AGVISE LABORATORIES

Timely Information for Agriculture

WINTER 2024-25

INSIDE

NORTHERN NOTES

JOHN BREKER
SOIL SCIENTIST, CCA, 4R NMS

What a difference one year can make! After the 2023 drought year that left a very dry soil profile, the 2024 growing season pushed the extremes of wet and dry in a single year. Some parts of the region produced spectacular crop yields with near-perfect rain timing, while other parts had average to below average crop yields, either from too much or not enough rain at the right (or wrong) time. Excessive rainfall in spring and summer created conditions for soil nitrogen losses via nitrate leaching or denitrification. A number of growers wisely pulled the trigger on in-season nitrogen and sulfur applications in situations where rescue applications were needed. By late summer and fall, much of the region received very little rain and has actually slipped back into moderate and severe drought conditions.

As we prepare for 2025, soil testing is the first step in making fertilizer plans for next year. With low crop prices and high fertilizer prices, nobody wants to apply more fertilizer than needed. Soil testing is the most reliable tool for making informed fertilizer decisions. If you did not get soil samples taken last fall, there is still time in spring to get soil samples collected before hitting the field.

This winter, I hope that you can join us at our AGVISE Soil Fertility Seminars. We will be talking about the latest soil fertility research in the region and new advances in soil testing. There will be a lot of great information to cover, and we expect to see you there!

AGVISE Soil Fertility Seminars 2025: Mark your calendar!

The AGVISE Soil Fertility Seminar dates and locations for 2025 are set. These seminars cover soil fertility and plant nutrition topics along with other issues that currently challenge our region. You will not want to miss the great program lineup, so mark your calendar now! A registration letter for the USA seminars was sent to AGVISE customers in early November.

If you did not receive the mailing, please call 701-587-6010 and we will send you the registration form. Please make sure you register early for these seminars to secure your spot. Space is limited and there is usually a waiting list. To register for the Soil Fertility Seminars, please call 701-587-6010 and ask for Emily or Patti.

Date	Location	CCA CEUs applied for
Tuesday, January 7	Willmar, MN	3.0 NM, 2.5 SW
Wednesday, January 8	Watertown, SD	3.0 NM, 2.5 SW
Thursday, January 9	Grand Forks, ND	3.0 NM, 2.5 SW
Tuesday, March 11	Portage la Prairie, MB	TBD
Thursday, March 13	Saskatoon, SK	TBD

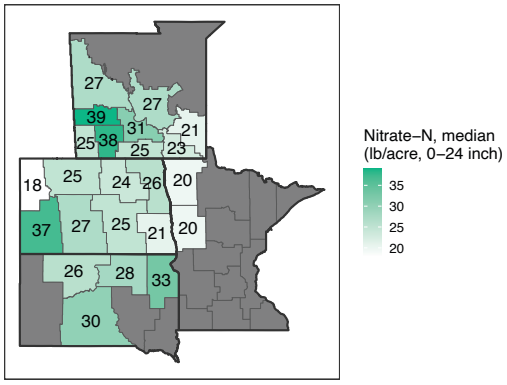
Soil Nitrogen Trends – Fall 2024

With wheat harvest completed, we summarized the amount of residual soil nitrate-nitrogen (0-24 inch soil profile) following wheat harvest in 2024. Across the region, soil nitrate-nitrogen amounts are closer to the long-term trend of 25 to 35 lb/acre nitrate-N after wheat. Compared to the 2021 or 2023 drought years, the more typical amounts of residual nitrate-nitrogen resulted from good to exceptional wheat yields, some nitrogen losses from wet spring and summer weather, and cooler summer temperatures that may have reduced nitrogen mineralization from soil organic matter. For regions with less than 20 lb/acre nitrate-N (0-24 inch) after wheat, this suggests that wheat crops may have run short on nitrogen, causing reduced crop yield and/or grain protein.

Although a region-wide average of 25 lb/acre nitrate-N after wheat may seem small compared to a drought year like 2021 or 2023, a small difference in nitrogen fertilizer savings translates to a lot of money in the real world. The real world savings of 25 lb/acre N for next year equals $73 million of nitrogen fertilizer, based on $0.54/lb N and 5.4 million acres of wheat in North Dakota–and that is just one state in the region. The dollars speak for themselves. Soil testing is more important than ever!

