Timely information for agriculture

AGVISE LABORATORIES

WINTER 2013

SOUTHERN TRENDS

RICHARD JENNY
AGRONOMIST/CCA

Early summer topsoil grid sampling continues to increase in the southern region. More agronomists and retailers are adding and increasing their grid and zone sampling services to their growers. Many customers are switching from post-harvest grid sampling in soybeans to an early summer (June) sampling program for their nutrient management planning.

The Wintex1000 soil sampler has been a big hit with customers, with some 3-dozen units now being used by customers who send samples to our Benson, MN laboratory. Several customers have now purchased their second Wintex unit. The Wintex does a good job of topsoil sampling in many soil conditions. It has consistent depth control, is fast and takes most of the labor away when compared to sampling topsoil grids using hand probes.

We have a great line up of topics and speakers for our seminars coming up January 7, 8, 9 (see article on seminars). We hope to see you all there!

Soil pH Decreasing! – Lime needed in new areas?

In areas that have very low soil pH (less than 6.0), liming is a common practice which increases crop yield. Applying lime (calcium carbonate or calcium and magnesium carbonate) increases the soil pH and enhances bacterial growth which helps legumes fix nitrogen. Raising a very low soil pH with a lime application also increases the availability of nutrients like phosphorus.

Over the past 30 years, many areas with a history of high soil pH, have watched the soil pH decrease to the point where lime may be needed to achieve high yields. Higher N fertilizer application rates in the past 15-20 years and normal soil weathering are two factors that cause soil pH to decrease over time. Lime application is recommended when the routine soil pH test is less than 6.0 and the buffer pH test is less than 6.8.

Research has shown that the pH of the "subsoil" is also an important factor in determining if lime is needed and at what rate. In states like Minnesota, research has shown that the rate of lime required is less, if the subsoil has a pH higher than 7.0. The rate of lime recommended by the University of Minnesota is reduced by 50% for western Minnesota in locations with a subsoil pH greater than 7.0.

In 2012 AGVISE started testing the subsoil pH on samples at our Benson, MN laboratory, and we now are testing the subsoil pH on all samples

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AGVISE Soil Fertility Seminars January 7, 8, 9

AGVISE soil fertility seminar dates and locations are set. The dates and locations for our 2014 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 Locations	CEU Credits applied for
January 7, Granite Falls, MN	1.5 - SW, 4.0 NM
January 8, Watertown, SD	1.5 - SW, 4.0 NM
January 9, Grand Forks, ND	1.5 - SW, 4.0 NM
March 19, Portage, MB	To be determined

INSIDE

Soil pH cont…

at our Northwood, ND laboratory as well. We do this testing at no charge to our customers. Having the subsoil pH will help us to provide better information to our customers when lime is being considered. In situations where the topsoil pH is low and lime is recommended, we will also know the pH of the subsoil. If the subsoil pH is more than 7.0, we will know that a lower rate of lime is needed. If the subsoil pH is less than 7.0, we will know that the full rate of lime should be applied.

We have summarized the topsoil and subsoil pH values of over 150,000 samples tested from this region. In the table we have summarized the samples which have a topsoil pH less than 6.0 and a subsoil pH less than 7.0. Now that we are routinely testing the subsoil pH on all two depth samples, we will start incorporating this information into our lime guidelines starting in 2014. We also hope this kind of data will create more interest for researchers in this region to do more research on lime needs in areas that have traditionally not needed lime, but may need it now or in the near future.

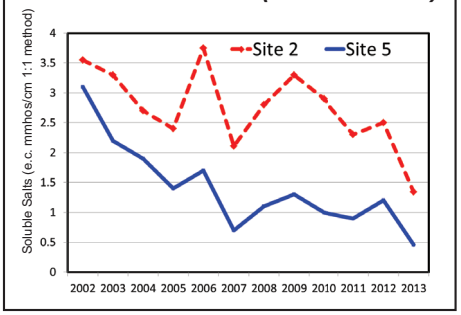
Topsoil and Subsoil pH Trends
AGVISE laboratories 2013

Zip code area	% Topsoil Samples with pH less than 6.0	% Subsoil Samples with pH less than 7.0
SW MN - 561, 562	19.3%	4.4%
NW MN - 565,567	0.9%	0.3%
E SD - 571, 572, 573, 574	10.1%	7.5%
W SD - 575, 576, 577	10.8%	7.8%
E ND - 581, 582, 583, 584	3.5%	1.7%
W ND - 585, 586, 587, 588	5.9%	1.5%
Manitoba	8.7%	2.4%

Tile Drainage – Salts Decrease & Productivity Increases

Tile drainage is not sold by the pound or by the gallon like some magical "Soil Amendments," but maybe it should be. Soil salinity is a high water table issue that continues to get worse in many areas which have experienced many wetter than normal years. With the water table too close to the surface, capillary action wicks the water to the soil surface where it evaporates, leaving behind any dissolved salts. In time, the soil surface may become white, showing the high levels of soluble salts and the productivity of the soil may decline rapidly.

