Micronutrients' role in turf management

>> Iron chlorosis on Kentucky bluegrass.

THE NEED FOR ELEMENTS other than N, P, and K in a turf fertility program is highly dependent on the soil. A clay loam soil will be different from a sand-based rootzone. Grass grown on soil with either excessively high or low pH will also have different needs than grass grown on soil with pH of 7. The environment may also play a role. For instance, deficiencies may occur in very wet years.

IRON (Fe). Iron is the micronutrient most likely to be deficient on turf. This generally occurs at high soil pH levels, where Fe changes its form and become unavailable to plants. The deficiency symptoms include a yellow discoloration that is referred to as chlorosis (a lack of chlorophyll). Iron plays an important role in the formation of chlorophyll (the material that gives the plant its green color) and deficiencies are readily visible on the tissue. The application of Fe will generally solve the problem in 24-48 hours following application. A "summer induced" form of Fe chlorosis is becoming more common on turf areas in recent years.

The symptoms of nutrient deficiencies often overlap and may be difficult to diagnose the problem.

This problem occurs as a yellowing of turf that comes on in midsummer and goes away in the fall as temperatures cool. This type of iron chlorosis generally does not respond to normal rates of Fe and may require higher rates of Fe than those usually needed to overcome normal chlorosis. For more information on summer induced chlorosis, see Devetter, D. N. Christians, and D. Minner. 2008. Dealing with summer induced chlorosis of turf. Golf Course Mgt. 76 (5): 123-126.

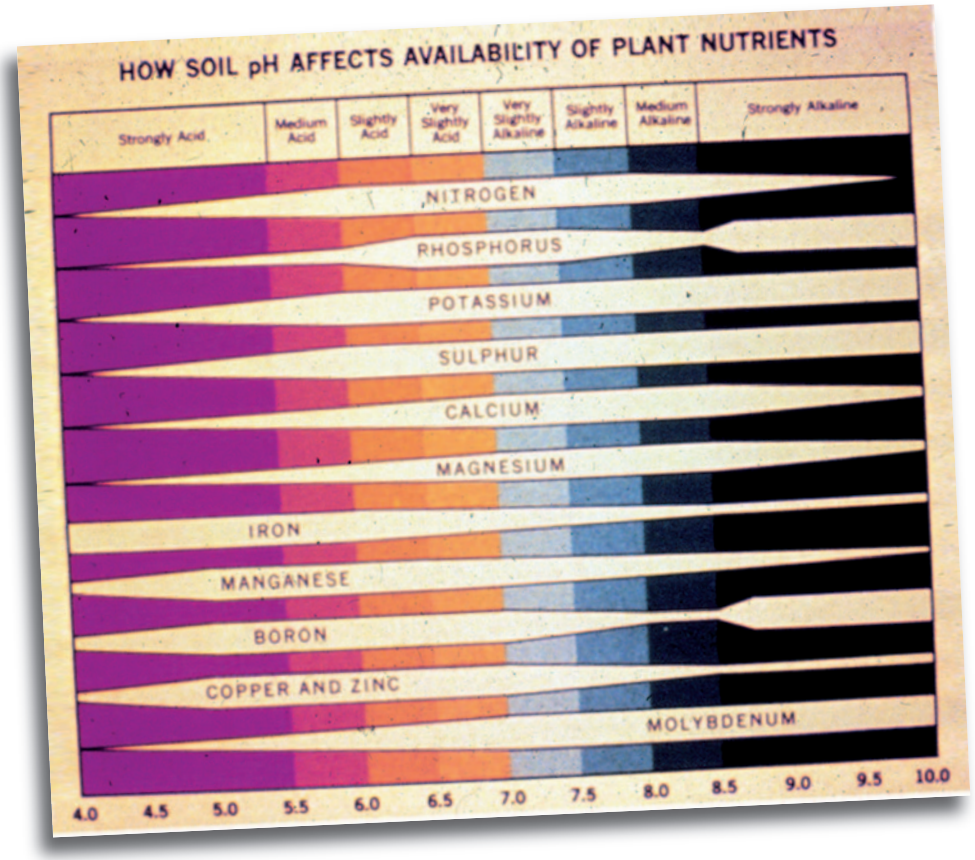
MAGNESIUM (Mg). Next to Fe, Mg is the second most likely element to be deficient on turf. Like Fe, the symptom is chlorosis. Deficiencies in Mg are most likely to occur on grass grown on sandy soil with a low pH, below 7. Remember that Fe chlorosis generally takes place on high pH soils. Magnesium deficiency often occurs during

grass establishment on sand-based sports fields. The problem often expresses itself first as a lack of response to N. Yellow grass often occurs during establishment and generally responds quickly to N with a green-up and increase in growth. In this case, however, the grass doesn't seem to respond to N. The application of more and more N does not provide a response. The first thought when this occurs is that there is a Fe deficiency, but in this case the grass does not respond to Fe either. When this occurs, consider Mg next, particularly on low pH sands. The problem can be solved by applying Epsom salts (magnesium sulfate) or dolomitic lime, a product that contain both Mg and Ca. The turf will respond very quickly to Mg containing fertilizers and the establishment process will proceed normally.

