

Soil Testing

Nutrient Management

Establishing and using a soil testing program to more efficiently manage crop essential nutrients.

Why soil test?

Soil test to determine crop nutrient needs before applying commercial fertilizer, lime, or manure. Soil tests are used to establish phosphorus (P), potassium (K) and lime recommendations. These recommendations are based on current soil test levels, and interpreted through research from field experimentation.

For producers, managing soil fertility is important economically as well as environmentally. Under-apply nutrients, and yield and profitability will suffer. Over-apply nutrients, and money is wasted. In addition, over-applied P may result in increased transport through runoff and tile lines into surface waters, where it can cause environmental problems.

When should I soil test?

Establishing a reliable soil testing history is a critical part of maintaining a profitable crop production operation. Reliable soil test data is dependent on sampling consistency. Soil test every two to four years, at the same time of year and following the same crop.

Soil test levels can vary throughout the growing season, so it is important to test at the same time of year and after the same crop. For example, if a soil-testing regime begins after a crop of soybean has been harvested from a particular field, sampling should continue after soybean harvest in order to achieve a consistent analysis over a period of time.

Key Points

- Use soil test information before applying fertilizer, lime, or manure.
- Soil test every 2 to 4 years, at the same time of year and following the same crop.
- Prepare a soil sampling plan before sampling.
- Sample according to an established protocol.
- Formulate nutrient applications after interpreting soil test results.
- Use Iowa State University Extension publications and pamphlets for information on soil test interpretations and application suggestions.

How do I get started?

Prepare a soil sampling plan before sampling. You can use your county's modern soil survey to prepare a soil sample plan. A soil survey is available at your ISU county Extension office, the Soil and Water Conservation District office, or a public library. Use the map to find out what soils are on

your farm. This will help you take soil samples that best represent your soils and different field areas. Management zone sampling, using farming history, aerial photographs, and yield maps can be used in addition to soil survey maps to delineate soil sampling areas.

What's a good soil sample?

Sample according to an established protocol. Accurate soil testing begins in the field. Getting an accurate, consistent and representative sample will provide the most accurate (and profitable) analysis. Sample depth is critical, and soil test calibrations are set with 6- to 7-inch sample depth.

Set up a sampling pattern before going to the field, and practice a consistent soil sampling technique. Soil sample by taking multiple cores per sample. If the uniform sampling area is large, take more than one sample.

Don't soil sample right after lime or fertilizer applications. Dust from gravel roads can affect soil tests, so be careful when sampling in field areas near roads.

Table 1. Interpretation of soil test values for phosphorus (P) determined by Bray P₁, Mehlich-3, or Olsen extractants and potassium (K) determined by ammonium acetate or Mehlich-3 extractants for surface soil samples (6- to 7-inch deep cores).

Relative level	Wheat, alfalfa	All crops except wheat, alfalfa		All crops	
		Subsoil P		Subsoil K	
		Low	High	Low	High
----- ppm -----					
	Bray P ₁ or Mehlich-3 P			AmmoniumAcetate or Mehlich-3 K	
Very low (VL)	0-15	0-8	0-5	0-90	0-70
Low (L)	16-20	9-15	6-10	91-130	71-110
Optimum (Opt)	21-25	16-20	11-15	131-170	111-150
High (H)	26-30	21-30	16-20	171-200	151-180
Very high (VH)	31+	31+	21+	201+	181+
Olsen P					
Very low (VL)	0-10	0-5	0-3		
Low (L)	11-14	6-10	4-7		
Optimum (Opt)	15-17	11-14	8-11		
High (H)	18-20	15-20	12-15		
Very high (VH)	21+	21+	16+		
Mehlich-3 ICP					
Very low (VL)	0-20	0-15	0-10		
Low (L)	21-30	16-25	11-20		
Optimum (Opt)	31-40	26-35	21-30		
High (H)	41-50	36-45	31-40		
Very high (VH)	51+	46+	41+		

How do I use this information?

Formulate nutrient and limestone applications after interpreting the soil test results. Soil test analyses are reported as parts per million (ppm). The results are interpreted by test category and adjusted by soil: very low (VL), low (L), optimum (Opt), high, (H), and very high (VH). The optimum category is the most profitable category to maintain over time. The low and very low categories indicate deficient soil test levels, while the high and especially the very high categories indicate a higher test level than required for crop production.

Nutrient applications with soil test levels in the H and VH categories seldom generate a profitable yield response. The very high soil test category indicates that the nutrient concentration exceeds crop needs, and further additions of that nutrient very seldom produce a profitable yield response.

Where can I find more information on soil testing?

For more detailed information on soil testing and formulating nutrient and limestone recommendations, read Iowa State University Extension publications and pamphlets on soil testing and nutrient recommendations. Call your ISU Extension county office, and ask for:

NCMR 348, *Soil Sampling for Variable Rate Fertilizer and Lime Application* (\$1.25 per copy)

PM 287, *Take a Good Soil Sample to Help Make Good Decisions*

PM 1310, *Interpretation of Soil Test Results*

PM 1428c, *Protecting our Water Quality with Effective Soil Sampling*

PM 1688, *General Guide for Crop Nutrient and Limestone Recommendations in Iowa* (\$1.00 per copy)

ST 8, *Soil Sample Information Sheet*

Your county Iowa State University Extension office can also make an appointment for you to visit with an Extension crop field specialist.

Best Management Practices, or BMPs, use the most effective and practical means available to reduce or prevent water pollution from farm operations. BMPs are selected based on assessment, analysis of the impact of alternative practices and their economic considerations. They are implemented using current available technologies, management skills and available resources. BMP information sheets available from ISU Extension include:

NMEP 1, *Soil Testing*

NMEP 2, *Phosphorus Application*

NMEP 3, *Manure Resources*

NMEP 4, *Residue Management*

NMEP 5, *Crop Rotation*

NMEP 6, *Crop Yields*

NMEP 7, *Nitrogen Application*

NMEP 8, *Nutrient Management Plan*

NMEP 9, *Equipment Calibration*

NMEP 10, *Conservation Reserve Program*

NMEP 11, *Conservation Practices*

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