Timely information for agriculture

AGVISE LABORATORIES

November 2015

SOUTHERN TRENDS

RICHARD JENNY
AGRONOMIST/CCA

The year 2015 should be one of those "Years to Remember" for our region. For the most part, producers had a tremendous growing season, great harvest conditions and excellent yields for corn, soybeans, sugarbeets and small grains. One of the drawbacks for 2015 are the low commodity prices. Unfortunately somebody in the world will probably have to have a crop failure for commodity prices to rally this coming year. Another issue is herbicide resistant weeds. That problem continues to increase in this region. There aren't any easy solutions to this issue either.

Fall soil testing was another year to remember! Sampling started early, got up to top speed quickly and continued strong all through the fall. There were hardly any weather delays or setbacks all fall. Agronomists have commented on the slightly lower soil test potassium (STK) levels this fall. The preliminary comparisons to past years data tend to confirm that the average K soil test level is a little lower than past years. Western MN and SD zip code averages from the Benson, MN lab do show that STK is 5-10% lower in the fall of 2015 than in the past 3 years. The main factors that contribute to lower than expected STK levels are:

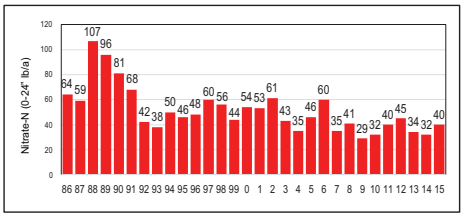
1) Little fall rainfall to leach potassium out of crop residues.
2) High yields means more K was removed in the grain than anticipated.
3) Dry soil tends to have a little lower K soil test compared to moist soils
4) Lower rates of potassium fertilizer were applied this year compared to past years.

We will be posting our annual soil test summaries on our web site by late November. At that point we will be able to compare nutrient trends across the region this year and to historic averages.

Why the higher N on wheat fields this year?

The year 2015 was a pretty good wheat year. Pretty high yields and good protein were the story in most areas. Many people were a little bit surprised when the soil nitrate (N) levels in many fields were a little higher than they expected after the good crop we harvested. You can see from the figure below that there was an average of 40 lb/a nitrate on over 25,000 wheat fields tested by AGVISE this fall. The 40 lb average is not that high when you look at the history over the past 29 years. There are some reasons why we should have expected a little more N left in the soil following wheat this year. Here are some of the factors that may have contributed to a little more N this year.

Residual Soil Nitrate Trends Following "Wheat" 1986 – 2015 (0-24" lb/a)



1. Growers applied some pretty high rates of N in 2015. They were trying to avoid the low protein wheat they had in 2014, so they did not skimp on the N fertilizer rates this spring.

Continued on page 2

AGVISE Soil Fertility Seminars Jan. 5, 6, 7

AGVISE soil fertility seminar dates and locations are set. The dates and locations for our 2016 Soil Fertility Seminars are listed below and 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 Location
(CEU Credits applied for)

January 5, Granite Falls, MN
1.5 - SW, 2.5 NM, 1.0 PM, 1.0 CM

January 6, Watertown, SD
1.5 - SW, 2.5 NM, 1.0 PM, 1.0 CM

January 7, Grand Forks, ND
1.5 - SW, 2.5 NM, 1.0 PM, 1.0 CM

March 16, Portage, MB
To be determined

INSIDE

Can You Change the %K? 2
Soil Testing Fertilizer Soybean Fields 3
Adam's Giant Pumpkin 3
Reclaiming Saline/Sodic Soils 4
Liming Up North 5
Tile Drainage Demo 5
Northern Notes 6
President's Column 6

Why the Higher N Cont…

2. Wheat yields were not quite as high this year compared to 2014. There was a stretch of high temperatures that reduced wheat yields. With a little lower yields in 2015, the total N uptake of the wheat crop was a little lower, probably contributing to more N left in the soil profile.

3. July and August were very warm this summer and probably resulted in more N being mineralized from the soil after the wheat was done taking up N. This extra N mineralized after the wheat crop was mature would result in slightly higher N in the soil profile in the fall.

