

Interpretive/Recommendation Statements for Micronutrients			
Micronutrient	LOW	ADEQUATE	HIGH
IRON	<p>Deficiency of iron in soil usually results in interveinal chlorosis (pale green to yellow leaves -or bleached white in extreme cases- between darker green veins of affected plants). Acid-loving plants are especially vulnerable. Lime only as recommended because soil pH strongly affects iron availability. Avoid excess phosphorus or nitrogen fertilization. Amending the soil with organic matter, especially composted animal manure, is the best long-term solution. In fertilizers, chelated iron is preferred for soil application. Foliar application can be made with iron sulfate or chelated iron fertilizers. Carefully follow product instructions. See FS971 for more information.</p>	<p>Iron should be sufficient as long as soil pH is in the optimum range for the plant being grown. The availability of iron to plants decreases as soil pH increases. Maintain soil pH in the recommended range to assure availability of iron to plant roots. See FS971 for more information.</p>	<p>Plant availability to iron is highly dependent on soil pH. Although soil iron appears plentiful, high soil pH could limit its availability. On the other hand, plant damage due to iron toxicity, though not common, could occur at low soil pH (acidic soil). Maintain soil pH in the optimum range as described in Recommendations. See FS971 for more information.</p>
MANGANESE	<p>Excess liming of soil can cause or contribute to low manganese availability to plants. Do not overlime (follow recommendations carefully). Symptoms of manganese deficiency include: interveinal chlorosis (pale green to yellow leaf tissue between darker green veins) appearing first on younger leaves, stunting, and gray-speck. Amendment with organic matter is the best long-term solution to build up manganese level in soil. Manganese fertilizers are available for application to soil or leaves. See FS973 for more information.</p>	<p>Manganese does not appear to be a limiting factor. Maintain soil pH in the optimum range, as directed in "Recommendations". See FS973 for more information about manganese in soil and plant nutrition.</p>	<p>In excessive amounts, soil manganese can cause plant damage. This occurs primarily in low pH soil. Lime soil as recommended to decrease availability of manganese to plants. Avoid fertilizers that contain manganese. See FS973 for more information.</p>

Micronutrient	LOW	ADEQUATE	HIGH
COPPER	<p>Copper deficiency most commonly occurs on heavily cropped or leached sandy soil, on organic soil, or on soil with high pH. Symptoms include: twisted leaves and stems, yellowing and stunting, withering of leaf tips and margins. Lime only as recommended to avoid high pH. Do not apply excess phosphorus. Application of copper fertilizer to soil prior to planting is preferred, since one application will be effective for five or more years. Foliar applications are possible for immediate treatment of deficiency symptoms, but have only short-term effect. See FS720 for more information.</p>	<p>As with most other micronutrients, copper availability is related to soil pH. Do not overlime. For more information about copper, see FS720.</p>	<p>To reduce availability of soil copper to plants, lime the soil to the appropriate pH level (if needed) and amend the soil with organic matter. For more information about copper in soil and plant nutrition, see FS720.</p>
BORON	<p>Plant types differ in their susceptibility to boron deficiency; certain fruit, vegetables, and field crops are most susceptible. Symptoms include improper development or dieback of growing tips and poor flowering or fruit set. Do not overlime, as pH above 7.0 limits boron availability. Increasing organic matter content of soil will build up boron in the soil. As an alternative, look for appropriate fertilizer formulations that include boron. Use of boron-only fertilizer must be done only with extreme care because of the toxicity that might occur if over-applied and difficulty of applying the low rates necessary. See FS873 for more information.</p>	<p>Plant types differ in their requirement for boron; certain fruit, vegetables, and field crops have greater need for boron. For more information, see FS873.</p>	<p>Too much boron can cause toxicity effects in certain sensitive plant types. Beans, cucumber and sweet potato are known to be sensitive. Symptoms are: chlorosis of leaf tips and edges, progressing to total death of the leaf in severe cases. To limit boron availability, aim for soil pH near 7.0 (except for acid-loving species). Avoid fertilizers containing boron. In the long term, boron can be reduced by leaching from soil, especially well-drained sandy soil. For more information on soil boron, see FS873. .</p>

Micronutrient	LOW	ADEQUATE	HIGH
ZINC	<p>Plants vary in their susceptibility to zinc deficiency. General symptoms include interveinal chlorosis (light green to yellow leaf tissue between darker-green veins), stunting, and poor development of growing tips. Many factors affect zinc availability. High pH reduces zinc levels, so lime only as recommended. Do not apply excess phosphorus fertilizer. To improve zinc levels, add organic matter. Fertilizers containing zinc are available. Application and thorough incorporation of zinc fertilizer into soil is most effective, but foliar sprays can also be used for immediate short-term solution. See FS721 for more information.</p>	<p>For information about zinc in soil for plant nutrition, see FS721.</p>	<p>Zinc toxicity is possibility for certain types of plants. If soil pH lower (more acidic) than optimum, lime as recommended below. Establish or maintain optimum phosphorus level in soil. If soil organic matter is low, soil amendment with leaf compost can immobilize as well as delute the soil zinc concentration. See FS721 for more information about soil zinc.</p>