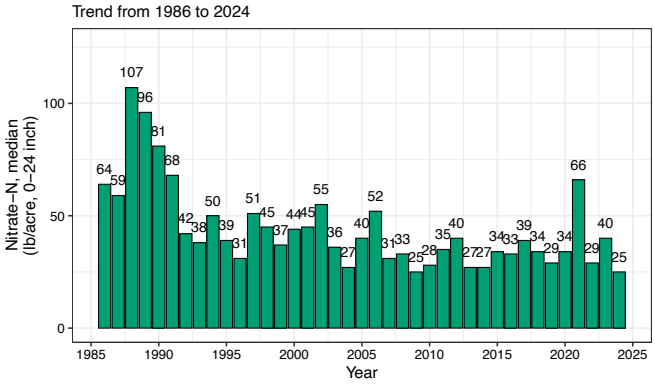
Each year, AGVISE summaries soil test data in our major trade regions of the United States and Canada. For more soil test summary data and other crops, please view our soil test summaries online: https://www.agvise.com/resources/soil-test-summaries.

Residual nitrate following wheat in 2024



Data not shown where n< 100
AGVISE Laboratories, Inc.

Residual nitrate following wheat



Data not shown where n< 100
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Soil Sensors: Helpful Gadgets or Hapless Gimmicks?

A number of new handheld sensors have hit the market, claiming to accurately and precisely measure soil nutrient content in the field, similar to traditional wet chemistry analysis at a soil testing laboratory. The draw for any person soil sampling is the ability to receive soil analysis results right in the field in real time. We know that our clients have a lot of questions about these types of sensors because we are getting these questions too. For almost 50 years, AGVISE has been an early adopter and innovator of new technologies in soil and plant analysis, and these new soil sensors are among the newest to gain popular attention in agriculture.

First, handheld sensors in general are nothing new for soil analysis. There are a number of handheld pH and electrical conductivity (EC) sensors available on the market that are often used for assessing and mapping environmental sites for reclamation and remediation projects. The environmental consultants still need to collect field soil samples and send them to the laboratory for calibration and validation in their official reports. The handheld sensors are used to help them assess the site size and variability.

Second, the type of sensor for the intended soil nutrient or property for measurement is important. After all, you should not try to measure something that the sensor cannot detect, right? The new handheld soil nutrient sensors often rely on near-infrared (NIR), mid-infrared (MIR), or X-ray fluorescence (XRF)

spectroscopy methods. These technologies have long existed as benchtop instruments in analytical laboratories for various applications, and each method has its strengths and limitations.

For example, NIR spectroscopy is widely used in feed and forage analysis, food processing, and even meat science. The American Society of Agronomy compiled an 800-page book on NIR applications in agriculture (https://doi.org/10.2134/agronmonogr44.c10). There is one chapter on soil analysis at the end of the book. The strengths of NIR for soil analysis include soil organic matter, total carbon, organic carbon, organic nitrogen, and even pH. However, it does not perform well for nitrate-N, P, K, sulfate-S, Ca, Mg, Na, Cu, Fe, Mn, Zn, or soluble salts (EC). Simply put, NIR fails at measuring the actual soil nutrients we are trying to manage! This is why we do not use benchtop NIR for any soil analyses at AGVISE, let alone a handheld unit with less accuracy or precision. You might see handheld NIR sensors being used for some things, but you will not see them replace soil sampling or soil nutrient analysis soon.

Third, the handheld sensor outputs are often correlated and converted, in the end, to traditional wet chemistry analysis methods, like Bray P, Olsen P, or ammonium acetate K. These are the plant-available soil test methods that we are all familiar with and have decades of soil test calibration research behind them, which allow us to make fertilizer guideline calculations from the soil test result. Whenever a correlation and conversion step takes place, this introduces error for any subsequent calculations, like fertilizer rates. It is important to know what is actually being measured versus what is being reported.

As new sensors hit the market, a person thinking about trying them should be asking a lot of questions. AGVISE is always evaluating new analysis technologies, which can help us do a better or faster job while providing high-quality data to our clients. The questions outlined above are those that we use when we evaluate new analysis technologies for our own operation, and we hope the same questions can help guide you through the gamut of new soil sensors too.

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 or claimed mode of action. In fact, some promotions sound pretty attractive. Many of these companies tell growers they can use less of their “new” fertilizer product and get the same crop yield as applying higher rates of conventional fertilizer products. In the short term, this may work if the grower has high soil test levels right now. But in the long term, nutrients like P and K will be removed by high-yielding crops, and the nutrients must be replaced for the soil to stay productive.

