AGVISE LABORATORIES

Timely information for agriculture

Spring 2021

NORTHERN NOTES

JOHN LEE
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Spring can't come soon enough for me. I am almost Zoomed-out after a full winter of virtual meetings. I think we are all ready to do something outside again, whether it is applying spring fertilizer or planting the next crop. Last fall, we had excellent weather for soil testing, but there are always a few soil samples left for spring. You might have a few stragglers who procrastinated through last fall, or maybe some land changed hands over winter and requires a new soil test to make a good fertilizer plan. While you may not have a ton of soil samples to collect this spring, the spring soil sampling window is short, and we know all your soil samples will require "rush" turnaround. Our staff is ready to provide you with the great service that you expect from AGVISE. The normal turnaround time is next-day service after the soil sample is received.

If you need soil sampling equipment or supplies for the spring soil sampling season, we have a full assortment of hand and hydraulic soil sampling equipment in stock. We also have an experienced staff of agronomists and soil scientists to answer your questions on soil fertility, soil health, and much more. Please do not hesitate to give us a call with any agronomic questions or equipment and supply orders. I hope you have a smooth and safe spring season!

2022 AGVISE Soil Fertility Seminars

The AGVISE Soil Fertility Seminars are back on the schedule for January 4-6, 2022. You will not want to miss the great program lineup! We'll be seeing you in all the old familiar places.

- **January 4: Granite Falls, MN**
- **January 5: Watertown, SD**
- **January 6: Grand Forks, ND**

Bring the starter phosphorus, it's Tiller Time!

Achieving high-yielding spring wheat starts with tillers. In fact, the wheat heads on the main stem, first tiller, and second tiller account for 90% of spring wheat yield (Figure 1). Since spring wheat develops very quickly from emergence to head development, there is no time to lose with tiller initiation, and starter phosphorus plays a key role for a good start.

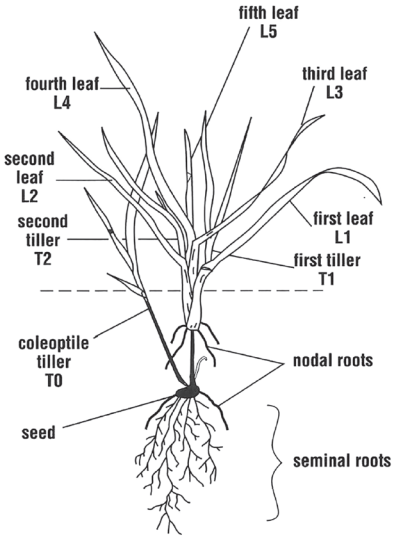

Figure 1. A young wheat plant with first (T1) and second (T2) tillers. About 90% of spring wheat yield is produced by the main stem, T1, and T2 tillers. Source: Klepper et al., Agron. J. 74:790.

Dr. R. Jay Goos, professor of soil fertility and management at North Dakota State University, has spent years researching optimal fertilization strategies in spring wheat. To ensure proper development of first (T1) and second (T2) tillers, he

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Starter Phosphorus Cont…

has found it is necessary to apply starter phosphorus fertilizer placed with or near the seed. With starter phosphorus (30 lb/acre P2O5), you can achieve T1+T2 tiller initiation on 80 to 90% of wheat plants at low or high soil test P (Figure 2). Even at high soil test P (18 ppm Olsen P), adding starter phosphorus added T1+T2 tillers on 10 to 20% more wheat plants! The research is clear that starter phosphorus pays dividends, even if soil test P is high.

Some producers try to skip starter phosphorus if soil test P is high because they think they can plant more acres per day and save a little on the fertilizer budget, but it is a mistake that reduces tiller initiation and ultimately costs higher wheat yields. If you want to achieve high-yielding spring wheat, starter phosphorus fertilizer is not optional. It is a critical part of your crop nutrition plan. Apply some starter phosphorus and enjoy some "tiller time" later!

