AGVISE LABORATORIES

Timely information for agriculture

Spring 2019

SOUTHERN TRENDS

RICHARD JENNY
AGRONOMIST/CCA

What a winter it has been! Record snowfall, record low temperatures—I cannot wait until the snow melts and the growing season is finally here.

This winter, I spoke at several grower meetings and was asked about the value of soil testing in these tight economic times. I will tell you, making fertilizer decisions without current soil test information is a costly approach to managing soil fertility. If you make fertilizer decisions based only on crop removal, this will result in poor use of your fertilizer dollars. Given that soil fertility levels vary from field to field and within each field, there is a high probability that fertilizer could be over- or under-applied on many fields. If yield-limited fields with low soil test P and K only receive fertilizer based on crop removal, soil test levels will stay in the low soil test range for some fields, whereas other fields will receive more fertilizer than needed. We must work with growers to help them achieve maximum economic crop yields and minimize environmental impacts. If you only use crop removal-based fertilizer rates to make fertilizer decisions (without soil testing), you are not considering what the soil itself contributes to plant nutrition. Your fields are likely over- or under-fertilized, hurting profitability in either case. Precision soil sampling, whether grid or zone, and soil test-based fertilizer rates will provide your growers greater opportunity to maximize their profits and minimize environmental impacts.

In closing, I sure hope that man-made global warming would get here soon. It has been a long cold winter this year!

INSIDE

New soil health test offered, POXC: What is it?

JOHN BREKER
SOIL SCIENTIST

Much attention around soil health focuses on increasing carbon (C) storage in soil. After all, carbon is the currency of nature: the backbone of soil organic matter and the energy source for soil microorganisms. When you reduce tillage or increase crop rotation diversity, you expect soil organic matter to increase. However, the more common experience is that increasing soil organic matter takes many years, if not decades. To provide a more sensitive tool for measuring soil C changes, AGVISE Laboratories will be offering the permanganate-oxidizable carbon (POXC) soil test. The POXC soil test is a quick, repeatable soil test that captures the biologically active C fraction. This portion of organic matter is actively involved in nutrient cycling. You may hear POXC called active C as well. In the early phase of no-till transition, more nitrogen fertilizer is often required while this active C fraction is being built, thereafter becoming the organic matter nitrogen mineralization source in the mature no-till phase.

A 17-year tillage experiment in Mandan, ND indicated that conversion to no-till had only slightly increased total organic C; however, POXC increased significantly from 470 mg kg^{-1} to 600 mg kg^{-1} (Weil et al., 2003, Amer. J. of Alternative Agric. 18:3-17). Recall that soil organic matter is a gross measurement that includes all forms of organic material (microbial biomass, recently decomposed plant materials, and stable humus). Whereas any change in total organic C was difficult to detect, the active C fraction present as microbial biomass and particulate organic matter had increased more quickly, and POXC was able to measure this improvement in soil quality.

As soil health testing evolves, AGVISE Laboratories continually evaluates soil health testing methods that can provide useful assessments of soil quality and productivity. Permanganate-oxidizable carbon is one measurement that responds to changes in crop and soil management much sooner than total

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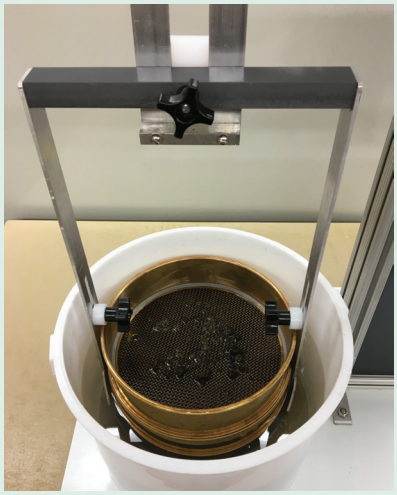
New Soil Test Cont…

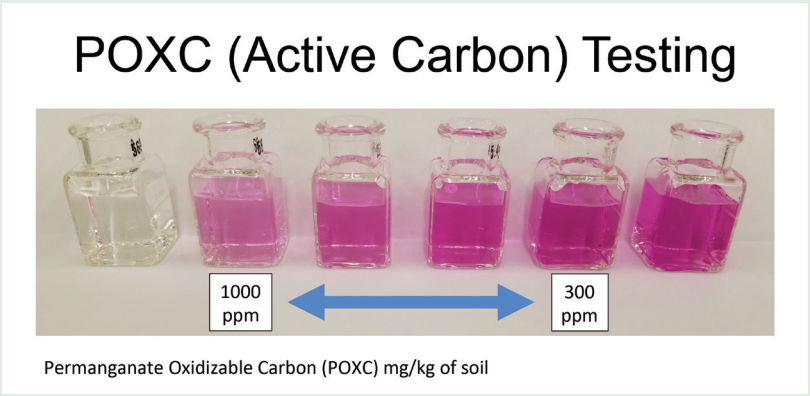
organic matter, which is why POXC is considered a "leading" soil health indicator. With POXC, you can more easily quantify positive changes achieved through better soil management.



