



Development of a Growing Degree Day Model for Plant Growth Regulators On Ultradwarf Bermudagrass Putting Greens



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Introduction

Plant growth regulators (PGRs) are frequently applied on ultradwarf bermudagrass putting greens. PGRs are often applied to increase ball roll distance (i.e. green speeds), reduce excessive clipping yields, allow for reduced mowing, and provide more consistent playing conditions. PGR application intervals for ultradwarf bermudagrass putting greens are not well characterized. There is concern that PGRs are applied too frequently, leading to increased biotic and abiotic stresses. Many ultradwarf bermudagrass samples submitted to the NCSU Turf Diagnostics Lab for disease diagnosis have often been treated with frequent, high rates of PGRs.

Growing degree day (GDD) models are used to determine when chemicals should be applied based on weather patterns. GDD models have been constructed for PGRs on cool season turfgrasses, but not ultradwarf bermudagrass. These models are beneficial to golf course superintendents allowing for more accurate PGR application timings. Two common PGRs labeled for ultradwarf bermudagrass putting greens include trinexapac-ethyl (Primo Maxx) and prohexadione calcium (Anuew). The influence of PGRs on ball roll distance and turf quality is vital for golf course superintendents managing ultradwarf bermudagrass putting greens.

Are you applying more or less PGRs than you were three years ago?

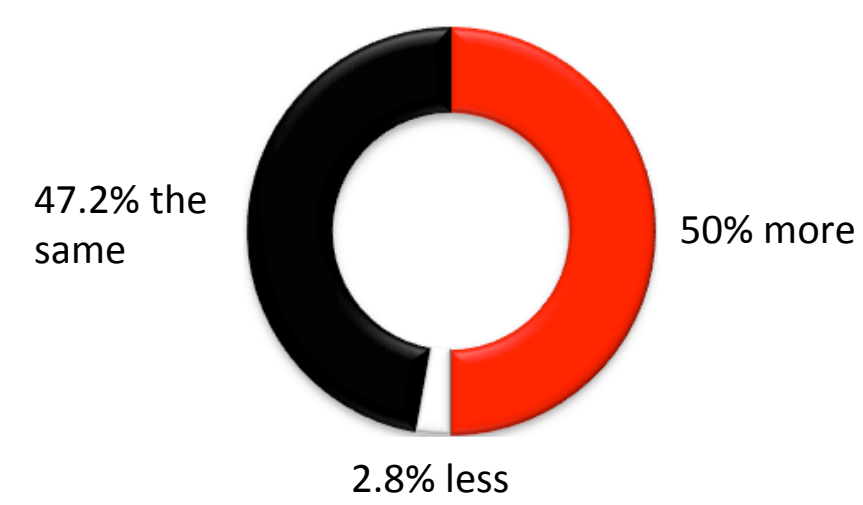


Figure 1. Survey conducted for ~300 golf course superintendents (GIE Media Inc., 2015)



Figure 2. Ultradwarf bermudagrass on the right exhibiting phytotoxicity from a recent PGR application (NCSU Turf Pathology, 2016)

Objectives

1. Develop growing degree day models for various PGRs
2. Determine effects of PGRs on ball roll distance and turf quality

Methods

- Study performed from July 5, 2016-September 27, 2016 at Lake Wheeler Research Station in Raleigh, NC
- PGRs Primo Maxx (118.294 ml/m²) and Anuew at two different rates (0.056 g/m² and 0.112 g/m²) applied on July 5, 2016 and August 2, 2016
- Treatments arranged in a RCBD with 3 replications
- Clippings collected 2-3 times per week
- Clippings were oven dried for 24 hours at 60°C
- Sand was separated using an electric razor to vibrate an oven pan propped at a ~30° angle and clippings were weighed
- Ball roll measurements were taken in two opposite directions using a Stimpmeter® and turf quality was visually assessed
- Data analysis was performed using SAS and growing degree day models were constructed using Solver in Microsoft Excel
- GDD estimates used a base 10°C temperature



