Timely information for agriculture

AGVISE LABORATORIES

SPRING 2013

NORTHERN NOTES

JOHN LEE
SOIL SCIENTIST/CCA

Spring is here and we are ready to provide top notch service and technical support to all our customers. Spring soil testing is always hectic, but our recent expansion in facilities, lab equipment and staff will help us serve you even better this spring.

Concerns about continued drought is on a lot of people's minds this spring. Last year, the northern region escaped the worst of the drought, but many of us old timers can remember 1988 and we don't want to experience that again. With that in mind I am sure everyone is trying to minimize tillage to conserve soil water this spring. Many areas do not have a lot of stored soil moisture, so any water you can save during seeding will benefit you later in the season.

Corn and soybean acres continue to increase in the northern region. This trend now reaches well into Manitoba. As northern growers learn more about growing high yield corn and soybeans they sometimes look to the southern Corn Belt for answers. In the southern Corn Belt some growers don't use a starter fertilizer for corn. In northern areas, with our shorter growing season, it is critical to have an aggressive starter fertilizer plan with as much P as you can safely put near the seed. Having a good starter program provides early season vigor and may reduce days to maturity.

If you need any soil or tissue sampling supplies please give us a call. We also have great sampling equipment that will make your soil sampling operation more efficient.

Have a safe spring season!

Early Summer Grid Sampling

Early summer (May-June) topsoil grid sampling has been increasing for several years in the areas served by our Benson, MN laboratory. Most of this area is in a corn soybean rotation with sugarbeets in southwestern MN. About 50% of all grid samples in this region are now taken from early May through late June with the remaining samples being taken in the fall after harvest on soybean stubble. Customers tell us that early summer topsoil grid sampling is a good time to take samples. Some of the reasons include excellent sample conditions due to moist and firm topsoil conditions after planting. The results are good quality topsoil samples which in turn provides quality soil test data and more time to prepare for fall P & K applications.

In the areas of sugarbeet production in southern MN, with corn and

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Nitrogen High Region Wide

Soil N levels last fall showed many areas with higher than normal carry over in the 0-24" soil profile. While drought affected all areas to various degrees, there were several reasons why high soil N levels should not be a surprise. Here are some reasons why many areas have higher than normal soil test levels:

1. Early seeding dates encouraged growers to shoot for high yields and high N rates were very common in most areas.
2. Little or no N was lost to leaching or denitrification during the season (we have gotten used to N losses through the wet cycle the past several years).
3. Mineralization of N from soil OM at the surface may have been increased due to warm summer temperatures.
4. Crop yields were good in most areas, but the soil N and moisture taken up by crops later in the

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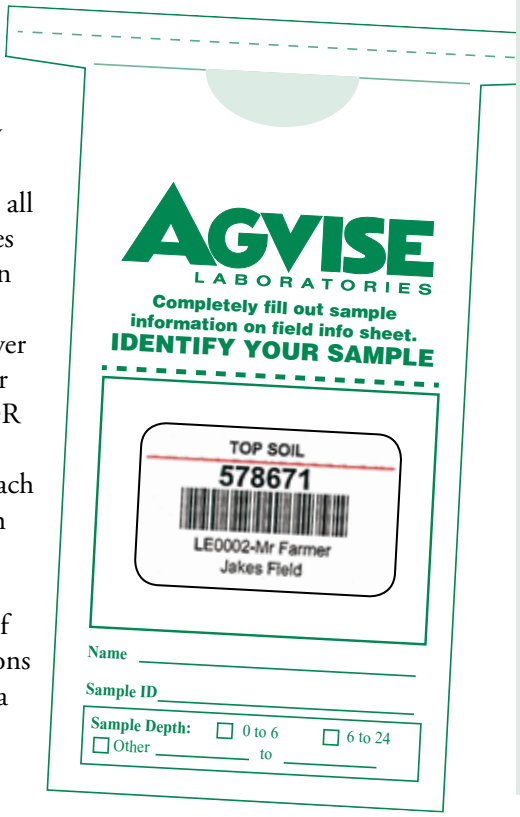
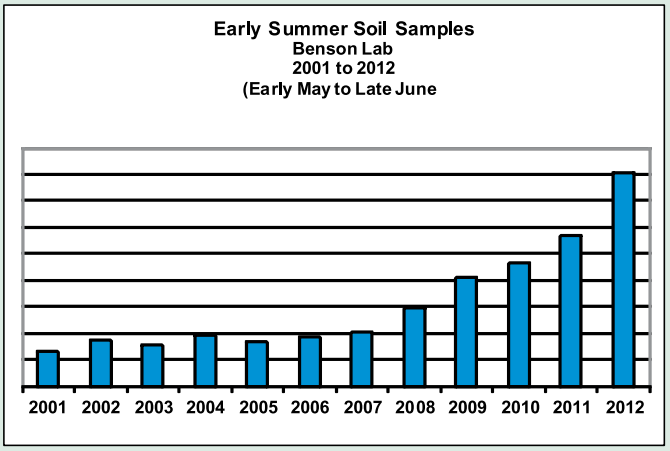
INSIDE

