



The Impact of Disease Suppressing and Plant Health Promoting Products on Creeping Bentgrass Grown Under Shade Stress



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Overview

- There are many products on the market that go beyond fungicidal properties or nutritional value but their role in plant protection is not well understood
- Plant defenses are activated prior to the onset of various environmental and biological stressors (Hsiang, 2011)
- Shade stress reduces photosynthesis, in turn depleting carbohydrate reserves (Sorochan, 2002)
- Low red light leads to more shoot growth while decreasing root growth (Sorochan 2002)
- Research is needed to address how plant-activating products impact creeping bentgrass (*Agrostis stolonifera*) tolerance to shade stress

Research Objective

Determine the impact that different plant health promoting products (PHPs) may have on creeping bentgrass grown under high shade stress.

Materials and Methods

- Location:** 'L-93' creeping bentgrass, Glade Road Research Facility, Blacksburg, Virginia.
- Years:** Summer 2015 and 2016.
- Experimental Design:** Randomized complete block design, two trials, four replications, 2.2 m² plot size.
- Treatments:** All treatments applied on a 21 day interval.

Treatment	Active Ingredient	Rate
Lexicon	fluxapyroxad + pyraclostrobin	0.18 + 0.36 kg ai ha ⁻¹
Lexicon	fluxapyroxad + pyraclostrobin	0.25 + 0.50 kg ai ha ⁻¹
Chipco Signature	aluminum tris	9.74 kg ai ha ⁻¹
Daconil Action	chlorothalonil + acibenzolar-s-methyl	8.12 + 0.016 kg ai ha ⁻¹
Heritage Action	azoxystrobin + acibenzolar-s-methyl	0.61 + 0.014 kg ai ha ⁻¹
Foursome	C ₃₂ H ₁₈ N ₆ (proprietary pigment)	3.60 L ha ⁻¹

- Plot Maintenance:** Chipco 26GT (3.05 kg iprodione ha⁻¹) and Secure (1.75 kg fluazinam ha⁻¹) were applied on a two week rotation throughout the duration of the trial to prevent dollar spot and brown patch from impacting treatment responses.
- Data Analysis:** Spectral reflectance and visual estimations of turf quality, density, and color were assessed bi-weekly in 2015 and weekly in 2016 throughout the duration of the study. Data were transformed to AUPC and subjected to ANOVA ($P=0.05$) and means separated using Fisher's protected LSD, when appropriate

Figure 1. Shade structure composed of Gemplers 60% black woven shade cloth (Ariens Specialty Brands LLC). Photosynthetically active radiation (PAR) average under shade structure equal to 357 $\mu\text{mol m}^{-2} \text{s}^{-1}$.



Figure 2. Ratio vegetation index (RVI=760nm/ 670nm) geo-referenced reflectance map using cart-mounted ACS470 (Holland Scientific). Highlighted plots represent: Untreated control (red), Lexicon 1.3 L ha⁻¹ (black), Foursome 1.1 L ha⁻¹ (blue).