4. Probably the biggest reason we have more N left after wheat this year is we did not have large N losses to very wet soil conditions when soils were warm. Many years we have an extended period in June when the soils are saturated and warm, resulting in denitrification losses on heavy soils and leaching on light soils. We didn't have any widespread events like that this year.

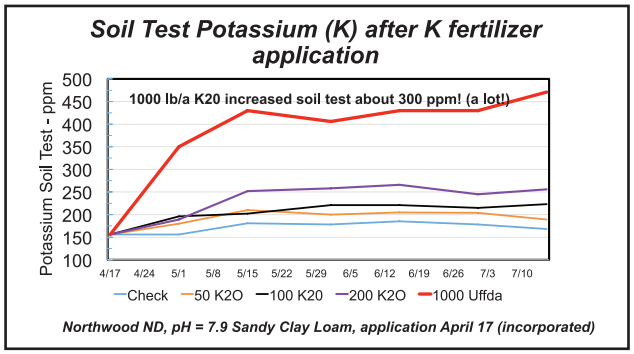
If each of these factors resulted in a few more pounds of N being left in the soil profile this fall, that would explain why the soil N following wheat is a little higher than last year, but not out of the ordinary in the long term. It is important to know that there can be large differences in the N left in the soil from one field to the next (see table). Each field has a different set of circumstances. The amount of N left in the soil on each field following any crop is affected, N rate applied, rainfall (too much, not enough), yield etc. Soil testing each field is the only way to know how much N is left over and to have a better idea how much N is needed for next years crop.

Residual N varies between Wheat Fields

Soil Nitrate Range (0-24" lb/a)	% of wheat fields in each range
0-20	21%
21-40	44%
41-60	20%
61-80	8%
81-100	4%
101-120	1%
>120	2%

Can you change %K on the Base saturation of your soil?

The past few years our staff has been getting questions about base saturation and cation ratios from farmers across the region. The farmers that called had attended meetings where they were told that a soil must have a certain %K of the base saturation to achieve high yields. At some of these meetings, farmers were told they needed to apply high amounts of potassium fertilizer to increase the %K of their soils to achieve higher yields. Some farmers were convinced by these meetings and went ahead with large applications of potassium fertilizer. (Even though their K ppm soil test level was already very high).



We know all of the research from the 1970's through today does not support the concept of ideal ranges for each cation. In order to show agronomists and growers that this cation range concept has a fatal flaw, we decided to do a demonstration project trying to increase the %K of a soil by applying more K fertilizer than is recommended based on the soil test level. The message at the meetings was that soils in this region have a low %K and they need additional potassium fertilizer for top yields. We chose a field near Northwood ND that has a K soil test level of about 150 ppm (0.6% K on the base saturation as calculated by the routine soil testing method). This spring we applied potassium chloride at rates of 50, 100, 200 and 1,000 lb/a K_2O and tilled the fertilizer into the soil before seeding. The 1000 lb/a rate is so high it really gets your attention. We figured we needed this high rate to have any chance on increasing the %K in this soil. This high rate of potash has been dubbed the "Uffda" treatment. I gave it this name because I am sure my Norwegian grandfather, who was a farmer, would have looked at this high rate and said "Uffda" that's a lot of potash!

We soil tested these treatment sites periodically through the season. As you can see in the graph, the K soil test level increased as the rate of K fertilizer increased. The Uffda treatment (1000 lb/a K2O) increased the K soil test a lot! (about 300 ppm). There were no visible differences in soybean growth with any of the treatments. The reason we did this demonstration was to see if we could increase the %K, as part of the base saturation. The graph shows that 1000 lb/a K_2O only increased the %K from 0.6% to 1.6%. This small increase in %K was not nearly enough to get the %K into a the higher magical range suggested to the farmers at these meetings (I guess we should have had rates higher than 1000 lb/a K2O - Ha Ha!)