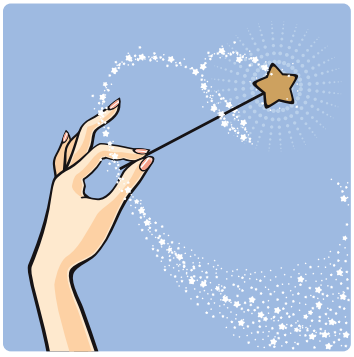
Soil aggregate stability: We are making progress, by golly!

In the Fall 2018 newsletter, I discussed how soil aggregate stability is one of the most important soil health parameters that we can measure. Multiple management practices come together to improve soil aggregate stability such as reduced tillage, greater crop rotation diversity, more plant roots, greater earthworm and microbial activity, and more soil organic matter. Soils with high soil aggregate stability have less soil erosion, better equipment trafficability, faster water infiltration, and more diverse habitat for soil microorganisms. The difficulty in measuring soil aggregate stability has been that the manual laboratory methods are time-consuming, expensive, and only used in research.

This winter, our staff of soil scientists and laboratory engineers has worked hard to design automated soil aggregate stability testing equipment that closely matches the procedure and results obtained with the manual method used in research. The results so far have been encouraging! The automated procedure also removes the person-to-person error in the manual method. We are still in the prototype phase, but we expect to have something viable later this year. With a commercially feasible, routine soil aggregate stability method, we will have another tool to measure real improvement in soil management.



New "magic" products: Will they pay on your farm?

