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Fairways, however, encompass a much larger area of the golf course and elimination of even one fungicide application would result in significant financial savings. Spraying large acreages of fairways can also be time consuming, and the reduction of one or two fungicide applications in the summer months may free up valuable labor for other pressing golf course needs and reduce the fuel costs required to power the application equipment. With the large acreages fairways encompass, reducing pesticide applications to golf course fairways by one or two per year would also result in a significant reduction in pesticide exposure to the environment.

"With the large acreages fairways encompass, reducing pesticide applications to golf course fairways by one or two per year would also result in a significant reduction in pesticide exposure to the environment."

CONCLUSION

The results presented here show that fall and spring fungicide applications can have a significant effect on the development of the primary diseases affecting golf course turfgrass in the Great Lakes region of the United States. The non-conventional timing that provided the greatest disease reduction with the fewest pesticide applications was the LF/LS timing. This treatment provided effective control of snow mold from the LF application while also significantly delaying the dollar spot epidemic as a result of the LS application. While EF and ES timings did appear to reduce or delay dollar spot incidence, the degree of additional control was minor and didn't appear to warrant the extra application. However, if fungicide applications are to be made during the EF and LF time frames, it is a good idea to apply a fungicide or mixture of fungicides that is efficacious against dollar spot.

In addition, reduced rates of fungicides may be able to be used once conventional applications resume in mid-summer because of the reduced dollar spot inoculum level and warrants further investigation. Along with the inclusion of proper cultural practices associated with integrated pest management, significant reductions in pesticide usage on large acreages of golf course turfgrass in the Great Lakes region of the United States can be achieved immediately without conversion to disease-resistant turfgrasses or sacrificing turfgrass quality. These reductions have both financial and environmental benefits that can aid superintendents in times of financial distress and lessen the environmental impact of golf course management.

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Effect of Humic Acids on Golf Putting Green Performance

By Dr. Doug Soldat, Department of Soil Science, University of Wisconsin - Madison

Golf course putting greens are maintained under extremely stressful conditions including high traffic and low mowing heights. Golf course managers are constantly seeking ways to improve stress tolerance and turfgrass responses. Humic acids have been identified as having the potential to improve turfgrass health, yet little information exists regarding the performance of individual humic acid products and their responses on root zone of varying carbon contents. This study was designed to investigate the agronomic effects of organic amendments on golf putting greens varying in total and bioactive soil carbon content.

Methods and Materials:

The study was initiated on May 8, 2012 at the O.J. Noer Turfgrass Research Facility. The treatments included two liquid humic acid products , ANO12011 and KOH extracted Humic Acid (KOHA) both from AMCOL International Corporation, and Humic DG, a granular product from The Anderson's. Treatments were applied on May 8, June 6, July 3, and August 7. Liquid treatments were applied using a CO2 pressurized backpack sprayer calibrated to deliver 2 gallons of water per 1000 sq. ft. The ANO12011 was applied at 3.8 fl. oz. per 1000 sq. ft., KOHA was applied at 12 oz. per 1000 sq. ft., and Humic DG was applied at 2 lbs. per 1000 sq. ft.

The treatments were arrayed in a randomized complete block design with four replications. Individual plots measured five feet by five feet. The study was replicated on three sand based root zones constructed according to USGA specifications. The oldest root zone was constructed in 2000 and planted to 'L-93' creeping bentgrass, the middle-aged root zone was constructed in 2005 and planted to 'Memorial' creeping bentgrass. The youngest root zone was constructed in 2008 and planted to 'A4' creeping bentgrass. The age distribution of the root zones ensured a range in soil organic matter content and quality (Table 1).

Table 1. Characterization of soil carbon and organic matter in the three root zones.

Putting Green ID	Age	Bioactive C	Total Organic Matter
	yrs	mg/L	%
Youngest	4	8.8	0.4
Middle-Aged	7	32.5	1.2
Oldest	12	24.3	1.2

Figure 1. The youngest root zone profile is shown on the left, and the oldest root zone profile on the right. Positive responses to humic acid were only found on the youngest root zone, likely because of its lower organic matter content.

Putting greens were maintained typical to high quality putting greens in the Upper Midwest. Turf was mowed six days per week using a walk behind mower set to a cutting height of 0.125 inches. Light topdressing was applied approximately weekly. Nitrogen fertilizer (as urea) was applied every other week at 0.2 lbs. N/1000 sq.ft. Irrigation was applied three times each week to replace 70% of reference ET as measured from an on-site weather station

Impact of the treatments was quantified by assessing the visual quality, turfgrass color, and clipping weight. Turfgrass quality was assessed weekly on a 1 to 9 scale, where 9 represents perfect turfgrass quality and 6 represents the minimally acceptable quality. Turfgrass color was measured weekly using a hand held reflectometer from Spectrum Technologies (CM-1000). Turfgrass clipping weight was measured approximately monthly. Statistical differences were calculated using JMP software, means were separated using Fisher's LSD at alpha=0.10, where appropriate.

