2008 Wisconsin Turfgrass Research Reports

Volume XXVI

TABLE OF CONTENTS

- Control of Dollar Spot on Creeping Bentgrass Maintained at Putting Green Height
- Early-Season Preventative Fungicide Applications for the Delay of Dollar Spot Symptom Development
- Fungicides for the Preventative Control of Anthracnose
- Control of Rhizoctonia brown patch on Colonial Bentgrass
- Control of Rhizoctonia brown patch on Creeping Bentgrass Maintained at Putting Green Height
- Fungicides for the Preventative Control of Pythium Blight
- Seasonal Program for Control of Turfgrass Diseases

Snow Mold trials

- 2007-2008 Snow Mold Control Evalution
    - OJ Noer Turfgrass Research Facility Verona, WI
    - Sentryworld Golf Course Stevens Point, WI
    - Timberstone Golf Course Iron Mountain, MI
- 2007-2008 Bayer Auxiliary Snow Mold Trials, OJ Noer, Sentryworld, Pine Grove, and Edina CC
- 2007-2008 Snow Mold Control Evalution
    - The Legends at Giants Ridge
    - The Quarry at Giantes Ridge
    - Edina Country Club

Entomology research

- Evaluation of Various White Grub Insecticides Applied as Rescue (Corrective) Treatments for Control of Japanese Beetle Grubs in Turf
- Evaluation of Optimal Preventative Timing of Insecticide Formulations for Control of Japanese Beetle Grubs in Turf

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Editor's Note

We are sincerely grateful for the tremendous industry support for the UW Turfgrass Program provided by the above sponsors. Without your help, our turfgrass research and educational program would be unable to function at anywhere near its current and targeted level. While we strive for perfection and attempt to list all our supporters, if we accidentally missed you then you have our sincere apology; please let us know so we may correct the situation in the future. If you have any comment or suggestions for next year's program, please contact Jim Kerns at 608-262-6531 or jpk@plantpath.wisc.edu References to pesticide products in this booklet are intended to convey objective, unbiased information and are not an endorsement of one product over similar products with similar results.

Yours truly,

Dr. Jim Kerns

Plant Pathology

Introduction to the Turf Program at the University of Wisconsin

Thanks in part to tremendous support by you, the turf industry, the turf program at the University of Wisconsin has expanded its commitment to turf research, extension, and instruction tremendously in the past several years. In 2008 the UW Turfgrass Program gained another faculty member, Dr. Jim Kerns in the Department of Plant Pathology. Now the UW Turfgrass Program is one of the few complete programs in the country, which is significant since many programs are losing positions. One M.S. graduate student Eric Koeritz graduated from the program and started a PhD program at the University of Minnesota under the direction of Dr. Eric Watkins. Please take a moment to read about the faculty, staff, and graduate students and their exciting and diverse research and extension programs. The university exists ultimately to serve the public good, and so though it may not be evident at first glance, all of the projects have the final goal of enhancing our understanding of turf management to help you become more successful and aid in sound decision-making at both the managerial and legislative levels.

The Faculty

Dr. Mike Casler
Mike Casler is a Research Plant Geneticist with the USDA-ARS US Dairy Forage Research Center. He is also a Professor of Agronomy at UW-Madison.

Dr. Randy Jackson
Randy Jackson is an Assistant Professor of Grassland Ecology in the Department of Agronomy. With projects throughout the state, his carbon sequestration project at the O.J. Noer Facility is generating a tremendous amount of information on the carbon sequestration of various turf, forage, and prairie systems.

Dr. Jim Kerns

Jim Kerns is an Assistant Professor of Turfgrass Pathology in the Department of Plant Pathology. He holds a 70% extension and 30% research appointment. His research is focused on the etiology, epidemiology, and management of turfgrass diseases. He joined the UW turfgrass team on June 23rd, 2008.

Dr. Wayne Kussow
Wayne Kussow is an Emeritis Professor of Soil Science. He continues to conduct applied research that is focused on the needs of the turfgrass industry.

Dr. Doug Soldat
Doug Soldat is an Assistant Professor of Turf Nutrition and Water Resources in the Department of Soil Science. He teaches turf nutrition and water resources, and is the state leader for training the turf industry for compliance with the new turf fertilization regulations, NR 151. His research currently focuses on fertilizer efficacy, drought stress, and water quality.

Dr. John Stier

John Stier is a Professor of Environmental Turfgrass Science in the Department of Horticulture. In addition to teaching introductory and advanced turf management courses, he conducts applied research and outreach on weed control, golf/lawn/sports turf management, turf water quality and invasive species. Recently John has assumed Department Chair responsiblities for the Department of Horticulture at UW-Madison.

Dr. Chris Williamson
Chris Williamson is an Associate Professor of Turfgrass Entomology in the Department of Entomology. He holds a 70% extension and 30% research appointment with responsibilities for turf and ornamentals. His research is focused on white grub, black cutworm, and most recently emerald ash borer.

The Staff

Audra Anderson (ARS/WTA secretary)
Audra keeps the WTA program running smoothly and serves as a receptionist at the O.J. Noer turfgrass facility. She takes a primary role in coordinating the details of the WTA projects, including Turf Expo and the summer field days. Without her, the turf program would fail to function as smoothly as it does.

Mr. Paul Koch
Paul Koch recently completed his M.S. degree in the Department of Plant Pathology on the development of fungicide resistance among dollar spot disease pathogen isolates, *Sclerotinia homeocarpa*. Paul runs the Turf Diagnostic Laboratory of the University of Wisconsin-Madison and conducts fungicide efficacy trials.

Mr. Eric Koeritz
Eric Koeritz is a research assistant in the Department of Horticulture and is finishing his M.S. degree. His degree research topic is "Development of Environmentally Sustainable Golf Course Turfs". Eric is going to pursue a PhD at the University of Minnesota, once he has completed his M.S. degree requirements.

Mr. William Kreuser
Bill Kreuser is an undergraduate in the Soil Science department. His current research focus is on the plant growth regulator Primo Maxx® and its effect on putting green nutrient requirements. Bill is the research coordinator for Dr. Soldat and will be starting his M.S. in 2009.

Mr. Ben Pease
Ben Pease graduated from UW-Madison in 2005 with a degree in Soil Science with an emphasis on Turfgrass Management. He is now starting his M.S. in Horticulture, which focuses on studying shade tolerance of velvet bentgrass. He oversees the day-to-day Horticulture operations at the Noer and plans to enter golf course management after finishing his degree.

Tom Schwab (ARS-O.J. Noer manager)

As manager of the O.J. Noer facility Tom's responsibilities include procuring equipment and product donations from many turf companies, most of which is donated. His other responsibilities include building and grounds maintenance, including fixing irrigation. He also assists faculty and students with their projects when necessary.

Graduate Students

Mr. Brad DeBels

Brad DeBels is working on his M.S. degree in the Department of Soil Science. His graduate research focuses on Environmental water quality and conservation for turfgrass irrigation in the Midwest. The Terry and Kathleen Kurth Wisconsin Distinguished Graduate Fellowship supports his graduate work.

Mr. Mark Garrison

Mark Garrison is working on his M.S. degree in the Department of Horticulture. He has assisted on numerous herbicide studies since beginning in spring 2006. His graduate research focuses on determining the invasive potential of turfgrasses into "natural" areas.

Mr. Eric Melby

Eric Melby is working on his M.S. degree in the Department of Soil Science under the direction of Dr. Doug Soldat. He graduate research will focus on analytical soil chemistry.

Ms. Chantel Wilson

Chantel Wilson is working on her PhD degree in the Department of Plant Pathology under the direction of Dr. Jim Kerns. Her graduate research will focus on the biology, epidemiology and management of dollar spot.

Mr. Dan Lloyd

Dan Lloyd is working on his M.S. degree in the Department of Soil Science under the direction of Dr. Doug Soldat. His graduate research focuses on late-season nitrogen fertilization of turfgrasses.

Management and Fertility research

Velvet Bentgrass Nitrogen Type and Rate Evaluation

Eric J Koeritz, Ben Pease and John Stier
Department of Horticulture

INTRODUCTION

Interest in velvet bentgrass (*Agrostis canina*) has increased in recent years due to its excellent quality, playability and stress tolerance characteristics. Velvet bentgrass has a lower fertility requirement and requires less water than creeping bentgrass to maintain quality turf (Brillman and Meyer, 2000) (DaCosta and Huang, 2006). Much of the research done on velvet bentgrass to date was on older cultivars and in the Northeast United States. Many of the new recommendations for nitrogen rates on velvet putting greens are inconsistent with older research. An extension publication from the University of Rhode Island claimed that liquid fertilizers work better than granular and that more acidifying fertilizers are better than ureas and nitrates which can temporarily raise soil pH around turfgrass roots and lead to micronutrient imbalance (Boesch, 2005). These claims about liquid fertilizers and fertilizer type seemed to be based mostly on anecdotal evidence. According to Barak (2007), all nitrogen fixation, even from *Rhizobium*, decreases soil pH to varying degrees over time.

Recently new and improved velvet bentgrass cultivars have been developed but proper management strategies are not known or have not been documented based on scientific research. Furthermore, velvet bentgrass has not been planted extensively or studied in great detail, especially in the upper Midwest under trafficked conditions.

OBJECTIVES

1) To determine if ureas and nitrates are suitable for use on velvet bentgrass putting greens and to compare them to more acidifying ammoniacal fertilizers.
2) To determine how the nitrogen application rate affects agronomic and playability of velvet bentgrass using each nitrogen form.

MATERIALS AND METHODS

The study was seeded on both a sand and native silt loam green on 7 August 2006 using 1.1 lbs of seed per 1000 square feet. The seed was pre-treated with metalaxyl to control root pythium diseases. Starter fertilizer was applied at a rate of 1 lb P_20_5 per 1000 square feet. Plots were grown in during autumn of 2006 and spring of 2007. Initial fertilizer treatment applications were made in June of 2007 and continued through October 2007. In the spring of 2008 initial applications will begin the week of April 23 and will be made every two weeks through October for a total of 14 applications. The four nitrogen types used in this study along with their calcium carbonate equivalent (CCE) are listed in Table 1.

Table 1. Nitrogen types and their residual basicity.

Nitrogen type	Calcium Carbonate Equivalent(CCE)/100 lb fertilizer (lb)
Urea	84
$Ca(NO_3)_2$	20 B†
NH_4NO_3	59
$(NH_4)_2SO_4$	110

† B indicates a residual basicity. All other values refer to acidifying effects.

Nitrogen Rates
1, 3, and 5 lbs N/M/yr
Application rates are .07, .21, and .36 lbs N/M/every 2 weeks.

Pesticides
Apply contact fungicides curatively after disease pressure develops to prevent significant stand loss.

Data Collection
Quality – rate weekly
Clipping yield – weekly
Shoot density – (count shoots in 3 plugs) May, August, and October
Disease incidence
Chlorophyll Content – weekly with hand held chlorophyll meter
Ball roll – weekly
Soil pH – Aug 1, October 1

Other Plot Maintenance
Mow daily at .156”
Topdress monthly
Irrigation Sand: 4x/week at 75%ET
Irrigation Soil: 4x/week at 60%ET

RESULTS FROM SAND BASED GREEN

Partial data from the 2008 growing season is shown in Tables 2 and 3 below. On sand, urea and ammonium sulfate provided the best turf quality for the first half of the growing season (Table 2). In addition the highest nitrogen rate provided better turf quality on sand than the low and middle rates.

Velvet bentgrass shoot density was affected by fertilizer rate with the medium and high rates of fertilizer yielding higher shoot densities than the low rate (Table 3). Nitrogen type did not affect turfgrass density.

Table 2. Effect of nitrogen type and rate on velvet bentgrass putting green turf quality (sand based rootzone), Verona, WI, 2008.

	Quality					
Source	**Spring**		**Summer**		**Fall**	
Nitrogen Type	April 14	May 12	July 1	July 10	Oct 10	Oct 19
1 Urea	4.0	4.0	5.3	5.4	4.7	4.4
2 Calcium Nitrate	3.5	3.5	4.5	4.9	4.3	4.6
3 Ammonium Nitrate	3.8	3.9	5.1	5.2	4.7	4.7
4 Ammonium Sulfate	4.0	3.9	5.4	5.3	4.8	4.5
LSD (0.05)	0.2	0.4	0.7	ns	ns	ns
Nitrogen rate						
1 (lbs N/M/yr)	3.1	3.0	4.3	4.2	4.0	3.5
3 (lbs N/M/yr)	3.9	4.0	5.4	5.7	4.8	4.8
5 (lbs N/M/yr)	4.4	4.6	5.5	5.8	5.1	5.3
LSD (0.05)	0.2	0.3	0.4	0.4	0.2	0.3

Quality rating scale: 1-9, 1=dead turf, 9=best quality, 6=acceptable.
ns = not significant at $P \leq 0.05$.

Table 3. Effect of nitrogen rate on shoot density of velvet bentgrass putting green turf (sand based rootzone), Verona, WI, 2008.

Source	**Shoot Density**		
Rate	**May**	**August**	**October**
1 (lbs N/M/yr)	83	117	110
3 (lbs N/M/yr)	106	149	142
5 (lbs N/M/yr)	116	164	186
LSD (0.05)	15	22	65

Average number of shoots from three 1” diameter plugs.

RESULTS FROM SOIL BASED GREEN

Nitrogen type and rate both had affects on turf quality on the soil based green (Table 4). While differences were not evident until late in the growing season, ammonium sulfate provided the highest quality ratings. Nitrogen rate had a highly significant affect on turfgrass quality, which increased as nitrogen rate increased. The results indicate that growing velvet bentgrass on soil requires less nitrogen to provide acceptable turf quality than when velvet bentgrass is grown on sand (Table 5).

Nitrogen rate was the only variable to affect shoot density on the soil based putting green (Table 6). Shoot densities were significantly higher when fertilized at the high rate versus the low rate. Shoot densities of the soil based green fertilized at the low rate were higher than the shoot densities of the sand based green fertilized at the high rate, again indicating that velvet bentgrass grown on soil requires less fertilizer than velvet bentgrass grown on sand.

Table 4. Analysis of variance for turfgrass quality on velvet bentgrass fertilizer trial (soil based rootzone), Verona, WI, 2008.

	Spring		**Summer**		**Fall**	
Source	April 14	May 12	July 1	July 10	Oct 10	Oct 19
Nitrogen type (N)	ns	ns	ns	ns	**	***
Nitrogen rate (R)	***	***	***	***	***	***
Type x Rate (NxR)	ns	ns	ns	ns	ns	ns

* Significant at $P \leq 0.05$, ** significant at $P \leq 0.01$, ***significant at $P \leq 0.001$.

Table 5. Effect of nitrogen type and rate on velvet bentgrass putting green turf quality (soil based rootzone), Verona, WI, 2008.

	Quality					
Source	**Spring**		**Summer**		**Fall**	
Nitrogen Type	April 14	May 12	July 1	July 10	Oct 10	Oct 19
1 Urea	4.7	5.7	6.0	6.2	5.6	5.8
2 Calcium Nitrate	4.6	5.6	5.7	5.9	5.2	5.2
3 Ammonium Nitrate	4.6	5.7	6.3	6.4	5.5	5.8
4 Ammonium Sulfate	4.9	5.7	6.1	6.5	6.0	6.6
LSD (0.05)	ns	ns	ns	ns	0.4	0.5
Nitrogen rate						
1 (lbs N/M/yr)	4.1	4.8	5.3	5.6	5.1	5.0
3 (lbs N/M/yr)	4.8	5.8	6.0	6.2	5.6	5.8
5 (lbs N/M/yr)	5.3	6.4	6.7	6.9	6.0	6.7
LSD (0.05)	0.3	0.3	0.3	0.3	0.2	0.4

Quality rating scale: 1-9, 1=dead turf, 9=best quality, 6=acceptable.
ns = not significant at $P \leq 0.05$.

Table 6. Effect of nitrogen rate on shoot density of velvet bentgrass putting green turf (soil based rootzone), Verona, WI, 2008.

Source	**Shoot Density**		
Nitrogen rate	**May**	**August**	**October**
1 (lbs N/M/yr)	169	231	210
3 (lbs N/M/yr)	184	243	230
5 (lbs N/M/yr)	190	277	231
LSD (0.05)	15	26	20

Average number of shoots from three 1” diameter plugs.

Cultural Practices Effect on Recovery from Non-Lethal Snow Mold Damage

Bill Kreuser, Doug Soldat
Department of Soil Science

INTRODUCTION

Non-lethal snow mold damage on turfgrass is commonly observed following spring snow melt. Snow mold damage is typically caused by *Microdochium nivale* or *Typhula incarnate* fungi. Non-lethal damage usually only occurs on the leaf blades and can be unsightly. Effected turfgrass typically has a wet, matted appearance with bleached coloration. If the turfgrass crown remains viable, the plant can grow new leaves and damaged leaves are mown off. Areas that are particularly prone to damage are golf course putting green surrounds due to their wide diversity of grass species. These areas usually had been seeded to 100% Kentucky bluegrass, a species relatively resistant to snow mold, but can become contaminated with more susceptible species including perennial ryegrass, creeping bentgrass, and annual bluegrass (Witt, 2000; Abler and Jung, 2005).

Turfgrass managers and homeowners unable to treat their turfgrass stands with preventative fungicides rely on several cultural practices to both limit and recover from snow mold damage. Various trade and extension publications describe several cultural practices to aid in snow mold recovery. For example, there are several thoughts published on fall mowing. One theory is to withhold mowing towards the end of fall to help increase carbohydrate storage before winter (Laidlaw, 2000). A contrasting theory is to mow the turf until top growth has stopped to help the plant harden off (Franklin, 1999). An additional management recommendation is to use late season or dormant nitrogen fertilization to aid in recovery. Prior University of Wisconsin research found 30 day quicker recovery from snow mold on golf putting greens when late season nitrogen had been applied to golf putting greens (Kussow, 1992). The last cultural practice frequently cited in trade and extension publications is to rake up fungal mats in the spring (Abler and Jung, 2005).

The purpose of this study was to evaluate the effect of fall mowing height, dormant fertility, and spring raking on recovery from non-lethal snow mold damage.

METHODS

This study was conducted on a north facing slope at the O.J. Noer Turfgrass Research and Education Facility in Madison, WI. The grass stand consists of a mixture of Kentucky bluegrass (*Poa pratensis)*, perennial ryegrass (*Lolium perenne*), creeping bentgrass (*Agrostis stolonifera),* roughstalk bluegrass (*Poa trivialis)*, and annual bluegrass (*Poa annua*).

Treatments were a factorial of three mowing heights, with or without dormant fertilization, and with or without spring raking. The 12 treatments were organized into a randomized complete block design with three replications. During the summer and fall of 2007 the grass was maintained to a height of 2 inches. The three late fall mowing treatments began on October 3rd 2007 and consisted of a 1 and 2 inch height of cut (HOC) with a Honda HRC 216 rotary mower along with an un-mown treatment. The height of the un-mown treatments was approximately 4-6 inches when top growth ceased in November. Dormant fertilization was applied to assigned plots on Nov 14th 2008 at the rate of 1.0 lb N/M from feed grade urea with a hand shaker jar. The area was under continuous snow cover from early December 2007 until the end of March 2008. Assigned plots were completely raked with a plastic leaf rake on April 2nd 2008. Plots weren't mowed in spring until the 2 inch HOC treatments had grown to approximately 3 inches, April 25th 2008. At that time all treatments were mowed to 2 inches weekly.

Initial percent snow mold cover was visually estimated and chlorophyll index (CI) was measured with a CM-1000 chlorophyll meter (Spectrum Technologies Inc., Plainfield, IL) on April 2nd 2008. Percent snow mold cover and CI were recorded weekly thereafter. All data were analyzed with the JMP statistical software package (Cary, NC). Means and interactions were separated using Tukey HSD.

RESULTS AND DISCUSSION

The prolonged snow and ice cover provided an ideal environment for development of snow mold. Both *Microdochium* patch (pink snow mold) and *Typhula* blight (gray snow mold) were found throughout the entire study area. Individual plots ranged from 10 to 100% blight. Fall mowing height had the greatest effect on the initial percent of snow mold damage. The plots that were not mown in October 2007 had significantly more snow mold than the plots that were lowered to a 1 inch HOC, 70% and 39% blight respectfully. The 2 in HOC experience an average of 50% blight. Dormant fertilization with 1.0 lb N/M from urea had no significant influence on initial disease severity. There were no significant interactions between any of the three variables and initial percent snow mold damage.

Recovery was most dramatic 3 weeks after the initial April 2nd ratings. The rate of change, percent reduction per week, was calculated by subtracting the percent snow mold cover from current percentage of snow mold cover for every week. The greatest rate of change regardless of treatments occurred between 2 and 3 weeks from initial ratings, April 16 to April 25. During this time period percent snow mold cover was reduced by an average of 40 percentage points while all other weeks the average reduction in snow mold cover was 3 percentage points or less.

The primary reason for the drastic reduction in snow mold cover can most likely attributed to soil temperature. During this time period the 2 inch soil temperatures exceeded 50ºF. This increase in temperature corresponded with a flush of growth. The 3 inch mowing threshold for the 2 inch HOC treatments was surpassed and all the plots were mowed to 2 inches prior to the April 25th rating day. Prior to April 16 air temperatures had been above 50ºF but had little effect on rate of recovery because soil temperatures remained below 40ºF.

The effect of the increased soil temperatures from approximately 35ºF to above 55ºF also had an effect on turfgrass chlorophyll index. Prior to the rapid increase in soil temperature CI values slowly increased. Once soil temperatures surpassed 50ºF CI begin to increase more rapidly. The rate of change was greatest between April 16 and April 25. Weeks that followed April 25th showed less rapid increases in CI. Similarly to the percent blight data the rate of CI increase was not significantly affected by late season fertilization, fall mowing height, or by raking of the plots on April 2nd.

Although mowing height didn't affect rate of grass green up statistically the mean CI for the 1 inch HOC treatments was consistently lower than the other mowing heights. It was qualitatively noted that the plots mowed to a 1 inch HOC had experience a reduction in density from the previous fall. This reduction in density appeared to last well into the summer. It is believed that the lower HOC reduced the turfgrass plant's ability to create and store non-structural carbohydrates before winter. However without having quantified total non-structural carbohydrates and stand density prior to beginning the fall mowing treatments this is only a hypothesis.

CONCLUSIONS

After one winter our primary findings were:

1. Increased soil temperature had the greatest influence on rate of spring green-up and recovery from non-lethal snow mold
2. Mowing effectively removed diseased leaf tissue
3. Raking disease patches had little effect on rate of recovery for snow mold
4. Dormant fertilization with a urea had no effect on color or rate of recovery the following spring in our study although previous research has shown it to be effective.

REFERENCES

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TABLES AND FIGURES

Table 1. The effect of different fall mowing heights on initial percent of snow mold cover and recovery.

Treatment	Mean Snow Mold Cover					
Height of Cut ---Inches-- -	4/2/2008	4/9/2008	4/16/2008	4/25/2008	5/2/2008	5/9/2008
	-----------------------% of Plot Affected------------------------------					
1	39 A	39 A	39	6	2 A	3
2	50 AB	46 AB	44	7	7 AB	6
Not Mow	70 B	64 B	58	8	9 B	7

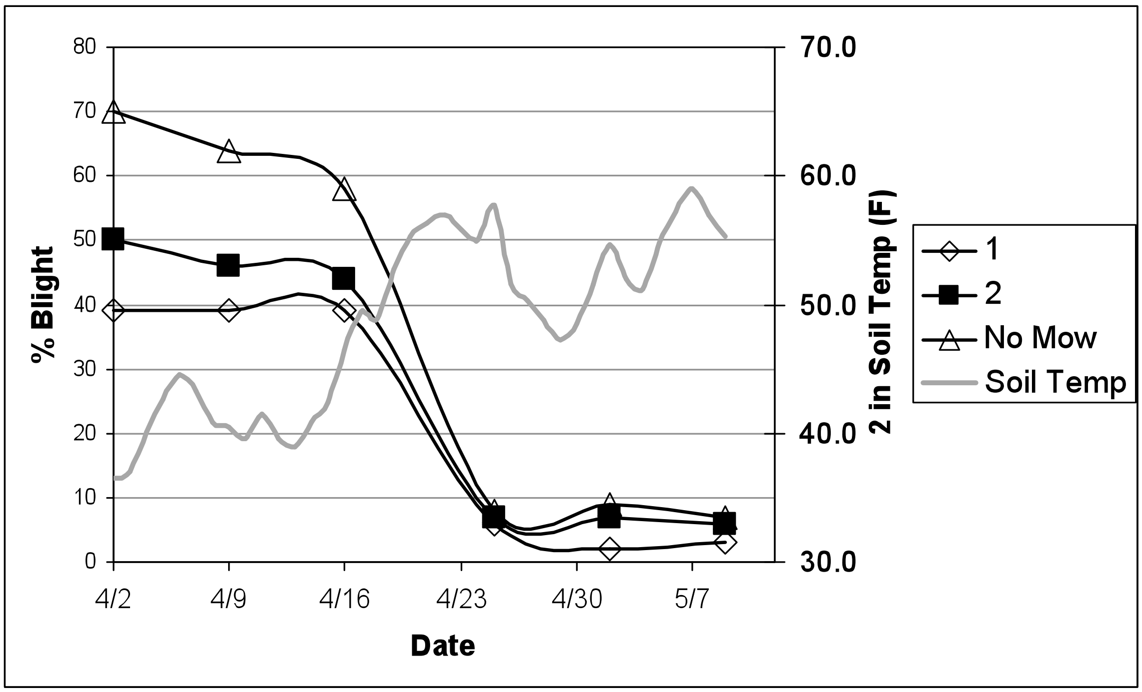

Figure 1. The effect of different fall mowing heights on initial percent of snow mold cover and recovery.

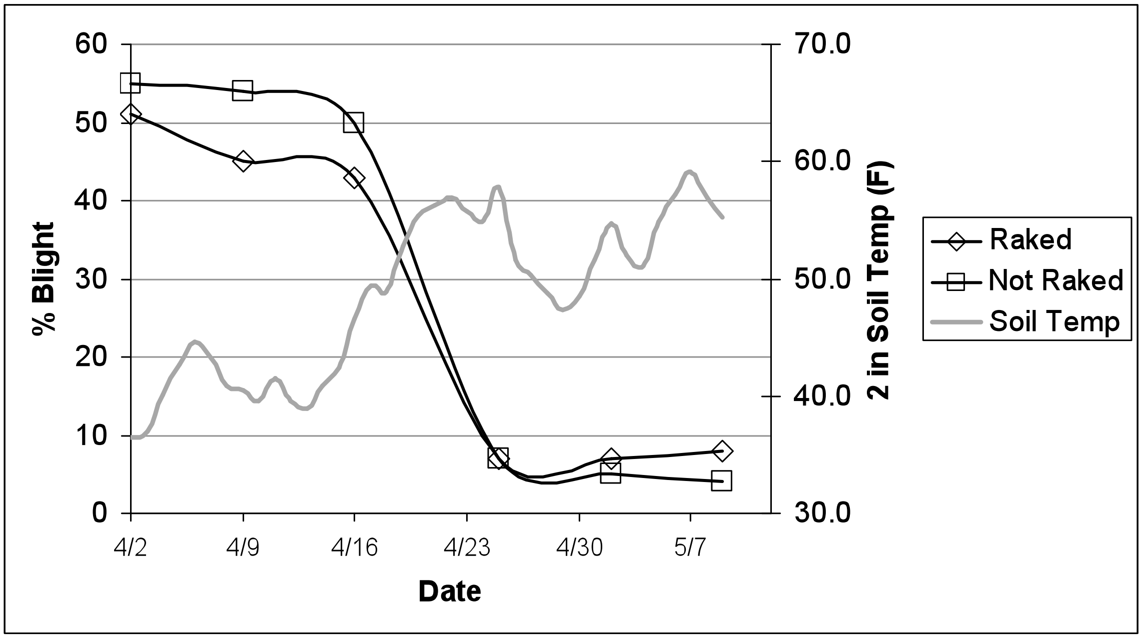

Figure 2. The effect of spring raking of snow mold affected turfgrass on snow mold recovery.

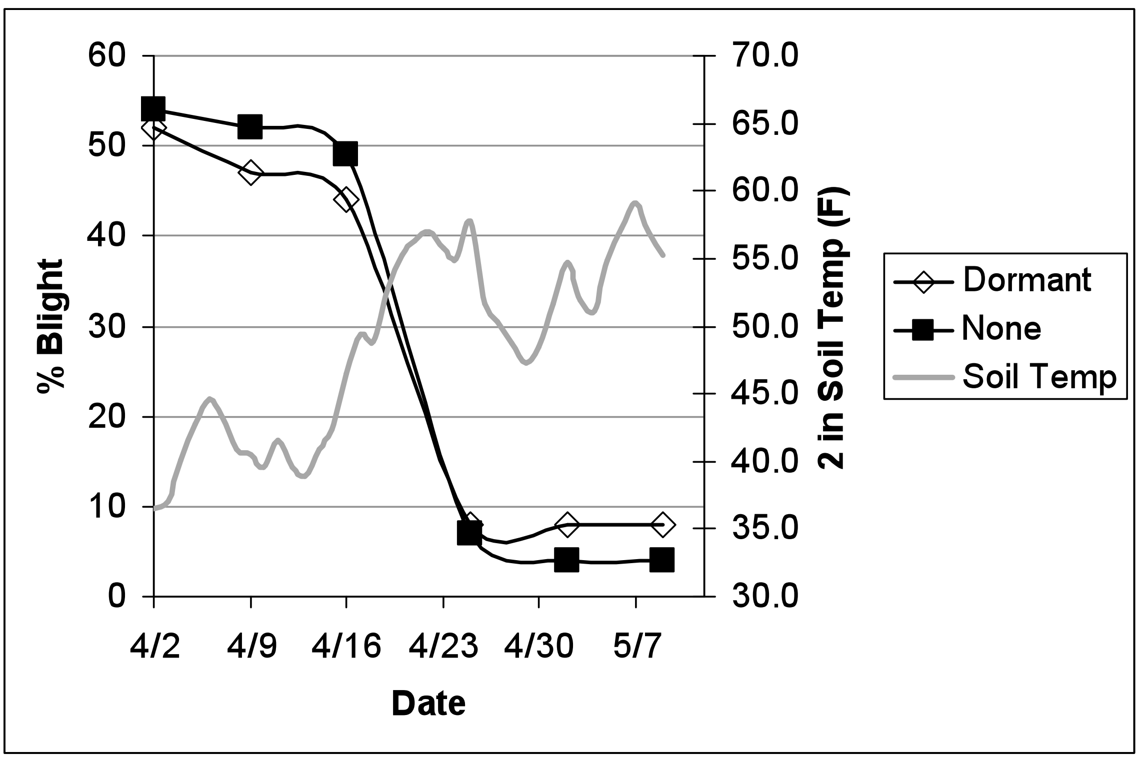

Figure 3. The effect of dormant applied nitrogen, 1.0 lb N/M urea, on snow mold severity and recovery.

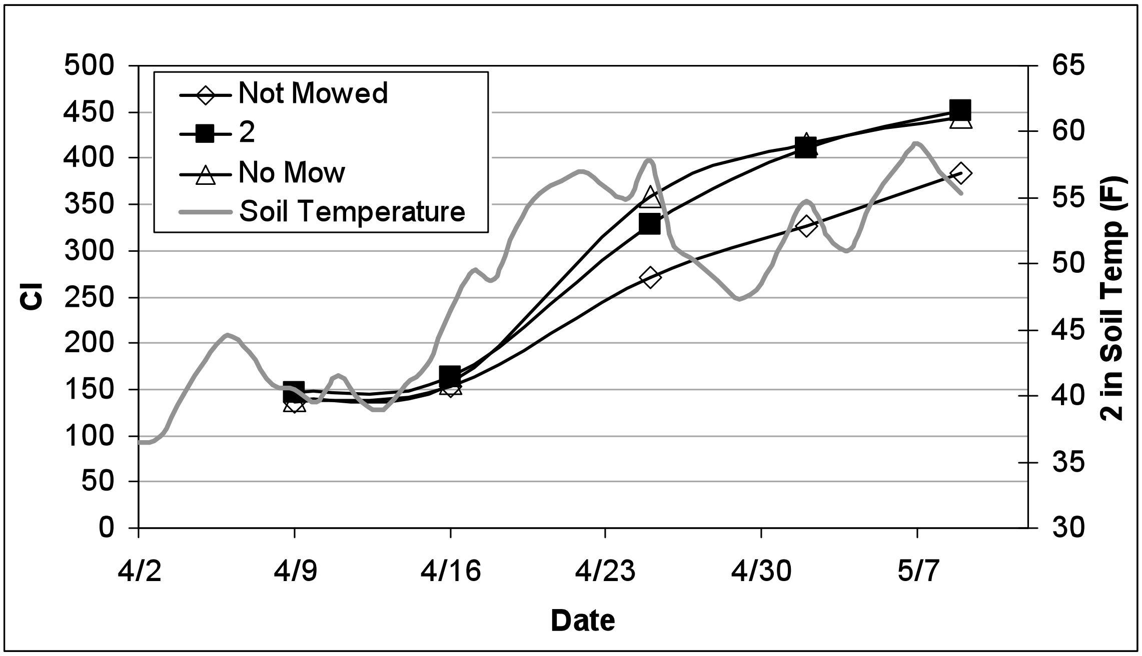

Figure 4. The effect of different fall mowing heights on chlorophyll index (CI), 0-999 and spring green up.

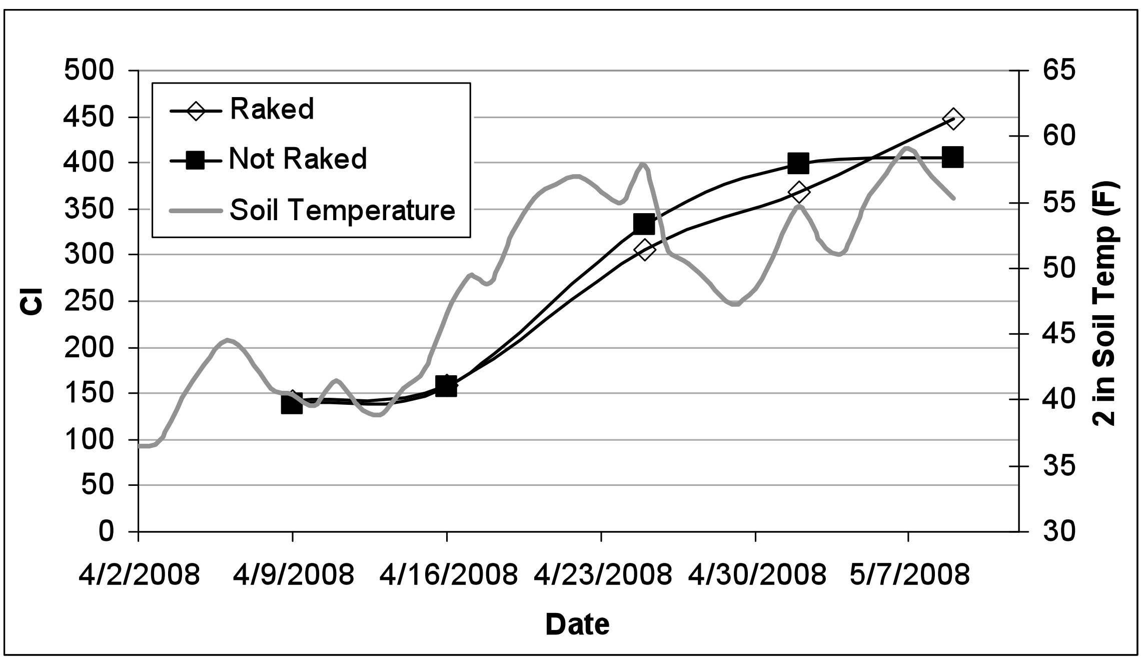

Figure 5. The effect of spring raking of snow mold affected turfgrass on chlorophyll index (CI), 0-999 and spring green up.

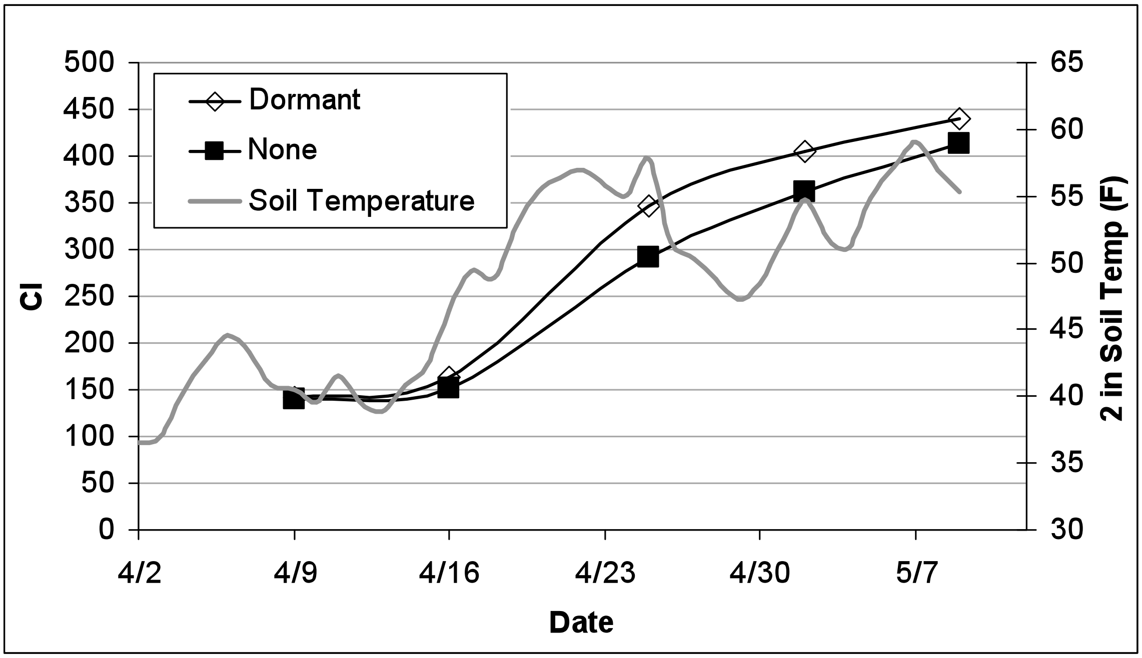

Figure 6. The effect of dormant applied nitrogen, 1.0 lb N/M urea, on chlorophyll index (CI), 0-999 and spring green up.

Evaluation of Chickity Doo Doo as an Organic Turfgrass Fertilizer

Doug Soldat, Brad DeBels, Bill Kreuser, Eric Melby
Department of Soil Science

INTRODUCTION

Land application of animal manure is becoming increasingly cost ineffective as land prices continue to rise from residential development. With residential development comes more lawns, and it is becoming attractive to turn animal manure into lawn fertilizer. An effective lawn fertilizer must contain a relatively high proportion of nitrogen, as this is the most important nutrient for growing high quality lawns. In addition, the product must be easy to handle and apply. Product testing and evaluation are important steps in determining the effectiveness of new organic fertilizers. The objective of this proposed research is to determine if Chickity Doo Doo fertilizer effective at maintaining high quality lawns compared to several other natural organic fertilizers currently on the market.

MATERIALS AND METHODS

This research was conducted at the O.J. Noer Turfgrass Research and Education Center in Madison, WI. The experiment was conducted on perennial ryegrass and Kentucky bluegrass mowed weekly (or as needed) at a cutting height of 2.5 inches. The plots were irrigated weekly to replace 80% of the evapotranspiration estimated by an on-site weather station. The soil at the site was a Batavia silt loam with a pH of 7.2.

