

Nutrient Demands of Turfgrass

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Most who completed their education even five years ago probably believe that plant uptake of nutrients is in direct proportion to the amount applied as fertilizer or is available in soil. We now know that much of the time this is not true. A strong relationship between the supply of a particular nutrient in the turfgrass rootzone and the quantity found in the plant arises only when the supply of that nutrient is growth limiting. The reason for this is fundamental. Recent research clearly demonstrates that plant themselves have internal mechanisms whereby they are able to control nutrient absorption according to their

needs rather than according to how much is supplied to the roots. Nutrient deficiency arises only when plant demand exceeds soil supply.

In the absence of temperature or moisture limitations on plant growth turfgrass nutrient demand is directly linked to nitrogen supply. The reason for this is the simple fact that today's nitrogen application rates are but one-third to one-half the amounts required to obtain maximum biomass production. In other words, turfgrass is managed in a near-continual state of nitrogen deficiency. Exceptions to this probably occur only during the first few hours or days after soluble fertilizer nitrogen application.

Because turfgrass growth is so often limited by nitrogen supply, plant needs for other nutrients are largely determined by the nitro-

gen status of the plant. Stated differently, nitrogen supply has strong regulatory action on turfgrass needs for other nutrients. Nutrient demand is what controls to a large degree plant uptake of these nutrients. Exactly how this control arises is not known. It relates to overall growth rate, but probably relies as well on levels of the nutrient and different organic compounds within plant roots and shoots and on some type of messenger compounds that relay nutrient demands to roots. Hormones produced in the shoots are often thought to be the messenger compounds through which shoots convey to roots the need to absorb more of a particular nutrient.

The degree to which nutrient demand regulates turfgrass uptake of nutrients varies somewhat with the nutrient in

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question. Phosphorus uptake appears to be closely regulated by nutrient demand while potassium often enters plants in excess of that actually required for growth. The same probably holds true for nutrients such as manganese, copper, zinc and boron that can accumulate to the point of being toxic.

Given that we now manage turfgrass in a way such that nitrogen is nearly continuously deficient has several important consequences. One is that nitrogen demand is almost always high. As a result, nitrate and ammonium ions in the rootzone are quickly absorbed. In fact, research has shown that if nitrate is injected into the rootzone of actively growing turfgrass, it virtually disappears with 24 to 48 hours

due to very rapid absorption by the grass roots and soil microorganisms. This, then, accounts for the fact that nitrate leaching from turfgrass is typically far less than from other crops where nitrogen fertilization rates are designed to achieve maximum biomass production by avoiding nitrogen deficits.

A second important consequence is that what constitute adequate soil test levels of nutrients other than nitrogen are directly dependent on the rate and frequency of fertilizer nitrogen applied. The majority of the research done to establish what are low, medium, sufficient or adequate, high and excessive soil tests is more than 20 years old and was conducted in an era when nitrogen rates for turf were considerably higher than today. This means that our interpreta-

tions of soil tests are likely to be in error. It is quite possible that what was found, for example, to be a high soil test 20 to 30 years ago is in reality excessive for today's turfgrass. The net result is that as a general rule, we're applying more and larger amounts of nutrients to turfgrass than are actually necessary.

Finally, let's recognize the strong control plants exercise over nutrient uptake. Putting more nutrient into the rootzone than the turfgrass plant needs and will utilize is wasteful and irresponsible. In many places healthy turf can be grown for a year or even for several years with application of nitrogen alone. If soil tests indicate high or excessive levels of phosphorus and/or potassium, fertilizing with just nitrogen is a proper and safe management response.

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