

Evaluation of Cytokinin Plant Extract Biostimulants, Iron and Nitrogen Products For Their Effect On Creeping Bentgrass Summer Quality

Peter Dernoeden
University of Maryland

Derek Settle
Chicago District Golf Association

Objectives:

1. To determine if products containing biostimulants, iron and/or nitrogen would affect dollar spot (*Sclerotinia homoeocarpa*) severity and summer quality of creeping bentgrass (*Agrostis stolonifera*) putting green turf in Illinois and Maryland.
2. To evaluate the impact of products containing biostimulants, iron and/or nitrogen on summer quality of creeping bentgrass putting green turf in Illinois and Maryland in the absence of disease.

Start Date: 2007

Project Duration: two years

Total Funding: \$40,000

Golf course superintendents often limit nitrogen (N) fertility on greens for the purpose of improving green speed. To maintain acceptable turf color and plant health under conditions of limited N input, superintendents often apply liquid biostimulants in the summer. Numerous companies market products containing cytokinins (usually from seaweed) and other plant extracts in liquid forms for use on golf greens.

Cytokinins are considered biostimulants, which have been shown to improve shoot and root health of creeping bentgrass in controlled environment studies. Biostimulant is a broad term and refers to products that may contain one or more active ingredients including: cytokinins, nutrients, humates, organic acids, hormones, vitamins, microbial inoculants, and other plant extracts.

Often biostimulant products contain either iron (Fe) or N or both. Manufacturer labels state that these prod-

ucts improve turf color, root growth, plant development, and environmental stress tolerance. While N and Fe are known to improve turf color and quality, it remains unclear if products containing cytokinins and/or other biostimulants provide any additional benefits in the field.

Lessons learned in 2007 resulted in a change in the treatment structure in 2008. In 2007, IronRoots, Knife, Lesco's 12-0-0 Chelated Iron Plus Micronutrients (hereafter Lesco 12-0-0), PanaSea Plus, Ultraplex, urea and Daconil Ultrex were evaluated for their ability to suppress dollar spot. Except for Daconil Ultrex, none of the other products claim disease suppression on their labels.



Iron darkened the turfgrass at both sites immediately after application and appeared as a checkerboard pattern across the study area where applied, but the effect was transient unlike urea.

As expected, plots treated with Daconil Ultrex exhibited the best summer quality in both IL and MD since it effectively controlled the disease. Urea was the next best treatment, but urea-treated plots eventually were severely damaged by dollar spot. Except as noted below, none of the other treatments reduced dollar spot and plots treated with those products were damaged severely, resulting in poor turf quality in both IL and MD. In MD, however, some slight reduction in dollar spot



NDVI measurements were taken to supplement visual color ratings at both sites by use of a small handheld meter.

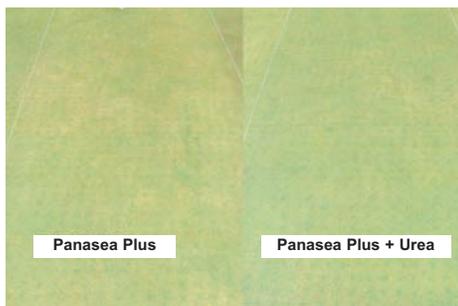
was observed in plots treated with Knife, but the effect was temporary and did not result in acceptable quality at any time.

Products containing Fe and N improved turf color, but due to the presence of disease, the plots could not be evaluated for environmental stress impact on summer quality. Hence, Daconil Ultrex was replaced by Roots Concentrate in 2008, and both sites were treated with fungicides to prevent blighting by pathogens.

Since PanaSea Plus, Roots Concentrate, and IronRoots contain no N, they were compared with and without N from urea. Therefore, urea was applied alone or tank-mixed with IronRoots, Roots Concentrate, and PanaSea Plus at 0.15 lb N/ 1000 ft². All treatments were applied on a 14-day interval, except Knife which was evaluated at two rates applied on either a 14-day or 28-day interval as specified on the label. All products were tested at label rates and application intervals as specified on product labels. Both study sites were treated with fungicides in 2008 throughout the study period to control dollar spot and brown patch (*Rhizoctonia solani*). (continued on next page)



Both studies were conducted on USGA constructed bentgrass greens that were either a 'G-2' / 'L-93' blend (IL) or 'Providence' (MD).



Panasea Plus and Roots Concentrate, which do not contain Fe or N, did not improve visual quality over untreated control at either site.

The studies were conducted on mature stands of either 'G-2' + 'L-93' blend (IL) or 'Providence' (MD) creeping bentgrass grown on a sand-based rootzone constructed to USGA recommendations. The research greens were mowed five to six times weekly to a height of 0.156 inches. The MD site received 1.75 lb N/ 1000 ft² between April 19 and May 30 2008, and an additional 0.25 lb N/1000 ft² was applied on August 6, 2008. The IL site received 0.5 lb N/1000 ft² during May 2008. Otherwise, both sites did not receive any supplemental N. All treatments were applied in 50-87 gal. water/A using a CO₂ pressurized backpack sprayer equipped with an 8004 Tee Jet nozzle. Plots were arranged in a randomized complete block with four replications.

