Phosphorus Best Management Practices
Protecting Water Quality

Soil Testing

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Definition:

Soil testing is the process of determining phosphorus (P) requirements for optimum plant growth (agronomic soil testing), and, recently, the potential of soil to enrich overland or subsurface flow with P (environmental soil testing).

Purpose:

Agronomic soil testing estimates how much P needs to be applied to soil (as fertilizer or manure) to meet plant growth requirements, ensure profitability, and avoid costly over-application. Environmental soil P testing is now used to estimate the degree to which agricultural runoff (overland or leaching) can be enriched with P.

Obtaining a Representative Soil Sample:

The first step is to obtain a representative soil sample from the field being evaluated. Individual states have developed various recommendations for sampling and state guidelines should be followed. In most cases, sampling involves taking ~20 soil cores of the "plow-depth" (0-15 cm), which are then composited so that one sample is submitted for analysis. In no-till or pasture situations, the depth is only 0-5 cm. Sampling and mixing must be done with care to avoid contamination and the sample submitted as soon as possible to ensure timely information and accurate recommendations are given.

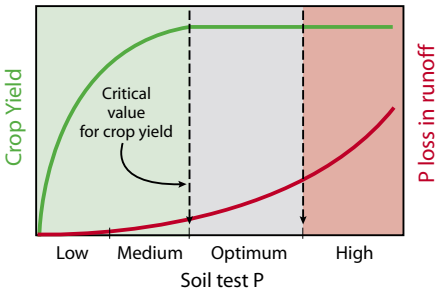
Soil testing is a key component of nutrient management.

Soil Analysis:

Agronomic tests "extract" an amount of P from soil that is proportional to what will be available to the plant during the growing season. As many tests have been developed to account for regional soil and management properties, it is essential that the right method be used. Some common methods used are Mehlich-3, Bray-1, Olsen, and Morgan's, which have been developed from extensive laboratory and field research, so as to best represent observed regional crop responses. Thus, it is important to submit soil samples to a laboratory familiar with the crops grown, dominant soils and management practices of the region concerned.

Environmental soil tests extract an amount of P that is correlated with P released to runoff water under practiced management conditions. Although the need for environmental tests has increased with development of P-based nutrient plans, few tests are specifically designed to do this. One such environmental test is the extraction of a soil sample with water (water-extractable P). Despite agronomic tests being designed to estimate plant-available P,

many states still use these tests as environmental indicators because of a lack of supporting research, costs of adopting a new test, but most notably, because agronomic tests have been shown to provide a reasonable estimate of environmental P risk. As P-based planning becomes more common place, it will be necessary to provide analytical laboratories with technically sound environmental soil P tests that can be justified to farmers, planners, and policy makers.



As soil P increases so does crop yield and the potential for P loss in runoff. The interval between the critical soil P value for yield and runoff P will be important for P management.

Limitations of Soil Testing:

For environmental soil P tests, the potential for runoff and erosion to occur (i.e., mechanisms of P transport), must be considered. Hence, the need for use of the P Indexing Site Assessment Tool rather than soil test P alone.

Effectiveness:

Soil testing can be an extremely effective tool to determine agronomically and environmentally sound P use, as long as long as proper sampling, analytical, and interpretation protocols set by each state and laboratory are followed.

Costs:

A standard soil fertility test costs from $5 to $10 and is, thus, one of the most cost-effective BMP in terms of determining sound P-based management. However, many states recommend no more than 20 acre be represented by a sample and site-specific farming required samples on a 1 to 10 acre basis. Thus, the entire soil sampling cost will reflect the total acreage being evaluated.

Frequent, representative soil testing is an essential part of agronomically and environmentally sound fertilizer and manure management planning.

Operation And Maintenance:

The frequency of sampling for soil testing varies among states and with land use. While some states require more frequent testing, soil tests are often recommended once during crop rotation and at least every five years for federal AFO/CAFO rules.

Refernces and Further Information:

Contact your local agricultural analytical laboratory, conservation district, USDA-NRCS or Cooperative Extension Service office.