Figure 3. Sand separating mechanism



Figure 4. Clipping collection

Growing Degree Day Models

Anuew at 0.056 g/m² rate

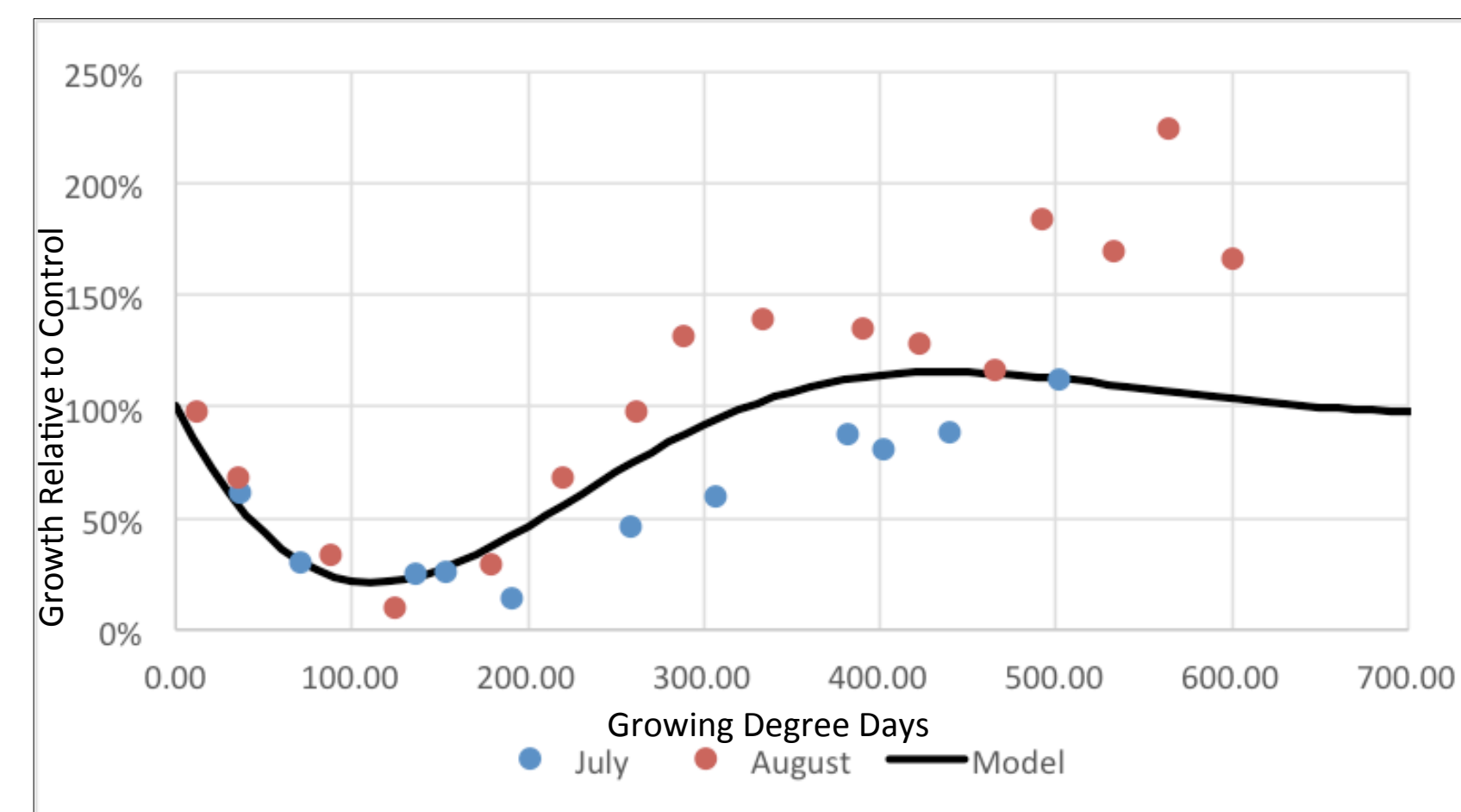


Figure 5. Anuew at 0.056 g/m² rate growing degree day model

Anuew at 0.112 g/m² rate

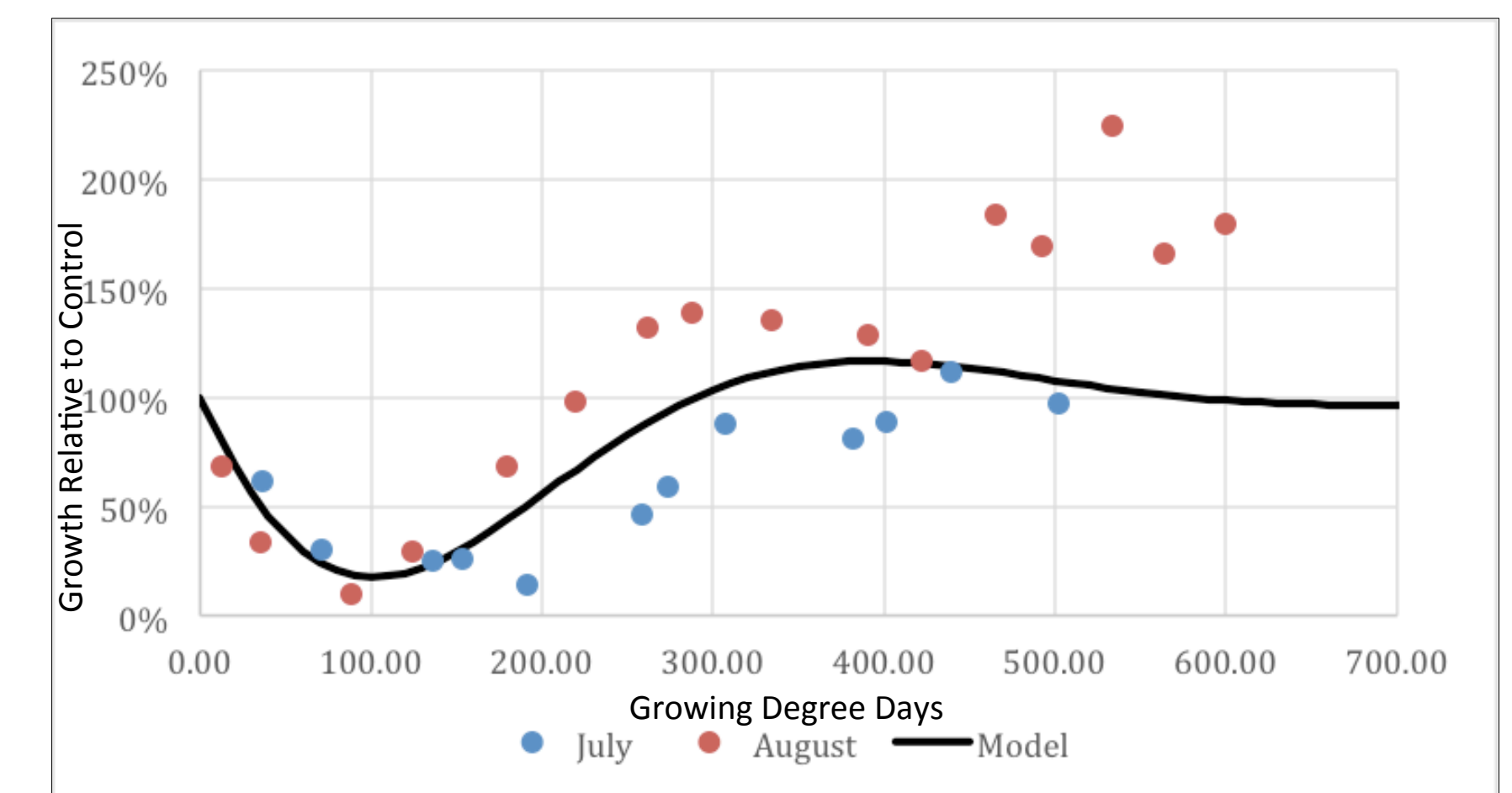