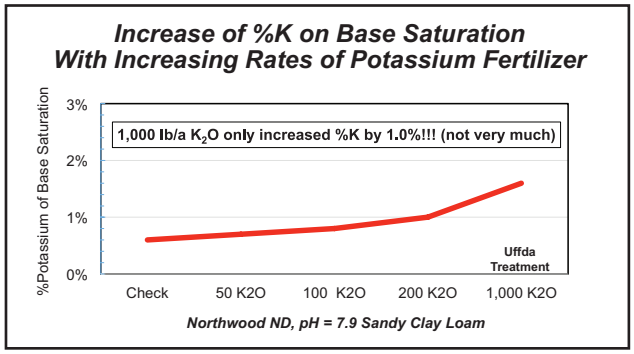
While this is just a demonstration project, there are some basic facts you can tell your growers:

1. Increasing the %K as calculated in the base saturation on a routine soil test requires extremely high rates of potash fertilizer (1,000 lb/a only increased the %K by 1.0%)

2. Soils with a K soil test level over 150 – 160 ppm, generally supply plenty of potassium to field crops (use plant tissue to confirm the K is OK)

3. If the K tissue level of a crop is in the sufficient range, it does not matter what %K of the soil base saturation is!

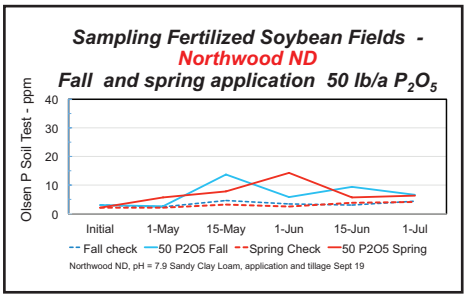
4. You should not worry about the %K in your soil, the only concern should be if the K soil test along with the applied K fertilizer is enough to achieve high yields.

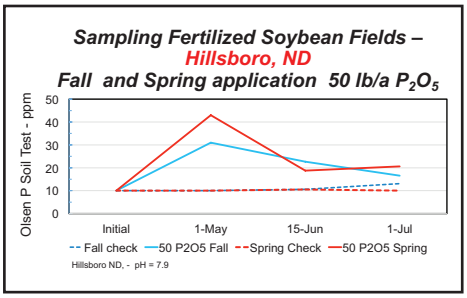


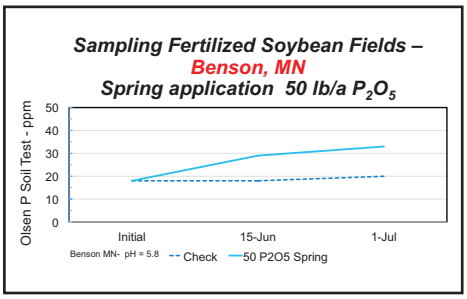
Soil Testing Fertilized Soybean Fields in Spring/Summer?

Spring/summer topsoil grid sampling has expanded greatly in areas with a corn/soybean rotation. Most of this sampling is done in growing soybean fields early in May and June. Usually the soybean fields have not had any P & K fertilizer applied to them. A common practice in many areas of the Corn Belt is to apply a high rate of P & K to the preceding corn crop and the soybean crop is not fertilizer with P & K. The rate of P & K applied is enough to take care of the needs for the corn crop and the following soybean crop. Grid sampling these soybean fields in May and June is a great time to collect good quality samples and provide soil test data that is ready for VR application of P & K immediately after soybean harvest. This type of sampling scenario has expanded greatly in the Corn Belt in the past several years. From a management stand point, doing sampling in May and June is easier than after harvest, you get a very high quality topsoil sample and you have plenty of time to get the test data back and develop the plan for variable fertilizer application right after soybean harvest.

Because of the success with spring grid sampling in soybean fields, we have received questions from agronomists about sampling soybean fields which "were" fertilized. They wanted to know if a moderate amount of P & K applied in the fall or even just before planting the soybeans, would affect the soil test values very much if they soil sampled the field in the growing soybean crop in May and June. To answer this question we set up a demonstration project in the fall of 2014. The rate of fertilizer used for this project was 50 lb/a P_2O_5 and 50 lb/a K2O. For this article we will only consider the data from the P fertilizer application. The P fertilizer was applied and tilled into the top 6" of soil after small grain or corn harvest on the three sites. The next spring, soybeans were planted on these sites and we soil sampled periodically until July 1. The







