

# Is tank-mixing herbicides worth it?

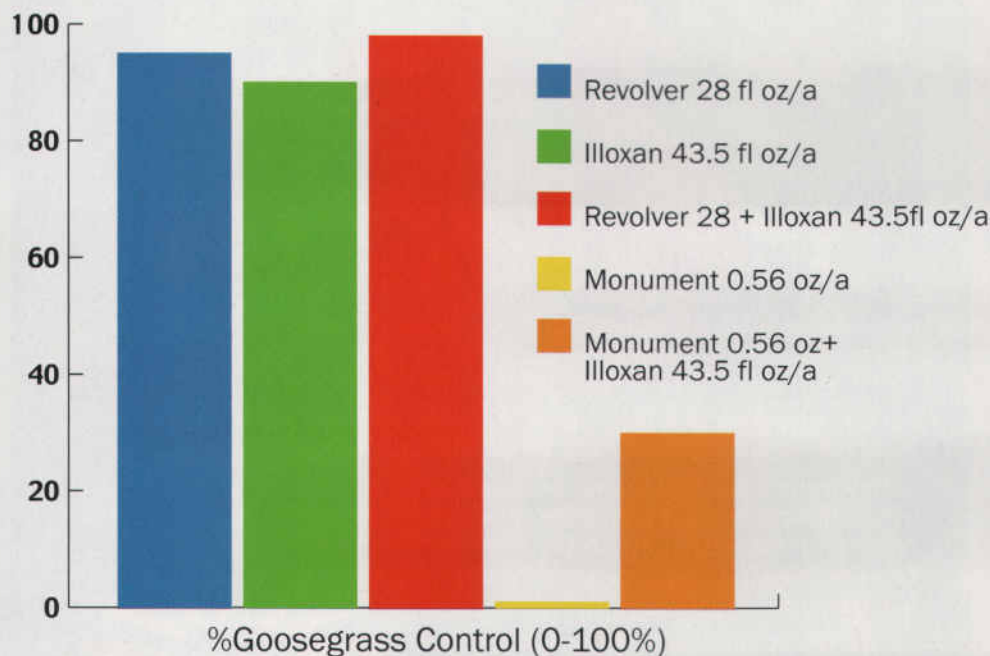
By Scott McElroy, Ph.D. and Greg Breeden

**N**ew sulfonylurea (SU) herbicides for use in turfgrass systems have revolutionized weed management in turf. Because of these new herbicides, such as Revolver (foramsulfuron), Monument (trifloxysulfuron), and Certainty (sulfosulfuron), just to name a few, we now have options for some of our toughest weed control problems. Weeds normally difficult to control, annual bluegrass (*Poa annua*), clumpy perennial ryegrass (*Lolium perenne*), yellow nutsedge (*Cyperus esculentus*), and *Kyllinga* spp. can now be easily controlled in Bermudagrass and zoysiagrass turf with these herbicides.

But while these herbicides can control many weeds, they are not

they panacea that one would hope. For example, many SU herbicides will control some broadleaf weeds, but no one SU herbicide will control all broadleaf weeds. So for complete control of a broad range of broadleaf weeds, you may want to tank-mix an SU herbicide with another herbicide to broaden your spectrum of weed control. But can you do this with out any antagonism occurring?

Well, with regard to tank-mixing SU herbicides with other herbicides to broaden the spectrum of weed control, we have some definite things we cannot do and there is much we simply do not know about tank-mixing these herbicides. Let's start with what we know we cannot do.



Goosegrass control with Revolver, Illoxan, and Monument alone and in tank-mixture. All treatments were applied twice with the second application applied 2 weeks after the first.

