

Improving Turf Quality During Tournament Preparation through Ethylene Inhibition

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Objectives:

1. Examine the growth of creeping bentgrass in an ethylene-enriched environment to determine if ethylene has a negative effect on turfgrass similar to other plants.
2. Determine the phytotoxicity of AVG (aminoethoxyvinylglycine hydrochloride) to creeping bentgrass putting green turf.
3. Determine if applications of AVG to stressed creeping bentgrass putting greens will reduce the decline in turfgrass quality and improve recovery.

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Project Duration: 2 years

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Little is known about the effects of direct ethylene exposure to turfgrass. In previous research, ethylene production was measured and correlated to other measurements such as turfgrass quality. However, there is a possibility that even though ethylene levels were elevated, other factors may have caused the decline in turfgrass quality. The effects of direct ethylene exposure to creeping bentgrass have not been demonstrated.

Creeping bentgrass plugs from an established creeping bentgrass green were harvested and acclimated in a greenhouse for two weeks. Afterwards, the plugs were sealed in glass jars and subjected to ethylene levels of 0, 100, 250, 500, 1,000, 1,500, 2,500, 5,000, 7,500, 10,000, and 15,000 ppm for a period of three hours. Gas chromatography was used to determine actual ethylene concentration at the conclusion of the three hours of exposure. Digital image analysis was used to evaluate turfgrass color. Regression analysis determined that no significant relationship existed between turfgrass color and ethylene exposure.



Creeping bentgrass plots treated with varying rates of AVG.

Aminoethoxyvinylglycine hydrochloride (AVG) is a naturally occurring compound from the process of fermentation that inhibits the production of ethylene in plants through reducing enzyme activity within the Yang cycle. Previous research has indicated that AVG was effective in preventing temperature stress-related injury and ethylene production on creeping bentgrass grown in a growth chamber, and the results from the study indicated that AVG could be used to prevent injury. However, the study had limited detail on the amount of AVG that could safely be applied to creeping bentgrass, or more importantly, how safe AVG was on creeping bentgrass being maintained as a putting green. Therefore, the objective of this study was to determine maximum application rates for AVG on creeping bentgrass putting greens that would not produce phytotoxicity.

The results of this study indicated that higher rates of AVG (> 0.3 pounds per acre) were phytotoxic at 4, 7, and 14 days after treatment, but symptoms of injury were not present after 21 days. The lower rates (<0.3 pounds per acre) did not cause any injury to the turf. When injury ratings were averaged over the entire 28-day evaluation period, AVG application ratings were not significantly different.

Creeping bentgrass is often used in areas of the United States, such as the transition zone, that are outside the optimum temperature range for the species. Recent studies have shown that under high temperature stress, the production of the plant stress hormone ethylene was increased in creeping bentgrass in a growth chamber. In addition, other stressors such as wounding have been shown to stimulate ethylene production in many plants.

Tournament conditions in putting green management in places where high temperature stress is prevalent may be



Apparatus for determining the effects of ethylene exposure to creeping bentgrass.

some of the most stressful conditions for turf. During tournaments, mowing heights are lowered, mowing frequency increased, light weight rolling is added, and irrigation is reduced to produce hard and fast putting surfaces. However, these practices are detrimental to the overall quality of the turf and slow the recovery afterwards.

No significant differences were noted across any treatments from applications of AVG or the untreated control for turfgrass quality, color, relative chlorophyll content, or tiller density. The lack of differences may be attributed to a cooling of temperatures over the evaluation period.

Summary Points

- To date, no effects of exogenous ethylene on creeping bentgrass have been demonstrated.
- Applications of the ethylene inhibitor, AVG at rates < 0.3 lb / acre did not produce any phytotoxic injury symptoms on creeping bentgrass putting green turf.
- To date, applications AVG have had no effect on the quality of creeping bentgrass when managed under stressful conditions.