figures show how the May and June P test levels were affected by P fertilizer applied in the fall or in the spring at two locations in ND and one in Minnesota. The dashed lines are the P soil test values of the check without any fertilizer and the solid lines are the test levels when P fertilizer was applied in the fall or spring. This demonstration project confirms that a moderate amount of P & K fertilizer applied in the fall or spring will affect the soil test values if soil sampled in May or June. Based on this demonstration project, we do not recommend soil testing soybean fields in May or June if P & K fertilizer was applied the fall before or in the spring before planting. If you do, you will see some effect of the P fertilizer on the soil test values. If you are in a situation where the P fertilizer was placed in a band and you know the location of the band, you could get good quality samples by taking cores away from the fertilizer bands.

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Adam's kids on top of the giant pumpkin, official weight - 1,794 lb!

Adam Grew a Giant this year!

AGVISE did not have a giant pumpkin contest this year but once it gets in your blood, you just keep going for it! Adam Johnson has been growing giant pumpkins for many years and was rewarded this year with a personal best 1,749 pound giant! (Adam actually won the AGVISE contest every year we had it!) Adam won sixth place at the Stillwater, MN Harvest Festival this fall with very tough competition. This is a great achievement, but I am sure he will be trying to break records again next year! Congratulations to Adam for growing a 1,749 pound giant this year and best wishes for next year!

Reclaiming Saline-Sodic Soil with Tile drainage and Gypsum

As tile drainage has become more common in North and South Dakota and Northern MN, growers are encountering fields that have areas with both high salinity (salts) and high sodicity (sodium). Tile drainage is one way to lower the water table and leach some of the salts and sodium out of the soil profile over many years. If an area of a field has both salinity and sodium issues, a soil amendment like gypsum (calcium sulfate) may be needed to help remove the sodium from the soil and avoid dispersion of the soil particles. If the sodium level becomes high enough in a soil, the soil particles can retain excess water and may become dispersed at which time the soil structure is destroyed (see pictures of soils with moderate and high sodium and how the soil particles are dispersed with high sodium). Soil that becomes dispersed because of high sodium will seal up and water flow through the soil will be greatly reduced. The dispersion effect of high sodium is greatly reduced if the soil has high salts as well. A soil that has high salts (>2.0) and moderate sodium (10-15%) will still have good characteristics for water flowing through the soil. The high salt level of the soil maintains the structure and reduces the dispersion effect of the high sodium. Over the years if the salt level decreases (<2.0) and the sodium level remains high, the soil particles will swell or disperse because of the high sodium level and water will not flow through the soil.

Saline-Sodic Field Demo

Is Sodium causing Soil to Disperse and restrict water flow to tile?

Soil Sample depth	Soluble salts	%Na (routine test)	Sodium Adsorption Ratio
	1:1 (mmhos/cm)	%	SAR
0-6	2.7	10.4	9.0
6-12	2.8	12.3	12.3
12-18	2.1	12.2	13.4
18-24	2.9	13.4	13.2
24-30	1.5	15.5	13.3
30-36	2.5	12.5	12.4
36-42	2.3	11.4	10.4

In 2007 AGVISE started monitoring a recently tiled field of Mike Kozojed located near Mayville, ND . This field has an area that is high in salts and also has high sodium (saline/sodic). The productivity in this area of the field was very poor. Tile drainage was installed in this field in 2007 and 10,000 lb/a (5 tons/a) gypsum was applied to the saline/sodic area over the next two years. The gypsum was applied to help with the removal of the sodium from the soil profile through the years. Even though gypsum is not very soluble, enough dissolves to provide soluble calcium which can displace the sodium on the soil exchange sites. Tiling a field allows the salts and sodium to be leached lower in the soil profile and out the tile line in years with above average rainfall.

Since it has been 7 years since the tile was installed and gypsum applied to this field, we decided it was time to do a detailed soil profile evaluation in the saline and sodic area of the field. With the help of Ellingson Drainage and GK Technologies Inc. we were able to locate a tile line in the middle of the saline/sodic area. We collected soil samples every 6" directly over the tile line located at 42" below the surface. We tested for salts (1:1), and %Na with the routine method, as well as for saturated paste SAR (Sodium Adsorption Ratio).

