***The Chem Gro Crop Watch*, Issue #4, 10/9/17**

Nicholas Paulsmeyer, CCA, Sales Agronomist, npaulsmeyer@chemgroil.com, 217-430-1440

Soils Science 101

October is here and harvest is in full swing throughout the county. This season thus far I have been hearing good numbers for yields on both the corn and soybean end of production and with commodity prices being where they are today, higher yields probably aren't a bad thing to have. So, before I get to my main topic I would like to wish everyone a happy and safe harvest this year.

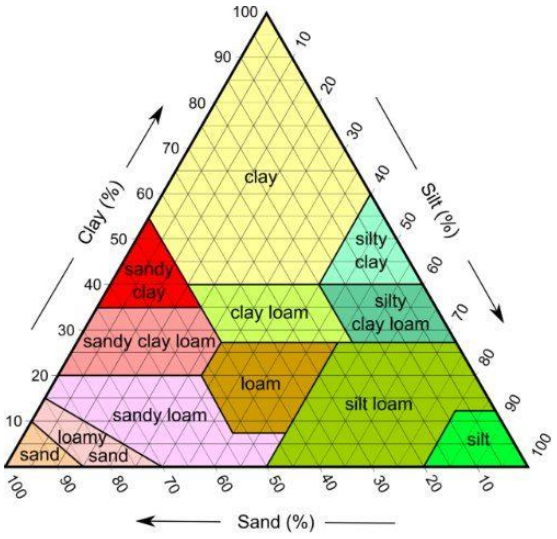
As with many of my topics for this year, I felt it necessary to break up my basics in soil science into different subcategories. After all, my degree in agronomy did come with a focus in soil science so naturally, I have a lot to say. In my mind there are 2 distinct properties that need to be touched on in order to get a basic understanding of soil science. That is the physical and chemical properties of a soil.

Physical Properties

When looking at a soil there are several physical properties that you can easily look at that can tell you a lot about it. Properties such as soil color, texture, and structure are physical properties that can be easily observed.

Of all the physical properties of a soil the color is the most easily recognizable one. Since the dawn of agriculture, man has recognized the significance of dark, organic matter rich soils as important cornerstone of agriculture. In Illinois and Iowa, we pride ourselves on our dark prairie soils that we are blessed with. How that organic matter got there can take you back in time before row crops dominated the landscape and the native vegetation was predominantly grassland or timber ground. Due to their thick fibrous roots, soils that formed under grassland developed deep and dark organic layers while timber soils developed thin dark organic layers. Dig deeper into the ground and you will eventually begin to see the various soil horizons that have formed over the centuries. These colors can also be a good indicator of how well a soil naturally drains. A soil layer that occasionally is saturated by soil water will often have brown speckles as Iron compounds in the soil begin to rust. Gray layers of soil, on the other hand, are indicative of very poor drainage and is often the result of the water table being so high that it leaves that layer of soil submerged almost year-round.

Texture in a soil is determined by the ratio of sand, silt, and clay in a soil and determines several import functions of soil such as water availability, soil aeration, and even soil fertility. The best way to determine the exact texture of a soil is to determine the percentage of each component in a soil and compare it with the texture triangle below.



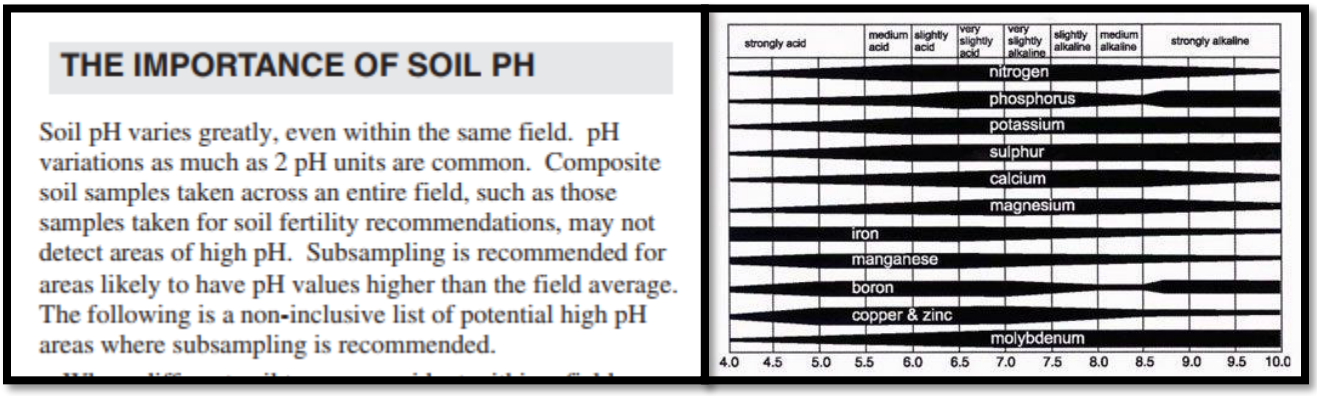
Soil structure is the way soil particles arrange themselves into aggregated forms. Now I know that sounds complicated but what it comes down to is when you take a handful of soil and break it apart into chunks what do those chunks look like. Soil structure is a management dependent property of soil because it is greatly affected by tillage type and frequency. After tillage, surface soils are left structureless and take quite a bit of time to fall back into their natural structure. This might be the reason why transitioning a field from conventional tillage to no-till is often such as painful process because even a year after tillage has stopped, the soil

is still coming together slowly. Soils with better structure tend to drain better and resist compaction better.

