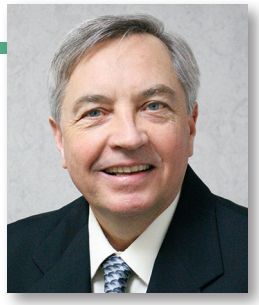
AGVISE LABORATORIES

Timely information for agriculture

40 YEARS ANNIVERSARY

Fall 2017

SOUTHERN TRENDS



RICHARD JENNY
AGRONOMIST/CCA

The harvest and soil sampling season this fall has been the latest that I can remember. Since late planting this spring, this year's delays have continued to multiply with excessive rain in late September and early October. Hopefully, we will have a long fall season, and harvest will end better than it started.

The Minnesota Department of Agriculture (MDA) is developing more nitrogen fertilizer regulations, specifically called the Nitrogen Fertilizer Rule. This summer MDA held many public meetings about the Draft Rule and requested public comments and input. They intend to release the final rule in Winter 2017 or Spring 2018. Once the rule is finalized, it is expected to be implemented in Fall 2018. The Draft Rule mainly targets areas designated as Vulnerable Groundwater Areas through restricting fall application of nitrogen-containing fertilizers.

We are slightly changing our January Soil Fertility Seminars this coming year. Previous meetings were held in Watertown, SD, but we are moving that seminar location to Dakota Magic Casino near Hankinson, ND (about one hour north). This meeting will be on Wednesday, January 10, 2018. We have a tremendous lineup of topics and speakers for the seminars. Hopefully, we will see you there!

Managing Nitrogen Following a Drought: How do you handle high residual soil nitrate tests?

Many areas of the western Dakotas, Montana, and Canadian Prairies experienced a severe drought in 2017. Crop yields were low in many drought-affected areas. Following drought, it is common to have high amounts of soil nitrate left in the soil profile (see figure). In some severe areas, more than 35% of wheat fields have tested over 100 lb/acre nitrate-N (0-24" depth) this fall.

We have received several questions about how to manage N fertilization for next year on fields that had high soil nitrate this fall. If you have a soil test report from a whole-field, composite soil sample, the nitrate test has value, but it does not address field variability. Most fields have areas with heavier soil types (more clay, higher organic matter) and lighter soil types (more sand, lower organic matter). In a drought, the

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AGVISE Soil Fertility Seminars January 9, 10, 11

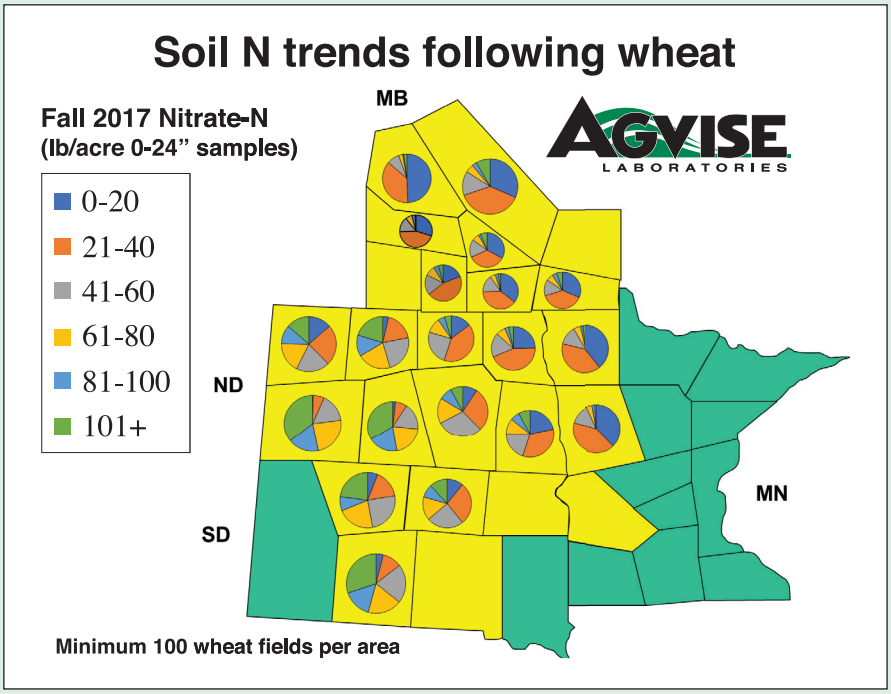
AGVISE Soil Fertility Seminar dates and locations are set. The dates and locations for our 2018 Soil Fertility Seminars are listed below. Please note that the new location of the January 10 seminar in Hankinson, ND. A registration letter was sent to AGVISE customers in early November. If you did not receive the mailing, please call 701-587-6010 and we will send it to you. 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 to let people know about these seminars. 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 Shelly or Patti.

