Potassium and Old Man Winter

BY KARL DANNEBERGER

Curious and controversial, potassium (K) is a difficult nutrient to evaluate regarding its impact on turfgrass growth and health, including its role in cold hardiness. Potassium is a macronutrient that's found at levels in leaf tissue second to nitrogen. It's considered a "luxury nutrient" in agriculture. Luxury consumption refers to a nutrient, in this case potassium, which can be absorbed in excess of what is required for plant yield but not cause toxicity.

While potassium isn't a plant constituent, it's important as an activator for more than 40 enzymes. These enzymes play an important role in photosynthesis and respiration. Potassium is especially important in starch synthesis, the reactions involved in converting glucose into starch (energy storage). Potassium applications made in the fall to maintain or establish adequate levels would likely result in enhanced starch storage, reducing the potential for winter injury.

Related to cold, potassium as an inorganic solute acts as an antifreeze helping to lower the cellular freeze point during cold acclimation in late fall. Along with other components, like cellular sugars, cellular water loss is minimized or regulated during extra-cellular ice freezing.

In the early 1970s, several researchers found fall applications of potassium reduced winter injury to warm-season turfgrasses, primarily bermudagrass (Reeves, et al., 1970; Gilbert and Davis, 1971). Twenty-five years later, researchers found various potassium application rates and varying content within the plant had no effect on freeze tolerance (Miller and Dickens, 1996).

It's easy to see why potassium is a controversial element. It appears if adequate levels of potassium are available as determined by soil tests, increasing the amount of potassium has little effect on freeze/winter injury. In essence, we have a "luxury stress" nutrient. The impact is minimal when increasing beyond adequate or ideal levels.

It should be pointed out that most of the studies with potassium have been done within the normal range of — in this case bermudagrass — adaptation. As an academic exercise, it would be interesting to know if increasing potassium levels impacted freeze tolerance or winter survival of bermudagrass in an extreme environment outside of its range of adaption.

'K' PLAYS VITAL ROLE IN OSMOTIC REGULATION, WHICH IMPACTS FREEZE TOLERANCE OF TURFGRASS

Where would potassium applications be beneficial? Potassium is a cation (K+) that's easily leached, especially through sandy rootzones or soils. Under these conditions, potassium levels should be monitored carefully.

Besides identifying and correcting deficiencies across an area, localized areas such as raised or knoll areas of greens high in sand content may be especially sensitive to potassium loss. After a summer of irrigating or hand-watering these areas of greens, the potential for leaching and the movement of potassium downward and diagonally to lower areas of the green may result in a potassium deficiency. One sign that potassium levels might be low is the presence of moss.

Maintaining the proper potassium levels through fall can help reduce spring dead spot (SDS) over time. SDS is a potentially serious disease in climatic areas where winter injury on bermudagrass is potentially high. Potassium applied through the fall in combination with ammonium sulfate has been reported to help reduce SDS severity (Dernoeden et al., 1991).

In summary, potassium plays an important role in osmotic regulation, which impacts the freeze tolerance of turfgrass, especially warm-season turfgrass. Maintaining adequate potassium levels, as determined by soil test reports, should be the goal in potassium programs to improve turf health through the fall and into the winter.

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