CALCIUM (Ca). Calcium deficiencies are rare on turf. Its deficiency symptom in extreme cases is a reddish discoloration of the leaves. This would only occur under very acidic conditions and a simple application of lime (calcium carbonate) is generally used long before actual Ca deficiencies occur. A number of Ca containing products have been developed in recent years to boost the Ca levels of turf. Research conducted at Iowa State has shown that these materials are not needed on turf grown in soils with high pHs. For turf grown on low pH soils, where Ca problems may occur, lime is low cost solution to the problem and these more expensive materials are usually not necessary.

SULFUR (S). Grasses deficient in S become chlorotic, similar to the conditions that develop when the grass is deficient in Fe and Mg. This condition is very rare in most of the United States

» **THE EFFECT** of soil pH on nutrient availability; the wider the line, the greater the availability.



ELEMENTARY GROWTH

SEVENTEEN ELEMENTS are currently accepted to be essential for the growth of plants. This number changes over time. Several years ago, the accepted list included 15. In the 80's and early 90's, scientists accepted 16. By the mid 90's, Ni was added to the list to make 17. A few others are considered to be beneficial to some plants, such as cobalt (Co), silicon (Si), sodium (Na), selenium (Se), and vanadium (Va) and it is possible that some of these may be added to the essential list as more information on their function is gathered.

Most of the plant is made up of carbon (C), hydrogen (H), and oxygen (O). These three elements are obtained by the plant from water and carbon dioxide and are not added as fertilizer. The other 14 are generally obtained from the soil by the root system and are referred to as the mineral nutrient elements. Some may also enter the plant through the leaf or stem when applied in liquid solutions.

These 17 essential elements are usually divided into macronutrients and the micronutrients. The definition depends on the amounts needed by plants to function. Macronutrients are used in the greatest quantities and are generally found in plant tissue in amounts of 1000 parts per million (ppm) or more. Micronutrients are found in plants at levels of 100 ppm or less.

By this definition, carbon (C), hydrogen (H), oxygen (O), nitrogen (N), phosphorus (P), potassium (K), sulfur (S), calcium (Ca), and magnesium (Mg) are macronutrients and iron (Fe), copper (Cu), zinc (Zn), manganese (Mn), boron (B), molybdenum (Mo), chlorine (Cl), and nickel (Ni) are micronutrients. These definitions have nothing to do with importance of an element and micronutrients are just as important to the function of the plants as are macronutrients. The definition refers only to the amount of each element found in plants. ■

because of our use of high sulfur coal. This puts a lot of S into the atmosphere that returns to earth in rainfall. In most regions, plenty of S is provided by rainfall to prevent S deficiencies on turf. The exception is a narrow band along the West Coast where prevailing winds bring in rainfall that lacks S and along the western coast of Florida where the rains come from the Gulf of Mexico. The test to determine if chlorosis is due to S deficiency is an easy one, simple apply an S containing fertilizer. If the turf responds, it was S deficiency. If it does not respond (which is likely), consider Fe or Mg as the cause and do some tests with these materials.

MANGANESE (Mn). A Mn deficiency can result in chlorosis similar to many of the other elements such as Mg. True Mn deficiencies are very rare, however, because of the very small amount of this element required by plants. Deficiencies are most likely to occur on grass grown on soils with very high or very low pHs. This may be a particular concern on sand-based systems, such as sports fields or golf greens. There are Mn-containing fertilizers that can be used if true Mn deficiencies occur. There are also micronutrient "packages" available that contain Mn in addition to other micronutrients that will solve the problem relatively inexpensively.

OTHER ELEMENTS. Deficiencies of other elements, such as Zn, Cu, Mo, Ni, Cl, and B are exceedingly rare and would not generally occur under most of the conditions in which we manage turf. In the rare situations where they do occur, the generally micronutrient "packages" can be used to overcome the problem. Elements such as Mo, Cu and B are more of a concern because of toxicities that can occur if they are present in very high levels. This can happen with B particularly where sewage effluent is used for irrigation. There are also rare conditions in some mountainous regions where Cu and Mo can be present in excessive amounts.

The symptoms of nutrient deficiencies often overlap and may be difficult to diagnose the problem. Soil tests for the micronutrients are generally considered to be of only minimal use in diagnosing the problem. The best way to determine the source of the condition is to do some simple testing on your own. Chlorosis is a common problem and can be due to a number of things. Start with nitrogen. This will generally solve the problem. If it does not, try other things. If the pH is high, it may be Fe. If the soil is sandy and the pH low, it may be Mg. If the problem is caused by an unusual deficiency of one of the other element, a micronutrient solution of several elements may overcome it. Some simple application of test strips of these materials in an out of the way area is the best method of diagnosis. ■

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