The micro-nutrients: Fe, Mg, Mn, Ca, Zn, B

It is not usually necessary to apply micro-nutrients to turf. Make sure they're really needed before spending any extra money.

by BILL KNOOP, Ph.D. / Technical Editor

All plants need nutrients to live and grow. The list of plant nutrients is split between those called macro-nutrients—so named because they are used by plants in the greatest amounts—and those called micro-nutrients (Table 1), which plants use in very small amounts.

The fact that plants need such small quantities of each of these six minor nutrients can be very misleading. They are among what are called the essential plant nutrients, because a plant cannot grow and complete its lifecycle without an adequate supply of even one of them. The need for a minor nutrient may be measured in parts per million.

No matter how small, the need of each of these minor nutrients plays a very necessary and vital role in plant growth. It would be convenient if a specific part of the plant growth process could be assigned to each nutrient, but it just doesn't work that way. The roles of these nutrients can be described in a very general way, but truly where and how they function in plant growth is very complex.

TABLE 1. PRIMARY PLANT NUTRIENTS AND THEIR SOURCE

Macro-Nutrients	*Primary Source*
(N) Nitrogen	Fertilizer, Soil
(K) Potassium	Fertilizer, Soil
(P) Phosphorus	Fertilizer, Soil
(S) Sulfur	Soil
(Mg) Magnesium	Soil
(Ca) Calcium	Soil
Micro-Nutrients	*Source*
(Fe) Iron	Soil
(Mn) Manganese	Soil
(Zn) Zinc	Soil
(Cu) Copper	Soil
(Mo) Molybdenum	Soil
(B) Boron	Soil
(Cl) Chlorine	Soil
Others	*Sources*
(O) Oxygen	Water, Carbon Dioxide
(H) Hydrogen	Water
(C) Carbon	Carbon Dioxide

The role of **iron (Fe)** is most easily understood. While not a part of chlorophyll in the plant, sufficient quantities must be present in order for the plant to produce the chlorophyll. Plants that cannot obtain enough iron tend to have yellow leaves, or chlorosis.

Several other nutrient deficiencies can also cause chlorosis, the most important of which is nitrogen. The yellowing caused by a nitrogen deficiency may be confused with an iron-related chlorosis. Nitrogen chlorosis first affects the older leaves and results in an overall pale green-yellow color. Iron chlorosis first affects the newest leaves. The veins in the leaf tend to stay green and the areas between the veins turns yellow. Iron may also play a role in drought tolerance, as well as the plant's ability to take head and cold stress.

Iron chlorosis may be corrected by either applying a product containing iron or by correcting the soil pH. Iron is more available when soil pH is below 6.0, but it becomes limited as the pH increases.

Iron sulfate is the most common remedy for iron chlorosis. If iron sulfate is added to a high-pH soil (over 7.0), it may quickly be changed to an unavailable form in the soil. The best way to make sure iron gets to a plant in a high-pH soil is to use an iron chelate. The chelated form of iron helps keep it available to plants in high-pH soils. In fact, chelated forms of most minor nutrients are available. They are very costly, but it's the only way of making sure the nutrients will get to the plant and not get tied up with other chemicals in the soil.

Magnesium (Mg) is a part of chlorophyll. When it is in low supply, the plant may also end up with yellow leaves. A magnesium deficiency is not very common, but it can become a problem in soils below a pH of 6.0 or over a pH of 8.5. It may be rather difficult to tell the difference between a nitrogen deficiency, an iron deficiency or a magnesium deficiency. The only practical way to correct any chlorosis is to first apply nitrogen and if there is no green-up, apply iron, and finally if those two do not have any effect, then apply magnesium. Two very common sources of magnesium are Epsom salts and dolomitic limestone.

Manganese (Mn) also is a part of chlorophyll, and its deficiency may result in a chlorosis. Any manganese deficiency is very rate and not usually a problem at all.

The other three minor nutrients, **copper (Ca), zinc (Zn)** and **boron (B)**, are needed in extremely small quantities, so most any soil contains them in adequate amounts. There is a greater chance that these chemicals can reach toxic levels in the soil than because of a low supply.

Testing tips

Many soil testing labs do not routinely test for these minor nutrients. Others may test for them, but only report their levels if they are extremely high or low. If you are concerned about possible minor nutrient problems, get your soil tested but make sure the lab is able to make the determination.

TABLE 2. THE INFLUENCE OF PH ON THE SOLUBILITY OF THE NUTRIENTS REQUIRED FOR PLANT GROWTH

Nutrient	*Most soluble pH range*	*Least soluble pH range*
Nitrogen	6.5-8.0	5.5 and lower
Phosphorus	6.5-7.2	less than 6.5, over 7.2
Potassium	6.5-8.5	6.5 and lower
Calcium	7.0-8.5	6.5 and lower
Magnesium	7.0-8.5	6.5 and lower
Sulphur	6.5-8.5	6.5 and lower
Iron	3.5-6.0	greater than 6.0
Manganese	4.5-6.5	greater than 6.0
Boron	5.0-7.0	less than 5.0, over 7.5
Zinc	5.0-7.0	greater than 6.0
Copper	5.0-7.0	greater than 6.0

A soil test can be a valuable first step when developing any fertility program. Depending on the test selected, it can determine the level of essential plant nutrients in the sampled soil, describe any salt problem, determine the pH and identify the soil's texture class.

The soil should come from the plant's rootzone. In most cases, this is just a few inches deep. The sample should represent a fairly uniform area. A sample shouldn't be made up of soil from a sandy area together with soil from a high clay area. These two soils should be treated separately.

Test tees, fairways separate from greens

On golf courses, greens wouldn't be included with tees or fairways, but soil from all 18 greens could be put together into one sample if all the greens had basically the same construction.

There may be enough variation in soils across a golf course that each fairway can be sampled separately. It even may be that a front lawn will be different from the back.

One single soil test may be of limited value. It's important to know the soil pH because of its impact on nutrient availability. The soil texture class information is needed to determine the rate of material needed to adjust pH.

Table 2 shows the influence of pH on nutrient solubility.

Any minor nutrient problem is fairly rare. Only if soil pH is very high or very low can a problem be expected. Even then it's rare. The only other situation that may suggest any minor element is when plants are grown in nearly pure sand. All-sand putting greens and football fields are areas that may need special consideration in developing the fertility program.

It is not absolutely necessary to automatically apply a fertilizer containing these minor nutrients to most landscapes. This is especially true if the grass clippings are allowed to stay on the lawn. All the nutrients contained in the leaves will be returned to the soil and eventually returned back to all the plants in the landscape. There is no question that when minor elements are needed, they are needed. Just make sure they are really needed before spending any extra money. It doesn't make sense to add extra materials to the landscape that are not needed.

Choosing a lab

If the soil sample was sent to 10 different labs there might be 10 slightly different analyses of the soil. Not all labs have the same analytical equipment nor do they use the same techniques. It does not make sense to compare results from different labs. Pick a dependable lab and stick with it.

Every state has a land grant university with a soil testing lab. Information for soil testing is available from the local office of the cooperative extension service.

Test in January-February

In order to get the most dependable test results possible, test when the system is fairly stable, usually January and February. At these times, the last fertilizer application was done weeks before, and the next application is weeks away.

A soil test every two or three years at the same time of the year should be sufficient. **LM**