Potassium, A key Nutrient for Plant Growth

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This issue discusses the importance of potassium as a key plant nutrient and problems associated with excess and/or deficiencies of potassium in the plant. Many plant physiologists consider potassium second only to nitrogen in importance for plant growth. Potassium is second to nitrogen in plant tissue levels with ranges of 1 to 3% by weight.

As a trivia, potassium is the only essential plant nutrient that is not a constituent of any plant part. Potassium is a key nutrient in the plants tolerance to stresses such as cold/hot temperatures, drought, wear and pest problems. Potassium acts as catalysts for many of the enzymatic processes in the plant that are necessary for plant growth to take place. Another key role of potassium is the regulation of water use in the plant (osmoregulation). This osmoregulation process affects water transport in the xylem, maintains high daily cell turgor pressure which affects wear tolerance, affects cell elongation for growth and most importantly it regulates the opening and closing of the stomates which affect transpirational cooling and carbon dioxide uptake for photosynthesis.

Unless truly deficiency occurs, potassium has very little effect on turfgrass quality such as color and density. However, once potassium deficiency occurs, it can have a dramatic affect on the plants ability to survive and function during stress periods such as high temperatures, drought and wear. Initial potassium deficiency shows up as yellowing of older leaf blades, lower leaf blades, which is then followed by dieback of the leaf tip and scorching of leaf margins as the deficiency problem becomes worse. Once these conditions occur, wear injury for the turf plants will increase significantly. Factors which can lead to potassium deficiency include: leaching in sandy soils or soils with low CEC values, sites being irrigated with water that is high in sodium and where high rates of calcium and magnesium or added through the irrigation water or through the fertilization program.

There are four different sources of potassium in the soil. The largest soil component of potassium, 90 to 98%, is the soil minerals such as feldspar and mica. Very little of this potassium source is available for plant use. The second soil potassium source is the nonexchangeable potassium, 1 to lo%, and is associated with the 2: 1 clay minerals. The nonexchangeable potassium source acts as a reserve source of potassium in the soil. The third soil potassium source, 1 to 2%, is called the exchangeable or readily available potassium and is found on the cation exchange sites or in the soil solution. The soil solution potassium is readily taken up by the plants root system and is then replaced by the potassium on the exchange sites. A fourth source of potassium in the soil is the potassium contained in organic matter and within the soil microbial population. This soil source of potassium provides very little of the potassium needed for plant growth.

Potassium uptake is most rapid on warm, moist soils that are well aerated and have a slightly acidic to neutral pH. As soil temperature increases, plant metabolic activity increases which increases root growth and root activity. Warmer soil temperatures also

increase the diffusion rate of potassium in the soil solution which increases potassium uptake by the root system. Excess soil moisture can lower soil oxygen levels which in turn decrease the respiration rate for the plants root system and thus lowers potassium uptake. Also, excess water can increase the amount of leaching of potassium, particularly in sandy soils. In alkaline soils, increased levels of other cations such as calcium, potassium and sodium can affect the availability of potassium in the soil. The calcium and magnesium cations can displace the potassium from the exchange sites on the clay particles and sodium competes with potassium for uptake by the plants root system.

Application of potassium fertilizer will be determined by factors such as soil potassium level, soil type, time of the year and use activity for the site. As with any nutrient, potassium programs should be based on soil test results.

1. Sandy soils or soils with low cation exchange capacity (CEC), will require light frequent applications of potassium fertilizer as opposed to clay type soils with high to very high levels of potassium. Soils with high levels of other cations such as calcium, magnesium or sodium will also probably require more frequent, light applications of potassium. When applications of amendments and/or fertilizers containing high rates of calcium or magnesium are used, a follow up application of potassium should be made to the site since these cations can displace potassium from the soil exchange sites.

2. As use of the site increases, so should the amount of potassium fertilization. During periods of heavy use, apply light, frequent applications of potassium to the soil.

3. Spring and fall is the most important time of the year to make potassium fertilizer applications. In the spring, turfgrass plants are often developing a entirely new root system. Potassium is a key nutrient in the development of new root growth. In the fall, plant tissue levels of potassium are very critical in preparing the plants for winter survival. Low plant tissue levels in the fall to early winter months can dramatically increase the potential for winter injury to turfgrass plants.

In summary, potassium is a key essential plant nutrient. Generally, clay soils in Texas contain more than adequate potassium to meet the turfgrass needs for home lawns and commercial properties. However, for sports fields and golf courses with increased activity and wear, it may be necessary to apply additional potassium in the fertilizer program to insure that turfgrass plants are obtaining adequate potassium uptake for healthy plant growth