

Evaluation of Cytokinin-Plant Extract, Iron, and Nitrogen Products On Creeping Bentgrass Putting Green Quality

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Introduction

Golf course superintendents often limit nitrogen fertility on greens for the purpose of improving green speed. During summer, superintendents often apply liquid fertilizer and plant extract products to maintain acceptable turf color and plant health under conditions of limited nitrogen input.

Numerous companies market products containing cytokinins and other plant extracts in liquid forms for use on golf greens (see images below). Generally, the plant extract components of these products as well as the amounts of iron, nitrogen and other nutrients are not specifically stated. For example, seaweed or kelp, *Ascophyllum nodosum*, represent the primary source of phytohormones but are also known to contain levels of N, P, K, as well as Ca, Mg, S, Fe, Cu, Mn, Zn and B.

While iron and nitrogen are known to improve turf color and quality, it remains unclear if products containing plant extracts provide any additional benefits. The objective was to compare the relative effect of plant extract products versus nitrogen by urea.



Products were tested on a creeping bentgrass green in IL and MD.



The golf green study at Lemont, IL during a field day on 10 Sep, 2008.

Methods

Treatment and analysis every 14 days	Application rate 1000 ft ²	Manufacturer	Additional micronutrients or other biostimulant (%)
Ultraplex 5-0-3	6.0 fl oz	Grigg Brothers	0.05% B, 0.05% Cu, 2.0% Fe, 0.4% Mn, 0.4% Zn
Iron Roots 0-2-4	2.0 fl oz	Novozymes	4.0% Fe
Knife 12-0-0	1.5 fl oz	Floraline	4.0% S, 6.0% Fe, extracts of kelp and terpenoids
Knife 12-0-0 every 28 days	2.5 fl oz	Floraline	4.0% S, 6.0% Fe, extracts of kelp and terpenoids
PanaSea Plus 0-2-2	3.0 fl oz	Emerald Isle	Unspecified sea plant extracts
Nitrogen by urea 46-0-0	0.15 lb N	na	none
LESCO's 12-0-0 + Micro	4.0 fl oz	Lesco	4.0% S, 6.0% Fe, 2.0% Mn, chelated iron + micro
Roots Concentrate	2.0 fl oz	Novozymes	4.6% humic acids, 3.9% kelp extract, 3.0% vitamin C, 1.0% amino acids, 0.5% myo-inositol, 0.3% vitamin B ₆ , 0.1% vitamin E
Untreated	---	---	none

Summer quality of creeping bentgrass, *Agrostis stolonifera* L, research greens in Lemont, IL (Penn G-2 plus L-93) and College Park, MD (Providence) was monitored in response to six liquid and plant extract products in 2008 (see Table 1 above). Mowing occurred 5-6 times weekly at 0.156 inch height. Supplemental nitrogen was not applied during the study period from Jun to Oct.

Both locations used a randomized complete block design with 4 replications. Individual plot size was 4 ft by 6 ft (IL) or 5 ft by 10 ft (MD). Application equipment was a CO₂-powered boom sprayer using flat-fan nozzles at 35 psi. Products were applied at labeled rates in water per 1,000 sq. ft. equivalent to 4.0 gal. (IL) or 3.0 (MD). Products were not watered in.



Five to six readings were averaged per plot to assess color (NDVI).

Weekly, 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 for a putting green in summer; and 10 = optimum greenness, texture and uniformity. Normalized difference vegetation index (NDVI) readings were also obtained as a means of assessing color (see image above). A Field Scout TCM 500 Color Meter (Spectrum Technologies Inc., Plainfield, IL). Scalping injury was also evaluated in MD on a 0 to 5 scale where 0 = no scalping; 2.5 unacceptable; and 5.0 = severe injury and loss of >20% cover.

Field Study Data

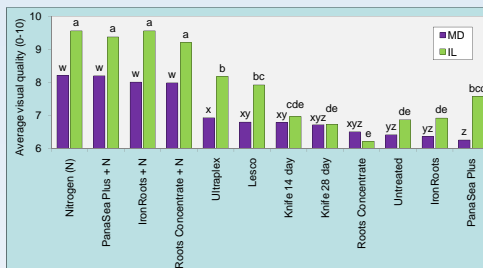


Figure 1. Visual quality ratings for all treatments when data were averaged over the 2008 season in IL and MD. Minimum acceptable quality was = 7.0. Bars with the same letter are not significantly different according to Fisher's protected LSD, P < 0.05.