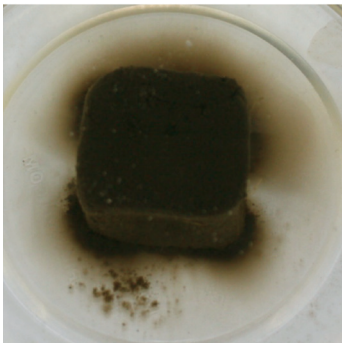
The data in the table shows the salt level in most parts of the profile are still greater than 2.0 and the % Na is less than 15%. The exception is the 24-30" portion which has a salt 1.5 and %Na of 15.5%. While this portion of the soil profile still has good structure and allows water to flow through, there is concern about the lower salt value and the higher sodium value in the 24-30" zone. If this trend continues, the salt value may get low enough so the sodium will cause swelling or dispersion of the soil particles and water flow in this portion of the soil profile will be restricted. This will make it difficult for surface water to reach the tile at 42". While changes in the salt and sodium level in the soil in this area of the field have been very slow, these changes will continue into the future. Having tile drainage in this field for 8 years has kept the size of the high salt and high sodium area from getting larger. Even though the productivity of the saline and sodic area of the field has not increased much with 8 years of tile drainage and 5 tons of gypsum, the rest of the field has benefited greatly with large increases in corn and soybean yields.

Options other than row crop production should be considered for the saline/sodic area of this field. The productivity of the saline/sodic area has not improved much in 8 years and there is no reason to think productivity will increase quickly in the future. Seeding this area to salt tolerant perennial grass should be considered. There is not enough crop produced in this area to cover the cost of the seed, fertilizer and other crop inputs each year. Once this area is seeded to grass, the area should be soil tested periodically to measure the improvement in salts and sodium. At some time in the future, if the salt and sodium issues have improved greatly, this part of the field can be brought back into row crop production.

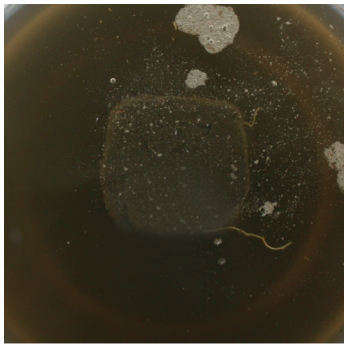
Topsoil - 2 minutes
10% Sodium - No Dispersion

Topsoil - 1 hour
10% Sodium - No Dispersion

Sodic Soil - 2 minutes
45% Sodium - Dispersion Starting

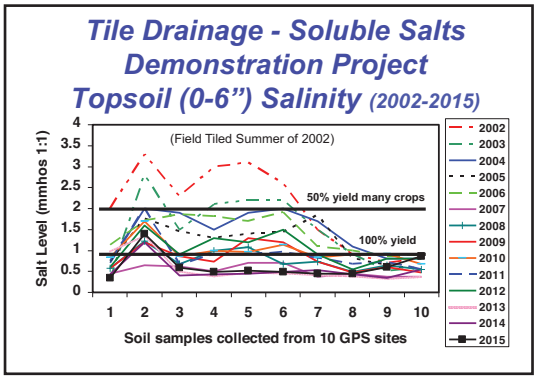


Sodic Soil - 1 hour
45% Sodium - Dispersion Continues



Tile Drainage Demo – 14 years and counting

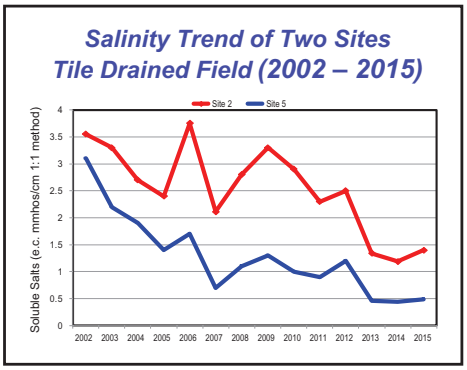
Increasing salinity (salts) has become more of a problem in many areas of the northern plains the past 15-20 years due to excessive rainfall. Excessive rain and fine textured poorly drained soils are a bad combination. High rainfall for many years has lifted the water table close enough to the surface to wick water to the soil surface and leave the salts behind. The soluble salts left on the soil surface can reduce plant growth and yield. If this situation occurs for many years, the soluble salts will accumulate on the soil surface and reach a high level which will reduce yields of many crops.



