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Modeling GA Production Improves Prediction of Turf Growth and PGR Performance

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Intro

Annual nitrogen fertilizer regimes for cool-season turf species have historically been based off of bimodal growth curves found in textbooks. These growth curves show highest growth in the spring and the fall. Recent research has indicated that at low temperatures, nitrogen uptake is reduced. This has led to reduced late-fall nitrogen recommendations. Another point of interest was summer nitrogen fertilization. Current growth potential models predict the magnitude of growth and when to fertilize based off of optimal temperatures for photosynthesis. These models currently do not have any scientific research to support them. Also, we have observed growth in some field studies that contradicts this model.

Research Question & Objective

- How is clipping yield affected by nitrogen fertilizer response and temperature in three cool season species?
- Quantify the effect that temperature and nitrogen response has on clipping yield from three turf species during the growing season.

Materials & Methods

We tested three cool-season species, 'L-93' Creeping bentgrass (1.3 cm HOC), 'Nu Destiny' Kentucky Bluegrass (5.1 cm HOC), and '5-Iron' Perennial Ryegrass (5.1 cm HOC). The species were started as plugs taken from the East Campus Turf Plots on the UNL campus. The plugs were grown in 10 inch black Cone-tainers. The plugs were grown in two Environ growth chambers with average air temperatures at 20C and 30C. Light intensity, humidity, and day length were all kept the same. The four nitrogen fertilizer treatments tested were 0, 0.6, 1.2, and 2.4 g m^{-2}. The plugs were acclimated to their respective chambers for three weeks and fertilized with 0.5 g m^{-2} N the first two weeks of acclimation. Nitrogen treatments were applied weekly. Clippings were collected, dried, and weighed weekly starting two weeks after treatments began and continuing for four weeks.

Results

We found that as nitrogen rate increased, clipping yield also increased for all three species. Although there were differences between the species in regards to nitrogen rate response. Creeping bentgrass and Kentucky bluegrass were much more sensitive to nitrogen increases as compared to perennial ryegrass. We also observed a much greater response to nitrogen in the cool (20C) growth chamber as compared to the hot (30C) growth chamber. Average weekly clipping yield at the high nitrogen rate was nearly double in the cool chamber than the hot chamber. Lastly, we found that perennial ryegrass was much more sensitive to temperature than creeping bentgrass and Kentucky bluegrass (Figure 1). Perennial ryegrass had about 4x the growth in the cool chamber as compared to

the hot chamber while creeping bentgrass showed very little difference in mean weekly clipping yield between the chambers.

Conclusion

We can conclude that temperature and nitrogen fertilizer do play a role in clipping yield. Clipping yield increased with nitrogen rate but the amount of response decreased from cool temperature to warm temperatures. The magnitude of these responses differed among the three species as well. Perennial ryegrass was much less sensitive to nitrogen rate and much more sensitive to temperature than creeping bentgrass and Kentucky bluegrass. More testing will be needed to observe growth at other temperatures.

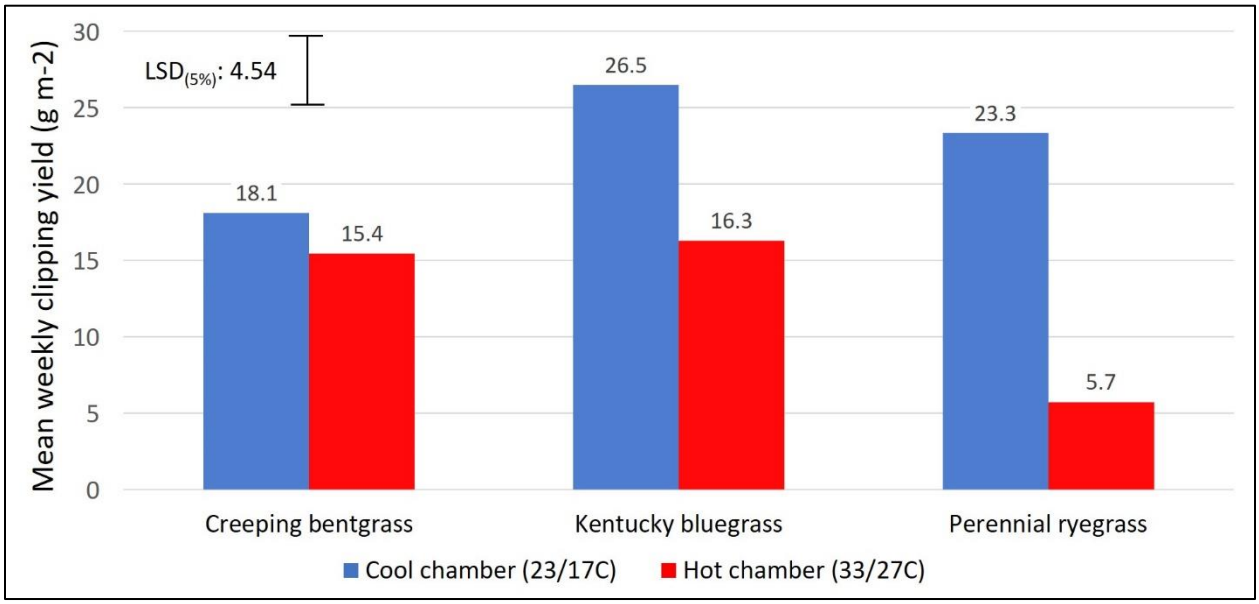

Figure 1. Three cool-season species mean weekly clipping yield in each growing environment.