The experiment was a randomized complete block design with four replications of each of the eight treatments listed in Table 1. The individual measured 48 ft^2 (6 by 8 ft). Each fertilizer was applied using hand shakers three times during the growing season (June 5, July 3, and September 4, 2008) to give a total of 3 lbs N/1000 ft^2. Chickity Doo Doo was applied at two rates (1.5 lbs N/1000ft^2 and 3 lbs N/1000 ft^2).

During the growing season several turfgrass and soil parameters were evaluated at various collection intervals. Turfgrass color was evaluated approximately every other week using a CM1000 meter from Spectrum Technologies. Visual turfgrass quality was also measured on this schedule on a 1 – 9 scale where a rating of 9 indicates highest possible turf quality. Clippings were collected seven times throughout the season, each time immediately dried at 60°C for 48 hours and then weighed to determine dry matter production. The clippings were collected from a 1.14 m^2 area of the plot using a rotary mower. On three of the clipping collection dates the clippings were analyzed for nitrogen, phosphorus, and potassium levels at the University of Wisconsin Soil and Plant Analysis Laboratory to determine plant nutrient uptake during the late spring, mid summer, and fall. Ten soil samples were collected from each plot in early November to determine how the various treatments affected soil pH, organic matter, phosphorus, or potassium levels in the soil. The soil samples were also analyzed at the University of Wisconsin

Soil and Plant Analysis Laboratory using standard methods and the Bray-1 soil test extract for phosphorus and potassium.

Statistical analysis was performed using the JMP 6.0 statistical software package (SAS Institute, Cary, NC). Analysis of variance (ANOVA) was used to determine statistical differences, and means were separated using the unprotected Student's t-test. Treatment means within table columns containing similar letters are not statistically different from each other at the alpha=0.05 level.

Table 1. Treatments employed in research study.

Fertilizer Product	Analysis	Application Rate
	$N - P_2O_5 - K_2O$	lbs N/1000 ft^2/yr
Chickity Doo Doo	5 – 3 – 2.5	3
Chickity Doo Doo	5 – 3 – 2.5	1.5
Milorganite	6 – 2 – 0	3
Espoma	7 – 2 – 2?	3
Bradfield Organics Luscious Lawn & Garden	3 – 1 – 5	3
Scott's Turf Builder	29 – 2 – 4	3
Scott's Organic Choice	11 – 2 – 2	3
Unfertilized Control	N/A	N/A

RESULTS AND DISCUSSION

Color

Turfgrass color results are presented in Table 1 and Figures 1 and 2. Early in the season (June 10 – June 17), Scotts Turf Builder had statistically greater turfgrass color ratings than all other treatments except for Milorganite on June 10. However, after July 8, Chickity Doo Doo (full rate) had similar or greater turfgrass color ratings than the Scotts Turf Builder and all other treatments. As shown in Figure 2, Chickity Doo Doo was had consistently better turfgrass color than most or all of the industry standard fertilizers, especially in July and September 2008. Applying Chickity Doo Doo at the half-rate (1.5 lbs N/M) did not significantly improve turfgrass color compared to the unfertilized control. Therefore, for enhanced color, it is recommended that at least 3 lbs N/M of Chickity Doo Doo be applied per season.

Table 1. Spring Color Index of fertilizers used in the study. The unitless color index is on a 1-999 scale, with 999 representing the greenest possible turfgrass. Treatment means within table columns containing similar letters are not statistically different from each other at the alpha=0.05 level.

Treatment	June 10		June 17		June 25		July 1		July 8	
Chickity Doo Doo	286	B	271	B	311	AB	276	AB	438	B
Chickity Doo Doo (1/2 rate)	280	B	246	BCD	269	CD	245	CD	350	C
Scotts Organic	294	B	243	CD	308	ABC	285	A	413	B
Scotts Turf Builder	350	A	303	A	325	A	287	A	510	A
Milorganite	303	AB	264	BC	294	ABC	273	ABC	409	B
Espoma	277	B	232	D	276	BCD	254	BCD	359	C
Bradfield	266	B	244	CD	294	ABC	250	BCD	356	C
No fertilizer	270	B	224	D	254	D	241	D	325	C

Table 1 (continued).

Treatment	July 16		July 25		July 31		Aug 5		Aug 12	
Chickity Doo Doo	434	AB	372	A	396	AB	404	AB	468	A
Chickity Doo Doo (1/2 rate)	337	DE	312	A	343	CD	361	CD	439	AB
Scotts Organic	443	AB	292	A	404	A	412	A	454	A
Scotts Turf Builder	454	A	369	A	389	AB	410	A	465	A
Milorganite	397	BC	348	A	384	AB	404	AB	465	A
Espoma	374	CD	337	A	365	BC	381	ABC	433	AB
Bradfield	367	CD	337	A	363	BCD	367	BCD	436	AB
No fertilizer	299	E	294	A	330	D	339	D	417	B

Table 1 (continued).

Treatment	Aug 19		Aug 27		Sept 18		Sept 23		Oct 3	
Chickity Doo Doo	411	A	478	A	551	A	529	A	435	A
Chickity Doo Doo (1/2 rate)	375	BC	436	BC	509	AB	487	AB	388	B
Scotts Organic	413	A	463	AB	519	AB	536	A	414	AB
Scotts Turf Builder	402	AB	458	ABC	529	AB	526	A	400	AB
Milorganite	398	ABC	458	ABC	516	AB	515	A	412	AB
Espoma	388	ABC	444	BC	524	AB	475	AB	412	AB
Bradfield	396	ABC	456	ABC	511	AB	483	AB	414	AB
No fertilizer	366	C	431	C	501	B	432	B	384	B

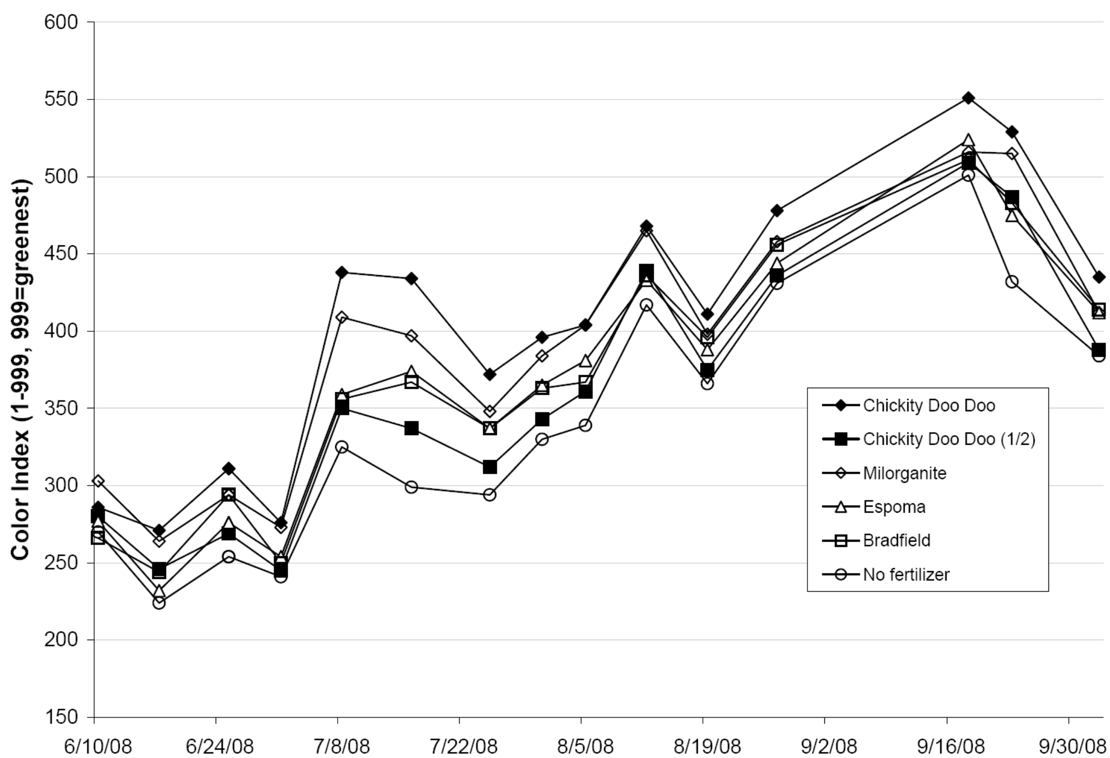

Figure 1. Color index of Chickity Doo Doo versus the industry standard natural/organic fertilizers. The color scale is 1-999, with 999 representing the greenest possible value.

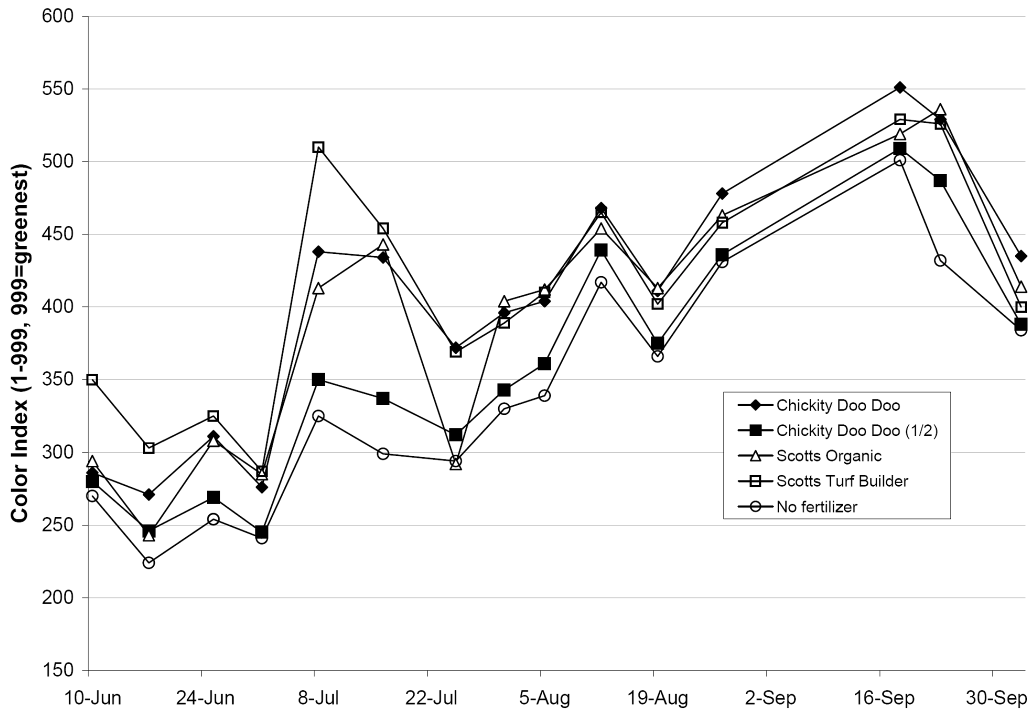

Figure 2. Color index of Chickity Doo Doo versus the Scotts Turf Builder and Scotts Organic fertilizers. The color scale is 1-999, with 999 representing the greenest possible value.

Turfgrass Quality

Visual turfgrass quality measurements are reported in Table 2 and Figures 3 and 4. One might expect that the fertilized treatments would exhibit significantly greater turfgrass quality than the unfertilized control treatment, but as show in Table 2, this was not the case. On several dates the unfertilized treatment was statistically similar to the fertilized plots. This can be attributed to residual soil N that mineralized and becomes plant available as soil temperatures increase. No differences in turfgrass quality were observed for three consecutive weeks in August. Significant differences were observed among other treatments on all other rating dates.

Over the season, Chickity Doo Doo displayed similar turfgrass quality to the Scotts Turf Builder treatment in the mid to late summer and fall, although Scotts Turf Builder typically had greater turf quality than Chickity Doo Doo and the other treatments in June and early July. With few exceptions, the Chickity Doo Doo treatment had the greatest turfgrass quality compared to the other organic fertilizers in the study. However, Chickity Doo Doo applied at the half rate (1.5 lbs N/M) was generally not statistically different from the unfertilized control treatment, indicating that Chickity Doo Doo should be applied at 3 lbs N/M or more for best results.

Table 2. Visual turfgrass quality ratings of the treatments. Turfgrass quality is rated on a 1-9 scale, with 9 representing the highest possible turf quality. Treatment means within table columns containing similar letters are not statistically different from each other at the alpha=0.05 level.

Treatment	**June 10**	**June 17**	**June 25**	**July 1**	**July 8**
Chickity Doo Doo	6.38 B	6.88 B	7.25 AB	6.75 AB	7.00 B
Chickity Doo Doo (1/2 rate)	6.00 B	6.38 CD	6.63 C	6.38 B	6.00 D
Scotts Organic	6.25 B	6.38 CD	7.50 A	7.25 A	6.88 BC
Scotts Turf Builder	7.38 A	7.50 A	7.63 A	6.88 AB	7.75 A
Milorganite	6.13 B	6.50 BC	7.25 AB	6.75 AB	6.88 BC
Espoma	6.00 B	6.13 CD	6.50 C	6.88 AB	6.38 CD
Bradfield	6.00 B	6.25 CD	6.88 BC	6.63 B	6.38 CD
No fertilizer	6.13 B	6.00 D	6.50 C	6.38 B	5.58 D

Table 2 (continued).

Treatment	**July 16**	**July 25**	**July 31**	**Aug 5**	**Aug 12**
Chickity Doo Doo	7.00 AB	6.63 A	6.88 AB	7.13 A	6.75 A
Chickity Doo Doo (1/2 rate)	6.13 CD	6.00 AB	6.378 CD	7.00 A	6.50 A
Scotts Organic	6.63 ABCD	6.63 A	6.88 AB	7.38 A	6.75 A
Scotts Turf Builder	7.38 A	6.75 A	7.13 A	7.25 A	6.88 A
Milorganite	6.75 ABC	6.38 AB	6.63 BC	6.88 A	6.50 A
Espoma	6.50 BCD	6.38 AB	6.38 CD	7.00 A	6.50 A
Bradfield	6.75 ABC	6.63 A	6.88 AB	7.00 A	6.88 A
No fertilizer	5.90 D	5.75 B	6.13 D	6.88 A	6.38 A

Table 2 (continued).

Treatment	**Aug 19**	**Aug 27**	**Sept 18**	**Sept 23**	**Oct 3**
Chickity Doo Doo	7.38 A	7.50 A	7.63 A	7.75 ABC	7.00 A
Chickity Doo Doo (1/2 rate)	7.00 A	6.75 D	7.00 B	7.38 BCD	6.63 AB
Scotts Organic	7.25 A	7.13 ABCD	7.13 AB	8.00 AB	6.88 A
Scotts Turf Builder	7.38 A	7.38 AB	7.50 AB	8.38 A	6.63 AB
Milorganite	7.00 A	6.88 CD	7.38 AB	8.00 AB	7.00 A
Espoma	7.25 A	7.00 BCD	7.38 AB	7.13 CD	7.00 A
Bradfield	7.13 A	7.25 ABC	7.38 AB	7.50 BCD	6.88 A
No fertilizer	6.88 A	6.75 D	7.00 B	6.75 D	6.38 B

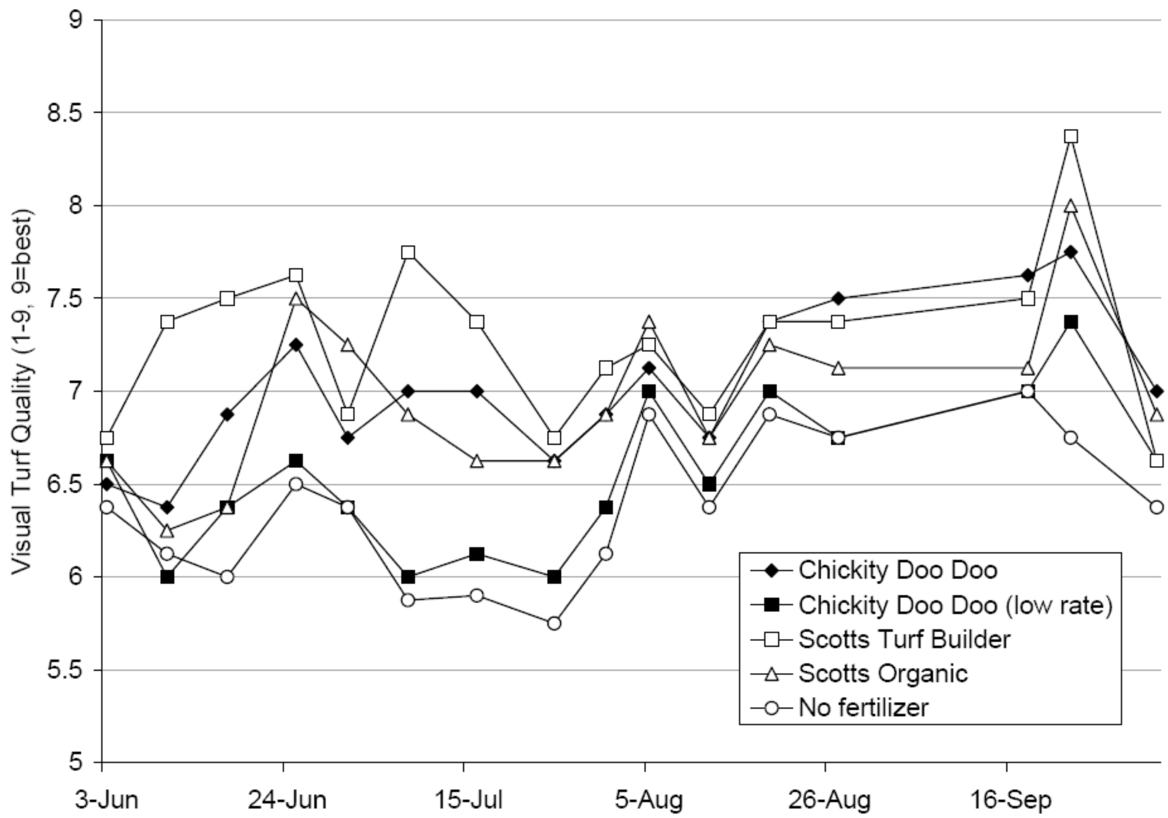

Figure 3. Visual turfgrass quality ratings of Chickity Doo Doo compared to Scotts fertilizer products. Turfgrass quality is rated on a 1-9 scale with 9 representing the highest possible turfgrass quality.

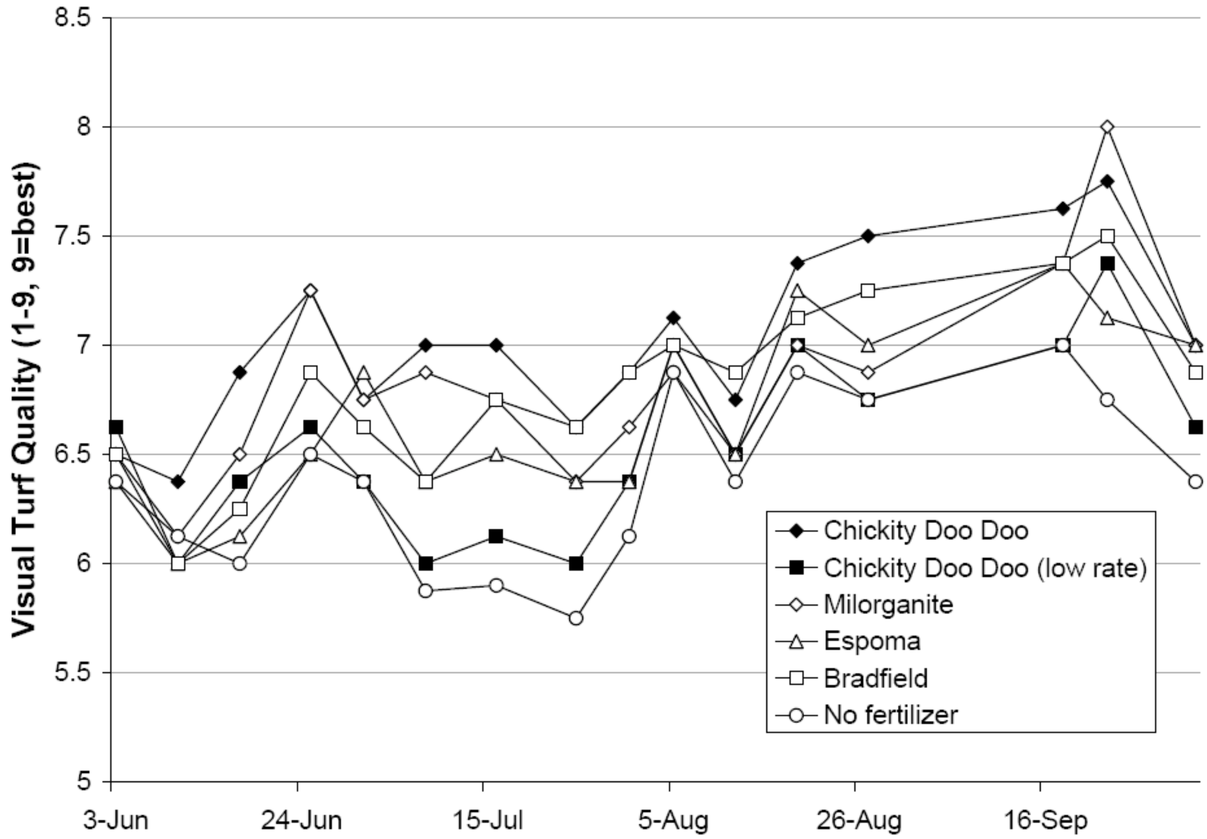

Figure 4. Visual turfgrass quality ratings of Chickity Doo Doo compared to industry standard organic fertilizers. Turfgrass quality is rated on a 1-9 scale with 9 representing the highest possible turfgrass quality.

Growth

Turfgrass growth is another indicator of plant health. Obviously maximum turfgrass growth is not desired, as this will increase mowing requirements. However, steadily growing turf is beneficial for speeding recovery from damage, and grow can be used to compare the efficiency and availability of the various fertilizers when applied at the same rate. As expected, the unfertilized treatment had the lowest amount of growth over the course of the season. As with color and quality, Scotts Turf Builder tended to have greater growth values than most other treatments. This is also expected because the majority of N in Scotts Turf Builder is in soluble and therefore immediately available for plant growth. Organic forms of N must undergo mineralization by microbes before becoming plant available. However, the Scotts Turf Builder had significantly greater growth than the Chickity Doo Doo treatment on only two dates, near the end of the season when temperatures are dropping and microbial mineralization slows. Chickity Doo Doo produced similar or greater growth as most of the other organic fertilizers in the study.

Table 3. Dry weight clipping production of the various fertilizers throughout the growing season. Treatment means within table columns containing similar letters are not statistically different from each other at the alpha=0.05 level.

Treatment	June 14		July 1		July 25		Aug 5		Aug 26		Sept 18		Oct 3	
	--						grams/m^2						--	
C.D.D.	40.3	A	15.4	AB	16.7	AB	6.5	AB	15.9	AB	25.3	B	8.8	BC
C.D.D. (1/2)	38.8	A	12.1	B	10.0	D	4.7	BC	15.9	AB	17.2	DE	7.7	BC
Scotts Organic	41.4	A	18.0	A	16.2	ABC	7.8	A	16.8	AB	19.2	D	8.3	BC
Scotts Turf B.	42.2	A	13.5	AB	17.6	A	6.1	AB	19.8	A	31.3	A	11.1	A
Milorganite	40.5	A	14.9	AB	13.7	BCD	6.9	AB	21.1	A	24.6	BC	8.8	BC
Espoma	36.9	A	12.9	B	13.4	BCD	5.6	ABC	17.5	AB	19.6	DE	9.6	AB
Bradfield	37.2	A	13.7	AB	12.8	CD	6.2	AB	17.7	AB	16.6	CD	9.4	ABC
No fertilizer	36.1	A	12.5	B	11.6	D	3.5	C	13.2	B	14.2	E	7.4	C

Tissue Nutrient Content

Tissue nutrient levels are presented in Tables 4-6 and are another indicator of the efficacy of various fertilizers when applied at similar rates. Chickity Doo Doo had intermediate tissue N levels on the first sampling on June 25, 2008; significantly lower than the Scotts Organic fertilizer, but significantly greater than the unfertilized treatment. On July 27th the Chickity Doo Doo treatment has statistically similar N content to all fertilized treatments. On the final sampling date, only Milorganite was found to have greater tissue N content.

The P and K tissue content numbers are more difficult to interpret because the various fertilizers had different N: P: K ratios, and therefore received differential amounts of P and K. Also, as shown in Tables 5 and 6, the results were not consistent across the three dates for many of the treatments. For example, the Scotts Organic fertilizer had the greatest tissue K on the first date, but the lowest on the final date. Chickity Doo Doo treatments were also variable across the P and K sampling dates, but tended to have high or intermediate levels compared to the other treatments.

Table 4. Tissue nitrogen content (% dry weight) of turfgrass as affected by various fertilizer treatments. Treatment means within table columns containing similar letters are not statistically different from each other at the alpha=0.05 level.

Treatment	June 25		July 27		Oct 3	
	-------Tissue N Content (% dry wt.)-------					
Chickity Doo Doo	2.78	BC	3.71	ABC	3.27	B
Chickity Doo Doo (1/2 rate)	2.57	D	3.77	AB	3.27	B
Scotts Organic	3.10	A	3.91	A	3.38	AB
Scotts Turf Builder	2.83	BC	3.90	A	3.35	AB
Milorganite	2.86	B	3.92	A	3.45	A
Espoma	2.62	CD	3.54	CD	3.30	B
Bradfield	2.65	BCD	3.65	BCD	3.26	B
No fertilizer	2.52	D	3.50	D	3.31	AB

Table 5. Tissue phosphorus content (% dry weight) of turfgrass as affected by various fertilizer treatments. Treatment means within table columns containing similar letters are not statistically different from each other at the alpha=0.05 level.

Treatment	June 25		July 27		Oct 3	
	-------Tissue P Content (% dry wt.)-------					
Chickity Doo Doo	0.47	A	0.64	B	0.42	BCD
Chickity Doo Doo (1/2 rate)	0.47	A	0.71	A	0.45	A
Scotts Organic	0.48	A	0.61	B	0.41	D
Scotts Turf Builder	0.47	A	0.65	AB	0.42	BCD
Milorganite	0.47	A	0.68	AB	0.42	CD
Espoma	0.46	AB	0.68	AB	0.44	AB
Bradfield	0.44	BC	0.68	AB	0.43	AB
No fertilizer	0.43	C	0.65	AB	0.44	AB

Table 6. Tissue potassium content (% dry weight) of turfgrass as affected by various fertilizer treatments. Treatment means within table columns containing similar letters are not statistically different from each other at the alpha=0.05 level.

Treatment	June 25		July 27		Oct 3	
	-------Tissue K Content (% dry wt.)-------					
Chickity Doo Doo	3.34	AB	3.96	B	2.48	B
Chickity Doo Doo (1/2 rate)	3.17	BC	3.80	C	2.54	AB
Scotts Organic	3.40	A	3.98	B	2.54	AB
Scotts Turf Builder	3.30	AB	4.14	A	2.54	AB
Milorganite	3.33	AB	3.92	B	2.57	AB
Espoma	3.16	BC	3.87	BC	2.60	AB
Bradfield	3.05	CD	3.91	BC	2.63	A
No fertilizer	2.96	D	3.62	D	2.50	AB

Soil Properties

The effect of the fertilizers on the soil properties was an important component of this study. The results are presented in Table 7. There were no statistical differences among pH of the various treatments (results not shown). All fertilizers significantly increased the amount of organic matter in the soil after the 3 applications. Milorganite was found to increase the organic matter the greatest followed by the half rate of Chickity Doo Doo. It was expected that the full rate of Chickity Doo Doo would increase organic matter more than the half rate, and the results are likely a statistical aberration.

As expected, adding P fertilizer increase soil test P levels, with the overall increases being fairly small (55 ppm unfertilized to 65 ppm for Milorganite). Chickity Doo Doo and Milorganite increased soil P levels the greatest, followed by the Bradfield fertilizer. The Bradfield fertilizer contained the greatest N: K ratio, and therefore resulted in the largest amount of K added. Therefore, it was not surprising to find that the Bradfield treatment contained the largest amount of soil K at the study's conclusion. No statistical differences were found among any other of the treatments for soil K.

Table 7. Soil chemical properties of the various treatments. Soil samples were collected in November 2008, after three fertilizer applications.

Treatment	Organic Matter		Soil Test P		Soil Test K	
	---------%---------		------------mg/kg------------			
Chickity Doo Doo	3.50	ABC	63	A	142	B
Chickity Doo Doo (1/2 rate)	3.70	AB	59	AB	140	B
Scotts Organic	3.50	ABC	53	C	130	B
Scotts Turf Builder	3.53	ABC	55	BC	133	B
Milorganite	3.80	A	65	A	139	B
Espoma	3.45	BC	57	BC	142	B
Bradfield	3.68	ABC	61	AB	169	A
No fertilizer	3.35	C	55	BC	136	B

CONCLUSIONS

When applied at 3 lbs N/M annually, Chickity Doo Doo performed similarly to the current industry standard lawn fertilizer from Scotts in color, visual quality, growth, and tissue nutrient content. In addition, Chickity Doo Doo performed similarly to and in many cases better than other industry standard organic fertilizers tested in this trial.

Bio-Ag Huma-Cal

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Department of Horticulture

OBJECTIVES

Our objectives were to determine the benefits of Huma-Cal on the quality of putting green turf when used as part of a conventional fertility program, and to determine if fungicide rates can be reduced when Huma-Cal is used.

MATERIALS AND METHODS

The trial was located at the University of Wisconsin's OJ Noer Turfgrass Research Facility in Verona, WI. The experimental design was a randomized complete block with four replications. The treatments were a 2 x 4 factorial. Main plots were fungicide rates of none, half, three-quarters or full-label. Sub-plot treatments were with or without Huma-Cal. Iprodione fungicide (Chipco 26019®) was used for controlling dollar spot disease (*Sclerotinia homoeocarpa*) at 2 oz/M (half rate), 3 oz/M (3/4 rate) and 4 oz/M (full rate). Fungicide was applied on September 8. Dollar spot is the most consistent disease of closely mown golf turf, and can typically be counted upon to cause problems every year if left untreated. The area chosen for the trial was a mature stand of creeping bentgrass (*Agrostis stolonifera*) with minimal annual bluegrass (*Poa annua*) populations. It was mowed 5-6 days per week during the growing season and maintained at .140" using a riding greens mower with clippings removed. The root zone was sand-based and irrigation was supplied four days per week to replenish 100% of estimated evapotranspiration. Six applications of urea were applied during the growing season using 0.5 lbs nitrogen per $1000ft^2$ at each application. Urea applications, Huma-Cal applications and ratings were performed according to the schedule in Table 1. The schedule used in 2007 was again followed for 2008.

RATINGS

Turfgrass color was visually evaluated on a 1-9 scale, with 1 being brown turf, 6 being the minimally acceptable value and 9 being dark green turf. Quality was visually evaluated on a 1-9 scale, 1 being dead/thin turf, 6 being the minimally acceptable value and 9 being healthy, thick turf. Disease was visually evaluated on a percent cover basis (0-100%). Ball roll data were collected using a modified Stimpmeter, rolling three golf balls in opposite directions and then averaging the combined distances. Chlorophyll fluorescence was measured using an Opti-Sciences OS5-FL Modulated Fluorometer. Five readings were taken per experimental unit and those values were averaged to find fluorescence.

Analysis of variance (ANOVA) was used to determine if treatment differences were statistically significant. In the ANOVA results, Treatment 1 was defined as experimental units without Huma-Cal application and Treatment 2 defined as experimental units with Huma-Cal application.

RESULTS AND DISCUSSION

ANOVA showed that only main effects occasionally occurred from either the fungicide or Huma-Cal treatments but no interactions (see Appendix). In other words, the effect of fungicide rate did not depend on the presence of Huma-Cal and vice-versa. Consequently, only the main effects of either factor are shown in the tables.

Neither Huma-Cal nor fungicide treatment affected ball roll (Table 2). This is important because if ball roll was positively or negatively altered due to application of the Huma-Cal product, golf course superintendents would be cautious to implement the product into their greens maintenance plans.

The application of Huma-Cal caused a significant difference in chlorophyll fluorescence on one of the four rating dates (Table 3). On July 2 Huma-Cal applied units had a higher fluorescence reading than non-Huma-Cal applied units. Fungicide treatments of ¾ and full rate had significantly different readings on August 14 of 0.916 and 0.8973, respectively. Fungicide treatments of zero and ½ rate were similar to each other and treatments of ¾ and full rate. While these differences were statistically significant, the relatively small differences do not imply any agronomic difference. Healthy, unstressed plants typically have Fv:Fm values of approximately 0.8-0.9, stresses sufficient to affect plant performance are only associated with values less than 0.7.

Color ratings of non-Huma-Cal and Huma-Cal were similar for all rating dates (Table 4). Color ratings of the fungicide treatments differed only at the first rating date (May 21) due to slow spring green-up, and had little practical significance. Disease pressure was nonexistent for that point in the growing season.

Disease occurrence was not measureable until the fifth rating date in September, and dollar spot was the only disease of note in 2008 (Table 5). Dollar spot disease was not affected by Huma-Cal treatments on any rating dates. Disease differences among fungicide treatments differed only on August 27, with treatments of zero and ½ rates having lower dollar spot populations than treatments of ¾ and full rates. This result is the opposite of expected but was likely due to experimental error; in any case, the low amount of dollar spot disease on August 27 was agronomically inconsequential. In many years dollar spot disease starts as early as June which could have affected study results as earlier disease development allows pathogen inoculum to increase over time. There could also be an interaction with summer heat stress, potentially influenced by Huma-Cal applications, which climatic conditions did not allow observation on this year. By the time significant dollar spot disease developed in September, cooler temperatures were prevailing which favored turf growth.

Quality ratings were slightly affected by disease populations but largely dependent upon weather and growing conditions. Quality ratings differed between fungicide treatments on three dates (Table 6). Differences could be due to experimental error because there were no trends in quality ratings for those three dates and the differences usually had little practical significance. Quality ratings for fungicide treatments were above 6 (i.e., turf quality was acceptable) for most of the growing season. Quality ratings between Huma-Cal treatments differed only on one date (2 July) when the plots treated with Huma-Cal had slightly lower quality than untreated plots. While the difference was statistically significant, the difference was not agronomically significant and turf quality was still acceptable.

CONCLUSION

The application of Huma-Cal did not decrease dollar spot disease incidence when compared to non Huma-Cal experimental units. The application of Huma-Cal had no agronomic influence on ball roll, turfgrass fluorescence, color or quality. In our situation this year, Huma-Cal did not appear to be a useful addition to a putting green fertility plan or disease control plan.

Table 1. Rating and Application Schedule for Huma-Cal Trial, 2008, Madison, WI.

Date	**Activity**
April 2	Apply Huma-Cal at 6 lbs/M
May 21	Apply Urea at .5 lbs N/M Apply Huma-Cal at 12 lbs/M Rate quality, color and disease
May 23	Collect ball roll data
June 4	Rate quality, color, disease and fluorescence
June 16	Apply Urea at .5 lbs N/M
June 23	Collect ball roll data
June 30	Apply Huma-Cal at 12 lbs/M
July 2	Rate quality, color, disease and fluorescence
July 14	Collect ball roll data
July 16	Rate quality, color, disease and fluorescence Apply Urea at .5 lbs N/M
July 31	Rate quality, color, disease and fluorescence
August 4	Apply Huma-Cal at 12 lbs/M
August 12	Rate quality, color, disease and fluorescence
August 15	Apply Urea at .5 lbs N/M
August 27	Rate quality, color and disease
September 8	Fungicide application
September 15	Rate quality, color and disease Apply Urea at .5 lbs N/M
October 16	Rate quality, color and disease Apply Urea at .5 lbs N/M
October 31	Apply Huma-Cal at 20 lbs/M

Table 2. Ball roll in inches for Huma-Cal trial on creeping bentgrass, 2008, Madison, WI.

Fungicide treatment	**May 23**	**June 23**	**July 14**
None	102.9 a†	52.8 a	63.4 a
Half-rate	100.8 a	54.8 a	63.5 a
Three-quarter rate	99.6 a	54.1 a	63.0 a
Full rate	102.2 a	55.5 a	64.1 a
LSD 0.05	4.8	4.5 a	4.0 a
Huma-Cal			
without	101.8 a	54.8 a	62.8 a
with	101.0 a	53.7 a	64.2 a
LSD 0.05	2.9	1.7	3.9

† Values followed by the same letter were not statistically different at $P \leq 0.05$.

Table 3. Chlorophyll fluorescence for Huma-Cal trial on creeping bentgrass, 2008, Madison, WI.

Fungicide treatment	June 10	July 2	July 24	August 14
None	0.8127 a†	0.8373 a	0.8249 a	0.8991 ab
Half-rate	0.8065 a	0.8369 a	0.8271 a	0.9041 ab
Three-quarter rate	0.8147 a	0.8434 a	0.8323 a	0.9126 a
Full rate	0.8143 a	0.8435 a	0.8256 a	0.8973 b
LSD 0.05	0.0276	0.0135	0.0153	0.0144
Huma-Cal				
without	0.8165 a	0.8345 b	0.8262 a	0.9041 a
with	0.8076 a	0.8460 a	0.8288 a	0.9025 a
LSD 0.05	0.0324	0.0083	0.0094	0.0132

† Values followed by the same letter were not statistically different at $P \leq 0.05$.

Table 4. Color ratings for Huma-Cal trial on creeping bentgrass, 2008, Madison, WI.

Fungicide treatment	May 21	June 4	July 2	July 17	Aug 1	Aug 12	Aug 27	Sept 15	Oct 16
None	4.8 b†	5.3 a	6.6 a	6.8 a	6.3 a	6.1 a	6.8 a	6.8 a	5.5 a
Half-rate	5.1 ab	5.0 a	6.8 a	6.9 a	6.8 a	6.1 a	6.8 a	6.8 a	5.9 a
Three-quarter rate	5.2 a	4.9 a	6.4 a	6.6 a	6.8 a	6.4 a	6.6 a	6.6 a	5.8 a
Full rate	5.2 a	5.1 a	6.9 a	7.0 a	6.6 a	6.4 a	6.9 a	6.8 a	5.8 a
LSD 0.05	0.3	0.4 a	0.6	0.6	0.6	0.5	0.3	0.2	0.6
Huma-Cal									
without	5.1 a	4.9 a	6.5 a	6.7 a	6.5 a	6.1 a	6.7 a	6.8 a	5.6 a
with	5.0 a	5.2 a	6.8 a	6.9 a	6.7 a	6.4 a	6.8 a	6.7 a	5.8 a
LSD 0.05	0.1	0.6	0.5	0.5	0.4	0.4	0.4	0.1	0.2

* ns = not significant at $P \leq 0.05$.

† Values followed by the same letter were not statistically different at $P \leq 0.05$.

Table 5. Dollar spot disease percent cover ratings for Huma-Cal trial on creeping bentgrass, 2008, Madison, WI.

