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Stivers, Russell K., "Micronutrients for Field Crops in Indiana" (1974). *Historical Documents of the Purdue Cooperative Extension Service*. Paper 310.

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AGRONOMY GUIDE

COOPERATIVE EXTENSION SERVICE, PURDUE UNIVERSITY, WEST LAFAYETTE, INDIANA (FERTILITY) AY-203

Micronutrients for Field Crops in Indiana

Russell K. Stivers, Agronomy Department

Many Indiana farmers are taking a closer look at the availability of micronutrients for their field crops. Micronutrients are elements taken up and utilized by plants but only in very small amounts. However, as we are discovering, their lack or absence can profoundly effect plant growth and yield.

In recent years, more and more field crop production problems have been traced to micronutrient deficiencies or excesses in the soil. Among the apparent reasons for this up-swing of micronutrient-associated problems are: (1) use of higher analysis fertilizers, (2) increasing crop yields, (3) aging and erosion of the soils, (4) changes in air purity, and (5) application of high rates of sewage sludge as fertilizer.

What are the micronutrients needed by field crops in Indiana? Where and on what soils are availability problems likely to occur? How can deficiencies be corrected or prevented? This publication seeks to answer such questions for seven micronutrient elements of importance in Indiana soils.

BORON

Light-colored, deeply-leached sandy and silty soils in Indiana may be boron deficient, which will affect alfalfa production. For a description of the problem, when it can occur and how to prevent or correct it, see Purdue Extension Publication AY-165, "Boron Deficiency in Indiana Soils."

Recent studies have been conducted on normal and high-lysine corn in Indiana to observe boron status in the plants and responses to broadcast applications of 1 pound of boron per acre. Results with the normal corn showed that, although there seemed to be some positive responses the first year, boron applications on the same fields the following year did not give consistent responses.

With high-lysine corn, however, there were continued yield increases for boron application. Hence, when high lysine corn is to be grown, broadcast and incorporate 1 pound per acre of actual boron in a material such as sodium borate, unless higher rates were applied to preceding crops. If boron is to be used in row fertilizer, do not use more than 0.1 pound per acre of actual boron or serious damage to the corn seedlings may result.

COBALT

Legume root bacteria require cobalt for the fixation of atmospheric nitrogen. Soybean field trials in Iowa, Illinois and Indiana so far have not shown consistent advantage for the use of cobalt, although small yield increases for cobalt have occurred. In northern Indiana, legumes normally contain insufficient cobalt to meet the needs of ruminant farm animals. Therefore, it is recommended that cobalt be supplied to ruminants in trace mineralized salt (see Purdue Extension Publication AS-411, "Minerals for the Beef Cow").

COPPER

Wheat, corn and soybeans occasionally show a positive response to copper fertilization in Indiana. Increases in corn or soybean yields may be expected in some years if the leaves contain 5 ppm of copper or less. (Copper fertilization of soybeans is discussed in Purdue Extension Publication AY-170, "Soybean Fertilization.")

Acid organic soils, such as Adrian muck, are more likely to be deficient in copper than are the mineral soils. Also, the fine sandy soils, such as Morocco loamy fine sand or Maumee fine sandy loam, found in much of northwestern and northcentral Indiana are potentially deficient in copper.

In those areas where copper fertilization can be expected to increase yield, 2 to 10 pounds per acre of elemental copper should be broadcast and plowed under. Fertilizer sources of copper are the sulfate, oxide, or EDTA salt. Applications of as much as 40 pounds per acre of copper in one year or 100 pounds over several years may be toxic to crops. Use plant analysis as a guide in determining when copper fertilization is needed.

IRON

Iron deficiency of field crops has not been reported in Indiana. Ordinarily, iron deficiency will show up on calcareous soils but not on acid soils, and may be closely related to manganese deficiency on calcareous soils. There is indication, however, that soil-soluble iron may replace manganese in chelates and thus intensify manganese deficiency of soybeans in acid soil areas.

MANGANESE

Black, sandy and heavy depressional soils in Indiana with pH above 6.2 may have a manganese deficiency that can affect soybeans, wheat, oats or barley, and sometimes corn. Further information on where this condition occurs and how to recognize, test for and treat it is given in Purdue Extension Publication AY-100, "Manganese Deficiency in Indiana Soils."

Very acid soils (below pH 5.0) can cause manganese (or aluminum) toxicity in plants, i.e., the presence of more than 1,000 ppm manganese in the dry matter. The problem can usually be remedied by liming.

MOLYBDENUM

Molybdenum is required both by the symbiotic nitrogen-fixing bacteria (Rhizobia) of legume crops

and by non-legume crops for nitrate reduction. Seed treatment with molybdenum is recommended for soybeans on certain dark-colored soils, such as Chalmers and Odell, when soil pH is 6.0 or below or molybdenum content of the soybean seed is 1.6 ppm or less. Use no more than ¼ ounce of molybdenum as sodium molybdate with sticker per bushel of seed, because excess molybdenum in forages can be toxic to ruminant animals.

ZINC

Zinc deficiency occurs somewhat irregularly on corn in Indiana. In 1969, 1970 and 1971, a commercial agronomist reported that, of a total of 90 plant samples from Indiana, 19 were low or deficient in zinc. Of those 19, all but one were corn plant samples. Purdue Plant and Soil Analysis Laboratory data for 1970 showed about the same thing — 16 of 81 corn samples were found to be zinc deficient. The problem is most likely to crop up during cold, wet springs, particularly on soils high in available phosphorus.

Soil and plant problems associated with zinc deficiency in corn and how to treat for it are discussed in Purdue Extension Publication AY-171 "Corn Fertilization." Zinc is not recommended unless the conditions outlined in AY-171 indicate that a growth or yield increase will result.

RELATED PUBLICATIONS

Single copies of the Purdue Extension Publications referred to in this paper are available free of charge to Indiana residents from their local County Extension Office or by writing to the Publications Mailing Room, Cooperative Extension Service, AGAD Building, Purdue University, West Lafayette, Indiana 47907. When ordering, please give both publication title and number.