Response of 'Tifdwarf' Bermudagrass to Seaweed-Derived Biostimulants

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Summary. "Tifdwarf" hybrid bermudagrass grown on a putting green in southern Florida was treated for two years with two seaweed-derived biostimulants, Kelpak and PanaSea' Plus. No significant treatment difference were observed in turfgrass quality (44 observation dates) or root weights (eight collection dates) . On only 1 of 22 collection dates for clipping weights was a significant difference obtained among treatments. Although the biostimulants did not enhance plant growth or quality, neither were they harmful to the turfgrass.

The primary concerns of golf course superintendents in southern Florida are the short lengths of hybrid bermudagrass roots and periodic declines in turfgrass quality that can be observed on putting greens year around. Most putting greens in southern Florida are maintained at a height of 4.7 mm or less. This places a stress on the plant since little leaf tissue is present to support photosynthesis. The photosynthetic rate is reduced even further by the reduction in light intensity during overcast, rainy weather typical during summer and fall. As demonstrated for common bermudagrass, low light intensity reduces biomass allocation to rhizomes, an effect that is stronger for short plants, such as those on golf greens. High soil temperatures also increase the shoot:root ratio of bermudagrass. Due to the subtropical climate, the bermudagrass does not become dormant during the winter, but its growth is reduced if extended cool temperature periods occur.

Biostimulants are products that are non-nutritive promoters of growth. Growth can be promoted by stimulating nutrient uptake, chelating nutrients, providing plant growth hormones or enhancing plant hormonal activity. Biostimulants that contain plant growth hormones can be produced synthetically or obtained from natural plant extracts. the latter are primarily obtained for the brown algae family Phaeophyceae, commonly called seaweed or kelp. Applications of seaweed preparations have increased plant growth , including root growth. This plant response is often associated with the presence of plant hormones, but the seaweed extract may also act as a nutrient chelator.

Biostimulants that contain plant growth hormones have benefited cool-season turfgrass under drought stress or salinity stress. They also enhanced growth of creeping red fescue and Kentucky bluegrass seedlings and Kentucky bluegrass sod. Although these biostimulants darken bermudagrass leaf color in temperate climates in the fall, no research has examined the effects of the plant-derived biostimulants on bermudagrass putting greens in a subtropical climate. Our study conducted in southern Florida, evaluated two commercially available seaweed-derived biostimulants, Kelpak and PanaSea' Plus, for their effect of 'Tifdwarf" bermudagrass quality, clipping weight and root weight.

Materials and Methods

A field experiment was conducted from May 1992 through April 1994 at the Fort Lauderdale Research and Education Center on an established 'Tifdwarf' bermudagrass research golf green built with a root-zone ix containing 80% sand and 20% Canadian spaghnum peat moss. The area was vertically mowed and topdressed approximately once per month, with the depth of vertical mowing depending on thatch layer thickness. Topdressing material was the same as the root-zone mix. The turfgrass height was maintained at 4.7 mm by mowing six times weekly. The area was irrigated as needed to maintain the best possible quality.

The area was fertilized every two weeks using a fertilizer blend containing IBDU™, potassium magnesium sulfate, iron sulfate and manganese sulfate. For both nitrogen (N) and potassium (K), a total of 879 $kg \cdot ha^{-1}$ of each nutrient was applied per year. Phosphorus was applied twice each year at 122 kg $P \cdot ha^{-1}$ per application. This is similar to the average fertility program used in southern Florida.

Treatments included an untreated control, Kelpak applied at 6 wk intervals and PanaSea' Plus applied at 2 wk intervals and at 4 wk intervals. Kelpak contains 0.3N:0.7P:0.6K and is derived from the brown alga Eclonia maima from which several indole compounds have been identified. PanaSea' Plus contains 0.2N:1.3P:1.7K and is derived from numerous seaweeds including Laminaria spp., Chondrus crispus, Porphyra spp., and Ascophyllum nodosum. Both products are liquids.

Biostimulants were applied according to the manufacturers' directions. The first Kelpak application was made as a drench with 1.4 $ml \cdot mm^{-2}$ Kelpak applied in 500 $ml \cdot mm^{-2}$ deionized water; all subsequent Kelpak applications were made as broadcast sprays at 0.3 $ml \cdot mm^{-2}$. PanaSea' Plus treatments were applied as broadcast sprays at 1.3 $ml \cdot mm^{-2}$. Broadcast sprays of both biostimulant products were made in 100 $ml \cdot mm^{-2}$ deionized water. Each plot was 2 m x 3 m with four replicated per treatment in a randomized complete-block design.

