Is the Cost Worth the Benefit?

Greens

Tees

Fairways

MATT'S WORLD

Disclaimer:

The opinions in this presentation are exclusively mine based upon my personal job experience on golf courses. My opinions are not substantiated by science, but are established by trial and error, as well as common sense.

Champion Green

Tif Eagle Tee

LDS – Localized Dry Spot

Moisture Management

- Longer term programs meant to reduce water use and increase efficiency.

What can be done to aid in managing turf without the assistance of wetting agent programs?

Verticutting Green #1

Aerification Green #2

Topdressing Greens

Verticutting Fairway

Aerifications #18 Pines B

Irrigation Sensors

Moisture Meter

Hand watering 1

Tom & Mark Burrows
International Turfgrass Services

Soils Audit For Royal Poinciana C.C. — Box 1387 Naples, FL 33939

Sample Location	Report Date: 11/3/2011		26773
PINE GREEN	2	5	7
Sample:	2"		
Lab Number	0033-1	0034-1	0035-1
Total Exchange Cap. (ME/100g)	2.35	2.15	2.10
pH (H2O 1:1)	7.5	8.0	7.8
Organic Matter (humus) %	0.35	0.33	0.38
Est. N. Release (lb/ac)	5	13	16
ANIONS Soluble Sulfur p.p.m.	16 LOW	15 LOW	16 LOW
Phosphorus — Easily Extractable PPM	68	84	66
Phosphorus — Easily Extractable Lbs/Ac	104	293	302
Phosphorus — Bray II PPM	144	137	129
Phosphorus — Bray II Found	220	627	588
Phosphorus — Bray II Deficit/Excess		-386 High	+355 high
Phosphorus — Olsen PPM			
Phosphorus — Olsen Lbs/Ac			
Exchangeable Cations Calcium PPM	293	290	276
Calcium lbs/acre Found	195	580	552
Calcium Deficit/Excess	+24	-5	-19
Magnesium PPM	69	53	52
Magnesium lbs/acre Found	46	106	104
Magnesium Deficit/Excess	-20	-94	-96
Potassium PPM	24	20	28
Potassium lbs/acre Found	16	40	56
Potassium Deficit/Excess	-43	-143	-126
Sodium PPM	37	30	32
Sodium lbs/acre Found	25	60	64
Sodium Excess	OK	OK	OK
Base Saturation (Percent)			
Calcium Ideal 68 %	62.34	67.44	65.71
Magnesium Ideal 12 %	24.47	20.54	20.63
Potassium Ideal 1.5 - 10 %	2.62	2.39	3.42
Sodium Ideal 0.5 - 3 %	6.55	6.07	6.63
Other Bases Ideal 5 %	3.90	3.40	3.60
Hydrogen Ideal 10 - 15 %	0.00	0.00	0.00
Extractable Minors (ppm)			
Boron Desired 1.2 - 1.3	0.49	0.37	0.27
Iron Desired 100 - 300	39	21	23
Manganese Desired 25 - 80	6	4	4
Copper Desired 0.5 - 3	0.66	0.81	0.54
Zinc Desired 5 - 17	1.79	1.67	1.22
Aluminum Desired 0 - 800	86	87	74
OTHER TESTS Soluble Salts (mmhos/cm)			
Chloride (ppm)			

K < Low | < Low | < Low

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International Turfgrass Services

