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MAKING SENSE OF SOIL TEST PHOSPHORUS AND SOIL BUFFER POWER

Have you ever wondered why crop advisers in some regions recommend a phosphorus soil test every 3 to 4 years, while at the same time sample for soil nitrogen every year? The answer is simple, but the reason involves a more complex explanation of soil phosphorus supply.

Nitrogen soil tests measure nitrate-nitrogen which occurs in soil water and moves with it. Therefore, levels fluctuate considerably from one year to the next. In contrast, available phosphorus occurs mostly on soil particle surfaces, is relatively immobile, and moves very little within the soil profile, providing stability in the soil test levels.

In the absence of plant growth and soil erosion, soil test phosphorus would change very little. But, as with nitrogen, soil test phosphorus declines due to crop removal. As a result, many growers use phosphorus removal estimates to determine crop requirements and maintain their soil phosphorus levels. It doesn't matter if the phosphorus originates from organic or inorganic sources, it behaves the same once in the soil.

Soil buffer power is the big difference between mobile nutrients like nitrogen and immobile nutrients like phosphorus. The capacity of the soil to re-supply phosphorus to the soil solution after crop removal defines its buffer power. A soil with a high buffer power quickly maintains phosphorus in solution around the plant roots. Alternatively, a soil with a low buffer capacity is not as capable of replacing soil solution phosphorus after crop uptake.

Routine soil tests do not measure the buffer power of the soil, but do measure the nutrients in solution and a fraction of the nutrients that may come into solution. Soils have different properties that affect their phosphorus buffering ability and the rate of phosphorus replenishment. Amount and type of clay minerals, organic matter level, other soil constituents, and fertilizer phosphorus history are all important contributors.

Buffer power increases with increasing clay and organic matter content. A finer-textured soil with high organic matter is better able to keep enough phosphorus in soil solution for optimum plant growth than a sandy-textured, low organic matter soil. This has big implications for soil testing and phosphorus fertilizer management.

Buffer power determines how quickly soil test phosphorus changes and the quantity of phosphorus required to change the soil test. Soil test phosphorus is usually easier to change with fertilizer additions on a coarse-textured soil than on medium or fine-textured soil. Soils with high buffer power (high organic matter and clay) need more phosphorus fertilizer to increase their soil test level than soils with low buffer power (high sand and low organic matter). Typically, 14 to 22 pounds of phosphate (P_2O_5) per acre are required to increase a phosphorus soil test by 1 part per million (2 pounds per acre).

We can't change the soil's natural buffer power characteristics, but if we understand them, we can use that information to do a better job managing phosphorus.

—AMJ—

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