Salinity Trend of Two Sites
Tile Drained Field (2002 – 2013)



Tile drainage is one way to lower the water table and break the capillary action that brings the salts to the soil surface. When you combine good surface drainage with tile drainage and crop rotations that use a lot of water, salinity can be reduced and soil productivity increased. AGVISE has been following the effect of tile drainage on the salt levels in a local field since 2002. 10 sites in this field have been tested for the level of salts each fall over that 11 year time period. Over that time, the areas of the field that had high salt levels initially have shown a decrease in the salt level and an increase in the productivity. In the figure (above) you can see how the soluble salt level has decreased on two sites over that time period. As the salt level in this field has decreased, the productivity has increased for all crops in the rotation.

Early Summer Soil Sampling

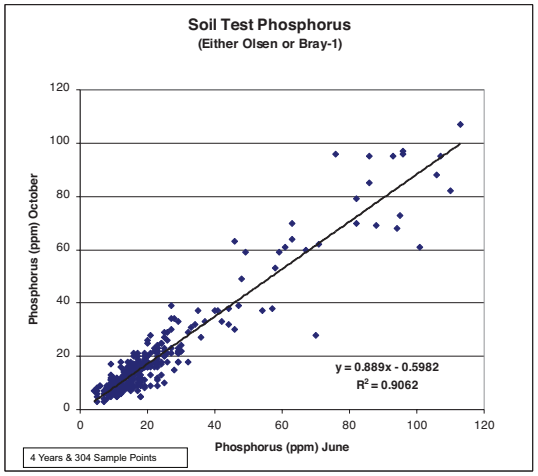
Topsoil grid soil sampling started about 30 years ago in the Midwest. The amount of grid sampling has grown through the years and has dramatically increased in the past 6-7 years. A common practice is to grid sample in the soybean year with P and K fertilizer and lime applied to cover the following corn crop and soybean crop as well. Initially, grid sampling was used in the cornbelt where lime applications are a common component of growers' nutrient management plans. This was before GPS was available for civilian use. Since then, much university research has been conducted on expanding and validating both grid sampling and zone sampling. From the early stages of variable rate lime application, researchers have found that macronutrients phosphorus and potassium could also be managed more effectively with grid sampling. Research has shown that an effective and economic grid size is 2.5 acres. Grids larger than 2.5 acres did not perform as well in several research projects. Research also shows that 1-acre grids are more effective when dealing with pH, P and K variability, but this is not practical or economical at this time.

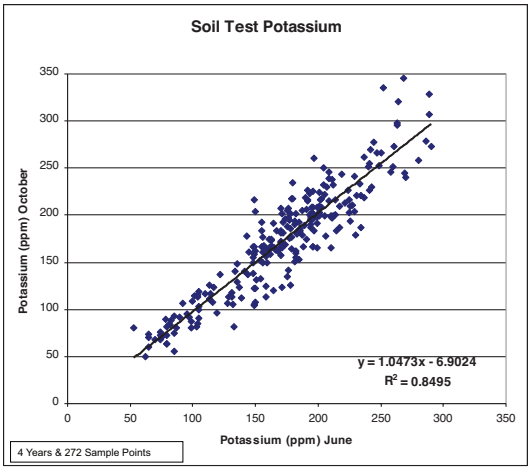
Grid sampling has its roots in the cornbelt where the common rotation is corn and soybeans and was usually done in the fall after harvest. In recent years, grid sampling is becoming more of a spring activity. Early summer grid sampling is done in mid-May through June on "unfertilized" soybean fields before the crop gets too big. These are soybean fields that were fertilized 2 years earlier before corn was seeded and the rates were high enough to cover the following soybean crop as well.

Much research has been conducted comparing soil test values from early summer sampling to harvest time sampling. The research has shown very similar soil test values for immobile nutrients like P, K, Zn, Ca and Mg. Soil

Continued on page 3

characteristics like CEC, pH, texture and organic matter are also not affected by time of year sampling. Mobile soil nutrients (N, S, and Cl) are not tested on topsoil grid samples because the levels of these mobile nutrients will vary during the growing season.