WATER ANALYSIS REPORT

Royal Poinciana C.C. — Box 1387 Naples, FL 33939

Report Date: 10/25/2011 — File Number: 28773

Submitted By: Mark Burrows

Lab Number	2781
Sample Location	Pines Front Lake
Sample Description	

		Desired Range			
pH		6.2 - 6.9	7.60		
Hardness	(ppm)		239.74		
Hardness	(grains/gal)		14.02		
Conductivity	(mmhos/cm)	1.5 - 5	1.04		
Sodium Adsorp. Ratio		0 - 4	3.08		
Adjusted SAR		0 - 7	5.75		
pHc			7.53		
Residual Sodium Carbonat (RSC)		0 - 1.025	-1.85		
			(ppm)	meq/l	lbs/ac in
Calcium	(Ca)	40 - 120	74.69	3.73	16.94
Magnesium	(Mg)	8 - 24	12.89	1.06	2.92
Potassium	(K)	0.5 - 10	14.12	0.36	3.20
Sodium	(Na)	0 - 50	109.50	4.76	24.83
Iron	(Fe)	2 - 5	< 0.10		
Total Alkalinity	(CaCO3)	0 - 100	146.83		33.30
Carbonate	(CO3)	0 - 20	0.00		
Bicarbonate	(HCO3)	0 - 120	179.17	2.94	40.64
Hydroxide	(OH)		0.00		
Chloride	(Cl)	0 - 140	199.98	5.64	45.38
Sulfur as	(SO4)	0 - 414	76.32	1.59	17.31
Salt Concentration	(TDS)	1000 - 1500	668.80		151.68
Boron	(B)	0.2 - 0.8	0.14		0.03
Manganese	(Mn)	0.5 - 2	< 0.020		
Copper	(Cu)	0 - 0.2	< 0.020		
Zinc	(Zn)	1 - 5	< 0.040		
Aluminum	(Al)	0 - 5	< 0.200		
Cation/Anion Ratio				0.97	
NO3-N	(ppm)	0 - 5	0.35		
Total P	(ppm)	0.005 - 5	< 0.20		

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Walking Greens Sprayer

Hydro Jet 2

GREENS

Product	Rate	Freqeuncy	Gal / Acre	$ / Gal	$ / Acre	$ X 3acres	$ X 6acres	$ for 6 Months
A	6oz / M	Monthly	2.04	$ 99.70	$ 203.39	$ 610.16	$ 1,220.33	$ 7,321.97
B	5oz / M	Monthly	1.7	$ 88.20	$ 149.94	$ 449.82	$ 899.64	$ 5,397.84

FAIRWAYS

Product	Rate	Freqeuncy	Gal / Acre	$ / Gal	$ / Acre	$ X 30acres	$ X 60acres	$ for 6 Months
A	1-2qts / A	Monthly	0.5	$ 75.00	537.50	$1,125.00	$2,250.00	$ 13,500.00
B	24oz / A	Monthly	0.19	$ 82.80	$15.73	$471.96	$943.92	$ 5,663.52
C	2oz / M	when needed	0.68	$ 30.38	$20.66			
D	4-8oz / M	30 - 60 days	1.4 - 2.7	$ 94.09	$131.70-$254.00	$3,951.00-$7,621.29	$7,902.00-$15,240.00	$47,412.00-$91,440.00

Drought Conditions:

We experience drought-like conditions every year in Southwest Florida and because of this, our water use is reduced each year 15 % - 30 % or as much as 45 % of our consumptive water use permits. This is when we really see the wetting agent vampires come out.

Greens, Tees and Fairways Get Top Priority.

Does it really matter if my roughs or fairways turn brown on Tuesday and yours, with a full wetting agent program, turn brown on Friday ?