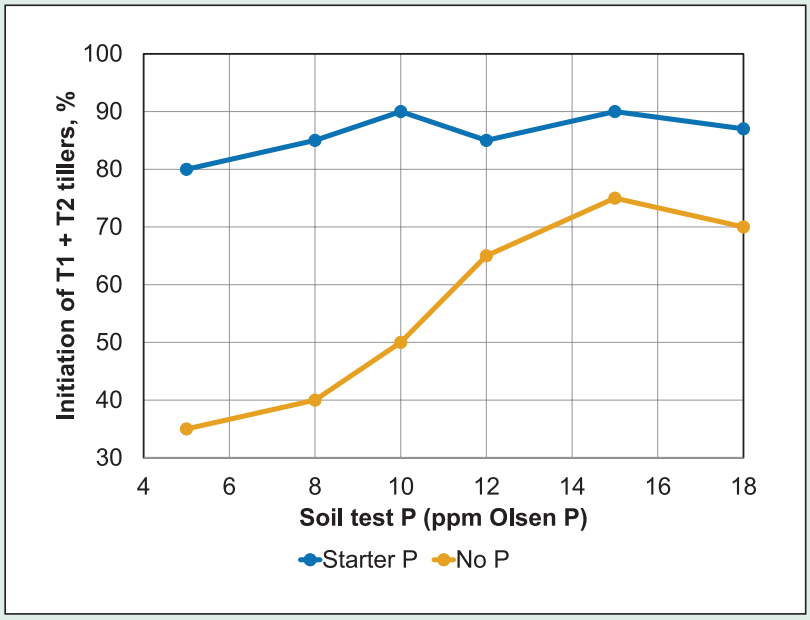

Figure 2. Effect of starter phosphorus on T1 and T2 tiller initiation of spring wheat. NDSU, 1990-1992. Source: Goos, Better Crops 79(3):12.

Soil Testing on Mars

The NASA rover *Perseverance* landed on the planet Mars in February, and it is actively collecting soil samples on the Martian surface. Mars is called the Red Planet because iron minerals in the soil surface oxidize to rust, causing the planet surface to look orangey red. The *Perseverance* soil samples will be sent back to Earth for further analysis. The turnaround time on these soils samples will be a little slower than AGVISE next-day turnaround, however. The soil samples are expected to arrive on Earth in 2031.

Researchers trust AGVISE for soil and plant analysis

While you may know AGVISE Laboratories for the soil and plant analysis services we provide you and your clients, AGVISE also has a long history of supporting university and industry research in the United States and Canada. Over the past 30 years, many university-operated soil testing laboratories have closed in the region. This has left a gap in the on- and off-campus research capacities at some institutions. To help bridge the gap, AGVISE partners with university and industry researchers to provide the laboratory analysis services they need to further research in soil fertility, plant nutrition, nutrient use efficiency, and many other areas. Researchers choose AGVISE for their research projects because of our reliability, consistency, and standard of excellence.

Through the years, we have collaborated on some fun and interesting research projects. You may have even heard of some projects like the Public–Industry Partnership for Enhancing Corn Nitrogen Research, which included USDA-ARS and eight land-grant universities across the U.S. Midwest. Currently, we are analyzing soil samples for the Potato Soil Health Project, supported by USDA-NIFA Specialty Crop Research Initiative (SCRI), which spans eight potato-producing states from the Pacific Northwest to Maine. The project aims to identify reliable indicators of soil health and effective methods for increasing soil health in potato cropping systems.

The next time you send your soil or plant samples to AGVISE Laboratories, you can be confident that you will be receiving the highest quality analyses and service, just like we provide to researchers across the United States and Canada.