The trend for topsoil grid samplers in our region is to move their soil sampling from post-soybean harvest in the fall to early summer sampling. Nearly all of this early summer sampling is done in soybean fields from emergence, until the beans get too tall for sampling. This trend has worked hand-in-hand with the big increase of 2.5-acre topsoil grid sampling. When all things are considered, everyone involved benefits from early summer grid sampling. Growers benefit by having their soil test data early and P and K fertilizer can spread right after soybean harvest. Agronomists and retailers benefit because they can have the VRT maps ready to spread P & K for growers right after harvest and don't have to wait for soil sampling. The laboratory benefits by moving some of the testing to spring and early summer to reduce the rush of the fall testing season and provide our customers with the best possible service.

Some major benefits of earlier summer sampling are soil core quality, depth control and consistency compared to fall sampling. Soil moisture conditions in May and June are usually very good compared to fall sampling. In the spring, the soil has firmed up by winter and the planting operation. This allows for very good depth control and consistency in sampling. Soil conditions in the fall are usually not as good for getting the best quality soil sample. Soils are usually drier in the fall and tillage becomes an issue. It is well known that sampling tilled fields (i.e. disk, chisel, rip or plow), makes it very hard to get consistent good quality soil cores. In these conditions it is hard to get the same quality sample as the spring, resulting in less repeatable soil test results. Sampling "in crop" or in a stubble situation provides a much better soil test result in consistency and repeatability when compared to a tilled situation.

Another major benefit to early summer sampling is in the consistency of soil test result values when comparing them to fall sampling before tillage. In a 4-year trial AGVISE conducted, we sampled 304 sample points in grower's fields in central, west-central MN and southeast SD. All sample points were marked with GPS. We sampled in standing soybeans in June (early) and then resampled them after soybean harvest (late) but before any tillage. When averaged over all these sample points, soil test results for P, K, pH, OM, and Zn, were nearly identical between fall and early summer sampling. Soil test P averaged slightly higher in the early sampling, by 3.0 ppm (see tables).

We further examined the correlation between early and late soil sample data, which shows the consistency between the sampling dates. The R-squared values were very good for P, K, pH and OM. The higher the R-squared value, the higher the correlation of the test results of the spring sampling compared to the fall sampling data (see figures for P & K). Zinc was not as well correlated as the other tests, but most of the zinc test levels at these sites were in the very high range.

In conclusion, this project confirms what other studies have in the past. Early summer sampling is a viable agronomic option for topsoil grid sampling compared to fall.

Early summer vs. Harvest Time Soil Test Comparison

Nutrient Tested	Early Sampling Mid May to Early June	Late Sampling after soybean harvest but before tillage
Phosphorus (P)	23 ppm	20 ppm
Potassium (K)	190 ppm	197 ppm
pH	7.4	7.4
%Organic matter	5.0%	4.8%
Zinc	1.8 ppm	1.7 ppm

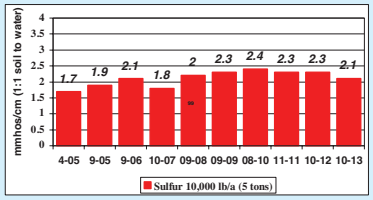
Early summer vs. Harvest Time Sampling Statistical Relationship

Nutrient Tested	Relationship Between Early Summer Sampling and Harvest Time Sampling (R^2)
Phosphorus (P)	0.91
Potassium (K)	0.85
pH	0.93
%Organic matter	0.87
Zinc	0.61