Fungicide treatment	August 1	August 12	August 27	September 15	October 16
None	2.3a†	2.5 a	2.9 b	9.3 a	13.9 a
Half-rate	2.4 a	2.4 a	2.8 b	7.4 a	16.6 a
Three-quarter rate	3.0 a	2.9 a	4.3 a	9.4 a	17.0 a
Full rate	3.3 a	3.6 a	4.8 a	16.8 a	17.0 a
LSD 0.05	1.1	1.3	1.4	10.2	8.8
Huma-Cal					
without	2.8 a	2.9 a	3.5 a	10.0 a	15.3 a
with	2.9 a	2.8 a	3.8 a	11.4 a	17.0 a
LSD 0.05	1.2	1.3	1.6	3.3	4.0

* ns = not significant at $P \leq 0.05$.
* Disease populations were 0.00 for all units May 21, June 4, July 2 and July 17.
† Values followed by the same letter were not statistically different at $P \leq 0.05$.

Table 6. Turfgrass quality ratings for Huma-Cal trial on creeping bentgrass, 2008, Madison, WI.

Fungicide	May 21	June 4	July 2	July 17	Aug 1	Aug 12	Aug 27	Sept 15	Oct 16
None	4.4 b†	4.2	6.3	6.3	6.3	6.1 b	6.1	4.9 ab	4.0
Half-rate	5.0 ab	4.2	6.4	6.9	6.8	6.6 a	6.1	5.0 ab	3.6
Three-quarter rate	5.2 a	4.1	6.1	6.9	6.6	6.3 b	5.9	5.3 a	3.8
Full rate	5.3 a	4.3	6.5	6.9	6.6	6.8 a	6.0	3.5 b	3.8
LSD 0.05	0.6	ns	ns	ns	ns	0.3	ns	0.6	ns
Huma-Cal									
without	4.9	4.0	6.4 a	6.7	6.5	6.3	5.9	5.1	3.8
with	5.0	4.3	6.2 b	6.8	6.6	6.6	6.1	4.8	3.8
LSD 0.05	ns	ns	0.3	ns	ns	ns	ns	ns	ns

† Values followed by the same letter were not statistically different at $P \leq 0.05$.
ns = not significant at $P \leq 0.05$.

Prairie Restoration and Invasive Species research

Golf Course Border Study

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INTRODUCTION

Currently, there are ecological concerns that since many of the most common cool-season turfgrasses are non-native and used extensively, they should be considered as invasive species. Although some turfgrasses such as Kentucky bluegrass and tall fescue are frequently a species targeted for removal during restoration projects, there is little scientific evidence to suggest the grasses were not purposefully introduced previously as a legitimate land management strategy. Twelve golf courses of various ages and locations were visited in Wisconsin and the Upper Peninsula of Michigan, with the objective of determining if the grasses used on golf courses are becoming established in adjacent natural and unmaintained areas. The null hypothesis is the grasses in the natural and unmaintained areas will be found in lesser abundance as distance from the golf course increases.

MATERIALS AND METHODS

Twelve golf courses were selected based on the criteria of age, location, and appropriate adjacent habits. Four golf courses from each region of Southern, Central, and Northern Wisconsin and within each region three course age groups where represented. Age class was defined as new course group 0-15 years, the mid-age represented courses between 25-35 years, and the old-courses were 75 years or older. Using a 100 meter measuring tape, transects of 315 feet were conducted perpendicular to the turfgrass border into adjacent natural or unmaintained areas. Bisecting the transects at distances of 9, 18, 29, 40, 79, 158, and 315 feet quadrats 9 x 19 feet were used to approximate percentages of each vegetative type using a Daubenmire cover class method (0 = none present, 1 = >0-5% coverage, 2 = >5-25% coverage, 3 = >25-50% coverage, 4 = >50-75% coverage, and 5 = >75 - 100% coverage). The groups of vegetative cover used for data classification were, Kentucky bluegrass, creeping bentgrass, fine fescue, other grasses, herbaceous dicots, woody species and other cover (bare soil ect.). Quantity of transects varied by course and were conducted at every 490 feet of surveyable border. Data were analyzed by ANOVA against the null hypothesis.

<u>Participating Golf Courses</u>
Bulls Eye Country Club – Wisconsin Rapids, WI
Chippewa Valley Golf Club – Menomonie, WI
Eagle Creek Golf Club – Hortonville, WI
Oconomowoc Golf Club – Oconomowoc, WI
Old Hickory Golf Club – Beaver Dam, WI
Peninsula Park Golf Course - WI
Timber Stone Golf Course – Iron Mountain, MI
Turtleback Golf Club – Rice Lake, WI

Trout Lake Golf Club – Arbor Vitae, WI
University Ridge Golf Course – Verona, WI
Voyager Village Country Club – Danbury, WI
Yahara Hills Golf Course– Madison, WI

RESULTS AND DISCUSSION

The amount of turfgrass cover found in areas adjacent to golf courses was minimal although occasionally sparse populations were observed. Creeping bentgrass was found in very small quantities close to the golf course border (Table 1). The populations of creepinig bentgrass were most likely the result of deposition of divots or aeration cores and not natural dispersal. Kentucky bluegrass was found in low quantities regardless of the distance from areas of maintained golf course turf (Table 1). The Kentucky bluegrass observed was often located in areas with adequate sunshine, such as maintenance paths or grassland areas. Similar to creeping bentgrass the presence of Kentucky bluegrass in areas such as maintenance paths was also likely the result of disposing of unused sod and not due to natural processes. Data indicate golf courses do not appear to be serving as a source for invasive populations of turfgrass into adjacent habitats. Proper management of turfgrass clippings and waste should greatly decrease potential establishment of turfgrasses in areas not maintained for turf.

Table 1. Mean percent cover of a turfgrass species within a 6 x 19' quadrat at various distances from maintained turf boundary at three of the twelve Wisconsin golf courses surveyed. Golf courses were a minimum of 25 years of age. Values of <5% indicate quantities were present in abundance greater than 0%.

Grass	**Distance (ft)**	**9**	**18**	**29**	**40**	**79**	**158**	**315**
Creeping bentgrass	mean % cover	<5%	<5%	<5%	<5%	0%	0%	0%
	SE	.03	.01	.03	.02	0.0	0.0	0.0
Kentucky bluegrass	mean % cover	<5%	<5%	<5%	<5%	<5%	<5%	<5%
	SE	.19	.14	.14	.11	.09	.12	.01

Turfgrass Plant and Seed Fate in Restored Prairies

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INTRODUCTION

Restoration of the natural areas has become to be viewed as a priority and environmental responsibility of many individuals and organizations in Wisconsin. There have been estimates of over 13 million acres in Wisconsin that require restoration or have a need for conservation. The removal of non-native species is a major focus of restoration, especially in restored prairies. Often many non-native species are considered to be invasive if they are present and prove difficult to control. Many cool-season turfgrasses, such as tall fescue, Kentucky bluegrass, and Canada bluegrass, have been used extensively for agricultural purposes and are now designated to be invasive species in areas which they were formerly cultivated. The successful control and removal of turfgrasses in restored areas of former agriculture varies. Within restored prairies the question remains unclear if cool-season turfgrasses pose a risk of establishing sustainable populations in areas in which they were not established previously. Two studies were conducted with the objective of the turfgrass colony study was to determine the competitive abilities of 10 common cool-season turfgrasses species within two restored prairies in Wisconsin. The null hypothesis is all turfgrasses will be equally competitive under these conditions. The objective of the seed survival study was to compare the seed survival of cool-season turfgrasses with those of native grass species. The null hypothesis was all grass seeds will have equal survival rates.

MATERIALS AND METHODS

Turfgrass colonies were established and maintained in 1.5 x 5" conetainers starting in June of 2006 at the West Madison Agricultural Research Station greenhouse. Species established included creeping bentgrass, colonial bentgrass, velvet bentgrass, perennial ryegrass, tall fescue, creeping red fescue, Chewing's fescue, rough bluegrass, Canada bluegrass and two cultivars of Kentucky bluegrass, "Touch down and Ken blue". The studies were conducted at two restored prairie locations at Monroe Country Club in Monroe and Greenwood Hills Country Club in Wausau, Wisconsin. The turfgrass colonies were transplanted with approximately eight feet spacing in a randomized complete block design consisting of five replications. To reduce herbivore damage protective cages were place over the colonies in the fall and removed in the spring. Colony diameters were measured during the growing season.

Seeds of tall fescue, creeping bentgrass, rough bluegrass, Canada bluegrass, and two cultivars of Kentucky bluegrass were used to represent the cool season turfgrasses. Virginia wild rye, big bluestem, and switchgrass were used for comparison as native grass species. 100 seeds of a species were mixed with autoclaved soil and sealed in a nylon mesh bag. Bags were buried beneath a light barrier in a randomized complete block design of five replications 2.5 inches under the soil surface. Six sets of experimental units were buried for extraction at 6, 12, 24, 36, 48, and 60 months. Viability tests to determine proportions of dead, germinated, and dormant seeds were conducted after each extraction period expires and seed had been separated form the soil. Tests were conducted by the Wisconsin Crop Improvement Association on the University of Wisconsin-Madison campus using the Association of Official Seed Analysts testing procedures.

RESULTS AND DISSCUSSION

The turfgrass colonies at the Monroe location suffered severe damage from herbivores and as of October 2008 only six of the 55 original colonies still had measurable verdure (data not shown). The colonies survival at the Wausau location was much greater, although herbivore damage remained influential on growth. Seven of the colony types, including creeping bentgrass (Table 1), both Kentucky bluegrasses (Table 1) and tall fescue, had a decrease in mean colony diameter. Creeping red fescue (Table 1), Chewing's fescue, velvet bentgrass, and colonial bentgrass had an increase in the mean colony diameter of replicates. Many of the turfgrasses appeared to be preferable forage of the local animal population. This relationship indicates the both the difficulty of establishing an accidental or invasive population and also a possible benefiting food source to local animal populations.

The viability of all of the seed species decreased greatly during the first six months of the study. The native species and tall fescue had a viability rate of less than 2% after 22 months (data not shown). Although there was an anomaly of very low viability for the six month results, following 22 months in the soil creeping bentgrass had the highest proportion of viable seeds (Table 2). The cultivars of Kentucky bluegrass also had 18 percent viability rate following the 22 month extraction (Table 2). The advantage of dormant survival increases a species ability to persevere until conditions become favorable. Turfgrass seeds ability to persist for long than native species in the soil seed bank could explain difficulties in removing turfgrasses from former agriculture systems.

Figure 1. Change in mean turfgrass colony diameter in two Wisconsin Prairies.

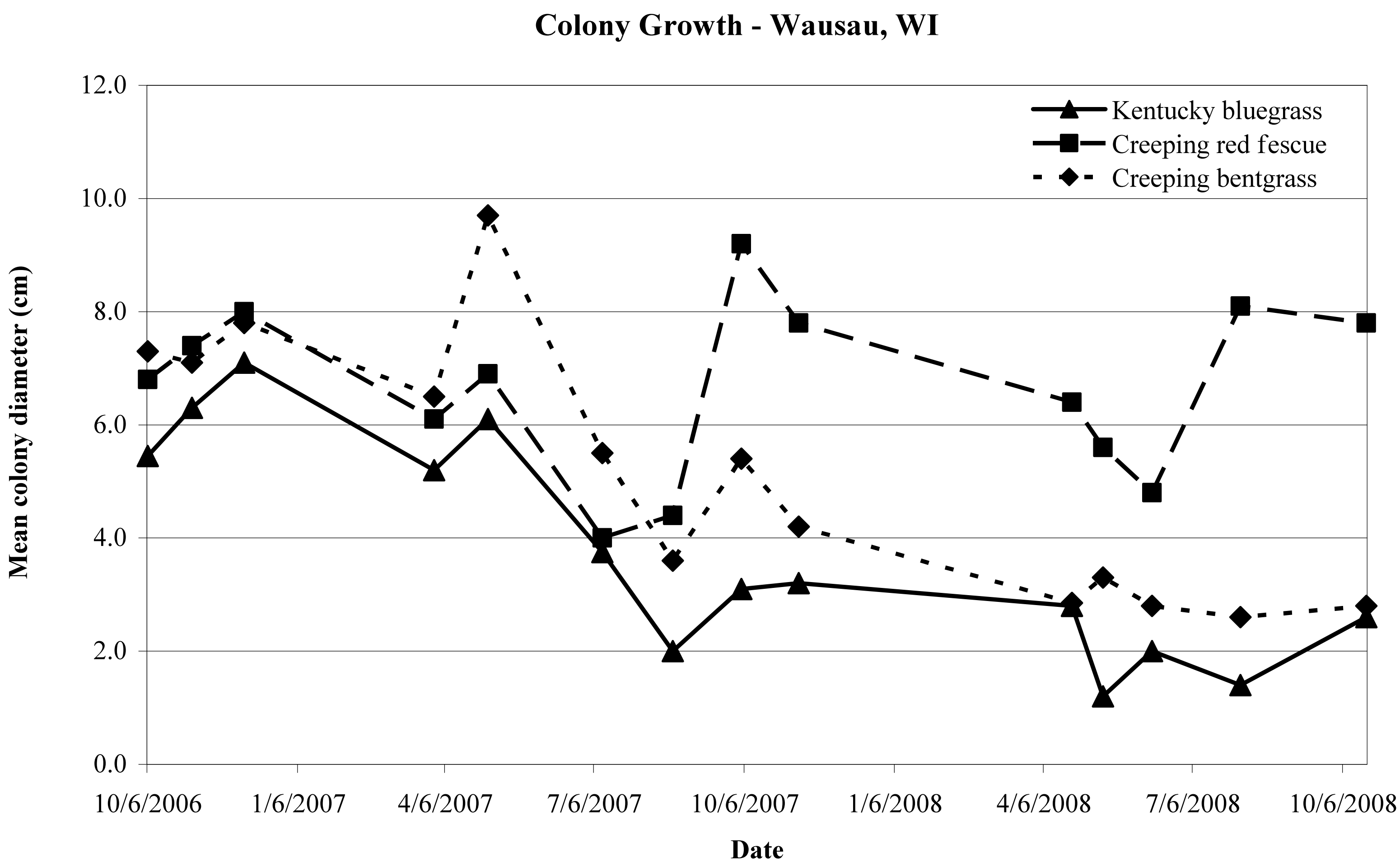
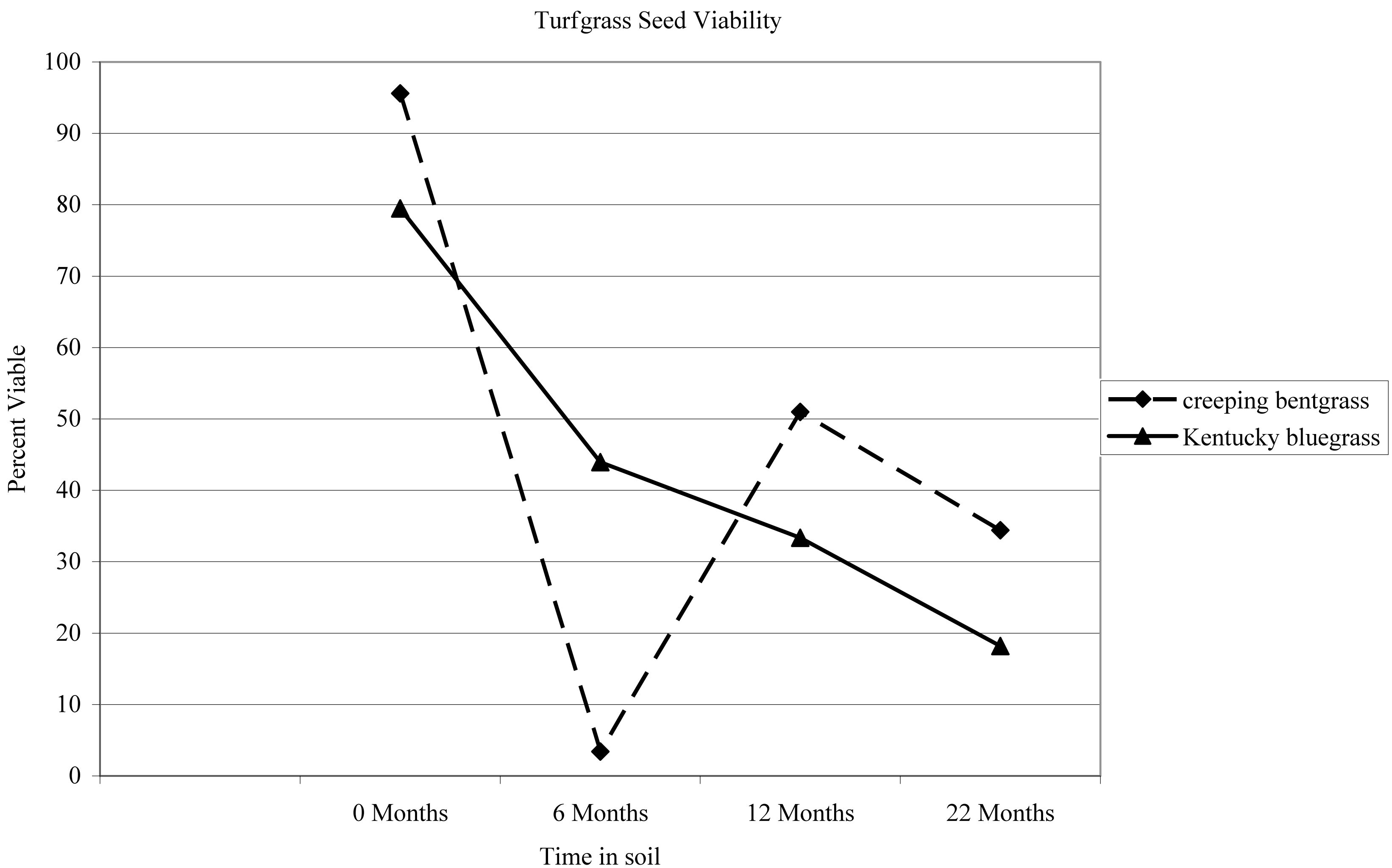


Figure 2. Change in viability of turfgrass seeds buried in two Wisconsin prairies



Herbicide trials

Mesotrione: Bentgrass Removal with Tenacity®

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OBJECTIVES

The objectives of this trial were to determine the efficacy of mesotrione on the removal of creeping bentgrass (*Agrostis stolonifera*) and to measure any associated turfgrass phytotoxicity. This is important because creeping bentgrass often appears in home lawns and sports fields. Because of its differing color, texture and growth habit from desirable turfgrasses, it is necessary to develop a chemical method of removal.

MATERIALS AND METHODS

This trial was conducted at the University of Wisconsin-Madison's O.J. Noer Turfgrass Research Facility in Verona, WI. The 3' by 5' experimental units were set up in a randomized-complete-block design with four replications. This relatively small size was sufficient because of our method of bentgrass distribution. Bentgrass plugs were taken, using a standard golf course cup cutter, from a mature stand of creeping bentgrass with minimal *Poa annua* infestation. Six plugs of home lawn type turf were removed from each experimental unit and replaced with the bentgrass plugs according to the spacing in Figure 1. This was performed approximately one month prior to the first application to allow the plugs of bentgrass to acclimate. The plot in which this trial was placed was a mature stand of Kentucky bluegrass and perennial ryegrass, soil type silt loam with pH approximately 7.6. Broadleaf weeds such as clovers and dandelions were evenly distributed across the plot because only irrigation and fertility have been managed in the past. Throughout the course of this trial, irrigation was applied twice per week to replace 100% evapotranspiration (ET). The plot was irrigated four times per week at 100% ET during grow-in of the bentgrass plugs. Mowing occurred three times weekly at 1.5," using a riding reel mower. Application dates varied by treatment (Table 1). Treatments were applied using a CO_2 powered backpack sprayer at 40psi, using TeeJet XR8004VS nozzles, in water equivalent to 1 gallon per 1000 square feet.

RATINGS AND STATISTICAL ANALYSIS

Bentgrass removal was rated visually at 2, 4, 6, 8, 12, 16 and 20 weeks after initial treatment (WAIT). Quantification of bentgrass removal was determined as the percent of bentgrass remaining in the six transplanted plugs. Therefore, control plots were rated 100% bentgrass cover initially. After a few months, the control plots began to rate above 100% (the bentgrass plugs were expanding). Desired turfgrass phytotoxicity was rated visually at 2, 4, 8 and 12 weeks after initial treatment. This was on a 1-9 scale, with 1 being no phytotoxicity and 9 being dead turf.

Data were analyzed using one-way ANOVA. Tukey's non-additivity tests were conducted to check for potential need of data transformation prior to ANOVA.

RESULTS AND DISCUSSION

All treatments provided 100% bentgrass removal by 12WAIT (Table 2). Prior to the fourth round of applications, all treatments had 100% removal. A fourth round of applications was unnecessary (but still applied) for the rates in this protocol. Both the low and high rates of Tenacity provided complete removal of bentgrass

Measureable turfgrass phytotoxicity was only observed 2WAIT and 4WAIT (Table 3). Phytotoxicity was never above unacceptable levels for all treatments. Turfgrass phytotoxicity was most evident after the first application and less after the second application possibly because of desirable turfgrass increasing tolerance or weather patterns.

Bentgrass populations in the control units increased throughout the trial by 10-20%. This shows that our bentgrass transplant method was successful and did not contribute to any decrease in bentgrass populations in the experimental units.

CONCLUSIONS

All Tenacity (mesotrione) treatments had equally sufficient bentgrass removal prior to the fourth application, suggesting that the rates could be reduced or the application interval increased to avoid phytotoxicity while still providing a commercially acceptable rate of control. Three applications of all treatments provided equivalent bentgrass removal by 4-6WAIT, leaving the option open to eliminate the last application of Tenacity.

For future Tenacity trials, we would suggest rating other broadleaf weed populations in addition to bentgrass populations. Trends in dandelion populations were seen but not sufficiently documented because the effects were not noticed until near the end of the trial.

Table 1. Bentgrass removal treatments for mesotrione formulations, 2008, Madison, WI.

Trt. #	Treatment Product	Rate (fl oz/A)	Application Date(s)
1	Control	----	----
2	Tenacity®	4.0	June 2, June 23, July 14
3	Tenacity	5.0	June 2, June 23, July 14
4	Tenacity	4.0	June 2, June 23, July 14, Aug. 4

* All treatments included Activator 90 at 0.25%v/v.

Diagram 1: Bentgrass Removal Plot Layout

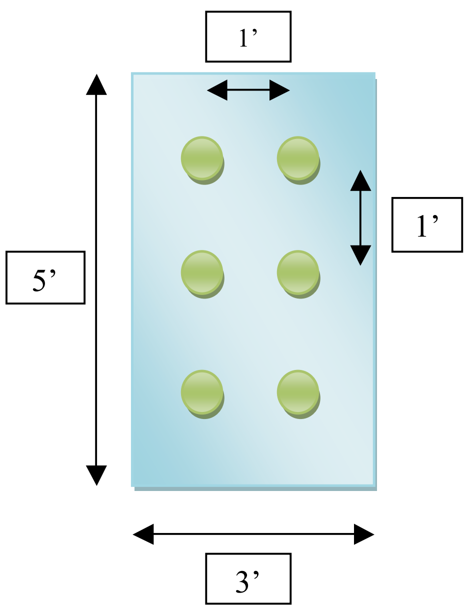

Table 2. Percent bentgrass living for bentgrass removal trial, 2008, Madison, WI.

Treatment	**June 16 2WAIT**	**June 30 4WAIT**	**July 14 6WAIT**	**July 28 8WAIT**	**Aug 25 12WAIT**	**Sept 22 16WAIT**	**Oct 20 20WAIT**
1	100.0 a†	100.0 a	100.0 a	110.0 a	116.25 a	120.0 a	117.5 a
2	16.25 b	6.50 b	3.25 b	0.50 b	0.0 b	0.0 b	0.0 b
3	10.00 b	3.25 b	1.50 b	0.25 b	0.0 b	0.0 b	0.0 b
4	13.75 b	1.00 b	0.0 b	0.0 b	0.0 b	0.0 b	0.0 b
LSD .05	13.49	6.17	4.47	6.96	6.29	5.93	8.03

† Values followed by the same letter were not statistically different at $P \leq 0.05$.

* WAIT = weeks after initial treatment.

Table 3. Turfgrass Phytotoxicity for bentgrass removal trial, 2008, Madison, WI.

Treatment	**June 16 2WAIT**	**June 30 4WAIT**	**July 28 8WAIT**	**August 25 12WAIT**
1	1.00	1.00	1.00	1.00
2	1.00	1.00	1.00	1.00
3	1.25	1.50	1.00	1.00
4	1.25	1.25	1.00	1.00
LSD 0.5	ns	ns	ns	ns

* ns = not significant at *P*=0.05.

* WAIT = weeks after initial treatment.

Reducing *Poa annua* Populations in Creeping Bentgrass Fairways with Cutless and Legacy

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OBJECTIVE

The purpose of the trial was to determine *Poa annua* population reduction in creeping bentgrass fairways in Wisconsin following applications of Cutless® 50W and Legacy® 1.52MEC.

MATERIALS AND METHODS

The trial was conducted at the University of Wisconsin-Madison's O.J. Noer Turfgrass Research Facility in Verona, WI. The experimental units were arranged as a randomized-complete-block design with four replications. Each experimental unit was 5' by 10'. This trial was conducted on a mature, mixed stand of creeping bentgrass (*Agrostis stolonifera*) and annual bluegrass (*Poa annua*). The soil type was a silt loam with pH of approximately 7.6. Irrigation was applied four times per week at 80% evapotranspiration replacement. The plot was mown at .500" three times per week using a John Deere® fairway mower. The plot received 4lbs N/M over four applications of 1lb N/M in April, June, August and November. Two dollar spot (*Sclerotinia homoeocarpa*) control treatments were applied: July 16 using chlorophenoxy and chlorothalonil at 0.9 and 3.0 oz/M, respectively; August 29 using propiconazole and chlorothalonil at 0.9 and 2.75 oz/M, respectively. The initial *Poa annua* control application was applied on June 3, with sequential applications at three week intervals. The last application was applied on October 9. Treatments were applied using a CO_2 -powered backpack sprayer operated at 40psi using TeeJet XR8004VS nozzles in the equivalent to 2 gallons water per 1000 square feet. Irrigation was applied within 24 hours after each application.

RATINGS AND STATISTICAL ANALYSIS

Bentgrass injury, bentgrass quality and percent *Poa annua* population were visually evaluated on two week intervals beginning after the first application of treatments. Bentgrass injury was rated on a 0-10 scale, with 0 being no injury, 3 being the highest acceptable value and 10 being completely dead bentgrass. Bentgrass quality was rated on a 0-9 scale, with 0 being poor quality, 6 being the lowest acceptable value and 9 being excellent quality. *Poa annua* population was rated on a percent ground cover basis.

Data were analyzed using one-way ANOVA. Tukey's non-additivity tests were conducted to check for potential need of data transformation prior to ANOVA. Means separations were evaluated at $\alpha=0.05$ using Tukey's HSD pairwise-comparisons.

For future trials, in addition to evaluating the above parameters, an overall turf quality rating should be collected.

RESULTS AND DISCUSSION

Bentgrass damage occurred on nine of eleven rating dates but commercially unacceptable levels of bentgrass phytotoxicity occurred on five of the eleven rating dates. Shortly after treatment initiation, the Legacy and middle rate of Cutless treatments caused phytotoxicity levels of 3.3 and 3.0, respectively. At the end of the growing season, all three rates of Cutless had bentgrass phytotoxicity above 3.0 on October 21 and November 5. On these dates, increasing the rate increased the bentgrass phytotoxicity. Commercially acceptable levels of bentgrass phytotoxicity varied across treatments and dates.

Differences in bentgrass quality were not statistically significant until the fall ratings of September 23, October 9, 21 and November 5 (Table 3). The Primo and Legacy treatments had higher bentgrass quality than the control and the high rate of Cutless had lower bentgrass quality than the control. Commercially unacceptable bentgrass quality (<6.0) was observed on all rating dates. Treatments causing unacceptable ratings varied across dates with the Cutless treatments ranging from 4.0 to 6.0, depending on the rate.

Poa annua populations were reduced by all treatments by the end of the growing season. Statistically lower populations of *Poa annua* were first reached by the high rate of Cutless (July 15) and were sustained throughout most of the season (Table 4). The middle rate of Cutless was the second treatment to reach statistically lower *Poa annua* populations than the control (July 29), followed third by the low rate of Cutless (August 11). After October 9 all treatments sustained lower *Poa annua* populations than the control.

CONCLUSIONS

Because all rates of Cutless reduced *Poa annua* populations more than the control, the low rate of 8.0 fl oz/A is sufficient when applied at three week intervals throughout the growing season. By using the lowest rate of Cutless, bentgrass phytotoxicity is avoided and acceptable levels of bentgrass quality are sustained while reducing *Poa annua* populations. The Legacy 1.52MEC and Primo Maxx treatments also both reduced *Poa annua* populations by the end of the season and were not associated with bentgrass damage. Cutless applications should begin in late May or early June and cease in early October to further reduce the possibility of bentgrass damage.

Table 1. Cutless and Legacy *Poa annua* population reduction treatments, 2008, Madison, WI.

Treatment	**Product**	**Rate (fl oz/A)**
1	Legacy 1.52MEC	14.0
3	Cutless 50W	8.0
4	Cutless 50W	12.0
5	Cutless 50W	16.0
6	Primo Maxx	12.0
7	Untreated control	----

Treatment 2 was not used due to a misprint in the protocol.

Table 2. Cutless and Legacy *Poa annua* population reduction trial, bentgrass injury ratings (0-10 scale), 2008, Madison, WI.

Trt. #	**June 17**	**July 1**	**July 15**	**July 29**	**Aug 11**	**Aug 26**	**Sept 10**	**Sept 23**	**Oct 9**	**Oct 21**	**Nov 5**
1	3.3a†	1.5	1.8a	1.3b	2.0a	1.8	1.5ab	2.3a	2.0b	1.8b	1.3b
3	1.3ab	0.5	1.5ab	1.5ab	1.3ab	1.8	1.3ab	1.8a	3.0ab	3.5a	3.3a
4	2.3a	1.3	3.0a	2.3a	2.0a	2.0	2.0a	1.8a	2.5ab	3.8a	3.5a
5	1.5ab	0.5	2.5a	2.0ab	1.8ab	1.3	2.0a	2.8a	3.8a	4.5a	4.0a
6	2.5a	1.3	1.8a	2.3a	2.3a	2.3	2.0a	2.3a	1.5bc	1.3bc	0.5bc
7	0.0b	0.0	0.0b	0.0c	0.3b	0.3	0.0b	0.0b	0.0c	0.0c	0.0c
LSD 0.05	2.1	ns	1.7	1.0	1.7	ns	1.6	1.4	1.6	1.5	1.0

† Values followed by the same letter are not statistically different at $P \leq 0.05$.

ns = not significant at $P \leq 0.5$.

Table 3. Cutless and Legacy *Poa annua* population reduction trial, bentgrass quality ratings (0-9 scale), 2008, Madison, WI.

Trt. #	June 17	July 1	July 15	July 29	Aug 11	Aug 26	Sept 10	Sept 23	Oct 9	Oct 21	Nov 5
1	5.8	7.0	6.8	6.0b†	6.5	6.0	5.8	7.0a	6.3ab	7.3ab	6.3ab
3	6.0	5.8	5.8	6.0b	6.3	5.8	5.5	6.5ab	6.0abc	5.3cd	5.0cd
4	6.0	6.0	5.8	5.5b	5.8	6.0	5.5	6.3ab	5.8bc	5.5cd	5.0cd
5	5.8	5.8	5.8	5.8b	6.0	6.3	5.3	5.5b	4.5c	4.3d	4.0d
6	5.5	6.5	6.8	5.5b	6.0	6.0	5.8	7.0a	7.5a	8.0a	7.0a
7	6.3	6.3	6.5	7.0a	6.3	6.3	6.3	5.8b	6.0abc	6.0bc	5.3bc
LSD 0.05	ns	ns	ns	0.9	ns	ns	ns	1.1	1.6	1.3	1.2

† Values followed by the same letter were not statistically different at $P \leq 0.05$.
ns = not significant at $P \leq 0.5$.

Table 4. *Poa annua* population percentages for Cutless and Legacy *Poa annua* population reduction trial, 2008, Madison, WI.

Trt. #	June 3	June 17	July 1	July 15	July 29	Aug 11	Aug 26	Sept 10	Sept 23	Oct 9	Oct 21	Nov 5
1	37.5	32.5	27.5	22.5ab†	22.5ab	22.5ab	21.3	18.8	14.5b	13.0b	10.5b	11.3b
3	36.3	36.3	32.5	21.3ab	15.0ab	16.3b	13.8	12.5	13.8b	15.0b	13.8b	14.5b
4	47.5	41.3	33.8	18.8ab	13.8b	13.8b	17.5	18.8	16.3ab	16.0b	15.0b	15.0b
5	35.0	32.5	28.8	13.8b	10.0b	11.3b	15.0	15.0	15.0ab	13.8b	13.0b	11.3b
6	43.8	38.8	30.0	26.3a	18.8ab	16.3b	15.0	12.0	10.0b	10.0b	10.0b	10.8b
7	31.3	28.8	33.8	28.8a	31.3a	33.8a	25.5	26.3	28.8a	31.3a	35.0a	37.5a
LSD 0.05	ns	ns	ns	11.7	16.9	13.1	ns	ns	13.8	12.3	11.4	12.5

† Values followed by the same letter are not statistically different at $P \leq 0.05$.
ns = not significant at $P \leq 0.5$.

Dimension® 2EW for Preemergent Crabgrass Control

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OBJECTIVE

The purpose of this trial was to determine the efficacy of split applications of Dimension® for crabgrass control.

MATERIALS AND METHODS

The trial was conducted at the University of Wisconsin-Madison's O.J. Noer Turfgrass Research Facility in Verona, WI. The experimental units were arranged as a randomized-complete-block design with three replications. Each experimental unit was 5' by 5'. This trial was conducted on a mature stand of Kentucky bluegrass (*Poa pratensis*) and perennial ryegrass (*Lolium perenne*) with a history of crabgrass (*Digitaria sanguinalis*) infestation. The soil type was a silt loam with pH of approximately 7.6. In April the plot was slit-seeded with crabgrass to help increase the crabgrass population. During grow-in the plot was irrigated to keep the soil moist and was cut at 1.5". After the application of treatments, the plot was cut at 2.5" twice per week using a Toro riding rotary mower and irrigated only to prevent turf loss. Treatments were applied at three different growth stages, 30 days prior to crabgrass germination, at crabgrass germination and 6-8 weeks after crabgrass germination. Corresponding application dates were April 22, May 22 and July 12. Application timings were labeled A, B and C, respectively. Treatments were applied using a CO_2 -powered backpack sprayer operated at 40psi using TeeJet XR8004VS nozzles in the equivalent to 2.5 gallons water per 1000 square feet.

RATINGS AND STATISTICAL ANALYSIS

Crabgrass control was visually rated on a percent ground cover basis. Data were collected at 4, 8 and 12 weeks after each treatment (WATA, WATB or WATC). Turfgrass phytotoxicity was noted on occurrence.

Data were analyzed using one-way ANOVA. Tukey's non-additivity tests were conducted to check for potential need of data transformation prior to ANOVA.

RESULTS AND DISCUSSION

Application timing A did not show differences in crabgrass populations between non-split and split application treatments but all treatments had lower crabgrass populations than the control (Table 2). At 4 and 8WAT, analysis was unavailable due to absence of crabgrass populations in control plots. At 12WAT rates of Dimension® and Barricade® did not cause differences between treatments. This unexpected non-difference between 0.25, 0.38 and 0.50 lb ai/A rates of Dimension® and 0.50 0.75 lb ai/A rates of Barricade® could be due to experimental error because of the very low populations of crabgrass. The 2008 spring in Madison was wet and cold, causing unfavorable conditions for crabgrass growth and development.

Application timing B did not show differences in crabgrass populations between rates until 12WAT. At 4WAT, analysis was unavailable due to absence of crabgrass populations in the control plots. At 8WAT, the error mean squares was too small to continue analysis. At 12WAT, all treatments had better crabgrass suppression than the control but the split low rate of Dimension® had higher crabgrass populations than all other treatments. Compared to the control, the split low rate of Dimension had approximately 50% crabgrass control while all other treatments had at least 80% crabgrass control.

Treatments which had the full rate split into three applications (C) all had lower crabgrass populations than the control. At 4WAT all treatments had lower crabgrass populations than the control with all treatments having at least 80% control. At 8 and 12WAT the low rate of Dimension had better crabgrass suppression than the control but had significantly lower suppression than all other treatments. By 12WAT the middle rate of Dimension also had lower suppression than the other treatments but not the control.

CONCLUSIONS

Although the spring of 2008 in Madison, WI hindered much of the early data collection effort, treatment differences were still evident. For early season application (timing A), both split and non-split rates of Dimension and Barricade controlled crabgrass populations. When applications are split once (timing B) and twice (timing C), the low rate of Dimension provided the least amount of crabgrass control. When splitting herbicide rates into two or three applications, higher split rates of Dimension or Barricade provided the best preemergent crabgrass control.

Table 1. Treatment descriptions for Dimension® 2EW preemergent crabgrass control trial, 2008, Madison, WI.

Treatment #	Product	Rate (lb ai/A)	Application Date(s)‡
1	Dimension® 2EW	0.25	A
2	Dimension® 2EW	0.125	AB
3	Dimension® 2EW	0.083	ABC
4	Dimension® 2EW	0.38	A
5	Dimension® 2EW	0.18	AB
6	Dimension® 2EW	0.125	ABC
7	Dimension® 2EW	0.50	A
8	Dimension® 2EW	0.25	AB
9	Dimension® 2EW	0.167	ABC
10	Barricade® 65WG	0.50	A
11	Barricade® 65WG	0.25	AB
12	Barricade® 65WG	0.167	ABC
13	Barricade® 65WG	0.75	A
14	Barricade® 65WG	0.38	AB
15	Barricade® 65WG	0.25	ABC
16	Untreated control	Not applicable	----

‡ A=April 22, B=May 22, C=July 12

Table 2. Efficacy trial of split Dimension applications for crabgrass control, preemergence application timing (A), 2008, Madison, WI.

Treatment #	**May 20 4WAT‡**	**June 17 8WAT**	**July 15 12WAT**
	-----------% control of crabgrass-----------		
1	Not sufficient data for computation	Not sufficient data for computation	100.0 b†
2			100.0 b
3			100.0 b
4			100.0 b
5			100.0 b
6			100.0 b
7			83.3 b
8			100.0 b
9			100.0 b
10			100.0 b
11			100.0 b
12			100.0 b
13			100.0 b
14			100.0 b
15			100.0 b
16			0.0 a
LSD .05	ns	ns	22.0

† Values followed by the same letter were not statistically different at $P \leq 0.05$.

ns = not significant at $P \leq 0.05$.

‡ WAT = weeks after treatment.

Table 3. Efficacy trial of split Dimension applications for crabgrass control, at germination timing (B), 2008, Madison, WI.

Treatment #	June 17 4WAT‡	July 15 8WAT	August 14 12WAT
	---------% control of crabgrass---------		
2	Not sufficient data for computation	Error mean square is too small	49.0 b
3			85.7 a
5			82.3 a
6			89.0 a
8			89.0 a
9			85.7 a
11			81.0 a
12			92.3 a
14			89.0 a
15			91.0 a
16			0.0 c
LSD .05	ns	ns	28.9

† Values followed by the same letter were not statistically different at $P \leq 0.05$.

ns = not significant at $P \leq 0.05$.

‡ WAT = weeks after treatment.

Table 4. Efficacy trial of split Dimension applications for crabgrass control, post germination application timing (C), 2008, Madison, WI.

