Soil testing procedures

Fertilizer Recommendations for Field Crops in Michigan, Extension Bulletin E-550A, March 1992

D. R. Christenson, D. D. Warncke, M. L. Vitosh, L. W. Jacobs and J. G. Dahl, Department of Crop and Soil Sciences, Michigan State University

The following is a brief discussion of the procedures used in the Michigan State University Soil Testing Laboratory.

Soil pH of mineral soils is measured using a 1:1 soil-to-water suspension; on organic soils, a 1:2 soil-to-water suspension is used. Lime requirement for mineral soils is determined using the SMP Buffer method.

On organic soils, lime requirement is based on soil pH. Available phosphorus is measured using the Bray-Kurtz P1 (weak acid) extractant while exchangeable potassium, calcium and magnesium are extracted using 1.0 N neutral ammonium acetate. Recommendations for phosphorus, potassium and magnesium are based on soil test values from these extractants.

The Bray-Kurtz P1 test does not extract all of the available phosphorus on soils which contain free calcium carbonate. These soils can be identified as having pH values above 7.2 and a Bray-Kurtz P1 test of less than 20 lb/A. Soils in this case are extracted with sodium bicarbonate (referred to as Olsen P). This test was designed for soils with free calcium carbonate. Available manganese and zinc are extracted with 0.1 N HCl and copper with 1.0 N HCL using a 1:10 soil-to-extractant ratio.

Mineral soil samples submitted to the MSU Soil Testing Laboratory are extracted using weighed samples. The amounts of nutrients are expressed as parts per 2 million or pounds per acre, which assumes that one acre of a loamy soil 6 2/3 inches deep weighs 2 million pounds. Organic soil samples are measured by volume because such materials usually have much lower densities than mineral soils. Results for organic soils are expressed on a volume acre furrow slice basis (volume of an acre 6 2/3 inches deep). Available phosphorus, calcium and magnesium are expressed as pounds of element (P, K, Ca, Mg) extracted. Available zinc, manganese and copper are expressed as parts per million (ppm). Some laboratories express all elements as parts per million. To convert parts per million to pounds for mineral soils, multiply by 2 (i.e., 2 X ppm = lb/A). The exact conversion varies with bulk density of the soil, but organic soils have a wider variation than mineral soils. For example, for an organic soil with a bulk density of 0.34 g/cm3, 1 ppm = 0.5 lb/acre. For soils with a bulk density of 0.68, 1 ppm = 1 lb/A. Some laboratories express phosphorus and potassium in terms of P_2O_5 and K_2O. The factors to convert between P and P_2O_5 or K and K_2O are: lbs P X 2.3 = lbs P_2O_5; lbs P_2O_5 X 0.44 = lbs P lbs K X 1.2 = lbs K_2O; lbs K_2O X 0.83 = lbs K The fertilizer recommendations are given in pounds of phosphate (P_2O_5) and potash (K_2O) per acre because fertilizers are expressed and sold in these terms.

MICHIGAN STATE
UNIVERSITY
EXTENSION

MSU is an affirmative-action, equal-opportunity institution. Michigan State University Extension programs and materials are open to all without regard to race, color, national origin, gender, religion, age, disability, political beliefs, sexual orientation, marital status, or family status. • Issued in furtherance of Extension work in agriculture and home economics, acts of May 8 and June 30, 1914, in cooperation with the U.S. Department of Agriculture. Tom Coon, Extension Director, Michigan State University, E. Lansing, MI 48824. • This information is for education purposes only. References to commercial products or trade names do not imply endorsement by MSU Extension or bias against those not mentioned.