Some “new” products are actually not new at all, and there may already be research conducted on them. Luckily, university researchers have compiled a database with replicated field research on non-traditional products that is publicly available. The compendium can be accessed online at the NCERA-103 Committee on Non-Traditional Materials for Crop Production (https://www.ncera103.org/). For example, humic substances (e.g., humic acid, fulvic acid) have been around and researched since the 1960s and 1970s. You can find numerous research reports on these types of products and others in the compendium. The company and product names may change over time, but the active ingredients remain the same.

Most growers are pretty savvy when it comes to new fertilizer products. If a grower wants to evaluate a new product on their own farm, the grower should put some replicated strips in one field and evaluate crop yield data before applying the product to the whole farm. The keywords are replicated and strips–a split field does not constitute a meaningful trial. With variable-rate equipment and yield monitors being more common, replicated fertilizer treatments to evaluate new products are much easier than before. The internet also allows growers to trade notes with other growers 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.

The Economics of Soil Testing

You might recall an old AGVISE poster that said "Soil Testing Makes Dollars and Sense." It was a clever turn of phrase, but it really summarized the principal reasons why we soil test in the first place. An obvious response to that statement is "Well, duh! How else would I learn how much fertilizer to buy, where to put those fertilizer dollars in my fields, or if I were neglecting some crop yield-limiting nutrient or soil property?" It may seem obvious to most of us (after all, you are reading the AGVISE Newsletter), but we still hear comments from agronomists or crop consultants who have clients that remain unconvinced or do not see that soil testing is the first step on the path to profitable nutrient management.

To help illustrate the economics of soil testing, we put together three different scenarios examining the profitability of soil sampling methods, flat-rate versus variable-rate (VRT) fertilizer application, and the potential costs associated with over- and under-applying fertilizer in the field (including crop yield loss from under-application). There are countless scenarios that we could examine, but let's keep things simple with a real corn field from south-central North Dakota (Table 1). The three scenarios include a crop removal-based fertilizer rate, a whole-field composite soil test-based fertilizer rate, and zone soil test-based variable fertilizer rates. The corn price was $4.00/bushel. The fertilizer prices were $500/ton urea (46-0-0), $810/ton MAP (11-52-0), and $450/ton potash (0-0-60). The cost of soil sampling and analysis was estimated at $150 per field or zone. The additional cost for zone map creation and VRT application was estimated at $5.00/acre. The fertilizer guideline type was university sufficiency, which is the most conservative guideline option.

Table 1. Soil test levels for zone soil test results and whole-field composite average.

	Zone Management			Whole-Field Composite
	Zone 1	Zone 2	Zone 3	Average
Acres	45	60	15	120
Nitrate-N, lb/acre	37	21	12	26
Olsen P, ppm	17	5	8	10
K, ppm	242	182	169	203

The zone-based variable rate scenario generated the highest crop yield, gross revenue, and partial profitability because it matched the appropriate fertilizer rates with crop yield potential and soil test levels across the field and did not over- or under-apply fertilizer. The extra cost associated with zone map creation and VRT application was more than worth it.

The whole-field composite flat rate scenario over-applied N on Zone 3, over-applied P on Zone 1, under-applied P on Zone 2, and under-applied K on Zones 2 and 3. The under-application of fertilizer in some zones did reduce crop yield and gross revenue, but the whole-field composite soil test did help save overall fertilizer cost across the field.

The crop removal flat rate scenario over-applied N on all zones, over-applied P on Zone 1, under-applied P on Zone 2, and over-applied K on all zones. The under-application of fertilizer in some zones did reduce crop yield and gross revenue, and the over-application of fertilizer across much of the field increased overall fertilizer cost. The over-application of fertilizer is not only expensive but also creates additional concern for nutrient losses to the environment. This was the least profitable scenario and emphasizes why crop removal-based fertilizer strategies are simply a bad idea.

These scenarios should help illustrate how soil testing not only helps save fertilizer costs but also can help maximize crop yield potential and profitability across the field, especially if coupled with precision nutrient management tools like grid or zone soil sampling. After all, soil testing DOES make dollars and sense.

Table 2. Fertilizer rates, crop revenue, fertilizer cost, and partial profit for three soil test and fertilizer rate scenarios.

