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## THE RIGHT PLACE TO PUT PHOSPHORUS

**Phosphorus is an essential nutrient for growing crops.** But in the wrong place – in excess concentration in streams, rivers, and lakes – it can lead to algal blooms. To grow crops without harming water, fertilizer P must be put in the right place.

**Unexpectedly, losses in some regions seem to be increasing.** In the Lake Erie watershed, Heidelberg University reports that soluble P levels in rivers and algal blooms in lakes are trending upward over the past 15 years, in contrast to the downward trends from 1975 to 1995. Fertilizers applied to cropland are not the only cause, but are one possibility among many. The approach of choice for managing losses from fertilizer is 4R Nutrient Stewardship, ensuring the right source of P is applied at the right rate, right time, and right place. The “right place” likely holds the greatest opportunity for improvement, but the other three need to be in tune as well.

**Source.** Plants need P dissolved in water. If we had a source that would dissolve only in the water taken up by the plant, but not in the water leaving the field, it would be the solution. But we don't. We do need sources that can be conveniently placed in the soil.

**Rate.** Fertilizing to recommendations based on soil and plant analysis is important. Crop nutrient balances show that current typical rates applied don't exceed removals, and reduction opportunity is small.

**Time.** It's important to apply when the risk of runoff is low. Research shows that when P fertilizer is left on the soil surface, any rainfall-induced runoff within the next several weeks will contain much-elevated levels of soluble P. While such runoff wouldn't carry away more than a small percentage of the P applied, it doesn't take much P loss to start an algal bloom.

**Place. The right place to put P is...**

1. **...where the soil doesn't have enough.** Soil testing identifies where crops need it most. In the Lake Erie drainage basin, the proportion of cropland on which some level of P application would be recommended has increased from 50% to 60% over the past 5 years.
2. **...in zones of need within fields.** This calls for mapping and managing spatial variability in soil properties and soil test levels.
3. **...close to the roots of the plants that need it.** Phosphorus isn't very mobile in the soil. Many crops, especially corn, have a special need for P early in the growing season. With or near the seed is a good place for P. Applying it in bands below the soil surface reduces the risk of it moving to water by surface runoff.
4. **...in a cropping system geared to higher yields.** Phosphorus enrichment gives a seedling greater potential, which can only be attained when everything else is managed to avoid limitations. High yields remove more P from the soil, and the removal must be replaced to maintain soil fertility.
5. **...into a soil that can take in and hold as much water as possible.** Tillage and crop residue management, over the long term, influence soil structure in a site-specific manner. No single tillage system fits all situations, but the soil conservation strategy needs to aim for high water infiltration, high water storage, and minimal stratification of soil P levels.

**There are wrong places to put P, too.** To minimize impacts on water quality, growers need to avoid putting soluble forms of P on the surface of runoff-susceptible soils, especially during the critical periods – late fall and early spring in most areas.

**What's the right place for P?** In the soil—not on the soil. Facilitating the availability of the sources and equipment to get P fertilizer into the right place is an important contribution toward better crops... and better water.

—TWB—

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Abbreviations: P = phosphorus

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