## Definite "do not"

There is only one definite "Do not" with respect to tank-mixing SU herbicides. Do not tank-mix SU herbicides with the two herbicide families that only have herbicidal activity on grasses, cyclohexandiones and aryloxyphenoxy propionates, also know simply as graminicides. Herbicides in these families include Illoxan (diclofop), Fusilade II (fluazifop), Acclaim Extra (fenoxaprop), Vantage (sethoxydim), and Select (clethodim). (Cyclohexandiones and aryloxyphenoxy propionates are more easily remembered by their nicknames, the "dims" and the "fops," respectively. These pseudonyms are attributed to the suffix of the chemical names of members in these herbicide families. Fenoxaprop is the exception to the rule.)

Both of these herbicide families only control grasses and do not have herbicidal activity on broadleaf weeds. There is firm evidence that indicates that tank-mixing SU herbicides with graminicides will antagonize the activity of the graminicides (Burke et al. 2002). The activity of the SU herbicide will not be antagonized, however, so weeds targeted by the SU herbicide will still be controlled.





Goosegrass control with Revolver, Illoxan, and a tank-mixture of Illoxan + Monument. Note the high density of goosegrass in the treated plots. Photos taken one week after the second of two applications of each treatment.

One potential problem that could arise would be the potential tank-mixing Monument, for sedge control, and Illoxan for goosegrass control. Since Monument is an excellent herbicide for control of almost all sedges, including nutsedges (*Cyperus* spp.) and *Kyllinga* spp., you would observe excellent sedge control. Goosegrass control with Illoxan could be severely decreased however, due to Monument antagonizing the herbicidal activity of Illoxan.

Research conducted at the University of Tennessee in 2004 evaluated this potential problem. Treatments included Illoxan at 43.5 fl oz/a, Monument at 0.56 oz/a, and Revolver at 28 fl oz/a, with Monument and Revolver also being applied in tank-mixture with Illoxan. All treatments were applied twice with the second application being made 2 weeks after the first. The first applications were made on August 6, 2004. Goosegrass plants were producing seedheads at the time of application and contained from 8 to 12 tillers. Ratings were taken 3 weeks after the second application.

As was expected, Monument antagonized goosegrass control with Illoxan. In this scenario, however, if Monument controlled goosegrass, the antagonism would not be noticed simply because the SU herbicide activity is not disrupted (Burke et al. 2003). This is illustrated by treating goosegrass with a tank-mixture of Revolver and Illoxan. While this tank-mixture is equivalent to Revolver or Illoxan alone with respect to goosegrass control, the observed control is most likely attributed to the activity of Revolver on goosegrass as opposed to Illoxan.

This study illustrates the problem with tank-mixing SU herbicides with graminicides. Tank-mixing SU herbicides with other herbicide groups is not as clear-cut however.

### Broadleaf herbicides

When determining if you can tank-mix SU herbicides with those other than graminicides, our knowledge of what you can and cannot tank-mix is a little murkier. Many SU herbicide labels allow for tank-mixtures with broadleaf herbicides, such as 2,4-D, dicamba, clopy-

ralid, and triclopyr, to broaden the spectrum of weed control. While there is currently no current research evidence available to suggest that one of these herbicides would be antagonized or would antagonize an SU herbicide, there is little evidence to suggest that antagonism does not occur. And while there have been isolated reports in 2005 of antagonism from turf managers who have used such tank-mixtures, there are countless others who have not had a problem or who have actually seen potential synergism of tank-mixtures.

Other herbicides that are commonly applied in tank-mixture with other herbicides are MSMA and Quicksilver (carfentrazone). Again, isolated complaints of MSMA or Quicksilver antagonizing an SU her-

bicide have surfaced, but there is little evidence to suggest that these herbicide cause SU herbicide antagonism. (Antagonism is potentially attributed to applicator error, but don't tell the applicator that.) To evaluate potential antagonism of one of these herbicides with an SU herbicide, a research trial was conducted at Tennessee. The trial evaluated Revolver, Monument, and an unlabeled SU herbicide, flazasulfuron, for control of clumpy tall fescue in bermudagrass turf. Each of these herbicides are known to provide excellent control of tall fescue, however, in our study we applied each alone or in tank-mixture with 2,4-D, MSMA, or Quicksilver to determine if any of these her-

bicides antagonize tall fescue control.