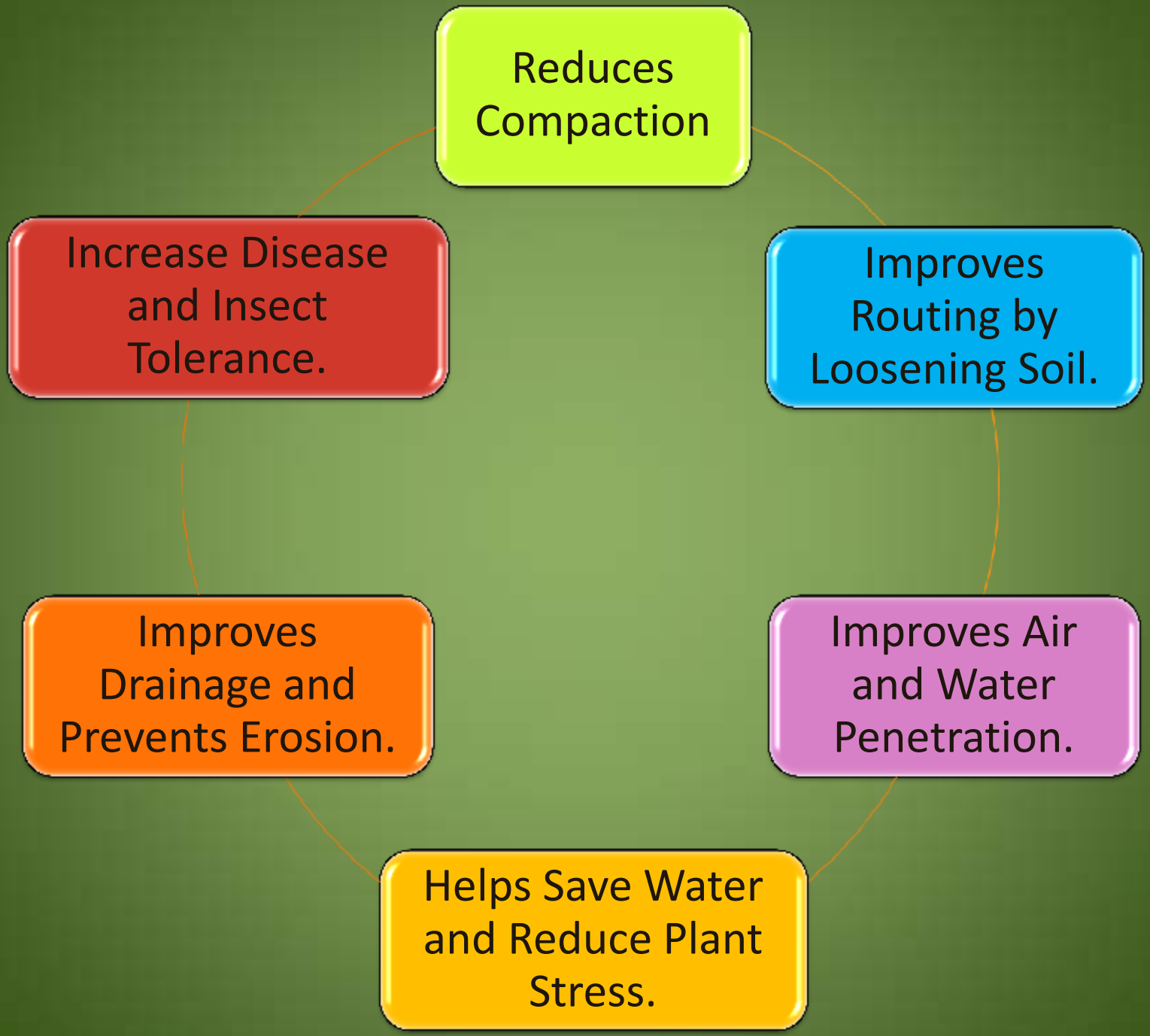
Wetting Agents

One product states that it has been University tested.

In fact, there are eight (8) University Studies on this particular product.

Two (2) of the university studies were done at the University of Florida. The university studies were not on Grass. The university studies were on the following:

- Tomatoes and
- Geraniums


Reduces Compaction
Improves Routing by Loosening Soil.
Improves Air and Water Penetration.
Helps Save Water and Reduce Plant Stress.
Improves Drainage and Prevents Erosion.
Increase Disease and Insect Tolerance.

Environmental Institute for Golf USGA This research was funded by The Environmental Institute for Golf and USGA.

GCSAA-USGA wetting agent evaluation

Superintendents can now reap the benefits of two years of comparative studies of wetting agents.

Clark Throssell, Ph.D.

GCSAA, through funding from The Environmental Institute for Golf and USGA, has completed an evaluation of selected wetting agents that began in spring 2003. For several years before the study was initiated, superintendents had expressed a strong desire for product comparison data to help them make informed product use and purchasing decisions. In response, the GCSAA research committee developed the concept of a program coordinated by GCSAA to evaluate products that are commonly used by superintendents but currently receive limited evaluation in university trials. The committee recommended, and the GCSAA Board of Directors approved, the evaluation of wetting agents for the pilot program. Wetting agents were chosen because they are widely used by superintendents across the country to manage localized dry spots, an important problem on greens, and because comparison of wetting agents in side-by-side university trials has been limited.

