AGVISE LABORATORIES

Timely information for agriculture

Winter 2022

NORTHERN NOTES

John Lee with wife Jan and grandkids

When you have a long career in agriculture, you get to experience all the extremes. Early in my career, I experienced the 1988 drought. Who knew the 1988 drought would be the dry weather benchmark for the next 35 years? The 2021 drought was severe and exceptional throughout the region, but some areas still scored surprising crop yields. We all speculate about the surprising crop yields: more stored deep subsoil water, reduced tillage, better weed control, better planting equipment, and better crop genetics. These are all better than we had in 1988.

As we prepare for 2022, soil testing is the first step in making your fertilizer plans. With near-record high fertilizer prices, nobody wants to apply more fertilizer than needed for the next year. Soil testing is the key tool to make the best decision. The 2021 drought left many fields with high residual nitrate-nitrogen, which will allow producers to apply lower nitrogen fertilizer rates and save thousands of dollars.

As I alluded earlier, my career in the soil test industry began 40 years ago, and I will be retiring at the end of January 2022. Through the years, I have had the great pleasure of serving our customers in the region and working with a great team of people at AGVISE. It has been a rewarding career to witness AGVISE grow as a company, while maintaining the highest standards of quality, service, and support to our customers. I have great confidence in our experienced technical support staff. John Breker and Jodi Boe at our Northwood laboratory have been doing a great job of supporting our customers and will continue the AGVISE tradition of providing the best technical support in the soil testing industry. In retirement, I will spend more time with my wife Jan, our children, and our six grandchildren. I have no doubt they will keep me busy, along with a little more hunting and fishing! I hope to see you in the upcoming months at the winter ag shows and our winter seminars.

AGVISE Soil Fertility Seminars 2022: January 4, 5, 6

The United States AGVISE Soil Fertility Seminars are scheduled for January 4-6, 2022. You will not want to miss the great program lineup! Please note the Minnesota location has changed to Willmar, MN. A registration letter was sent to AGVISE customers in mid-November. If you did not receive the mailing, please call 701-587-6010 and we will send you the registration form. Please make sure you register early for these seminars if you plan on attending. Space is limited and there is usually a waiting list. An email was also sent to everyone on our mailing list in mid-November.

If you received this newsletter, you are on our mailing list, but you may not be on our email list. If you want to receive future emails on our seminars, newsletters, and technical information, please call Teresa at our Northwood office and give her your current email (701-587-6010). To register for our Soil Fertility Seminars, call 701-587-6010 and ask for Emily or Patti.

Date	Location	CCA CEUs applied for
January 4	Willmar, MN	CEUs: 2.0 SW, 3.5 NM, 0.5 PM.
January 5	Watertown, SD	CEUs: 2.0 SW, 3.5 NM, 0.5 PM.
January 6	Grand Forks, ND	CEUs: 2.0 SW, 3.5 NM, 0.5 PM.

INSIDE

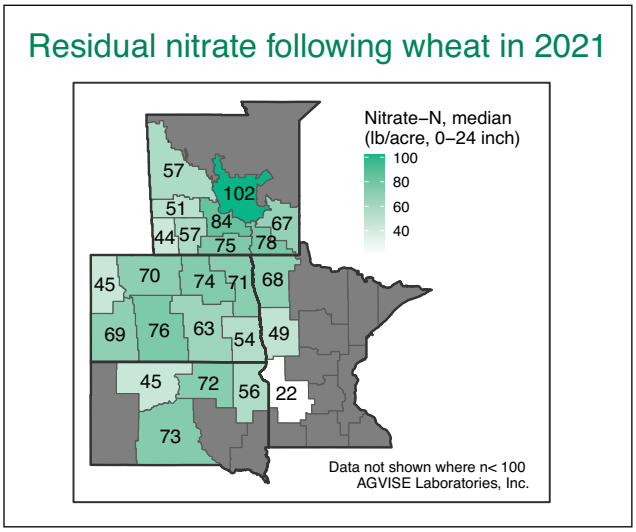
2021 Drought: High residual soil nitrate-nitrogen across the region