Treatment #	August 7 4WAT‡	September 8 8WAT	October 3 12WAT
	---------% control of crabgrass---------		
3	85.0 a†	54.7 b	69.3 b
6	89.0 a	87.0 a	87.7 ab
9	88.3 a	88.3 a	96.7 a
12	89.0 a	95.0 a	98.0 a
15	81.7 a	88.3 a	92.7 a
16	0.0 b	0.0 c	0.0 c
LSD .05	15.7	25.5	21.2

† Values followed by the same letter were not statistically different at $P \leq 0.05$.

‡ WAT = weeks after treatment.

Dimension® 2EW and Barricade® 65WG for Postemergent Crabgrass Control

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OBJECTIVES

The purpose of this trial was to compare application timings of Dimension® 2EW and Barricade® 65WG for early postemergent crabgrass control.

MATERIALS AND METHODS

The trial was conducted at the University of Wisconsin-Madison's O.J. Noer Turfgrass Research Facility in Verona, WI. The experimental units were arranged as a randomized-complete-block design with four replications. Each experimental unit was 5' by 10'. This trial was conducted on a mature stand of Kentucky bluegrass (*Poa pratensis*) and perennial ryegrass (*Lolium perenne*) with a history of crabgrass (*Digitaria sanguinalis*) infestation. The soil type was a silt loam with pH of approximately 7.6. In April the plot was slit-seeded with crabgrass to help increase the crabgrass population. During grow-in the plot was irrigated to keep the soil moist and was mown at 1.5". After the application of treatments, the plot was mown at 2.5" twice per week using a Toro® riding rotary mower and irrigated only to prevent turf loss. Treatments were applied at three different growth stages, 1-2 leaves per plant, 1 tiller per plant and 2-3 tillers per plant. Corresponding application dates were June 9, July 15 and September 3. Application timings were labeled A, B and C, respectively. Treatments were applied using a CO_2 -powered backpack sprayer operated at 40psi using TeeJet XR8004VS nozzles in the equivalent to 2 gallons water per 1000 square feet. Irrigation was applied 24 hours after each application.

RATINGS AND STATISTICAL ANALYSIS

Crabgrass control was visually rated on a percent ground cover basis. Data were collected at 4, 8 and 12 weeks after each treatment (WATA, WATB or WATC). Turfgrass phytotoxicity was noted on occurrence.

Data were analyzed using one-way ANOVA. Tukey's non-additivity tests were conducted to check for potential need of data transformation prior to ANOVA. Data were converted to percent control compared to the untreated prior to analysis.

RESULTS AND DISCUSSION

Application timing A (1-2 leaf stage) was applied on June 9 because the wet and cold spring of Madison, WI slowed the development of crabgrass populations. Application timing A had the highest control of crabgrass populations relative to the untreated and was also the only application timing with significant control differences between the treatments and the untreated. For application timing A, both Dimension 2EW and Barricade 65WG controlled crabgrass better than the untreated at 8 and 12WAT (Table 2). Dimension 2EW reached 85% control and Barricade 65WG reached 76% control, both at 12WAT.

Application timing B (1 tiller stage) could not be applied until July 15, resulting in two of three rating dates occurring before frost killed all crabgrass plants. At 4 and 8WAT both Dimension 2EW and Barricade 65WG controlled crabgrass but statistically not more than the untreated. Percent control of Dimension 2EW reached 45% and Barricade 65WG reached 30%, both at 8WAT.

Application of timing C (2-3 tiller stage) was also delayed because of 2008 Madison, WI weather conditions and could not be applied until September 3. An initial crabgrass population rating was collected at this point to supplement the data in anticipation of cold weather interfering with future data collections. Initial crabgrass populations did not differ between the treatments and the untreated. Both treatments did not have significantly better crabgrass control than the untreated at 4WAT. Dimension 2EW had 25% control and Barricade 65WG had 12% control.

No measureable turfgrass phytotoxicity was present at all rating dates for all treatments.

CONCLUSIONS

Application timing A had the highest percent postemergent crabgrass control for both Dimension 2EW and Barricade 65WG, controlling crabgrass populations by 85% and 76%, respectively. Application timings B and C did control crabgrass but not to the extent of application timing A. For a northern climate such as Madison, WI all ratings were not able to be collected due to frost kill but the overall trend of crabgrass control (timing A > timing B > timing C) was still evident. To reach commercially acceptable levels of crabgrass control, early postemergent application of Dimension 2EW or Barricade 65WG had the best results.

Table 1. Treatment descriptions for Dimension® 2EW and Barricade® 65WG postemergent crabgrass control trial, 2008, Madison, WI.

Treatment #	**Product**	**Rate (lb ai/A)**	**Application Date**
1	Dimension® 2EW	0.38	June 9
2	Barricade® 65WG	0.75	June 9
3	Dimension® 2EW	0.38	July 15
4	Barricade® 65WG	0.75	July 15
5	Dimension® 2EW	0.38	September 3
6	Barricade® 65WG	0.75	September 3
7	Untreated control	Not applicable	----

Table 2. Application timing A results for Dimension® 2EW and Barricade® 65WG postemergent crabgrass control trial, 2008, Madison, WI.

Treatment	**July 7** **4WAT‡**	**August 4** **8WAT**	**September 2** **12WAT**
	------------------------% control of crabgrass------------------------		
1	57.5	73.0 a	85.3 a
2	50.0	49.0 a	76.0 a
7	0.0	0.0 b	0.0 b
LSD .05	ns	45.0	33.3

† Values followed by the same letter were not statistically different at $P \leq 0.05$.

ns = not significant at $P \leq 0.05$.

‡ WAT = weeks after treatment.

Table 3. Application timing B results for Dimension® 2EW and Barricade® 65WG postemergent crabgrass control trial, 2008, Madison, WI.

Treatment	**August 12** **4WAT‡**	**September 9** **8WAT**	**October 9±** **12WAT**
	------------------------% control of crabgrass------------------------		
3	36.8	45.0	0.0
4	11.8	30.3	0.0
7	0.0	0.0	0.0
LSD .05	ns	ns	ns

ns = not significant at $P \leq 0.05$.

‡ WAT = weeks after treatment.

± Not measureable due to frost kill.

Table 4. Application timing C results for Dimension® 2EW and Barricade® 65WG postemergent crabgrass control trial, 2008, Madison, WI.

Treatment	**September 9 (initial)**	**October 1 4WAT‡**	**October 30± 8WAT**
	% crabgrass cover	------------% control of crabgrass------------	
5	11.3	25.0	25.0
6	15.0	12.5	12.5
7	22.5	0.0	0.0
LSD .05	ns	ns	ns

± Data same as Oct. 1 due to frost kill.

ns = not significant at $P \leq 0.05$.

‡ WAT = weeks after treatment.

Sedge Control and Cool-Season Turfgrass Tolerance with Dismiss

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OBJECTIVE

The objective of this study is to determine post-emergence control of sedges and to confirm cool-season turfgrass tolerance.

MATERIALS AND METHODS

The Dismiss nutsedge control study is located at the O.J. Noer Turfgrass Facility in Verona, WI. The trial is being conducted on a plot that has a history of nutsedge infestation. Soil type is a silt loam with pH of approximately 7.5. The plot was tilled in late April and left fallow until early June. The plot was lightly raked and slit-seeded with Madison Parks Seed Mix (Kentucky bluegrass, perennial ryegrass, and fine fescues) on 10 June 2008. Nutsedge was already growing in the plot and was left undisturbed as possible during the seeding process. Over the next two weeks the plot was irrigated 4 times per day, 3 minutes per event. Mowing began 1 July at 2.5" twice per week. The first treatments were applied on 7 July, followed by the 4WAIT application on 5 August. Both treatments were applied using a CO_2 powered backpack sprayer at 40 PSI, using TeeJet XR8004VS nozzles, in water equivalent to 1 gallon per 1000 square feet. Each experimental unit is 3' by 8,' with randomized running checks of the same size. The experimental units were set up in a randomized complete block design with four replications.

RATINGS AND ANALYSIS

Ratings were done on a visual basis 3, 5, 14, 21, 28, 35, 42, 60 and 90 days after the initial application. For the nutsedge control ratings, the running checks were evaluated as 0% control and the experimental units were compared to the checks to determine the level of control of each treatment. Turf color, quality and density were evaluated on both the experimental units and the running checks. This was useful in seeing turfgrass phytotoxicity and decline. These ratings were on a 1-9 scale, 1 being no/dead turf and 9 being dark, dense turf. Dark turf with weeds might receive a rating of 4-6, depending on turf thickness and weed infestation. For example, some treatments reduced the population of crabgrass along with nutsedge, thus increasing this treatment's turf ratings. Turf density ratings were assessed on only the amount of turfgrass in the experimental unit, 1 being 0% turf and 9 being 100% turfgrass cover.

For future trials, it would be useful to also rate broadleaf weed populations, especially crabgrass. To reduce undesired weed competition with desired weeds (nutsedge) a pre-emergent weed control application might be necessary. The site for this trial is a low-lying plot and adjacent plots also have nutsedge infestation. This has been recorded and will ease plot choice for future nutsedge control trials.

RESULTS

Turf injury in the form of reduced color (phytotoxicity) began to appear from Sedgehammer herbicide at 16 days after initial treatment (DAIT) and reduced turf color to below acceptable (6.0 on a 1 to 9 scale) levels between 3-5 weeks after initial treatment (WAIT; Table 2). None of the Dismiss applications ever reduced turf color below the untreated turf color.

Dismiss treatments resulted in turf quality and density as good or better than untreated turf throughout the study (Tables 3, 4). Sedgehammer reduced turf quality and density relative to untreated turf and Dismiss-treated turf beginning 16 DAIT which continued through early September (Tables 3, 4).

All Dismiss treatments provided good to excellent control of yellow nutsedge, comparable to Sedgehammer (Table 5).

CONCLUSION

Dismiss controlled yellow nutsedge as well as Sedgehammer, but without the reduction in turf color, quality or density which occurred with Sedgehammer. All rates of Dismiss were equally effective, and a single application worked as well as sequential applications of Dismiss.

Table 1. Dismiss Nutsedge Control treatments, Verona, WI, 2008.

Trt. #	Trt. Name	App. Rate (lb a.i./acre)	# of Applications
1	Dismiss 4F	0.125	1
2	Dismiss 4F	0.188	1
3	Dismiss 4F	0.125 + 0.0625	2
4	Dismiss 4F	0.125 + 0.125	2
5	Sedgehammer*	1 oz prod/acre	1
6	Untreated Control	----	----

*Added 0.25% non ionic surfactant.

Table 2. Color (1-9 scale, 1=chlorotic/necrotic turf, 9=dark green) of mixed Kentucky bluegrass, perennial ryegrass and fine fescue turf treated 7 July 2008 with Dismiss and Sedgehammer herbicides, Madison, WI.

Trt #	8 Jul	15 Jul	23 July	29 July	5 Aug	11Aug	29 Aug	7 Sept
1	6.5	7.0	7.2 a†	7.0 a	6.5 a	6.5 ab	6.5	6.2
2	6.5	6.5	7.5 a	7.0 a	7.0 a	6.8 a	6.5	6.2
3	6.8	6.8	7.2 a	6.5 b	6.8 a	6.0 bc	6.2	6.5
4	6.5	6.5	7.0 a	7.0 a	6.5 a	6.0 bc	6.5	6.8
5	6.5	6.5	6.0 b	5.8 c	5.8 b	5.8 c	6.0	6.2
6	6.5	7.0	7.6 a	6.9 ab	6.6 a	6.3 abc	6.3	6.2
LSD.05	ns	ns	1.0	0.5	0.7	0.6	ns	ns

ns = not significant at $P \leq 0.05$.
†Means followed by the same letter were not significantly different at $P \leq 0.05$.

Table 3. Quality (1-9 scale, 9=ideal) of young Kentucky bluegrass, perennial ryegrass and fine fescue turf treated 7 July 2008 with Dismiss and Sedgehammer herbicides, Madison, WI.

Trt #	8 Jul	15 Jul	23 July	29 July	5 Aug	11Aug	29 Aug	7 Sept
1	2.5	2.8	3.5 ab†	3.5 a	4.0 ab	3.8 a	3.5 a	3.8 a
2	2.8	2.8	3.5 ab	3.8 a	4.2 a	3.8 a	4.0 a	4.2 a
3	2.5	2.8	3.0 ab	3.5 a	3.2 bc	3.5 a	3.8 a	3.5 a
4	2.5	2.5	3.8 a	3.5 a	4.5 a	4.0 a	4.2 a	4.2 a
5	2.5	2.5	2.5 b	2.2 b	2.5 c	2.2 b	2.2 b	2.2 b
6	2.8	3.1	3.8 a	3.8 a	3.3 b	3.4 a	3.4 a	3.4 a
LSD.05	ns	ns	1.0	0.8	0.8	0.7	1.1	1.0

ns = not significant at $P \leq 0.05$.
†Means followed by the same letter were not significantly different at $P \leq 0.05$.

Table 4. Density (1-9 scale, 9=ideal) of mixed Kentucky bluegrass, perennial ryegrass and fine fescue turf treated 7 July 2008 with Dismiss and Sedgehammer herbicides, Madison, WI.

Trt #	**8 Jul**	**15 Jul**	**23 July**	**29 July**	**5 Aug**	**11Aug**	**29 Aug**	**7 Sept**
1	3.2	3.0	3.8 a†	3.5	3.8 a	3.2 ab	3.5 a	3.5 ab
2	2.8	2.8	4.2 a	3.8	4.0 a	4.2 ab	4.0 a	3.5 ab
3	2.5	2.8	3.8 a	3.2	3.2 ab	3.5 ab	2.8 ab	2.8 bc
4	2.5	2.8	4.0 a	4.0	4.5 a	4.5 a	4.5 a	4.2 a
5	2.8	2.8	2.2 b	2.2	2.0 b	1.2 c	1.2 b	1.8 c
6	2.6	2.9	4.2 a	3.7	3.2 ab	2.9 b	2.9 ab	3.0 b
LSD.05	ns	ns	1.2	ns	1.5	1.6	1.8	1.2

ns = not significant at $P \leq 0.05$.
†Means followed by the same letter were not significantly different at $P \leq 0.05$.

Table 5. Percent yellow nutsedge (*Cyperus esculentus*) control using Dismiss and Sedgehammer herbicides with applications beginning 7 July 2008, Madison, WI.

Trt #	**15 Jul**	**23 July**	**29 July**	**5 Aug**	**11Aug**	**29 Aug**	**7 Sept**
1	46.2 a†	85.0 a	86.2 a	91.2 ab	86.2 a	86.2 a	88.8 a
2	51.2 a	87.5 a	83.8 a	96.2 ab	83.8 a	84.2 a	89.2 a
3	48.8 a	83.8 a	83.8 a	93.8 ab	85.8 a	83.2 a	83.2 a
4	52.5 a	88.8 a	90.0 a	89.5 b	97.0 a	98.8 a	97.5 a
5	13.8 b	90.0 a	92.5 a	100.0 a	100.0 a	100.0 a	100.0 a
6	0.0 b	0.0 b	0.0 b	0.0 b	0.0 b	0.0 b	0.0 b
LSD.05	18.2	13.3	15.5	10.3	25.6	27.2	23.6

ns = not significant at $P \leq 0.05$.
†Means followed by the same letter were not significantly different at $P \leq 0.05$.

Dow Roadside Milestone Trials

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OBJECTIVES

The objectives of these trials were to determine the efficacy of Milestone mixes on different species of common roadside weeds such as wild carrot (*Daucus carota*) and wild parsnip (*Pastinaca sativa*).

MATERIALS AND METHODS

Two locations were chosen in Dane county, WI, the county of the University of Wisconsin-Madison. The first location was in Verona, WI, just southwest of Madison. The second location was in northern Dane county, near Sauk City, WI. Each roadside site was chosen in early May for its indigenous weed populations. Treatments were applied using a CO_2 -powered backpack sprayer operated at 40psi using TeeJet XR8004VS nozzles in water equivalent to 20 gallons per acre. Treatments were applied on 27 May. Plot borders were maintained throughout the growing season with metal corner markers and flags. At each location, the experimental units were arranged in a randomized-complete-block design with four replications.

Transline® was used as the commercial standard at the Verona location. Experimental units were 5' by 30' with equal size running checks. Garlon® was used as the commercial standard at the Sauk City location. Experimental units were 5' by 15.'

RATINGS AND STATISTICAL ANALYSIS

Ratings were collected at 30, 60 and 120 days after treatment (DAT). Percent weed cover by species was visually evaluated as percent ground covered per experimental unit. Treated areas and running checks were individually evaluated.

Data were analyzed using one-way ANOVA. Tukey's non-additivity tests were conducted to check for potential need of data transformation prior to ANOVA. Each location was analyzed separately because of different commercial standard treatments and the use of running checks versus control units.

NOTES

At the 60 day Sauk City rating, it was observed that five to eight feet of each experimental unit had been mown due to adjacent farming activities. Percent cover ratings then only took into account the areas that were not mown for all experimental units. Approximately the same area was again mown prior to the 120 day rating and the same procedure followed for evaluation. The Verona location was far enough from the roadway that it was never mown.

RESULTS AND DISCUSSION

Control of wild carrot data for both locations were available for collection at only 30 and 60DAT because wild carrot populations had completed their life cycle by 120DAT. At the Sauk City location treatment 5 had better control than treatments 8 and 9 at 30DAT and all treatments had lower wild carrot populations than the control at 60DAT (Table 2). At the Verona location treatments 1, 5 and 7 had better control (>88%) than treatments 2, 3 and 8 (5-50%) at 30DAT (Table 3). At 60DAT, treatments 1, 4 and 5 had better control (>87%) than treatment 8 (0.0%).

Wild parsnip control data were available for all three rating dates at both locations. At the Sauk City location, treatments 5, 6 and 7 had lower populations than the control at 30DAT. At 60DAT treatment 1, 5, 6 and 7 were better than the control but by 120DAT only treatments 5 and 7 had better wild parsnip suppression than the control (Table 4). Wild parsnip treatments varied at 30 and 60DAT at the Verona location (Table 5). Treatments 6 and 8 had lower control (<45%) than all other treatments (60-100%) at 30DAT. Treatments 1, 3, 4 and 5 had higher control (>85%) than treatment 8 (0.0%).

Growth regulation of desired roadside species was associated with treatments that sufficiently controlled wild carrot and wild parsnip.

CONCLUSIONS

GF-2050 treatments performed equally with or better than controls and commercial standards for both weed species and both locations with >50% control for all rates. The low rate of GF-2050 had the highest level of control across all dates and species possibly due to experimental error because it was not always significantly different from the other rates of GF-2050. The Milestone VM Plus treatment had better weed control (>70% for both species) than the commercial standards and the control. The Milestone VM treatments had mixed results, often being similar in weed suppression to the control or commercial standard. For the Verona location, the Milestone VM + fluroxypyr-meptyl treatment suppressed both species better than the commercial standard Transline. This trend was not seen at the Sauk City location versus Garlon.

Table 1. Efficacy of Milestone mixes treatment descriptions, 2008, Madison, WI.

Trt. #	Treatment Products	Rate (fl oz/A)
1	Milestone VM Plus	128.0
2	Milestone VM	5.0
3	Milestone VM	7.0
4	Milestone VM Fluroxypyr-Meptyl	7.0 23.0
5	GF-2050	2.0
6	GF-2050	2.5
7	GF-2050	3.3
8	Transline (Verona) Garlon (Sauk City)	10.9 48.0
9	Control (Sauk City only)	

All treatments included a nonionic surfactant at 0.25%v/v.

Table 2. Efficacy of Milestone mixes roadside trial for the Sauk City location, 2008, University of Wisconsin-Madison.

Treatment	**June 27 30DAT‡**	**July 28 60DAT**	**October 1 120DAT**
	-------------% control of wild carrot-------------		
1	40.0 ab	97.5 a†	0.0
2	47.5 ab	79.5 a	0.0
3	5.0 ab	62.5 a	0.0
4	5.0 ab	72.0 a	0.0
5	60.0 a	97.0 a	0.0
6	40.0 ab	100.0 a	0.0
7	55.3 ab	98.8 a	0.0
8	2.5 b	90.8 a	0.0
9	0.0 b	0.0 b	0.0
LSD .05	57.3	47.5	ns

† Values followed by the same letter were not statistically different at $P \leq 0.05$.

ns = not significant at $P \leq 0.05$.

‡DAT = days after treatment.

Table 3. Efficacy of Milestone mixes roadside trial for the Sauk City location, 2008, University of Wisconsin-Madison.

Treatment	June 27 30DAT	July 28 60DAT	October 1 120DAT
	------------% control of wild parsnip------------		
1	17.0 bc†	71.0 ab	67.0 ab
2	3.5 c	20.0 bc	27.3 ab
3	0.0 c	22.8 bc	37.5 ab
4	18.0 bc	41.8 abc	47.0 ab
5	73.3 a	97.5 a	97.0 a
6	51.3 ab	75.0 ab	75.0 ab
7	71.0 a	96.3 a	82.0 a
8	31.5 abc	62.0 abc	75.0 ab
9	0.0 c	0.0 c	0.0 b
LSD .05	43.3	67.3	79.6

† Values followed by the same letter were not statistically different at $P \leq 0.05$.

‡DAT = days after treatment.

Table 4. Efficacy of Milestone mixes roadside trial for the Verona location, 2008, University of Wisconsin-Madison.

Treatment	June 27 30DAT	July 28 60DAT	October 1 120DAT
	------------% control of wild carrot-----------		
1	88.3 a†	87.0 a	0.0
2	48.0 b	39.3 ab	0.0
3	49.3 b	33.3 ab	0.0
4	65.0 ab	88.3 a	0.0
5	89.8 a	92.3 a	0.0
6	82.8 ab	59.8 ab	0.0
7	88.0 a	41.8 ab	0.0
8	5.0 c	0.0 b	0.0
LSD .05	37.1	80.1	ns

† Values followed by the same letter were not statistically different at $P \leq 0.05$.

ns = not significant at $P \leq 0.05$.

‡DAT = days after treatment.

Table 5. Efficacy of Milestone mixes roadside trial for the Verona location, 2008, University of Wisconsin-Madison.

Treatment	**June 27 30DAT**	**July 28 60DAT**	**October 1 120DAT**
	-------------% control of wild parsnip-------------		
1	64.0 ab†	83.5 a	62.5
2	59.0 ab	54.3 ab	37.5
3	68.0 ab	83.0 a	85.0
4	79.5 ab	87.5 a	3.3
5	100.0 a	98.3 a	83.3
6	45.0 bc	52.8 ab	50.0
7	69.0 ab	50.0 ab	62.5
8	0.0 c	0.0 b	29.3
LSD .05	53.7	74.8	ns

† Values followed by the same letter were not statistically different at $P \leq 0.05$.

ns = not significant at $P \leq 0.05$.

‡DAT = days after treatment.

Echelon Herbicide Trial

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OBJECTIVE

The objective of this trial was to determine the efficacy of Echelon herbicide in crabgrass and other broadleaf weed control. Confirming cool-season turfgrass tolerance was the second goal.

MATERIALS AND METHODS

The Echelon herbicide trial was conducted at the O.J. Noer Turfgrass Facility in Verona, WI. The turf was a mixture of Kentucky bluegrass and perennial ryegrass on a silt loam soil with pH approximately 7.5. The turf was approximately eight years age and receives 1 lb N/1000 ft^2 each autumn. The trial was located on a plot that has previously not received any herbicide treatments. Dandelions were widespread in the plot but there was minimal crabgrass activity. Because of this, the plot was vertically power-raked and slit-seeded with crabgrass seed on 22 April. To encourage crabgrass growth, the plot was mowed at 1.5" during the spring months to help raise soil temperatures. The plot did not receive fertilization to keep weed pressure high. During the summer and fall, the plot was mowed twice weekly at 2.5" with clippings returned. After the herbicide treatments were applied on 8 May, irrigation was stopped to further encourage weed growth. Hot, dry weather began to cause turf loss in July and August, so irrigation was resumed at the rate of 100% evapotranspiration replacement once a week for a couple of weeks until turf recovered, after which irrigation ceased.

Treatments were applied using a CO_2 powered backpack sprayer at 40 PSI, using TeeJet XR8004VS nozzles, in water equivalent to 1 gallon per 1000 square feet. Each experimental unit was 5' by 5,' with randomized running checks of the same size. The experimental design was a randomized complete block with four replications.

RATINGS AND ANALYSIS

Ratings were done on a visual basis according to the following schedule: turf quality and percent weed control at 14, 30, 60, 90 and 120 days after treatment. A final rating of all experimental units was done on 26 September. Turf quality was rated on a 1-9 scale, with 1 being no/dead turf, 9 being dense, dark turf, and 6 being minimal acceptable turf. Weed infestation lowered the quality rating. Some treatments improved turfgrass color while also improving weed control. Percent weed control was evaluated on a percent cover basis, using the running checks as a 0% control reference. Ratings for checks were evaluated on 26 September to determine percent total dandelion and crabgrass control. Control was determined by dividing the percent of weed cover in a treatment by the average weed cover of the 2 adjacent control plots. This method was used to reduce the effect of variability among the check plots and enhance the accuracy of data analysis. Data were analyzed using 1-way ANOVA.

RESULTS

This spring in Wisconsin was mild. Soil warm-up was slow due to low daytime temperatures and heavy, consistent rainfall. Spring green-up and growth was delayed greatly. These factors contributed to less than desirable broadleaf weed growing conditions. Turf loss was observed during the late-summer dry period of July and August after which weed pressure greatly increased (Tables 1 and 2). Crabgrass pressure was near zero for most of the spring and summer, with measurable levels not being seen until late August and early September.

Echelon provided effective control of crabgrass (both smooth and large crabgrass was present), with control ranging from approximately 75 to 95% (Table 3). The low rate (0.57 lb ai/A) of Echelon provided less control than the other three treatments. Combining fertilizer with the low rate of Echelon improved control (96%) compared to the low rate without fertilizer (76%). Combining fertilizer with the high rate of Echelon did not improve control (>90% for both treatments). Echelon treatments provided marginal dandelion control (Table 3). Echelon at the 0.75 lb ai/A rate with fertilizer provided better dandelion control than the same rate of Echelon alone (Table 3). However, control was still only approximately 35%. Echelon treatments did not cause noticeable injury to the turf at any time (Table 4).

CONCLUSION

Echelon did not appear to harm a mature turf composed of Kentucky bluegrass and perennial ryegrass. Dandelion control was marginal and would not be considered sufficient using Echelon as a stand-alone product. All Echelon treatments effectively controlled crabgrass on a pre-emergent basis.

Table 1. Crabgrass (*Digitaria* spp.) cover on a percentage basis when mixed cool-season turf was treated on 8 May using Echelon formulations, Madison, WI, 2008. Treatments were applied prior to crabgrass emergence. Running checks were included in the study but not rated until Sept. 26 (see Table 1).

Treatment	Rate (lb ai/A)	10 June	7 July	6 Aug	5 Sep	26 Sep
Echelon 4SC	0.57	0.8†	0.0†	1.8	2.2 ab‡	2.8 b
Echelon 4SC	0.75	0.5	0.0	0.8	1.0 b	6.0 ab
Echelon 0.3% Fert. Carrier	0.57	0.0	0.0	3.0	4.8 a	0.8 b
Echelon 0.3% Fert. Carrier	0.75	0.0	0.0	2.5	2.2 ab	0.8 b
Untreated turf		Data not collected				12.6 a
LSD .05		ns	ns	ns	ns	9.1

ns = not significant at $P \leq 0.05$.
† Signficant crabgrass amounts were not visible until late July.
‡ Values followed by the same letter(s) were not significantly different at $P \leq 0.05$.

Table 2. Dandelion cover (% of ground area) following Echelon treatments, Madison, WI, 2008. Treatments were applied as a pre-emergent on 8 May prior to crabgrass emergence and before dandelion bloom.

Treatment	Rate (lb ai/A)	10 June	7 July	6 Aug	5 Sep	26 Sep
Echelon 4SC	0.57	10.5	13.5	40.0 a†	57.5 a	63.8
Echelon 4SC	0.75	4.0	3.5	37.5 ab	50.0 a	56.2
Echelon 0.3% Fert. Carrier	0.57	11.2	12.0	35.0 ab	45.0 a	47.5
Echelon 0.3% Fert. Carrier	0.75	15.0	20.0	20.0 ab	43.8 a	47.5
Untreated turf		Data not collected				66.9
LSD .05		ns	ns	38.8	33.9	ns

ns=not significant at $P \leq 0.05$.
†Values followed by the same letter(s) were not significantly different at $P \leq 0.05$.

Table 3. Dandelion (*Taraxacum officianale*) and crabgrass (*Digitaria* spp.) control (% basis) in mixed Kentucky bluegrass, perennial ryegrass, and fine fescue turf, Madison, WI, 26 September 2008. Treatments were applied on 8 May 2008 prior to crabgrass emergence.

	% Dandelion control	**% Crabgrass control**
Echelon 4SC	9.7 abc†	75.8 b
Echelon 4SC	5.0 bc	87.1 ab
Echelon 0.3% Fert. Carrier	31.4 ab	95.6 a
Echelon 0.3% Fert. Carrier	34.8 a	91.0 ab
Untreated turf	0.0 c	0.0 c
LSD (0.05)	29.0	18.2

†Values followed by the same letter(s) were not significantly different at $P \leq 0.05$.

Table 4. Turf quality on a 1 to 9 scale, where 9=ideal, 6=acceptable and 1=dead turf, Madison, WI, 2008.

Treatment	**22 May**	**10 June**	**7 July**	**6 Aug**	**5 Sept**	**26 Sept**
Echelon 4SC	4.5†	4.5	4.6	4.6	3.8	3.5
Echelon 4SC	4.5	5.0	5.2	4.8	4.0	4.0
Echelon 0.3% Fert. Carrier	4.5	4.9	5.2	4.8	4.4	4.2
Echelon 0.3% Fert. Carrier	4.2	4.8	5.1	4.8	4.2	4.0
Untreated turf	Not rated until 26 September					3.0
LSD (0.05)	ns	ns	ns	ns	ns	ns

ns=not significant at $P \leq 0.05$.
†Untreated turf quality data were not collected, but observations revealed that no phytotoxicity was seen on treated turf and turf quality was similar due to low fertilization and numerous weeds, primarily dandelion.

Liquid Molasses as a Surfactant

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OBJECTIVES

The purpose of this trial was to compare a liquid molasses-based product with traditional methylated seed oil (MSO) in use as a surfactant to enhance herbicide efficacy. Drive® herbicide was selected because it requires the addition of a surfactant like MSO to help the active ingredient spread and stick to the plant. We compared three rates of liquid molasses to the MSO surfactant with Drive® and Drive® alone.

MATERIALS AND METHODS

The trial was conducted at the University of Wisconsin-Madison's O.J. Noer Turfgrass Research Facility in Verona, WI. The soil type of the research plot was a silt loam with a pH of approximately 7.6. The trial was located on a mature stand of Kentucky bluegrass (*Poa pratensis*) and perennial ryegrass (*Lolium perenne*) that was heavily infested with many grassy and broadleaf weeds. The plot has been managed for many seasons to promote weed growth. Irrigation was only applied to prevent stand loss during periods of extended drought. The plot was mown twice a week at 2.5" using a Toro riding rotary mower with clippings returned. Treatments were applied using a CO_2- powered backpack sprayer equipped with XR Teejet 8004VS nozzles and operated at 40psi. Carrier volume (water) was two gallons per thousand square feet. The experimental units were 5' by 10' and set up in a randomized complete block design with four replications. The trial was initiated on 11 June 2008. Treatments and rates are listed in Table 1.

RATINGS AND STATISTICAL ANALYSIS

Turf phytotoxicity ratings were collected at 2, 4, 8, 12 and 24 days after treatment (DAT) using a 1-9 scale, with 1 being no turf damage, 3 being the highest acceptable value and 9 being dead turf. Weed control ratings were collected on a percent ground cover basis at initiation, 15, 30, 45 and 60DAT. Weeds observed were common dandelion (*Taraxacam officianale*), white clover (*Trifolium repens*) and ground ivy (*Glechoma hederacea*).

Data were analyzed using one-way ANOVA. Tukey's non-additivity tests were conducted to check for potential need of data transformation prior to ANOVA.

RESULTS AND DISCUSSION

All treatments reduced dandelion populations to near zero within 4 weeks after treatment and all treatments were statistically similar (Table 2). The Drive® rate of 0.37 fl oz/M was sufficient for dandelion control with or without MSO or liquid molasses.

All treatments were effective in reducing white clover populations (Table 3). On June 26 (15 DAT) , the Drive® + MSO treatment had significantly better control than the Drive® + high rate of liquid molasses treatment but not better than the other treatments (except the control). At 30, 45 and 60DAT no treatments were statistically different except the control.

All treatments were equally ineffective in reducing ground ivy populations (Table 4). Drive® is not often used to control ground ivy.

No turfgrass phytotoxicity was associated with any of the treatments.

Drive is labeled for post-emergent control of dandelions, white clover and some other weeds. It is not labeled for control of ground ivy, but we were interested to see if the molasses extract had any ability to improve Drive efficacy on ground ivy. Surprisingly, the Drive product without any surfactant provided dandelion and clover control equal to treatments with surfactant. Usually Drive applications without surfactant provide noticeably less weed control than applications with surfactant. Applying a lower than full label rate of Drive with and without the surfactants might be better able to distinguish between treatments with and without surfactants in future trials. The lack of phytotoxicity from use of molasses as a surfactant was promising but not surprising.

CONCLUSIONS

The liquid molasses product did not reduce the efficacy of Drive®. The Drive® + liquid molasses treatments controlled weed populations with the same efficacy as Drive® alone and Drive® + MSO treatments. The liquid molasses product could be a suitable replacement of conventional surfactants such as MSO, but an additional trial(s) would need to be conducted to show if molasses additive provides better weed control than without a surfactant. Evaluation of a larger suite of herbicides, weed species, timing of applications and/or locations could be used to better evaluate molasses as a surfactant.

Table 1. QLF molasses surfactant treatments, 2008, Madison, WI.

Treatment	Product	Rate (fl oz/M)
1	Control	Not applicable
2	Drive®	0.37
3	Drive® + MSO	0.37 + 0.55
4	Drive® + Liquid molasses	0.37 + 0.25
5	Drive® + Liquid molasses	0.37 + 0.50
6	Drive® + Liquid molasses	0.37 + 1.00

MSO = methylated seed oil

Table 2. QLF molasses surfactant trial, percent dandelion cover, 2008, Madison, WI.

Treatment	June 11 (initial)	June 26 15DAT‡	July 11 30DAT	July 25 45DAT	August 11 60DAT
1	20.00 a†	22.50 a	22.50 a	31.25 a	31.25 a
2	11.25 a	6.50 b	0.25 b	0.50 b	0.50 b
3	15.00 a	6.75 b	0.00 b	0.00 b	0.25 b
4	20.00 a	6.25 b	0.25 b	0.50 b	0.50 b
5	11.25 a	4.75 b	0.00 b	0.00 b	0.00 b
6	12.50 a	5.00 b	0.00 b	0.00 b	0.00 b
LSD 0.05	ns	7.54	6.09	18.48	25.02

† Values followed by the same letter were not statistically different at $P \leq 0.05$.

ns = not significant at $P \leq 0.05$.

‡DAT = days after treatment.

Table 3. QLF molasses surfactant trial, percent white clover cover, 2008, Madison, WI.

Treatment	June 11 (initial)	June 26 15DAT‡	July 11 30DAT	July 25 45DAT	August 11 60DAT
1	21.50 a†	22.50 a	22.50 a	23.75 a	20.00 a
2	15.00 a	10.00 bc	4.75 b	5.50 b	5.50 b
3	15.00 a	8.75 c	3.50 b	3.75 b	6.25 b
4	16.25 a	10.00 bc	4.50 b	5.75 b	7.75 b
5	15.00 a	12.50 bc	4.25 b	5.50 b	5.25 b
6	17.50 a	15.00 b	3.75 b	4.00 b	5.50 b
LSD 0.05	ns	5.10	6.49	7.37	8.78

† Values followed by the same letter were not statistically different at $P \leq 0.05$.

ns = not significant at $P \leq 0.05$.

‡DAT = days after treatment.

Table 4. QLF molasses surfactant trial, percent ground ivy cover, 2008, Madison, WI.

Treatment	**June 11 (initial)**	**June 26 15DAT‡**	**July 11 30DAT**	**July 25 45DAT**	**August 11 60DAT**
1	10.00 a†	13.75 a	17.50 a	21.25 a	25.00 a
2	32.50 a	25.00 a	18.75 a	18.75 a	16.25 a
3	16.25 a	12.50 a	13.75 a	13.75 a	15.00 a
4	22.50 a	20.00 a	10.75 a	12.50 a	13.25 a
5	23.75 a	20.00 a	20.00 a	18.75 a	16.25 a
6	23.75 a	20.00 a	18.75 a	22.50 a	21.25 a
LSD 0.05	ns	ns	ns	ns	ns

† Values followed by the same letter were not statistically different at $P \leq 0.05$.

ns = not significant at $P \leq 0.05$.

‡DAT = days after treatment.

Plant Growth Regulator research

Influence of Plant Growth Regulators on the Critical Soil Test Phosphorus Level in Golf Putting Greens

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INTRODUCTION

Out of concern for having a negative impact on the environment, on March 10, 2008 all Wisconsin golf courses must have in place nutrient management plans based in part on soil test levels of phosphorus (WDNR NR 151.14). Phosphorus fertilizer cannot be applied if the soil test is above an optimum level established by the research of Houlihan (2005).

Plant demand for phosphorus is determined primarily by the rate of shoot growth (Adams, 1960). On golf putting greens shoot growth has traditionally been regulated by rate and frequency of nitrogen application (Beard, 2002). However, the application of plant growth regulators to further curtail growth is rapidly becoming a widespread cultural practice (McCarty, 2005). A commonly used plant growth regulator is trinexapac-ethyl (TE), trade name Primo Maxx®. Our research (Kreuser & Kussow, 2007) and that of McCullough, et al. (2006) has shown that turfgrass shoot growth as well as phosphorus uptake on golf putting greens can be reduced by as much as 60 to 70% through Primo application. To date, no one has questioned what impact these large reductions in shoot growth may have on critical soil test levels of phosphorus. Our hypothesis is that plant growth regulators reduce the level of soil test phosphorus required to meet turfgrass demand, which in turn reduces the quantity of phosphate fertilizer needed to maintain optimum soil test levels of the nutrient.

The objective of this ongoing research project is to assess the effect of Primo Maxx® on the Mehlich-3 soil test phosphorus (P) critical level of creeping bentgrass (*Agrostis palustris*) putting greens. A putting green was constructed with various Mehlich-3 soil phosphorus levels with and without application of Primo Maxx®. During the experiment various observations of putting green performance will be analyzed and used to determine critical Mehlich-3 phosphorus levels.

MATERIALS AND METHODS

This experiment is being conducted on a new putting green at the OJ Noer Turfgrass Research and Education Facility in Madison, WI. This creeping bentgrass (*Agrostis stolonifera* var. 'Penn A4') putting green was constructed with straight sand to United States Golf Association specifications for putting green construction in April 2008. Four replicates of four fertilizer treatments with and without biweekly application of Primo Maxx® at 0.125 oz product/M are organized into a randomized complete block design.

Monopotassium phosphate (0-52-34) was incorporated into the sand with a roto-tiller at the rate of 0, 1.1, 2.1, and 4.3 lb P_2O_5/1000 ft^2 (0, 7.5, 15, 30 mg P per Kg soil) to the 5 x 6 ft plots during construction. The mowing height was reduced from 0.400 in to 0.100 in during May through July. The green is irrigated daily to 100% of estimated potential evapotranspiration.