Kick Start Your Online Sample Submission

We can help you "Kick Start" your online sample submission! We now have a program that can help you import all of your grower names and field information from 2012. All you need to do is look over the grower names for samples in AGVISOR Lite and make corrections so that each name is on the list in only one way. Please do these corrections on crop year 2012. If you have any questions please give our staff a call so we can help.

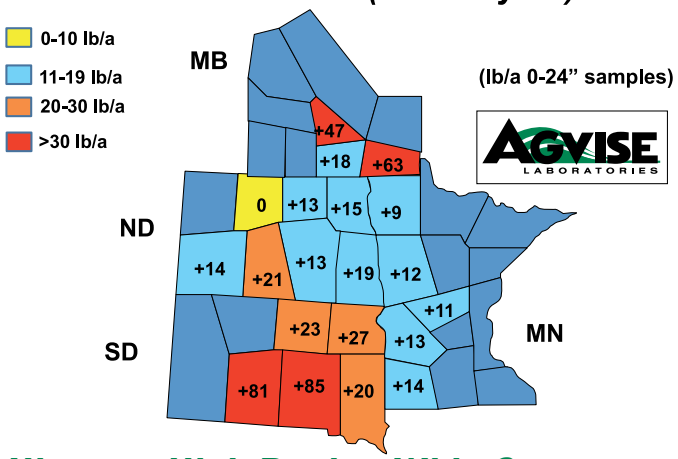




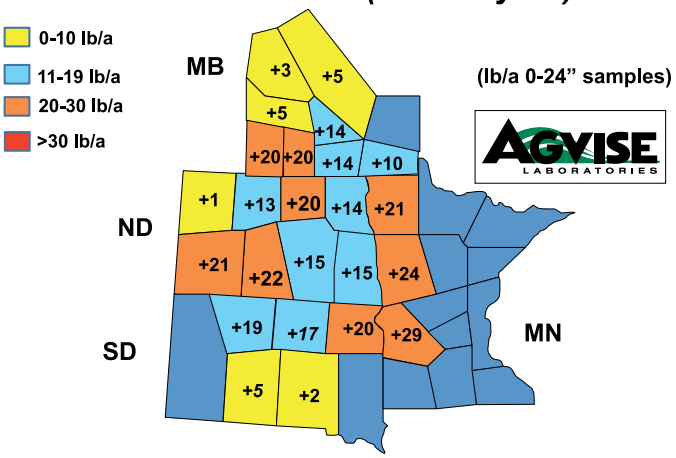
Early Summer Grid Sampling Cont…

soybeans also in the rotation, fields are topsoil grid sampled (2.5 acre) the soybean year for the following corn crop and then prior to sugarbeets they are zone sampled for deep nitrates (0-6", 0-24" and 42-48" deep nitrate testing). These zone samples going into sugarbeets are primarily based upon the relative organic matter (OM), productivity and topography. In areas with a corn-soybean rotation, grid samples are taken every 3-4 years.

Average 2012 Soil N Following Corn Increase Over 2009 (normal year)



Average 2012 Soil N Following Wheat Increase Over 2009 (normal year)



Nitrogen High Region Wide Cont…

season came from deep in the soil profile. Some nitrogen was stranded in the topsoil when it became too dry for root uptake.

The figures show how the average soil N following wheat and corn in 2012 compare to a more normal year like 2009. The areas in orange and red have average N levels that are much higher than normal. One of the effects of drought is variable yield across fields, based on the soil water holding capacity. For customers who have been zone sampling fields, this is a big advantage. When dry conditions occur, zones which produced lower yields due to drought stress have higher amounts of residual soil N. This allows you to better manage the nitrogen fertilizer needs for the following year for each zone in that field.