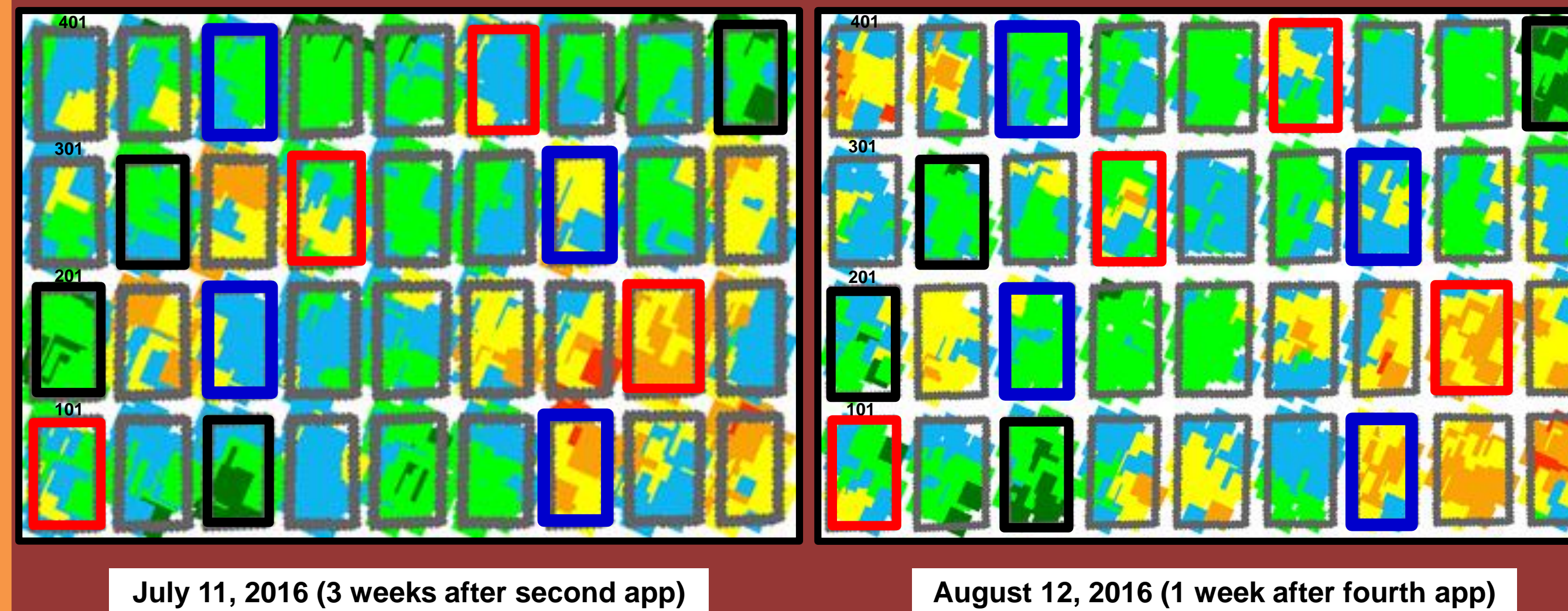


Figure 3. Standardized area under the progress curve (AUQPC) of turf quality objectively quantified using the ratio vegetation index (RVI) across 2015 and 2016 trials. Mean separation analyzed by year where 'A=A, 2016' and 'a=a, 2015'.

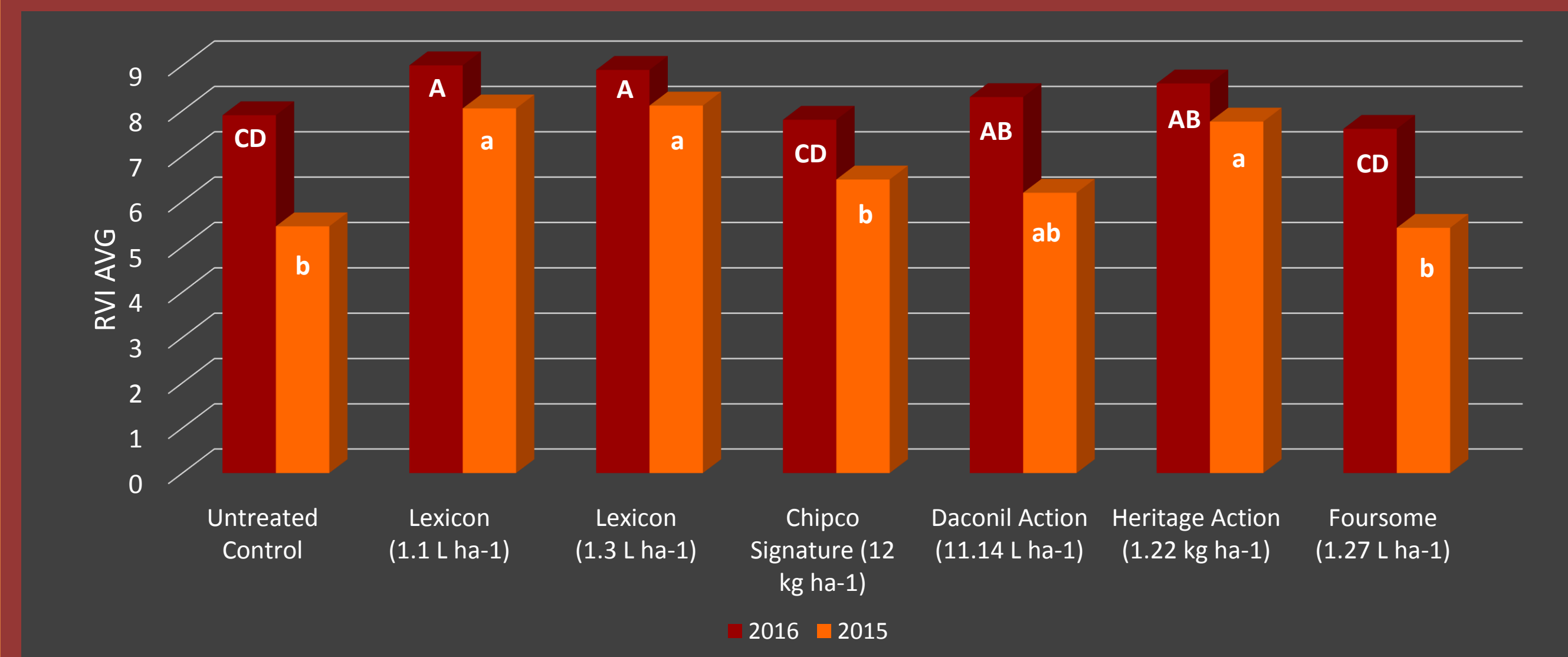


Figure 4. Visual turf quality (1-9 scale, 9 = highest quality and 6 = minimally acceptable) assessed throughout Summer 2016.