At seeding, the entire green was fertilized with 0.75 lbs P_2O_5 (10-18-22). Grass clipping were returned for the first four weeks of mowing to aid in establishment. Primo Maxx® applications began on July 1, 2008. Primo was applied with a CO_2 powered backpack sprayer which delivered 2 gallons of water per 1000 ft^2 with Teejet XR 11008 nozzles. Primo applications were stopped at the end of July 2008. Soil samples were taken monthly and sent to the UW Soil and Plant Analysis Laboratory (SPAL) for Mehlich-3 soil P determination.

During July, ratings of overall turfgrass quality, cover, and chlorophyll index (CI) were recorded weekly. Quality was rated on a 1-9 scale where 1 is bare soil, 9 is highest quality, and quality of 6 or above is considered acceptable putting green quality. Turfgrass cover was estimated on a 1-9 scale where 1 is bare soil, 9 is completely covered and established. CI is quantified with a CM-1000 chlorophyll meter (Spectrum Technologies Inc., Plainfield, IL). Clippings were collected biweekly by mowing a 5 x 1.75 ft pass with a Toro GM1000 walking greens mower (Toro Co., Bloomington, MN). Clippings were then dried and stored. At time of this publication clipping mass and nutrient concentration were not available.

RESULTS AND DISCUSSION

During the month of July Primo application didn't have any effect on CI, Visual Quality, or percent cover (Figures 1-4). Primo applications were stopped in August because Primo treated plots slowly weren't developing the characteristics of mature bentgrass. The first Primo treatments began in early July only 7 weeks after germination. It is known that the plant hormone gibberellic acid (GA) is important for the transition from juvenile to adult plants. The addition of Primo affects GA concentrations and may have been a hindrance on plant maturation. Plants were allowed to mature completely during after July.

Primo applications and ratings were also stopped in August due to a limited range of soil test P. Clipping removal from mowing and phosphorus immobilization due to high root zone pH, ~8.8, required a month maintenance application of 0.2 lb P_2O_5 applied to maintain consistent P level (Figure 5.). Fertilizing with greater than 0.2 lb P_2O_5 led to increased soil P level whereas fertilizing with less than 0.2 lb P_2O_5 led to decreased soil test P. During August and September additional P fertilizer was applied to establish a broader range of soil test P levels. A soil test on October 10 indicated that P fertilizer applications had increased the range of soil test P levels (Figure 6.). The goal is to apply one more spring P fertilizer application and then restart the study in the summer of 2009.

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FIGURES

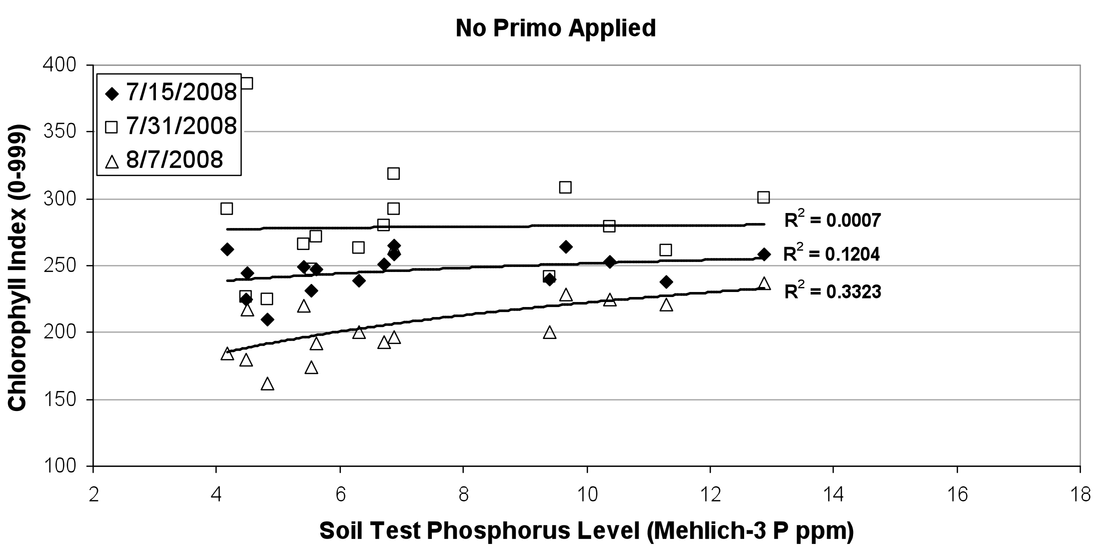

Figure 1. The effect of Mehlich-3 soil P level on turfgrass chlorophyll index when Primo is not applied.

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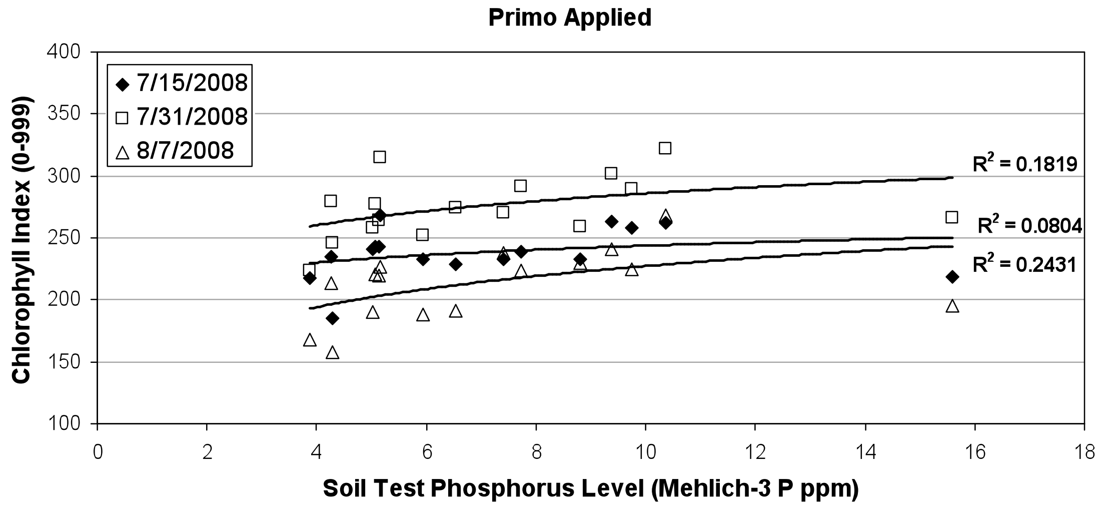

Figure 2. The effect of Mehlich-3 soil P level on turfgrass chlorophyll index when Primo is applied.

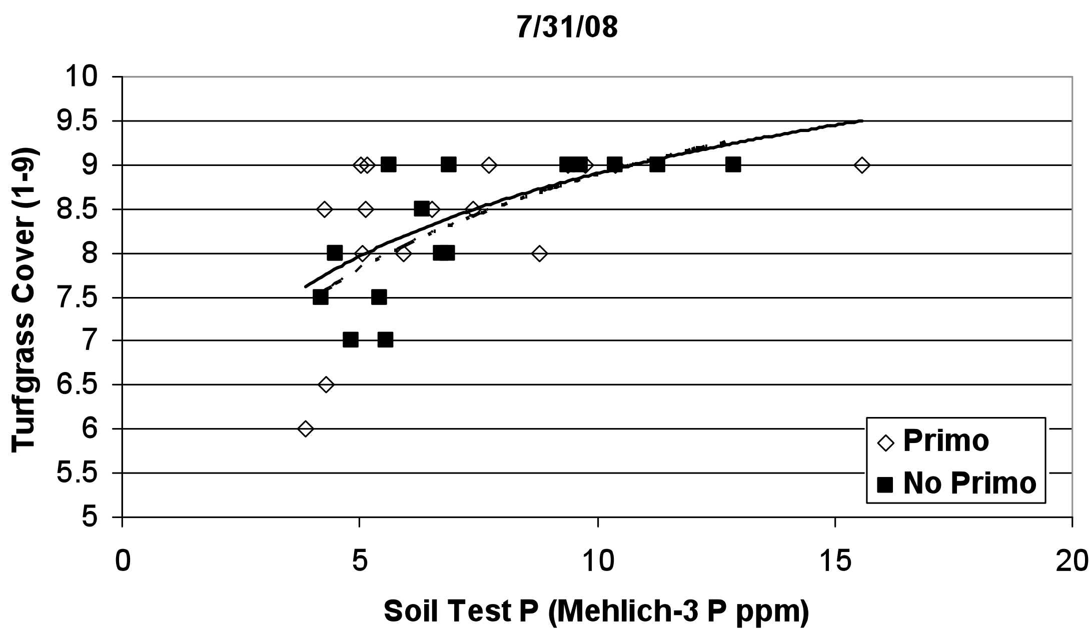

Figure 3. The effect of soil test P level on turfgrass cover (1-9; 1=bare soil, 9=complete cover) with and without Primo two months after germination.

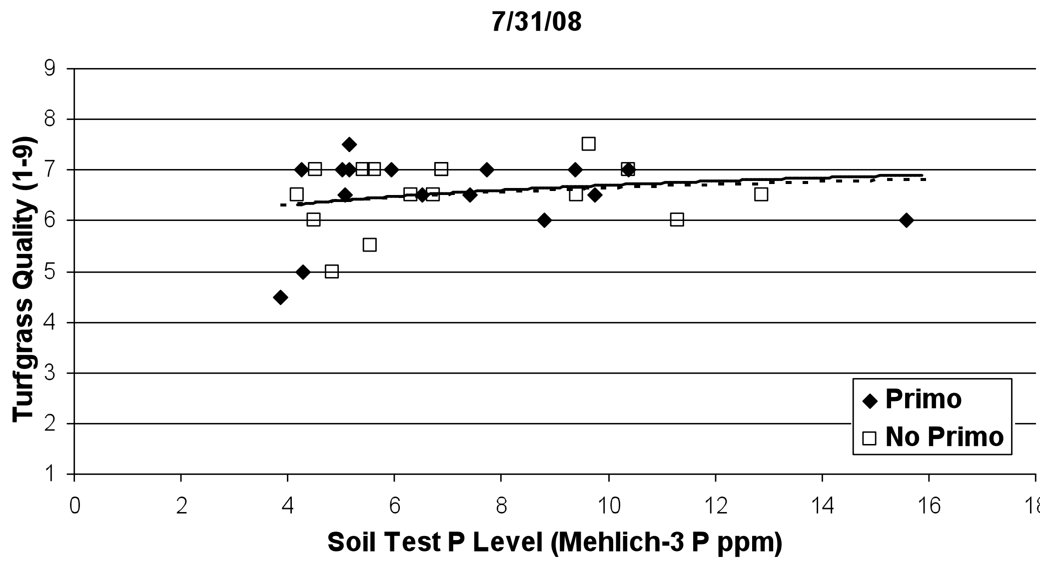

Figure 4. The effect of soil test P level on turfgrass visual quality (1-9; 1=bare soil, 9=highest possible quality, above 6=acceptable) with and without Primo two months after germination.

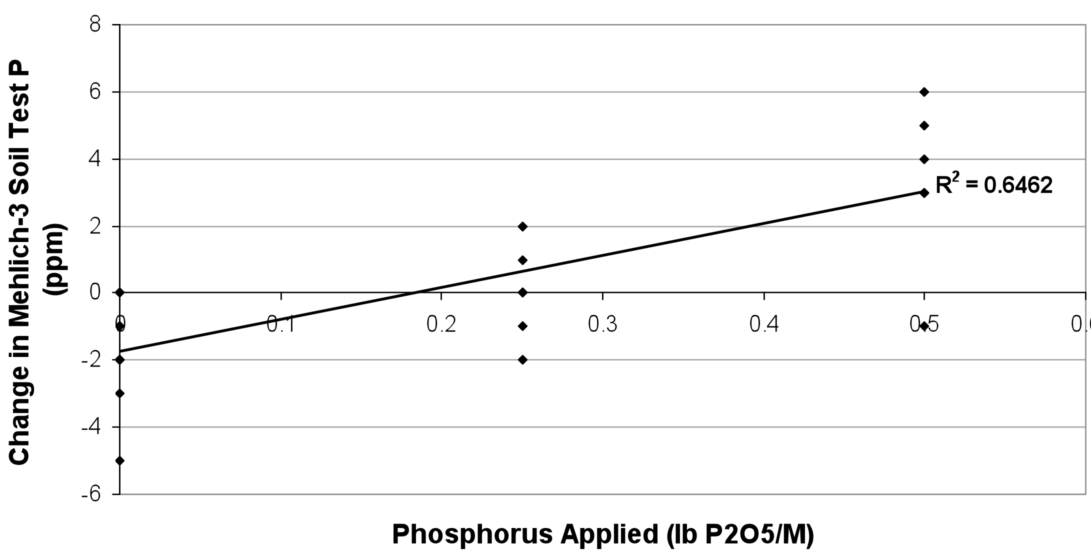

Figure 5. The effect of P2O5 fertility per month on change in soil test P level.

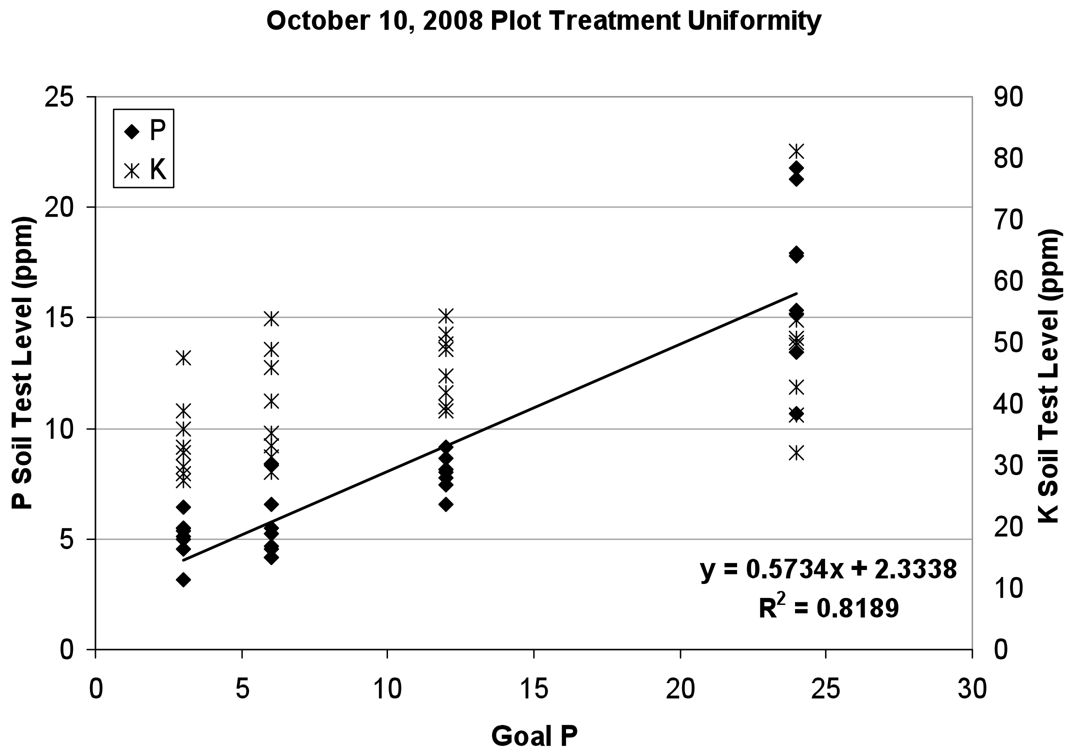

Figure 6. The soil test P and K concentrations from October 10, 2008 soil testing with respect to target or goal P level.

Maintaining Constant Growth Regulation with Primo Maxx

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INTRODUCTION

The Primo Maxx label states the product will provide a 50% reduction in clipping production for 4 weeks when used according to directions. However, our experiences indicate that many superintendents perceive a reduction of Primo's efficacy during summer months. Research published in Golf Course Management by Drs. Branham and Beasley in July 2007 showed that Primo is metabolized by the plant faster at higher air temperatures. More specifically, they reported that the half life of Primo in the plant is 6 days at 64 °F, but only 3 days at 86 °F. In this case, a half life is defined as the amount of time required for 50% of the material to be metabolized. That means Primo was disappearing (being metabolized) in the plant twice as fast at 86 °F compared to 64 °F. Branham and Beasley correctly conclude that understanding these physiological aspects of Primo will help superintendents more effectively utilize the product. We thought that it might be interesting to take this concept one step further and investigate whether or not more specific re-application recommendations could be developed based on air temperatures.

Our hypothesis was that a GDD system can be used to estimate Primo metabolism and provide a tool for turfgrass managers to schedule Primo re-application. Establishing such a system would provide superintendents a method to more effectively maintain consistent growth regulation throughout the growing season. To test our hypothesis we designed an experiment that had five Primo re-application intervals along with a control that received no Primo.

MATERIALS AND METHODS

This experiment is being conducted on a sand-based L-93 creeping bentgrass putting green at the O.J. Noer Turfgrass Research and Education Facility in Madison, WI. The plots are watered daily to prevent water stress from interfering with the growth regulation. The study is a randomized complete block design with 4 replicates of five re-application intervals along with a zero Primo control. Four of the re-application intervals are based on a growing degree day system (GDD) and the fifth interval is re-applied every 4 weeks as per the label. Growing degree days are calculated by adding the mean daily air temperature, in degrees Celsius, from our weather station, daily until the desired re-application threshold has been surpassed. The four re-application thresholds in this study are 100, 200, 400, and 800 GDD. Once the appropriate GDD has been achieved, Primo is applied and the growing degree days are reset. Primo is applied at the labeled rate of 0.125 fl oz of product/M in 2 gallons of water with a CO_2 power backpack sprayer. Grass clippings are collected daily, washed, dried, and weighed. Then we calculate the clipping production in comparison to the control. This is done by dividing the treatment clipping mass by the clipping mass of the control. Values less than one represent a reduction in clipping production while values greater than one represent increased clipping production compared to the control. Overall visual quality and chlorophyll readings are recorded weekly.

RESULTS AND DISCUSSION

Both the 100 and 200 GDD re-application treatments maintained constant growth regulation during the summer (200 GDD results shown in Fig. 1). Compare the 200 GDD re-application interval (Fig. 1) to the 4-week interval shown in Fig. 2. You'll notice that on most dates, the 4-week interval is actually producing more clippings than the untreated control. This can be attributed to the "rebound effect" often reported in other studies where turf coming out of growth reduction and will experience enhanced growth. However, by re-applying Primo every 200 GDD, this re-bound effect was minimized and growth suppression was fairly constant throughout the summer of 2008. However, for all re-application treatments, the 0.125 application rate reduced clipping production by only 20 to 30% at peak suppression, significantly lower than the 50% reduction claimed on the label (Table 1). This is likely related to the rate of application, as we have seen growth reductions up to 80% in Kentucky bluegrass plots at much higher application rates (data not shown).

As you can see in Figure 3, following a Primo application at GDD=0, the maximum reduction in clipping production occurs around 150 GDD, and then growth rates increase until the are approximately equal to that of the untreated control around 300 growing degree day units. During July, 300 GDD can occur in as little as twelve days. However, in the May or September 300 GDD may occur after 21-28 days. Between 300 and 500 GDD units following Primo application, the turfgrass will enter a rebound phase (Fig. 3). During this phase clipping reduction is greater than the control. Typically the duration and magnitude of this rebound phase is similar to the suppression phase. At the labeled application rate the rebound is 300-500 GDD units long and with a 15 to 35% increase in clipping production in comparison to the control treatments.

As reported in previous Primo studies turfgrass color/chlorophyll index (CI) and overall visual quality increased with Primo application (Tables 2 & 3). Similarly to the clipping production data the color and quality were consistently greatest for the 100 and 200 GDD treatments. The 400 GDD, 800 GDD, and 4 week re-application treatments varied slightly as the turfgrass experienced the suppression/rebound cycling. Statistical differences for both color (CI) and quality didn't occur until approximately six weeks after the study. It's unclear if that is due to initial plot variability or if it takes the plant that time to develop those qualities.

CONCLUSIONS

From our preliminary research during this summer, we found that re-applying Primo every 200 GDD or less will provide consistent growth regulation on a creeping bentgrass putting green. Additionally this re-application interval will maintain darker green color and higher turfgrass quality. Re-applying more frequently didn't increase growth suppression measurably, nor did it significantly affect quality or color; even when Primo was being re-applied every 4-5 days in July. It is important to stress that these results occurred on a bentgrass putting in full sun.

The green is watered to 100% of estimated potential evapotranspiration and fertilized with 0.6 lb N/M monthly. These factors may be important in rate of Primo metabolism.

REFERENCES

Branham, B., & Beasley, J. (2007, July). PGRs: metabolism and plant response. *Golf Course Management*, *75(7)*, 95-99.

Table 1. Clipping Production with Respect to Control as Influenced by Primo Re-application

Primo Application		Clipping Production (Percent Growth of Control)									
Re-application Frequency	Rate fl oz/M	6/28/2008	7/9/2008	7/15/2008	7/20/2008	7/25/2008	7/30/2008	8/2/2008	8/8/2008	8/14/2008	8/18/2008
100 GDD	0.125	**88** A	**79** A	**79** A	**83** AB	**82** A	**72** A	**68** A	**84** A	**100** A	**93** A
200 GDD	0.125	**95** A	**89** AB	**87** AB	**84** AB	**79** A	**95** BC	**91** AB	**86** A	**104** A	**96** A
400 GDD	0.125	**100** A	**123** B	**105** CD	**67** AB	**101** AB	**106** C	**86** AB	**93** AB	**105** A	**115** C
800 GDD	0.125	**81** A	**101** AB	**106** CD	**95** AB	**120** B	**109** C	**87** AB	**84** A	**98** A	**105** ABC
4 Week	0.125	**101** A	**127** B	**120** D	**124** B	**90** AB	**76** AB	**113** B	**117** B	**113** A	**115** BC
Control	0	**100** A	**100** AB	**100** BC	**100** AB	**100** AB	**100** C	**100** AB	**100** AB	**100** A	**100** AB

Table 2. Chlorophyll Index as Influenced by Primo Re-application

Primo Application		Chlorophyll Index							
Re-application Frequency	Rate fl oz/M	6/22/2008	7/9/2008	7/23/2008	7/31/2008	8/14/2008	8/21/2008	8/28/2008	9/7/2008
100 GDD	0.125	**248** A	**310** A	**275** A	**293** A	**325** A	**338** A	**303** A	**384** A
200 GDD	0.125	**244** A	**299** A	**269** A	**285** AB	**306** AB	**315** AB	**279** AB	**355** AB
400 GDD	0.125	**248** A	**305** A	**267** A	**284** AB	**303** B	**319** AB	**277** B	**346** B
800 GDD	0.125	**243** A	**304** A	**261** A	**269** B	**288** BC	**310** AB	**268** B	**339** B
4 Week	0.125	**250** A	**310** A	**271** A	**280** AB	**306** AB	**313** AB	**279** AB	**350** AB
Control	0	**240** A	**301** A	**262** A	**274** AB	**283** C	**305** B	**263** B	**324** B

Table 3. Overall Putting Green Quality as Influenced by Primo Re-application

Primo Application		Overall Quality Rating							
Re-application Frequency	Rate fl oz/M	6/22/2008	7/9/2008	7/23/2008	7/31/2008	8/14/2008	8/21/2008	8/28/2008	9/7/2008
		Scale of 1 to 9 (perfect quality)							
100 GDD	0.125	**7.5** A	**7.9** A	**7.6** A	**8.3** A	**8.6** A	**8.3** A	**8.5** A	**8.5** A
200 GDD	0.125	**7.4** A	**7.6** A	**7.8** A	**7.8** A	**8.1** AB	**7.5** AB	**8.1** AB	**8.0** ABC
400 GDD	0.125	**7.5** A	**7.4** A	**7.6** A	**7.9** A	**8.0** A	**7.4** AB	**7.9** AB	**8.4** ABC
800 GDD	0.125	**7.5** A	**7.4** A	**7.6** A	**7.5** A	**7.8** BC	**7.4** AB	**7.4** B	**7.8** BC
4 Week	0.125	**7.5** A	**7.9** A	**7.6** A	**7.8** A	**8.1** AB	**7.5** AB	**7.8** AB	**7.9** ABC
Control	0	**7.4** A	**7.1** A	**7.6** A	**7.6** A	**7.3** C	**6.9** B	**7.2** B	**7.6** C

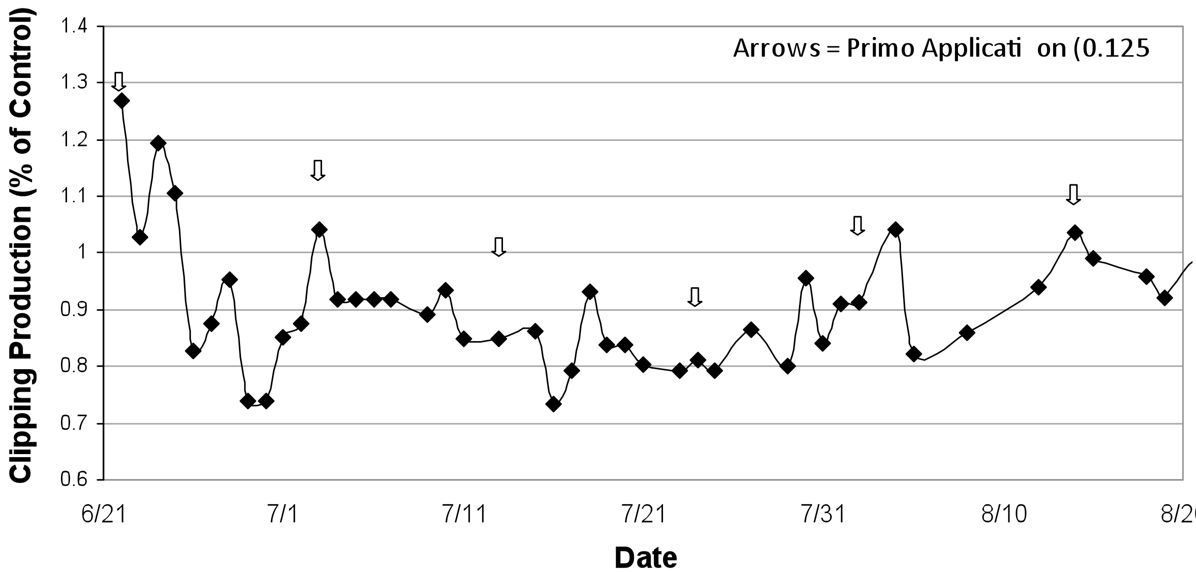

Figure 1. The effect of re-applying Primo every 200 GDD on turfgrass clipping production.

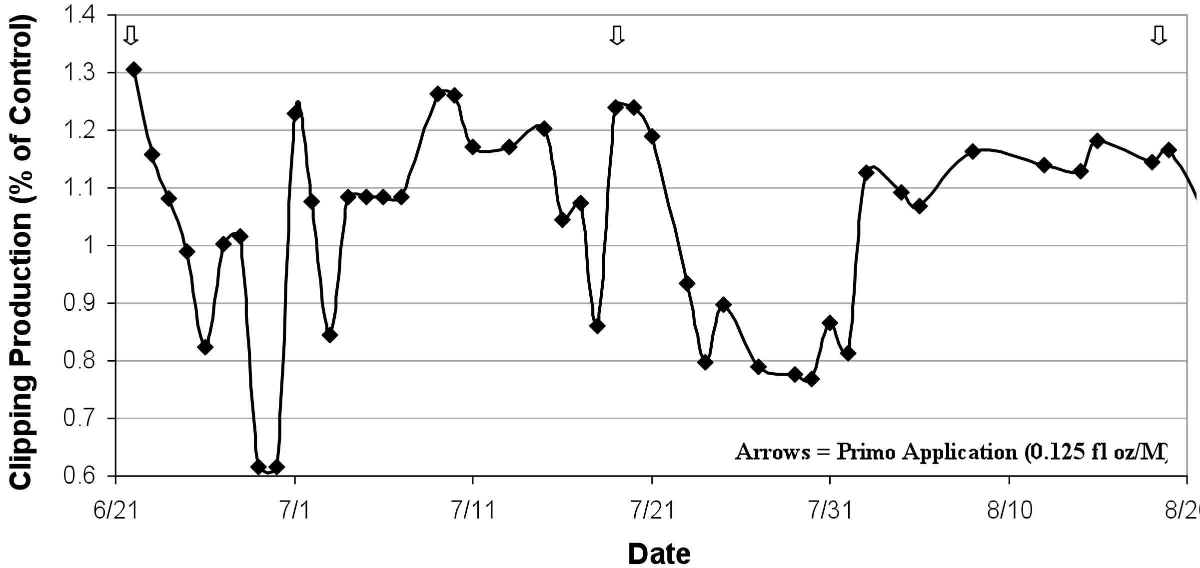

Figure 2. The effect of re-applying Primo every 4 weeks on turfgrass clipping production.

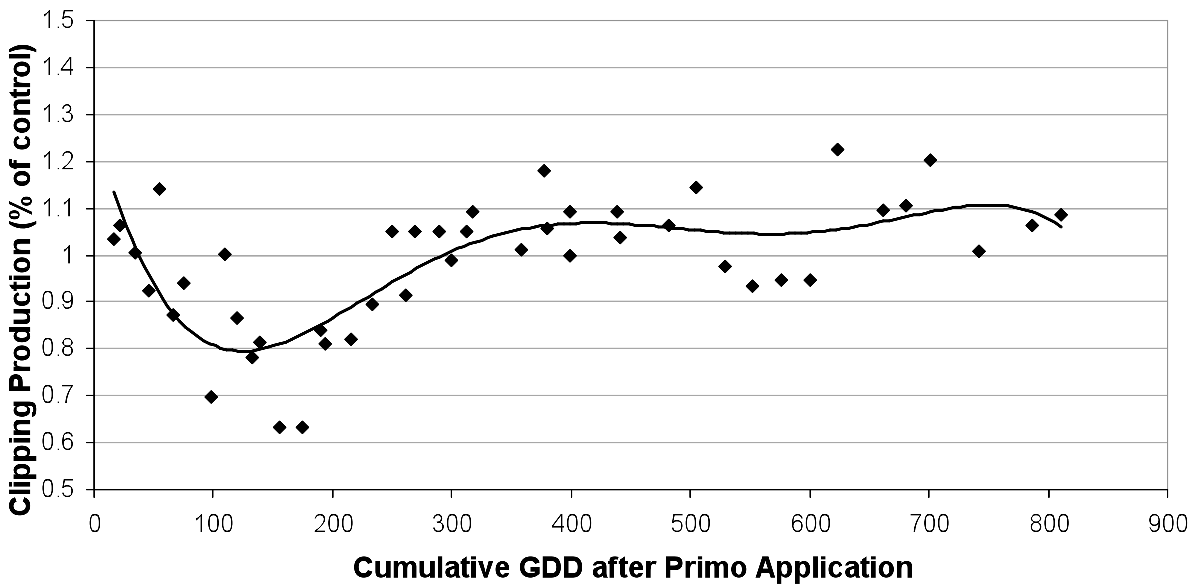

Figure 1. The magnitude of turfgrass growth regulation at various growing degree days after Primo application.

The Effect of Primo Maxx® on Rate and Re-application Frequency on Kentucky Bluegrass Sports Turf

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INTRODUCTION

The plant growth regulator Primo Maxx® has been widely used in the golf industry for the last 15 years. Along with many secondary benefits to its use, Primo is primarily used to reduce turfgrass clipping production. Now sports turf managers have begun to use Primo as a tool to reduce the mowing requirements and increase the color and quality of their playing fields. Sports turf managers have many of the same questions as golf course superintendents regarding the use of Primo. The primary questions include; how often do I need to re-apply Primo to maintain consistent growth reduction, and how much growth regulation will Primo provide.

Our previous research on creeping bentgrass golf putting greens has shown that the rate of Primo application and not application frequency has the greatest effect on reduction in clipping production. Additionally we have found that a using a growing degree day model to re-apply Primo can be used to maintain consistent growth regulation on golf putting greens.

The purpose of this research study was to assess the effectiveness of the plant growth regulator Primo Maxx® on clipping yield, overall quality, and color of Kentucky bluegrass sports turf. Various Primo application rates and growing degree day re-application intervals along with a control (no Primo) will be investigated.

MATERIALS AND METHODS

This study was conducted on a stand of Kentucky bluegrass (*Poa pratensis*) grown on native silt-loam soil at the O.J. Noer Turfgrass Research Facility in Madison, WI during August and September 2008. The plots were irrigated to 100% of estimated potential evapotranspiration three days a week. Plots were mowed 3 days a week at 1.5 inches with a Honda HRC-216 rotary mower with clippings returned. The entire plot was fertilized with 0.3 lb N/M from urea every two weeks.

Individual 6 x 10 ft plots were arranged into a randomized complete block design with four replicates. There were a total of 10 treatments in each block; a factorial of 3 application rates (0.1, 0.2, 0.4 fl oz Primo Maxx/M) and 3 growing degree day re-application intervals (100, 200, 400 GDD) with a no Primo control plot. Initial Primo applications were applied on August 8, 2008. Cumulative growing degree days were calculated by adding the mean daily air temperature, degrees Celsius, together. Once the desired cumulative growing degree day threshold (100, 200, or 400 GDD) had been surpassed Primo was re-applied and the GDD number is reset to zero.

Clippings were collected by mowing a 10 x 1.75 ft pass with the Honda rotary mower three days a week. Clippings were then dried and weighed. The clipping weight for each treatment was then divided by the clipping weight of the control from each block to calculate percent clipping reduction. Percentages less than 100 indicate growth reduction while percentages greater than 100 indicate increased clipping production in relation to the control plots. Visual estimates of turfgrass quality (1-9 scale, 1 = bare soil, 9 = perfect quality, 6 or above = acceptable) and chlorophyll index was recorded was recorded weekly. Chlorophyll index (CI) was measured with a CM-1000 chlorophyll meter (Spectrum Technologies Inc., Plainfield, IL). All data were analyzed with the JMP statistical software package (Cary, NC). Means were separated using Tukey HSD.

RESULTS AND DISCUSSION

Both the 100 and 200 GDD re-application intervals maintained growth suppression throughout the study (Figures 1 & 2). The 400 GDD re-application interval was effective at maintaining growth suppression for approximately two weeks or 200 GDD (Figure 3). After 200 GDD clipping production began to return to a similar level as the control. The 0.2 oz, 400 GDD treatment was the only treatment to experience a sustained 'rebound effect' or period of increased growth rate compared to the control (Figure 3).

A wide range of reduction in clipping yield occurred during this study (Table 1). Application rate was the primary influence on degree of growth regulation. The 0.4 fl oz rate treatments experienced a 50% reduction in clipping production when averaged across all re-application frequencies. The 0.1 and 0.2 fl oz treatments experienced a 20% and 30% reduction in clipping yield respectively. These levels of regulation are consistent our previous research on golf putting greens. The 100 GDD re-application frequency enhanced application rate to increase magnitude of growth reduction. For example the 0.4 oz, 100 GDD treatments experienced a 95% reduction in clipping production towards the end of the study. The 200 GDD rate maintained a most uniform level of clipping production throughout the study.

Overall visual turfgrass quality and CI were both influenced by Primo application (Table 2 & 3). However, the increase in turfgrass quality and CI took approximately a month to become statistically significant. The increased color and quality appeared to last well after the last Primo application. Differences in CI for example were visible well into November. The high Primo rate at 100 GDD interval produced the highest quality and CI by the end of the study. However these treatments did experience leaf tip damage due to frequent mowing in combination with the high level of growth suppression. The relationship between level of growth regulation and turfgrass wear tolerance wasn't assessed in this study but may be important to consider in the future.

CONCLUSIONS

1. Constant growth regulation can be achieved on Kentucky bluegrass when Primo is re-applied every 200 growing degree days.
2. Application rate primarily determines magnitude of growth suppression; 0.4 fl oz Primo/M ~ 50% growth suppression.
3. Increases in turfgrass quality and color occur approximately 4 to 6 weeks following initial Primo applications. This increase in color can last for several weeks after Primo has been applied.

TABLES AND FIGURES

Table 1. The effect of rate and re-application frequency of Primo Maxx on Kentucky bluegrass clipping production as compared to the control.

Primo Application		Clipping Production (Relative to Control)					
Rate	Frequency	8/14/2008	8/20/2008	8/25/2008	8/29/2008	8/31/2008	9/7/2008
--fl oz/M--	--GDD--			-----%-----			
0.1	100	80 A	58 ABC	85 BC	58 AB	70 ABC	96 AB
0.1	200	84 A	88 C	88 BC	74 AB	89 BC	82 AB
0.1	400	69 A	62 BC	84 BC	76 AB	91 BC	69 A
0.2	100	85 A	45 AB	69 AB	25 AB	40 ABC	71 A
0.2	200	65 A	51 AB	69 AB	39 AB	54 ABC	89 AB
0.2	400	76 A	62 BC	103 C	91 B	113 C	125 B
0.4	100	74 A	26 A	50 A	5 A	5 A	42 A
0.4	200	75 A	44 AB	52 A	26 AB	29 AB	64 A
0.4	400	103 A	37 AB	72 AB	83 B	98 BC	93 AB

Table 2. The effect of rate and re-application frequency of Primo Maxx on Kentucky bluegrass visual overall quality.

Primo Application		Turfgrass Visual Quality			
Rate	Frequency	8/14/2008	8/21/2008	8/28/2008	9/7/2008
----fl oz/M----	-----GDD-----				
			(1 to 9 scale)		
0.1	100	7.88 A	7.25 AB	7.50 A	8.00 AB
0.1	200	8.13 A	7.38 A	7.50 A	7.88 AB
0.1	400	7.88 A	7.50 A	7.13 A	7.75 BC
0.2	100	7.88 A	7.38 A	7.50 A	8.38 A
0.2	200	8.00 A	7.38 A	7.88 A	8.13 AB
0.2	400	7.75 A	7.13 AB	7.25 A	7.75 BC
0.4	100	8.00 A	6.25 B	7.00 A	8.38 A
0.4	200	7.63 A	6.88 AB	7.63 A	8.38 A
0.4	400	7.88 A	7.13 AB	7.25 A	7.88 AB
0	Control	7.88 A	7.63 A	6.75 A	7.25 C

Table 3. The effect of rate and re-application frequency of Primo Maxx on Kentucky bluegrass chlorophyll index (CI).