In this situation there was no antagonism of any of the SU herbicides. All of the herbicide treatments evaluated controlled tall fescue from 85 to 100%, regardless if it was applied with one of the tank-mix herbicides or not.

This research was also conducted on tall fescue a second time to confirm the results and also on clumpy perennial ryegrass. In both of these additional cases, no antagonism of the SU herbicides was observed. Does this mean that there is no problem with tank-mixing SU herbicides with these particular three herbicides? Not necessarily. There is still much research to be done to evaluate potential problems that may occur.

## Can you mix any herbicides without any antagonism occurring?



## SU herbicides with SU herbicides

This is one area where no one has spotted any definite problems concerning one SU herbicide antagonizing another SU herbicide. So spray on. In fact one of the best combinations for total weed control in Bermudagrass or zoysiagrass turf is to tank-mix Manor and Monument both at 0.5 oz/a. With this combination you will say goodbye to cool-season grasses, sedges, wild garlic/onions, and almost all broadleaf weeds.

New herbicides and other pesticides in the turfgrass market often bring great benefit in solving pest problems that once had few, if any, solutions. With new chemistry usually can come with potential unforeseen problems. To avoid potential antagonism problems, remember to always consult the herbicide label on proper mixing instructions and tank-mix partners. ■

*Scott McElroy, Ph.D., is Assistant Professor, Turfgrass Weed Science, at the University of Tennessee. Greg Breeden is a Research and Extension Associate, Turfgrass Weed Science, at Tennessee.*

## Literature Cited

Burke, I.C. and J.W. Wilcut. 2003. Physiological basis for antagonism of clethodim by CGA 362622. *Weed Sci.* 51:671-677.

Burke, I.C., J.W. Wilcut, and D. Porterfield. 2002. CGA-362622 antagonizes annual grass control with clethodim. *Weed Technol.* 16:749-754.

Vencill, W.K. 2002. *Herbicide Handbook*, 8th Edition. Weed Science Society of America: Lawrence, KS. pp. 493.

## Definitions of herbicide tank-mixture effects (Vencill 2002)

**Additive.** An interaction of two herbicides would be considered additive when the observed weed control of the mixture is the combined effect of when the two herbicides are applied separately. Example: Product A and B each control crabgrass 50%, but when applied together they control crabgrass 100%.

**Antagonism.** An interaction of two herbicides such that the observed weed control when herbicides are combined is less than the weed control of the herbicides when they are applied separately. Example: Product A and B each control crabgrass 100% alone, but when applied together only 20% crabgrass control is achieved.

**Synergism.** An interaction of two herbicides such that the observed weed control when herbicides are combined is greater than the additive effect of the herbicides when they are applied separately. Example: Product A controls crabgrass 10% and Product B controls crabgrass 20%. When they are combined they control crabgrass 100%, instead of an additive effect of 30%.

## You're Always Ahead of the Game with a COVERMASTER® Raincover...

### "Great Service..., The Best..."

wrote **Chip Baker**, Asst. Baseball Coach,  
**Florida State University**, Tallahassee, FL

Chip's comments confirm what we hear from the many groundskeepers who use a COVERMASTER® raincover to keep their fields dry and ready for play.

Call us and we'll gladly tell you more.