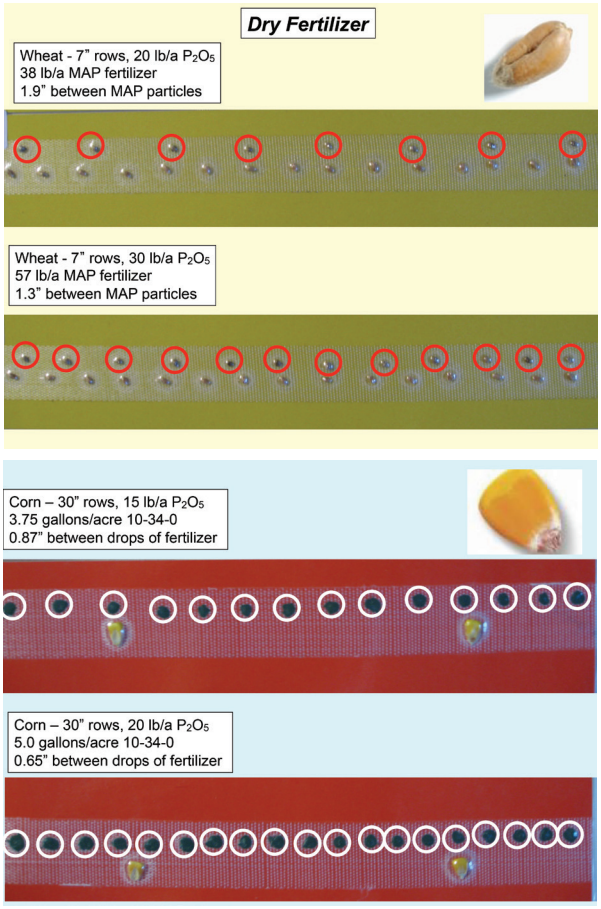


It is again that time of year when growers are bombarded with "new" fertilizer products. While products do have to be labeled for their nutrient content (%), there is little else required, like proven efficacy. Some promotions sound pretty attractive. Many of these companies tell growers they can use less of their "new" fertilizer product and get the same yields as applying higher rates of conventional fertilizer products. In the short term, this may be true, especially if the grower's soil test levels are high right now. But in the long term, nutrients like P and K removed by high-yielding crops must be replaced for the soil to stay productive. Some companies will tell growers to apply a normal rate of their conventional fertilizer products and also apply some of their new magic fertilizer material. These companies will have growers split fields and apply their new product to one half of the field. Then when they find one field where the new product yielded better, they claim it was due to their product (it may have taken 20 split-field comparisons to find one field where their magic product appeared to make a difference). Since there are no replicated strips, there is no way to know if the response was real or if it was just a random event. These companies do not care since they just need one split-field example to market their magic product for several years or until a new magic product is formulated that is even better! Most growers are pretty savvy when it comes to new magic fertilizer products. If a grower wants to evaluate a new product, the grower should put some replicated strips in one field and evaluate yield data before applying the product to the whole farm. With variable-rate equipment and yield monitors being more common, replicated fertilizer treatments to evaluate new products are much easier than before. In the end, the marketplace will decide which new fertilizer products will survive and which ones will not. The internet also allows growers to trade notes with other farmers evaluating the same products in replicated trials on their farms. The more information that can be gained from new products, the sooner everyone will know if they are better than the products we are using now.

Starter fertilizer is no limbo – How low can YOU go?

With spring approaching, we are receiving more questions on starter fertilizer. As profits are being squeezed, more growers are discussing optimal starter fertilizer rates and how low starter fertilizer rates can be. These questions are the result of wanting to keep fertilizer costs down, to plant as many acres per day as possible, and to take advantage of more efficient, low-rate banded P fertilizer compared to higher broadcast P fertilizer rates.

To illustrate the role of starter fertilizer rates and seed placement, we put together displays showing the distance between fertilizer granules or droplets at various rates and row spacings. You can see several pictures with corn, soybean, canola, and sugarbeet on our website: **https://www.agvise.com/educational-articles/starter-fertilizer-display/.** We greatly thank John Heard with Manitoba Agriculture for helping with these displays.



The displays show the normal seed spacing for several crops with different dry or liquid fertilizer rates alongside the seed. These displays help visualize the distance between the seed and fertilizer at several rates. University research shows that to achieve the full starter effect, a fertilizer granule or droplet must be within 1.5-2.0 inches of each seed. If the fertilizer granule or droplet is more than 1.5-2.0 inches away from the seed, the starter effect is lost. Some people wonder about these displays, but you can prove it to yourself pretty easily. Just run the planter partially down on a hard surface at normal planting speed. You will see what you imagine as a constant stream of liquid fertilizer, ends up being individual droplets at normal speed, especially with narrow row spacings and lower fertilizer rates.

These displays will help you explain to growers how the starter fertilizer rate must be adequate to keep fertilizer within 1.5-2.0 inches of each seed for the full starter effect. In addition to an adequate starter fertilizer rate, additional P and K should be applied to prevent nutrient mining, causing soil test levels to decline in years when minimum fertilizer rates are applied.

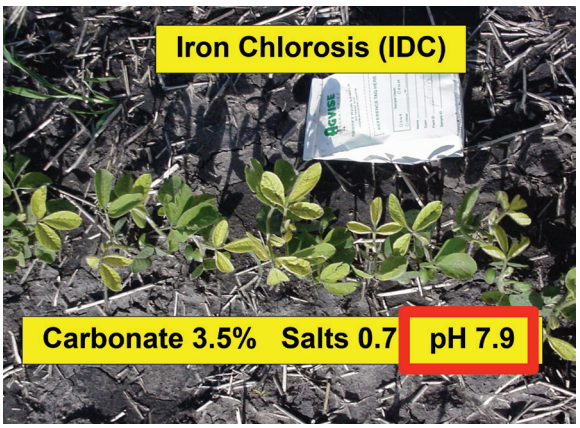
Molybdenum: The micro-est of micronutrients

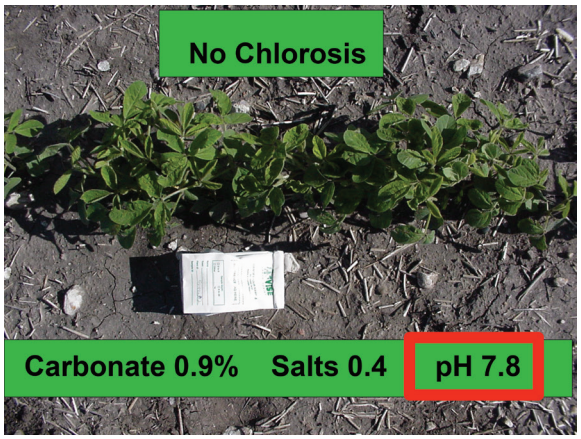
Lately, we have received more questions about molybdenum (Mo) analysis of soil and plant tissue. Molybdenum is an essential plant nutrient, necessary for nitrate assimilation and biological nitrogen fixation. Legumes, relying on N fixation, have greater Mo requirement than non-legumes. Nevertheless, the Mo requirement of plants is the lowest among all micronutrients, with critical deficiency concentrations ranging from 0.1 to 1.0 ppm in plant leaves. This low Mo concentration lies near the detection limit for most laboratory instruments used in commercial soil testing, so you may see Mo concentration reported as "below instrument detection limit."