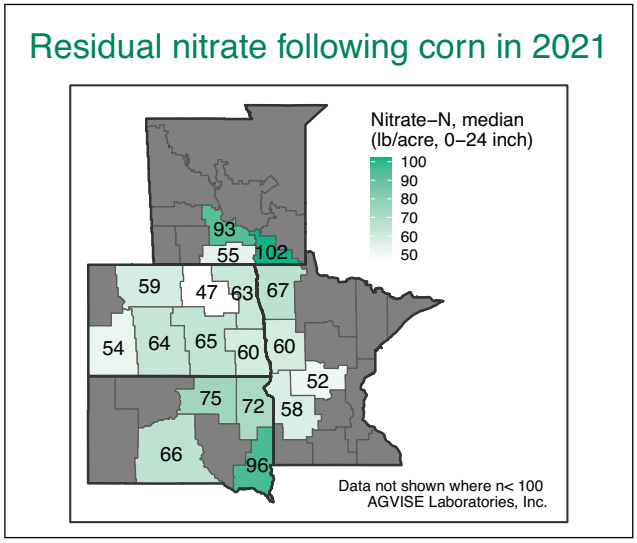
The 2021 drought rivals the 1988 drought, and it covered much of the northern Great Plains and Canadian Prairies. From previous experience with droughts, we expected that residual soil nitrate-N following crops would be higher than normal, caused by the drought and reduced crop yields. The first wheat fields that were soil tested in August and September confirmed our expectation that residual soil nitrate-N was already trending much higher than normal.

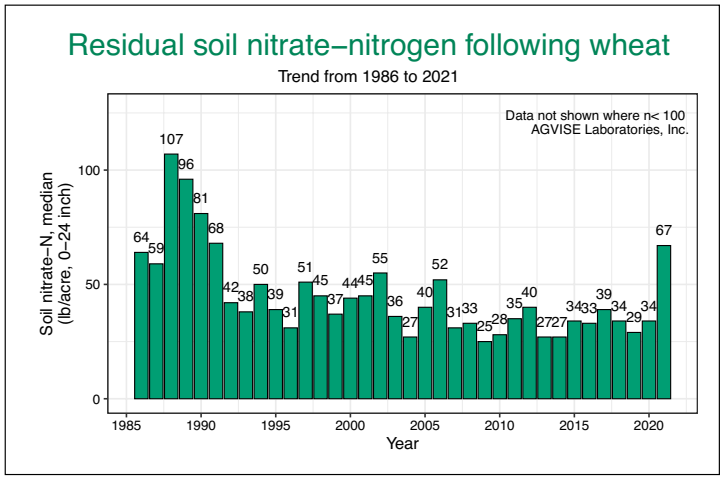
The 2021 AGVISE soil test summary data highlights how exceptional the 2021 drought was. The median amount of soil nitrate-N across the region was markedly higher following wheat and corn. Over 20% of wheat fields had more than 100 lb/acre nitrate-N (0-24 inch) remaining, and another 40% of wheat fields had a sizable 40 to 80 lb/acre nitrate-N (0-24 inch) left over. For any given farm, the great variability in residual soil nitrate-N makes choosing one single nitrogen fertilizer rates impossible, and soil testing is the only way to decide that right rate for each field.

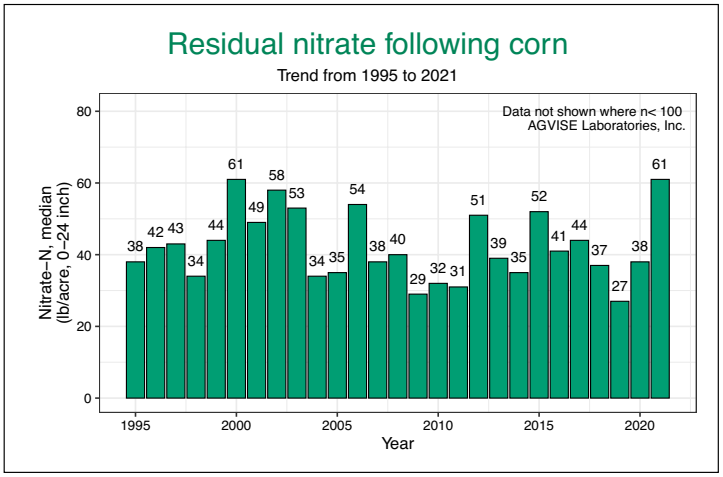
Through zone soil sampling, we were also able to identify that residual soil nitrate-N varied considerably within a field. This makes sense because we know that some areas of the field produced a fair yield, leaving behind less soil nitrate, while other areas produced very poorly and left behind much more soil nitrate. These differences across the landscape are driven by soil texture, soil organic matter, and stored soil water as well as specific problems like soil salinity or low soil pH (aluminum toxicity). Although the regional residual soil nitrate-N trends were higher overall, it is truly through zone soil sampling that we can begin to make sense of the field variability that drives crop productivity and the right fertilizer rate for next year.