### The COVERMASTER® Advantage...

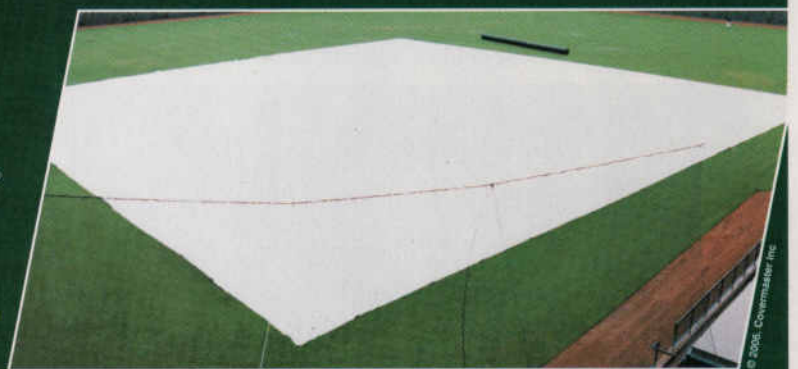
- Superior in strength and UV resistance
- Outstanding heat reflective properties
- Light weight - easy to handle
- Widest materials for least number of seams
- Largest choice of weights and colors
- Backed by truly dependable warranties

### TARP MACHINE VIDEO!

Call, fax or e-mail for a free video, material samples and a brochure.

**COVERMASTER™**  
**COVERMASTER**  
**COVERMASTER**

MASTERS IN THE ART OF SPORTS SURFACE COVERS



Covers for football and soccer fields are also readily available.

TARP MACHINE™ lets you roll the cover on and off in minutes.

TARPMATE™ roller comes in 3 lengths with safety end caps.

CALL TOLL FREE  
**1-800-387-5808**

**covermaster.com**

E-MAIL: [info@covermaster.com](mailto:info@covermaster.com)



COVERMASTER INC., 100 WESTMORE DR. 11-D, REXDALE, ON, M9V 5C3 TEL 416-745-1811 FAX 416-742-6837

Circle 119 on card or [www.oners.ims.ca/5903-119](http://www.oners.ims.ca/5903-119)



# Football field prep for small crews

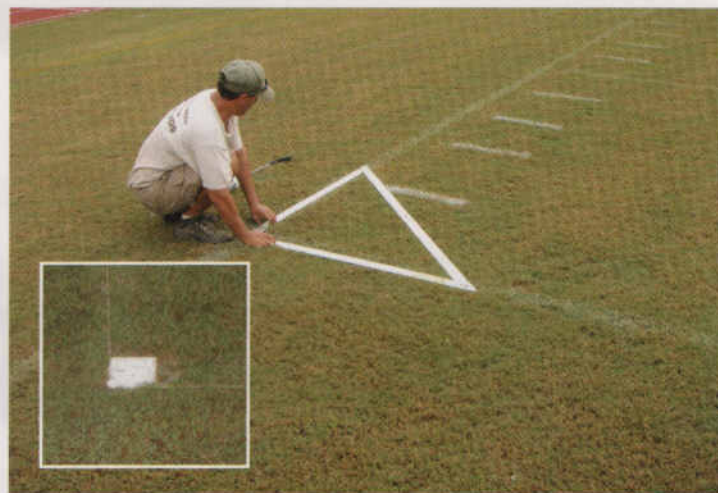
By Floyd Perry

**S**mall, two or three-person grounds staffs can create fields that look great during prime time on football Friday nights. You can set up a schedule that can accomplish your goals with a minimal amount of effort. Let's set up a staff checklist for materials, equipment, and supplies so everything is in place and ready to go when you punch in Thursday mornings.

Mow the game field in two directions on Wednesday afternoon, the day before painting. If your mower has a set of rollers behind the blades (reel or rotary), then make your second mowing sideline to sideline with every other 10-yard section in the same direction to create the light/dark striping effect. This brings out the "TV look," especially with cool season turf blades. The higher your bleachers rise, the more effective the striping appears to fans.



- Before placing strings, go over the lines with your mower without the blades on to remove moisture from the turf so the paint adheres upon spraying. You can drag in the same direction or use mower rollers as your final mowing pattern.



- Set your 4 x 4 corner markers in the proper position and correctly located throughout the year. Notice when setting your plates you use a triangular template so every corner is square and accurate.