Surface drainage, along with tile drainage and continuous cropping are the only way to lower the water table and reduce the salt level in soil over time. There are no magical soil amendments that will reduce the salt level in soil (we wish there were!). Once the water table is lowered, this stops the capillary action which brings water and salts to the soil surface. Once the wicking is stopped, the salts can be moved down and out of the topsoil and the production of the field will increase.

AGVISE started a tile demonstration project in 2002 with the cooperation of Grady Thorsgard a farmer in the Northwood ND area. The salinity level in this field had increased to the point yields of many crops were reduced. Tile was installed in this field and we started monitoring the salt level in the fall of 2002. We established 10 GPS points to monitor the change in salinity each year. Each fall after harvest we collect 0-6" and 6-24" soil samples and test them for salinity and all other nutrients.

In the figure you can see that over the past 13 years the topsoil salinity has decreased significantly in this field. Site 2 and site 5 had the highest initial salinity of the ten sites. You can see in the figure that in the dry years the salinity stayed the same or increased slightly, but over many years, the salinity at these two site has decreased greatly. The salinity has been reduced, because the tile drainage has lowered the water table and excessive rainfall has leached some of the salts out of the topsoil. Improving crop growth through the years has also helped remove more water from the soil profile each year, helping to keep the water table lower in the soil profile. This field now produces high yields of many different crops without losing yield to salinity. We expect the salt levels in this field to continue to decrease slowly into the future.



Liming up North?

Liming is not a routine practice in the northern great plains like it is in the eastern Corn Belt. Most soils in this region have a pH higher than 6.0 which do not generally require liming for high yields of most crops. Soybeans is the row crop that will suffer the most if a low soil pH limits the activity of bacteria that help fix nitrogen for the crop. Zone and grid soil sampling divides fields into smaller areas is revealing areas of fields with very low pH. With zone and grid sampling increasing across this region, we are becoming more aware of soils with pH less than 6.0 that may require liming.

In the spring of 2014 we found an area of very low soil pH in a field just a few miles from our laboratory in eastern ND. The topsoil pH was 4.8 and the subsoil pH was less than 6.0! This low pH area in the field was over 20 acres and was large enough for the grower to consider applying lime. In May of 2014 we applied three rates of lime to a demonstration area in this field. We used spent beet lime because it is available locally and the only cost is the transportation to the field and spreading. Sugarbeet lime has an ENP (effective neutralizing power) of about 80%.

Three rates of lime were applied and tilled into the soil (see table). Soybeans were planted on this field last year and corn was grown this year. The soil pH has increased based on the rate of lime applied (see table). This year we did observe a height difference in the corn early in the season based on the treatments. We collected tissue samples and the only nutrient that was different between the treatments was sulfur. Apparently there is some sulfur in the beet lime that did increase the concentration of the sulfur in the plants and the growth of the corn early in the season.

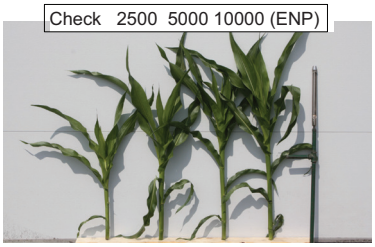
Next year this field will be planted to soybeans which are more sensitive to a very low soil pH. This demonstration project is a long term project as we measure the effects of the lime application on the soil pH and on the growth subsequent crops in this field. We are doing this project to increase the awareness of low pH soil in areas that historically do not apply lime. Zone and grid soil sampling are tools which can help you to reveal areas of fields which may require lime to reach top yield potential.

Effect of lime on Soil pH (so far!)

