Report: Historically Productive Soils at Risk Due to Phosphorus Shortages

A new report due out this month from the Potash & Phosphate Institute that analyzes nutrient budgets in North America suggests that the combination of increasing yields and declining phosphorus (P) fertilizer use over the last two decades has left many farms in a P deficit.

According to Dr. Paul Fixen, senior vice president, North American program coordinator and director of research of PPI, many growers are mining their soils of P and could be putting future yields at risk if soil tests drop below optimum levels. He says the downward trend in phosphate applications was triggered back in the mid-70s after it was first learned that producers were building soil P levels by applying crop nutrients at rates significantly greater than removal.

“This new report shows that we’ve not only reversed the situation, in many cases we’ve taken it too far,” he says. “It goes against our grain today to think additional phosphate may be needed. But the fact of the matter is that many regions of North America have been in a soil-mining mode for some time, a condition that will eventually prove detrimental to the productivity of our soils unless it is reversed through proper soil fertilization practices.”

For example, in the six leading corn producing states (Illinois, Indiana, Iowa, Minnesota, Nebraska and Ohio), estimated P removal by crops exceeds P fertilizer applications by 70 percent and exceeds the sum of P fertilizer applied and recoverable manure P by 33 percent.

“The budget shows that at least one third of the P leaving production fields of these states is being supplied by soil reserves that are not at this time being replaced,” Fixen says.

“Negative nutrient budgets of this magnitude should result in declining soil test P levels over time.”

Tap the benefits of DAP (18-46-0)

An excellent source of phosphorus for high-production crops is diammonium phosphate (DAP), says Dr. Joe O’Connor, agronomic services manager for IMC Global.

“DAP is an ideal phosphate fertilizer because of its additional nitrogen content and high-level of solubility,” he says. “Because the nutrients are highly available, growers should consider incorporating this phosphate fertilizer into a balanced soil fertility program when soil tests indicate that P needs to be replenished.”

DAP fertilizer, composed of 46 percent phosphate and 18 percent nitrogen, is manufactured by the reaction of ammonia and phosphoric acid. Its nitrogen to phosphate ratio makes it an excellent direct application product or one that blends well with other fertilizer materials to produce a variety of NPK fertilizers.

DAP is typically 90 percent water soluble (expressed as a percentage of available P_2O_5). The typical pH of the product is 7.5 when it is measured on saturated slurry of the product. In the soil, the initial stages of the product's breakdown releases ammonia (NH_3) and causes a small zone around the DAP particles in the soil to have a pH of about 8.0. After a short time and as the DAP continues to breakdown, the product has a net effect of acidifying the soil.

“Plants cannot survive without phosphorus,” O’Connor says. “Phosphorus is recognized for its role in capturing and converting the sun’s energy into useful plant compounds.”

Phosphorus is a vital component of ATP and ADP, the ‘energy units’ of plants. ATP forms during photosynthesis from ADP, and transports energy from the beginning of seedling growth through to the formation of grain and maturity.

In addition, phosphorus is a vital component of DNA, the genetic ‘memory unit’ of all living things. And, it is a component of RNA, the compound that reads the DNA genetic code to build proteins and other compounds essential for plant structure, seed yield, and genetic transfer.

“There is no doubt that phosphorus is essential for the general health and vigor of all plants,” O’Connor says. Some specific growth factors that have been associated with phosphorus include:

- stimulated root development
- increased stalk and stem strength
- improved flower formation and seed production
- more uniform and earlier crop maturity
- increased nitrogen N-fixing capacity of legumes
- enhanced crop quality
- improved resistance to plant diseases.

“Phosphorus deficiency is more difficult to diagnose than a deficiency of nitrogen or potassium,” he says. “Crops usually display no obvious symptoms of phosphorus deficiency, other than a general stunting of the plant, and some reddening, during early growth. By the time a noticeable visual deficiency of phosphorus is recognized, it may be too late to correct in annual crops.”

Fixen concludes: “It will be critical to replace needed phosphorus in order to maintain our highly productive soils. Unless we ramp up nutrient replenishment programs, this chronic under-replacement of essential nutrients will eventually reduce the productivity and competitiveness of agricultural systems in these regions.”

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