Turfgrass color and quality were assessed visually on a 0 to 10 scale where 0 = entire plot area brown or dead; 7 = minimum acceptable color and quality and 10 = optimum greenness and uniformity. Chlorophyll levels influence turf color and normalized difference vegetation index (NDVI) readings also were obtained using a Field Scout TCM 500 Color Meter. Scalping injury was evaluated in MD on a 0 to 5 visual scale where 0 = no scalping; 2.5 = objectionable levels of scalping; and 5.0 = severe injury.

The performance of treatments in



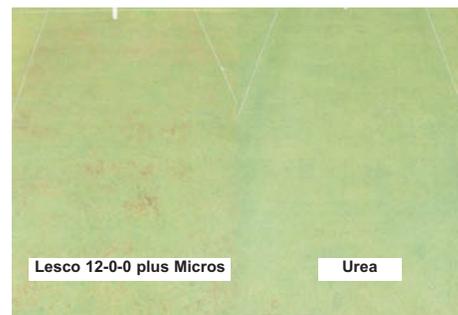
The first year, products were evaluated for ability to suppress dollar spot disease but were unable to do so at both sites.

IL and MD were very similar. When data were averaged over the season, treatments containing urea provided the best quality at both sites. There were no significant differences in color or quality in plots treated with urea alone compared to plots treated with IronRoots + urea, Roots Concentrate + urea, or PanaSea Plus + urea at either site. Hence, little or no benefit was observed by tank-mixing any of the biostimulant products with urea.

Furthermore, urea alone provided equal or better color and quality when compared to all other treatments on most rating dates in late summer at both locations. Only treatments containing urea mitigated the injurious effects of scalping in MD. When data were averaged over the season, Ultraplex (IL and MD) and Lesco 12-0-0 (IL) improved quality compared to the control. Knife, IronRoots, Roots Concentrate and PanaSea Plus improved quality in early summer in MD.

In IL, PanaSea Plus consistently improved quality over the control from midsummer on, whereas plots treated with Knife, IronRoots, and Roots Concentrate had a level of quality equal to the control. When data were averaged over the season, the aforementioned biostimulants had provided a level of quality equivalent to the control at both locations.

Visual color ratings often were improved by products containing Fe and N. PanaSea Plus and Roots Concentrate



Urea alone and treatments containing urea helped mitigate injury from scalping on a 'Providence' bentgrass green in MD, 2008

sometimes improved color, but they did not improve color to an acceptable level on most rating dates. Color ratings, as determined by NDVI, were similar between sites. In both IL and MD, highest NDVI ratings were observed in plots treated with urea alone or mixed with IronRoots, Roots Concentrate, or PanaSea Plus.

In MD, there were no other treatments that consistently improved color as measured by NDVI. In IL, plots treated with Ultraplex and Lesco 12-0-0 registered NDVI ratings equivalent to urea-treated plots when monitored 3 days, but not 7 days, after application. Since NDVI measures color as influenced largely by chlorophyll, it can be concluded that the Fe applied did not impact chlorophyll levels. Applications of Fe improved turf color by eliciting a darkening of foliar color. That is to say, the canopy does not appear greener, but darker.

Summary Points

- Early in the season in MD, IronRoots, Knife, Lesco 12-0-0, Ultraplex, and treatments containing urea improved turf color and quality compared to the control and often provided for enhancement of color and quality to a high level. In IL, differences among treatments became evident in July. Both Ultraplex and Lesco 12-0-0 consistently improved turf quality and color compared to the control, whereas Knife had provided no apparent beneficial effect in IL.
- When data were averaged over the season in both IL and MD, urea alone and treatments containing urea generally provided for best summer quality, but there were no differences among plots treated with urea alone or mixed with biostimulants.
- Urea alone and treatments containing urea helped to mitigate scalping injury.
- When data were averaged over the 2008 season, Lesco 12-0-0 (IL) and Ultraplex (IL and MD) improved quality compared to the control; whereas, IronRoots, Knife, PanaSea Plus, and Roots Concentrate did not improve quality at either location.
- Any potential visual benefits from the biostimulants were masked by the presence of Fe or N in Knife and IronRoots or by the N in urea when tank-mixed with Roots Concentrate or PanaSea Plus.
- PanaSea Plus and Roots Concentrate, which do not contain Fe or N, had only a small impact on turf color and quality, and did not improve quality above the minimum acceptable level on most rating dates after early July in MD and mid-August in IL.
- NDVI color ratings were consistently highest in plots treated with urea, IronRoots + urea, Roots Concentrate + urea, and PanaSea Plus + urea in IL (2007 and 2008) and MD (2008). Iron generally had little or no effect on color as measured by NDVI.