After the results from the evaluation have been made available, feedback will be sought from golf course superintendents, wetting agent manufacturers and the university scientists who conducted the research to help determine the value of the pilot program. Ultimately, the association will decide whether to continue the program and evaluate other products.

Advisory panel

To help GCSAA conduct the best-possible evaluation, a 10 member advisory panel was created to define experimental objectives, develop the scientific protocol, select evaluation sites, determine the method to use for including products in the evaluation and provide direction for disseminating the results. The panel comprised golf course superintendents Darren Davis, Mark Kienert, CGCS; Robert J. Maibusch, CGCS, MG; Brian Sullivan, CGCS, MG; and Mark Woodward, CGCS. Also on the panel were three university scientists who have conducted wetting agent research — John Cisar, Ph.D.; Keith Karnok, Ph.D.; and Robert Shearman, Ph.D. — and the directors of research for the USGA Green Section, Mike Kenna, Ph.D., and for GCSAA, Clark Throssell, Ph.D.

Objectives

Superintendents use wetting agents to address many different problems on the golf course, but limitations in time and funding required the scope of the evaluation to be very specific. The advisory panel decided the overall objective of the evaluation was to determine the effectiveness of selected wetting agents for managing localized dry spots on putting greens. Specific objectives were to determine:

- phytotoxicity damage to turf following wetting agent applications
- the impact of wetting agent applications on turf color and quality
- the degree of soil hydrophobicity following wetting agent applications
- dew formation following wetting agent applications
- pest damage following wetting agent applications

Localized dry spots

Although localized dry spots on putting greens can have many causes, this evaluation focused on hydrophobic or water-repellent soils. An organic coating on the soil particles, which may originate from plants, microorganisms and decomposing organic matter, causes soil to become hydrophobic (1). Soil hydrophobicity is most severe in the upper 1-2 inches (2.5-5 centimeters) of the soil profile.

Symptoms of localized dry spots are roughly circular patches of tan-colored, drought-stressed turf 12 inches (30.5 centimeters) to several feet in diameter. Turf within the localized dry spots may thin out over time, and, in severe cases, portions of the turf may die. Localized dry spots are most severe during periods of extended high temperatures and dry weather (2).

Recommended treatments for managing localized dry spots caused by hydrophobic soil include cultivation of localized dry spots to increase water penetration, hand watering to increase soil moisture content, and preventive and/or curative application of wetting agents (2).

Materials and methods

Evaluation sites

The advisory panel determined that the evaluation should be conducted at nine sites around the country that represented broad geographic regions with diverse climates and growing conditions. Interested scientists were required to submit a site profile of the putting green that would be used to conduct the evaluation. Criteria for selecting sites

RESEARCH

Wetting agents: What are they, and how do they work?

A better understanding of how wetting agents work will lead to their more effective use on the golf course.

Keith J. Karnok, Ph.D.; Kang Xia, Ph.D.; and Kevin A. Tucker

Without question, soil wetting agents have become an important management tool for superintendents. The senior author conducted a survey of more than 600 superintendents that showed 87% use wetting agents as part of their regular maintenance program while another 11% use them in certain situations. According to the survey, wetting agents are used for four primary purposes: relieving localized dry spots (42%), managing water (32%), improving drainage (11%) and improving pesticide movement into the soil (9%). In addition, superintendents use wetting agents for a variety of other reasons such as reducing dew and frost formation, improving seed germination, reducing fairy ring damage, reducing soil compaction, improving irrigation efficiency, reducing dust in golf car paths, improving firmness of bunker sand, etc. Little research supports the use of wetting agents in all these scenarios. However, when used in the right situation, a wetting agent can be an effective management tool.

Although superintendents commonly use wetting agents, confusion about what wetting agents are and how they work is widespread. In this article we explain the characteristics of wetting agents and how they work in certain situations. Perhaps, through a better understanding of the chemical nature of wetting agents, superintendents will be able to determine whether a wetting agent will be effective in a given situation.