Seminar Locations	CEU Credits applied for
January 9	
Granite Falls, MN	1.0 - SW, 4.0 NM
January 10	
Hankinson, ND	1.0 - SW, 4.0 NM
January 11	
Grand Forks, ND	1.0 - SW, 4.0 NM
March 14	
Portage La Prairie, MB	To be determined

Managing Nitrogen cont…

areas with heavier soils will produce a higher yield than the lighter soils. Heavier soils hold more soil water and produce higher yield, which turns into their having lower soil nitrate in fall because crop uptake and yield was much higher. The lighter soils, which do not hold as much water and produce much lower yield, would have high nitrate remaining in the soil profile. If you collect a composite soil sample from the whole field (e.g., 160 or more acres), the soil test report only shows you the average nitrate for the field. The composite sample does not address variability in soil nitrate across the field.

With this in mind, when you have a composite soil test and you intend to apply one N rate across the field, you will have to make a guesstimate about the range in soil nitrate levels across the field. Let's assume you have a composite soil sample with 130 lb/acre nitrate-N (0-24" depth) and the fertilizer guideline suggests 20 lb/acre fertilizer N for next year's crop. You need to decide if that 20 lb/acre N rate is sufficient for those parts of the field that produced moderate yield and have lower soil nitrate than the field average. To put numbers to it:



Let's assume the areas of the field that produced a moderate yield had 30 lb/acre less soil nitrate than the field average. You would need to apply 50 lb/acre N across the field to account for these lower testing areas [20 lb/acre N guideline based on composite soil sample + 30 lb/acre N to cover moderate yielding areas = 50 lb/acre N]. Hopefully, this N fertilizer rate would take care of the lower testing parts of the field.

In a perfect world, all fields would be soil sampled with several management zones. The zone samples would tell you how much nitrate is left in the different zones, even after a drought that increased field variability in soil nitrate; this would allow each part of the field to receive the fertilizer N required. In regions that test for fall soil nitrate, we receive more zone samples each year, so it is clear that farmers understand the benefits of zone soil testing and zone nutrient management.

Giant Pumpkins—Kids have a blast!

Adam Johnson has been growing pumpkins for many years. His personal best was 1,749 pounds in 2014 and took sixth place at the Sillwater, Minn. weigh off! This year, disease and weather took 5 of his 6 plants, so he only had one pumpkin that weighed 723 pounds. Even though mother nature threw him a curve ball this summer, his kids had a great time growing their giant pumpkin! You can see in the picture how proud they are of the pumpkin they grew this year. Who knows, maybe one of these kids will be setting new records for giant pumpkins in the next 20 years!

Implementing the New NDSU Potassium Recommendations for Corn

The August 2017 announcement of new potassium (K) recommendations for corn from North Dakota State University has generated much discussion. The new K recommendations are the result of the first serious evaluation of corn response to K in North Dakota. The recommendations are partly based on my M.S. research under Dr. David Franzen, NDSU Extension Soil Specialist. The new recommendations deviate considerably from previous recommendations because they now include clay mineralogy, an important factor in soil K dynamics, in predicting crop response.

We discovered that soils with high proportions of smectite clay require a higher soil test K critical level (200 ppm) in dry years; this is because smectite clay layers tend to trap K when soil becomes dry. Soils with greater illite clay were sufficient with the existing 150 ppm K critical level. This spring Dr. Franzen conducted a clay mineralogy survey of North Dakota to identify where soils with greater smectite clay were located (Figure 1).