Soil Amendment – Elemental S

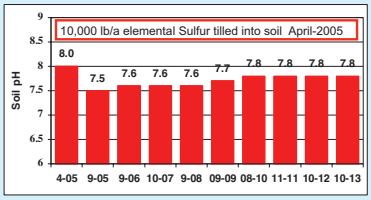
Increasing levels of soluble salts over the past 15 years have some people grasping for solutions to this issue. One urban legend that growers get from different sources is that applying elemental sulfur will decrease the salts or somehow make the salts less harmful to crops. To dispel this rumor, in 2005 AGVISE started a demonstration project where we applied 10,000 lb/a, (yes that is 5 tons/a!) of elemental sulfur and tilled it into the soil. Each fall we collect soil samples from this site to see if the elemental sulfur has had any effect on the salt levels in the soil or the soil pH. In the first figure you can see there has been no significant effect on the soluble salt level in the soil 8 years after 10,000 lb/a elemental S has been tilled into the soil. In the second figure you can see that the soil pH was reduced by about 0.5 pH units for a few years, but within 5 years, the soil pH is almost back to the original level. Elemental sulfur will acidify the soil in the process of converting from elemental sulfur to sulfate sulfur, but to decrease the soil pH permanently can take very high rates. If a soil contains some carbonates, it will require very high rates to decrease the soil pH permanently. At this site, 10,000 lb/a elemental sulfur was not enough to decrease the soil pH permanently. While the soil pH did decrease by 0.5 units for a few years, the change was not permanent and the cost of 10,000 lb/a of elemental sulfur would not have been recovered. The plant growth at this site was no different than the check site. For growers who have been told that applying 50-100 lb/a of elemental sulfur will decrease soluble salts and decrease the soil pH, I am sorry but you will be very disappointed with the results.

Does Elemental Sulfur Reduce Soluble Salts? (NO!)



Does Elemental Sulfur Decrease Soil pH?

YES, But The Decrease May Not Be Permanent!



Soil (CCE) Carbonate level is 1.5%, loam soil texture

Soil Amendment – Beet Lime

In recent years beet lime has become a common soil amendment in the sugarbeet growing areas of this region. Beet lime is a byproduct of the process used to extract sugar from sugarbeets. The primary reason for applying beet lime to this point in time has been to reduce Aphanomyces root disease in sugarbeets and for the 20 lb/a P_2O_5 phosphorus in each ton of lime. Some of the questions we have received from customers prompted us to start a beet lime demonstration project in 2008. Treatments of 1-6 tons of beet lime were tilled into the soil the fall of 2008. Each fall we soil test these sites to measure any changes in soil pH and salt levels which were the concern of many agronomists. As you can see in the table, there have been no changes in soil pH or soluble salt levels over 5 years. Since the soil pH of this site was high to begin with (>7.0), there is no chemical reaction taking place between the beet lime and the soil and the soil pH has not increased. If beet lime were applied to an acid soil (pH less than 7.0), the beet lime would react with the hydrogen (acid) in the soil and increase the soil pH, the same as any other liming material. Beet lime is a very good source of lime for increasing the pH of soils which require lime (pH less than 6.0). The effective neutralizing power (ENP%) for beet lime is very good. Beet lime quality as reported by the MN Dept. of Ag in 2012 and 2013 is about 72-84% ENP. For more specific information on the ENP (effective neutralizing power) of the beet lime in your area, please contact the factory where the beet lime was produced.

Does Beet Lime Increase Soil pH? (No!)

Site ID	Rate of Lime Applied	Soil pH Initial	Soil pH	Soil pH	Soil pH	Soil pH	Soil pH
		Sample date	Sample date	Sample date	Sample date	Sample date	Sample date
		9-08	10-09	08-10	11-11	10-12	10-13
1	1 ton	7.8	7.7	7.9	7.8	7.7	8.0
2	2 ton	7.9	7.9	8.1	7.9	7.9	8.0
3	3 ton	7.9	7.9	8.1	7.9	7.9	8.1
4	4 ton	7.8	7.8	7.9	7.7	7.8	8.1
5	5 ton	7.8	7.8	8.0	7.9	7.9	8.0
6	6 ton	8.0	7.9	8.2	8.0	8.0	8.1

Beet lime applied September of 2008 1:1 routine soil pH method

Does Beet Lime Reduce Soluble Salts? (NO)

Rate of Lime Applied	Soluble Salts	Soluble Salts	Soluble Salts	Soluble Salts	Soluble Salts	Soluble Salts
	Sample date	Sample date	Sample date	Sample date	Sample date	Sample date
	9-08	10-09	08-10	11-11	10-12	10-13
	mmhos/cm	mmhos/cm	mmhos/cm	mmhos/cm	mmhos/cm	mmhos/cm
1 ton	1.5	1.2	1.8	1.7	1.6	1.2
2 ton	1.9	2.1	2.3	2.5	2.3	2.0
3 ton	1.9	2.0	2.6	2.5	2.4	1.9
4 ton	1.0	1.3	1.4	1.2	1.5	1.9
5 ton	1.7	2.2	2.3	2.3	2.2	1.7
6 ton	2.6	2.1	2.7	2.9	2.5	1.9

