

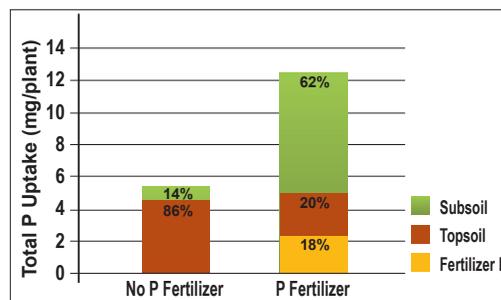
Phosphorus Fertility – Do We Need to Look Deeper?

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



McBeath et al., Plant soil, 2011.

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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