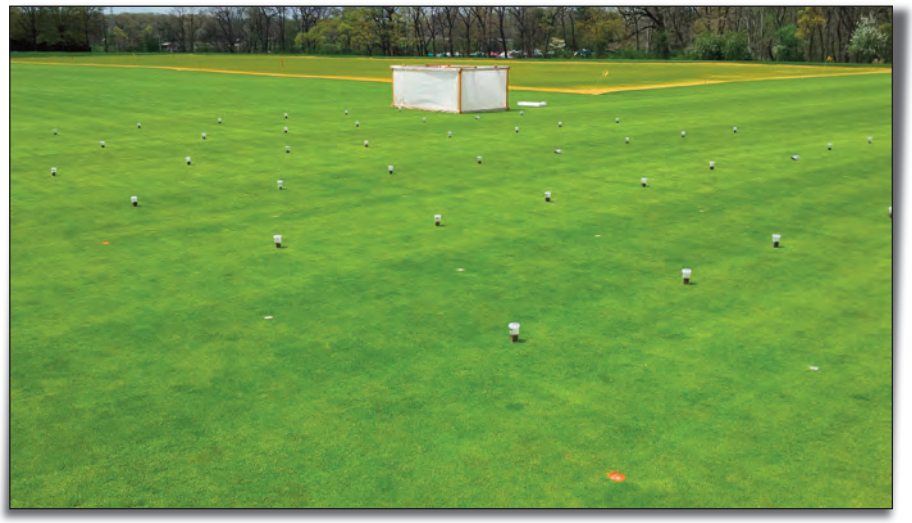
OBJECTIVE:
To determine the season long performance of a putting green subjected to stress when fertilized with Country Club MD and experimental fertilizers.

FACILITY:
Rutgers University

PRIMARY RESEARCHER:
Dr. James Murphy



When Country Club MD was first released, golf course superintendents identified the stress-buffering biostimulant components of humic acid and seaplant kelp meal as innovative and effective agronomic tools to help manage stress in their turf. Some superintendents were already using these substances in separate applications as a part of their regular maintenance program. Country Club MD, however, became the first fertilizer product to incorporate both of them as a part of the fertilizer granule, making the application and use significantly easier. The lone question remaining was whether or not the amount of each biostimulant contained in Country Club MD products was optimal. The real question that needed to be answered was, "What are the optimal amounts of humic acid and seaplant kelp meal to apply to putting greens that will achieve the best overall performance?"

There are numerous humic acid and seaplant products currently available on the market with a wide array of application levels. Obviously if too little of either biostimulant is applied there would be no benefits to the turf, and if too much is applied then it would be wasteful and add unneeded costs to the product.

Currently, Country Club MD products contain 1.5% humic acid and 1% seaplant kelp meal. These specifications were developed after extensive research by our Ph.D. staff to review relevant university data on both components and the beneficial response in turfgrass. In order to validate the levels of both biostimulants, we embarked on a season long performance research study with Rutgers University in 2014. The objective was simple: determine the performance of putting green turfgrass subjected to traffic stress when fertilized with Country Club MD and other experimental fertilizers with varying levels of each biostimulant.

Dr. Clark Throssell designed the research protocols for the study that included varying elevated rates of both humic acid and seaplant kelp meal at 2X and 4X of the current levels found in Country Club MD products, along with one fertilizer containing no humic acid or seaplant kelp meal as a control plot. The underlying logic sought to solicit answers to several simple questions, "Is more better? If so, which one; humic acid, seaplant kelp meal or both? And if both, what combination of humic acid to seaplant kelp meal is most effective? "