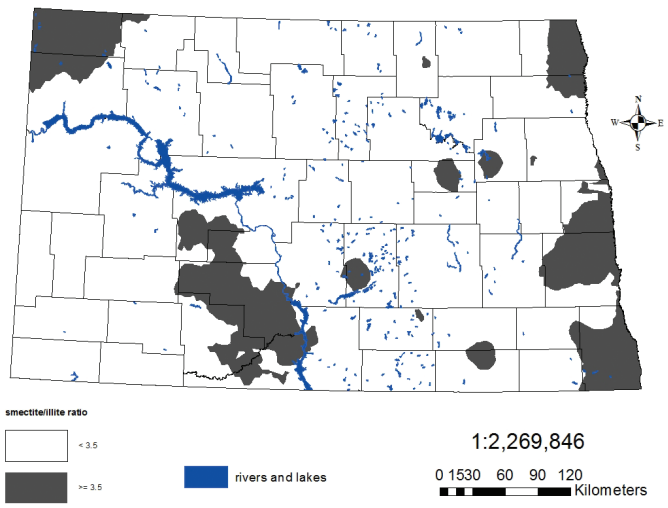


Figure 1. Smectite/illite ratio of the clay fraction of soils in North Dakota, where ratio>3.5 (gray) indicates areas with soil test K critical level of 200 ppm. *Results of soil sampling two to three major soil groups in each county of North Dakota, Spring 2017. (Courtesy of Dr. David Franzen, NDSU)*

For soils with soil test K above 250 ppm, a yield response to K fertilization is unlikely for soils with either clay type. For soils testing below 100 ppm, large K rates are still required in the new recommendations. Soils between 150 and 200 ppm K are those in the 'gray area,' where clay type becomes important. Incorporating these new recommendations into our AGVISE guidelines will not be not simple. We do not know where most soil samples were collected, and we serve customers across multiple states and provinces, where clay mineralogical data is sparse. For our North Dakota customers, we encourage them to consult the new NDSU recommendations and its clay mineralogy survey map to determine the soil test K critical level for your area (https://www.ag.ndsu.edu/cpr/soils/new-potassium-recommendations-for-north-dakota-crops-08-31-17). You may want to modify your K rates based on the clay type in your area.

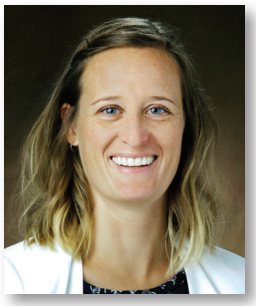
JOHN BREKER
SOIL SCIENTIST

The research also showed that if you were broadcasting K, a minimum amount of fertilizer material (60 lb/acre K_2O) was needed before a significant corn yield response occurred. A higher K rate is apparently required to deliver enough fertilizer granules close enough to each corn plant to increase yield. If K were banded, I suspect effective K placement may be achieved with K rates lower than 60 lb/acre K_2O. This research did not evaluate banded K application.

We also learned that there is a maximum fertilizer K amount that should be applied in a single application. When more than 120 lb/acre K_2O was broadcasted, there were often yield reductions. We are not certain why this occurred, but other researchers in the region have observed these yield reductions as well. If you are trying to build soil test K or apply multiple-year K rates, the highest rate to apply prior to corn is 120 lb/acre K_2O to avoid potential yield reduction.

The dry conditions of 2017 revealed more K deficiencies than previous years, and these observations have prompted more questions about K management. This winter AGVISE staff will be discussing how to incorporate this new research into our K guidelines, including their application to lower yield areas (e.g., western North Dakota) and grid/zone-sampling systems. Potassium is one topic that will be featured in our 2018 AGVISE Soil Fertility Seminars, where we will address more aspects of soil K dynamics and management. I encourage you to attend our upcoming seminars in January to learn more about this recent K research.

The Meaning of Soil Health: Testing and the Big Picture



DR. CALEY GASCH
NDSU

Multiple definitions of "soil health" exist. In general, they all recognize that soil is a complex system, with interacting physical, chemical, and biological factors, which should be managed in a manner that sustains its function and integrity over the long term. Conceptually, soil health is a topic that is easy to understand and support.