Plant-available Mo in soil is present as molybdate (MoO_4^{2-}). Unlike other micronutrients, molybdate availability in soil increases with soil pH. With soil pH greater than 6.0, Mo deficiency is exceedingly rare. In the Great Plains and Canadian Prairies where most soils have high pH, Mo deficiency is virtually unknown, and background plant Mo concentration in legumes ranges from 4 to 8 ppm, indicating that plants obtain sufficient Mo from soil naturally. In the Upper Midwest where low pH soils are more common, crop response to Mo fertilization has been limited to legume crops grown on strongly acidic, sandy or peat soils. Since Mo deficiency is uncommon and most soils are limed above pH 6.0, no reliable plant-available soil test method for Mo has been developed in this region. The acid ammonium oxalate method has been used infrequently in the southeast United States, but the prediction of crop response to Mo fertilization aligns more closely with soil pH than soil test Mo.

If soil pH is less than 6.0 and Mo fertilization is necessary, a molybdate fertilizer seed treatment or foliar application is usually sufficient. Overapplication of Mo fertilizer is not a concern for grain production. In forage production however, overapplication is a serious concern because excessive Mo in forages can cause Mo-induced copper deficiency (molybdenosis) in ruminant livestock.

Soybean Iron Deficiency Chlorosis: Symptoms, Causes, and Management





If soybeans turn yellow during an early growth stage, you may have a case of soybean iron deficiency chlorosis (IDC). The distinctive yellow symptoms of soybean IDC often appear as soybean enters the first- to third-trifoliate leaf stage. Soybean IDC is characterized by distinct interveinal chlorosis (yellow leaf with green leaf veins) in the newest leaves and may result in substantial yield loss. Soybean IDC is not caused by low soil iron but instead caused by soil conditions that decrease iron uptake by soybean roots.

Soybean IDC risk and severity are primarily related to soil carbonate content (calcium carbonate equivalent, CCE) and worsened by soluble salts (electrical conductivity, EC). Soybean IDC can be common in soybean-growing regions of the Upper Midwest, Northern Plains, and Canadian Prairies, where soils frequently have high carbonates and/or soluble salts (see map of high risk of IDC). Within a field, chlorosis symptoms are usually confined to soybean IDC hotspots with high carbonates and soluble salts; however, symptoms may appear across a field if high carbonates and salts are present throughout a field. Soybean IDC severity is made worse in cool, wet soils and soils with high residual nitrate. Soil pH is not a good indicator of soybean IDC risk because some high pH soils lack high carbonates and soluble salts, which are the two principal risk factors.

Unlike a nitrogen or sulfur deficiency, soybean IDC is not correctable with an in-season fertilizer application. Foliar application of iron fertilizers, including FeEDDHA products, may have short-term cosmetic effects, but foliar Fe applications have not consistently increased yield of soybeans affected by IDC. Chlorosis symptoms often alleviate naturally as environmental conditions improve (e.g., drier, warmer weather), but severe cases can persist and cause yield loss. University research has shown that chlorosis persisting into the fifth- and sixth-trifoliate leaf stage will reduce yield. For fields with historical soybean IDC problems, you should delineate soybean IDC hotspots for selective management using aerial or satellite imagery.

Guidelines for managing soybean IDC:

1. Soil test each field, management zone, or grid for soil carbonate and salinity. This may require soil sampling prior to soybeans (possibly outside of your usual soil sampling rotation) or consulting previous soil sampling records.