For fields that have not been soil tested yet, there is still time to collect soil samples in winter (see winter soil sampling article). Nobody wants to experience another drought, but this kind of weather reminds us how important soil nitrate testing is every year for producers in the Great Plains. Each year, AGVISE summarizes soil test data for soil nutrients and properties in our major trade region of the United States and Canada. For more soil test summary data and other crops, please take a look at our soil test summaries online: https://www.agvise.com/resources/soil-test-summaries/









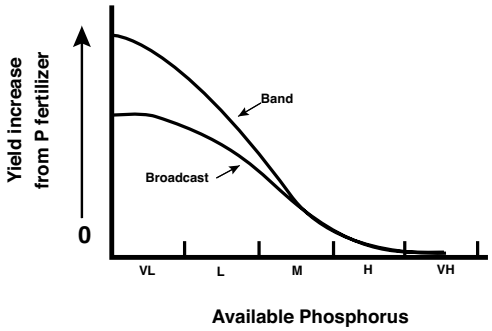
Banding Phosphorus and Potassium: Stretch your fertilizer dollars farther

JOHN BREKER
SOIL SCIENTIST, CCA, 4R NMS

Broadcast or band? For phosphorus and potassium, these are big fertilizer questions. In recent months, high fertilizer prices have prompted farmers and agronomists to consider other strategies to reduce fertilizer costs without jeopardizing crop yield. Among the most common and effective options is placing fertilizer in a tight band below the soil surface, also known as a subsurface band.

Subsurface banding helps improve fertilizer recovery and efficiency. It ensures that fertilizer is placed in the plant root zone, facilitating direct uptake of crop nutrients. It also minimizes potential fixation reactions (aka tie-up) that reduce soil nutrient availability, allowing more phosphorus or potassium to remain available in soil for plant uptake. You ultimately get more bang for your buck on each pound of fertilizer applied. In addition, placing fertilizer below the soil surface protects fertilizer from soil erosion and runoff losses via wind and water. This is important for fall-applied phosphorus and potassium because spring snowmelt runoff and wind erosion can move fertilizer lying on the soil surface from neighbor to neighbor and watersheds beyond.

When we discuss banding phosphorus and potassium, it also comes along with the question, "How far can I cut fertilizer rates?" It is important to recognize that the improved efficiency of banding over broadcast is a function of soil test levels (figure) and proximity to the seed row. If you have high soil test levels (>15 ppm Olsen P), then the expected crop yield response to fertilizer, whether broadcast or banded, is lower. Banding fertilizer still helps with the fertilizer recovery, but the expected crop yield increase is often similar to broadcast. However, if you have low soil test levels, then the expected crop yield response is much greater with banding.



Idealized crop response to phosphorus as affected by fertilizer placement and soil test level (figure from J. Prod. Agric. 1:70-79).

Where does seed row proximity fit in? The greatest efficiency comes with in-furrow or near-seed placement (e.g. 2x2 band), allowing effective fertilizer rates of one-half to two-thirds their broadcast equivalent. The near-seed placement also provides the starter effect, which enhances early plant growth and development in cool, wet soils of the upper Midwest and northern Great Plains. Of course, you must watch seed safety with any seed-placed fertilizer in the furrow.

