

RESEARCH UPDATE

Pitting PGRs and Biostimulants Against Summer Bentgrass Decline

Rutgers Researchers Seek Practical Measures for Alleviating SBD on Creeping Bentgrass Greens

Creeping bentgrass, *Agrostis stolonifera* L., is a cool-season grass widely used on putting greens because of its highly desirable turf characteristics. During spring and fall, this grass species grows vigorously. During summer months, however, creeping bentgrass turf frequently shows signs of stress. Commonly referred to as summer bentgrass decline (SBD), this syndrome is a major concern of superintendents growing creeping bentgrass greens across the country.

Many factors could contribute to SBD, but heat stress has proved the primary culprit in the decline in turf quality and physiological activities of creeping bentgrass.

The telltale sign of bentgrass decline is a thinning turf canopy, which typically begins as new root production slows, root dieback occurs, and shoot growth declines. Root dieback inhibits water and nutrient uptake, as well as other metabolic pathways including the synthesis of essential hormones such as cytokinins. A decline in cytokinin content may limit shoot growth and cause leaf senescence. Hoping to help superintendents avoid the

ill effects of summer bentgrass decline, the Tri-State Turf Research Foundation has supported Dr. Bingru Huang and her research team from Rutgers University in their work to identify best management practices for alleviating SBD on bentgrass putting greens.

In their second and final year of foundation-funded work, the researchers continued to examine the role plant growth regulators (PGRs) and biostimulants could play in sparing these greens from undue stress and decline.

PGRS AND BIOSTIMULANTS IN PLANT GROWTH HEALTH

Since the 1980s, the use of PGRs has become a standard practice in turfgrass management on golf courses, particularly with a number of chemicals showing improved efficacy and reduced phytotoxicity. Once used solely to suppress plant growth and seed-head formation, PGRs are now being widely used by turfgrass managers to enhance overall turf quality, promote a smooth and uniform playing surface, and improve stress tolerance in higher maintenance areas.

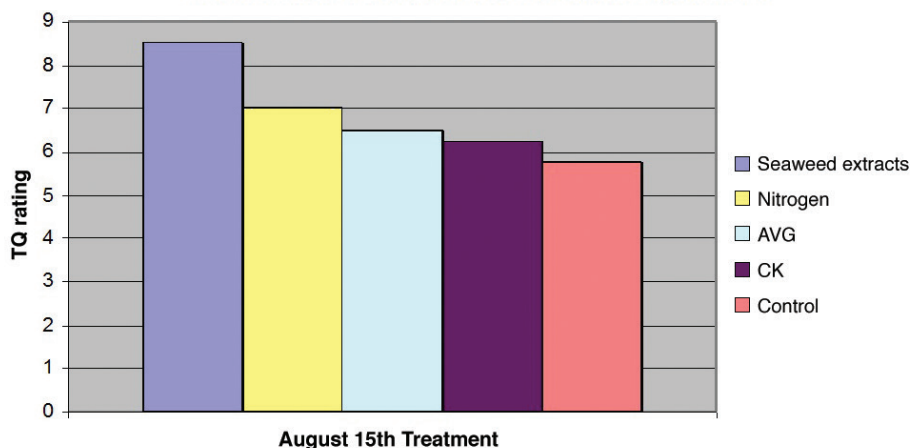
A PGR inhibiting cell elongation, trinexapac-ethyl (TE, Syngenta Crop Protection, Greensboro, NC), has been used mainly for clipping reduction and improving general turf quality. Recently, however, TE has proved effective in improving turf performance under unfavorable environmental conditions, such as shade, freezing, and drought and heat stress.

Also showing promise in aiding creeping bentgrass stress tolerance and recovery are biostimulants. Classified collectively as plant growth promoters, these natural products contain a variety of components, including carbon sources, humates, microbial suspensions or powders, and hormone-containing products such as seaweed extracts. Seaweed extracts are among the most widely used ingredients in biostimulant product formulations and contain a large number of organic compounds, such as cytokinins, auxins, amino acids, vitamins, simple and complex sugars, enzymes, and proteins, as well as inorganic nutrients, such as nitrogen, phosphorous, potassium, and iron. Of those ingredients, cytokinins—plant hormones regulating cell division, leaf senescence, and stress defense—have shown the most promise in stimulating turfgrass growth and stress tolerance.

As with any class of products, however, their effectiveness varies greatly with the individual product's precise formulation and with such factors as plant species, physiological conditions of the plants, and application rate and timing. Myriad environmental factors can also influence the effectiveness of biostimulants, leading to inconsistent and unreliable outcomes.