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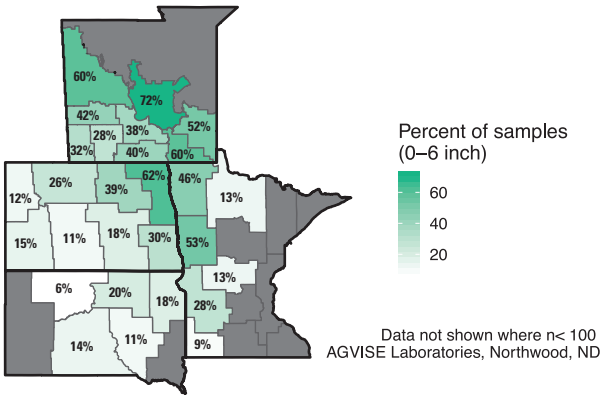
Soil samples with high risk of soybean iron deficiency chlorosis (IDC) in 2018



Risk of Soybean IDC – AGVISE Laboratories

CCE Soil Level (Carbonate)	Salt level (routine 1:1 test)	IDC Severity Risk
%	Mmhos/cm	Relative Risk
0-2.5%	<0.5	Low
0-2.5%	0.5 – 1.0	Moderate
0-2.5%	>1.0	Very High
2.6-5.0%	0-0.25	Low
2.6-5.0%	0.26-0.50	Moderate
2.6-5.0%	.51-1.0	High
2.6-5.0%	>1.0	Very High
>5.0%	0-0.25	Moderate
>5.0%	.26-0.50	High
>5.0%	0.51-1.0	Very High
>5.0%	>1.0	Extreme

Soybean Iron Deficiency Cont…

2. Plant soybeans in fields with low carbonates and soluble salts (principal soybean IDC risk factors). See table to estimate soybean IDC risk.
3. Choose an IDC tolerant soybean variety on fields with moderate to high carbonates and soluble salts. This is your most practical option to reduce soybean IDC risk. Consult seed dealers, university soybean IDC ratings, and neighbor experiences when searching for IDC tolerant soybean varieties.
4. Plant soybeans in wider rows. Soybean IDC tends to be less severe in wide-row spacings (plants are closer together) than narrow-row spacings or solid-seeded spacings.
5. Apply chelated iron fertilizer (e.g., high quality FeEDDHA) in-furrow at planting. In-furrow FeEDDHA application may not be enough to help an IDC susceptible variety in high IDC risk soils (see points #2 and #3).
6. Avoid planting soybean on soils with very high IDC risk.

Please call AGVISE Laboratories in Northwood, ND (701-587-6010) or Benson, MN (320-843-4109) with questions. AGVISE offers routine soil testing for carbonates and soluble salts.

GREEN THUMB HUMOR!

What do you call it when worms take over the world?
Global Worming.

If only I could grow green stuff in my garden like I can in my refrigerator.

What do you get when you cross a canary and a lawn mower?
Shredded tweet.

It has been so dry this week, the trees are whistling for the dogs.

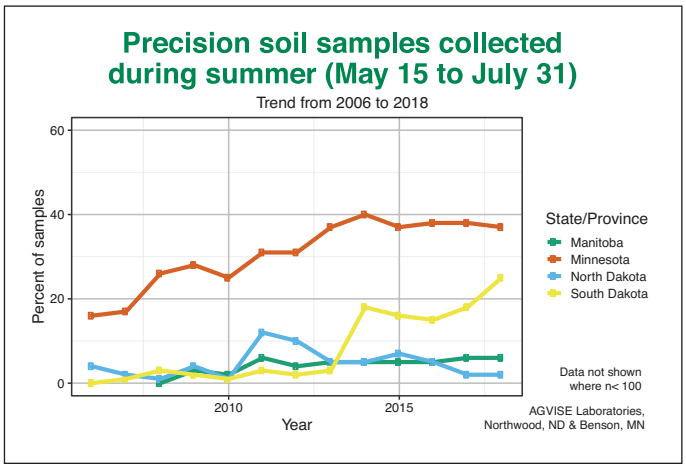
"The philosopher who said that work well done never needs doing over never weeded a garden."

"Your first job is to prepare the soil. The best tool for this is your neighbor's motorized garden tiller. If your neighbor does not own a garden tiller, suggest that he buy one."

Early Summer Precision Soil Sampling

Early summer topsoil grid sampling, most commonly 2.5 acres per grid, continues to increase, especially in traditional corn-soybean growing areas. Early summer, that is late May through early July, is an excellent period of time to collect soil samples, instead of waiting until after soybean harvest, which has presented major time constraints in the past few years. These early summer soil samples are collected while soybean is in early vegetative growth stages when you can travel across soybean fields without causing unnecessary harm. Over the past 12 years, summer grid sampling has increased considerably at both Benson and Northwood laboratories, as shown in the figure.

