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Subsoil: The Farming Unknown

In farming, we tend to focus a lot on that which we can control. In crop fertility, we focus on the top 6" of soil because that is fraction of the soil that we can fertilize and till. We don't, however, have much control over the soil beneath those 6", yet it is this subsoil that's highly important to crop yields and how we interpret fertilizer recommendations. We have some general ideas about the pH and nutrient status of the subsoil in this area. Generally, we know that subsoil tends to be acidic east of the Flint Hills (or east of the Chautauqua Hills here) and south of the Kansas River. That however, leaves a lot of area between transition zones from one geological feature to the next and is a big area to group together. We also assume that subsoil is very low in nutrients like phosphorus, organic matter, and in this area, potassium. zinc and manganese tend to be lower in the subsoil as well.

There is no specific definition for subsoil, beyond the general 'soil beneath the topsoil', and there is no specific delineation between what topsoil is and what subsoil is. Many agronomists, myself included, consider anything in the top 6" to be topsoil and anything below that to be subsoil. This is largely because most of our soil nutrients indexes are considered with a standard 6" soil core, including pH, phosphorus, potassium, zinc, and all the other immobile nutrients. Only the mobile nutrients of nitrogen, sulfur, and chloride are taken with a deeper sample. This has left the world of the subsoil within agricultural fields largely unknown.

Recently a currently unpublished survey of 30 alfalfa fields in Eastern Kansas left me with some expected, but also some surprising results. Note that we weren't looking for differences in topsoil vs subsoil and the study was not designed in a way to accurately do so. Basically, one set of soil samples for 30 fields spread over such a large area is not a good representation of soil differences. However, contrasting the surface and subsoil samples in these fields left me wondering about some established paradigms. Many of the samples did have subsoil that was more acidic than the topsoil but it wasn't consistent. Nearly every subsoil sample has phosphorus levels that were much lower than the topsoil, as expected, but there were a few samples with phosphorus levels so high in the topsoil that they were also high in subsoil. Sulfur tended to be higher in the topsoil but the subsoil had plenty of sulfur too (showing that a full profile sample really is needed to capture sulfur quantities in the soil). The one that really surprised me though was the potassium. Potassium didn't universally drop into much lower levels in the subsoil as expected. Many of the 30 samples had slightly lower potassium levels and there were a few with

slightly higher subsoil potassium. This would be expected in the fields of central and western Kansas where the native soils have naturally high potassium levels. As it turns out, our subsoil might have more potassium too. Of course, more research is needed to state anything definitive. The nutrient and pH status of the subsoil might explain why some fields respond better to lime or fertilizer applications than other fields. It might also add some complexity to fertilizer recommendations as currently we consider our fertilizer indexes to be largely universal.

If a farmer is curious about the nutrient status of their subsoil, now would be a great time to take those soil test. Now is when it is ideal to take a full profile test for the mobile nutrients left by the corn before fertilizing before wheat planting. The profile soil sample can be divided into the 6" topsoil and subsoil fractions. Both fractions can be tested for the mobile nutrients (nitrogen, sulfur, chloride), but also pH, phosphorus, potassium, and zinc that we normally only test for in the topsoil. While the extra subsoil results can't be used for fertilizer recommendations, it would be a curious look into unknown subsoil of a field. If you have any questions about taking soil samples or soil fertility, please give me a call at 620-724-8233 or email jcoover@ksu.edu.

For more information, please contact James Coover, Crop Production Agent, at jcoover@ksu.edu or (620) 724-8233.

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