

## THE BASICS OF PHOSPHORUS

Lee Jacobs

Michigan State University

Phosphorus (P) is an essential nutrient for plant and animal growth. If not present in sufficient amounts, plant growth will be limited and retarded by a deficiency of P. Phosphorus is one of the major nutrients which include nitrogen(N), P and potassium (K) that typically must be replenished to the soil-plant system to sustain plant growth over time.

Phosphorus can be provided to the soil-plant system as fertilizers, plant residues returned to the soil, and various other organic residues containing P, such as animal manure, biosolids and composted yard waste materials (i.e., leaves, grass clippings, and chipped tree branches). The nutrient value of these P-containing materials is usually expressed as a percentage of phosphate ( $P_2O_5$ ), and major nutrient fertilizers are expressed as percentages of each nutrient, i.e., N- $P_2O_5$ -K<sub>2</sub>O. Triple superphosphate (0-46-0) contains 46%  $P_2O_5$  by weight with zero percent of N or K.

Total P levels in soils typically range from 50-1,500 ppm (parts per million; 10,000 ppm = 1%), but not all of this P is available for plants to use. The majority of P in soils is contained as primary and secondary minerals and as P sorbed onto mineral surfaces in the soil. Some will be present in organic forms, primarily as soil organic matter, plant residues and other forms of biological material (biomass). The amount of plant-available P is assessed by a soil fertility test, and will represent only a fraction of the total P present in the soils. The soil test P value is used to recommend the amount of additional P that should be added to the soil-plant system to provide adequate amounts of P for desired plant growth.

When excess P is added to soils, soil test P levels can become very high and may exceed the ability of the soil to effectively hold P in the soil. When this occurs, soluble P levels in the soil increase and P can become more mobile. If P is lost from the soil-plant system and gets into surface waters (lakes and streams), it can cause eutrophication in these water resources. Eutrophication is increased fertility of the water which leads to an increase in biomass production like weeds and algae. The increased biomass produced can decrease the recreational use of surface waters and cause fish kills due to lack of dissolved oxygen in the water, caused by high decomposition of decaying biomass.

To reduce the potential risk of losing P from the landscape into surface waters (often called nonpoint source pollution), it is important to manage the inputs of P to the soil-plant system. The goal is to provide adequate quantities P for plant growth and avoid high accumulations of P in the soil that can increase the risk of P loss to surface waters. Therefore, soils should be sampled periodically and tested for available P levels. The soil fertility test can then be used to recommend when additional P is needed, and when additional P is not needed to avoid high accumulations in the soil that can be an environmental risk.