Figure 7. Anuew at 0.112 g/m² rate growing degree day model

Primo Maxx at 118.294 ml/m² rate

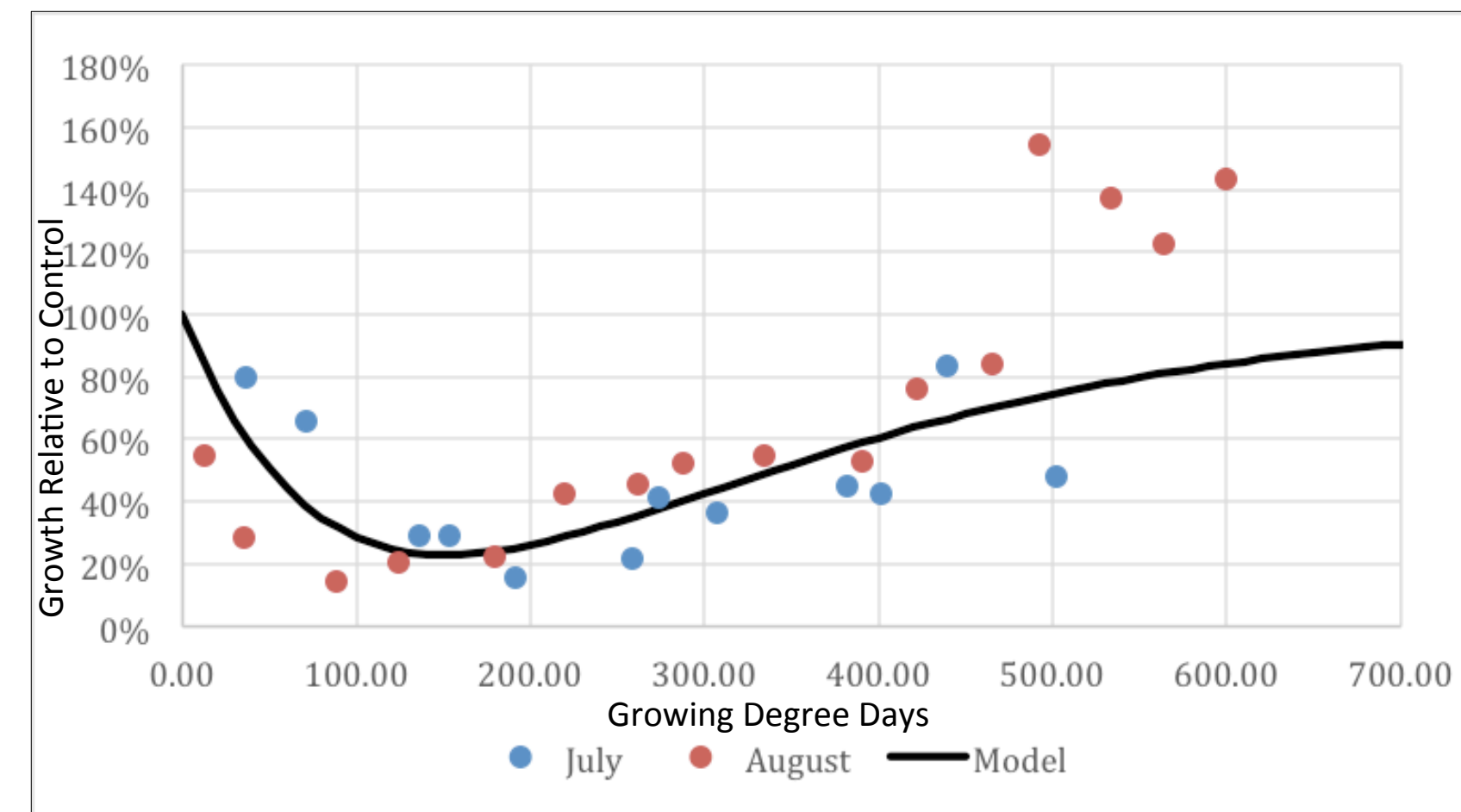


Figure 6. Primo Maxx at 118.294 ml/m² rate growing degree day model

Growing Degree Day Model Results

PGR	Rate	July GDD Interval	July Maximum Suppression	August GDD Interval	August Maximum Suppression	Average GDD Interval	Average Maximum Suppression
Anuew	0.056 g/m ²	191.32	81%	150.35	80%	170.84	80.50%
Anuew	0.112 g/m ²	170.92	81%	134.27	87%	152.6	84%
Primo Maxx	118 ml/m ²	281.21	73%	149.04	91%	215.13	82%