Project Update: Let's Get Serious, Building the Base Cation Saturation Ratio (BCSR)

From time to time, you might still hear people talk about the old base cation saturation ratio (BCSR) concept of the 1930s and 1940s. In 2015, we started a demonstration project to figure out how much extra potassium fertilizer (potassium chloride, KCl, 0-0-60) would be required to increase the K saturation on a high pH soil, following the BCSR concept. The highest K rate was 1000 lb/acre K2O (1700 lb/acre KCl, 0-0-60), and it failed to reach the 4 to 6% K saturation recommended by followers of the BCSR concept. So this time, we decided to get serious and actually try to hit that target 4 to 6% K saturation with another field project in 2021. We started with a preliminary laboratory project to make sure we got the potassium fertilizer rates correct before hitting the field.

In the laboratory project, we applied potassium fertilizer rates ranging from 0 to 4200 lb/acre K2O (0 to 7000 lb/acre KCl) to reach 4 to 6% K saturation. This time, we did it! But… it took 2100 to 3500 lb/acre K2O (3500 to 5800 lb/acre KCl). We proved that it is possible to build K saturation if you apply enough potassium fertilizer, but it comes at a cost that is not for the faint of heart. We also showed that the same potassium fertilizer rates built soil test K into the 750 to 1000 ppm range, but it does not do you much good since the soil test K critical level for agronomic crops is only 150 to 200 ppm.

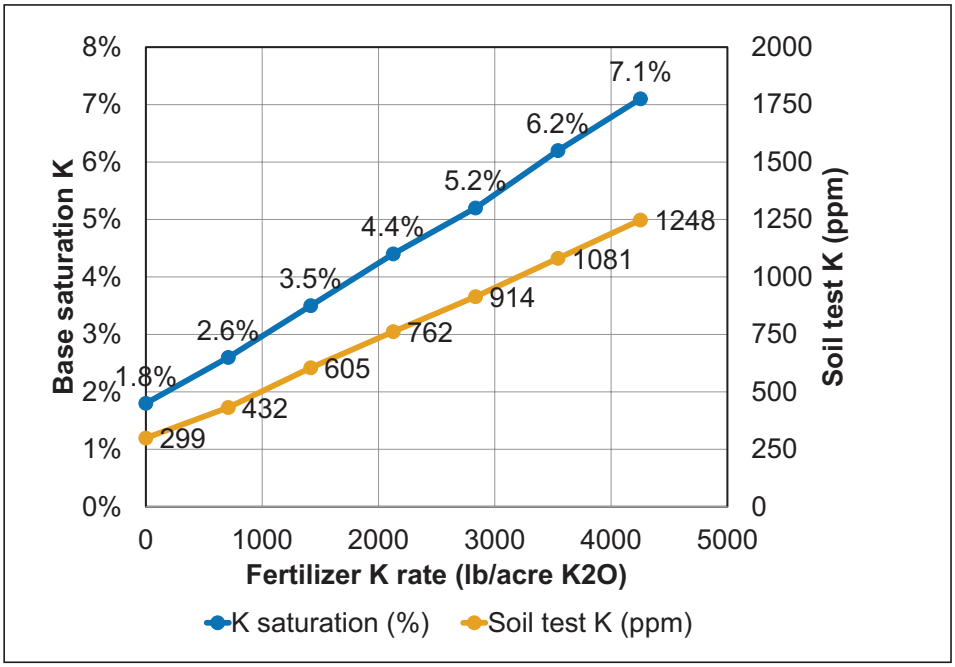

Figure 3. Effect of potassium fertilizer on soil test K (ppm) and K saturation (%) on a high pH soil. Reaching the 4 to 6% K saturation target required 2100 to 3500 lb/acre K2O (3500 to 5800 lb/acre KCl, 0-0-60). AGVISE Laboratories, 2021.

Beyond the economic cost, there are some agronomic risks associated with building K saturation so high. Some recent land-grant university research has documented occasional crop yield losses if potassium chloride rates exceed 120 lb/acre K2O (200 lb/acre KCl) in corn and 60 lb/acre K2O (100 lb/acre KCl) in soybean. The risk in soybean has been linked to excessive chloride accumulation, creating potential chloride toxicity. In the laboratory project, the potassium fertilizer rates required to reach the 4 to 6% K saturation target also increased soil test Cl into the 700 to 1160 ppm range, surpassing the chloride toxicity limit for most agronomic and horticultural crops (Xu et al., Advances in Agronomy 68:108).