KEY points

More info: www.gcsaa.org

- **Most of the soil wetting agents** used in turfgrass management are nonionic surfactants.
- **Wetting agents bond** both with water and with the organic coating on the soil or sand particle, thus allowing the soil or sand particle to become wet.
- **A wetting agent applied to a non-water-repellent soil** would most likely increase the downward movement of water out of the root zone and decrease the upward capillary movement of the water in the soil.
- **When a wetting agent is applied to an area** with excessive thatch or mat, the area dries more slowly than an untreated area at the same site.

Surfactants

Wetting agents fit into a class of chemical compounds called *surfactants*, which are chemicals that cause a physical change at the surface of liquids. Such changes occur at the interface between two liquids or between a liquid and a gas or a liquid and a solid. Because they cause changes at the surface, they are known as "SURFace ACTive AgeNTs." Surfactants are commonly used in herbicide formulations to enhance the desired properties of the formulation and the ultimate spray mixture.

Surfactants have many other uses depending on their specific chemical properties. For example, other types of surfactants include emulsifiers, dispersants, spreaders, penetrants, stickers and detergents. Each type of surfactant has one or more characteristics in common, but all possess the common feature of a water-soluble (hydrophilic) group attached to a long, oil-soluble (lipophilic) hydrocarbon chain (Figure 1). These two groups may be linked together or by an intervening group. Literally thousands of chemical combinations are possible.

Ionization

Small differences in the structure of surfactants can significantly affect their behavior. Depending on their ionization or charge, surfactants are commonly separated into four major groups: anionic, cationic, nonionic and amphoteric. Basically, anionic and cationic surfactants ionize when mixed with water. Their surface active properties are due to their negative charge (anion) and positive charge (cation), respectively. Nonionic surfactants do not ionize in aqueous or water solutions, whereas amphoteric surfactants can be either anionic or cationic depending on the acidity of the solution.

Anionic and cationic surfactants have the disadvantage of reacting with other ions in the solution, causing a precipitate or foam to form. Nonionic surfactants do not react with other ions so they are unaffected by hard water. In other words, they do not form insoluble salts with calcium, magnesium or ferric ions. They can also be used in strong acid solutions and tend to have relatively low toxicity to plants. Most of today's soil wetting agents used in turfgrass management are nonionic surfactants.

Soaps

Superintendents often ask, "What about soaps?" Soaps are a type of surfactant; can they be used as a soil wetting agent? Although soaps have both a polar and a nonpolar end, they owe their surfactant properties to an anionic portion of the molecule. Therefore, soaps are actually anionic surfactants. They have the disadvantage of forming insoluble salts with magnesium, calcium and ferric ions in hard water. These salts will precipitate from solution and form a scum on the water. Therefore, soap would not be a good substitute for a nonionic surfactant or wetting agent.

Which wetting agent is best?

Only one person can decide which wetting agent is best: the superintendent.

Keith J. Karnok, Ph.D.

At the 2006 Golf Industry Show in Atlanta, I conducted a survey of everyone who attended any of my six half-day seminars. The survey, which I have used at GIS and regional seminars for the past few years, focuses on superintendents' use of biostimulants and wetting agents. In this article, I discuss the results of the wetting agent portion of the survey. The biostimulant results will be presented in a future article.

The attendees in my Atlanta seminars represented 43 states, seven countries and one territory (Guam). A poll of this diverse population should give a good indication of the use of wetting agents across the United States and beyond its borders. Ninety-one percent used wetting agents as part of their regular turf management program, and 98% had used a wetting agent under certain circumstances. These numbers clearly show how important wetting agents are to the management of golf course turf.

At the end of the survey, I ask superintendents to name one thing they would most like to know about wetting agents. The most common response is, "Which wetting agent is best?" Although this question appears straightforward, its answer is not. Over the years I have found that each superintendent has his or her own idea of what constitutes "best," not just for wetting agents, but for equipment, grass cultivars and a variety of other items and management practices.

Superintendents often consider several factors when choosing a wetting agent: overall efficacy, longevity of performance, management philosophy, phytotoxicity potential, available formulations, cost and product availability.

What makes a good wetting agent?