Table 1. Application intervals and maximum suppression for each PGR

Ball Roll Distance

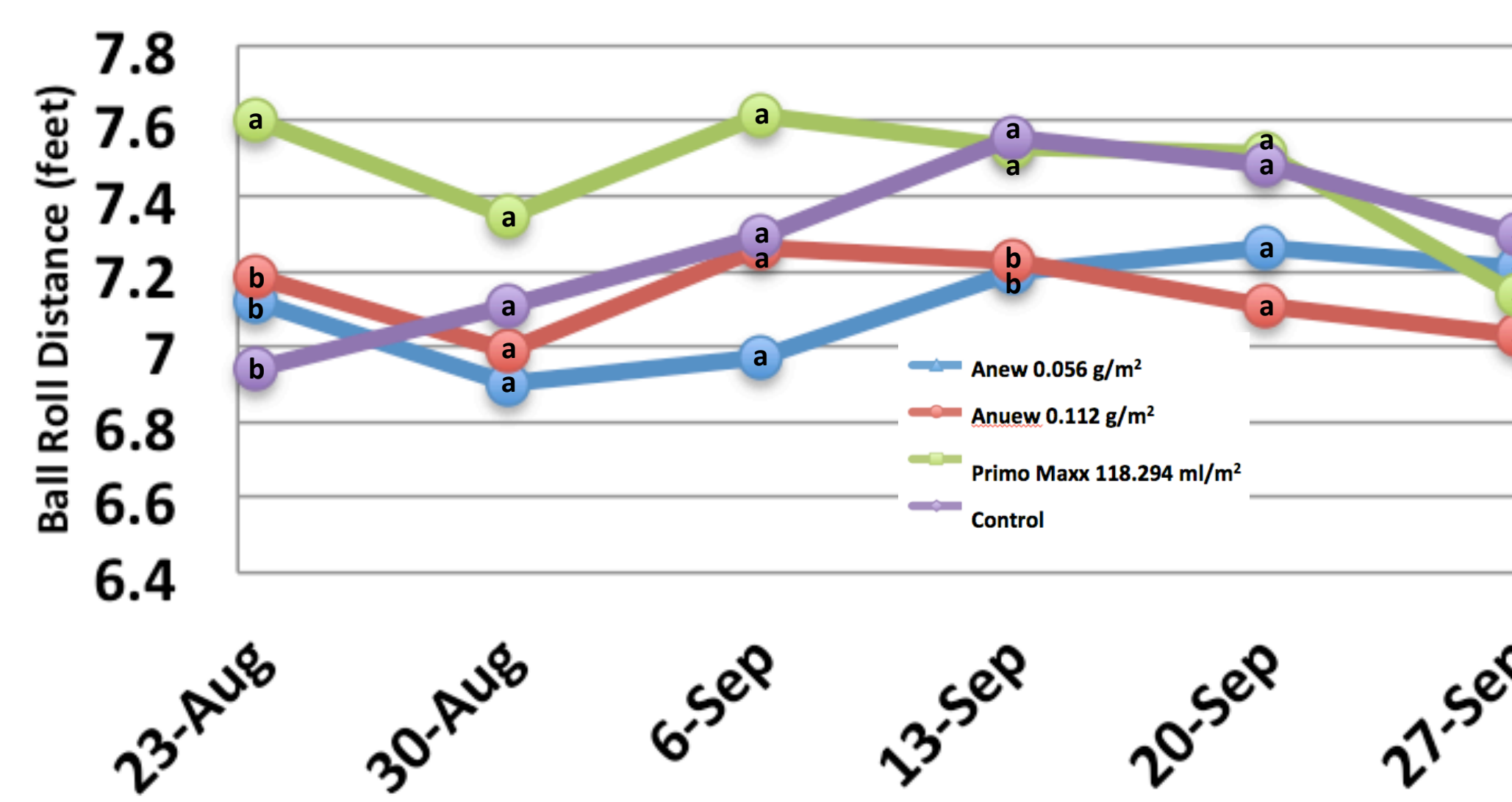


Figure 8. Effect of PGRs on ball roll distance

Anuew 0.056 g/m²

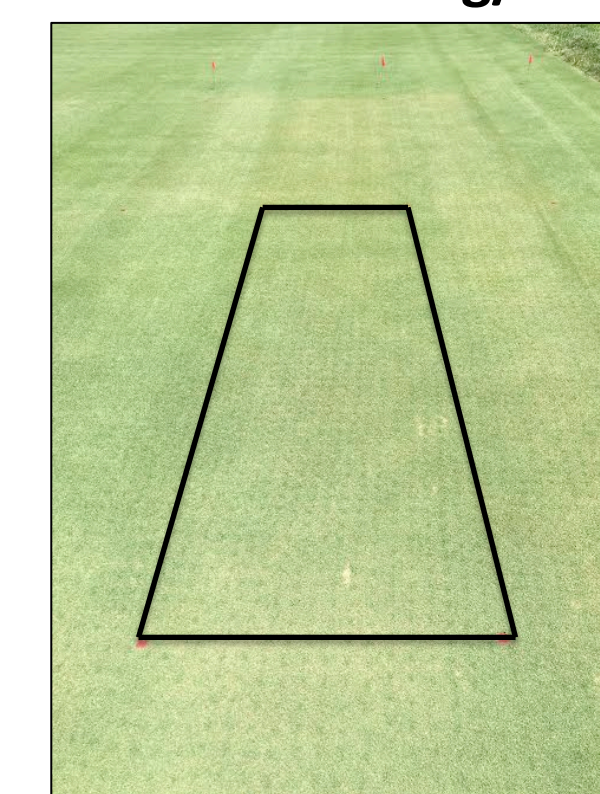


Figure 10. Plot 2 weeks after application of Anuew at 0.056 g/m² rate

Anuew 0.112 g/m²

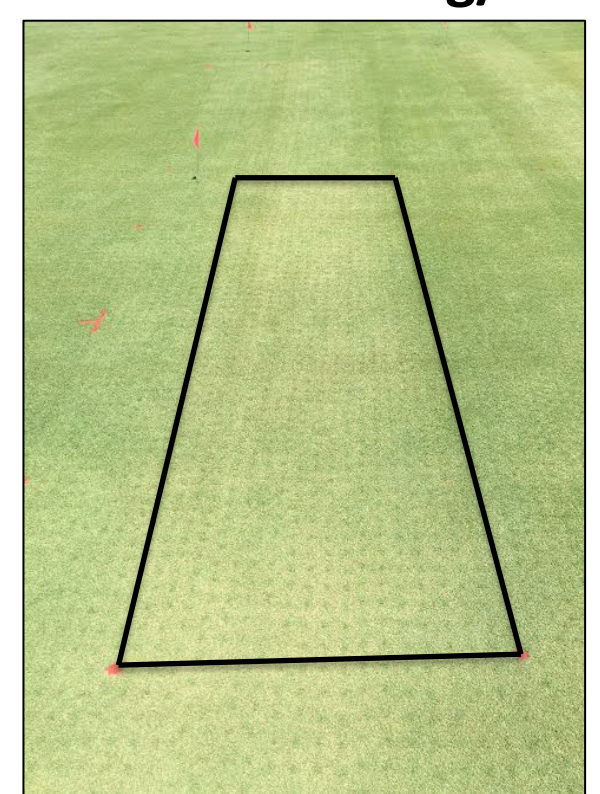


Figure 11. Plot 2 weeks after application of Anuew at 0.112 g/m² rate