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Results and Discussion:

Over the duration of the season no significant differences in clipping yield, turfgrass color, or quality were observed on the middle-aged and oldest root zones (Table 2). On the youngest root zone, no significant differences in clipping yield or turfgrass color were observed, however the KOHA and ANO12011 treatments had significantly greater turfgrass quality that the Humic DG and the non-treated control.

The turfgrass quality over the season for the youngest root zone is shown in Figure 1. The KOHA and ANO12011 treatments generally were generally 0.5 to 1.0 turfgrass quality units greater than the Humic DG and Non-treated control for much of June, July, and early August. This suggests that the KOHA and ANO12011 were improving summer stress tolerance of the bentgrass. However, it is unusual that no significant differences in turfgrass color or clipping yield were observed during this time, as grass exhibiting greater stress tolerance usually show increases in these two parameters as well.

Conclusions:

1. ANO12011 and KOHA have potential to improve turfgrass quality on sand-based putting greens with low total and/or bioactive soil carbon content.
2. There were no advantages of applying humic acid products on sand putting greens with higher soil organic matter and bioactive carbon.
3. Humic DG did not improve turfgrass response compared to the non-treated control, even on the low organic matter content root zone.
4. More work is required done to confirm, and better understand the nature of the summer stress response of turfgrass to ANO12011 and KOHA.