	Zone Management			Whole-Field Composite	Crop Removal
	Zone 1	Zone 2	Zone 3	Flat Rate	Flat Rate
Yield Potential, bushel/acre	200	180	150	184	184
Nitrogen Rate, lb/acre N	203	195	168	195	221
Phosphorus Rate, lb/acre P2O5	15	86	52	49	51
Potassium Rate, lb/acre K2O	0	18	26	0	35
Gross Revenue, $/acre	$735.00			$707.04	$719.27
Fertilizer Cost, $/acre	$152.95			$143.15	$172.47
Partial Profit, $/acre	$570.80			$562.63	$546.80

A Stroll Around the Block

DR. JED GROW
AGRONOMIST

Growing up, I spent countless hours at the feet of my grandparents, listening to wildly funny tales of bygone years. AGVISE, too, is no spring chicken—with over 48 years of experience, we've been "around the block" a few times and seen our fair share of wild things. Today, AGVISE boasts an exceptional team of expert agronomists and soil scientists. And when it comes to some of the more, shall we say, unique requests, it often takes every bit of that technical know-how to fulfill them for our clients.

We have analyzed every kind of manure you can think of (some more fragrant than others)—from bison and elk to rabbit, mink, and even cricket dung! In the geographic heart of North America, we have seen seaweed, crushed seashells, and byproduct crab and lobster meal make their way into our laboratory. We have fielded questions on the agronomic potential (if any) for barrels filled with liquid salt brine (no further comment) or liquid fish emulsion from fish cleaning stations. There is really no end to the strange materials that we encounter.

In addition to the usual questions about soil fertility and fertilizers for field crops, we answer questions from home gardeners with questions ranging from troubleshooting tomato problems to issues with fruit trees and irrigation water for lawns. Our team has analyzed soils after train derailments and other industrial accidents, and we have also helped small cottage businesses evaluate their homemade compost and fertilizers. If there is a plant or plant part, there is a good chance that we have tested it—from watermelon leaves to whole apples, blueberries, and potato tubers.

So, yes—keep coming to us with your interesting questions and analysis needs. We are proud to deliver excellent service and provide you with the best laboratory analysis services for soil, plant, manure, fertilizer, water, and whatever it might be. After 48 years in business, AGVISE has helped numerous clients with the usual and the unusual. It is the unusual that keeps us on our toes and helps us feel young.

SOUTHERN TRENDS

DR. BRENT JAENISCH
AGRONOMIST, CCA

Wow! That was a harvest and soil sampling season for the record books. After an excessively wet spring and summer, the fall turned dry and stayed dry. The official weather record at the Benson, MN airport had only two measurable rain events in September and October. The two rain events amounted to 0.02 inches on September 17 and 0.04 inches on October 25–not even enough to settle the dust. With no rain delays, harvest and soil sampling started and continued without delay. I am always amazed how much work can get done in a short amount of time with some cooperation from Mother Nature.

The 2024 growing season presented some real challenges for nitrogen management. The spring and summer rains broke precipitation records in some areas, and many fields were left with numerous acres of yellow corn and waterlogged parts in fields. Growers were faced with the decision to sidedress corn with nitrogen and at what rate. Some fields were not fit for sidedress applications until mid-July, which was well past the optimal window. These late sidedress applications turned into rescue applications. In spite of struggles, the final corn yields were better than anticipated for many growers. I know it was no record corn crop in the Benson service area, but the harvest conditions and crop yields were a pleasant surprise considering the growing season.

I wish to thank you all for a very productive fall soil sampling season. We got a lot done! I hope you have a great winter and hope to run into you at a trade show.

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PRESIDENT'S CORNER

CINDY EVENSON
PRESIDENT
AGRONOMIST, CCA

Another fast and furious fall harvest and soil sampling season is already behind us. Farmers, agronomists, and crop consultants everywhere are looking forward to 2025.

For a third year in a row, the dry fall weather pushed along harvest and soil sampling progress without any delays. The larger size and capacity of harvest equipment, along with automated soil sampling equipment, has accelerated the speed at which we can harvest fields and get them soil sampled right behind the combine. October was an extremely busy month at both the Northwood and Benson laboratories. We broke daily receiving records for multiple days in the same week. In other words, all the fall soil samples from across the region were coming in at the same time! It was a FAST soil sampling season.

Throughout the year, we strive to maintain our normal next-day turnaround on routine analyses. We are currently working on plans to increase daily laboratory throughput for next year and help alleviate bottlenecks as we process soil samples during the busy fall soil testing season.

I wish to extend a special thank you to all our customers for trusting AGVISE Laboratories with your agricultural testing needs. It is our privilege to serve you and provide you with a high standard of laboratory services. This winter, I look forward to seeing many of you at winter trade shows and agronomy update meetings. We wish you and your team a very successful end to 2024, a Merry Christmas, and a Happy New Year.