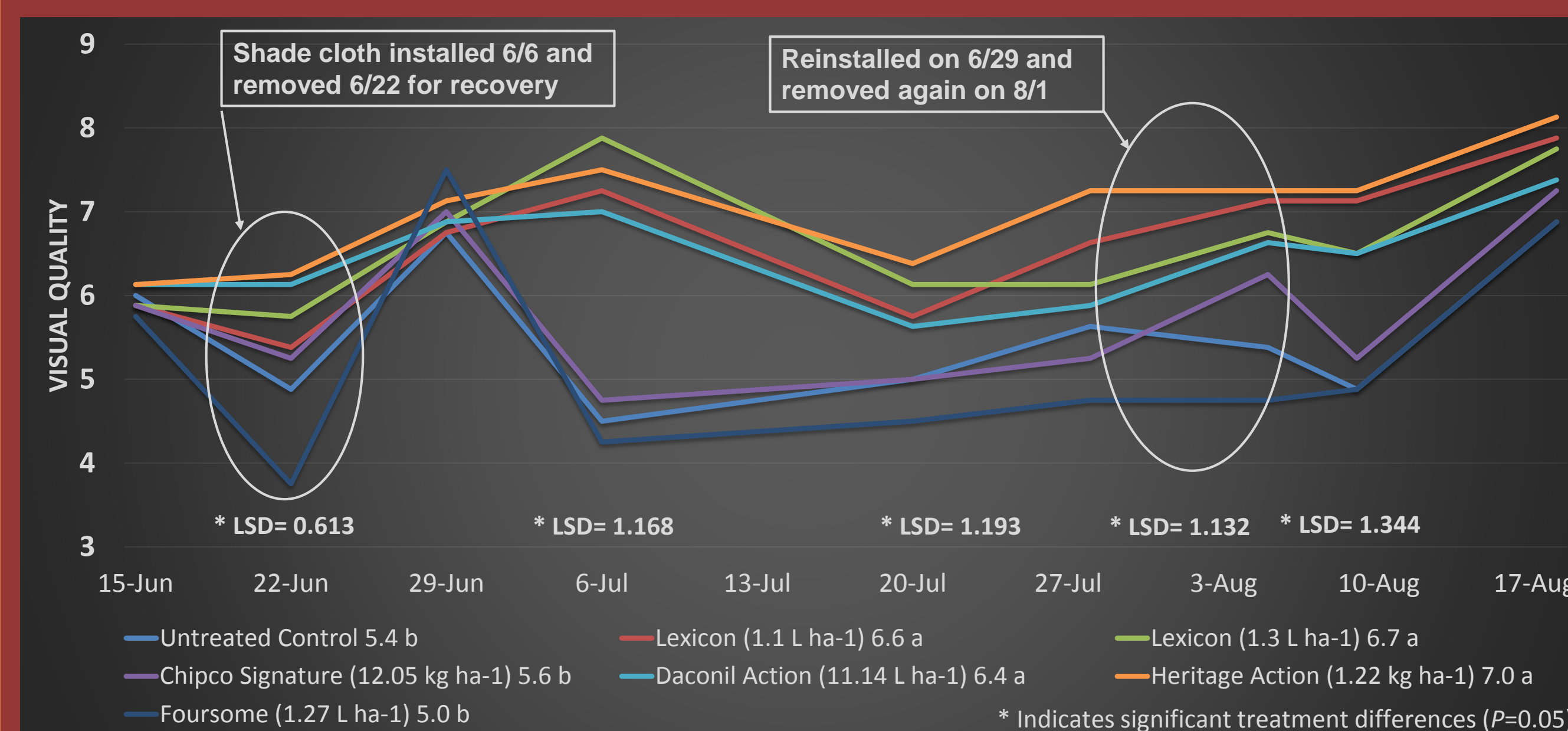


Figure 5. Turf quality as affected by treatment under shade stress on August 5, 2016. This image taken three weeks after the third application.

