Soil Fertility/Variable Rate Nitrogen
Update 3

Rademacher Farms
6/14/2018

Hey everyone,

We wanted to send a thank you for everyone's interest and support. We've loved the feedback and these updates are now sent to 6 people after a few referrals! I'll spend this update talking about soil fertility, nitrogen, and our new Variable Rate (VR) practice based on those concepts. Soil is a very complex topic, and I don't claim to be an expert, but no one really is. And this topic is rather controversial, but also one of my favorites, so as always, I welcome any questions, comments or concerns and can provide sources and more info on everything.

Intro

My soil professor was from the Natural Resources and Environmental Sciences department and did research with, and taught within the Crop Sciences department for his entire career. He exclusively studied potassium and nitrogen. He stressed that soil types are incredibly variable, undergo poorly understood interactions, and have huge nutrient stores that are not represented accurately by most soil tests.

The soil is not a bank. Putting something there does not mean it stays there, is beneficial, or is even every used by the plant. Nutrients are affected by other nutrients, chemical properties of soil and nutrients, and especially soil biology. For each nutrient, there are many different forms that are in equilibrium, but a soil test may only read the small amount immediately available to the plant. The soil is characterized by complex nutrient cycles driven by bacteria, fungi, and nematodes.

Soil Fertility

Soils naturally contain a large amount of nitrogen. Depending on soil quality, mostly organic matter, soils make this nitrogen available to plants during the growing season. Most of the nitrogen that ends up in the plant occurs from the soil, *not* fertilizers. Researchers use a

Fact Summary

- Nitrogen efficiency is very low. 50%+ is often wasted.
- The soil provides most of the nitrogen
- Excess nitrogen = Soil breakdown, economic loss, pollution
- Variable Rate puts N where it's needed, reducing economic loss and waste.
- Living soils = more nutrient availability

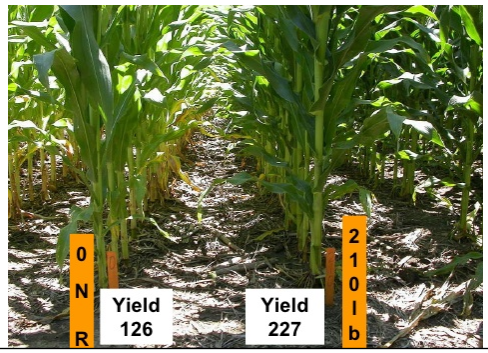
"radioactive" nitrogen form in fertilizer that is distinguishable from the regular nitrogen produced by soil. They can then determine how much of the plant's nitrogen came from the fertilizers and from the soil. In agricultural situations, roughly speaking, this maxes out around 50% from fertilizer, typically closer to a range of 20-40%. This means that generally at least 50% of the nitrogen applied is wasted on a soil type with good N production ability. Nitrogen waste causes huge economic impacts, destroys soil over time, acidifies soil causing more need for lime, and leads to massive environmental pollution issues.

"Eutrophication" in the Gulf of Mexico – Devastating algal blooms from excessive nitrogen and phosphorus in water.

Variable Rate Nitrogen

If different soils produce vastly different amounts of nitrogen and much is wasted, why is most applied as a blanket, flat rate application over most acres? VR nitrogen is not very common. As a solution, a program my soil professor spent years developing was a soil test that estimates nitrogen producing ability of soils. This test is relatively accurate in showing which areas of a field require less/more fertilizer nitrogen. As a result, one highly productive area may call for only 100 lbs N, while a soil type with low N production ability would require 200 lbs. With the relatively good soils in the area, this method results in a reduced total N input, while greatly increasing nitrogen use efficiency (the % of fertilizer that ends up in the plant) and greatly impacts soil health. As a result, this year our *<u>average</u>* per acre N input was 146 lbs, ~40 lbs less than our typical N plan.

This picture is an illustration from the research company offering the VR nitrogen testing. It shows an area with high N producing ability. The corn on left got 0 lbs N and on the right got 210 lbs N (the farmers typical rate.) The two rates yielded only 16 bushels apart. While they still recommend an economic optimum N payback amount based on their research, there is huge economic potential here.



In the same field, the corn on the left received 0 lbs N and yielded 126 bushels/acre. The corn on the right received 210 lbs N (The farmers typical rate) and yielded 227 bu/acre. This soil area clearly has low N production ability.

We're very excited about this new practice. While we were applying the VR nitrogen, there were several areas we could visually tell would be high/low rate areas by plant color. The final picture shows our VR map. Next update will cover our wheat crop and our double crop and cover crop plans after harvest.

Frank