Chemical Properties

Chemical properties of a soil are those which we can easily test and fertilize for. In all, there are 14 essential elements required by a plant for proper growth when ignoring the Carbon, Hydrogen, and Oxygen supplied by water and Carbon Dioxide. The elements and other chemical properties we test in soils can take up a whole book's worth of information but for ease of reading I will focus mainly on properties that we might go over in a soil test.

- **Organic Matter:** While I have already touched on organic matter as a physical property of soils, it's chemical importance cannot be ignored, as much of the nutrients supplied to your crops comes directly from organic matter. Management plays a big role in organic matter levels as both the crop you raise and the tillage you use play a role in how much exists in the soil. Proof of this could be found at the Morrow Plots at the University of Illinois where organic matter levels have been observed in soils for over a century in various rotations and tillage types.
- **pH:** Liming of soils is one of the most overlooked aspect of any operation and is critical to the success of a crop. pH alone in a soil can affect not only nutrient availability to your crops but can also lead to carryover concerns in herbicides or reduce herbicide performance
  in the soil. The picture below shows an excerpt from a Classic herbicide label stating the importance on knowing where high pH might exist in a field and on the right, is a graph showing how pH effects the availability of certain nutrients.



THE IMPORTANCE OF SOIL PH

Soil pH varies greatly, even within the same field. pH variations as much as 2 pH units are common. Composite soil samples taken across an entire field, such as those samples taken for soil fertility recommendations, may not detect areas of high pH. Subsampling is recommended for areas likely to have pH values higher than the field average. The following is a non-inclusive list of potential high pH areas where subsampling is recommended.

- **Nitrogen:** Every year the number one question on any corn growers mind is going to do I have enough Nitrogen? The reason for this being simply because Nitrogen is the most limiting element in our soils and yet it plays such a vital role in creating proteins and performing photosynthesis. Nitrogen comes in two plant available forms: Ammonium (NH_4+) and Nitrate (NO_3-) and has many sources that it can come from. The majority of Nitrogen supplied to corn crops come from application of anhydrous ammonia or NH_3. Once in the soil, Anhydrous turns into Ammonium with the help of water. Here at Chem Gro, we use N-Serve to protect that Ammonium from being converted by microbes to Nitrate which can be easily lost through leaching. By waiting until soil temperature is

below 50 degrees, we ensure that the microbes that act on ammonium are already at a slower state of activity. The combination of these two tactics helps to protect both your investment and the environment.

- **Phosphorus:** This essential element it vital for protein synthesis and energy production in plants. In the soils, Phosphorus can be found in the form of phosphoric acid ($H_2PO_4^-$) and is supplied to our crop mainly from organic and mineral sources. When testing soils for Phosphorus levels we often shoot for a test value of 45 on our tests. This often requires us to take into account how much phosphorus our crop is taking off as well as how much Phosphorus is required to bump up soil test levels by 1 point.
- **Potassium:** Unlike Nitrogen and Phosphorus, Potassium is not found in any organic compounds in plants. Instead it exists in cell liquids and on cell tissues where it regulates the movement of water and sugars in a plant. In the soil, Potassium exists as a positively charged ion (K+). This positive charge can lead to some availability issues in soils and is what makes it difficult to reach the soil test value of 350 that we shoot for when testing our soils.
- **Secondary Macronutrients:** Sulfur, Calcium, and Magnesium make up the secondary macronutrient elements in the soil. Often time both Calcium and Magnesium are supplied by minerals in the soil and the lime we apply. In the past, every acre of ground received a foliar application of sulfur when it rained due to the sulfuric acid that formed in rain clouds as a result of polluted air. Now that we are doing a better job keeping the air clean we receive less of that sulfur from the rains and sulfur applications to fields have become more and more common.
- **Micronutrients:** Zinc, Iron, Boron, Molybdenum, Manganese, Chlorine, Nickel, and Copper are the 8 micronutrients required by plants. The majority of these minerals can be supplied by minerals in the soil and are critical to cell structure and enzyme activity in plants. Application of micronutrient through dry fertilizer and foliar sprays has become more of a standard accepted practice in recent years due to higher crop yields and a concern that with higher yields, more micronutrients will be required to sustain those yields.

Are you still awake? That's good! It means you have made it through my own personalized soil science 101 lesson for the month. If nothing else, I would like you the reader to start thinking about those soils in your fields and why it is that we do what we do to them. In my mind the greatest change in attitude on soils around the industry has been the change in language from saying "what can our soils do for me?" to "what can I do for my soils?" Because there is no turning back once a soil has been depleted and degraded. Like always, my job is to give you the best advice possible, what you do with it is up to you.