

When Are Micronutrients Needed for Farm Fields?

Hubert J. Savoy, Jr., Associate Professor
Biosystems Engineering and Environmental Science

This factsheet provides a listing of secondary and micronutrient soil tests available through the University of Tennessee Soil Testing Laboratory in Nashville. It also summarizes all of the university's secondary and micronutrient recommendations and guidelines based on current research. Some recommendations are based upon soil test values (Table 1) interpreted as either satisfactory (levels adequate for excellent crop production) or unsatisfactory (levels indicating a need for fertilization). For other micronutrients, such as boron or molybdenum, a general recom-

mendation is made for those crops observed to respond consistently to such fertilization. For copper, the soil test is currently only used to monitor changes in soil copper levels.

A general discussion is provided for sulfur, as it is often included in fertilizer blends, but seldom increases yield in Tennessee. A weak acid extractant called Mehlich 1 is used by the University of Tennessee to test soils for nutrient levels. Critical micronutrient soil test values listed in this factsheet are only valid when the laboratory testing your soil uses the Mehlich 1 soil test.

Table 1. Guidelines for Selecting Laboratory Secondary and Micronutrient Soil Tests

Test	Crop	Location	General Conditions
Calcium	Tomatoes and Peppers	Tomato-and-pepper producing areas.	Sandy or light-textured soils. Where blossom-end-rot is an annual problem.
Magnesium	Tomatoes, Tobacco, Cabbage, Grapes	Cumberland Plateau, Highland Rim	Sandy or light-textured soils. Magnesium deficiencies in each of these crops may be induced by using high-grade calcitic limestone or by excessive amounts of potassium or ammonium fertilizers.
Copper	All	Statewide	Used to monitor changes in copper levels where biosolids high in copper are continually applied.
Iron	Ornamentals (only)	Isolated or problem areas.	High soil pH.
Manganese	Soybeans	Isolated or problem areas	Sandy or light-textured soils with a pH above 7.0.
Zinc	Corn, Snap Beans	Cumberland Plateau, Middle Tennessee	When soil pH is above 6.0 or lime is applied and phosphate is high.

Secondary Nutrients

Calcium

The calcium (Ca) soil test is used for tomatoes and peppers. **If calcium (Ca) tests below 500 pounds per acre and soil pH is 6.1 or above, 500 pounds of calcium sulfate (gypsum) are recommended to reduce the risk of blossom-end-rot in tomatoes and peppers.** However, if limestone is recommended and applied, there is no need to apply calcium sulfate. A calcitic (low-magnesium) lime source may be beneficial where there is a history of blossom-end-rot.

Magnesium

Most soils in West Tennessee contain adequate supplies of magnesium (Mg) and do not normally need additional magnesium except in perhaps isolated cases (sandy soils, soil with excessive potassium). The same is true for soils in East Tennessee. However, some soils on the Cumberland Plateau and the Highland Rim have been found to contain low levels of magnesium. Therefore, the greatest potential for use of the magnesium soil test is in these areas.

Soils testing less than 40 lbs. Mg/acre may need magnesium fertilization. Crops for which magnesium is recommended when the soil tests below 40 pounds per acre include: grapes, tomatoes, tobacco, cabbage and ornamentals. **Twenty pounds of magnesium per acre is the recommended application rate.** When soil pH is low, dolomitic (high-magnesium) limestone is recommended as the magnesium source, since it can be used to correct both low magnesium and soil acidity. In addition, dolomitic limestone is the most economical source of magnesium and provides a favorable balance between calcium and magnesium. If calcitic limestone is used, or lime is not needed, magnesium sulfate

(Epsom salt) or potassium-magnesium sulfate (K-mag) should be used to supply the 20 pounds of magnesium per acre.

Sulfur

Sulfur (S) soil tests are unreliable, and so the University of Tennessee laboratory does not test for sulfur. Growers suspecting a sulfur problem can verify the deficiency using plant analysis. Field plot research and demonstrations with corn and wheat in Tennessee have not shown a consistent response to added sulfur. **Excess sulfur content of forage crops is known to cause animal nutrition problems such as animal copper deficiency. Sulfur should not be applied to these crops without plant analysis results supporting a deficiency.** Plant analysis is currently not available from the University of Tennessee laboratory, but is offered by many privately operated laboratories.