Yet, it has been difficult to capture this definition with measurements. Soil scientists can choose from hundreds of field- or laboratory-based methods to quantify different properties in the soil, but there is no single best test for assessing soil health. Research and commercial labs and focus groups across the country have compiled lists of properties that are being used to assess soil health, but we still have a lot to learn about how these suites of measurements can guide management decisions.

As much as we desire hard numbers that support the concept of soil health, I argue that we should keep the big picture in mind. Last summer, I heard a perfect analogy that demonstrates the disparity between the concept of soil health and the push for soil health testing. The idea solidified for me on a recent doctor visit.

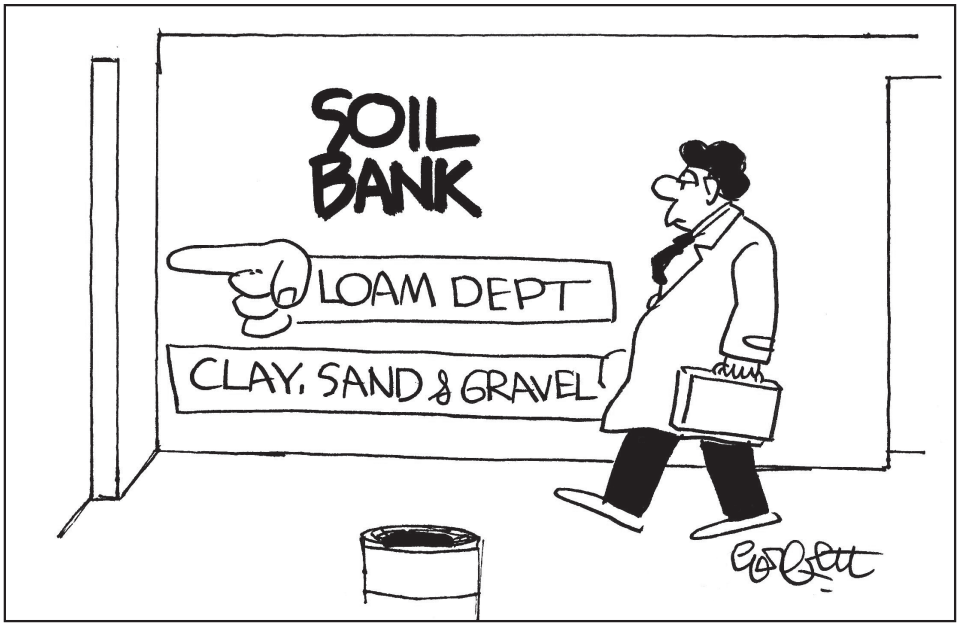
You visit your doctor for a routine check-up. The doctor will ask you about your lifestyle: How often do you exercise? Do you smoke? What do you eat? How many drinks do you have per week? Which medications are you taking? What is your family history? They'll take your weight, pulse, blood pressure, and temperature. They may order a few more tests, and they'll most likely give you some advice: Wear sunscreen, eat more oatmeal, and come back in a year.

The doctor learns something from your vital signs and can compare them to the past; however, the doctor learns more about your overall health after understanding your eating habits and levels of activity. After all, it wouldn't be good practice for the doctor to prescribe blood pressure medication solely based on a single blood pressure reading, or claim to know your heart condition based on your pulse alone (what if you ran up a flight of stairs on your way to the doctor's office?). You are not given a mathematical health score or rank. The doctor knows that your body is a complex system, and that to understand its overall condition, we need to consider how you care for yourself, any risky behaviors, and the results of some routine tests. Certainly, if you have a specific complaint, or if the doctor identifies a particular problem, appropriate tests are available to diagnose and monitor the malady.

I propose that we take a similar approach to soil health. First, understand the "lifestyle" of a soil: What is the rotation? What kind of tillage do you use and how frequently? Do you ever use cover crops? What is your fertility plan? What are the "genetic" limitations of the soil? Second, identify specific barriers to overall health: salinity, erosion, poor drainage, disease issues, etc. Third, identify areas for improvement, address them with a lifestyle adjustment, and develop a monitoring plan to track specific problem areas, realizing that it may take a few years to see change.