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LebanonTurf

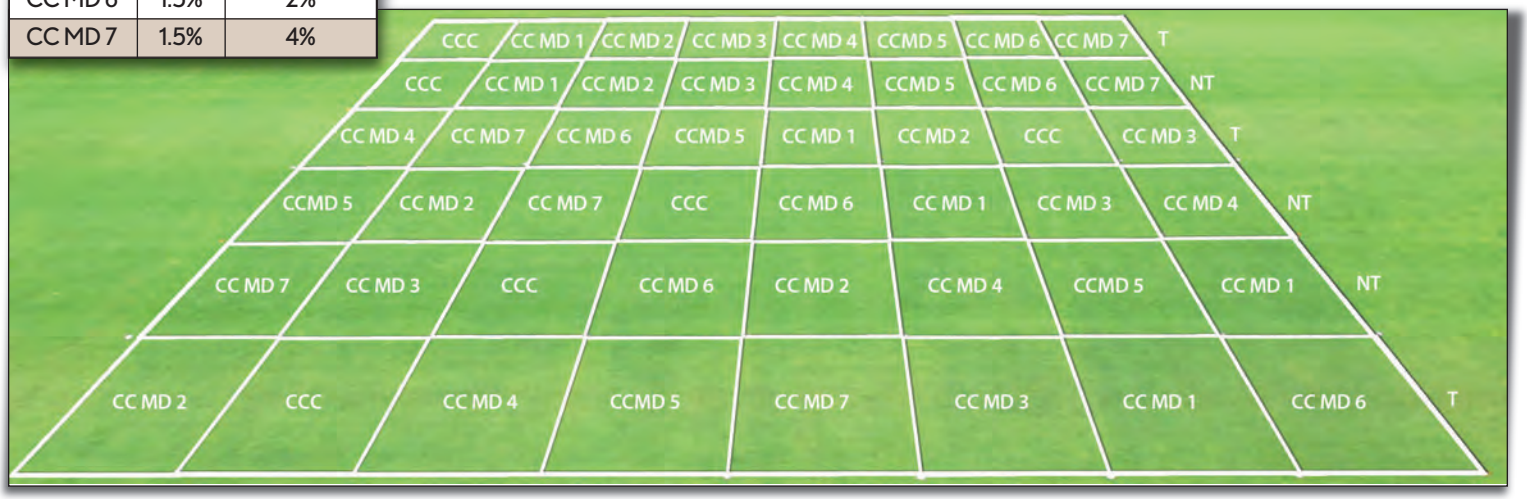
RESEARCH DESIGN

TThe study was conducted at Rutgers University Research Farm from April 18 until October 17, 2014. All fertilizers applied had an 18-3-18 analysis with varying levels of humic acid and seaplant kelp meal formulated in each treatment. All fertilizer treatments were applied at 0.25 lbs. nitrogen per 1,000 sq. ft. every two weeks to an annual bluegrass (Poa annua) putting green. A total of 3.0 lbs. nitrogen per 1,000 sq. ft. was applied in 2014. The green was mowed at 0.110 inches six days per week and received regular topdressing and applications of plant growth regulators and pesticides necessary to maintain a high quality green.

"CC MD 1" was the designation for the fertilizer treatment with the current levels of biostimulants found in the Country Club MD product line, 1.5% humic acid and 1% seaplant kelp meal. The main plots are divided by traffic plots, "T", and non-traffic plots, "NT". Traffic was applied to the plots with a 3,700 pound, smooth drum, vibratory asphalt roller with four passes, five days a week from June to October.

Fertilizer	Humic Acid	Seaplant Kelp Meal
CCC	0%	0%
CC MD 1	1.5%	1%
CC MD 2	3%	2%
CC MD 3	6%	4%
CC MD 4	3%	1%
CC MD 5	6%	1%
CC MD 6	1.5%	2%
CC MD 7	1.5%	4%

Overhead view of the putting green turf plots utilized for the research study. The main plots are divided by traffic simulated plots, "T", and non-traffic simulated plots, "NT". Additionally, the subplots are designated with each different fertilizer product containing varying levels of humic acid and seaplant kelp meal, "CCC, CC MD 1 to 7". This research trial had three replications.



Traffic was applied to the plots with a 1.7 metric ton, smooth-drum, vibratory asphalt roller with four passes, five days a week from June through October.

Light box images and NDVI data measurements were collected on a weekly basis throughout the duration of the research study.

Visual evaluations were performed on all plots and sub-plots to determine ratings for turfgrass quality, color, uniformity, yellowing and anthracnose severity.

The following data were collected weekly throughout the growing season to assess the impact of the fertilizer treatments:

Visual Turfgrass Quality; (1=dead turf; 5=acceptable turf; 9=ideal turf)

Visual Turfgrass Color; (1=brown; 9=dark green)

Dark Green Color Index (DGCI); Determined by digital imaging analysis. The greater the DGCI value, the darker green the color.

Normalized Difference Vegetation Index (NVDI); Spectral reflectance of the turf canopy. NVDI is a measure of plant stress; the greater the NDVI value, the less stress the plant is experiencing.

Visual Turfgrass Uniformity; (1=the most irregular or varied turfgrass; 9=perfectly uniform turfgrass)

Visual Turfgrass Yellowing; (1=equals completely yellow or dead; 7=acceptable yellowing; 9=no yellowing)

RESEARCH RESULTS

CC MD 1, 18-3-18 with 1.5% humic acid and 1.0% seaplant kelp meal, provided the best season-long turf performance of any treatment. For comparison purposes, the performance of CC MD 1 will be compared to a Country Club composite fertilizer (CCC) with an 18-3-18 analysis that contained the exact same nutrients as CC MD 1 but had no humic acid or seaplant kelp meal.