Primo Application		Clipping Production (Relative to Control)					
Rate --fl oz/M--	Frequency --GDD--	8/14/2008	8/20/2008	8/25/2008	8/29/2008	8/31/2008	9/7/2008
		-----%-----					
0.1	100	80 A	58 ABC	85 BC	58 AB	70 ABC	96 AB
0.1	200	84 A	88 C	88 BC	74 AB	89 BC	82 AB
0.1	400	69 A	62 BC	84 BC	76 AB	91 BC	69 A
0.2	100	85 A	45 AB	69 AB	25 AB	40 ABC	71 A
0.2	200	65 A	51 AB	69 AB	39 AB	54 ABC	89 AB
0.2	400	76 A	62 BC	103 C	91 B	113 C	125 B
0.4	100	74 A	26 A	50 A	5 A	5 A	42 A
0.4	200	75 A	44 AB	52 A	26 AB	29 AB	64 A
0.4	400	103 A	37 AB	72 AB	83 B	98 BC	93 AB

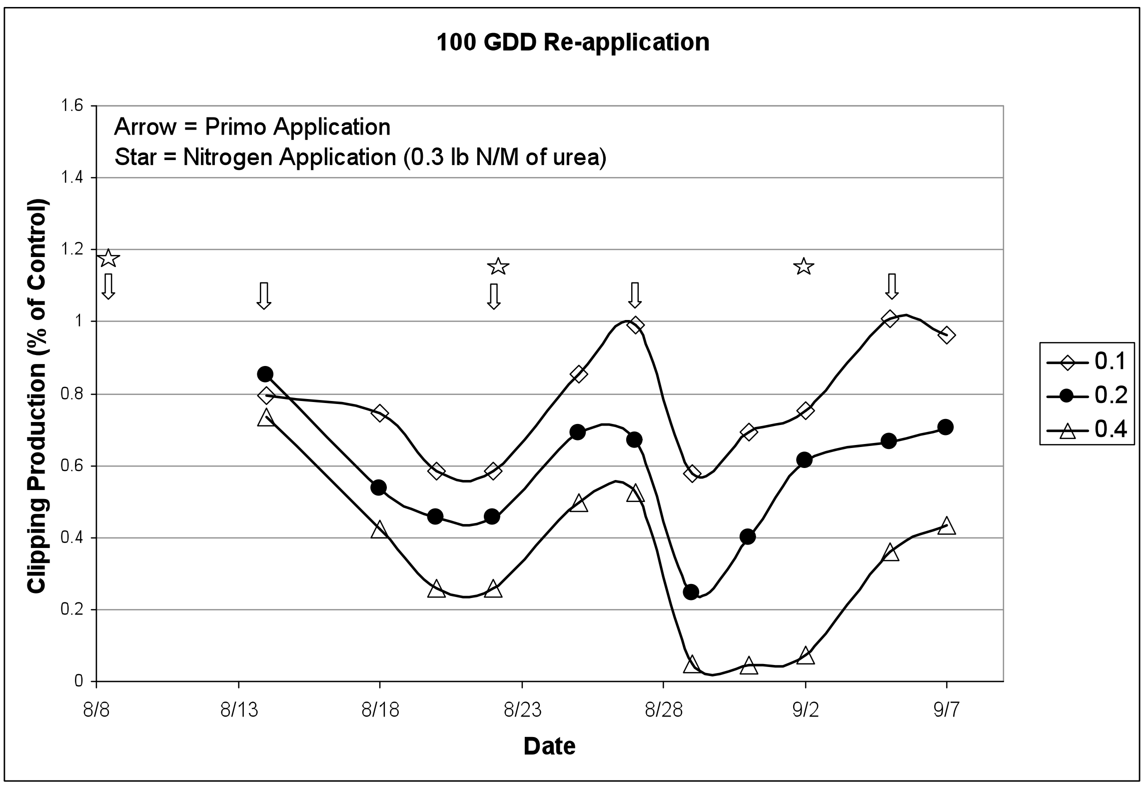

Figure 1. Clipping production of three Primo application rates re-applied every 100 GDD with respect to the control

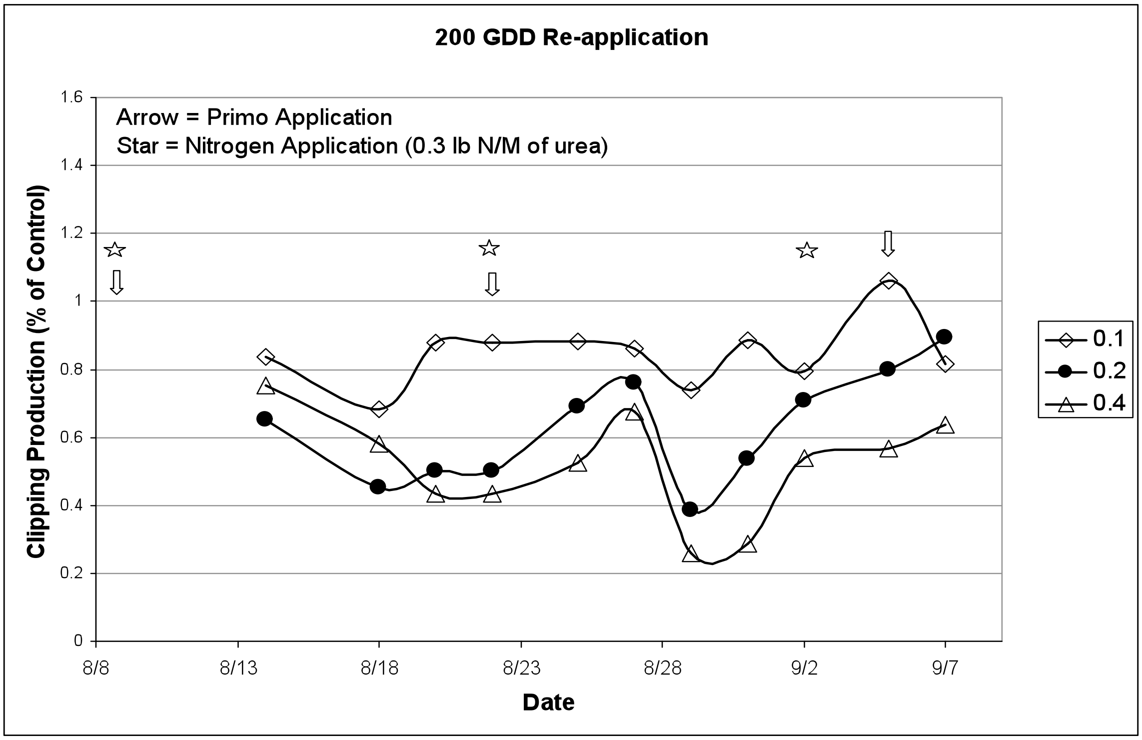

Figure 2. Clipping production of three Primo application rates re-applied every 100 GDD with respect to the control

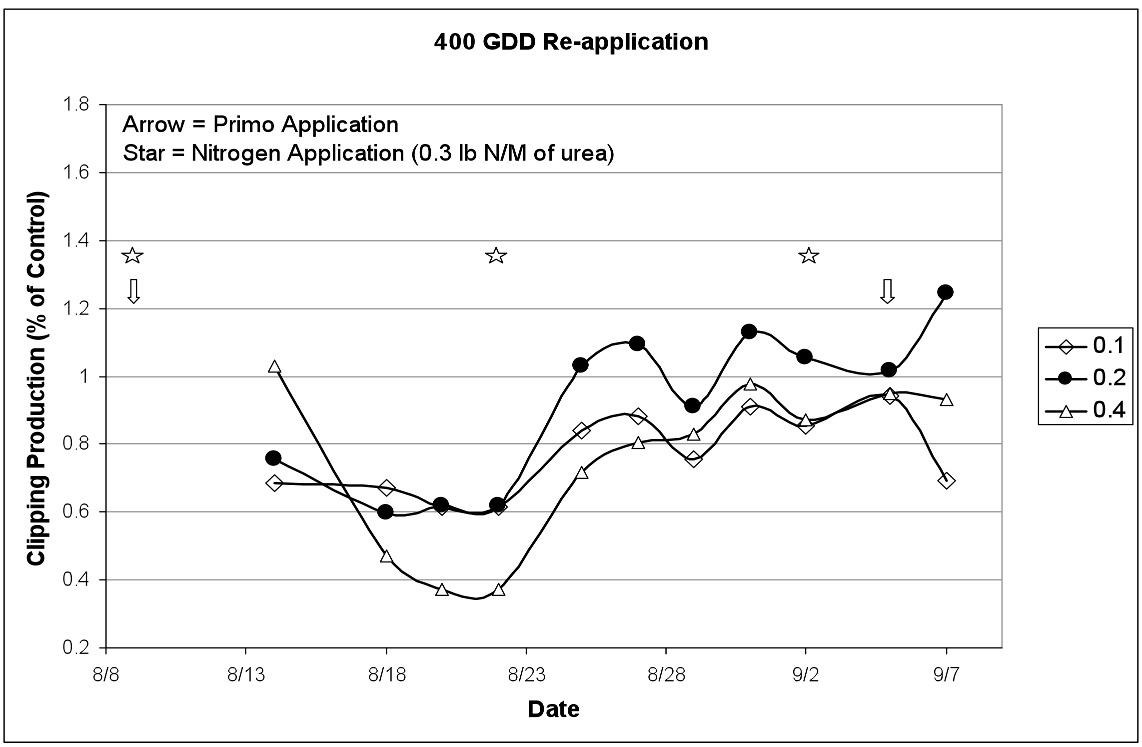

Figure 3. Clipping production of three Primo application rates re-applied every 100 GDD with respect to the control

Fungicide trials

Curative Fungicide Applications for Dollar Spot Control

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OBJECTIVE

To determine the efficacy of standard and experimental fungicides for curatively controlling dollar spot caused by the fungus *Sclerotinia homoeocarpa* on turfgrass.

MATERIALS AND METHODS

This study was performed at the OJ Noer Turfgrass Research and Education Facility in Verona, WI on a 'Penncross' creeping bentgrass plot maintained at 0.140 inches. Individual plots measured 3 x 5 ft, and were arranged in a randomized complete block design with four replications. Individual treatments were applied at a nozzle pressure of 40 psi using a CO_2 pressurized boom sprayer equipped with two XR Teejet 8005 VS nozzles. All fungicides were shaken by hand and applied in the equivalent of 2 gallons of water per 1000 ft^2. Treatments were initiated on August 28th once all plots exhibited at least 10% severity and reapplied 14 days later. Disease severity ratings were done immediately preceding the initial spray on August 28th, the second spray on September 11th, and 14 days later on September 23rd. Disease severity at each rating date was visually assessed and the data was subjected to an analysis of variance to determine statistical differences between treatments.

RESULTS AND DISCUSSION

Spring flooding and unseasonably cool conditions led to the delayed development of dollar spot at the OJ Noer Turfgrass Research Facility in 2008, and disease levels did not reach the minimum requirement for the initial application on most plots until late August. The lack of significant differences in the August 28th rating shows a fairly uniform spread of dollar spot throughout the plot prior to fungicide applications. Though optimum environmental conditions for dollar spot infection were observed immediately preceding the initial spray and for a short time following, conditions quickly became unfavorable for dollar spot development. This explains why even without the aid of any fungicides or other inputs the severity of dollar spot on the untreated controls dropped from 47.5% on August 28th to 27.5% one month later. Despite these conditions, all treatments provided significant reductions in dollar spot when compared to the control. Though no statistical differences existed among the treatments; Concert at 5.4 fl oz, Chipco 26GT at 4 fl oz, Banner MAXX at 2 fl oz, and tank mixes of Chipco 26GT plus Daconil Ultrex and QP Iprodione plus Daconil Ultrex provided complete control of dollar spot on September 23rd.

Table 1. Mean disease severity as measured by percent disease for standard and experimental treatments for the curative control of dollar spot on a creeping bentgrass fairway at the OJ Noer Turfgrass Research and Education Facility in 2008.

	Treatment	Rate		Interval	Rating Date*		
					Aug 28	Sep 11	Sep 23
1	Non-treated control				47.5a	41.3a	27.5a
2	Trinity	1.5	FL OZ/M	14 days	35a	9.5b	3b
3	Emerald	0.18	OZ/M	14 days	48.8a	11b	0.5b
4	QP Propiconazole	0.5	FL OZ/M	14 days	23.8a	13b	2.5b
5	QP Propiconazole	2	FL OZ/M	14 days	20a	4.3b	1b
6	QP Ipro	2	FL OZ/M	14 days	31.3a	3.5b	2.5b
7	QP Ipro	4	FL OZ/M	14 days	47.5a	5.8b	0.8
8	QP Propiconazole QP Ipro	3.6 2	FL OZ/M FL OZ/M	14 days 14 days	33.8a	4b	1.8b
9	Concert	5.4	FL OZ/M	14 days	28.8a	3.3b	0b
10	Banner MAXX	0.5	FL OZ/M	14 days	31.3a	10.5b	4.5b
11	Banner MAXX	2	FL OZ/M	14 days	20a	3.3b	0b
12	Chipco 26GT	2	FL OZ/M	14 days	38.8a	12.5b	0.5b
13	Bayleton	0.25	OZ/M	14 days	25a	13b	4.5b
14	Bayleton	1	OZ/M	14 days	18.8a	6.3b	0.5b
15	Chipco 26GT	4	FL OZ/M	14 days	30a	4.5b	0b
16	Daconil Ultrex	3.25	OZ/M	14 days	36.3a	10.5b	3.3b
17	Daconil Ultrex	5	OZ/M	14 days	27.5a	10b	1.8b
18	Banner MAXX Daconil Ultrex	0.5 3.25	FL OZ/M OZ/M	14 days 14 days	26.3a	7.5b	1.3b
19	QP Propiconazole Daconil Ultrex	0.5 3.25	FL OZ/M OZ/M	14 days 14 days	27.5a	7.5b	0.5b
20	Chipco 26GT Daconil Ultrex	2 3.25	FL OZ/M OZ/M	14 days 14 days	52.5a	2.8b	0b
21	QP Ipro Daconil Ultrex	2 3.25	FL OZ/M OZ/M	14 days 14 days	28.8a	2b	0b
22	Trinity Daconil Ultrex	1.5 3.25	FL OZ/M OZ/M	14 days 14 days	22.5a	1.3b	0.5b
	LSD				NS	10.87	6.55

*Means followed by same letter do not significantly differ (P=.05, Student-Newman-Keuls)

Carryover effects of snow mold fungicide applications for the control of dollar spot

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Department of Plant Pathology

OBJECTIVE

To determine length and degree of efficacy of different fungicides and fungicide combinations applied for snow mold control the previous fall in preventing dollar spot caused by the fungus *Sclerotinia homoeocarpa*.

MATERIALS AND METHODS

This study was performed at the OJ Noer Turfgrass Research and Education Facility in Verona , WI on 'Crenshaw' creeping bentgrass maintained at 0.5 inches. The individual plots measured 3 x 5 ft and were arranged in a randomized complete block design with four replications. All fungicides were agitated by hand and applied in the equivalent of 2 gallons of water per 1000 ft^2. Early applications were applied on October 30th, 2007 and late applications were applied on November 27th, 2007. Fungicide treatments were applied at a rate of 2 gallons per 1000 ft2 using a CO2 pressurized boom sprayer (40 psi) equipped with XR Teejet 8005 VS nozzles. The number of dollar spot infection centers per plot was visually assessed on July 11th and August 5th and the data subjected to an analysis of variance to determine statistical differences between treatments (Table 1).

RESULTS AND DISCUSSION

Spring flooding and unseasonably cool conditions led to the delayed development of dollar spot at the OJ Noer Turfgrass Research Facility in 2008. Dollar spot development during the July 11th rating date was minor, and no treatment had significantly fewer dollar spot infection centers than the untreated control. Many treatments allowed fewer than 5 infection centers per plot on the July 11th rating date, though moderate dollar spot breakthrough was observed with several treatments. By the August 5th rating date most treatments had broken down and did not provide an acceptable level of dollar spot control. Treatments 13, 32, and 33 were the most effective on the August 5th rating date.

Table 1. Mean number of dollar spot infection centers per treatment for the control of dollar spot with snow mold fungicides from the previous fall at the OJ Noer Turfgrass Research and Education Facility in Verona, WI in 2008.

Treatment	Rate	Timing[a]	Rating Date[b]	
			11-Jul	5-Aug
1 Untreated Control			2.8 c	37.8 bcd
2 Spectro	4 OZ/M	Early	9.8 bc	69 a-d
26/36	4 FL OZ/M	Late		
CLEX-09	1.2 OZ/M	Late		
3 Spectro	4 OZ/M	Early	5 bc	43.5 bcd
26/36	8 FL OZ/M	Late		
CLEX-09	1.2 OZ/M	Late		
4 Spectro	5.75 OZ/M	Late	5.8 bc	44.8 a-d
Endorse	4 OZ/M	Late		
5 Spectro	4 OZ/M	Early	10.8 bc	65.5 a-d
Spectro	4 OZ/M	Late		
Endorse	4 OZ/M	Late		
6 Spectro	4 OZ/M	Early	14.5 bc	68.5 a-d
26/36	4 FL OZ/M	Late		
Endorse	4 OZ/M	Late		
7 Spectro	4 OZ/M	Early	8.8 bc	55.5 a-d
26/36	8 FL OZ/M	Late		
Endorse	4 OZ/M	Late		
8 Spectro	4 OZ/M	Early	14.8 bc	74 abc
26/36	4 FL OZ/M	Late		
Endorse	4 OZ/M	Late		
Alude	5.5 FL OZ/M	Late		
9 26/36	8 FL OZ/M	Late	9.3 bc	34.8 bcd
CLEX-09	1.2 OZ/M	Late		
10 26/36	4 FL OZ/M	Late	27.8 a	83.8 ab
CLEX-09	1.2 OZ/M	Late		
11 CLEX-15	1 OZ/M	Late	1.3 c	30.5 cd
12 Lynx	1.5 FL OZ/M	Late	3 c	25 cd
Compass	0.25 OZ/M	Late		
Daconil WeatherStik	5.5 FL OZ/M	Late		
13 Tartan	2 FL OZ/M	Late	2 c	21.3 d
Daconil WeatherStik	5.5 FL OZ/M	Late		
14 Tartan	2 FL OZ/M	Late	1.5 c	35.8 bcd
Turfcide 400	6 FL OZ/M	Late		
15 Lynx	1.5 FL OZ/M	Late	2 c	23 cd
Chipco 26GT	4 FL OZ/M	Late		
Daconil WeatherStik	5.5 FL OZ/M	Late		
16 Reserve	7.6 FL OZ/M	Late	3 c	36.8 bcd
17 Reserve	7.6 FL OZ/M	Late	3.5 c	47 a-d
Chipco 26GT	4 FL OZ/M	Late		
18 Reserve	3.8 FL OZ/M	Late	1.5 c	24.5 cd
Compass	0.25 OZ/M	Late		
19 Reserve	7.6 FL OZ/M	Late	2 c	34.8 bcd
20 Instrata	9.3 FL OZ/M	Late	5 bc	31.3 cd
21 Tourney	0.44 OZ/M	Early/Late	13.8 bc	64 a-d
LSD			**8.74**	**28.47**

Means followed by same letter do not significantly differ (P=.05, Student-Newman-Keuls)

[a]Early and late fungicide treatments were applied on Oct. 30th, 2007 and Nov. 27th, 2007, respectively

[b]Mean number of dollar spot infection centers per treatment

Treatment		Rate		Timing[a]	Rating Date[b]			
					11-Jul		8-Aug	
22	Tourney	0.44	OZ/M	Early/Late	1.3	c	47.5	a-d
	Daconil Ultrex	3.2	OZ/M	Early/Late				
23	Tourney	0.44	OZ/M	Early/Late	20.5	ab	94.8	a-d
	3336	4	FL OZ/M	Early/Late				
24	Disarm	0.36	FL OZ/M	Late	9.3	bc	61	a-d
25	ARY 0534002	0.6	FL OZ/M	Late	8	bc	59	a-d
26	ARY 0474006	5.5	FL OZ/M	Late	7.3	bc	44.8	a-d
27	Insignia	0.7	OZ/M	Late	2.8	c	34	bcd
	Trinity	1	FL OZ/M	Late				
	Daconil WeatherStik	3.7	FL OZ/M	Late				
28	Insignia	0.7	OZ/M	Late	3.5	c	44.8	a-d
	Trinity	1	FL OZ/M	Late				
	Turfcide 400	6	FL OZ/M	Late				
29	Insignia	0.7	OZ/M	Late	4	c	48	a-d
	Chipco 26GT	4	FL OZ/M	Late				
	Daconil WeatherStik	3.7	FL OZ/M	Late				
30	Insignia	0.7	OZ/M	Late	6.5	bc	41.5	bcd
	Chipco 26GT	4	FL OZ/M	Late				
	Turfcide 400	6	FL OZ/M	Late				
31	Instrata	9.3	FL OZ/M	Late	3	c	49.3	a-d
32	Instrata	11	FL OZ/M	Late	1.8	c	21.8	d
33	Instrata	7	FL OZ/M	Late	1.8	c	18.3	d
34	Instrata	5.4	FL OZ/M	Late	1	c	28	cd
35	QP Iprodione	4	FL OZ/M	Late	5	bc	39.3	bcd
	QP TM/C	6	OZ/M	Late				
36	QP Iprodione	4	FL OZ/M	Late	8	bc	31.3	cd
	QP Propiconazole	2	FL OZ/M	Late				
	QP TM/C	6	OZ/M	Late				
37	Daconil WeatherStik	5.5	FL OZ/M	Late	2.8	c	32.5	bcd
	Chipco 26GT	4	FL OZ/M	Late				
38	Banner MAXX	3.2	FL OZ/M	Early	6	bc	41.8	bcd
	Daconil WeatherStik	4.5	FL OZ/M	Late				
	Medallion	0.27	OZ/M	Late				
39	Banner MAXX	3.2	FL OZ/M	Late	2.3	c	37	bcd
	Daconil WeatherStik	4.5	FL OZ/M	Late				
40	Banner MAXX	3.2	FL OZ/M	Late	8.3	bc	39.5	bcd
	Medallion	0.27	OZ/M	Late				
41	Daconil WeatherStik	4.5	FL OZ/M	Late	1.5	c	27	cd
	Medallion	0.27	OZ/M	Late				
42	Curalan EG	1	OZ/M	Late	2.8	c	36.5	bcd
	Insignia	0.9	OZ/M	Late				
	LSD				**8.74**		**28.47**	

Means followed by same letter do not significantly differ (P=.05, Student-Newman-Keuls)

[a]Early and late fungicide treatments were applied on Oct. 30th, 2007 and Nov. 27th, 2007, respectively

[b]Mean number of dollar spot infection centers per treatment

Control of dollar spot on creeping bentgrass maintained at fairway height

Paul Koch, Tom Huncosky, Sam Soper, and Dr. Jim Kerns
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Department of Plant Pathology

OBJECTIVE

To determine the efficacy of standard and experimental fungicides for controlling dollar spot caused by the fungus *Sclerotinia homoeocarpa* on turfgrass maintained under fairway conditions.

MATERIALS AND METHODS

The study was conducted at the O. J. Noer Turfgrass Research and Education Facility on a stand of creeping bentgrass (*Agrostis stolonifera* 'Penneagle') maintained at 0.5 inches. The individual plots measured 3 feet by 5 feet and were arranged in a randomized complete block design with four replications. Individual treatments were applied at a nozzle pressure of 40 p.s.i. using a CO_2 pressurized boom sprayer equipped with two XR Teejet 8005 VS nozzles. All fungicides were agitated by hand and applied in the equivalent of 2 gallons of water per 1000 ft^2. All treatments except 21 and 22 were initiated June 4th and subsequent applications were made at either 14 or 21 day intervals until the final application was made on August 26th. Treatment 21 and 22 were initiated on July 22nd. The number of dollar spot infection centers per plot and quality (1-9, 9 being excellent and 6 acceptable) were visually assessed and the data was subjected to an analysis of variance to determine statistical differences between treatments.

RESULTS AND DISCUSSION

Spring flooding followed by unseasonably cool and dry conditions for most of the season resulted in very little dollar spot development in 2008. Due to the limited disease development, no significant differences in dollar spot control were observed. Subtle differences in turfgrass quality were observed on the August 5th rating date and throughout the season. Treatment 26, the high rate of Legacy B, was the only treatment to provide a significant increase in turfgrass quality when compared to the untreated control. No decreases in quality were observed with any treatments. The surfactant Dewcure® was included to test its disease-suppressing capabilities, and while the lack of disease present prevented any meaningful disease ratings, the product did suppress dew formation on the fairways plots for approximately one week.

Table 1. Mean number of dollar spots and quality ratings per treatment on a creeping bentgrass fairway plot at the OJ Noer Turfgrass Research and Education Facility in Verona, WI in 2008.

	Treatment	Rate		Interval	August 5th	
					Dollar spot	Quality
1	Non-treated control				0a	7b
2	Trinity	1	FL OZ/M	14 days	0.5a	7b
3	Trinity	2	FL OZ/M	14 days	0.3a	7b
4	Dewcure	4	FL OZ/M	14 days	0.3a	7b
5	Emerald	0.18	OZ/M	21 days	0.8a	7b
6	Emerald T-Methyl	0.13 3	OZ/M FL OZ/M	14 days	0.8a	7b
7	Emerald T-Methyl	0.13 4	OZ/M FL OZ/M	14 days	1a	7b
8	Emerald Trinity	0.13 0.75	OZ/M FL OZ/M	14 days	0.8a	7b
9	Emerald Trinity	0.13 1	OZ/M FL OZ/M	14 days	0.3a	7b
10	Emerald Iprodione Pro	0.13 3	OZ/M FL OZ/M	14 days	0.3a	7b
11	Emerald Iprodione Pro	0.13 4	OZ/M FL OZ/M	14 days	0a	7b
12	Trinity Iprodione Pro	1 2	FL OZ/M FL OZ/M	14 days	0a	7b
13	Trinity Iprodione Pro	1 3	FL OZ/M FL OZ/M	14 days	0a	7b
14	Trinity Iprodione Pro	1 4	FL OZ/M FL OZ/M	14 days	0a	7b
15	Curalan EG	1	OZ/M	14 days	0a	7b
16	26/36	4	FL OZ/M	21 days	0a	7b
17	3336 Plus CLEX-8	4 2	FL OZ/M OZ/M	21 days	0a	7b
18	3336 Plus CLEX-8	3 1.5	FL OZ/M OZ/M	21 days	0a	7b
19	3336 Plus CLEX-8	2 2	FL OZ/M OZ/M	21 days	0a	7b
20	3336 Plus CLEX-8	2 1	FL OZ/M OZ/M	21 days	0a	7b
21	CLEX-24	5.5	FL OZ/M	21 days	0a	7.13b
22	CLEX-15	1	OZ/M	21 days	0.3a	7b
23	Legacy B	0.4	FL OZ/M	21 days	0a	7b
24	Legacy B	0.55	FL OZ/M	21 days	0a	7.25b
25	Legacy B	0.75	FL OZ/M	21 days	0.8a	7.25b
26	Legacy B	1.1	FL OZ/M	21 days	0a	7.75a
27	DPX-LEM17-50-76	0.3	OZ/M	14 days	0a	7b
28	DPX-LEM17-50-76	0.5	OZ/M	14 days	0a	7b
29	Concert	5.4	FL OZ/M	21 days	0a	7b
30	Experimental 1			21 days	0.3a	7b
31	Experimental 2			21 days	0a	7.13b
32	Experimental 3			21 days	0a	7b
	LSD				**NS**	**0.151**

***Means followed by same letter do not significantly differ (P=.05, Student-Newman-Keuls)**

Control of dollar spot on creeping bentgrass maintained at putting green height

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Department of Plant Pathology

OBJECTIVE

To determine the efficacy of standard and experimental fungicides for controlling dollar spot caused by the fungus *Sclerotinia homoeocarpa* on turfgrass maintained under putting green conditions.

MATERIALS AND METHODS

The study was conducted at the O. J. Noer Turfgrass Research and Education Facility on a stand of creeping bentgrass (*Agrostis stolonifera* 'Penncross') maintained at 0.140 inches. The individual plots measured 3 feet by 5 feet and were arranged in a randomized complete block design with four replications. Individual treatments were applied at a nozzle pressure of 40 p.s.i. using a CO_2 pressurized boom sprayer equipped with two XR Teejet 8005 VS nozzles. All fungicides were agitated by hand and applied in the equivalent of 2 gallons of water per 1000 ft^2. All treatments were initiated June 2nd, and subsequent applications were made at 14 or 21 day intervals until the final application was made on August 25th. The number of dollar spot infection centers per plot was visually assessed and quality rated on a 1-9 scale (9 being excellent, 6 being acceptable) and the data was subjected to an analysis of variance to determine statistical differences between treatments.

RESULTS AND DISCUSSION

Spring flooding followed by unseasonably cool and dry conditions for most of the season resulted in very little dollar spot development in 2008. Due to the limited disease development, no significant differences in dollar spot control were observed between treatments on all three rating dates. Significant differences in turfgrass quality were observed at each rating date. Treatment 12 provided the best quality throughout the season, and treatment 11 provided significant increased quality over the untreated control on the final rating date. A significant decrease in quality compared to the untreated control was observed with treatments 15 and 20, a possible reaction to the inclusion of growth regulating demethylation inhibitor (DMI) fungicides. The surfactant Dewcure® was included to test its disease-suppressing capabilities, and while the lack of disease present prevented any meaningful disease ratings, the product did suppress dew formation on the fairways plots for approximately one week.

Table 1. Mean number of dollar spots per treatment on a creeping bentgrass putting green plot at the OJ Noer Turfgrass Research and Education Facility in Verona, WI in 2008.

	Treatment	Rate		Interval	Rating Date*		
					Jul 31	Aug 5	Aug 27
1	Non-treated control				3.3a	3.5a	3.8a
2	Emerald	0.13	OZ/M	14 days	0a	0a	0a
3	Emerald	0.18	OZ/M	21 days	0a	0a	0a
4	Trinity	1	FL OZ/M	14 days	6a	3.5a	0.8a
5	CLEX-8	2	OZ/M	14 days	0a	0a	0a
6	Dewcure	4	FL OZ/M	14 days	0a	0.3a	0a
7	Daconil WeatherStik	2	FL OZ/M	14 days	0a	0.3a	0a
8	Daconil WeatherStik	3.6	FL OZ/M	14 days	0.5a	0a	0a
9	A16422 (A)	2	FL OZ/M	14 days	0.8a	0.5a	0a
10	A16422 (A)	3.6	FL OZ/M	14 days	0a	0.3a	0a
11	A16422 (B)	2	FL OZ/M	14 days	4.5a	5.5a	3a
12	A16422 (B)	3.6	FL OZ/M	14 days	0a	0a	0a
13	Daconil Ultrex	1.8	OZ/M	14 days	0a	0a	0a
14	Daconil Ultrex	3.2	OZ/M	14 days	0a	0.3a	0a
15	Instrata	4	FL OZ/M	14 days	0a	0a	0a
16	Concert	4	FL OZ/M	14 days	0a	0.3a	0a
17	Tartan	1	FL OZ/M	14 days	0a	0a	0a
18	Experimental 1			21 days	0a	0.8a	0a
19	Experimental 2			21 days	0a	0a	0a
20	Experimental 3			21 days	0a	0a	0a
	LSD				**NS**	**NS**	**NS**

***Means followed by same letter do not significantly differ (P=.05, Student-Newman-Keuls)**

Table 2. Mean quality ratings for each treatment on a creeping bentgrass putting green plot at the OJ Noer Turfgrass Research and Education Facility in Verona, WI in 2008.

Treatment		Rate		Interval	Rating Date*		
					Jul 31	Aug 5	Aug 27
1	Non-treated control				7bc	7bcd	7c-f
2	Emerald	0.13	OZ/M	14 days	7bc	7bcd	7c-f
3	Emerald	0.18	OZ/M	21 days	7bc	7bcd	7c-f
4	Trinity	1	FL OZ/M	14 days	7bc	7bcd	6.88def
5	CLEX-8	2	OZ/M	14 days	7bc	7bcd	7c-f
6	Dewcure	4	FL OZ/M	14 days	7bc	7bcd	7c-f
7	Daconil WeatherStik	2	FL OZ/M	14 days	7bc	7.13bc	7c-f
8	Daconil WeatherStik	3.6	FL OZ/M	14 days	6.75c	7.13bc	7.13cde
9	A16422 (A)	2	FL OZ/M	14 days	7bc	7.13bc	7.25cd
10	A16422 (A)	3.6	FL OZ/M	14 days	7.5b	7.5b	7.5bc
11	A16422 (B)	2	FL OZ/M	14 days	7.63b	7bcd	7.63b
12	A16422 (B)	3.6	FL OZ/M	14 days	8a	8a	8a
13	Daconil Ultrex	1.8	OZ/M	14 days	7bc	7bcd	7c-f
14	Daconil Ultrex	3.2	OZ/M	14 days	7bc	7bcd	7c-f
15	Instrata	4	FL OZ/M	14 days	6.5c	6.25ef	6.13g
16	Concert	4	FL OZ/M	14 days	7bc	6.75cde	6.75def
17	Tartan	1	FL OZ/M	14 days	7bc	6.88bcd	7c-f
18	Experimental 1			21 days	6.75c	6.63c-f	6.63ef
19	Experimental 2			21 days	7bc	6.13f	6.5f
20	Experimental 3			21 days	7bc	6.38def	6g
LSD					**0.364**	**0.384**	**0.299**

***Means followed by same letter do not significantly differ (P=.05, Student-Newman-Keuls)**

Early Season Preventative Fungicide Applications for the Delay of Dollar Spot Symptom Development

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OBJECTIVE

To determine length and degree of efficacy of different fungicides and fungicide combinations in delaying the onset of dollar spot caused by the fungus *Sclerotinia homoeocarpa*.

MATERIALS AND METHODS

This study was performed at the OJ Noer Turfgrass Research and Education Facility in Verona , WI on 'Penneagle' creeping bentgrass maintained at 0.5 inches. The individual plots measured 3 x 5 ft and were arranged in a randomized complete block design with four replications. All treatments were applied on May 15th at a growing degree day 50 rating of 120. Fungicide treatments were applied at a rate of 2 gallons per 1000 ft2 using a CO2 pressurized boom sprayer (40 psi) equipped with XR Teejet 8005 VS nozzles. The number of dollar spot infection centers per plot was visually assessed on August 19th and August 26th and the data was subjected to an analysis of variance to determine statistical differences between treatments.

RESULTS AND DISCUSSION

Spring flooding and unseasonably cool conditions led to the delayed development of dollar spot at the OJ Noer Turfgrass Research Facility in 2008. Turf damaged from flooding in early June prevented any ratings from being taken until early August. No treatments completely controlled dollar spot as of August 18th, a full 95 days after the initial application. All treatments aside from Emerald significantly reduced dollar spot compared to the untreated control on the August 18th rating date. There were no significant differences among the remaining 13 treatments. Warm and humid conditions in the days following the August 18th rating date led to a significant increase in dollar spot pressure and breakdown in any significant differences between the treatments and the control on the August 26th rating date.

Table 1. Mean number of dollar spot infection centers per treatment for early season disease control at the OJ Noer Turfgrass Research and Education Facility in Verona, WI in 2008.

Treatment		Rate		Rating Date*	
				Aug 18th	Aug 26th
1	Non-treated control			26a	106.3a
2	Emerald	0.18	OZ/M	19.5ab	90a
3	Tourney	0.28	OZ/M	9.5c	92.8a
4	Tourney	0.37	OZ/M	4.5c	93.8a
5	Chipco 26GT	4	FL OZ/M	5.5c	66.3a
6	Banner MAXX	2	FL OZ/M	10.5c	124.3a
7	Eagle	2.4	FL OZ/M	12.3bc	100.5a
8	Bayleton	1	OZ/M	6.8c	69a
9	Trinity	1	FL OZ/M	4c	51.3a
10	CLEX-8	4	OZ/M	4.3c	80a
11	CLEX-15	1	OZ/M	4c	87.3a
12	CLEX-8 3336 Plus	2 4	OZ/M FL OZ/M	8.3c	95.3a
13	Concert	4	FL OZ/M	4.5c	59.8a
14	Tartan	2	FL OZ/M	5c	123a
15	Urea	34.8	OZ/M	4.5c	41a
LSD				**7.3**	**NS**

***Means followed by same letter do not significantly differ (P=.05, Student-Newman-Keuls)**

Fungicides for the Preventative Control of Anthracnose

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OBJECTIVE

To determine the efficacy of experimental and standard fungicides for preventing anthracnose caused by the fungus *Colletotrichum cereale*.

MATERIALS AND METHODS

The study was conducted on an annual bluegrass (*Poa annua*) and creeping bentgrass (*Agrostis stolonifera* 'Penncross') putting green maintained at a mowing height of 0.100 inches at the OJ Noer Turfgrass Research and Education Facility in Verona, WI as well as a creeping bentgrass and annual bluegrass fairway maintained at 0.5 inches at Blackhawk Country Club in Madison, WI and a creeping bentgrass and annual bluegrass fairway maintained at 0.5 inches at Janesville Country Club in Janesville, WI. The individual plots measured 3 X 10 feet and were arranged in a randomized complete block design with four replications. Individual treatments were applied at a nozzle pressure of 40 p.s.i. using a CO_2 pressurized boom sprayer equipped with two XR Teejet 8005 VS nozzles. All fungicides were agitated by hand and applied in the equivalent of 2 gallons of water per 1000 ft^2. Treatments were initiated on June 10^{th} at the OJ Noer center, June 11^{th} at Blackhawk CC, and June 19^{th} at Janesville CC and subsequent applications were made at 14 day intervals until the final application was made in late August. Visual ratings of percent anthracnose and turfgrass quality were recorded and the data was subjected to an analysis of variance to determine statistical differences between treatments.

RESULTS AND DISCUSSION

Anthracnose was slow to develop at Blackhawk CC this year, and minor symptoms did develop after a warm period in early August. All 14 treatments included in the study reduced anthracnose compared to the untreated control on August 20th, though there was no difference between treatments. No anthracnose was observed at the OJ Noer center or at Janesville CC. On the fairway height turf at Blackhawk CC, slightly higher quality was observed with those treatments containing high rates of Banner MAXX and Bayleton, which belong to the growth-reulating demethylation-inhibitor (DMI) class of fungicides. At the OJ Noer Center, where the plots were maintained at a very low 0.100 inches, the worst quality turf was on those treatments including the growth-regulating DMI compounds.

Table 1. Percent Anthracnose from the OJ Noer Turfgrass Research Facility in Verona, WI; Blackhawk Country Club in Madison, WI; and Janesville CC in Janesville, WI in 2008.

	Treatment	Rate		Interval	Percent Anthracnose Rating Date*					
					OJ Noer		Blackhawk		Janesville CC	
					Aug 5	Aug 27	Aug 7	Aug 20	Jul 31	Aug 14
1	Unt. control				0a	0a	2.5a	5a	0a	0a
2	Banner MAXX	1	FL OZ/M	14 days	0a	0a	0a	0b	0a	0a
3	Banner MAXX	2	FL OZ/M	14 days	0a	0a	0a	0b	0a	0a
4	Eagle	1.2	FL OZ/M	14 days	0a	0a	0a	0b	0a	0a
5	Insignia	0.9	OZ/M	14 days	0a	0a	0a	0.5b	0a	0a
6	Trinity	1	FL OZ/M	14 days	0a	0a	0a	0b	0a	0a
7	Insignia Trinity	0.7 1	OZ/M FL OZ/M	14 days 14 days	0a	0a	0a	0.5b	0a	0a
8	Banner MAXX Daconil Ultrex	1 3.5	FL OZ/M OZ/M	14 days 14 days	0a	0a	0a	0b	0a	0a
9	Eagle Daconil Ultrex	1.2 3.5	FL OZ/M OZ/M	14 days 14 days	0a	0a	0a	0b	0a	0a
10	Heritage TL	2	FL OZ/M	14 days	0a	0a	0a	0.5b	0a	0a
11	Compass	0.2	FL OZ/M	14 days	0a	0a	0a	1.3b	0a	0a
12	Bayleton	1	OZ/M	14 days	0a	0a	0a	0b	0a	0a
13	Compass Bayleton	0.15 0.5	OZ/M OZ/M	14 days 14 days	0a	0a	0a	0b	0a	0a
	LSD				**NS**	**NS**	**NS**	**NS (p=.08)**	**NS**	**NS**

*Means followed by same letter do not significantly differ (P=.05, Student-Newman-Keuls)

Table 2. Mean quality ratings from the OJ Noer Turfgrass Research Facility in Verona, WI; Blackhawk Country Club in Madison, WI; and Janesville CC in Janesville, WI in 2008.