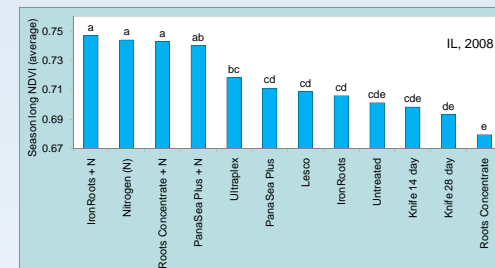


Figure 2. Normalized Difference Vegetation Index (NDVI) for all treatments when data were averaged over the 2008 season in IL. Bars with the same letter are not significantly different according to Fisher's protected LSD, P < 0.05.

Treatment and analysis every 14 days	Application rate 1000 ft ²	Scalping injury (0-5; >2.5 objectionable)				
		Jul 28	Aug 5	Aug 12	Aug 19	Aug 26
Ultraplex 5-0-3	6.0 fl oz	3.9 abc	4.5 ab	3.6 a	3.5 a	3.8 a
Iron Roots 0-2-4	2.0 fl oz	4.6 a	4.8 a	4.0 a	3.6 a	4.1 a
Iron Roots 0-2-4 + N	2.0 fl oz + 0.15 lb N	2.8 cd	3.4 b-e	2.5 bc	0.6 d	2.1 b
Roots Concentrate	2.0 fl oz	3.3 bc	2.8 def	2.0 cde	1.5 bc	3.8 a
Roots Concentrate + N	2.0 fl oz + 0.15 lb N	1.4 e	2.8 def	2.1 cde	0.4 d	1.6 bc
Knife 12-0-0	1.5 fl oz	4.3 ab	4.3 a	3.9 a	3.4 a	3.6 a
Knife 12-0-0 every 28 days	2.5 fl oz	4.3 ab	4.0 abc	3.4 ab	3.4 a	3.9 a
PanaSea Plus 0-2-2	3.0 fl oz	3.0 bc	3.8 a-d	2.3 cd	1.9 b	3.9 a
PanaSea Plus 0-2-2 + N	3.0 fl oz + 0.15 lb N	1.5 de	2.4 ef	1.3 ef	0.8 cd	1.6 bc
Nitrogen by urea 46-0-0	0.15 lb N	1.3 e	1.8 f	1.0 f	0.8 cd	1.1 c
LESCO's 12-0-0 + Micro	4.0 fl oz	4.0 abc	4.7 a	3.6 a	3.8 a	3.9 a
Untreated	---	3.1 bc	3.3 cde	1.5 def	1.5 bc	3.4 a



Table 2 and Image. Scalping injury in 'Providence' creeping bentgrass as influenced by cytokinin-plant extract products (left), iron and urea (right), MD.

Results and Conclusions

Nitrogen

- Over the season in both IL and MD, urea alone and treatments mixed with urea provided best quality and color/NDVI (Fig. 1 & 2).
- Treatments containing N by urea provided acceptable quality on every rating date in IL, but not MD where scalp injury occurred. However, urea minimized scalping and improved quality (Table 2).
- Lesco 12-0-0 and Ultraplex provided acceptable quality on every rating date in IL, but not MD where scalp injury occurred (Table 2).
- Tank-mixing nitrogen can mask potential visual benefits of cytokinin-plant extracts (Fig. 1 & 2). Plant extract formulations containing iron and/or nitrogen may dictate plant health response.

Iron

- Iron visibly darkens foliage <1 hour after application. Foliage is tinted a black, gray, or purple color which may be objectionable.
- Iron had little or no effect on average season color/NDVI. However, on certain dates, Ultraplex and Lesco 12-0-0 (both contain Fe and N) had higher NDVI readings versus untreated.
- Chelated iron darkens the cuticle/mesophyll without enhancing green color. The mechanism that darkens leaves is unknown.

Cost

- Nitrogen by urea alone was most economical product with best summer quality and color. With an application cost of \$7.50 per acre, urea was 3X less expensive than the nearest priced product.

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Green Section