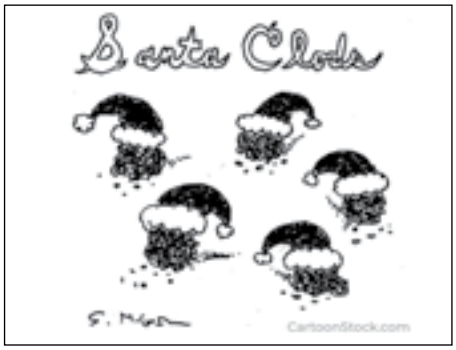
For deep-band or mid-row band placement, the benefits over broadcast begin to disappear. These are still great placement options for anhydrous ammonia or urea, but the greater distance between the seed row and fertilizer band does not provide the same efficiency for immobile soil nutrients like phosphorus and potassium. This will surprise some people hoping that strip-till with deep-banded phosphorus and potassium or a one-pass air seeder with mid-row banders might be their answer to reducing fertilizer costs. For these "far-from-seed" banding options, reduced fertilizer rates are not suggested, and some in-furrow or near-seed banded fertilizer should still be applied for the current crop.

Winter Soil Sampling: You need the right tools

The right equipment is the key to any project, and winter soil sampling is no different. AGVISE heavy-duty (HD) chromoly soil probes were designed for hard, frozen soil conditions. The chromoly steel is much tougher than stainless steel, and it handles the stress of sampling frozen soil. To punch through several inches of frost, you will also require additional weight. Most soil sampling trucks have the hydraulic cylinder mounted inside the truck cab, where you can take advantage of the entire truck weight to push through the frost. This enables you to take soil samples through 4 to 6 inches of frost on most medium- and fine-textured soils in winter. For receiver hitch-mounted hydraulic cylinders, you will need extra weight in the truck box, and it may limit you to pushing through only 1 to 3 inches of frost.

AGVISE offers wet and dry soil probe tips for the HD chromoly soil probe. The wet soil probe tip is best suited for frozen soils. The HD chromoly soil probe is available with or without a slot.

You can view examples of in-cab and receiver hitch-mounted hydraulic soil sampling systems on our website (https://www.agvise.com/installed-soil-sampling-kit-examples/). You can also find videos of soil sampling in frozen soils with the HD chromoly soil probe and wet soil probe tip.



Zone Soil Sampling and Variable Rate Fertilization: Optimizing profits

JODI BOE
Agronomist, CCA

Farmers, like all business owners, are profit maximizers: things are good when revenue exceeds cost. The math behind increasing profit is simple: reduce costs, increase revenue. But, the difficult part is finding and implementing strategies on the farm to do this. Why not start with fertilizer, which is typically the largest annual input cost on the farm?

Your fields are variable. You know the hilltops have lower crop yields than the mid-slopes, and you know exactly how far the saline spots creep into the more productive part of the field. So why use the same rate of fertilizer in the unproductive areas as you would in the productive areas? Optimize your fertilizer inputs by reducing rates in low-yielding areas and reallocate those fertilizer dollars to the productive ground.

How does one actually do this? Creating zone maps for your fields, soil sampling and testing based on productivity zones, and variable rate (VRT) fertilizer application is the place to start. Applying VRT fertilizer allows you to apply fertilizer where it is needed and not waste fertilizer dollars where it is not. Let me show you an example from my family's farm in western North Dakota.

I farm with my dad and brother in southwest North Dakota. This past fall, I created zone maps for each of our fields, with help from GK Technology and their ADMS program. The final maps are based on historical satellite imagery. I will show you one of our fields, the North Field, and take a deep dive on nitrogen fertilizer optimization using zone soil sampling and VRT fertilization in the dryland "out west" country.

The North Field is variable. That is expected on a 120-acre field with many hills and ravines. For the newsletter, I will keep the soil test data short and focus on nitrogen; the actual zone map and other soil test nutrients can be found on the AGVISE website under Educational Articles. For discussion, we will use residual soil nitrate-nitrogen results and make a nitrogen fertilizer plan using urea for hard red spring wheat (HRSW) in 2022. You can see the soil nitrogen data, crop yield goals, and final nitrogen rates in Table 1.

The first place to optimize fertilizer inputs is setting realistic crop yield goals for each zone. Spring wheat yield goals range from 65 bushel/acre in the best zone (zone 1) to 30 bushel/acre on the hilltops (zone 5). Adjusting the nitrogen rate for the proper crop yield goal ensures that the high-producing zones are not limited by lack of nitrogen (increased fertilizer cost, increased revenue) and the low-producing zones are not overfertilized (decreased fertilizer cost, same revenue).