	Treatment	Rate		Interval	Quality Rating Date*					
					OJ Noer		Blackhawk		Janesville CC	
					Aug 5	Aug 27	Aug 7	Aug 20	Jul 31	Aug 14
1	Unt. control				4.13d	4.8bc	7a	6.5b	7a	7a
2	Banner MAXX	1	FL OZ/M	14 days	5.25bcd	5abc	7a	7.13ab	7a	7a
3	Banner MAXX	2	FL OZ/M	14 days	4.75cd	4.5c	7a	7.25ab	7a	7a
4	Eagle	1.2	FL OZ/M	14 days	5.5a-d	5abc	7a	7ab	7a	7a
5	Insignia	0.9	OZ/M	14 days	6.25abc	5.8abc	7a	7ab	7a	7a
6	Trinity	1	FL OZ/M	14 days	6.25abc	6abc	7a	7ab	7a	7a
7	Insignia Trinity	0.7 1	OZ/M FL OZ/M	14 days 14 days	5.75abc	5.8abc	7a	7ab	7a	7a
8	Banner MAXX Daconil Ultrex	1 3.5	FL OZ/M OZ/M	14 days 14 days	6abc	6abc	7a	7.63a	7a	7a
9	Eagle Daconil Ultrex	1.2 3.5	FL OZ/M OZ/M	14 days 14 days	6.5ab	6.8ab	7a	7ab	7a	7a
10	Heritage TL	2	FL OZ/M	14 days	7a	7a	7a	7ab	7a	7a
11	Compass	0.2	FL OZ/M	14 days	6.25abc	6.5abc	7a	7ab	7a	7a
12	Bayleton	1	OZ/M	14 days	5.25bcd	5.5abc	7a	7.75a	7a	7a
13	Compass Bayleton	0.15 0.5	OZ/M OZ/M	14 days 14 days	5.38bcd	5.3abc	7a	7ab	7a	7a
LSD					**0.975**	**1.2**	**NS**	**0.473**	**NS**	**NS**

*Means followed by same letter do not significantly differ (P=.05, Student-Newman-Keuls)

Control of Rhizoctonia brown patch on colonial bentgrass maintained at fairway height

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Department of Plant Pathology

OBJECTIVE

To determine the efficacy of standard and experimental fungicides for the control of Rhizoctonia blight (brown patch) caused by the fungus *Rhizoctonia solani*.

MATERIALS AND METHODS

The study was conducted at the O. J. Noer Turfgrass Research and Education Facility on a mixed stand of colonial bentgrass (*Agrostis capillaries* 'SR7150') and annual bluegrass (*Poa annua*) maintained at a 0.5 inch cutting height. The individual plots measured 3 ft X 10 ft and were arranged in a randomized complete block design with four replications. Individual treatments were applied at a nozzle pressure of 40 p.s.i. using a CO_2 pressurized boom sprayer equipped with two XR Teejet 8005 VS nozzles. All fungicides were agitated by hand and applied in the equivalent of 2 gallons of water per 1000 ft^2. All treatments were initiated on June 24th and subsequent applications were made at 14, 21, or 28 day intervals until the final application was made on August 26th. Plots were not inoculated with *R. solani*, however, plots received increased irrigation (200% of estimated evapotranspiration) and monthly applications of 0.5 lb N/1000 ft^2 when conditions were conducive for disease development. Percent brown patch per plot and quality (1-9, 9 being excellent and 6 acceptable) were visually assessed and the data was subjected to an analysis of variance to determine statistical differences between treatments.

RESULTS AND DISCUSSION

Spring flooding followed by cool and dry summer conditions delayed the development of brown patch symptoms until late in the summer. All but one treatment significantly reduced brown patch symptoms compared to the untreated control on the August 15th rating date. More treatments were statistically similar to the untreated control on the August 28th date, but more due to lower percent disease in the control than increased breakthrough on the treatments. All treatments slightly increased turfgrass quality over the untreated control on both dates, though there was no difference amongst treatments.

Table 1. Percent Brown Patch and Quality Ratings from the O. J. Noer Turfgrass Research and Education Facility in Verona, WI in 2008.

	Treatment	Rate		Interval	August 15		August 28	
					% BP	Quality	% BP	Quality
1	Non-treated control				14.5a	6.5b	11.3a	6.25b
2	Insignia	0.9	OZ/M	28 Days	3b	7a	1.3b	7a
3	Trinity	1.5	FL OZ/M	21 Days	1.3b	7a	0b	7a
4	A14912 (A)	64	OZ/M	21 Days	2b	7a	2.5ab	7a
5	A14912 (C)	64	OZ/M	21 Days	1.3b	7a	2.5ab	7a
6	EXC3949	71	OZ/M	21 Days	0b	7a	0b	7a
7	Heritage TL	2	FL OZ/M	21 Days	1.8b	7a	1.8b	7a
8	Compass	64	OZ/M	21 Days	3b	7a	3.8ab	7a
9	Fungicide X	77	OZ/M	21 Days	3.3b	7a	5ab	7a
10	Headway	1.5	FL OZ/M	21 Days	1.8b	7a	2.5ab	7.13a
11	DPX-LEM17-50-76	0.3	OZ/M	14 Days	0b	7a	0b	7a
12	DPX-LEM17-50-76	0.5	OZ/M	14 Days	0b	7a	0b	7a
13	Banner MAXX	1.2	FL OZ/M	14 Days	2.5b	6.8a	2.5ab	7.13a
14	Heritage	0.7	OZ/M	14 Days	3.3b	7a	5ab	7.13a
15	Daconil Ultrex	2.54	OZ/M	14 Days	0.5b	7a	0b	7a
16	MTF-753	0.41	FL OZ/M	14 Days	0b	7a	0b	7a
17	MTF-753	0.82	FL OZ/M	14 Days	0b	7a	0b	7a
18	SSF-126	2.44	OZ/M	14 Days	8.8ab	7a	5ab	6.5ab
19	SSF-126	7.28	FL OZ/M	14 Days	4.5b	7a	5ab	7a
20	NB36278	3.28	OZ/M	14 Days	3.5b	7a	1.3b	7a
21	NB36278	6.54	OZ/M	14 Days	3.8b	7a	1.3b	7a
22	Disarm	0.18	FL OZ/M	21 Days	8.3ab	7a	3.8ab	7a
	LSD				**6.86**	**0.23**	**5.44**	**0.364**

*Means followed by same letter do not significantly differ (P=.05, Student-Newman-Keuls)

Control of Rhizoctonia brown patch on creeping bentgrass maintained at putting green height

Paul Koch, Tom Huncosky, Sam Soper, and Dr. Jim Kerns
University of Wisconsin - Madison
Department of Plant Pathology

OBJECTIVE

To determine the efficacy of standard and experimental fungicides for the control of Rhizoctonia blight (brown patch) caused by the fungus *Rhizoctonia solani*.

MATERIALS AND METHODS

The study was conducted at the O. J. Noer Turfgrass Research and Education Facility on a mixed stand of ‘Penncross’ creeping bentgrass (*Agrostis stolonifera*) and annual bluegrass (*Poa annua*) maintained at a 0.140 inch cutting height. The individual plots measured 3 ft X 10 ft and were arranged in a randomized complete block design with four replications. Individual treatments were applied at a nozzle pressure of 40 p.s.i. using a CO_2 pressurized boom sprayer equipped with two XR Teejet 8005 VS nozzles. All fungicides were agitated by hand and applied in the equivalent of 2 gallons of water per 1000 ft^2. All treatments were initiated on June 10th and subsequent applications were made at 14 or 21 day intervals until the final application was made on August 19th. Plots were not inoculated with *R. solani*, however, plots received increased irrigation (200% of estimated evapotranspiration) and monthly applications of 0.5 lb N/1000 ft^2 during the summer. Percent brown patch per plot and quality (1-9, 9 being excellent and 6 acceptable) were visually assessed and the data was subjected to an analysis of variance to determine statistical differences between treatments.

RESULTS AND DISCUSSION

Spring flooding followed by cool and dry summer conditions prevented the development of brown patch symptoms on the research trial. No brown patch was observed on the experimental plot and no differences in turfgrass quality were observed.

Table 1. Standard and experimental treatments for the control of brown patch at the OJ Noer Turfgrass Research and Education Facility in 2008.

	Treatment	Rate		Interval
1	Non-treated control			
2	A15935	2.5	FL OZ/M	14 days
3	A15935	4.5	FL OZ/M	14 days
4	A15935	2.5	FL OZ/M	21 days
5	A15935	4.5	FL OZ/M	21 days
6	Heritage Daconil WeatherStik	0.2 2	OZ/M FL OZ/M	14 days 14 days
7	Headway	1.5	FL OZ/M	14 days
8	Tartan	1	FL OZ/M	14 days
9	Concert	3	FL OZ/M	14 days
10	Heritage	0.2	OZ/M	14 days

Fungicides for the Preventative Control of Pythium Blight

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Department of Plant Pathology

OBJECTIVE

To determine the efficacy of standard and experimental fungicides for preventing Pythium blight caused by *Pythium* spp.

MATERIALS AND METHODS

The study was conducted at the O.J. Noer Turfgrass Research and Education Facility in Verona, WI on a stand of perennial ryegrass (*Lolium perenne*) seeded on June 1st and maintained at a one inch cutting height. The individual plots measured 3 feet by 5 feet and were arranged in a randomized complete block design with four replications. Individual treatments were applied on July 31st at a nozzle pressure of 40 p.s.i. using a CO_2 pressurized boom sprayer equipped with two XR Teejet 8005 VS nozzles. All fungicides were agitated by hand and applied in the equivalent of 2 gallons of water per 1000 ft^2. On August 1st, the trial was covered with an Evergreen® growth blanket to increase the turfgrass canopy temperature and humidity and make the environment more conducive for Pythium blight infection. The plots were visually rated for percent Pythium blight on August 3rd, 5th, and 7th. The data was subjected to an analysis of variance to determine statistically significant differences between individual treatments.

RESULTS AND DISCUSSION

June flooding damaged the plot the Pythium trial was to be conducted on, resulting in significant weed contamination. Unseasonably cool conditions throughout the season prevented optimum Pythium blight infection conditions despite increased irrigation and use of the Evergreen® growth blanket.

Table 1. Fungicide treatments and rates for the preventative control of Pythium blight at the OJ Noer Turfgrass Research and Education Facility in Verona, WI in 2008.

Treatment		Rate		Rating Date*		
				8/3/2008	8/5/2008	8/7/2008
1	Non-treated control			0	0	0
2	QP Mefenoxam	1	FL OZ/M	0	0	0
3	QP Fosetyl-AL	4	OZ/M	0	0	0
4	QP Mefenoxam QP Fosetyl-AL	0.5 2	FL OZ/M OZ/M	0	0	0
5	Subdue MAXX	1.1	FL OZ/M	0	0	0
6	Heritage	0.4	OZ/M	0	0	0
7	Segway	0.82	FL OZ/M	0	0	0
8	MTF-753	0.41	FL OZ/M	0	0	0
9	MTF-753	0.82	FL OZ/M	0	0	0
10	SSF-126	2.44	OZ/M	0	0	0
11	SSF-126	7.28	OZ/M	0	0	0
12	NB36278	3.28	OZ/M	0	0	0
13	NB36278	6.54	OZ/M	0	0	0
14	Chipco Signature	4	OZ/M	0	0	0
15	NB36691B	20.2	FL OZ/M	0	0	0
16	NB36691B	10.1	FL OZ/M	0	0	0

Seasonal Programs for Control of Turfgrass Diseases

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Department of Plant Pathology

OBJECTIVE

To determine the efficacy of fungicide spray programs for the control of turfgrass diseases and abiotic stresses throughout the summer.

MATERIALS AND METHODS

The study was conducted at the O.J. Noer Turfgrass Research and Education Facility on a mixed stand of creeping bentgrass (*Agrostis stolonifera*) and annual bluegrass (*Poa annua*) maintained at 0.100 inch cutting height. The individual plots measured 6 ft X 10 ft and were arranged in a randomized complete block design with four replications. Individual treatments were applied at a nozzle pressure of 40 p.s.i using a CO_2 pressurized boom sprayer equipped with two XR Teejet 8005 VS nozzles. All fungicides were agitated by hand and applied in the equivalent of 2 gallons of water per $1000ft_2$. A leaf spot application was applied to treatments 2-4 on April 17th, and an early-season dollar spot/summer patch application was made on May 15th. The fungicide programs were initiated on June 2nd and applied every 14 days until a final fall dollar spot application was made on September 1st. Dollar spot and turfgrass quality (1-9, 9 being excellent and 6 acceptable) were visually assessed and the data was subjected to an analysis of variance to determine statistical differences between treatments. Emerald was included in the study but not statistically analyzed along with treatments 1-4.

RESULTS AND DISCUSSION

Dollar spot pressure was fairly low for the majority of the season, but pressures increased in late July and early August. Every program significantly reduced dollar spot compared to the untreated control, but there was no difference between the programs. Turfgrass quality on the untreated control fell below acceptable levels in mid-July and remained there through the remainder of the study. The Emerald program fell slightly below acceptable levels in early August, mostly due to the decline of annual bluegrass. All other programs significantly increased turfgrass quality compared to the untreated control, and on the August 27th rating date programs 3 and 4 provided significantly higher quality than program 2.

Table 1. Mean number of dollar spot infection centers (DSIC) per treatment at the O. J. Noer Turfgrass Research and Education Facility in Verona, WI in 2008.

	Treatment	Rate		Interval	Dollar Spot Rating Date*			
					Jun 10	Jul 21	Aug 5	Aug 27
1	Non-treated control				14.3a	48.8a	110.5a	51a
2	Chipco 26GT	4	FL OZ/M	April 17	0b	0b	0.3b	0b
	Bayleton	1	FL OZ/M	May 15				
	Signature Ultra	4	OZ/M	June 2				
	Tartan	1.5	FL OZ/M	June 2				
	Signature Ultra	4	OZ/M	14 day				
	Daconil Ultrex	3.2	OZ/M	14 day				
	Signature Ultra	4	OZ/M	14 day				
	Chipco Triton	0.225	OZ/M	14 day				
	Signature Ultra	4	OZ/M	14 day				
	Chipco 26GT	4	FL OZ/M	14 day				
	Signature Ultra	4	OZ/M	14 day				
	Tartan	1.5	FL OZ/M	14 day				
	Signature Ultra	4	OZ/M	14 day				
	Daconil Ultrex	3.2	OZ/M	14 day				
	Signature Ultra	4	OZ/M	14 day				
	Chipco Triton	0.225	OZ/M	14 day				
	Signature Ultra	4	OZ/M	14 day				
	Chipco 26GT	4	FL OZ/M	14 day				
	Chipco Triton	0.6	OZ/M	Sept 1				
3	Chipco 26GT	4	FL OZ/M	April 17	0b	0b	2.5b	0b
	Bayleton	1	FL OZ/M	May 15				
	Signature Ultra	4	OZ/M	June 2				
	Tartan	1.5	FL OZ/M	June 2				
	Signature Ultra	4	OZ/M	14 day				
	Daconil Ultrex	3.2	OZ/M	14 day				
	Signature Ultra	4	OZ/M	14 day				
	Legacy B	0.4	FL OZ/M	14 day				
	Signature Ultra	4	OZ/M	14 day				
	Chipco 26GT	4	FL OZ/M	14 day				
	Signature Ultra	4	OZ/M	14 day				
	Tartan	1.5	FL OZ/M	14 day				
	Signature Ultra	4	OZ/M	14 day				
	Daconil Ultrex	3.2	OZ/M	14 day				
	Signature Ultra	4	OZ/M	14 day				
	Legacy B	0.4	FL OZ/M	14 day				
	Signature Ultra	4	OZ/M	14 day				
	Chipco 26GT	4	FL OZ/M	14 day				
	Legacy B	1.1	FL OZ/M	Sept 1				

	Heritage TL	2	FL OZ/M	April 17				
	Banner MAXX	2	FL OZ/M	May 15				
	Signature Ultra	4	OZ/M	June 2				
	Chipco 26GT	4	FL OZ/M	June 2				
	Signature Ultra	4	OZ/M	14 day				
	Tartan	1.5	FL OZ/M	14 day				
	Signature Ultra	4	OZ/M	14 day				
	Daconil Ultrex	3.2	OZ/M	14 day				
	Signature Ultra	4	OZ/M	14 day				
4	Chipco 26GT	4	FL OZ/M	14 day	0b	0b	0.3b	0b
	Signature Ultra	4	OZ/M	14 day				
	Daconil Ultrex	3.2	OZ/M	14 day				
	Signature Ultra	4	OZ/M	14 day				
	Heritage TL	1	FL OZ/M	14 day				
	Signature Ultra	4	OZ/M	14 day				
	Chipco 26GT	4	FL OZ/M	14 day				
	Signature Ultra	4	OZ/M	14 day				
	Daconil Ultrex	3.2	OZ/M	14 day				
	Banner MAXX	2	FL OZ/M	Sept 1				
5	Emerald	0.18	OZ/M	14 Days	0	0	0.5	1
		LSD			**4.73**	**9.76**	**54.86**	**22.55**

*Means followed by same letter do not significantly differ (P=.05, Student-Newman-Keuls)

Table 2. Mean quality ratings per treatment at the O. J. Noer Turfgrass Research and Education Facility in Verona, WI in 2008.

	Treatment	Rate		Interval	Quality Rating Date*			
					Jun 10	Jul 21	Aug 5	Aug 27
1	Non-treated control				6b	5.5b	3.5b	4c
	Chipco 26GT	4	FL OZ/M	April 17				
	Bayleton	1	FL OZ/M	May 15				
	Signature Ultra	4	OZ/M	June 2				
	Tartan	1.5	FL OZ/M	June 2				
	Signature Ultra	4	OZ/M	14 day				
	Daconil Ultrex	3.2	OZ/M	14 day				
	Signature Ultra	4	OZ/M	14 day				
	Chipco Triton	0.225	OZ/M	14 day				
	Signature Ultra	4	OZ/M	14 day				
2	Chipco 26GT	4	FL OZ/M	14 day	7a	7a	6.8a	6.5b
	Signature Ultra	4	OZ/M	14 day				
	Tartan	1.5	FL OZ/M	14 day				
	Signature Ultra	4	OZ/M	14 day				
	Daconil Ultrex	3.2	OZ/M	14 day				
	Signature Ultra	4	OZ/M	14 day				
	Chipco Triton	0.225	OZ/M	14 day				
	Signature Ultra	4	OZ/M	14 day				
	Chipco 26GT	4	FL OZ/M	14 day				
	Chipco Triton	0.6	OZ/M	Sept 1				
	Chipco 26GT	4	FL OZ/M	April 17				
	Bayleton	1	FL OZ/M	May 15				
	Signature Ultra	4	OZ/M	June 2				
	Tartan	1.5	FL OZ/M	June 2				
	Signature Ultra	4	OZ/M	14 day				
	Daconil Ultrex	3.2	OZ/M	14 day				
	Signature Ultra	4	OZ/M	14 day				
	Legacy B	0.4	FL OZ/M	14 day				
	Signature Ultra	4	OZ/M	14 day				
3	Chipco 26GT	4	FL OZ/M	14 day	7a	7a	6a	7.5a
	Signature Ultra	4	OZ/M	14 day				
	Tartan	1.5	FL OZ/M	14 day				
	Signature Ultra	4	OZ/M	14 day				
	Daconil Ultrex	3.2	OZ/M	14 day				
	Signature Ultra	4	OZ/M	14 day				
	Legacy B	0.4	FL OZ/M	14 day				
	Signature Ultra	4	OZ/M	14 day				
	Chipco 26GT	4	FL OZ/M	14 day				
	Legacy B	1.1	FL OZ/M	Sept 1				

4	Heritage TL Banner MAXX Signature Ultra Chipco 26GT Signature Ultra Tartan Signature Ultra Daconil Ultrex Signature Ultra Chipco 26GT Signature Ultra Daconil Ultrex Signature Ultra Heritage TL Signature Ultra Chipco 26GT Signature Ultra Daconil Ultrex Banner MAXX	2 2 4 4 4 1.5 4 3.2 4 4 4 3.2 4 1 4 4 4 3.2 2	FL OZ/M FL OZ/M OZ/M FL OZ/M OZ/M FL OZ/M OZ/M OZ/M OZ/M FL OZ/M OZ/M OZ/M OZ/M FL OZ/M OZ/M FL OZ/M OZ/M OZ/M FL OZ/M	April 17 May 15 June 2 June 2 14 day 14 day 14 day 14 day 14 day 14 day 14 day 14 day 14 day 14 day 14 day 14 day 14 day 14 day Sept 1	7a	7.25a	6.8a	8a
5	Emerald	0.18	OZ/M	14 Days	6	6	5.25	5.75
		LSD			**NS**	**0.516**	**0.84**	**22.55**

*Means followed by same letter do not significantly differ (P=.05, Student-Newman-Keuls)

Snow Mold trials

2007-2008 Snow Mold Control Evaluation
OJ Noer Turfgrass Research Facility – Verona, WI.

Paul Koch and Brad Williams
Department of Plant Pathology
University of Wisconsin-Madison

OBJECTIVE

To evaluate fungicides for the control of Typhula blight (caused by *Typhula incarnata*) and pink snow mold (caused by *Microdochium nivale*).

MATERIALS AND METHODS

This evaluation was conducted at the OJ Noer Turfgrass Research Facility in Verona, WI on a 'Crenshaw' creeping bentgrass (*Agrostis stolonifera*) stand maintained at 0.5-inch cutting height. Individual plots measured 3 ft x 5 ft (15 ft^2), and were arranged in a randomized complete block design with 4 replications. Individual treatments were applied at a nozzle pressure of 40 p.s.i using a CO_2 pressurized boom sprayer equipped with two XR Teejet 8004 VS nozzles. All fungicides were agitated by hand and applied in the equivalent of 2 gallons of water per 1000 ft^2. Early applications were applied on October 30th, 2007 and late applications were applied on November 27th, 2007. The experimental plot area was not inoculated. There was continuous snow cover on the plots from December 1st to March 20th, 2008; a total of approximately 110 days. The percent disease and color ratings were recorded on April 1st, 2008. Data obtained was subjected to an analysis of variance to determine significant differences between treatments. The mean percent disease area and mean color rating for each individual treatment are located in the table below.

RESULTS AND DISCUSSION

Due to record snowfalls totaling over 100 inches in many southern Wisconsin communities, disease pressure at the OJ Noer Turfgrass Research Facility was higher than average in the winter of 2007-2008. Untreated controls averaged over 67% disease, with the majority of that damage being caused by *Typhula incarnata*. Despite this pressure, all treatments statistically reduced disease compared to the untreated control and most of the treatments included in the trial gave excellent control of all snow molds. Only 8 of 41 treatments, not including the untreated control, had any disease present. Treatments 11 and 24 were the only treatments to have statistically higher amounts of disease compared with the rest of the treatments. Differences in plot color were also observed, with treatments 15-19 having a statistically significant greener color. All five of these treatments contained a green pigment in addition to the active ingredient. No treatments caused a reduction in green color compared to the untreated control.

Snow Mold and Color Ratings Recorded on April 1st, 2008 at the OJ Noer Facility

	Treatment	Rate	Timing[a]	% Snow Mold[b]	Color[c]
1	Untreated Control			67.5 a	7 b
2	Spectro	4 OZ/M	Early	0 d	7 b
	26/36	4 FL OZ/M	Late		
	CLEX-09	1.2 OZ/M	Late		
3	Spectro	4 OZ/M	Early	0 d	7 b
	26/36	8 FL OZ/M	Late		
	CLEX-09	1.2 OZ/M	Late		
4	Spectro	5.75 OZ/M	Late	9.3 d	7 b
	Endorse	4 OZ/M	Late		
5	Spectro	4 OZ/M	Early	0 d	7 b
	Spectro	4 OZ/M	Late		
	Endorse	4 OZ/M	Late		
6	Spectro	4 OZ/M	Early	0 d	7 b
	26/36	4 FL OZ/M	Late		
	Endorse	4 OZ/M	Late		
7	Spectro	4 OZ/M	Early	0 d	7 b
	26/36	8 FL OZ/M	Late		
	Endorse	4 OZ/M	Late		
8	Spectro	4 OZ/M	Early	0 d	7 b
	26/36	4 FL OZ/M	Late		
	Endorse	4 OZ/M	Late		
	Alude	5.5 FL OZ/M	Late		
9	26/36	8 FL OZ/M	Late	0 d	7 b
	CLEX-09	1.2 OZ/M	Late		
10	26/36	4 FL OZ/M	Late	0 d	7 b
	CLEX-09	1.2 OZ/M	Late		
11	CLEX-15	1 OZ/M	Late	51.3 b	7 b
12	Lynx	1.5 FL OZ/M	Late	0 d	7 b
	Compass	0.25 OZ/M	Late		
	Daconil WeatherStik	5.5 FL OZ/M	Late		
13	Tartan	2 FL OZ/M	Late	0 d	7 b
	Daconil WeatherStik	5.5 FL OZ/M	Late		
14	Tartan	2 FL OZ/M	Late	0 d	7 b
	Turfcide 400	6 FL OZ/M	Late		
15	Lynx	1.5 FL OZ/M	Late	0 d	8 a
	Chipco 26GT	4 FL OZ/M	Late		
	Daconil WeatherStik	5.5 FL OZ/M	Late		
16	Reserve	7.6 FL OZ/M	Late	0 d	8 a
17	Reserve	7.6 FL OZ/M	Late	0 d	8 a
	Chipco 26GT	4 FL OZ/M	Late		
18	Reserve	3.8 FL OZ/M	Late	0 d	8 a
	Compass	0.25 OZ/M	Late		
19	Reserve	7.6 FL OZ/M	Late	0 d	8 a
20	Instrata	9.3 FL OZ/M	Late	0 d	7 b
21	Tourney	0.44 OZ/M	Early/Late	0 d	7 b

Means followed by same letter do not significantly differ (P=.05, Student-Newman-Keuls)

[a]Early and late fungicide treatments were applied on Oct. 30th, 2007 and Nov. 27th, 2007, respectively

[b]Mean % diseased area

[c]Color was rated on a scale of 1-9 where 1 = straw colored, 6 = acceptable, 9 = dark green

Snow Mold and Color Ratings Recorded on April 1st, 2008 at OJ Noer Facility

	Treatment	Rate	Timing[a]	% Snow Mold[b]	Color[c]
22	Tourney	0.44 OZ/M	Early/Late	0 d	7 b
	Daconil Ultrex	3.2 OZ/M	Early/Late		
23	Tourney	0.44 OZ/M	Early/Late	0 d	7 b
	3336	4 FL OZ/M	Early/Late		
24	Disarm	0.36 FL OZ/M	Late	30 c	7 b
25	ARY 0534002	0.6 FL OZ/M	Late	0 d	7 b
26	ARY 0474006	5.5 FL OZ/M	Late	5 d	7 b
27	Insignia	0.7 OZ/M	Late	0 d	7 b
	Trinity	1 FL OZ/M	Late		
	Daconil WeatherStik	3.7 FL OZ/M	Late		
28	Insignia	0.7 OZ/M	Late	0 d	7 b
	Trinity	1 FL OZ/M	Late		
	Turfcide 400	6 FL OZ/M	Late		
29	Insignia	0.7 OZ/M	Late	0 d	7 b
	Chipco 26GT	4 FL OZ/M	Late		
	Daconil WeatherStik	3.7 FL OZ/M	Late		
30	Insignia	0.7 OZ/M	Late	0 d	7 b
	Chipco 26GT	4 FL OZ/M	Late		
	Turfcide 400	6 FL OZ/M	Late		
31	Instrata	9.3 FL OZ/M	Late	3.8 d	7 b
32	Instrata	11 FL OZ/M	Late	0 d	7 b
33	Instrata	7 FL OZ/M	Late	0 d	7 b
34	Instrata	5.4 FL OZ/M	Late	0 d	7 b
35	QP Iprodione	4 FL OZ/M	Late	0 d	7 b
	QP TM/C	6 OZ/M	Late		
36	QP Iprodione	4 FL OZ/M	Late	0 d	7 b
	QP Propiconazole	2 FL OZ/M	Late		
	QP TM/C	6 OZ/M	Late		
37	Daconil WeatherStik	5.5 FL OZ/M	Late	0 d	7 b
	Chipco 26GT	4 FL OZ/M	Late		
38	Banner MAXX	3.2 FL OZ/M	Early	0 d	7 b
	Daconil WeatherStik	4.5 FL OZ/M	Late		
	Medallion	0.27 OZ/M	Late		
39	Banner MAXX	3.2 FL OZ/M	Late	2 d	7 b
	Daconil WeatherStik	4.5 FL OZ/M	Late		
40	Banner MAXX	3.2 FL OZ/M	Late	0 d	7 b
	Medallion	0.27 OZ/M	Late		
41	Daconil WeatherStik	4.5 FL OZ/M	Late	2.5 d	7 b
	Medallion	0.27 OZ/M	Late		
42	Curalan EG	1 OZ/M	Late	0.5 d	7 b
	Insignia	0.9 OZ/M	Late		

Means followed by same letter do not significantly differ (P=.05, Student-Newman-Keuls)

[a]Early and late fungicide treatments were applied on Oct. 30th, 2007 and Nov. 27th, 2007, respectively

[b]Mean % diseased area

[c]Color was rated on a scale of 1-9 where 1 = straw colored, 6 = acceptable, 9 = dark green

2007-2008 Snow Mold Control Evaluation
Sentryworld Golf Course - Stevens Point, WI.

Paul Koch and Brad Williams
Department of Plant Pathology
University of Wisconsin-Madison

OBJECTIVE

To evaluate fungicides for the control of Typhula blight (caused by *Typhula ishikariensis* and *T. incarnata*) and pink snow mold (caused by *Microdochium nivale*).

MATERIALS AND METHODS

This evaluation was conducted at Sentryworld Golf Course in Stevens Point, WI on a 'Penneagle' creeping bentgrass (*Agrostis stolonifera*) fairway nursery maintained at 0.5-inch cutting height. Individual plots measured 3 ft x 10 ft (30 ft^2), and were arranged in a randomized complete block design with four replications. Individual treatments were applied at a nozzle pressure of 40 p.s.i using a CO_2 pressurized boom sprayer equipped with two XR Teejet 8004 VS nozzles. All fungicides were agitated by hand and applied in the equivalent of 2 gallons of water per 1000 ft^2. Early applications were applied on October 21st, 2007 and late applications were applied on November 19th, 2007. The experimental plot area was not inoculated. There was continuous snow cover on the plots from December 1st until early April of 2007, a total of approximately 120 days. The percent cover of snow mold and color were recorded on April 15th, 2007. Data obtained was subjected to an analysis of variance to determine significant differences between treatments. The mean percent diseased area snow mold and mean color rating for each individual treatment are located in the table below.

RESULTS AND DISCUSSION

Disease pressure was high at this site this year with untreated checks averaging 85% disease. Though all three major snow mold diseases were observed, the dominant pathogens causing damage were *Typhula ishikariensis* and to a lesser degree *Typhula incarnata*. Despite the high disease pressure, most treatments gave 100% control of snow mold and all treatments gave significant reduction of snow mold compared with the untreated control. Treatments 11, 24, and 42 had significant disease breakthrough. Differences in plot color were also observed, with treatments 16, 17, and 19 having a statistically significant greener color. All three of these treatments contained a green pigment in addition to the active ingredient. Those treatments containing PCNB caused some slight turfgrass discoloration, but the discoloration was minimal and recovered quickly.

Snow Mold and Color Ratings Recorded on April 15th, 2008 at Sentryworld GC

Treatment	Rate	Timing[a]	% Snow Mold[b]	Color[c]
1 Untreated Control			85 a	7 bc
2 Spectro	4 OZ/M	Early	0 e	7 bc
26/36	4 FL OZ/M	Late		
CLEX-09	1.2 OZ/M	Late		
3 Spectro	4 OZ/M	Early	0 e	7 bc
26/36	8 FL OZ/M	Late		
CLEX-09	1.2 OZ/M	Late		
4 Spectro	5.75 OZ/M	Late	3.3 e	7 bc
Endorse	4 OZ/M	Late		
5 Spectro	4 OZ/M	Early	0.5 e	7 bc
Spectro	4 OZ/M	Late		
Endorse	4 OZ/M	Late		
6 Spectro	4 OZ/M	Early	0 e	7 bc
26/36	4 FL OZ/M	Late		
Endorse	4 OZ/M	Late		
7 Spectro	4 OZ/M	Early	0 e	7 bc
26/36	8 FL OZ/M	Late		
Endorse	4 OZ/M	Late		
8 Spectro	4 OZ/M	Early	0 e	7 bc
26/36	4 FL OZ/M	Late		
Endorse	4 OZ/M	Late		
Alude	5.5 FL OZ/M	Late		
9 26/36	8 FL OZ/M	Late	0 e	7 bc
CLEX-09	1.2 OZ/M	Late		
10 26/36	4 FL OZ/M	Late	0 e	7 bc
CLEX-09	1.2 OZ/M	Late		
11 CLEX-15	1 OZ/M	Late	72.5 b	7 bc
12 Lynx	1.5 FL OZ/M	Late	0 e	7.13 b
Compass	0.25 OZ/M	Late		
Daconil WeatherStik	5.5 FL OZ/M	Late		
13 Tartan	2 FL OZ/M	Late	0 e	7 bc
Daconil WeatherStik	5.5 FL OZ/M	Late		
14 Tartan	2 FL OZ/M	Late	0 e	7 bc
Turfcide 400	6 FL OZ/M	Late		
15 Lynx	1.5 FL OZ/M	Late	0 e	7.13 b
Chipco 26GT	4 FL OZ/M	Late		
Daconil WeatherStik	5.5 FL OZ/M	Late		
16 Reserve	7.6 FL OZ/M	Late	0 e	7.63 a
17 Reserve	7.6 FL OZ/M	Late	0 e	7.75 a
Chipco 26GT	4 FL OZ/M	Late		
18 Reserve	3.8 FL OZ/M	Late	0 e	7.25 b
Compass	0.25 OZ/M	Late		
19 Reserve	7.6 FL OZ/M	Late	0 e	7.63 a
20 Instrata	9.3 FL OZ/M	Late	0 e	6.75 bc
21 Tourney	0.44 OZ/M	Early/Late	0 e	7 bc

Means followed by same letter do not significantly differ (P=.05, Student-Newman-Keuls)

[a]Early and late fungicide treatments were applied on Oct. 21st, 2007 and Nov. 19th, 2007, respectively

[b]Mean % diseased area

[c]Color was rated on a scale of 1-9 where 1 = straw colored, 6 = acceptable, 9 = dark green

Snow Mold and Color Ratings Recorded on April 15th, 2008 at Sentryworld GC

Treatment	Rate	Timing[a]	% Snow Mold[b]	Color[c]
22 Tourney	0.44 OZ/M	Early/Late	0 e	7 bc
Daconil Ultrex	3.2 OZ/M	Early/Late		
23 Tourney	0.44 OZ/M	Early/Late	0 e	7 bc
3336	4 FL OZ/M	Early/Late		
24 Disarm	0.36 FL OZ/M	Late	50 c	7 bc
25 ARY 0534002	0.6 FL OZ/M	Late	1.5 e	7 bc
26 ARY 0474006	5.5 FL OZ/M	Late	10 e	7 bc
27 Insignia	0.7 OZ/M	Late	0.5 e	7 bc
Trinity	1 FL OZ/M	Late		
Daconil WeatherStik	3.7 FL OZ/M	Late		
28 Insignia	0.7 OZ/M	Late	0 e	6.5 cd
Trinity	1 FL OZ/M	Late		
Turfcide 400	6 FL OZ/M	Late		
29 Insignia	0.7 OZ/M	Late	0.5 e	7 bc
Chipco 26GT	4 FL OZ/M	Late		
Daconil WeatherStik	3.7 FL OZ/M	Late		
30 Insignia	0.7 OZ/M	Late	0 e	6.25 d
Chipco 26GT	4 FL OZ/M	Late		
Turfcide 400	6 FL OZ/M	Late		
31 Instrata	9.3 FL OZ/M	Late	0 e	6.75 bc
32 Instrata	11 FL OZ/M	Late	0 e	7 bc
33 Instrata	7 FL OZ/M	Late	0 e	7 bc
34 Instrata	5.4 FL OZ/M	Late	0 e	7 bc
35 QP Iprodione	4 FL OZ/M	Late	0.5 e	7 bc
QP TM/C	6 OZ/M	Late		
36 QP Iprodione	4 FL OZ/M	Late	0 e	7 bc
QP Propiconazole	2 FL OZ/M	Late		
QP TM/C	6 OZ/M	Late		
37 Daconil WeatherStik	5.5 FL OZ/M	Late	3.8 e	7 bc
Chipco 26GT	4 FL OZ/M	Late		
38 Banner MAXX	3.2 FL OZ/M	Early	0 e	7 bc
Daconil WeatherStik	4.5 FL OZ/M	Late		
Medallion	0.27 OZ/M	Late		
39 Banner MAXX	3.2 FL OZ/M	Late	0 e	7 bc
Daconil WeatherStik	4.5 FL OZ/M	Late		
40 Banner MAXX	3.2 FL OZ/M	Late	0.8 e	7 bc
Medallion	0.27 OZ/M	Late		
41 Daconil WeatherStik	4.5 FL OZ/M	Late	2.5 e	7 bc
Medallion	0.27 OZ/M	Late		
42 Curalan EG	1 OZ/M	Late	26.3 d	7 bc
Insignia	0.9 OZ/M	Late		

Means followed by same letter do not significantly differ (P=.05, Student-Newman-Keuls)

[a]Early and late fungicide treatments were applied on Oct. 21, 2007 and Nov. 19, 2007, respectively

[b]Mean % diseased area

[c]Color was rated on a scale of 1-9 where 1 = straw colored, 6 = acceptable, 9 = dark green

2007-08 Snow Mold Control Evaluation
Timberstone Golf Course – Iron Mountain, MI.

Paul Koch and Brad Williams
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University of Wisconsin-Madison

OBJECTIVE

To evaluate fungicides for the control of Typhula blight (caused by *Typhula ishikariensis* and *Typhula incarnata*) and pink snow mold (caused by *Microdochium nivale*).

MATERIALS AND METHODS

This evaluation was conducted at Timberstone Golf Course in Iron Mountain, MI on a creeping bentgrass (*Agrostis stolonifera*) target green maintained at 0.5-inch cutting height. Individual plots measured 3 ft x 10 ft (30 ft^2), and were arranged in a randomized complete block design with four replications. Due to space restrictions on the target greens replications one and two were applied on a single target green and replications three and four were applied on a target green 50 yards away. Individual treatments were applied at a nozzle pressure of 40 p.s.i using a CO_2 pressurized boom sprayer equipped with two XR Teejet 8004 VS nozzles. All fungicides were agitated by hand and applied in the equivalent of 2 gallons of water per 1000 ft^2. Early treatments were applied on October 21st, 2007 and late applications were applied on November 15th, 2007. The experimental plot area was not inoculated. There was continuous snow cover on the plots from November 15th 2007 to April 15th of 2008, a total of approximately 150 days. The percent cover of snow mold and color were recorded on April 22nd, 2008. Data obtained was subjected to an analysis of variance to determine significant differences between treatments. The mean percent diseased area snow mold and mean color rating for each individual treatment are located in the table below.

