The Effects of Humate and Organic Fertilizer on Establishment and Nutrition of Creeping Bentgrass Putting Greens

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Humate, the salt of humic acid reactions, is one humic substance now being marketed as a soil conditioner. Humic substances have been shown to be an energy source for soil microbes, increase cation exchange capacity, improve nutrient retention, and enhance water-holding capacity of the soil. Three humate products were incorporated in into a USGA soil mix (85% sand, 15% organic matter) at 15 kg 100 m^2 (0.15 kg or 150 g per 1 meter square) to a depth of 10 cm, in combination with Suståne, an *aerobically composted* turkey litter based natural fertilizer mixed at 10 g m^2 only, before seeding with Creeping bentgrass (Agrostis palustris Huds.) at 0.49 kg 100 m^2 on October 4, 1994.

Following germination, monthly treatments of liquid humate were applied at 48 ml per 100 m^2 and quarterly treatments of granular humate at 2.4 kg per 100 m^2 .

In addition to measuring germination rate, percent coverage, and turf quality, bi-monthly analysis of harvested leaf tissue using NIRS technology was completed to study the effects of humates, in combination with organic fertilizer, on nutrient availability. Differences in germination rate and percent coverage were observed between plots receiving humate plus Suståne natural fertilizer and the control. No significant differences in nutrient status of creeping bentgrass leaf tissue was found. The use of humate appeared to improve root growth over the control.

PRODUCTS TESTED	CHEMICAL ANALYSIS
Granular Humates	
Vigoro modified humate	7-0-0-8 Fe + Mn, Mg, Ca, Zn
Earthgreen Menefee Humate	0.9-0-0-0.5 Fe + Mn, Mg, Ca, Zn
Humate International AG 16-35	0.6-0-0-0.1 Fe
Liquid Humates	
Vigoro fine grade suspension	
Earthgreen Grow Plex suspension	10-10-10-4 Fe - 4 Mn - 4Ca
Humate International LS	0.6-0-0-0.1 Fe
Suståne Natural Fertilizer	5-2-4+2 Fe

Introduction

Humate, the salt of humic acid reactions is one humic substance now being marketed as a soil conditioner. Humate is partially decomposed humus, or soil organic matter. It is one of the least soluble components of humus and is relatively slow to decompose. Some studies have shown improved germination, seedling growth after germination, increased shoot and root growth, enhanced nutrient uptake, and increased microbial population and activity. The greatest effects on plants appeared when humic substances were added to sterile nutrient solutions or soils high in sand content and low in organic matter. USGA type golf course putting greens are typically 80%-90% sand and contain less than 5% organic matter in the top 12 inches. Pressure to quickly establish a dense and uniform stand of turfgrass may lead to excessive fertility, much of which may be lost to leaching from the sandy profile. Karnok (1990) examined the effects of a humate product on creeping bentgrass grown on a USGA standard green. No negative plant growth effects were found from use of humates. There was increased root growth during one month of the study.

This experiment examined the effects of humate applications on germination rate, turf quality, nutrient uptake, and root growth effects on creeping bentgrass grown on a USGA type putting green compared to with and without treatment of a natural fertilizer.

Materials and Methods

Three granular humate products in combination with a natural fertilizer (Suståne 5-2-4+Fe) were incorporated into an 85:15 (85% sand, 15% Canadian sphagnum peat moss) USGA type bentgrass green at 150 g. per m^2 and Suståne at 10 g per m^2, to a depth of 10 cm, before seeding with Creeping bentgrass (Cato and Crenshaw at 1:1 blend) at 0.48 kg per 100 m^2 on October 4, 1994.

Pre-plant fertilization: All plots received fertilization at 4.4 g N – 4 g P – 7.6 g K per m^2 [0.9 lb. N – 0.8 lb. P – 1.6 lb. K per 1,000 $ft.^2$] incorporated to depth of 10 cm [about 4 inches] five days before seeding.

Maintenance fertilization: Over the following 10 months plots were fertilized with 29 g N – 3.7 g P – 14.8 g K per m^2 [6 lb. N – 0.75 lb. P – 3 lb. K per 1,000 $ft.^2$].

Mowing and Irrigation: From March – September 1995 turf was mowed three times per week at 4.8 mm [about 3/16 inch]. Seeding was followed by 30 days of irrigation, followed by irrigation sufficient to prevent wilt until April, and thereafter at 1.3 cm every 2 days to supplement rainfall.

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Three different granular humate products were applied in a split-plot design with three replications. Each plot was split again to test combinations of products with and without a natural organic fertilizer (Suståne 5-2-4). This design created 16 treatments for each of 3 different humates or 48 different treatments (144 plots).

Major Plots (Pre-plant incorporated)	Application Rates
Granular Humates (3 products)	150 g m^2
Suståne Natural Fertilizer (pre-plant only)	10 g m^2
Granular Humates (3) + Suståne (pre-plant only)	150 g m^2 + 10 g m^2

Minor Plots (Maintenance)	
Granular Humates every 3 months	2.5 g m^2
Liquid Humates every 1 month	0.48 ml m^2
Granular Humates + Liquid Humates monthly	2.5 g m^2 + 0.24 ml m^2

Measurements of Treatment Effect	Evaluation Intervals
Percent coverage on a scale of 0-100%	every 14 days for first 3 months
Turf Quality on a scale of 1-9	every 14 days for first 11months
Root length from 10-cm dia. plug	at 2 and 6 months after seeding
Root density from 10-cm dia. plug, 15 cm deep	at 6 and 11 months after seeding
Leaf tissue nutrient levels (NIRS)	every 14 days beginning 6 months after seeding

Results and Discussion:

Percent coverage - Plots in which either natural organic fertilizer (Suståne) and humate, or natural organic fertilizer alone were incorporated before seeding had the highest amount of coverage after three weeks, 15%. Humates alone showed only 8% coverage. The control plot showed only 5.5%.

Turf Quality - Turfgrass quality responses after 10 weeks of growth were similar to percent coverage measurements. Plots treated with the combination of the humates and the (Suståne) organic fertilizer had the highest turf quality response, although it was not different from the natural organic treatment. There was no difference in turf quality responses to granular humate compared to liquid humate applications.

Similar responses were also found when turf quality was averaged over all dates in the experiment. Turf quality responses were significantly higher in the natural organic pre-plant treatment, whether with or without humates. Turf quality in plots treated with humate alone was not significantly better than the control.

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Root Density

Bentgrass treated with humate treatments did produce a significantly greater root density than did the untreated. Again, the Sustâne natural organic fertilizer plus humate produced the highest density of roots. Root plug scores were: 2.0 g per plug Sustâne + Humates, 1.8 g Sustâne alone, 1.55 g Humates, 1.4 g untreated control.

Leaf Tissue Analysis

Chemical composition of leaf tissue was largely unaffected by treatment. However, granular humate treatments showed higher level of Fe than liquid humates alone or the untreated control. There were no differences in leaf tissue level of N, P or K.

Summary and Discussion

- Improvements in germination and percent cover were largely due to the (Sustâne) natural organic fertilizer treatment, although the organic fertilizer contributed only an additional 0.10 lb. N per 1,000 ft.^{2}, applied just one time, pre-plant at the beginning of the study.

- For the entire study, no differences existed in response from any of the individual humate products.

- Improvements in turf quality were due largely to the treatments with organic fertilizer.

- In contrast to the few positive results (derived from the humate treatments) in this study, no negative effects (from using humates) appeared.