Potassium - A Miracle Element?

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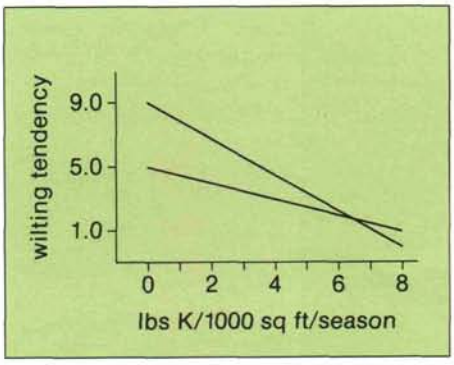
EVIDENCE gathered in surveys of turfgrass nutrition programs shows that golf course superintendents are taking more interest in the role of potassium in their turfgrass nutrition programs. The surveys were conducted at GCSAA Nutrition Seminars. Further evidence came from superintendents attending regional turfgrass conferences. The growing interest in potassium nutrition has also coincided with the increased use of light, frequent sand topdressing, and with the use of higher sand concentrations in rootzone media.

Potassium is one of 16 essential elements required by plants for growth and development. Though it is an essential element, potassium is not a constituent of turfgrass tissues. It is found in plants only in the elemental form (K^+). Potassium enhances carbohydrate synthesis and translocation, protein and amino acid synthesis, and enzyme activity. It controls transpiration, respiration, and uptake of certain nutrients, like nitrogen and magnesium. It has been reported to enhance rooting and stress tolerance of turfs.

Turfgrasses require fairly large quantities of potassium, second only to nitrogen, and there is growing evidence that potassium may be useful to turfgrasses in equal amounts to nitrogen, particularly in relation to environmental stress tolerance. The term "luxury consumption" has often been associated with potassium, since it may be taken up by plants in greater quantities than that required for growth and development. Luxury consumption of potassium has been associated with crop production and subsequently has been related to turfgrass management. This association may not be fair or realistic, since clipping yield and dry matter production are not of primary concern to superintendents, but increased turfgrass stress tolerance is. Tolerance for heat, cold, drought, and wear grows with increased potassium fertilization of turfs. Therefore, luxury consumption of potassium likely does not occur in relationship to turfgrass stress tolerance.

(Below) Wilting tendency of Kentucky bluegrass increased with higher nitrogen rates (2 versus 8 lbs N/1000 sq ft/season) but declined with addition of potassium ranging from 0 to 8 lbs K/1000 sq ft/season. (Bottom) Potassium nutrition is important in minimizing turfgrass wilt and enhancing drought avoidance.



A DROUGHT avoidance study conducted at Nebraska on a Kentucky bluegrass turf growing on a soil that was high in potassium (i.e., greater than 500 pounds available per acre) demonstrated that wilting tendency decreased with

increasing potassium, ranging from zero to eight pounds per 1,000 square feet during the growing season. Recovery from drought injury was also enhanced by potassium fertilization. The evapotranspiration rate declined and turfgrass depth and extent of rooting increased with potassium fertilization in this Nebraska study. Wear tolerance increased and desiccation injury decreased with potassium treatment in a Michigan study conducted on a Penncross creeping bentgrass green. These responses were observed even though soil potassium levels were considered to be high. Similar reports of stress exist for warm-season turfgrass species like St. Augustinegrass and bermudagrass.

Potassium deficiency symptoms are usually subtle and not seen as easily as in nitrogen-deficient turf. Deficiency symptoms often show up as reduced tolerance to environmental stress and to disease. Potassium deficiencies occur most often on sandy soils that receive frequent irrigation. Daily irrigation on a seaside creeping bentgrass green growing on a sandy rootzone resulted in a soil potassium level only 79% of a similar grass growing on the same rootzone, but given the same amount of water in three installments per week. In this study, potassium content of turfgrass tissues showed a similar trend as the soil levels; lower levels were found in the frequently irrigated turf.

(Above) Turfs with adequate potassium levels hold up to traffic better than those that are potassium deficient. (Below) Potassium deficiencies occur most readily on sandy rootzones that receive frequent irrigation.

ON SANDY SOILS with low nutrient retention capabilities, it is better to apply potassium in light and frequent rather than heavy and less-frequent applications. This is particularly the case when frequent irrigation is also required to maintain desired turfgrass quality. The low nutrient retention capability of sand coupled with frequent irrigation results in much of the potassium being leached from the rootzone and a subsequent reduction in potassium uptake by the plant. Light, frequent topdressing with sand results in similar potassium management problems as those encountered with high sand content rootzones. Superintendents need to be aware of these relationships and to adjust their nutrition programs accordingly.

Potassium is not a miracle element; it is an essential nutrient, and superintendents should keep its role in perspective. A fair degree of evidence supports potassium's role in turfgrass stress tolerance, but controversy exists among turfgrass researchers regarding its potential benefits. For example, concern has been raised about high potassium levels increasing *Poa pratensis* competition in turfs, but little research evidence supports this concern.

More work is needed to further delineate the role of potassium in golf course fertilization programs, and superintendents should be willing to approach its use for enhancing stress tolerance in a reasonable manner. A concerted research effort with potassium is being conducted at the University of Nebraska. This research is part of an extensive cultural practice research project supported by the USGA.