While the primary ingredients in biostimulant products have proved

Effects of biostimulants on turf quality in August 2013



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beneficial to plant growth in controlled laboratory and/or greenhouse experiments, there is still a lack of season-long, field experiments to confirm manufacturer claims or controlled-environment studies.

The effectiveness of both PGRs and biostimulants in alleviating SBD are not yet well documented. With the increasing use of these products on creeping bentgrass putting greens, the goal is to help turfgrass managers determine precisely how PGRs and biostimulants can be applied in promoting summer stress tolerance and recovery for creeping bentgrass.

THE STUDY AT WORK

From May through October 2012, Dr. Huang and her team evaluated treatments combining different PGRs and biostimulants based on their biological functions for alleviating summer bentgrass decline or promoting summer bentgrass performance.

Their methodology:

- » Studies were conducted on a 6-year-old Putter bentgrass green built to USGA greens specifications at Rutgers University's Horticultural Farm II.
 - » The green was managed using typical irrigation, fertilization, and pesticide application programs, and it was mowed daily at 1/8 inch.
 - » Several commercial products and experimental materials containing seaweed extracts, amino acids, hormones, hormone-inhibitors, and humic acids were put to the test. All were applied biweekly, unless otherwise noted:
1. *Ocean Organics Experimental seaweed extracts*: Spring applications: Experimental seaweed extract at 6 fl. ozs./1,000 ft² and experimental granular 12-4-4 (once/

month) at 4.2 lbs./1,000 ft². Summer applications: Experimental seaweed extract 5-0-1 at 4 fl. ozs./1,000 ft² and experimental seaweed extract 6-0-3 at 6 fl. ozs./1,000 ft².

2. *Floratine commercial biostimulants and plant growth regulators*: All products applied weekly. Spring applications: Astron at 2 fl. ozs./1,000 ft² and Knife Plus at 3 fl. ozs./1,000 ft². Summer applications: Perk Up at 3 fl. ozs./1,000 ft², Renaissance at 1.5 fl. ozs./1,000 ft², and Protesyn at 6 fl. ozs./1,000 ft².

3. *Sequential application of Primo (trinexapac-ethyl) and aminoethoxyvinylglycine (AVG, an ethylene inhibitor)*: Spring applications: Primo at 0.125 fl. ozs. (containing 0.001 lbs. ai)/1,000 ft². Summer applications: AVG at 25 µm.

4. *Sequential application of Primo and cytokinins (CK, kinetin)*: Spring applications: Primo at 0.125 fl. ozs./1,000 ft². Summer applications: Kinetin at 25 µm.

5. *Sequential application of Primo and nitrogen*: Spring applications: Primo at 0.125 fl. ozs./1,000 ft². Summer applications: Urea at 0.1 lbs. nitrogen/1,000 ft².

6. *The control treatment*: Water-only was used in the same amount as each product application.

NOTABLE RESULTS

- » Most of the treatments had beneficial effects on turf performance during summer stress, with the commercial treatments provided by Ocean Organics having the most significant impact, followed by Floratine.

» The application of the experimental seaweed extracts from Ocean Organics and Floratine products promoted significantly higher turf quality, green leaf biomass, and plant density compared to the control during most of the experimental periods.

» The combined treatments of Primo with CK, AVG, or nitrogen had some beneficial effects in promoting turf density (turf quality and plant density) and green color (chlorophyll content), but the effects were not statistically different from the control treatments on some sampling days due to the variations between replicates in the field conditions.

» Spring product applications seemed to have the most pronounced effect on turf quality and stress tolerance. Though the positive effects of all the treatments were still evident in the summer, they were not as significant as in the spring.

It is worth noting that the results reported here are preliminary. Some of the treatments were repeated in the 2013 growing season to confirm the 2012 results. Though the data for this past season's trials have not yet been fully analyzed, the outcomes appear similar:

» Ocean Organics' seaweed extract treatments clearly offered the most notable results during both the spring and summer.

» The other treatments—CK, AVG, nitrogen, and the combined treatment—in general seem to have beneficial effects compared to the control, with the combined and nitrogen treatments showing the most significant improvement.

For further information on the researchers' trials, you can contact Dr. Huang at Huang@aesop.rutgers.edu.



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Ocean Organics' products used in this study included Stress Rx™, Guarantee® Natural Kelp Extract, NuRelease®, X-P Micro Pigment™, and SeaBlend®.