- Pull your string with a large reel and carry a bucket of pins and hammer for efficient placement. If you can hold 500 yards on your reel, then you can lay out approximately one-half of the field before getting another reel. When setting the yard lines, create a 6-inch separation from sidelines so officials can correctly visualize the foot placement from the sidelines.

- Set up the strings for numbers and hash marks by using the same 4-inch square metal, sub-surface plates positioned below the playing field. Once the hash mark and number plates are used for the first game, you can repaint future games by just using aerosol paint.



Quality football field painting requires some hard work and cooperation between turf managers and coaching staffs. Encourage the pre-game warm-ups to be accomplished off the yard lines and away from yard line numbers. By doing this your lines will remain bright for the game.

Please encourage line drills and heavy foot action to be done in the endzones or behind the goal posts. Also encourage the teams to enter from the side of the field rather than through the goal posts, if possible.

Many of the above previous points are the last thing considered on Friday nights by the team or coaching staff so on Monday morning it's the turf managers who must overhaul the surface for either next Friday's game or in some areas of the country, Tuesday's soccer match. If dual sports are played on the same field, try to use a light-colored paint for your soccer line marking and attempt to solid tine aerate whenever possible.

Please remember: "Turf grows by the inch and is killed by the foot," so have all your equipment and supplies ready each week since you are always on the "hot seat" when it comes to quality playing fields. The more efficient you can be as a staff, the more respect and cooperation you will receive from administration and coaches. ■

*Floyd Perry is president of Grounds Maintenance Services and is one of the most recognized turf managers in the country. He can be reached at 800-227-9381.*



- Set up your logo stencil and conference stencils in the correct position and attempt to use white paint as your primary color to avoid turf decline due to lack of photosynthesis from darker colors over the course of a 10 or 12-week fall season.



## AERA-VATOR™



CALL FOR A FREE VIDEO TODAY  
**800-363-8780**

SALES@1STPRODUCTS.COM  
WWW.1STPRODUCTS.COM

*"I love the ability to go out and aerate in the afternoon and play a game that night. We are one of the largest townships in the state of New York with several athletic fields. I put down perennial ryegrass seed every time I go out with my Aera-vator. Since we are restricted on chemical applications I use turf seed to compete with weed seeds. I also use my Aera-vator to stripe while using for all my playoff baseball, soccer, and field hockey games."*



**Mike O'Neil**  
South Colonie  
Central Schools  
Albany, NY 12205

**f** **First**  
**Products**  
INNOVATIVE TURF EQUIPMENT

164 OAKRIDGE RD TIFTON GA 31794

Circle 140 on card or [www.oners.ims.ca/5903-140](http://www.oners.ims.ca/5903-140)



**NEW  
PRODUCT!**



## TEST FIELD STABILITY

The new Turf-Tec Toma Shear Strength Tester is a specially designed instrument to test the stability of athletic field root systems. The instrument also tests the type of cleats that will perform best in your particular turfgrass root system and environment. It works by inserting the cleat to be tested into the bottom of the instrument and placing the cleats into the playing surface. By turning the tool until tearing occurs, readings can be taken in foot pounds of torque. Different cleat depths can be tried and compared to each other directly on the field to be played upon. It is also useful in testing new sod rooting, newly seeded or sprigged turf, field stability, footing and shear strength. This instrument works on natural turf surfaces as well as artificial turf surfaces and skinned areas. Inspired by the legendary George Toma.

Turf-Tec/800-258-7477

For information, circle 059 or

see <http://www.oners.ims.ca/5903-059>

## VERDUR FROM RAINBOW TREECARE

Verdur is Rainbow Treecare Scientific Advancement's solution to the problem of interveinal chlorosis in birch and oaks. Chlorosis is a serious condition in which a tree is unable to produce sufficient amounts of chlorophyll. Without chlorophyll a tree's ability to absorb sunlight is diminished, photosynthetic capacity suffers, sugar production diminishes, and tree health is compromised.