For humans and soils alike, we know that there are certain risk factors associated with health and condition. We know a great deal about how practices influence soil properties, and we don't usually need a test to detect whether or not a practice is healthy. The testing becomes meaningful only after we focus on a specific challenge area, which will differ from person to person and from field to field. Targeted testing and acute treatments are useful and necessary, but they should not be the basis for managing a complex system.

I'm grateful that soil health is a popular topic, because it is helping us all to think about soil in a way that recognizes its true value and potential. But I challenge us to remember our overall goal for soil health, rather than focusing solely on the vital signs. Approach each field with a broad view, understanding that it is a unique case that reflects its own history and management. From this perspective, we can identify and adopt practices that will protect our soil and improve its value throughout our region.



Lime Recommendations for the North

In the northern region, more soil samples are testing below soil pH 6.0, and lime applications are becoming more common. An accurate lime recommendation requires a buffer pH test (measures soil pH-buffering capacity) on samples with pH less than 6.0. To address the lime requirements of low pH samples received at the Northwood laboratory, we have included buffer pH on all conventional, composite samples with pH less than 6.0 at no charge. The buffer pH will tell you the lime rate required. In the northern region, many soils have subsoil pH greater than 7.0, which greatly reduces the likelihood of a yield response to lime, even when topsoil pH is less than 6.0. Ongoing lime research in North Dakota should help clarify if lime is necessary in these fields where subsoil pH is greater than 7.0. If you are encountering situations such as this, please call to talk with one of our soil scientists for help on deciding to lime.

Does Elemental Sulfur Lower Soil pH?

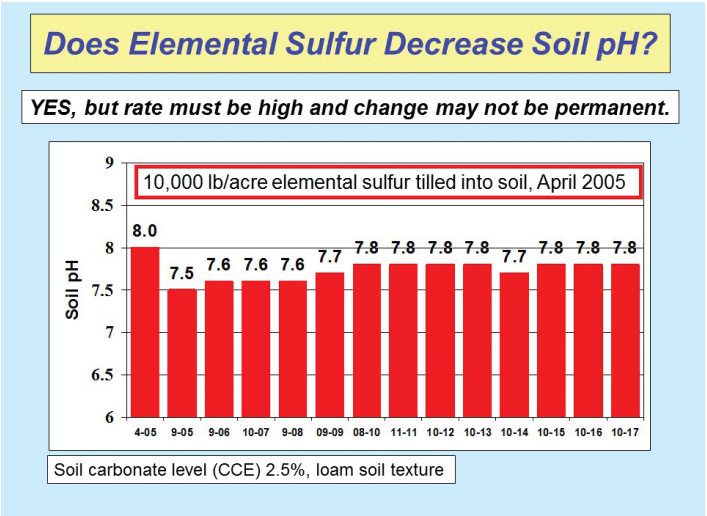
Some farmers have been calling and asking about something they heard on TV recently. They heard that applying large amounts of elemental sulfur (for example, 1000 lb/acre) would quickly lower soil pH.

Soil pH is a soil chemical property that measures soil acidity or alkalinity, and it affects many soil chemical and biological activities. Soils with high pH can reduce the availability of certain nutrients, such as phosphorus and zinc. Soils of the Northern Plains and Canadian Prairies frequently have high soil pH (greater than 7.3). Most of these soils have calcium carbonate (free lime) in the topsoil. Calcium carbonate is relatively insoluble and buffers soil pH around 8.0. Carbonates in topsoils of this region originate from soil formation processes since the latest glacial period.

So what about this suggestion that applying 1000 lb/acre elemental sulfur will lower pH? Elemental sulfur is oxidized by soil bacteria to create sulfuric acid, which certainly will lower soil pH. However, a high rate of elemental sulfur is required to permanently lower pH on soils with carbonates (soils with pH higher than about 7.3).

To lower pH in soils containing carbonates, the naturally-occurring carbonate must first be neutralized by the sulfuric acid produced by the breakdown of elemental sulfur. You can visualize the fizz that takes place when you pour acid on a soil with carbonates. That fizz is the acid neutralizing (reacting with) the carbonates in soil. Once all calcium carbonate in the soil has been neutralized by sulfuric acid, only then can the soil pH be lowered permanently. It is important to note that sulfate sources, such as gypsum ($CaSO_4$), do not create sulfuric acid when they react with soil, so they cannot neutralize the calcium carbonate.