Table 1. North Field Nitrogen Fertilizer Rate Strategies

Zone	Acres	HRSW yield goal	Soil nitrate-N 0-24" depth	Suggested N rate	
				VRT application	No rate variation across field*
Total acres:	120.5	(bu/A)	(lb/A)	(lb/A)	(lb/A)
1	12.6	65	52	124	100
2	32.1	60	29	133	100
3	39.4	50	27	108	100
4	22.3	40	58	50	100
5	14.1	30	29	52	100

*Yield goal at 50 bu/A; suggested N rate takes into account 36 lb/A residual nitrate test, assuming a composite soil sample was taken.

Table 2. Total Nitrogen Fertilizer Costs per Application Strategy

Zone	Acres	Total Urea per N Strategy			
		Vary rate across zones		No rate variation across field	
		(lb/A)	(lb/zone)	(lb/A)	(lb/zone)
1	12.6	270	3,396	217	2,739
2	32.1	289	9,281	217	6,978
3	39.4	235	9,250	217	8,565
4	22.3	109	2,424	217	4,848
5	14.1	113	1,594	217	3,065
Total lbs urea/field			25,946		26,196
Tons urea/field			12.97		13.10
Urea cost/field at $855/ton			$11,092		$11,199
Zone creation ($2.00/acre)			$241		$0
Soil sampling cost			$150		$100
Soil testing cost (small grain option)			$158		$32
Custom fertilizer application ($6.50/acre + $3.00/acre for VRT)			$1,145		$783
Total fertilizer costs			$12,786		$12,114

Table 3. Season-end Net Revenue after Nitrogen Fertilizer Expenses

Zone	Acres	Nitrogen Fertilization Strategy	
		Vary rate across zones	No rate variation across field
		Yield (bu/A)	Yield (bu/A)
1	12.6	65	50
2	32.1	60	50
3	39.4	50	50
4	22.3	40	40
5	14.1	30	30
Gross yield/field		6030 bu	5520 bu
Gross revenue/field*		$51,979	$47,582
Gross revenue minus fertilizer costs		$39,193	$35,468

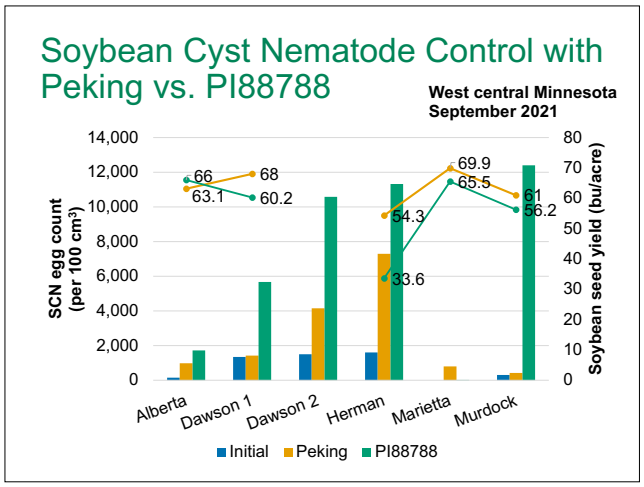
*Using Minneapolis Sep '22 futures price of $8.62 (11-03-21)

Continued on page 5

Controlling Soybean Cyst Nematode: Do you have a resistance problem?

This is the third year of our soybean cyst nematode (SCN) resistance project. Each year, we have flagged spots in soybean fields and collected paired SCN soil samples in June and September. If the SCN egg count increases through summer and into fall, we can quickly learn if the soybean SCN-resistance source, either PI88788 or Peking, is working or failing. University SCN surveys have found that the PI88788 resistance source has begun to lose its effectiveness at controlling SCN populations in much of Minnesota. This is a particular problem because 95% of SCN-resistant soybean varieties still use the PI88788 resistance source.

In 2021, paired soybean variety comparisons with SCN soil samples and soybean yield data really helped us see the difference in these SCN resistance sources. Among the sites, the Peking resistance source always had a lower SCN egg count than the PI88788 comparison, indicating that the Peking soybean varieties had better control of the SCN population at 4 of 5 sites. The Alberta site had similar SCN population control with both PI88788 and Peking resistance sources, so the soybean yield was similar at the site. However, the other sites demonstrated SCN resistance to PI88788, and the resulting soybean yield with the Peking resistance source was better with 7-bu/acre soybean yield increase on average.