Dentrification Potential and N Variability

Following drought years, there is a tendency to have a higher concentration of nitrate-nitrogen in the topsoil compared to years with normal rainfall (see table). Some of the reasons this occurs are:

1. Fertilizer nitrogen in the topsoil gets stranded when the soil gets so dry that roots can't take up the nitrogen.
2. Mineralization of organic matter continues at the surface when small rain showers wet the top few inches of soil stimulating the microbes to release nitrogen from the organic matter but not enough moisture to help crops.
3. No nitrogen is moved from the top soil by leaching during the growing season.

Topsoil N – Higher after Dry 2012

Crop Year	Crop Grown	Crop Grown
	Wheat 2012	Corn 2012
	Ave. 0-6" N	Ave. 0-6" N
2012 (hot and dry)	22 lb/a	25 lb/a
2009 (normal)	12 lb/a	13 lb/a

You would think that having a ready supply of nitrate-nitrogen in the topsoil would always be a good thing, but there is also risk that comes with this situation. Early in the spring the topsoil is full of water and frozen. Even small amounts of rainfall last fall supplied enough water to fill the top several inches of topsoil with water. When the snow melts, the topsoil will be saturated with water for some time on soils that have not completely thawed. This is the time when denitrification losses can happen.

Denitrification can happen at temperatures in the low 50's F. The top inch or so of a black soil can easily warm to 50° F even when the soil temperature is only 35-40 at a 4" depth. Once the soil reaches 50°F at the surface, if the soil is water logged and there is plentiful nitrate-nitrogen near the surface, the bacteria in the soil will use the oxygen from the nitrate converting it to N2 gas which is lost to the atmosphere (see chemical reaction).

$$NO_3^- \rightarrow NO_2^- \rightarrow NO \rightarrow N_2O \rightarrow N_2\ (Gas)$$

Many of us witnessed this happen following the drought of 1988. In areas where there were snow drifts such as by shelter belts, the top soil was saturated with water and the spring warmed up very quickly causing denitrification losses from the surface soil. These areas of the field became nitrogen deficient and you could see this effect wherever there was deeper snow in fields.

Another factor that comes into play following a drought is the variability of N from one area to another in fields. Areas that yielded well may have very little nitrogen left in the soil profile while other areas of the field that had poor yield have much more nitrate nitrogen left over in the soil profile. The more severe the drought, the more variable the nitrate level is from one area to another within a field. We have observed this variability as more fields are zone soil sampled each year for nitrate-nitrogen 0-24". When fields are split into zones for soil sampling, many times the zones created are related to productivity. In many instances this productivity is related to soil texture and drainage which are highly related to crop yield in a drought situation.

So what are you supposed to do if you have a lot of fields with composite soil test results showing a high level of nitrate nitrogen in the 0-24" profile and a lot of that N is in the topsoil?

Example:
N = 90 lb/a 0-6"
N = 70 lb/a 6-24"
Total N = 160 lb/a 0-24"

Let's say this is a wheat field going into corn and you are working with a budget of about 170 lb/a for nitrogen (soil plus fertilizer N). Because of the N variability the drought causes in fields, we know that there will be parts of this field testing at least 30-40 lb/a less than the 160 lb/a composite soil test result. You may want to apply 30 - 40 lb/a actual N to make sure those areas testing lower than the field average will receive enough nitrogen. While we know some of the field will get more nitrogen than needed, there is no way to know where those areas are without sampling the field in productivity zones. A base rate of 30 - 40 lb/a actual N will cover some of the N variability in the field caused by the drought. In the future, zone soil testing based on productivity will provide better information to know which areas of a field need more or less nitrogen following good yields and even following a drought year like 2012.

Fallow Syndrome—Don't Forget History!

Fallow syndrome in corn has been recognized since the early 80's and is popping up again in northern areas new to corn production! Fallow syndrome is caused by the lack of mycorrhiza fungus infecting corn roots and resulting in reduced uptake of nutrients such as phosphorus. This syndrome was initially observed when summer fallow was a common practice and tillage was used to keep fields weed free. With no plant growth in these fields, the population of mycorrhiza fungus crashed and the following crop of corn suffered P deficiency symptoms. Additional research found that canola and sugarbeet crops do not support the mycorrhiza fungus either, so a corn crop following these crops suffered the same P deficiency symptoms as "Fallow Syndrome" due to lack of mycorrhiza fungus helping the corn crop take up enough P.

The information we learned on "fallow syndrome" from the mid 80's is worth looking at one more time. A research project was set up by establishing low and high P sites and then establish different crop rotations. Table 1 shows the early growth response to corn from having different previous crops on soils with low and high P soil test levels. There was a very large corn growth response early in the season when the previous crop was fallow on the high P soil, compared to the other previous crop and tillage situations. We would expect this same kind of response if the previous crop was canola or sugarbeets because these crops do not support mycorrhiza fungus on their roots.