In 2005, AGVISE started a soil amendment demonstration project on a soil with pH 8.0 and 2.5% calcium carbonate equivalent (CCE). One of the treatments was 10,000 lb/acre elemental sulfur. We figured if 1000 lb/acre elemental sulfur is suggested to lower pH, then 10,000 lb/acre should be even better! Good science tells us that this treatment would not significantly lower soil pH, but sometimes people must see the results for themselves. The figure below shows the soil pH decreased markedly in the first year, but the pH increased over the next few years because calcium carbonate in the soil was too much for the sulfuric acid generated from the elemental sulfur to neutralize. The soil pH increased back into the original pH range because of the remaining carbonates in the soil. The 10,000 lb/acre elemental sulfur rate was *too low* to neutralize the carbonate in the soil, and the lower pH was only temporary.



A rough calculation showed that this soil with 2.5% CCE would require about 16,000 lb/acre elemental sulfur to neutralize all carbonates in the topsoil. Such high rates of elemental sulfur are both impractical and expensive. The suggestion that adding a large amount of elemental sulfur, say 1000 lb/acre, to lower soil pH is probably not going work for most high pH soils in our region. We hope farmers do not spend their hard-earned money applying high rates of elemental sulfur in hope of lowering soil pH.

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PRESIDENT'S CORNER

BOB DEUTSCH
PRESIDENT
SOIL SCIENTIST/CCA

Since AGVISE started doing soil analysis in the 1970s, the way our customers receive their soil test results has changed greatly. In 1977, soil test results were typed onto soil report forms, and fertilizer guidelines were handwritten (ouch). Results were mailed to customers or delivered by phone if in a rush.

In 1980, AGVISE purchased a computer to print soil test results. The operating system and soil testing programs were stored on two 5 ¼-inch floppy drives. If my memory serves me correctly, we still handwrote the fertilizer guidelines on the reports for a few more years.

In the mid-1980s, we got a computer capable of allowing multiple users. All computer programs were re-written in Basic language, and we now had the capability of transferring data by modem. The first AGVISOR program was created, allowing customers to retrieve data from our server. In 1989, we started using barcoded reference number stickers to track soil samples and to eliminate customers having to write on sample bags. This was a huge improvement for our customers and our quality control in the laboratory!

The original AGVISOR program was written in DOS, and a second version called AGVISOR Gold was written for Windows. This program was installed on each customer's computer and required Microsoft Internet Explorer to work. AGVISOR Gold was difficult to support; every time Microsoft released a new operating system or Internet Explorer was updated, the program needed to be modified.

In 2011, AGVISOR was re-written as web application (current platform), which eliminated the need for on-site support! Customers could now view soil test reports using either Microsoft or Apple operating systems. In 2015, we added the capability to send results to customers in the MODUS format. The MODUS format is a universal data format for soil and plant analysis results that was developed by the soil testing industry. The current version of AGVISOR also has a feature called an API that allows the user to access results from our server and import them into their software. Through the years, AGVISE has been a leader not only in soil and plant analysis methodology but also in data delivery. With these advances in data transfer over the past 40 years, we want you to know that we are always examining the latest technology and data formats to make handling soil test data easier for our customers.

NORTHERN NOTES

JOHN LEE
SOIL SCIENTIST/CCA

I have lived through the drought of 1988, 2012 and now 2017. The drought this year was as serious as I have seen in the western Dakotas and parts of the Canadian prairie. I had never seen spring wheat not germinate until August, when rain finally came to the driest areas. Because of the drought, many fields in these western areas have very high soil nitrates levels this fall (see article on managing high N soils).

In the eastern areas, there were dry pockets here and there, but for the most part, crop yields were better than expected. The full profile of water from last fall really helped the eastern Dakotas get a good crop, with little rainfall this growing season.

The winter meeting season will start soon. We hope to see you at the Northern Ag Expo in Fargo on November 28 and 29. Our soil fertility seminars are also scheduled for January 9, 10, 11 (see article on seminars). We very much appreciate your business and hope we can keep serving you for many years to come!

Hope you have a great holiday season with family and friends!