Following the preliminary laboratory project, we thought agronomists and producers should have access to the data to make informed decisions. If you are thinking about applying extra potassium fertilizer to build K saturation following the BCSR concept, you may want to reconsider. The downsides include 1) extra expense for unneeded potassium fertilizer and 2) potential crop yield loss if potassium fertilizer rates exceed 120 lb/acre K2O (200 lb/acre KCl). We will update you on the field project at the AGVISE Soil Fertility Seminars in 2022.

More soybean acres? Make a soybean fertility plan

JODI BOE
AGRONOMIST, CCA

Higher soybean prices mean more soybean acres across the region. Whether or not you're a new soybean grower or a weathered veteran, we thought it would be a good time to get back to soybean soil fertility basics. Soybean is often billed as a low maintenance crop, requiring no fertilizer or even seed inoculation. The reality is if you expect soybean will be a low maintenance crop, you can expect low soybean yields.

Phosphorus

Soybean does not respond to phosphorus as dramatically as grass crops like corn or wheat do. Nevertheless, adequate soil test P is required to achieve good soybean yields. Soybean responds to broadcast P placement better than seed-placed or sideband P. In dryland regions where soybean is planted with air drills, seed-placed P or sideband P is often the only opportunity to apply phosphorus, and you must pay special attention to seed-placed fertilizer safety with soybean. An air drill with narrow row spacing (7.5 inch) should not exceed 20 lb/acre P2O5 (40 lb/acre MAP, 11-52-0). Fertilizer rates exceeding the seed safety limit may delay seedling emergence and reduce plant population. For wider row spacings, no fertilizer should be placed with seed.

Potassium

Be careful with placement of potassium fertilizer with soybean. The most common potassium source in the region is muriate of potash (potassium chloride, KCl, 0-0-60-50Cl). Do not place KCl with soybean seed; delayed seedling emergence and reduced plant population can occur. Any potassium fertilizer should be broadcasted or banded away from seed. Furthermore, the extra chloride in KCl can cause chloride toxicity and decrease soybean yields if too much is applied. Do not apply more than 100 lb/acre KCl before soybean or more than 200 lb/acre KCl before corn (assuming corn-soybean rotation).

Iron

Soybean is very susceptible to iron deficiency chlorosis (IDC). Soybean IDC is not caused by low soil iron but instead by soil conditions that decrease iron uptake by soybean roots. Soybean IDC risk and severity are primarily related to soil carbonate content (calcium carbonate equivalent, CCE) and worsened by salinity (electrical conductivity, EC) (Table 1).

Table 1. Soybean iron deficiency chlorosis (IDC) risk potential based on salinity (EC) and carbonate (CCE).

Salinity (1:1)	Calcium carbonate equivalent (CCE)		
dS/m	< 2.5 %	2.6 – 5.0 %	> 5.0 %
< 0.25	low	low	moderate
0.26 – 0.50	low	moderate	high
0.51 – 1.00	moderate	high	very high
> 1.00	very high	very high	extreme

Guidelines for managing soybean IDC:

1. Soil test each field, zone, or grid for soil carbonate and salinity. This may require soil sampling prior to soybeans (possibly outside of your usual soil sampling rotation) or consulting previous soil sampling records.
2. Plant soybean in fields with low carbonate and salinity (principal soybean IDC risk factors).
3. Choose an IDC tolerant soybean variety on fields with moderate to high carbonate and salinity. This is your most practical option to reduce soybean IDC risk. Consult seed dealers, university soybean IDC ratings, and neighbor experiences when searching for IDC tolerant soybean varieties.
4. Plant soybeans in wider rows. Soybean IDC tends to be less severe in wide-row spacings (more plants per row, plants are closer together) than narrow-row spacings or solid-seeded spacings.
5. Apply chelated iron fertilizer (e.g., high quality FeEDDHA) in-furrow at planting. In-furrow FeEDDHA application may not be enough to help an IDC susceptible variety in high IDC risk soils (see points #2 and #3).
6. Avoid planting soybean on soils with very high IDC risk.