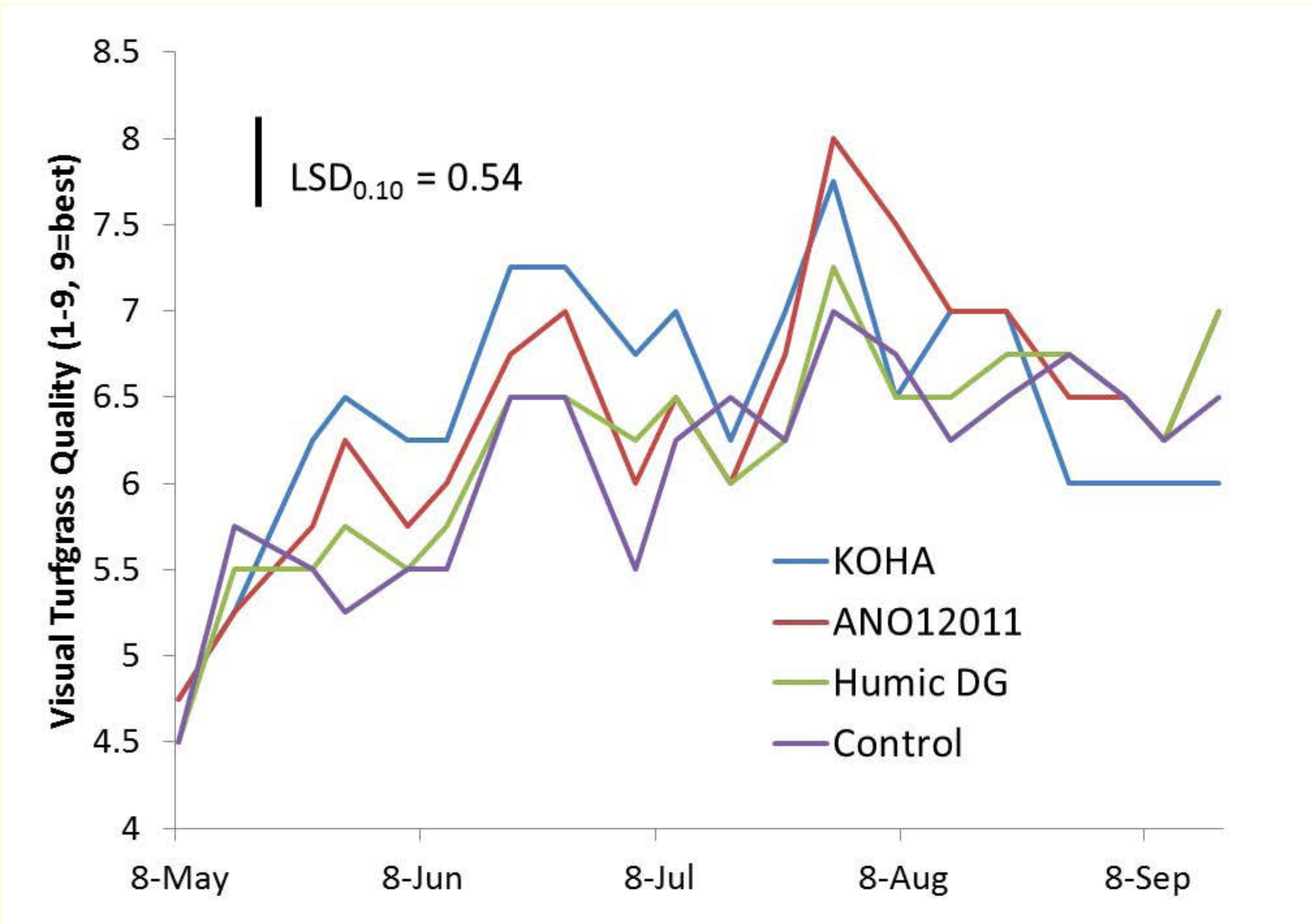

Figure 2. Visual turfgrass quality during the season on the youngest root zone (low organic matter). This was the only root zone for which a significant response was observed. Differences between treatments greater or equal to 0.54 are considered statistically significant according to Fisher's LSD at alpha=0.10.

Table 2: Average growth and visual responses for the treatments on the (a) oldest root zone, (b) middle-aged root zone, and (c) youngest root zone. Treatment means were separated using Fisher's LSD at alpha=0.10.

(a) Oldest Root Zone

Treatment	Clipping Yield	Turfgrass Color	Turfgrass Quality
	$g/m^2/day$	0-999, 999=best	1-9, 9=best
KOHA	3.07 A	259 A	5.50 A
ANO12011	2.51 A	257 A	5.54 A
Humic DG	2.52 A	264 A	5.66 A
Non-Treated Control	2.50 A	263 A	5.61 A

(b) Middle-Aged Root Zone

Treatment	Clipping Yield	Turfgrass Color	Turfgrass Quality
	$g/m^2/day$	0-999, 999=best	1-9, 9=best
KOHA	2.20 A	276 A	6.21 A
ANO12011	2.23 A	278 A	6.31 A
Humic DG	1.99 A	280 A	6.35 A
Non-Treated Control	2.14 A	277 A	6.21 A

(c) Youngest Root Zone

Treatment	Clipping Yield	Turfgrass Color	Turfgrass Quality
	$g/m^2/day$	0-999, 999=best	1-9, 9=best
KOHA	1.71 A	271 A	6.45 A
ANO12011	1.92 A	266 A	6.43 A
Humic DG	1.96 A	271 A	6.20 B
Non-Treated Control	1.99 A	264 A	6.10 B

Summer Lab Update

By Bruce Schweiger, Turfgrass Diagnostic Lab Manager, O.J. Noer Turfgrass Research and Education Facility

I received the friendly reminder from Dave Brandenburg that my next article for the Grassroots and was due and he said, "Hopefully there will be no talk of excessive rain, cold, heat, snow, hail or locusts." So there I sat with a thousand ideas of what I could write about and then that comment. OK, I hope you have enjoyed my article!

I know that will not fly, so I will share the happenings around the OJ Noer and TDL. The lab has had a steady stream of sample submissions. The two most common sentences in the lab this year have been: "Paul do you have a minute to check on my diagnosis?" Or "Paul do you have minute, what is this?" Ok three sentences, "They call this a what?" Ok so looking at these samples through a microscope is different than in the field, but I am getting a good handle on the process. I am thankful to a good, patient teacher, thanks Paul! I will apologize to Dr. Kerns and Dr. Koch for all the trouble I caused them in the past, there is so much going on here every day, I guess they were working and not just playing golf. My number one goal this year is to get Dr. Koch an afternoon to play golf somewhere! Any volunteers to find Dr. Koch a tee time, call me I will make it happen?

The spring soil temperatures were able to stay in that 50-65 degree ranges for a long period of time. This meant that the period for active infections of Necrotic Ring Spot (Ophiospherella korrea), Take-all-patch (Gaemannomyces gramminis var. avenae) and Summer Patch (Magnaporthe poae) was longer than usual. Dr. Koch and I had been discussing the possible increase in these diseases this summer. We did not have to wait long and the Take-all-Patch (Gaemannomyces ssp.) samples began arriving. To date we have seen many samples with Take-all-patch but to a lesser degree so that is may not be the only factor in the turf sample. I assume that the Take-all-patch (Gaemannomyces ssp.) is causing the plant to not function at its peak performance and we are seeing anthracnose and other secondary pathogens invading the plant. In the southern part of the state with all the rainfall and cooler early season temperatures the plants were not showing the usual signs of Take-all-patch (Gaemannomyces ssp.) due to the cooler weather pattern.

The last few weeks the true story for the severity of our Take-all-patch (Gaemannomyces ssp.) has shown itself. Just a reminder we can find Take-all-patch (Gaemannomyces ssp.) in many samples but just because it is present does not mean it is causing the symptoms or the damage.