(Application May 22, 2014)

Beet Lime Rate (ENP)	pH 7-15-14	pH 9-27-14	pH 6-22-15	pH 7-28-15
Check	4.8	4.8	5.1	4.7
2,500 lb/a	5.3	5.5	5.3	5.2
5,000 lb/a	5.7	5.6	5.6	5.7
10,000 lb/a	6.6	7.4	7.0	7.0

Observed differences with Beet Lime



(Corn sulfur sufficient range is .16% to .50%)

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BOB DEUTSCH
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The "Holy Grail" for a soil fertility scientist would be to develop a soil test that would predict the amount of nitrogen a soil would release/mineralize during an average growing season. If this nitrogen mineralization test could accurately predict the release of nitrogen from the soil for the coming year, that would be heralded by agronomists, the farming community and environmentalists as well. We are all trying to protect the water sheds we all drink from! To the layman, developing a soil N mineralization test sounds like a simple task, but hard working researchers have not been able to come up with this test in many decades of research.

The amount of nitrogen a soil will release during a growing season is affected by a multitude of factors. Some of these factors include: organic matter content, the type of organic matter, carbon-nitrogen ratio of fresh residue, N fertilization history, tillage history, soil texture, soil moisture, and soil temperature. The last two factors, moisture and temperature, are important variables in the amount of N that a soil will release and cannot be predicted with any reliability before the season begins.

About fifteen years ago a new soil test was introduced by researchers in Illinois that became somewhat of a rage in the Midwest. Many labs, including AGVISE, offered this test known as the Illinois Soil Nitrogen Test (ISNT). This test measures the amount of amino sugar nitrogen in the soil, which was thought to be related to nitrogen release. Researchers outside of Illinois found the ISNT test was not highly correlated to crop yield response. As it turns out the ISNT test was highly related to soil organic matter but not how much N was going to be mineralized by the soil the next season. The ISNT test has been dropped by most labs, including AGVISE.

Currently a new soil test called the 24 hour carbon burst test (also called the Solvita test) has become the "hot" soil test across the US. The carbon burst test is the basic building block of the "Soil Health Test" promoted by the NRCS. One of the payment enhancements offered farmers by the NRCS is having fields tested for "soil health". This fall we have tested hundreds of fields for soil health which includes the carbon burst test. Since research is very limited on the carbon bust test in the Upper Midwest, AGVISE does not adjust fertility recommendations based on the carbon burst test.

Researchers will continue looking for a new test which will give us a better idea of the amount of nitrogen a soil will mineralize/release each year (Holy Grail!). Being able to incorporate the expected precipitation and temperature for the next growing season will make this task very difficult. What may be possible is some type of mineralization test that can be used to do minor adjustments ("tweak") our existing nitrogen recommendation up or down 10 or 20 pounds/acre. In future columns, I will discuss some impacts of moisture and temperature on soil nitrogen mineralization.

NORTHERN NOTES

JOHN LEE
SOIL SCIENTIST/CCA

The year 2015 was crazy for the northern region. The spring started out very early and very dry. The small grain crops were seeded early and some of the corn as well. Then we had rain, two weeks of cold temperatures and frost. These conditions did cause some stand loss in the early planted corn and a lot of canola had to be reseeded. We had a long warm growing season and some areas suffered with dry conditions. Harvest season started early and progressed very nicely in most areas. Wheat yields were pretty good and the protein levels were much improved from last year. Soybean yields were all over the board as rainfall was hard to come by in late July and August in some areas. Corn yields ranged from good to great and having dry corn at harvest saved growers a lot of money.

Fall soil testing started early and the demand for soil testing has been very high. With lower commodity prices, growers are watching all of their expenses closely. Soil testing helps them to apply only the fertilizer they need for the coming year. AGVISE soil fertility seminars will be held January 5, 6, 7. We have a great group of speakers and topics again this year and are looking forward to seeing everyone. We mailed the seminar announcement to our customers early in November so they have the first chance to sign up. An email announcement was also sent a couple weeks later. In the past we have had waiting lists due to space limitations, so please sign up early to reserve your spot at our seminars. If you did not receive the email about our seminar, please give our office a call so we can get your current email address.

We hope everyone has a fun and safe Holiday season with family and friends!