Soil Health Focus: Picking a stable indicator

JOHN BREKER
SOIL SCIENTIST, CCA, 4R NMS

As soil health testing evolves, AGVISE Laboratories continually evaluates soil health testing methods that can provide useful assessments of soil quality and productivity. A suite of soil health indicators has emerged as a good set of tools to track soil management changes and improved soil health. These soil health indicators explore a range of important soil properties concerning soil microbial activity, nutrient cycling, water infiltration, and field trafficability. The soil health indicators are listed here:

- 24-h CO2 respiration (Solvita): general indicator of microbial activity
- Active carbon (POXC): easily accessible carbon food source for microorganisms
- Total organic carbon (TOC): overall organic matter and carbon sequestration
- Bioavailable nitrogen (ACE protein): protein-like organic nitrogen source for microorganisms
- Soil aggregate stability (water-stable aggregates): strength of soil aggregates to resist physical breakdown and maintain soil structure

As tracking tools, soil health indicators must be stable yet sensitive to changes in soil management. You want an indicator that will measure steady and gradual improvement in soil health, but not one that is so sensitive that seasonal variability masks the change. Some biological soil properties, like bacteria and fungi populations, fluctuate with the seasons and a single rain event may shift the populations up or down.

To learn if the new soil health indicators can be used as stable tracking tools, we found a long-term cropping trial near Hatton, ND with alfalfa, corn, soybean, and perennial grasses (CRP) and collected soil samples every two weeks during the growing season. We compared all the new soil health indicators as well as the popular Haney Soil Health Test, which had been required for some producers in UDSA-NRCS programs since 2015.

Let's focus on active carbon (POXC) as an example (Figure 4). It was much higher in the long-term CRP than the alfalfa or corn-soybean strips. Furthermore, active carbon was a little higher in the perennial alfalfa than the corn-soybean rotation, highlighting the role of active carbon as a leading indicator in soil organic matter stabilization. Overall, active carbon was stable throughout the year, making it a good tracking tool to measure soil management changes. To quantify the in-season variability, we calculated the coefficient of variation (CV, the lower the better). The active carbon CVs were quite low at 6-7% among the cropping strips, indicating good consistency in the data.