Earlier in the year we had many cases of Ascochyta leaf blight (spp.) and Septoria Leaf Spot (spp.) affecting many general turfgrass areas. Both of these diseases are most common during periods of cool moist conditions. Ascochyta can be distinguished from other leaf spot from the almost white necrosis on the leaf tip, whereas Septoria has a more normal leaf spot appearance with a general thinning and tan leaf with black or dark brown pycnidia. The best cure for both of these diseases is sunny days with low humidity, and to mow the area once the leaf blades have dried.

As usual we have many dollar spot (sclerotinia spp.) trials at the OJ Noer Research Facility. Unfortunately the dollar spot has not been cooperating. In June when our trials flooded Dr. Koch speculated that much of the dollar spot (sclerotinia spp.) inoculum might have washed away. I think he was correct because as I begin to write this article we are struggling to get dollar spot (sclerotinia spp.) on our bentgrass plots.

We also have a Brown Patch(Rhizoctonia solani) trial and a few weeks ago Dr. Koch made some adjustments to our maintenance program and we had Brown Patch everywhere, we were so happy. Three days later the morning lows were in the 40's and all of our hard work was gone. We decided to covered our Brown Patch trial with a tent and have added some nitrogen to try to encourage the return of the Brown Patch. The weather as I write this is 90+ degrees and plenty of humidity and we have been very successful. Come by during Field Days and check our brown patch.

They say it is hard to teach old dog new tricks; well they are doing a good job of it at the Noer. The other day I came in from walking the plots and I was so happy to report some disease activity. For the last ___(fill in the blank) years my main goals has to provide turfgrass with NO DISEASE, and if I saw disease I was disappointed the program had possibly failed., Now no disease means no research. Ok I will admit that this week, with the weather we have experienced, I have seen everything on the OJ Noer Facility, dollar spot, brown patch, pythium, cutworms and isolated dry spots. Now I am sleeping so sound knowing I have been successful!

Oh how my life has changed!

Slow Start Results in Delay in Japanese Beetle Emergence

By Dr. R. Chris Williamson, Department of Entomology, UW-Madison

Rarely are any two years (seasons) are alike, after all it's weather! Compared to last year, as of about June 20, we were between 230-350 GDD (growing degree-days) or the equivalent of 2-3 weeks behind in heat units this year. Because insects are cold-blooded animals, they are dependent on temperature for biological activity, most insects are inactive at temperatures below 50ºF. Japanese beetle adults typically begin emerging around 1030 GDD, and on June 20 (when they normally start to emerge) we had only accumulated about 760 GDD units in the Madison area. It was not until around July 4 that we reached 1030 GDD units, this is often when peak adult emergence occurs.

As a result, Japanese beetle emergence is measurably behind compared to the average. This occurrence of the delayed emergence has a profound impact the timing of preventative insecticide treatments for Japanese beetle; applications should be delayed accordingly (i.e., about a two week delay). This being said, it is important to understand that nature frequently tends or finds a way to make-up or catch-up to get things back to some degree of normalcy. What does this mean for your management approach or strategy for managing insect pests such as the Japanese beetle?

The ideal IPM strategy is be to closely monitor adult emergence by either using pheromone traps or merely observing preferred hosts of Japanese beetle adults such as linden, birch, maple, etc. Once Japanese beetles adults are captured in traps or observed on plants, respective preventative grub insecticide treatments can be applied. There are several preventative insecticide treatments available, they include: 1) chlorantraniliprole (Acelepryn); 2) clothianidin (Arena); 3) imidacloprid (Merit as well as numerous other brand names); and 4) thimethoxam (Meridian). It is important to make certain to appropriately water grub insecticide treatments into the turf with an adequate amount of water (about 0.10-0.20 inches) immediately following insecticide application to move the insecticide into the soil profile where the grubs are located to ensure maximum performance.

Should you choose to make a curative or corrective grub control application over the preventative approach, understand that smaller grubs (younger) are much easier to control than larger (older). Since most curative or rescue grub insecticides are relatively short-residual products (< 15 days) and the grub are delayed as a result of the cool conditions, be sure to closely inspect the turf for the presence of young larvae to ensure maximum control. The result of the delayed emergence of adult Japanese beetles directly influences the timing of insecticide treatment applications. Consequently, be sure to routinely monitor and sample Japanese beetle adults to accurately determine the appropriate insecticide timing to ensure the greatest likelihood of success.

Japanese Beetle Adults feed and defoliate the leaves on a number of plants.
The adults feed on over 300 species but prefer apples, cherries, grapes, peaches, plums, birch, crabapples, hollyhocks, linden, maples, mountain ash, roses.