Phosphorus Fertility – Do We Need to Look Deeper?

When measuring phosphorus (P) availability in the soil profile, agronomists tend to focus on the first few inches of topsoil. After all, P fertilizer is applied to the upper soil layer, reduced tillage limits soil mixing, most roots are present at upper depths and P is relatively immobile in the soil. So, the top layer should be where plants take most P from, right? Not entirely.

Researchers in South Australia used labeled P to determine how much soil and fertilizer P wheat plants take up, and where in the soil profile the P was obtained. They found that while the topsoil (top 6 inches) continues to be very important in P availability and uptake, wheat plants do utilize subsoil (6-12 inches) P as well (Figure 1). Thus, growers need to start looking deeper as they plan their P management.

The researchers also found that plants fertilized with P had greater P uptake, and that P uptake was not dominated by topsoil P supply, but rather by increased subsoil contributions. The increase in total uptake in plants fertilized with P was to be expected, but the difference between topsoil and subsoil contributions was a surprising discovery. Why do fertilized plants take up significantly less P from the topsoil than the subsoil? The findings suggest that the effect of available early season P on root growth is responsible.

Early in the growing season, when growth is limited, roots seek P where it is most readily available — in the top layer of soil. When P fertilizer is applied, root growth is stimulated, and plants begin building bigger, healthier root systems that can explore deeper soil layers. That increased

**Figure 1.** Total uptake of P in wheat plants with and without added fertilizer P in adequate moisture conditions. Phosphorous contributed from topsoil (6 inches), subsoil (6-12 inches) or fertilizer is indicated by color. Without fertilizer, plants take up as much as 85 percent of total P from the topsoil, versus only 14 percent from the subsoil. When P fertilizer is applied, however, topsoil contributions drop to 20 percent, and plants draw as much as 62 percent of total P from the subsoil.

**FACT**

Plants take up to 62 percent of their total P from the subsoil when P fertilizer is applied and moisture is adequate.
growth allows plants to take P from the subsoil, provided it's available. Since the amount of plant-available P is relatively small, subsoil reserves help provide plants with adequate amounts of P throughout the season, and particularly during late-season growth stages.

The study found that when P fertilizer is applied and moisture levels are sufficient, plants can take up as much as 62 percent of their total P from subsoil layers. Fertilizer application plays a critical role in helping maintain an adequate supply of P throughout the soil profile and the growing season. Subsoil P isn’t always accounted for in nutrient management plans, but it is always used by plants. Ignore the subsoil, and depleted P reserves can become a yield-limiting factor.

Phosphorus fertilizers help plants throughout the growing season by increasing root system development and access to soil P reserves. They can also improve soil test levels in subsequent years. Products such as MicroEssentials® are uniquely formulated to increase phosphorus uptake in young plants, helping to build up nutrient reserves and provide the balanced nutrition necessary for high yields.

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