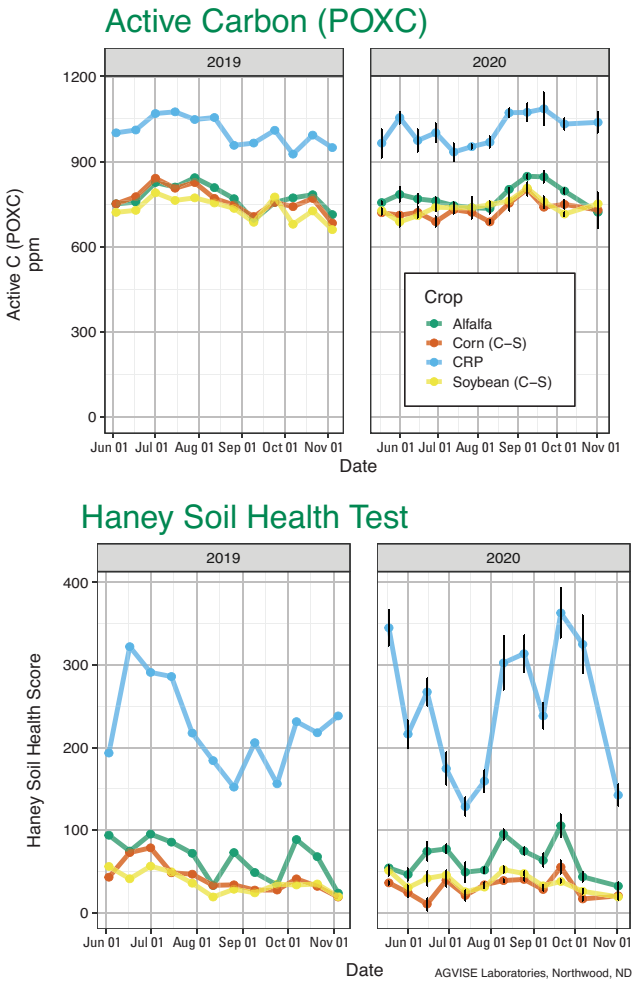

Figure 4. Soil health indicators, active carbon (POXC) and Haney Soil Health Test, measured biweekly at long-term cropping trial near Hatton, ND with alfalfa, corn, soybean, and perennial grasses (CRP).

In contrast, the Haney Soil Health Score was surprisingly noisy with CVs ranging from 33 to 45%! The Haney Soil Health Test is far too sensitive to environmental noise (i.e. weather) and cannot be considered a stable soil health indicator. If you collected a new soil sample every two weeks, you'd get a much different result. This helps explain why the Haney Soil Health Test has quickly dwindled in popularity since its debut.

The new soil health indicators offer promise in soil health monitoring, if used as tracking tools with soil samples collected every 3 to 5 years. When you change soil management practices, you need to know if soil health is actually improving with consistent and reliable soil health measurements. Take a look at these new soil health indicators and see if you are building soil health in your fields.

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CINDY EVENSON
PRESIDENT
AGRONOMIST, CCA

Welcome back spring! It is again that time of year when the new growing season has begun. It also means the spring soil sampling season is here, and you can be assured that we are ready to receive your soil samples.

During the winter months, we spend a lot of time preparing for the next growing season, much like farmers and other agribusinesses. In addition to cleaning and painting, we have made some laboratory upgrades to better serve our customers. Some new technology for nitrate and sulfur analysis is being phased into both Benson and Northwood laboratories. The new instrumentation will reduce chemical use and waste without sacrificing method accuracy or precision. We have also increased our total carbon analysis capacity with another dry combustion analyzer. The demand for total carbon analysis on soil and manure is increasing, and AGVISE is prepared to continue delivering fast turnaround times.

You may have also noticed our new website (www.agvise.com)! The new website has a sleek and clean appearance with new customer features including a rebuilt educational article section, online invoice payment, and shopping cart style ordering for soil sampling equipment and supplies. You also have free access to our AGVISOR online platform for submitting samples, viewing soil and plant analysis reports, and exporting data.

It was a productive winter "slow" season at AGVISE. I hope you were able to check some items off your winter to-do list as well. Have a safe and productive spring!

SOUTHERN TRENDS

RICHARD JENNY
AGRONOMIST, CCA

I think most of us are ready for winter to end and spring to arrive. It looks like a lot of corn and soybean acres will be going in and maximum (economic) yields will be the primary target. One of the basic necessities to achieve maximum economic yields is precision soil sample (grid or zone). It is well established that "one soil sample per field" is neither an economically or environmentally sound way to manage fertilizer rates.

Soybean cyst nematode (SCN) resistance to the PI88788 resistance trait continues to advance through the region and robs more soybean yield each year. This year, we will expand the SCN resistance project and ask that you look in your clients fields to learn if the soybean varieties are controlling/suppressing SCN population or not. As mentioned in the Fall 2020 Newsletter, it is easy to collect early and late season soil samples to monitor SCN egg counts. It only takes a couple large flags (sampling points) and a hand soil probe. With more soybean acres in 2021, it is an excellent time to investigate potential SCN resistance. Please call me to discuss the project if you're interested.

Let's all plan and expect an excellent growing season in 2021!