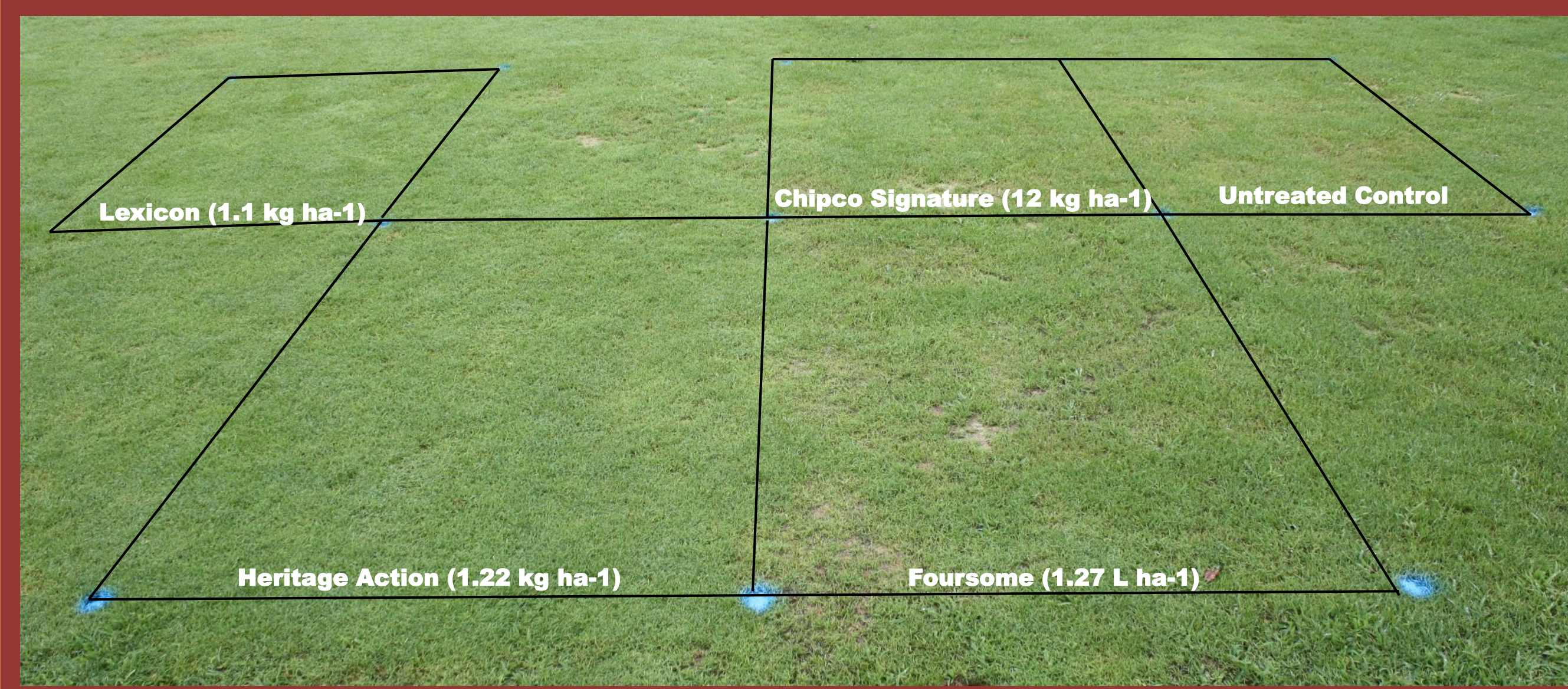
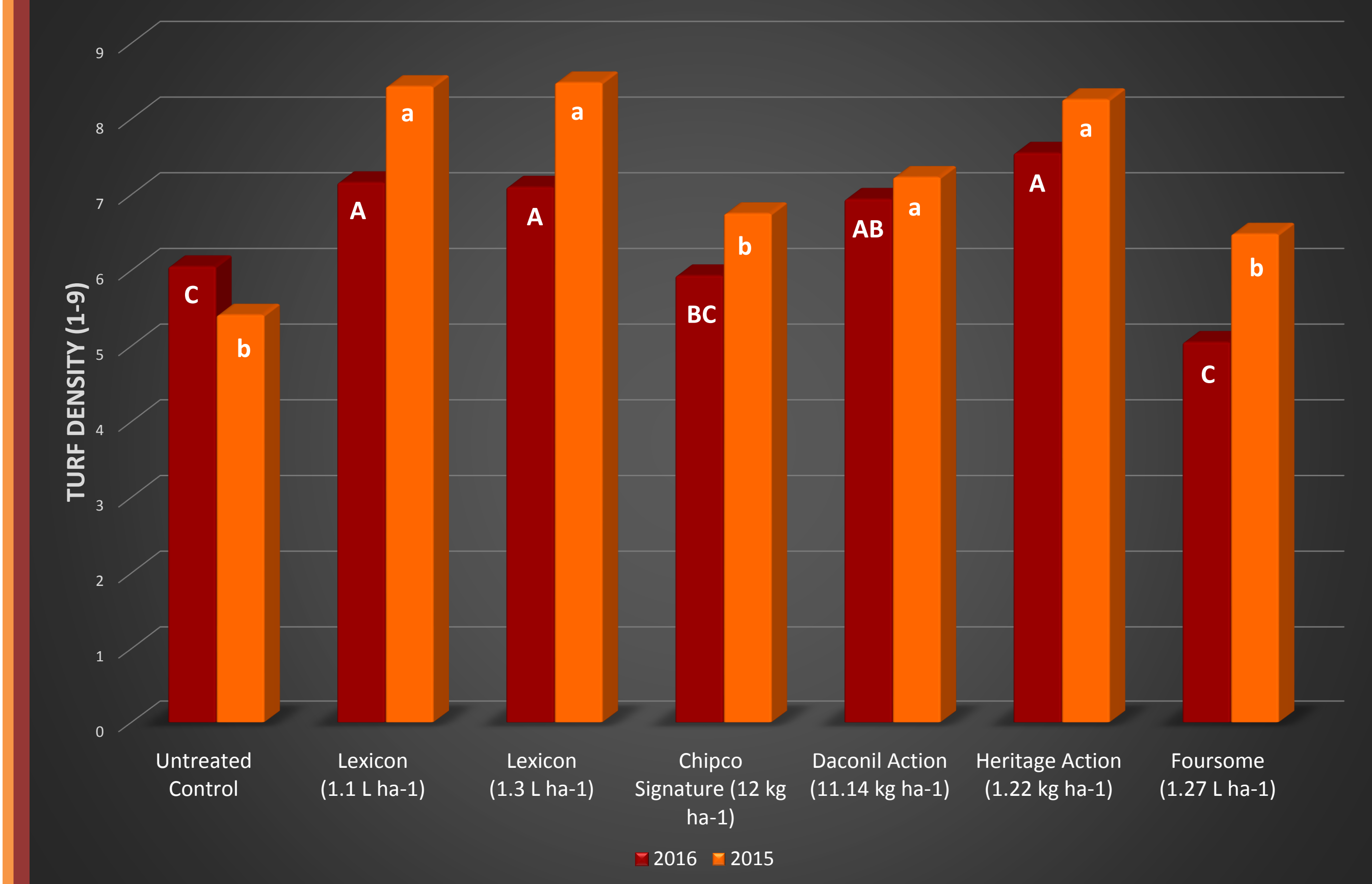