Traffic

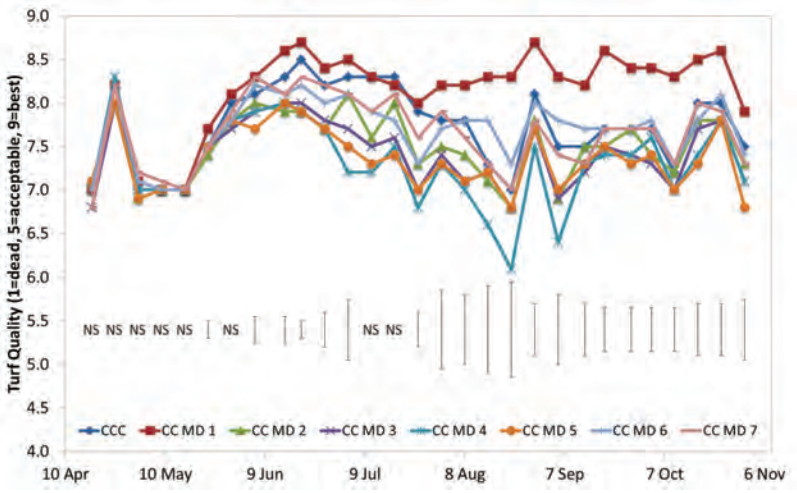
- Plots that received traffic, in general, had lower visual turfgrass quality, lower visual turfgrass color, DGCI, NDVI, visual turfgrass uniformity and visual turfgrass yellowing than plots that did not receive traffic. This indicates that the traffic applied provided additional stress to the turf and helps to determine if the addition of humic acid and seaplant kelp meal to the fertilizer treatments reduced stress.

Visual Turfgrass Quality

- Season-long average visual turfgrass quality was highest in plots fertilized with CC MD 1, averaging 8.1, which was statistically higher than the 7.7 rating provided by CCC (Figure 1).

Visual Turfgrass Color

- Turf fertilized with CC MD 1 had the highest season-long average color ratings of 8.2 which was statistically higher than the season-long color rating of 7.7 of turf fertilized with CCC.



(Figure 1)

RESEARCH RESULTS (*continued*)

Dark Green Color Index (DGCI)

- CC MD 1 fertilized turf was in the highest statistical group for DGCI on 100% of measurement dates and CCC fertilized turf was in the top statistical group on 92% of measurement dates.

Normalized Difference Vegetation Index (NVDI)

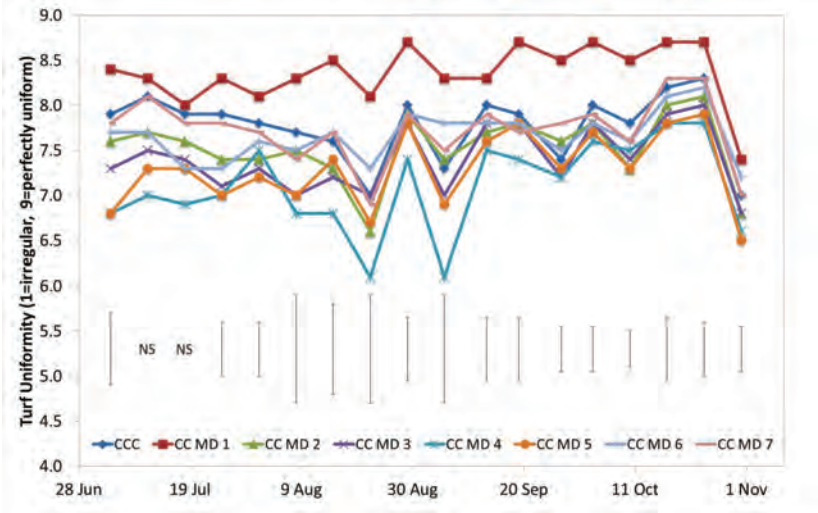
- CC MD 1 was in the highest statistical group for NDVI on 100% of measurement dates while CCC was in the highest statictical group for 55% of measurement dates.

Visual Turfgrass Uniformity

- Average season-long visual uniformity ratings for turf fertilized with CC MD 1 was 8.3 which was statistically higher than the season-long visual uniformity rating of 7.8 for turf fertilized with CCC (Figure 2).

Visual Turfgrass Yellowing

- Visual turfgrass yellowing was least severe in turf fertilized with CC MD 1. The season-long average yellowing of turf fertilized with CC MD 1 was 8.3 (with 9.0 = to no yellowing) which was statistically higher than the 7.7 rating for season-long yellowing of turf fertilized with CCC.



(Figure 2)

CONCLUSIONS

CC MD 1 improved season-long turfgrass quality, color, uniformity and non-yellowing compared to all other fertilizer treatments. Additionally, CC MD 1 was always in the highest performing statistical category for all data collected across all dates during this trial.

CONCLUSIONS REGARDING BIOSTIMULANT AMOUNTS

From this research study at Rutgers University, the current levels of biostimulants incorporated in Country Club MD product, 1.5% humic acid and 1% seaplant kelp meal, have been confirmed as the optimum levels of biostimulants needed to achieve the best overall results in maximizing turfgrass performance by providing stress management benefits.

This study also strongly suggests that elevating biostimulant levels above the 1.5% humic acid and 1% seaplant kelp meal does not provide any additional turfgrass performance benefit. Rather, it clearly implies that those treatments performed at a statistically significant lower levels. These results suggest that applying more biostimulants may actually be hindering overall turfgrass performance.

In conclusion, Country Club MD products contain the proper amounts and ratio of humic acid and seaplant kelp meal to help golf course superintendents deliver superior turf quality and golf course playability by providing optimum nutrients and stress-buffering biostimulants all season long.

To view the full report, visit www.countryclubmd.com.