The early summer timeframe works well for 0-6 inch soil sampling and analyzing non-mobile nutrients and soil properties. The commonly tested nutrients and soil properties are P, K, pH, buffer pH, organic matter, salts, Zn, Fe, Cu, Mn, B, Ca, Mg, Na, CEC, BS% and carbonates (CCE). It is not applicable for 2-ft residual nitrate-N testing, which must wait until after the crop has been harvested. If soybean or pulse crops will follow wheat, the early summer timeframe offers another opportunity to accomplish grid/zone sampling in the early vegetative growth stages of wheat, just avoid any fertilizer bands. You want to avoid soybean fields that have been fertilized or manured in the fall or spring prior, as this nutrient application will skew soil test results. In these situations, it is best to wait until after the soybean crop has been harvested to soil sample.



Advantages to early summer grid sampling:

- High-quality soil cores with consistent depth
- No chasing around in the fall trying to soil sample fields that have been harvested and before any fall tillage operation occurs
- More time in summer to develop fertilizer management plans with growers
- Fields can be fertilized immediately after harvest
- Avoid post-harvest rush in fall
- More available labor (interns) in the summer timeframe compared to the fall season
- On-ground assessment of soybean stands, especially if iron deficiency chlorosis is observed
- 40% discount on summer grid/zone analysis in 2019 (May 15 – July 31)

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BOB DEUTSCH
PRESIDENT
SOIL SCIENTIST/CCA

Gypsum, or calcium sulfate, has been used to reclaim sodium-affected soils for over 250 years. Recently, interest in gypsum application has greatly increased as more sodium-affected, or sodic soils, are confirmed with soil testing. Installation of tile drainage often prompts questions about gypsum application, especially on sodic or saline-sodic soils.

In numerous research studies, gypsum has been demonstrated to improve sodic soils. Sodic soils have poor water infiltration, percolation, and high bulk density, reducing root growth. With enough rainfall, calcium in gypsum displaces sodium attached to clay particles, which allows sodium to leach from the soil profile. Over time, gypsum helps maintain soil structure and reduce the detrimental effects of high sodium in soil.

When considering a gypsum application, there are two important points to remember. Gypsum is a sparingly soluble salt, which will not dissolve much if calcium or sulfate are already high (these are two of the most common salt ions in Great Plains soils). If soil salinity is already high (greater than 2.0 dS/m, 1:1 method), then gypsum is unlikely to dissolve and improve soil water movement. Soils with salinity above 2.0 dS/m usually have good soil water movement without requiring gypsum. Only after tile drainage has sufficiently lowered soil salinity, which may take many years, should you then consider gypsum application when it will provide more benefit and save the investment until needed.

The second point to remember is soils in the Great Plains often contain significant amounts of gypsum naturally. We analyzed a number of saline soils (EC > 2.5 dS/m) near the Northwood area that naturally contained over 5% gypum. This is equivalent to 100,000 lb/acre gypsum. Adding a few more tons of gypsum will do diddly-squat since naturally occurring gypsum is already plentiful (until tile drainage leaches calcium and sulfate away).

AGVISE will be offering a gypsum soil test in 2019. I would suggest that saline and sodic soils with recent tile drainage installations should be monitored yearly for salinity and sodium levels. If your soil has high sodium, you should also test for gypsum to know if gypsum is already present in the soil or if gypsum application is needed. Knowing your soil salinity, sodium, and gypsum levels will aid in making good management decisions for long-term sodic soil amelioration.

NORTHERN NOTES

JOHN LEE
SOIL SCIENTIST/CCA

My father used to tell stories about tough winters with 30-foot snow drifts and -50 °F here in the North Country. This past winter, we did have a rough patch of snow and cold in February, but nothing like the old days! I think we are just getting a bit soft when we complain if our heated seats do not work! While complaining might make us feel better, it still does not get the job done, so I guess we all better just get ready for spring anyway.

With spring right around the corner, there is a lot of fertilizer to be applied in a short window this spring, following the wet soil conditions and late harvest last fall. Some areas really struggled last fall to complete their soil testing. In those areas, many customers will have a short window to do their spring soil testing. We are ready to give you great service and support on your spring samples. We know every sample we get will be a rush! If you need any supplies or sampling equipment, we have everything in stock and can send it ASAP. While spring season will be fast and furious this year, please take your time and keep everyone safe.