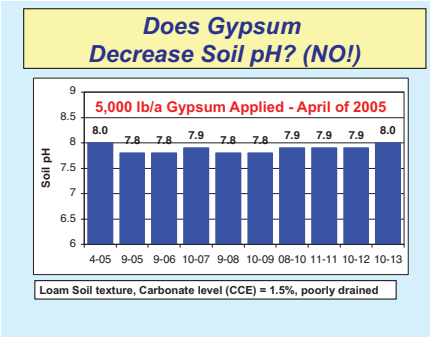
Beet lime applied September of 2008 1:1 routine salt test method

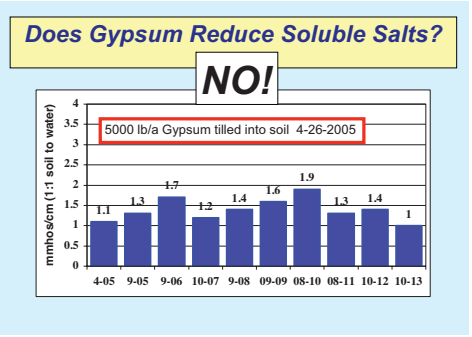
Giant Pumpkins Update

AGVISE did not have a giant pumpkin contest this year due to the very late cold spring, but this didn't stop some of the hard core growers. Rick Swenson raised his personal best pumpkin at 918 pounds. The picture shows Rick with his wife, Erin and son, Leland and his 918 and 858 pound pumpkins from this year. Rick is hoping to break 1,000 lbs next year! "Great Pumpkin Rick! Good luck next year breaking 1,000 lb!

Soil Amendment – Gypsum

Gypsum is a proven soil amendment that generates lots of questions from agronomists and growers in this region. One of the urban legends in this region is that applying gypsum will decrease soluble salts and lower soil pH. This urban legend has a little truth to it. Gypsum (calcium sulfate) is used as a soil amendment when reclaiming sodic soils (soil with a high level of sodium salt). Sodic soils initially have a soil pH of 8.5 to 9.5 and after being amended with gypsum and leached with additional water, the final pH may be 7.5 to 8.2. So the soil pH does decrease on a sodic soil when amended with gypsum, but this is a special circumstance. If gypsum is applied to a saline soil (no sodium issues), the initial pH may be in the 7.8 to 8.2 range. Since the initial pH is not affected by sodium, there will be no change in the pH of a saline soil when gypsum is applied (see figure). Many soils in our region have salinity (salts) issues and few have issues with sodium.

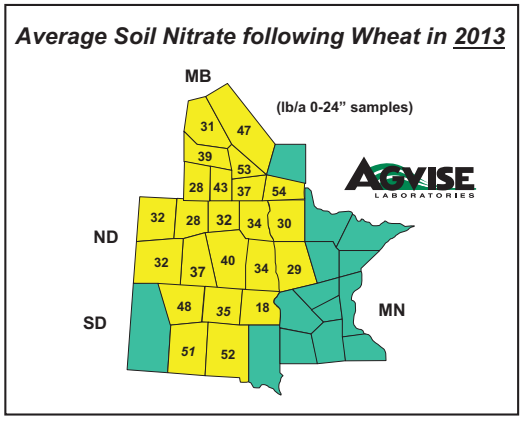


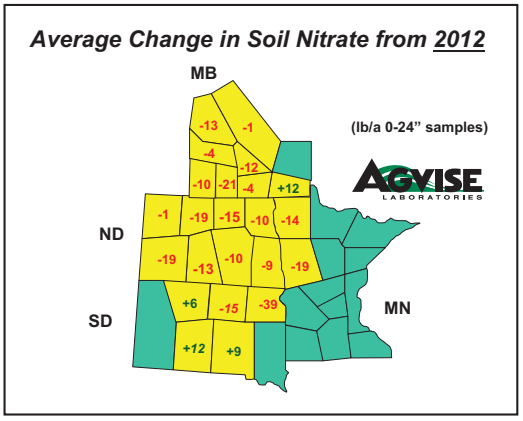


AGVISE started a gypsum demonstration project in 2005 by applying 5000 lb/a gypsum and then tilling it into the soil. The site was chosen because it has a high pH and high soluble salt level. Each fall we soil test this site to see if the soil pH and the salt level in the soil has changed. As you can see in the figures, gypsum has had no effect on the soil pH. Since gypsum (CaSO4) is a low solubility salt, there is no logical reason to think that it would have any effect on soil pH. You can also see that gypsum has had little if any effect on the salt level in 8 years. If you have spent money applying gypsum to a saline soil in hopes it will make your salts decrease or the soil pH decrease, I am sorry, but this will never happen. Please see the article on tile drainage if you want to see a practice that will lower the soluble salt level in the soil through the years.