Turfgrass quality ratings were deter-

mined based on observation of grass color and density using a scale of 1 to 10 with 10 representing turf with a dark green color and uniform dense stand. The plots were rated approximately every two weeks, one week after each nitrogen application.

Turfgrass clippings, from plots that had not been cut for 48 hr, were collected once each month from a 1 m^2 area in the center of each plot. Clippings were dried at 60C for 72 hr and then weighed. When possible, we tried to rate and collect clippings on the same day or subsequent days.

Root weights were obtained every three months. At each sampling date, two 15 - cm diameter by 10 - cm deep samples were obtained from each end of each plot for a total of four sub samples per pot. Root samples were not collected randomly with the plot because samples collected from the center would have resulted in voids that would have interfered with clipping weight evaluations. A 1.25 cm cap was cut from the top of the sample and then discarded to remove leaf tissue and the majority of the thatch layer. Samples were then processed with a commercial root washer using 760 µm primary and secondary sieves. The accumulated material was dried at 80C for 36-48 hr and then weighed. Weights from the four sub samples of each plot were added together to obtain the total weight per plot. Resulting "holes" from sampling were filled with topdressing material.

Data were analyzed using the ANOVA procedure; the Waller-Duncan k-ratio t test was used to separate means.

Results and Discussion

Quality ratings were obtained on 44 dates. Except for eight dates, there were no quality differences among any plots of any treatment; the entire experimental bermudagrass area was uniform in color and density. Differences among treatments for those eight dates were not significant (data not shown). Clipping weights were collected on 22 dates, but significant treatment differences were obtained only on 27 January 1993 (Table 1). However, there were no quality rating differences among any plots of any treatment on that same date. Root weights were collected on eight dates, and no significant differences were obtained among any treatments on any date (data not shown).

Although other research has demonstrated that turfgrasses respond best to hormonal biostimulants when the turf is under environmental stress, no benefits were observed in our experiment during stressful periods such as extensive rainfall or cool temperatures. For example, 112.5 cm rain was received between 1 June 1993 and 31 October 1993. The turfgrass quality gradually declined during this time period, but no quality rating difference were observed among any treatments.

Researchers who have worked with both cool-season and warm-season turfgrasses have indicated that warm-season turfgrasses do not respond to hormonal biostimulants as well as cool-sea-

Clipping weight (grams)[z]

Application		1992						1993			
Treatment[y]	Interval	29 July	27 Aug.	23 Sep.	28 Oct.	27 Nov.	30 Dec.	27 Jan.	24 Feb.	7 Apr.	21 Apr
PanaSea Plus	2 weeks	7.47	5.20	5.07	1.84	4.10	4.25	2.71 a	3.18	6.42	4.65
PanaSea Plus	4 weeks	8.09	5.45	5.00	1.71	4.22	3.47	2.74 a	3.17	6.05	4.08
Kelpak	6 weeks	7.59	6.18	5.79	1.63	4.00	3.78	2.28 b	2.84	6.27	4.30
Control		7.28	5.47	5.23	1.59	4.19	3.96	2.65 a	3.28	6.62	4.58
Pr>F		0.89	0.43	0.51	0.47	0.96	0.23	0.05	0.84	0.88	0.84

[y]PanaSea Plus application rate was 1.3 ml·m^{-2}; Kelpak application was 0.3 ml·m^{-2}

[z]Values are means of four replicated plots. F values were too small to conduct mean separation teston al dates except 27 January 1993. Mean separation for that date by Waller-duncan k ratio t test (P=0.05)

Table 1. *Effect of Seaweed-derived biostimulant application on 'tifdwarf' bermudagrass clipping weights during the first year of the study (May 1992 through April 1993)*

son turfgrasses, and that the responses are highly variable. In our experiment, a consistent lack of response was observed over the two year study period. Although the seaweed-derived biostimulants did not enhance plant growth or quality, neither were they ever harmful to the turfgrass. Before a golf course superintendent applies these products to all of the putting greens on the course, it would be advantageous to only treat half of two or three greens to determine if a response will be observed. This would save both time and money if there is no response.

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