Turf Quality

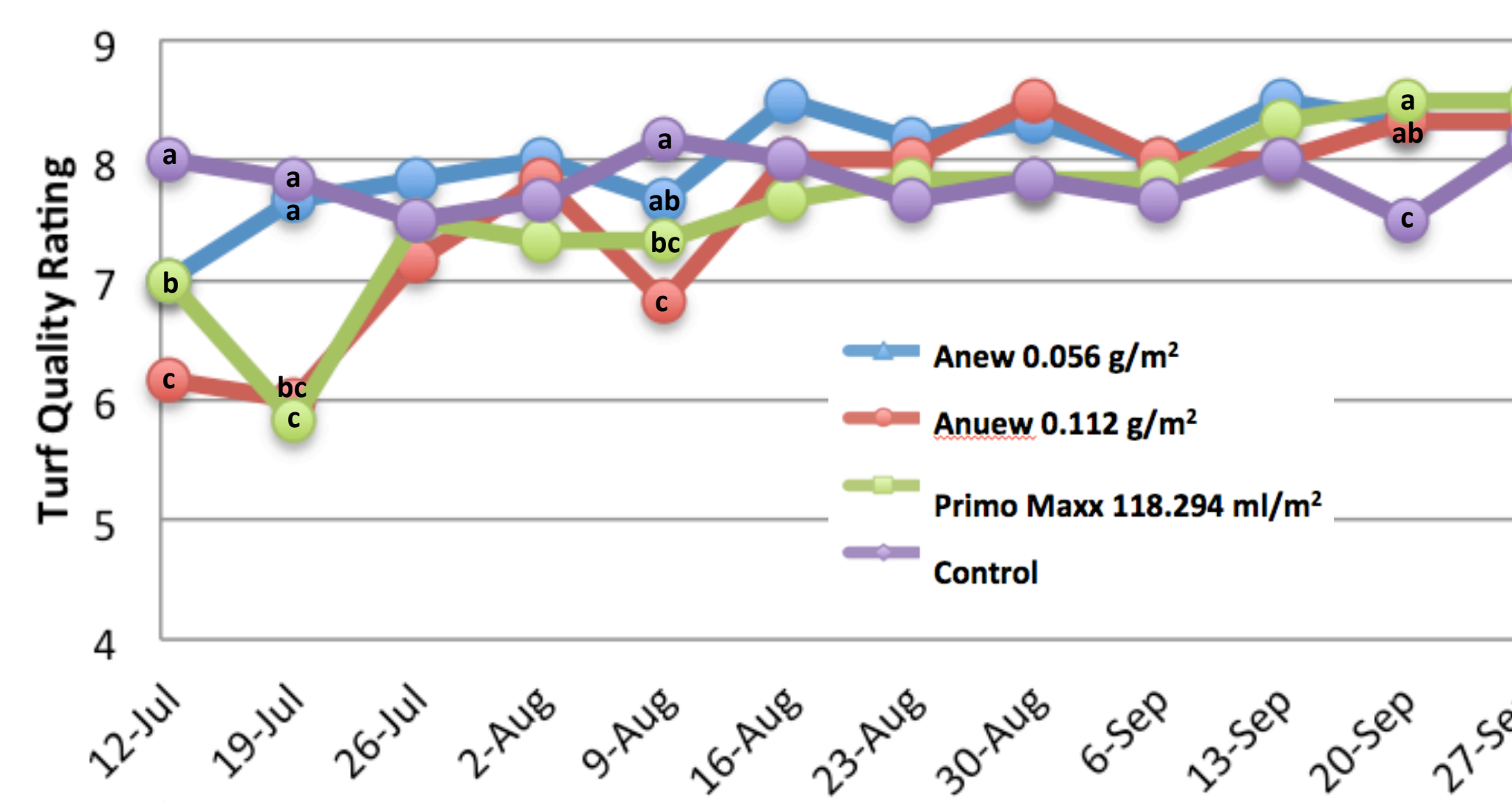


Figure 9. Effect of PGRs on turf quality

Primo Maxx 118.294 ml/m²

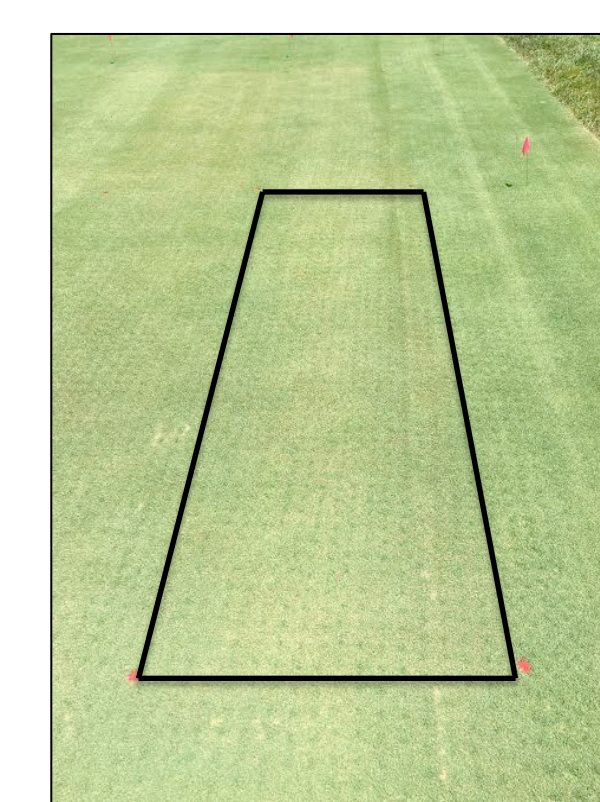


Figure 12. Plot 2 weeks after application of Primo Maxx at 118.294 ml/m² rate

Control

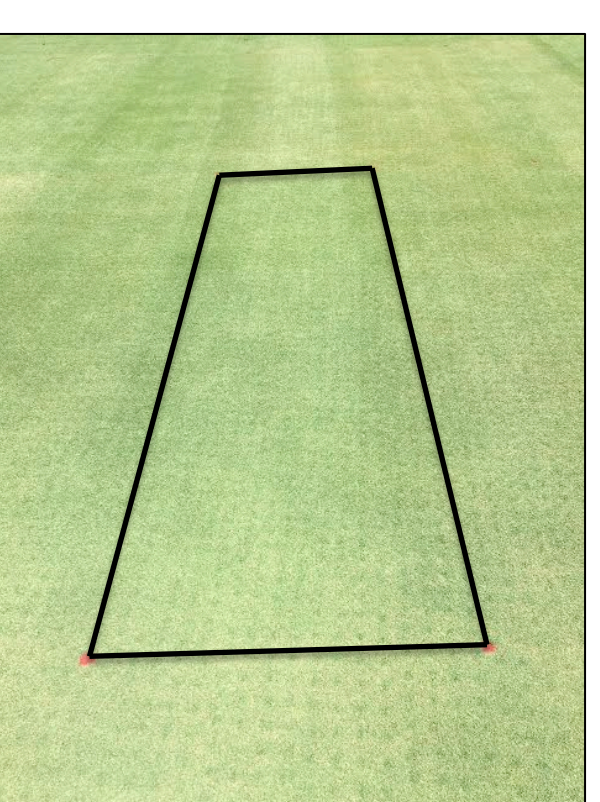


Figure 13. Plot 2 weeks after no application of PGR

Discussion

Growing degree day models revealed that average application intervals are 170.84 GDD for Anuew at the 0.056 g/m² rate, 152.6 GDD for Anuew at the 0.112 g/m² rate, and 215.13 GDD for Primo Maxx at the 118.294 ml/m² rate

PGRs should not be solely applied on a calendar basis

Applications on August 2, 2016 resulted in regulation until late September

PGR applications had minimal impact on ball roll distance

PGRs only had a negative effect on turf quality for 1-2 weeks after each application

Funding provided by



References

- "Controlled growth." *Golf Course Industry*, 30 June 2015, <http://www.golfcourseindustry.com/article/pgrs-063015-pgr-research-critical/>. Accessed 8 Dec. 2016.
- NCSU Turf Pathology. *Trivia time! Which side of this 'Champion' bermudagrass green received a PGR application recently??*. 13 June 2015. Twitter. <https://twitter.com/ncturfpathology>. Accessed 9 Dec. 2016.