The organic matter in the soil is the main sulfur reservoir. Topsoil may typically contain several hundred pounds of sulfur per acre, primarily in organic form. As organic sulfur forms are mineralized each year, approximately four to 13 pounds of sulfur may be released through the action of soil microbial activity. This is in addition to that supplied by rainfall. About 10 to 15 pounds of sulfur per acre may be deposited by rainfall annually. This has reportedly decreased about a third as industries responded to a call for cleaner air and fewer emissions. **The potential for crop response to added sulfur is greatest for very low organic matter soil (under 1 percent), under conditions not favorable for mineralization of organic sulfur fractions or in areas very isolated from industrial emissions.**

Growers choosing to add sulfur as an “insurance policy” should not exceed a rate of application in the range of 15 to 20 pounds of actual sulfur per acre. Elemental sulfur and ammonium

sulfate are common fertilizer products used to supply sulfur in a blend with primary nutrients. The sulfur from ammonium sulfate is very quickly available to the plant and is more appropriate for use with cool-season crops (i.e., a spring fertilizer application to wheat). Sulfur supplied from elemental sulfur must first be converted by soil microbial activity to the sulfate form. This is a process that may take several weeks or longer.

Micronutrients

Boron

A soil test for boron (B) is not currently available through the university laboratory. A general boron recommendation is made for cotton, alfalfa, broccoli, cauliflower and cabbage. Two pounds of boron per acre are recommended for alfalfa, broccoli, cauliflower and cabbage. One-half pound of boron per acre is recommended for cotton when the pH is above 6.0 or anywhere lime is used. A pound of boron per acre is recommended for burley or dark tobacco anywhere deficiency symptoms have been noted previously or where plant analysis results show a need for boron.

Iron

The iron (Fe) soil test is used for ornamental plants such as azaleas, hydrangeas, etc. The Plant Sciences Department makes all ornamental recommendations for iron, as well as for calcium, magnesium, zinc and manganese.

There is no established need in Tennessee for fertilization with iron for any agronomic, vegetable, tree fruit or small fruit crop. Thus, the iron test should not be requested for these crops. If, however, iron is requested on samples for crops other than ornamentals, iron will be

determined and always reported as sufficient. Iron sulfate is a commonly used and locally available source for iron. Chelated iron sources are often more appropriate for established plantings when soil pH is very much above the desired range. Such use is not based upon soil test results but upon plant appearance (unthrifty and usually chlorotic [yellowing] condition).

If soil is tested prior to plant establishment, then a more desirable approach is to avoid an iron deficiency by lowering the soil pH using elemental sulfur or other acidifying amendments well ahead of planting. The soil test lab report gives specific instructions for amount of elemental sulfur (the most economical soil-acidifying material) to use. Lowering of soil pH or attempted correction of iron deficiency after establishment of shrubs or small fruits is a salvage operation that usually does not achieve the desired result.

Manganese

Manganese (Mn) is recommended only for soybeans when soil pH is above 7.0 and soil test manganese is below 16 pounds per acre. The recommendation is to apply 20 pounds of manganese per acre broadcast just prior to planting.

NOTE: Manganese should not be confused with magnesium nor should it be requested when manganese toxicity (low soil pH) is the problem.

Molybdenum

A general molybdenum (Mo) recommendation, as a seed treatment, is made for soybeans. Treat seed with 0.2 ounce actual molybdenum per bushel when the soil pH is 6.5 or below. This can be accomplished by applying either 0.5 ounce of sodium molybdate per bushel of seed or following the product label for specific liquid hopper-box-applied sources con-

taining fungicides. Research has shown very favorable results to seed application of Mo down to a soil pH of about 5.8.

Zinc

A general zinc (Zn) recommendation is made for corn and snap beans on soils from those counties where zinc deficiencies commonly occur (Middle Tennessee and Cumberland Plateau). However, when zinc is tested on a soil sample from any county for corn or snap beans, the zinc recommendation is based on the result of the soil test as follows: If the Zn results are two pounds per acre or less, five pounds of elemental zinc per acre will be recommended for corn or two pounds per acre for snap beans.

Also, a general zinc recommendation of two pounds of zinc sulfate per 1000 square feet is made for pecan trees. Unless

deficiency symptoms persist, this should be considered as a one-time application.

When a zinc soil test is requested for crops other than corn or snap beans, the results are always reported as sufficient. Zinc sulfate is the commonly used and locally available source for Zn.

Other

No research information is currently available to suggest the use of other micronutrients [Phosoi.e., chlorine (Cl), copper (Cu)] other than those described in this factsheet. The Mehlich 1 soil test for copper has been used solely for monitoring changes in soils continually receiving biosolids high in copper content to avoid potential copper toxicity problems. No fertilizer recommendation should be made on the basis of this soil test.

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