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Why manage phosphorus?

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Abstract
There are 17 nutrients that are essential for plant growth and production. An insufficient supply of one or more can have an adverse effect on plant growth, maturity, and yield. Phosphorus (P)--one of three key macronutrients (nitrogen and potassium are the other two)--is present in every living plant and animal cell, and is vital in plants for harvesting the sun's energy for growth and reproduction. This requirement is the same whether the plant is growing on soil or in water (such as algae); hence, the concern regarding P levels in surface water and the accelerated aquatic plant growth associated with high P levels.

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There are 17 nutrients that are essential for plant growth and production. An insufficient supply of one or more can have an adverse effect on plant growth, maturity, and yield. Phosphorus (P)--one of three key macronutrients (nitrogen and potassium are the other two)--is present in every living plant and animal cell, and is vital in plants for harvesting the sun's energy for growth and reproduction. This requirement is the same whether the plant is growing on soil or in water (such as algae); hence, the concern regarding P levels in surface water and the accelerated aquatic plant growth associated with high P levels.

When plant available P is deficient in soils, crops demonstrate symptoms of deficiency, such as reduced growth, leaf discoloration (purpling of corn leaves early in the season), and reduced yield. Visual symptoms typically show early in the season but disappear as the plant grows (for corn, approximately 2 to 3 feet in height). It is important, therefore, to monitor soil tests and apply P when the plant-available soil supply is deficient.

Economic and environmental focus. Be aware, however, that overapplying P to soils can enhance decline in surface water quality by providing increased levels of P to surface waters and aquatic plants. Many Iowa producers are interested in finding ways to squeeze profit out of their input dollars while avoiding negative impacts related to the environment and water quality. Managing soil P levels is one way to address profitability and environmental sustainability. And it is an important one. By identifying critical nutrients (such as P) that provide the greatest potential return in their operations, producers can target input dollars to high-priority areas, thus reducing risk and potential regulation of nutrient application.

To make informed decisions about P application, producers need to know what plant-available levels exist in their soil. Soil tests are the only reliable way to determine the status of available nutrients in a field. Reliable soil test results and recommendations depend upon good soil sampling, calibrated soil analysis procedures, and research-based fertilizer recommendation guidelines. With accurate soil test results, producers can calculate their specific fertilization needs and make good decisions about the application of P to meet reasonable crop yield expectations.

Phosphorus losses

Phosphorus is strongly adsorbed by soil particles and readily retained in soil. Therefore, if P moves to surface waters, it does so primarily with eroded soil, but it also is dissolved in runoff water. Avoiding P movement to streams, rivers, and lakes is largely dependent upon maintaining agronomically optimum and not excessively high levels of plant-available P in the soil, and then keeping that soil in place. Using best management practices such as

conservation tillage, erosion control practices, soil testing, accounting for P from manure, and buffer strips go a long way toward improving water quality.

Phosphorus management

Phosphorus management on the landscape is a long-term proposition--monitoring soil tests, determining application needs when soil tests are low, avoiding applications when tests are very high, and replacing P removed in harvested crops when tests are optimum. Only with a long-term approach can soil P be adequately managed for optimal crop production and minimal environmental risk. Each production system, which includes all P sources (fertilizer and manure) and crop fields, must take this approach.

Many P management activities are important--crediting P input from manure application is especially pertinent in Iowa. Most manure contains a significant amount of crop-available P. Usually, it can supply the entire P requirements of one or more years of cropping. Not accounting for P being applied with manure can easily result in over-enriched P soils.

Producers know that nutrient deficiencies can have an impact on productivity, but in today's challenging climate of uncertain economic return and environmental regulation, managing P application well and avoiding P buildup in soils is a critical exercise for both the individual producer and all producers combined. Everyone must ask, answer, and act upon unique questions about P management. Throughout the year, the ICM newsletter will provide articles to aid in the development of a P management strategy.

For more information on soil testing and P or nutrient management, please visit your county extension office, or the website at http://extension.agron.iastate.edu/fert/

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