SCN egg count and soybean yield data from the 2021 AGVISE SCN resistance project. Bars of the graph represent SCN egg count, lines of the graph represent soybean yield.

For 4 of 5 sites, it is apparent that a Peking-traited soybean variety is the better choice. To learn if you have SCN resistance problems in your field, the simple early-late SCN soil sampling exercise, like we did in this project, is a quick way to learn if your current soybean variety is still controlling SCN and delivering the best soybean yield.

Brent Jaenisch joins AGVISE Technical Support Team

In September, we welcomed Dr. Brent Jaenisch to our technical support team in Benson, MN. A Minnesota native, Brent was raised on a diversified grain and livestock farm near Maynard, MN. Brent took his passion for agriculture to school, obtaining a degree in Agronomy from the University of Nebraska-Lincoln, then his M.S. and Ph.D. in Agronomy from Kansas State University. Brent's research at K-State evaluated wheat management in Kansas where he spent many hours surveying wheat growers and evaluating their practices in small-plot research. Brent looks to continue the soybean cyst nematode (SCN) project that Richard Jenny started a few years ago. He will also be starting soil fertility projects tailored to the Benson trade area.

BRENT JAENISCH
AGRONOMIST

In his free time, Brent enjoys helping his family on the farm, gardening, and cheering on the Minnesota Vikings (even when they do not deserve it). We are excited to have him on the AGVISE Laboratories team and hope that you will be able to meet him soon.

Zone Soil Sampling Cont...

With a responsible crop yield goal on the low-producing zones, the crop still receives the amount of nitrogen it requires, and excess nitrogen is not lost to nitrate leaching (wasted input cost). As a result, the excess nitrogen fertilizer is reallocated to high-producing zones, resulting in more crop yield with the same total fertilizer budget, and increased revenue.

The nitrogen fertilizer scenarios in Tables 2 and 3 breakdown the projected revenues and expenses, demonstrating the benefits of zone soil sampling and VRT fertilization. For the North Field on my farm, the projected profit increase was $3,725 for the field or $31.05 per acre. It is tough to argue with a dollar amount like that! Prices will vary, of course, for fertilizer and precision ag services in your geography. Do the math for yourself and see how zone soil sampling and VRT fertilization can maximize profits for you.

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PRESIDENT'S CORNER

CINDY EVENSON
PRESIDENT
AGRONOMIST, CCA

Amid the 2021 drought, we witnessed widespread potassium deficiencies, severe spider mite infestations, and crops shriveling in the sweltering heat. Most of us were prepared for very low crop yields, but some areas did fare okay and some with above average crop yields where a little more rain came. With great crop yield variability within fields and across the region, there was also great variability in soil test levels. We expect to find large swings in residual soil nitrate-nitrogen following a drought, but there were some minor changes in soil test P and soil test K as well. It is always important to soil test, no matter what the weather was like during the growing season.

I wish to extend a special thank you to all our customers for trusting AGVISE Laboratories with your agricultural testing needs. We strive to provide you with accurate results in a timely manner with superior technical support. It is our privilege to serve you and provide you with the highest standard of excellence in the industry.

This winter, I hope to see many of you again at winter trade shows and agronomy update meetings. It is so nice to visit with customers again face to face. You will also have the opportunity to meet Brent Jaenisch, our newest addition to the AGVISE technical support team.

We wish you and your company a very successful end to 2021, a Merry Christmas, and a Happy New Year.

SOUTHERN TRENDS

RICHARD JENNY
AGRONOMIST, CCA

What a difference a little rain makes! After a droughty summer across much of the region, many growers in the Benson trade area started receiving rain on August 20 that saved their crops. The fall soil sampling season started early and clipped along quickly throughout the fall.

This will be my last Southern Trends article in the AGVISE newsletter, as I will be retiring at the end of December 2021. I started with AGVISE in August 2000, just in time for the fall soil testing season. I am very thankful for my years at AGVISE and the opportunity to work with all of you.

In September 2022, Brent Jaenisch joined the AGVISE team as an agronomist. Like me, he started right at the beginning of another busy fall soil testing season. Brent will be your new sales and technical support representative for the Benson laboratory. He has a great background in agronomy and soil fertility from the University of Nebraska-Lincoln and Kansas State University. He also has a good understanding of the retail side through many summer internships at fertilizer retailers in Minnesota while attending college.