RESULTS AND DISCUSSION

While disease pressure on surrounding areas of the golf course was extremely high, pressure on the actual experimental plots was relatively low. Untreated controls averaged only 26%, and all treatments except 11 provided statistically significant control compared with the control. Only seven of 41 treatments, not including the control, had any disease present at all. Though all three major snow mold diseases were observed, the dominant pathogen causing damage was *Typhula ishikariensis*. Differences in plot color were also observed, with treatments 16 and 17 having the greenest color. Five other treatments had a statistically significant greener color compared to the untreated control. All of these treatments contained a green pigment in addition to the active ingredient. Those treatments containing PCNB caused some slight turfgrass discoloration, but the discoloration was minimal and recovered quickly.

Snow Mold and Color Ratings Recorded on April 22nd, 2008 at Timberstone GC

Treatment	Rate	Timing[a]	% Snow Mold[b]	Color[c]
1 Untreated Control			25.8 a	7 c
2 Spectro	4 OZ/M	Early	0 d	7 c
26/36	4 FL OZ/M	Late		
CLEX-09	1.2 OZ/M	Late		
3 Spectro	4 OZ/M	Early	0 d	7 c
26/36	8 FL OZ/M	Late		
CLEX-09	1.2 OZ/M	Late		
4 Spectro	5.75 OZ/M	Late	7 cd	7 c
Endorse	4 OZ/M	Late		
5 Spectro	4 OZ/M	Early	3.5 cd	7 c
Spectro	4 OZ/M	Late		
Endorse	4 OZ/M	Late		
6 Spectro	4 OZ/M	Early	0 d	7 c
26/36	4 FL OZ/M	Late		
Endorse	4 OZ/M	Late		
7 Spectro	4 OZ/M	Early	0 d	7 c
26/36	8 FL OZ/M	Late		
Endorse	4 OZ/M	Late		
8 Spectro	4 OZ/M	Early	0 d	7 c
26/36	4 FL OZ/M	Late		
Endorse	4 OZ/M	Late		
Alude	5.5 FL OZ/M	Late		
9 26/36	8 FL OZ/M	Late	0 d	7 c
CLEX-09	1.2 OZ/M	Late		
10 26/36	4 FL OZ/M	Late	0 d	7 c
CLEX-09	1.2 OZ/M	Late		
11 CLEX-15	1 OZ/M	Late	20 ab	7 c
12 Lynx	1.5 FL OZ/M	Late	0 d	7.63 b
Compass	0.25 OZ/M	Late		
Daconil WeatherStik	5.5 FL OZ/M	Late		
13 Tartan	2 FL OZ/M	Late	0 d	7.5 b
Daconil WeatherStik	5.5 FL OZ/M	Late		
14 Tartan	2 FL OZ/M	Late	0 d	7 c
Turfcide 400	6 FL OZ/M	Late		
15 Lynx	1.5 FL OZ/M	Late	0 d	7.63 b
Chipco 26GT	4 FL OZ/M	Late		
Daconil WeatherStik	5.5 FL OZ/M	Late		
16 Reserve	7.6 FL OZ/M	Late	0 d	8 a
17 Reserve	7.6 FL OZ/M	Late	0 d	8 a
Chipco 26GT	4 FL OZ/M	Late		
18 Reserve	3.8 FL OZ/M	Late	0 d	7.63 b
Compass	0.25 OZ/M	Late		
19 Reserve	7.6 FL OZ/M	Late	0 d	7.63 b
20 Instrata	9.3 FL OZ/M	Late	0 d	7 c
21 Tourney	0.44 OZ/M	Early/Late	5 cd	7 c

Means followed by same letter do not significantly differ (P=.05, Student-Newman-Keuls)
[a]Early and late fungicide treatments were applied on Oct. 21st, 2007 and Nov. 15th, 2007, respectively
[b]Mean % diseased area
[c]Color was rated on a scale of 1-9 where 1 = straw colored, 6 = acceptable, 9 = dark green

Snow Mold and Color Ratings Recorded on April 22nd, 2008 at Timberstone GC

Treatment	Rate	Timing[a]	% Snow Mold[b]	Color[c]
22 Tourney	0.44 OZ/M	Early/Late	0 d	7 c
Daconil Ultrex	3.2 OZ/M	Early/Late		
23 Tourney	0.44 OZ/M	Early/Late	0 d	7 c
3336	4 FL OZ/M	Early/Late		
24 Disarm	0.36 FL OZ/M	Late	5 cd	7 c
25 ARY 0534002	0.6 FL OZ/M	Late	0 d	7 c
26 ARY 0474006	5.5 FL OZ/M	Late	0 d	7 c
27 Insignia	0.7 OZ/M	Late	0 d	7 c
Trinity	1 FL OZ/M	Late		
Daconil WeatherStik	3.7 FL OZ/M	Late		
28 Insignia	0.7 OZ/M	Late	0 d	6.5 d
Trinity	1 FL OZ/M	Late		
Turfcide 400	6 FL OZ/M	Late		
29 Insignia	0.7 OZ/M	Late	0 d	7 c
Chipco 26GT	4 FL OZ/M	Late		
Daconil WeatherStik	3.7 FL OZ/M	Late		
30 Insignia	0.7 OZ/M	Late	0 d	6 e
Chipco 26GT	4 FL OZ/M	Late		
Turfcide 400	6 FL OZ/M	Late		
31 Instrata	9.3 FL OZ/M	Late	0 d	7 c
32 Instrata	11 FL OZ/M	Late	0 d	7 c
33 Instrata	7 FL OZ/M	Late	0 d	7 c
34 Instrata	5.4 FL OZ/M	Late	0 d	7 c
35 QP Iprodione	4 FL OZ/M	Late	0 d	7 c
QP TM/C	6 OZ/M	Late		
36 QP Iprodione	4 FL OZ/M	Late	0 d	7 c
QP Propiconazole	2 FL OZ/M	Late		
QP TM/C	6 OZ/M	Late		
37 Daconil WeatherStik	5.5 FL OZ/M	Late	2 d	7 c
Chipco 26GT	4 FL OZ/M	Late		
38 Banner MAXX	3.2 FL OZ/M	Early	0 d	7 c
Daconil WeatherStik	4.5 FL OZ/M	Late		
Medallion	0.27 OZ/M	Late		
39 Banner MAXX	3.2 FL OZ/M	Late	0 d	7 c
Daconil WeatherStik	4.5 FL OZ/M	Late		
40 Banner MAXX	3.2 FL OZ/M	Late	0 d	7 c
Medallion	0.27 OZ/M	Late		
41 Daconil WeatherStik	4.5 FL OZ/M	Late	0 d	7 c
Medallion	0.27 OZ/M	Late		
42 Curalan EG	1 OZ/M	Late	13.3 bc	7 c
Insignia	0.9 OZ/M	Late		

Means followed by same letter do not significantly differ (P=.05, Student-Newman-Keuls)

[a]Early and late fungicide treatments were applied on Oct. 21st, 2007 and Nov. 15th, 2007, respectively

[b]Mean % diseased area

[c]Color was rated on a scale of 1-9 where 1 = straw colored, 6 = acceptable, 9 = dark green

2007-2008 Bayer Auxiliary Snow Mold Trials
OJ Noer Research Center, Sentryworld GC, Pine Grove CC, Edina CC

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OBJECTIVE

To evaluate fungicides for the control of Typhula blight (caused by *Typhula incarnata* and *Typhula ishikariensis*) and pink snow mold (caused by *Microdochium nivale*).

MATERIALS AND METHODS

This evaluation was conducted at the OJ Noer Turfgrass Research Facility in Verona, WI; Sentryworld GC in Stevens Point, WI; Pine Grove CC in Iron Mountain, MI; and Edina CC in Edina, MN. Please refer to the "Materials and Methods" sections of each of those particular reports in the 2007-2008 Wisconsin Snow Mold Research Reports for further information about each site. The auxiliary trials were placed adjacent to the standard trials at all sites except for Pine Grove CC, where it is a stand-alone trial. Length of continuous snow cover at Pine Grove was approximately 150 days. To compare to other treatments, please refer to that specific trial elsewhere in the report. Data obtained was subjected to an analysis of variance to determine significant differences between treatments. The mean percent diseased area snow mold and mean color rating for each individual treatment are located in the tables below.

RESULTS AND DISCUSSION

Disease pressure was high at Pine Grove CC in Iron Mountain, MI and Sentryworld GC in Stevens Point, WI and more moderate at Edina CC in Minneapolis, MN and the OJ Noer Research Center in Madison, WI. All four treatments significantly reduced disease compared to the untreated control at each site, with the exception of treatment 11 at Edina CC. Treatments 4 and 5, both which contained more than one active ingredient, were the most effective at the highest disease pressures. Differences in plot color were also observed, with treatment 5 having a significantly greener color at all 4 sites. Treatment 5 contained a green pigment in addition to the active ingredient. Treatment 2, which contained PCNB, caused some slight turfgrass discoloration at all sites, but the discoloration was minimal and recovered quickly.

Snow Mold and Color Ratings Recorded on April 1st, 2008 at the OJ Noer Facility

	Treatment	Rate	Timing[a]	% Snow Mold[b]	Color[c]
1	Untreated Control			18.8 a	7 b
2	Revere 4000	12 FL OZ/1000 FT2	Late	0 b	6 c
3	Heritage	0.7 OZ/1000 FT2	Late	0.5 b	6.8 b
4	Heritage Daconil Ultrex	0.7 OZ/1000 FT2 5 OZ/1000 FT2	Late	0 b	6.8 b
5	Compass Chipco 26GT SP102000014862	0.25 OZ/1000 FT2 3 FL OZ/1000 FT2 0.4 FL OZ/1000 FT2	Late Late Late	0 b	8 a

Means followed by same letter do not significantly differ (P=.05, Student-Newman-Keuls)
[a]Late fungicide treatments were applied on Nov. 26, 2007
[b]Mean % diseased area
[c]Color was rated on a scale of 1-9 where 1 = straw colored, 6 = acceptable, 9 = dark green

Snow Mold and Color Ratings Recorded on April 15th, 2008 at Sentryworld GC

	Treatment	Rate	Timing[a]	% Snow Mold[b]	Color[c]
1	Untreated Control			86.3 a	7 b
2	Revere 4000	12 FL OZ/1000 FT2	Late	1 e	6 c
3	Heritage	0.7 OZ/1000 FT2	Late	26.3 d	7 b
4	Heritage Daconil Ultrex	0.7 OZ/1000 FT2 5 OZ/1000 FT2	Late	5.5 e	7 b
5	Compass Chipco 26GT SP102000014862	0.25 OZ/1000 FT2 3 FL OZ/1000 FT2 0.4 FL OZ/1000 FT2	Late Late Late	11.3 e	8 a

Means followed by same letter do not significantly differ (P=.05, Student-Newman-Keuls)
[a]Late fungicide treatments were applied on Nov. 19, 2007
[b]Mean % diseased area
[c]Color was rated on a scale of 1-9 where 1 = straw colored, 6 = acceptable, 9 = dark green

Snow Mold and Color Ratings Recorded on April 22nd, 2008 at Pine Grove CC

	Treatment	Rate	Timing[a]	% Snow Mold[b]	Color[c]
1	Untreated Control			83.8 a	7 b
2	Revere 4000	12 FL OZ/1000 FT2	Late	41.3 c	6 c
3	Heritage	0.7 OZ/1000 FT2	Late	45 bc	7 b
4	Heritage Daconil Ultrex	0.7 OZ/1000 FT2 5 OZ/1000 FT2	Late	13.8 de	7 b
5	Compass Chipco 26GT SP102000014862	0.25 OZ/1000 FT2 3 FL OZ/1000 FT2 0.4 FL OZ/1000 FT2	Late Late Late	17.5 de	7.8 a

Means followed by same letter do not significantly differ (P=.05, Student-Newman-Keuls)
[a]Late fungicide treatments were applied on Nov. 15, 2007
[b]Mean % diseased area
[c]Color was rated on a scale of 1-9 where 1 = straw colored, 6 = acceptable, 9 = dark green

Snow Mold and Color Ratings Recorded on April 16th, 2008 at Edina CC

	Treatment	Rate	Timing[a]	% Snow Mold[b]	Color[c]
1	Untreated Control			27.5 a	7 b
2	Revere 4000	12 FL OZ/1000 FT2	Late	0 c	6.8 b
3	Heritage	0.7 OZ/1000 FT2	Late	11.3 bc	7 b
4	Heritage Daconil Ultrex	0.7 OZ/1000 FT2 5 OZ/1000 FT2	Late	0 c	7 b
5	Compass Chipco 26GT SP102000014862	0.25 OZ/1000 FT2 3 FL OZ/1000 FT2 0.4 FL OZ/1000 FT2	Late Late Late	22 ab	8 a

Means followed by same letter do not significantly differ (P=.05, Student-Newman-Keuls)
[a]Late fungicide treatments were applied on Nov. 16, 2007
[b]Mean % diseased area
[c]Color was rated on a scale of 1-9 where 1 = straw colored, 6 = acceptable, 9 = dark green

2007-2008 Snow Mold Control Evaluation
The Legend at Giants Ridge - Biwabik, MN.

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Dr. Brian Horgan
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OBJECTIVE

To evaluate fungicide efficacy for the control of Typhula blight (caused by *Typhula ishikariensis* and *Typhula incarnata*), and pink snow mold (caused by *Microdochium nivale*).

MATERIALS AND METHODS

This evaluation was conducted at Giants Ridge Golf Resort, Biwabik, MN on a creeping bentgrass (*Agrostis stolonifera*) golf course fairway maintained at a height of 0.5 inch. Individual plots measured 3 ft x 10 ft (30 ft^2), and were arranged in a randomized complete block design with four replications. Individual treatments were applied at a nozzle pressure of 40 p.s.i using a CO_2 pressurized boom sprayer equipped with two XR Teejet 8004 VS nozzles. All fungicides were agitated by hand and applied in the equivalent of 2 gallons of water per 1000 ft^2. Early treatments were applied on October 22nd, 2007 and late treatments were applied on November 16th, 2007. There was continuous snow cover on the plots from December 1st until early April, a total of approximately 120 days. A week long break in snow cover in early April was then followed by several feet of snow that finally melted in late April. Percent snow mold and color were recorded on April 30th, 2008. Data obtained were subjected to an analysis of variance to determine significant differences between treatment means. The mean percent diseased area and mean color rating for each individual treatment are located in the tables below.

RESULTS AND DISCUSSION

The disease pressure at the experimental site was high this year, with snow mold damage averaging 76.3% on the untreated check plots. The predominant snow mold species that caused damage was *Typhula ishikariensis*. All treatments significantly reduced disease compared to the untreated control. Treatments 2, 4, 6, 7, 11, 17, 21-24, and 26 were statistically the most effective at controlling *T. ishikariensis*. Treatments 14, 20, and 25 provided the poorest control. Treatment 25 contained a high rate of PCNB and had a slight reduction in color, though color was still acceptable.

Snow Mold Ratings Recorded on April 30th, 2008 at The Legend at Giants Ridge

	Treatment	Rate	Timing[a]	% Snow mold	Color[c]
1	Untreated Control			76.3 a	7 a
2	Spectro	4 OZ/M	Early	0 f	7 a
	26/36	4 FL OZ/M	Late		
	CLEX-9	1.2 OZ/M	Late		
3	Spectro	4 OZ/M	Early	5 ef	7 a
	26/36	8 FL OZ/M	Late		
	Endorse	4 OZ/M	Late		
4	Spectro	5.75 OZ/M	Late	0 f	7 a
	CLEX-9	1.2 OZ/M	Late		
5	Spectro	4 OZ/M	Early	9.8 ef	7 a
	26/36	4 FL OZ/M	Late		
	Endorse	4 OZ/M	Late		
	Alude	5.5 FL OZ/M	Late		
6	Insignia	0.7 OZ/M	Late	0.8 f	7 a
	Trinity	1 FL OZ/M	Late		
	Daconil WeatherStik	3.7 FL OZ/M	Late		
7	Insignia	0.7 OZ/M	Late	0 f	7 a
	Trinity	1 FL OZ/M	Late		
	Turfcide 400	6 FL OZ/M	Late		
8	Insignia	0.7 OZ/M	Late	14.3 def	7 a
	Chipco 26GT	4 FL OZ/M	Late		
	Daconil WeatherStik	3.7 FL OZ/M	Late		
9	Insignia	0.7 OZ/M	Late	9 ef	7 a
	Chipco 26GT	4 FL OZ/M	Late		
	Turfcide 400	6 FL OZ/M	Late		
10	Instrata	9.3 FL OZ/M	Late	4.3 ef	7 a
11	Instrata	11 FL OZ/M	Late	1.8 f	7 a
12	Instrata	7 FL OZ/M	Late	4.5 ef	7 a
13	Instrata	5.4 FL OZ/M	Late	23.8 cd	7 a
14	QP Iprodione	4 FL OZ/M	Late	32.5 bc	7 a
	TM/C	6 OZ/M	Late		
15	QP Iprodione	4 FL OZ/M	Late	12.5 def	7 a
	QP Propiconazole	2 FL OZ/M	Late		
	TM/C	6 OZ/M	Late		
16	Banner MAXX	3.2 FL OZ/M	Late	7.8 ef	7 a
	Daconil WeatherStik	4.5 FL OZ/M	Late		
	Medallion	0.27 OZ/M	Late		
17	Banner MAXX	3.2 FL OZ/M	Late	1 f	7 a
	Daconil WeatherStik	4.5 FL OZ/M	Late		
18	Banner MAXX	3.2 FL OZ/M	Late	6.8 ef	7 a
	Medallion	0.27 OZ/M	Late		
19	Daconil WeatherStik	4.5 FL OZ/M	Late	18.8 def	7 a
	Medallion	0.27 OZ/M	Late		
20	Chipco 26GT	4 FL OZ/M	Late	37.5 b	7 a
	Daconil WeatherStik	3.7 FL OZ/M	Late		

Means followed by same letter do not significantly differ (P=.05, Student-Newman-Keuls)

[a]Early and late fungicide treatments were applied on Oct. 22, 2007 and Nov. 16, 2007, respectively

[b]Mean percent diseased area

[c]Color was rated on a scale of 1-9 where 1 = straw colored, 7 = acceptable, 9 = dark green

Snow Mold Ratings Recorded on April 30th, 2008 at The Legend at Giants Ridge

Treatment	Rate	Timing[a]	% Snow mold[b]	Color[c]
21 Tartan	2 FL OZ/M	Late	1.8 f	7 a
Daconil WeatherStik	5.5 FL OZ/M	Late		
22 Tartan	2 FL OZ/M	Late	0 f	7 a
Turfcide 400	6 FL OZ/M	Late		
23 Reserve	3.8 FL OZ/M	Late	0 f	7 a
Compass	0.25 OZ/M	Late		
24 Tourney	0.44 OZ/M	Late	2.5 f	7 a
Daconil Ultrex	3.2 OZ/M	Late		7 a
25 Turfcide 400	10 FL OZ/M	Late	32.5 bc	6.3 b
26 Turfcide 400	6 FL OZ/M	Late	2.8 f	7 a
Banner MAXX	2 FL OZ/M	Late		

Means followed by same letter do not significantly differ (P=.05, Student-Newman-Keuls)

[a]Early and late fungicide treatments were applied on Oct. 22, 2007 and Nov. 16, 2007, respectively

[b]Mean percent diseased area

[c]Color was rated on a scale of 1-9 where 1 = straw colored, 7 = acceptable, 9 = dark green

2007-2008 Snow Mold Control Evaluation
The Quarry at Giants Ridge – Biwabik, MN

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University of Wisconsin-Madison

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OBJECTIVES

The primary objective was to evaluate fungicide efficacy for the control of snow scald (*Myriosclerotinia borealis*), which was observed in 2005 at this site. Also, fungicide efficacy for the control of Typhula blight (caused by *Typhula ishikariensis* and *Typhula incarnata*), and pink snow mold (caused by *Microdochium nivale*) was evaluated.

MATERIALS AND METHODS

This evaluation was conducted at Giants Ridge Golf Resort in Biwabik, MN on a creeping bentgrass (*Agrostis stolonifera*) golf course fairway maintained at a height of 0.5 inches. Individual plots measured 3 ft x 10 ft (30 ft^2), and were arranged in a randomized complete block design with four replications. Individual treatments were applied at a nozzle pressure of 40 p.s.i using a CO_2 pressurized boom sprayer equipped with two XR Teejet 8004 VS nozzles. All fungicides were agitated by hand and applied in the equivalent of 2 gallons of water per 1000 ft^2. Early treatments were applied on October 22nd, 2007 and late treatments were applied on November 16th, 2007. There was continuous snow cover on the plots from December 1st until early April, a total of approximately 120 days. A week long break in snow cover in early April was then followed by several feet of snow that finally melted in late April. Percent snow mold, color, and snow scald occurrence were all recorded on April 30th, 2008. Data obtained were subjected to an analysis of variance to determine significant differences between treatment means. The mean percent snow mold damage, mean color, and occurrence of snow scald for each individual treatment is located in the table below.

RESULTS AND DISCUSSION

The disease pressure at the experimental site was moderate this year, with snow mold damage averaging 57.5% on the untreated check plots. The predominant snow mold species that caused damage was *Typhula ishikariensis,* though snow scald was observed both within and surrounding the treatment area. All treatments significantly reduced disease compared to the untreated control. Treatments 2, 4, 5, 7, 9, 11, 17, 21-24, and 26 were statistically the most effective at controlling *T. ishikariensis*. Treatment 20 provided the poorest control of Typhula blight. Snow scald was observed in several treatment plots, but only found in more than half of the four replications in treatments 6, 12, 17, and 19.

Snow Mold Ratings Recorded on April 30th, 2008 at The Quarry at Giants Ridge

Treatment	Rate	Timing[a]	% Snow mold[b]	Color[c]	Snow Scald[d]
1 Untreated Control			57.5 a	7 a	4
2 Spectro	4 OZ/M	Early	2.3 c	7 a	0
26/36	4 FL OZ/M	Late			
CLEX-9	1.2 OZ/M	Late			
3 Spectro	4 OZ/M	Early	4.3 bc	7 a	0
26/36	8 FL OZ/M	Late			
Endorse	4 OZ/M	Late			
4 Spectro	5.75 OZ/M	Late	0.8 c	7 a	0
CLEX-9	1.2 OZ/M	Late			
5 Spectro	4 OZ/M	Early	3 c	7 a	0
26/36	4 FL OZ/M	Late			
Endorse	4 OZ/M	Late			
Alude	5.5 FL OZ/M	Late			
6 Insignia	0.7 OZ/M	Late	8 bc	7 a	4
Trinity	1 FL OZ/M	Late			
Daconil WeatherStik	3.7 FL OZ/M	Late			
7 Insignia	0.7 OZ/M	Late	0.5 c	7 a	0
Trinity	1 FL OZ/M	Late			
Turfcide 400	6 FL OZ/M	Late			
8 Insignia	0.7 OZ/M	Late	10 bc	7 a	0
Chipco 26GT	4 FL OZ/M	Late			
Daconil WeatherStik	3.7 FL OZ/M	Late			
9 Insignia	0.7 OZ/M	Late	1.3 c	6.5 ab	0
Chipco 26GT	4 FL OZ/M	Late			
Turfcide 400	6 FL OZ/M	Late			
10 Instrata	9.3 FL OZ/M	Late	6 bc	7 a	2
11 Instrata	11 FL OZ/M	Late	2.3 c	7 a	2
12 Instrata	7 FL OZ/M	Late	6.5 bc	7 a	3
13 Instrata	5.4 FL OZ/M	Late	8.5 bc	7 a	2
14 QP Iprodione	4 FL OZ/M	Late	10.8 bc	7 a	0
TM/C	6 OZ/M	Late			
15 QP Iprodione	4 FL OZ/M	Late	5.8 bc	7 a	0
QP Propiconazole	2 FL OZ/M	Late			
TM/C	6 OZ/M	Late			
16 Banner MAXX	3.2 FL OZ/M	Late	4.5 bc	7 a	1
Daconil WeatherStik	4.5 FL OZ/M	Late			
Medallion	0.27 OZ/M	Late			
17 Banner MAXX	3.2 FL OZ/M	Late	3.8 bc	7 a	3
Daconil WeatherStik	4.5 FL OZ/M	Late			
18 Banner MAXX	3.2 FL OZ/M	Late	4.3 bc	7 a	2
Medallion	0.27 OZ/M	Late			
19 Daconil WeatherStik	4.5 FL OZ/M	Late	9.5 bc	7 a	3
Medallion	0.27 OZ/M	Late			
20 Chipco 26GT	4 FL OZ/M	Late	16.8 b	7 a	0
Daconil WeatherStik	3.7 FL OZ/M	Late			

Means followed by same letter do not significantly differ (P=.05, Student-Newman-Keuls)
[a]Early and late fungicide treatments were applied on Oct. 22, 2007 and Nov. 16, 2007, respectively
[b]Mean percent diseased area
[c]Color was rated on a scale of 1-9 where 1 = straw colored, 7 = acceptable, 9 = dark green
[d]Number of replicaitons snow scald was observed out of a possible 4 reps

Snow Mold Ratings Recorded on April 30th, 2008 at The Quarry at Giants Ridge

Treatment		Rate	Timing[a]	% Snow mold[b]	Color[c]	Snow Scald[d]
21	Tartan	2 FL OZ/M	Late	0.8 c	7 a	0
	Daconil WeatherStik	5.5 FL OZ/M	Late			
22	Tartan	2 FL OZ/M	Late	0 c	7 a	0
	Turfcide 400	6 FL OZ/M	Late			
23	Reserve	3.8 FL OZ/M	Late	0.5 c	7 a	1
	Compass	0.25 OZ/M	Late			
24	Tourney	0.44 OZ/M	Late	2 c	7 a	0
	Daconil Ultrex	3.2 OZ/M	Late			
25	Turfcide 400	10 FL OZ/M	Late	6.8 bc	6.3 b	0
26	Turfcide 400	6 FL OZ/M	Late	1.3 c	6.8 a	0
	Banner MAXX	2 FL OZ/M	Late			

Means followed by same letter do not significantly differ (P=.05, Student-Newman-Keuls)

[a]Early and late fungicide treatments were applied on Oct. 22, 2007 and Nov. 16, 2007, respectively

[b]Mean percent diseased area

[c]Color was rated on a scale of 1-9 where 1 = straw colored, 7 = acceptable, 9 = dark green

[d]Number of replicaitons snow scald was observed out of a possible 4 reps

2007-2008 Snow Mold Control Evaluation
Edina Country Club - Biwabik, MN

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University of Wisconsin-Madison

Dr. Brian Horgan
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OBJECTIVES

To evaluate fungicides for the control of Typhula blight (caused by *Typhula ishikariensis* and *T. incarnata*) and pink snow mold (caused by *Microdochium nivale*).

MATERIALS AND METHODS

This evaluation was conducted at Edina CC in Edina, MN on a creeping bentgrass (*Agrostis stolonifera*) and annual bluegrass (*Poa annua*) golf course fairway maintained at a height of 0.5 inches. Individual plots measured 3 ft x 10 ft (30 ft^2), and were arranged in a randomized complete block design with four replications. Individual treatments were applied at a nozzle pressure of 40 p.s.i using a CO_2 pressurized boom sprayer equipped with two XR Teejet 8004 VS nozzles. All fungicides were agitated by hand and applied in the equivalent of 2 gallons of water per 1000ft^2. Early treatments were applied on October 22nd, 2007 and late treatments were applied on November 16th, 2007. There was continuous snow cover on the plots from December 1st until the first week of April, a total of approximately 120 days. Percent snow mold and color were recorded on April 16th, 2008. Data obtained was subjected to an analysis of variance to determine significant differences between treatments. The mean percent diseased area snow mold and mean color rating for each individual treatment are located in the tables below.

RESULTS AND DISCUSSION

Disease pressure at Edina CC was relatively low this year compared with other sites and compared with what was expected based upon the length of snow cover. While all three snow mold pathogens were present at the site, the majority of damage was caused by *T. ishikariensis*. Untreated controls averaged only 11% disease, and most treatments gave 100% control of snow mold. All treatments, with the exceptions of treatments 14 and 20, significantly reduced snow mold compared with the untreated control. Only 8 of 25 treatments had any disease present. Differences in plot color were also observed, with treatments 21-23 having a significantly greener color. All three of these treatments contained a green pigment in addition to the active ingredient. Those treatments containing PCNB caused some slight turfgrass discoloration, but the discoloration was minimal and recovered quickly.

Snow Mold Ratings Recorded on April 16th, 2008 at Edina CC

Treatment	Rate	Timing[a]	% Snow mold	Color[c]
1 Untreated Control			11.3 a	7 b
2 Spectro	4 OZ/M	Early	0 b	6.5 b
26/36	4 FL OZ/M	Late		
CLEX-9	1.2 OZ/M	Late		
3 Spectro	4 OZ/M	Early	2.3 b	6.75 b
26/36	8 FL OZ/M	Late		
Endorse	4 OZ/M	Late		
4 Spectro	5.75 OZ/M	Late	0 b	6.25 b
CLEX-9	1.2 OZ/M	Late		
5 Spectro	4 OZ/M	Early	3.3 b	7 b
26/36	4 FL OZ/M	Late		
Endorse	4 OZ/M	Late		
Alude	5.5 FL OZ/M	Late		
6 Insignia	0.7 OZ/M	Late	1 b	7 b
Trinity	1 FL OZ/M	Late		
Daconil WeatherStik	3.7 FL OZ/M	Late		
7 Insignia	0.7 OZ/M	Late	0 b	7 b
Trinity	1 FL OZ/M	Late		
Turfcide 400	6 FL OZ/M	Late		
8 Insignia	0.7 OZ/M	Late	1.3 b	7 b
Chipco 26GT	4 FL OZ/M	Late		
Daconil WeatherStik	3.7 FL OZ/M	Late		
9 Insignia	0.7 OZ/M	Late	0 b	7 b
Chipco 26GT	4 FL OZ/M	Late		
Turfcide 400	6 FL OZ/M	Late		
10 Instrata	9.3 FL OZ/M	Late	0 b	6.5 b
11 Instrata	11 FL OZ/M	Late	0 b	6.75 b
12 Instrata	7 FL OZ/M	Late	0 b	7 b
13 Instrata	5.4 FL OZ/M	Late	0 b	7 b
14 QP Iprodione	4 FL OZ/M	Late	12.8 a	7 b
TM/C	6 OZ/M	Late		
15 QP Iprodione	4 FL OZ/M	Late	0.8 b	6.5 b
QP Propiconazole	2 FL OZ/M	Late		
TM/C	6 OZ/M	Late		
16 Banner MAXX	3.2 FL OZ/M	Late	0 b	6.5 b
Daconil WeatherStik	4.5 FL OZ/M	Late		
Medallion	0.27 OZ/M	Late		
17 Banner MAXX	3.2 FL OZ/M	Late	0 b	6.75 b
Daconil WeatherStik	4.5 FL OZ/M	Late		
18 Banner MAXX	3.2 FL OZ/M	Late	0 b	6.75 b
Medallion	0.27 OZ/M	Late		
19 Daconil WeatherStik	4.5 FL OZ/M	Late	3.5 b	7 b
Medallion	0.27 OZ/M	Late		
20 Chipco 26GT	4 FL OZ/M	Late	8.8 ab	7 b
Daconil WeatherStik	3.7 FL OZ/M	Late		

Means followed by same letter do not significantly differ (P=.05, Student-Newman-Keuls)

[a]Early and late fungicide treatments were applied on Oct. 22, 2007 and Nov. 16, 2007, respectively

[b]Mean percent diseased area

[c]Color was rated on a scale of 1-9 where 1 = straw colored, 7 = acceptable, 9 = dark green

Snow Mold Ratings Recorded on April 16th, 2008 at Edina CC

	Treatment	Rate	Timing[a]	% Snow mold[b]	Color[c]
21	Tartan	2 FL OZ/M	Late	0 b	8 a
	Daconil WeatherStik	5.5 FL OZ/M	Late		
22	Tartan	2 FL OZ/M	Late	0 b	7.88 a
	Turfcide 400	6 FL OZ/M	Late		
23	Reserve	3.8 FL OZ/M	Late	0 b	8 a
	Compass	0.25 OZ/M	Late		
24	Tourney	0.44 OZ/M	Late	0 b	6.75 b
	Daconil Ultrex	3.2 OZ/M	Late		
25	Turfcide 400	10 FL OZ/M	Late	0 b	7 b
26	Turfcide 400	6 FL OZ/M	Late	0 b	7 b
	Banner MAXX	2 FL OZ/M	Late		

Means followed by same letter do not significantly differ (P=.05, Student-Newman-Keuls)

[a]Early and late fungicide treatments were applied on Oct. 22, 2007 and Nov. 16, 2007, respectively

[b]Mean percent diseased area

[c]Color was rated on a scale of 1-9 where 1 = straw colored, 7 = acceptable, 9 = dark green

Entomology research

Evaluation of Various White Grub Insecticides Applied as Rescue (Corrective) Treatments for Control of Japanese Beetle Grubs in Turf

R. Chris Williamson
Department of Entomology

INTRODUCTION

The objective of this research study was to evaluate the performance (i.e., efficacy) of various white grub insecticides when applied as rescue (i.e., corrective) treatments for control of Japanese beetle grubs in turf. This study was conducted at Naga-Waukee Golf Course (Pewaukee, WI). An irrigated Kentucky bluegrass/perennial ryegrass stand of turf with a minimum of 20 Japanese beetle grubs per square foot was selected to conduct this study. Four insecticide treatments (Table 1) were applied on September 24, 2008. Plots (5' x 5') were arranged in a randomized complete block design with four replications. A hand-held CO_2 backpack sprayer equipped with TeeJet flat-fan extended range spray nozzles calibrated to deliver 2.0 gallons/1000 ft^2 was used to apply the sprayable formulations of insecticides. A shaker-jar applicator was used to apply the granular treatment. All insecticide treatments were watered-in immediately following treatment application with about 0.15 inches of water. Approximately four weeks post-treatment (October 22, 2008), plots were destructively sampled to determine the performance (i.e., efficacy) of respective insecticide treatments by counting the number (alive) of Japanese beetle larvae per 1.5 square feet

Table 1. Insecticide treatments and rate applied as a rescue treatment to control Japanese beetle larvae in turf.

TRT	Rate
Dylox 420 SL	6.9 fl oz/M
Aloft SC	10.0 fl oz/A
Aloft SC	14.0 fl oz/A
Merit 0.5G	0.3 lb ai/A
UNT	---

RESULTS and DISCUSSION

The Dylox 420 SL treatment provided the best control (> 94%), while the Merit 0.5G treatment also provided excellent control (Table 2).. The high rate of Aloft SC (14.0 fl oz/A) also provided acceptable control (65-70%). The low rate of Aloft SC (10.0 fl oz/A) did not provide an acceptable level of control (Table 2).

Table 2. Performance of various insecticides applied as a rescue (corrective) treatment for control of Japanese beetle grubs in turf.

TRT	# alive/1.5ft^2	Mean # alive/1.5ft^2	% Control
Dylox 420 SL	2/2/0/2	1.5	94.2
Aloft SC	1/26/4/27	14.5	44.2
Aloft SC	8/8/6/10	8	69.2
Merit 0.5G	1/10/2/0	3.25	87.5
UNT	33/27/19/25	26	---

Evaluation of Optimal Preventative Timing of Insecticide Formulations for Control of Japanese Beetle Grubs in Turf

R. Chris Williamson
Department of Entomology

INTRODUCTION

The objective of this research study was to determine the optimal preventative timing and performance (i.e., efficacy) of insecticide formulations for control of Japanese beetle grubs in turf. This study was conducted at the University Ridge Golf Course (Verona, WI). An irrigated Kentucky bluegrass/perennial ryegrass stand of turf with a history of Japanese beetle grubs was selected to conduct this study. A total of 13 insecticide treatments were applied. Seven treatments were applied on April 17, 2008 and seven were applied on July 30, 2008 (Table 1). Identical treatments were applied on both dates and respective treatments were duplicated to allow one treatment to be watered-in with 0.15 inches of water immediately following treatment application and the other to not receive any post-treatment irrigation for at least 14 days (Table 1). Plots (5' x 5') were arranged in a randomized complete block design with four replications. A hand-held CO_2 backpack sprayer equipped with TeeJet flat-fan extended range spray nozzles calibrated to deliver 2.0 gallons/1000 ft^2 was used to apply the insecticide treatments. The plots were destructively sampled on October 17, 2008 to determine the performance (i.e., efficacy) of respective insecticide treatments by counting the number (alive) of Japanese beetle larvae per 1.5 square feet

Table 1. Insecticide treatments and rate applied April 17 and July 30 to control Japanese beetle larvae in turf.

TRT	Post-Treatment Irrigation	Rate	Appl. Date
1) Acelepryn SC	Y	8.0 fl oz/A	April 17
2) Acelepryn SC	N	8.0 fl oz/A	April 17
3) Acelepryn SC	Y	12.0 fl oz/A	April 17
4) Acelepryn SC	N	12.0 fl oz/A	April 17
5) Merit 75WP	Y	6.4 oz/A	April 17
6) Merit 75WP	N	6.4 oz/A	April 17
7) Acelepryn SC	Y	8.0 fl oz/A	July 30
8) Acelepryn SC	N	8.0 fl oz/A	July 30
9) Acelepryn SC	Y	12.0 fl oz/A	July 30
10) Acelepryn SC	N	12.0 fl oz/A	July 30
11) Merit 75WP	Y	6.4 oz/A	July 30
12) Merit 75WP	N	6.4 oz/A	July 30
13) UNT	---	---	---

Respective treatments intended to receive post-treatment irrigation (Y) were individually watered-in with ~0.15 inches water immediately following treatment application. The treatments signified by (N) did not receive post-treatment irrigation for at least 14 days.

RESULTS and DISCUSSION

With the exception of the two Merit 75 WP treatments (i.e., with and without post-treatment irrigation) and the Acelepryn SC (12.0 fl oz/A, without post-treatment irrigation) applied on April 17, 2008 (about 75 day pre-Japanese beetle egg hatch), all insecticide treatments performed quite well (Table 2).. A noticeable trend was observed whereby the post-treatment irrigation enhanced the performance of all the insecticide treatments tested with the exception of the Merit 75 WP treatment applied on July 30 (Table 2). These result re-confirm the necessity for post-treatment irrigation when using white grub insecticides. Lastly, this study suggests that Acelepryn, regardless of rate (i.e., 8.0 or 12.0 fl oz/A) is an excellent white grub insecticide that can be applied in mid-April through late-July.

Table 2. Performance of insecticide treatments and rate applied April 17 and July 30 to control Japanese beetle larvae in turf, with and without post-treatment irrigation.

TRT	# alive/1.5ft^2	Mean # alive/1.0ft^2	% Control
1) Acelepryn SC	0/0/0/3	0.75	96.5
2) Acelepryn SC	0/0/0/19	4.75	77.9
3) Acelepryn SC	0/0/1/0	0.25	98.8
4) Acelepryn SC	0/26/18/8	13.0	39.5
5) Merit 75WP	11/2/29/22	16.0	25.5
6) Merit 75WP	20/0/32/8	15	30.2
7) Acelepryn SC	2/0/0/0	0.5	97.7
8) Acelepryn SC	0/0/8/12	5	76.7
9) Acelepryn SC	0/0/0/0	0	100
10) Acelepryn SC	0/3/3/9	3.75	82.6
11) Merit 75WP	0/0/0/0	0	100
12) Merit 75WP	0/0/0/0	0	100
13) UNT	34/23/10/19	21.5	---