too."
	"It's the same with soil and tissue. There's so many variables. To remove as many variables as you can is really difficult. Sampling the same spot at the same time of day is really hard."

Theme	Quotes
	"We use soil testing and tissue testing. I'm not going to say religiously. Both soil and tissue testing to me are an indicator of your program…. In the fall, we tend to follow our program, but in the spring we're a little more flexible and that's a result of soil testing. Now with the tissue testing, we'll change things based on what we're seeing in the tissue test from last year. We do a lot more postmortem than predictive."
Timing and frequency	"Well, and especially around here, mainly because of our pH, the issues we have with pH and I think [soil testing] needs to happen every year. I know there's some people who say take one once and then use that as your basis for deciding for the next five years, but I don't see how you see if you're improving. And I think soils are far more dynamic than that."
	"You can't just take one or two tissue tests. You got to do it constantly to be able to tell when that occurs."

TABLE 2 | ***Interview themes related to sap testing***

Theme	Quotes
Helps determine fertility needs	"I was deficient in everything, and so I knew I needed to apply stuff…the sap tests have led us to find out what we're deficient in and trying to add stuff that's healthy for the plants to make up those deficiencies."
	"When I took the sap tests of the weeds, that was really fascinating. It was just very fascinating to see what nutrients they were taking up. And I'm not sure I didn't continue that process, but it would have been interesting to see what was going on over time, but I don't want that many weeds anyway."
Difficult to interpret	"Nobody knows how to read it."
	"Quite frankly, at this point, sap testing, especially in commodity crops, is really hard to understand what you're seeing."
	"I'm not sure I would continue to sap test because I don't understand the results and there doesn't seem to be a interpretation that I have confidence in that's timely."
Timing	"When I took the SAP test, you had to time it literally to the point in the day where it makes the most sense, and you had to take a lot of samples in order to get a somewhat accurate picture…. More than anything, sap sampling on especially commodity crops is a logistics issue of quantity, timing during the day, timing during the crop growth."
	"In the beginning, the biggest challenge was just it was 12 days, you had to harvest it at the same time at 10:00 or whatever in the morning when the sugars are right, and then it's supposed to give you a real-time thing and you should have applied it the next day."
	"Did you have a flat tire on the way out and in that half hour to change the tire? And so, you were sampling at 8:45 in the morning and not 8:15 in the morning and that ruined your data. I mean, sap is like that. And I think that that's something that we've got to address and be realistic about and try and take out."

Theme	Quotes
No data baseline	"As far as the sap testing, I think the most important thing is that we have a lot of work to do…and it isn't going to be cheap, I think. It's one of those things I think to build a really accurate curve for a whole region is a ton of work." "The problem is we didn't have a baseline." "On a large scale, you're probably playing catch-up and putting the wrong thing because they don't have a calibration for our area."
New technology/not enough knowledge	"At this point, I think sap testing for commodities is still in its infancy." "I don't know [if I will use sap testing in the future]. It's one of those things where ... I don't know at this point, because it's also a technology or a tool that's not readily used by agronomists." "Needs more practice. So, I tell my mom with her cooking every time. 'That was great, but it needs more practice.'" When asked, "Overall, do you think sap testing is more useful, less useful, or equally useful to other nutrient management decisions or support strategies?" the farmer answered, "I think it's too early to tell."
Other	"[this WSARE-funded project] put me in connection with people that can understand what we're trying to do." "The most useful was just now I can look at this graph and tell a story over time, tell this story over time that I wouldn't have otherwise had. And it is extremely interesting." "I honestly don't know how anybody uses [sap testing] efficiently unless they have a big supply of all the products they need."

TABLE 3 | ***Interview themes related to project implementation***

Theme	Quotes
Working with PCD is rewarding	"I got to visit with you guys." "Working with Palouse Conservation District."
Information and sharing is useful	"Probably the information, the information sharing…. We did on the cover crop ground, and that was particularly interesting, I thought." "Data that I can go through and try and interpret." "Well, it gave me a little bit more of an insight into some of the products and the pricing of some of these regenerative products, and some of them, it just cracks me up. Some of them are like, 'You've got to use this stuff. This is the best stuff. This will make you money.' And then you're like, 'Oh my God, that's 20 bucks an acre.'"

Theme	Quotes
Feedback	"I thought you did a very good job. Maybe not use the Excel template form for economic data collection? Or maybe, and maybe you guys did this and I totally spaced it, but providing the forms and saying, 'Hey, fill these out right after.' And I know this, but it's like, 'Oh, what form do I put this in?' So, actually that template that Dianna provided was really helpful because it gave me a format and I don't know if I got that before or not."
	"The only thing I would say is that we all went into it blind enough that I think we all realized that after that meeting, it was like, I guess that was year two, huh? Yeah. We really need to focus on the things that we now know that we don't know. And so not that that feedback, it's like that was after two years, and it's kind of an unglamorous project. It sounds so much better to utilize a tool to make these wild improvements. Whereas where we actually were at was we need to come up with the calibration. And so then in the future we can utilize this tool, which is a lot less glamorous in grant writing."

TABLE 4 | ***Interviewees' interests and ideas for future projects***

Theme	Quotes
Interests	"Oil and alfalfa."
	"Rotational grazing of riparian areas…. That's something I really want to do if I could get the funding."
	"Weed Seeker…the one that detects the weeds and sprays them…it's horribly expensive. It's AI powered. And the other big question is, would it work on a hill?"
	"I would love to come up with a regional specific [data] curve, get together with other farmers…who have probably at this point gotten closer to building a scale curve and look into some of these micro differences."
	"I mean, for me, organic and particularly fertility and organic, I think weeds and organic, there's a lot of research that needs to be done in tools, but I think that that's maybe the resources, that's a farmer to farmer. It's homework that I feel like I need to do as a grower where it's like, talk to an organic farmer, flame cultivator, that's the jam. These are the problems. This is where it works really good. I'm not sure that the District is well poised to go out and buy a half million dollars of plot equipment or a million dollars of plot equipment just so I can decide that I should buy this instead of going and talking to some farmers."

Theme	Quotes
Ideas for other projects	"PCD needs to go to where you did the riparian project 10 years ago, five years ago and last year, and then you need to pull soil tests and test for your chemicals infield five feet into the field, 10 feet into the field or 10 feet into the riparian, and then at water's edge…. This is a great educational piece backed by science saying, 'yes, this is what is happening.' This is proof that we are reducing the amount of chemicals in the water because that is ultimately the goal that the public wants to know is happening…. You could easily get EPA funding to do that." "Plasma activated water. Green Lightning. That would be very interesting." "How do you do plot research other than field-scale type stuff with some of that equipment base? But plot scale, growing our own fertilizer and cycling nutrients, and it's like, how can we take FLOURISH and some of the organic stuff that's been going on and utilize some of that information to conventional or organic, grow our own fertilizer, maybe find a value added…. In my eyes, there should be a premium for conventional crops grown without fertilizer…. Organic or non-organic, growing our own fertilizer is the frontier of innovation that I'm itching for the most."