In table 2, the research shows the delayed silking date caused by the previous crop of fallow (the same would be true for canola or sugarbeets as previous crop). This is a critical factor as corn acreage expands into northern North Dakota, Northern Minnesota and areas of Manitoba as well. With an 8 day delay in silking, this may be the difference in making corn grain or ending up with silage (remember 2004?).

Corn – Early Growth Response to Previous Crop and Soil P (Fallow Syndrome)

SDSU – SE Exp Station 1987

Tillage	Previous Crop	Low P Site	High P Site	Increased growth	% Increased Early Growth
		Grams/12 plants	Grams/12 plants		
MP	Fallow	11.6	56.1	44.5	384%
MP	Barley	20.5	44.8	24.3	119%
MP	Corn	30.8	47.1	16.3	53%
RP	Soybean	47.6	51.1	3.7	8%
RP	Corn	28.7	35.4	6.7	23%

MP = Moldboard Plow RP = Ridge Plant
Low P site = 12 ppm High P site = 45 ppm
Plant samples collected at 6 leaf stage

TABLE 1

Corn – Silking Date Response to Previous Crop and Soil P (Fallow Syndrome)

SDSU – SE Exp Station 1987

Tillage	Previous Crop	Silking Date	Silking Date	Difference
		Low P site	High P Site	Difference
MP	Fallow	July 11	July 3	8 days
MP	Barley	July 7	July 9	2 days
MP	Corn	July 7	July 4	3 days
RP	Soybean	July 5	July 5	0 days
RP	Corn	July 6	July 6	0 days

MP = Moldboard Plow RP = Ridge Plant
Low P site = 12 ppm High P site = 45 ppm

TABLE 2

Corn – Influence of Previous Crop and tillage on Micorrhizal Rating (Fallow Syndrome)

SDSU – SE Exp Station 1987

Tillage	Previous Crop	Micorrhizal Rating (1) Low P site
MP	Fallow	1.23
MP	Barley	1.50
MP	Corn	1.72
RP	Soybean	1.88
RP	Corn	2.07

(1) 1to 5 with 5 indicating 100% root infection

TABLE 3

Corn – Influence of Previous Crop, Soil P and Tillage on Yield (Fallow Syndrome)

SDSU – SE Exp Station 1987

Tillage	Previous Crop	Grain Yield	Grain Yield	Yield Increase
		Low P site	High P site	
		bu/a	bu/a	bu/a
MP	Fallow	141	170	+29
MP	Barley	153	160	+7
MP	Corn	127	158	+31
RP	Soybean	179	175	-4
RP	Corn	135	156	+21

MP = Moldboard Plow RP = Ridge Plant
Low P site = 12 ppm High P site = 45 ppm

TABLE 4

Table 3 shows the influence of crop rotation and tillage on mycorrhizal rating on the low soil P site. You can see that the mycorrhizal rating is the lowest where "fallow" was the previous crop. This would be true if the previous crop was canola or sugarbeets as well.

Table 4 shows a significant yield response for corn following fallow and continuous corn (MP and RP) on the high P site. While there were tremendous early season growth differences for corn following fallow, the researchers said the corn seemed to catch up by the end of the season. It is important to remember that this research was conducted in southeast South Dakota with a long growing season. In the new corn growing areas to the north, there are less days in the growing season and less heat units in most years.

The take home message from this research is to avoid planting corn on fields that were fallow, canola or sugarbeets the previous year if you don't have too! If you must plant corn on these acres, be sure to place the highest safe rate of P with or near the corn seed. It is also advisable to broadcast additional P fertilizer if the P soil test is not in the very high range. This past year as corn acres expanded north it was easy to find ugly purple corn fields that were planted on sugarbeet ground in the Red River Valley and some on canola ground in areas to the north. There is no need for history to repeat itself when we have the information to avoid this situation. Please make sure your growers understand what can happen when corn is planted on fields that were sugarbeets or canola the previous year.

Ammonium Sulfate With the Seed? (Beware!)

Banding fertilizer with the seed is a common practice in canola production. Having P fertilizer near the seed increases seedling vigor and is a recommended practice as long as the rate is low and stand is not reduced significantly. Sulfur is also important in canola production but care needs to be taken if you are considering placing ammonium sulfate (AMS) with the seed.