Figure 6. Standardized AUPC of visual turf density in plots treated with different PHPs, using 1-9 scale (9 = highest density) during the Summer 2015 and 2016. Mean separation analyzed by year where 'A=A, 2016' and 'a=a, 2015'.



Summary of Results

- There were treatment differences in RVI, visual quality, and density (Figure 3, 4, and 6).
- Creeping bentgrass quality and density declined under high shade stress, and was slow to recover as the season progressed.
- Lexicon, Daconil Action and Heritage Action improved turf quality and increased turf density compared to the untreated control in both years.
- Foursome reduced visual turf quality, RVI and turf density on some collection dates but the cumulative effect was comparable to the untreated in both years.
- Chipco Signature had no impact on creeping bentgrass quality or density after exposure to shade stress in either year.

Significance to the Turf Industry

Plant health promoting products tested in this study had varying impacts on creeping bentgrass grown under shade stress. Lexicon, Daconil Action, and Heritage Action improved turf quality beyond traditional disease suppression. These products are fungicides labeled to control turf diseases but this research proves an added benefit of improved shade tolerance. Foursome and other pigmented products (data not shown) decreased turf density under shaded conditions and should be avoided when light quality is low.

Literature Cited

- Sorochan, John. (2002) *Sugar in Shade: The Effects of Exogenous Fructose Applications to Turfgrass Under Reduced Light Conditions*. Diss. Michigan State University.
- Madden, Lauren. Hughes, Garreth. Bosch, Frank. (2006) *The Study of Plant Disease Epidemics*. American Phytopathological Society. St. Paul, MN. 64
- Hsiang, Tom. Goodwin, P.H. Cortes-Barco, A.M. (2011) *Plant Defense Activators and Control of Turfgrass Diseases*. Outlooks on Pest Management. Research Information Corporation. University of Guelph.