Soil Nitrate Testing Is Important!

What a difference a year makes. 2012 was a dry year in general and the average soil nitrate levels following harvest were higher than normal. The higher than normal soil nitrate levels were likely caused by reduced yield in some areas and higher N mineralization from the soil organic matter caused by warm temperatures. In 2013, planting was delayed in many areas due to cool wet spring conditions. These wet conditions continued all season in some areas and other areas actually dried out at the end of the season.





With wheat harvest finally completed, we have summarized the average soil nitrate (0-24") level in fields where wheat was grown in 2013. The average soil nitrate following wheat, for each zip code area is shown in the figure above. The second figure on the right shows the difference in the average soil nitrate from 2012 in each area. Most areas have lower levels of soil nitrate in the fall of 2013 compared to the fall of 2012. These lower levels of N are likely due to very high wheat yields, some losses of N due to wet soil conditions and cooler summer temperatures which may have reduced N mineralization from soil organic matter.

While these changes do not seem large, in the real world, this translates into a lot of money ! The real world cost of having an average soil nitrate 10 lb/a less than last year is $28,500,000.00 of N fertilizer based on $0.50/lb on N on 5.7 million acres of wheat planted in ND alone. SOIL NITRATE TESTING IS IMPORTANT!!!!

AGVISE LABORATORIES
604 Highway 15 West
P.O. Box 510
Northwood, North Dakota 58267
701-587-6010 / FAX: 701-587-6013
Home Page: www.agvise.com

PRESIDENT'S CORNER

BOB DEUTSCH
PRESIDENT
SOIL SCIENTIST/CCA

AGVISE customers have used the AGVISOR program to access soil test information for over 20 years, but you probably don't know the whole story. The AGVISOR program got its start when customers like you wanted to have their soil data stored on their brand new computers. They wanted to be able to change crops, yield goals and fertilizer guidelines and print soil reports. In about 1991 the first AGVISOR program was written by Dan Kucenski, a scientist at our Benson lab who also did computer programming. The first AGVISOR program ran on DOS and worked pretty well. Many times our sales staff had to install dial up modems in customer's computers so they could call in and get their soil test data. Remember those terrible screeching sounds of the dial up modems?

Things went well for several years and then issues came up with printers. To get past some of the printer issues we started from scratch and reprogrammed the AGVISOR program in the Windows operating system. The AGVISOR program was designed to work with the browser Internet Explorer, which was the rage at the time. Through the years we have overcome many issues with new Windows operating systems (Remember 95, 98, Vista, 2000 ME etc.?) and many error filled versions of Internet Explorer. I am sure Bill Gates is still laughing at the trouble he caused us!

Two years ago we moved the AGVISOR to a web based program which has been a very good thing for our customers. This allows customers to access their data on AGVISOR from any computer using their favorite browsers like Google Chrome or FireFox. With the AGVISOR now being web based, we started offering online soil sample submission about two years ago and customers really like it! (no paper forms to fill out!).

We will continue to improve the AGVISOR program, guided by your comments and suggestions. Some new features coming in 2014 include: online submission of plant tissue samples, downloading GLP soil test data and providing more billing information online. We are always looking for input from customers on AGVISOR so please email any suggestions directly to me at agvise@polarcomm.com.

NORTHERN NOTES

JOHN LEE
SOIL SCIENTIST/CCA

2013 was like a roller coaster ride. Planting season was a low point as late snow and cool temperatures delayed planting in the Northern region. Over 4 million acres in North Dakota didn't get seeded at all! The crops that did get seeded progressed nicely until a cool period in July, which increased worries about an early frost! Then the heat came back in August and September to finish the row crops (Whew!). A high point was the very good wheat yields and respectable soybean and corn yields we ended up with! Harvest has been very difficult in many areas due to excessive rainfall.

Soil testing this fall has been a mad rush as well. Late harvest limited the days for soil sampling, so having an efficient soil testing operation was critical. Many AGVISE customers have recently updated their hydraulic sampling systems, so the new equipment really helped this fall.

The winter meeting season is just around the corner and we have our "Soil Fertility Seminars" scheduled for January 7, 8, 9 (see article on seminars). We mailed the seminar announcement to our customers so they have the first opportunity to sign up. In past years, we have had a waiting list, so please sign up early to reserve a spot. See you all there!

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