1. *Overall efficacy.* Obviously, a product's effectiveness is one of the top considerations in making a purchasing decision. Here I discuss overall efficacy only in relation to the relief of water-repellent soils that cause localized dry spot. As shown in the recent GCSAA/USGA wetting agent evaluation study (www.eifg.org/programs/research/wetagent_index.asp), wetting agents differ significantly in their ability to reduce soil water repellency. The GCSAA/USGA study also showed that a product's performance in one location does not predict its performance at another site. Therefore, wetting agent performance may be site-specific to some extent. Only the superintendent can determine which product is best for his or her particular situation.

2. *Longevity of performance/management philosophy.* There are various approaches to managing localized dry spot with wetting agents. For example, some short-term products are applied at least every 30 days, and with season-long products, one application may last three to five months. In my seminars, superintendents are often evenly split in terms of the approach they favor. Season-long users like the convenience of a single application (or two half-rate applications one week apart) in the spring. Those who prefer the short-term approach believe that applying a wetting agent every 30 days gives them the flexibility of not applying a wetting agent when it is not needed. In some cases, the superintendent may use both strategies or other approaches on different areas of the golf course. Which approach is best depends on the management philoso-

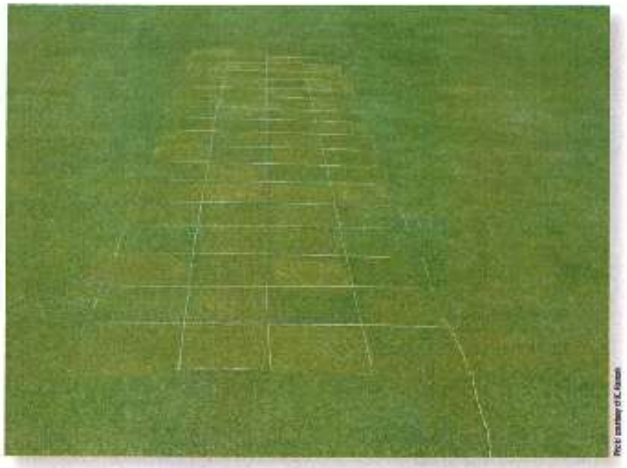


Photo courtesy of K. Karnok

Figure 1. Wetting agents vary significantly in terms of efficacy, formulation, cost, availability and potential phytotoxicity. This photo shows the range in phytotoxicity caused by wetting agents applied to bentgrass during stress conditions.

Your logo here

Premium Turf Wetting Agent

Premium Turf Wetting Agent is specifically designed to be applied to help manage water efficiency in turf root zone and to relieve localized dry spot (LDS) and areas suffering from drought on all types of turf. These include golf greens, golf tees, fairways and lawns.

Application Recommendation:

Application Rate	Timing	Water Volume	Watering In
6 fl oz per 1000 sq ft	2 applications at 14 day intervals to begin the program	2-4 gallons	As soon as possible after application
Followed by 3 fl oz per 1000 sq ft	Repeat once a month as necessary	2 gallons	As soon as possible after application

Premium Turf Wetting Agent is best applied as part of a managed application program. **Premium Turf Wetting Agent** may be tank mixed with most all other turf materials being applied including nutrients, biostimulants, fungicides and insecticides. The addition of **Premium Turf Wetting Agent** at time of application of these materials may enhance their performance due to the **Premium Turf Wetting Agent** providing a more uniform and deeper wetting at time of application.

Premium Turf Wetting Agent should be watered in to turf root zone within 18 hours of application to ensure the product is properly placed in the soil profile. There is no need to immediately water behind the application of **Premium Turf Wetting Agent** as **Premium Turf Wetting Agent** is tested as non phytotoxic to turf.

Warranty: Seller warrants that this product conforms to its chemical description and is reasonably fit for the purpose stated on the label when used in accordance with the directions under normal conditions of use, but neither this product nor any other warranty of merchantability or fitness of a particular product expressed or implied, extends to the use of this product contrary to label conditions, or under conditions not reasonably foreseeable to the seller and the buyer assumes the risk of any such risk.

Net Contents: 2.5 Gallons

Your name here