Recent research from the University of Manitoba reminds us that ammonium sulfate can be quite damaging to a canola stand when placed with the seed. Soil properties such as a high level of calcium carbonate (CaCO3) in the soil can cause additional stand loss when AMS is placed with the seed (see figure 1). When AMS is applied to a soil with a high calcium carbonate level, it reacts to form ammonium carbonate which transforms to ammonia gas, water and carbon dioxide. When this reaction happens near the seed, the ammonia gas will cause stand reduction. This is a similar reaction that occurs when urea is placed with the seed and causes stand loss.

In figure 1, the "Hollow" soil, which is located low on the landscape, has a calcium carbonate level of 0.5%. The "Hilltop" soil from an eroded area, has a calcium carbonate level of 21%. In this study, you can see that as the rate of AMS increased, the stand loss was much worse on the "Hilltop Soil" compared to the "Hollow Soil" The AMS reacted with the calcium carbonate in the "Hilltop soil" resulting in ammonia gas near the seed causing extensive stand loss.

Additional research from Carman, Manitoba shows that if both AMS and MAP are placed with the seed, even at relatively low rates, stand loss can be extensive. In figure 2 you can see that even a rate of 9 kg/h S (8 lb/a) applied with 20 kg/ha (18 lb/a), P_2O_5 caused stand loss of about 25%. Once the stand gets below about 50-70 plants/m2, yield loss would be expected.

While sulfur is important for canola production it must be applied in a safe manner. AMS should be broadcast or placed in a band away from the seed. This will allow you to put the maximum amount of P with the seed safely. Placing AMS with the seed at a very low rate should be the last option and stand loss should be expected, particularly on soils with calcium carbonate. Soils with a pH higher than 7.3 will have some level of calcium carbonate. While new seeding equipment is a big step forward for many growers, be sure to remind them that it is important to keep a safe amount of P fertilizer with the seed and that AMS should be broadcast or placed in a band away from the seed to prevent stand loss.

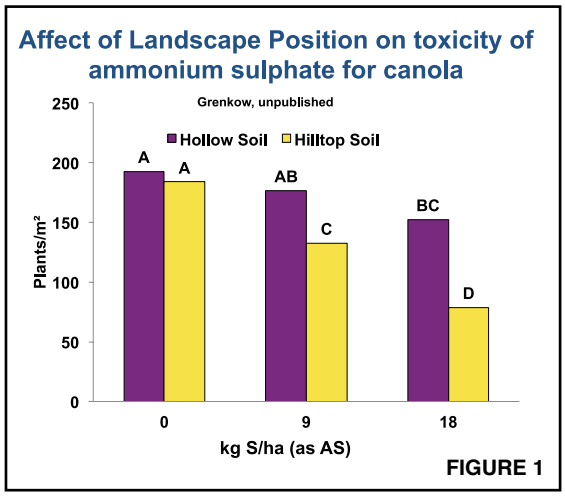
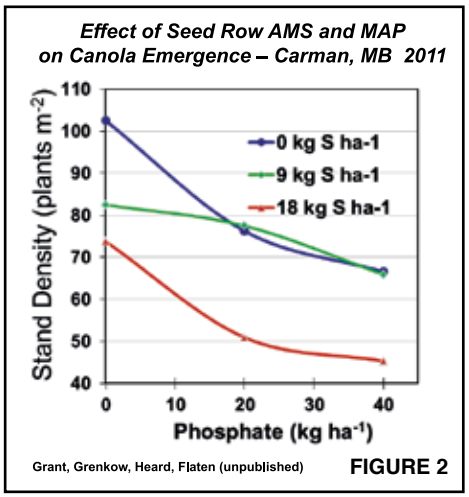


FIGURE 1



Grant, Grenkow, Heard, Flaten (unpublished) FIGURE 2

President's Corner *Continued from page 6*

fertilizer material that contains ammonium or converts to ammonium in the conversion to nitrate will cause the soil pH to decrease over time (Urea, MAP, DAP etc.).

One cultural factor that is probably contributing to the decline of soil pH levels is the decline of the Moldboard plow. When the moldboard plow is used, the surface soil is well mixed from 6-10 inches. In most of our soils in this region, the soil pH will increase with every inch you go deeper in the profile. In the past, the plow would bring to the surface high pH soil from the deeper depths and mix it with surface soils resulting in a higher pH at the surface. With more in minimum till and no till farming, this mixing of some subsoil with topsoil is reduced or no longer occurs.

