SOIL DEPTH AND NUTRIENT ACCUMULATION

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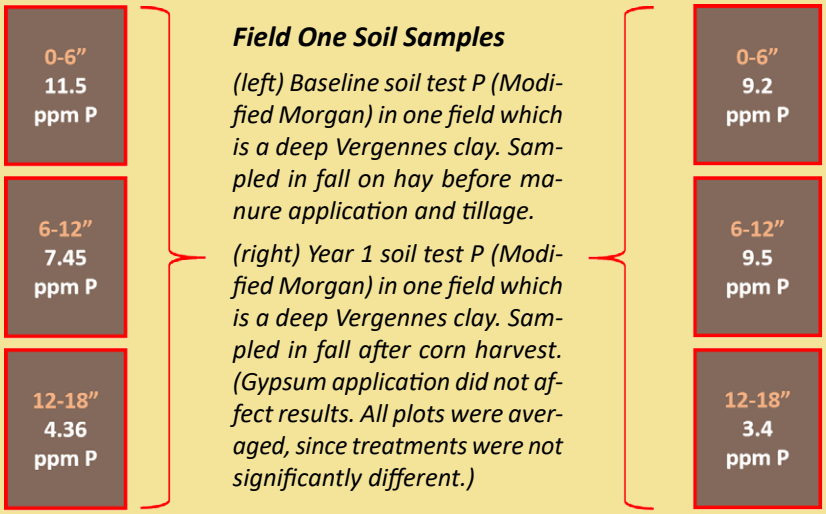
In the last newsletter, I wrote about how during our research we stumbled upon what should be an obvious phenomenon – fields are not really one soil test level. Fields that come back as overly high in phosphorus (P) may not actually be universally high in P. What if you were limited in manure applications on that field, while in reality, only one-third of the field was actually above optimum? Also, if you've observed noticeable differences in your yields that aren't easily attributable to drainage across a field, field history or soil type may be affecting your soil test's available P.

Adding to this observation, we also found (as research has borne out through decades) that soil test P varies by depth. This isn't all a "bad" thing as we want the nutrients in the top layer of the soil where they are most easily assessable to the plant roots. However, this emphasizes the point that when we lose topsoil, we are losing the most fertile part of the soil.

In the hay years of a rotation - particularly in permanent hay fields - soil P will probably accumulate in the top zero to six inches of the soil. This isn't necessarily bad as many roots are shallow, but surface applications on top of hay can lead to soluble P loss. We have a new grassland manure injector that is making the rounds in Addison County! In addition to being a best management practice for manure, it might have the potential to increase yields; we will have to wait and see. Another thing folks can do in permanent perennial systems is build root diversity through diverse species. We usually think of taprooted plants bringing nutrients up from below. However, I think it may be more important to think of encouraging growth below the optimal nutrient zone, to reach water during periodic drought stress and maybe actually deepen the nutrient and higher organic matter zone. Deep-rooted cover crops serve a similar purpose in no-till fields, but in order to get a deep taproot the plant has to be established early.

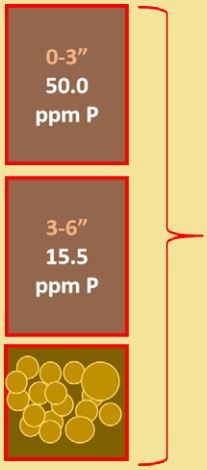
Much more to come from this project as we measure another year of soil and corn silage results from gypsum applications, and expand our trials to some hay/alfalfa/pasture fields, exploring gypsum with and without humates and beneficial mycorrhizae fungi.



Field One Soil Samples

(left) Baseline soil test P (Modified Morgan) in one field which is a deep Vergennes clay. Sampled in fall on hay before manure application and tillage.

(right) Year 1 soil test P (Modified Morgan) in one field which is a deep Vergennes clay. Sampled in fall after corn harvest. (Gypsum application did not affect results. All plots were averaged, since treatments were not significantly different.)



Field Two Soil Sample

Baseline soil test P (Modified Morgan) in a corner of one field which is a rockier subsoil. Sampled in fall on no-till corn ground after harvest. (The soil type and P is not uniform across the field.)

Above are illustrations of two different fields that we looked at where the original field soil test was above optimum (>10 ppm P in Modified Morgan). In the figure on the left, you can see the difference between our fall soil samples: taken on hay ground before manure and tillage, and the results taken after corn silage harvest. These results were part of a gypsum trial, but the numbers are averaged since gypsum was not a significant factor. The manure was worked into the ground and with active roots the P has actually become more uniform, from zero to 12 inches instead of just the top six inches.

In the second illustration, we are only looking at baseline samples. These were from a field added after the first year, so we will have results from that field late this year. This particular field is no-till and this corner of the field is rockier soil. No-till is considered a soil conservation practice because it keeps and builds the "native" soil structure, which can reduce erosion and provide a stable living habitat for soil biology. There are tradeoffs with all choices, though; even things that we think of as better options. One reason humans ever began tilling was to integrate nutrients into the soil. In this illustration, you can see that soil P is accumulating in the very shallow zero to three-inch depth. Again, manure injection might be a good compromise on otherwise no-till ground, as it puts the nutrients a little deeper down for roots. However, this particular soil has a rocky substrate that would be less than ideal for injection or even tillage. But we certainly don't want to limit root growth to three inches. In long-term no-till situations, it is a good idea to do a field check at different depths. It should be noted that this field yields quite well in tonnage and in this corner the three- to six-inch depth is still above optimum P, so it probably isn't a yield concern.