We are starting to get more questions on the need for lime as lower soil pH values become more common. "Do we need to start applying lime in the north country?" Before we start making lime applications on soil with lower pH values (less than 6.0) we need to look at the pH of the subsoil as well. Research has shown that if the subsoil has a high pH, there is no need for lime as long as the subsoil had a relatively high pH. Last year we built some new testing equipment that allows us to test the pH of both the topsoil and subsoil. We started testing this new equipment at our Benson, MN lab last fall. Hopefully this fall, all 2 depth samples tested in our Benson lab will have subsoil pH tested on them as well. At our Northwood lab, we hope to install at least 2 of these new instruments that will test the topsoil and subsoil for pH this year. By the fall of 2014, we hope all samples at our laboratories will have the soil pH determined on the top two depths. If both the subsoil and topsoil have a low pH value, then it may be time to start shopping for a lime source.

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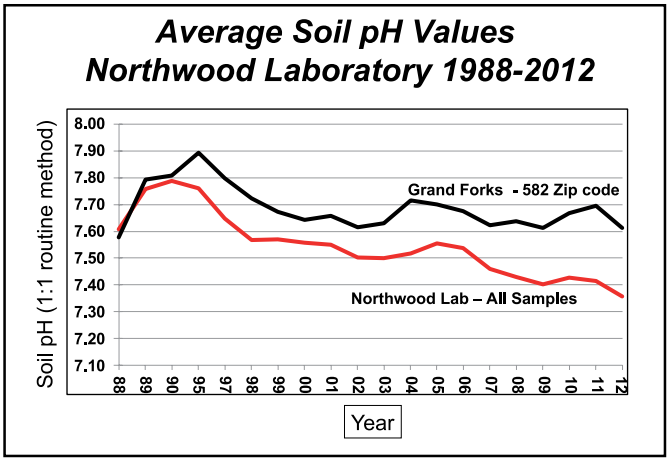
PRESIDENT'S CORNER

BOB DEUTSCH
PRESIDENT
SOIL SCIENTIST/CCA

It doesn't take a rocket scientist to see that the soil pH values of samples tested at our Northwood lab are declining. We see a similar decline in the soil pH of samples tested at our Benson laboratory over the past 25 years.

To make sure this trend is real and not due to an expanding soil test volume from a broad trade area, we looked at a specific area such as the 582 zip code area near Grand Forks, ND. We have been testing the majority of samples in this area for the past 25 years and the data from that area shows the same downward trend (see figure).



The decline in soil pH is real and is the result of nitrogen fertilizer application and cultural practices over the past 25 years. Through the years, the application of ammonium containing fertilizers is one reason soil pH is declining. The higher the rate of N applied, the more acid is released when ammonium (NH_4) releases H^+ ions in the conversion to NO_3^- nitrogen. Any N

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SOUTHERN TRENDS

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AGRONOMIST/CCA

It looks like 2013 is starting out more "normal" than 2012. The 2012 winter was short, mild and open for most areas while this year we've gone back in the freezer with a little more snow. In the long run that may be a good thing as we need quite a bit of precipitation to restore soil moisture levels and maximize crop yields this year.

The fall 2012 sampling season kept us very busy and we are already preparing in the lab for 2013. We expect a very busy early summer grid sampling season and plant tissue testing looks to be bigger than ever. We continue to update the instrumentation and equipment in our laboratory to increase capacity and serve our customers better. In recent years many customers have upgraded their sampling equipment with the Wintex1000 automatic topsoil sampler. We've got about 30 customers now who have been using the Wintex1000 for about 3 years with great success. I've tested the new "Wintex2000" soil sampler designed as an automatic 2-depth (24" deep) sampler. This unit looks like it has a lot of potential and is still in the testing phase. Once the final bugs are out we hope to have a Wintex2000 available as soon as this fall. We will keep you posted on how the testing is going this summer.

Many AGVISE customers use GIS software from various companies. This software allows customers to manage their grid and zone soil test data from the day test results are available from the lab until the day the fertilizer is variably spread on the field. AGVISE is working towards integrating programs to delivery soil test data from our lab to these GIS programs. We want to streamline the handling of soil sample information we receive from our customers (online submission) through the delivery of the soil test data back to our customers software. As we bring these programs online, we will work with you to integrate them into your everyday operation.

I'll be involved with various soil and plant tissue projects with cooperating customers this year. I hope to help customers learn more about maximizing crop production and the newest technologies. I'm open to your ideas in crop production and testing, so give me a call if you have a project we can cooperate on. We have high hopes for a successful 2013 growing season.