Chlorotic trees often show symptoms where leaf color is light green, yellow, reddish, and in severe cases white. Verdur is applied through the process of Macro-Infusion, ensuring even and complete distributed throughout the canopy.

A single treatment in the late summer will provide approximately three years of green-up, restoring important aesthetic qualities and healthy energy production.

Rainbow Treecare Scientific Advancement/877-272-6747

For information, circle 057 or

see <http://www.oners.ims.ca/5903-057>



Before Treatment



One Year After Treatment



# DIAMOND PRO®

## PROFESSIONAL GROUNDSKEEPING PRODUCTS

**STMA Show  
Booth # 713**



[diamondpro.com](http://diamondpro.com) 800.228.2987



Circle 135 on card or [www.oners.ims.ca/5903-135](http://www.oners.ims.ca/5903-135)



## ARBORSYSTEMS WEDGLE DIRECT-INJECT

ArborSystems Wedgle Direct-Inject system is a fast, effective, and tree-friendly trunk-injection system used to control a wide range of destructive pests and diseases. The Wedgle Direct-Inject system injects chemical directly through the bark without drilling, eliminating damage to sapwood. A single operator can treat almost any tree in five minutes or less. With this fast method there is no waiting for caplets to empty, no guarding trees and no overspray concerns. No heavy equipment is required. All tools and chemicals are contained in a lightweight carrying case. Inexpensive start-up: complete hardware kit only \$525. With this efficient delivery system, you can save 50 to 80 percent in chemical costs. ArborSystems chemicals include insecticides, fungicides, PGRs and nutrients.

ArborSystems/800-698-4641

For information, circle 055 or

see <http://www.oners.ims.ca/5903-055>



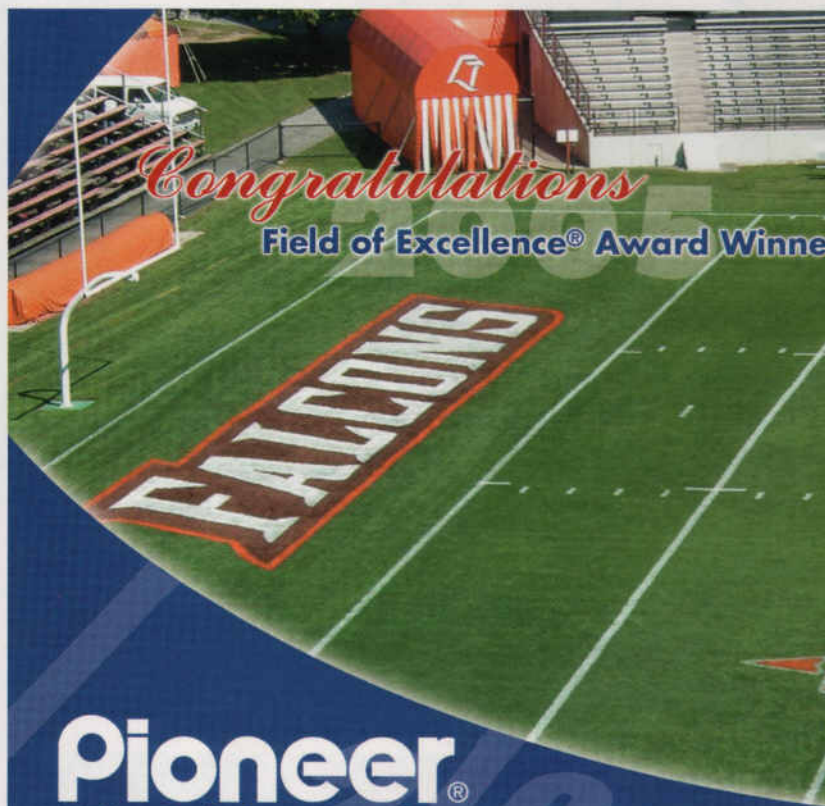
## EXCELLERATOR

Excellerator is a prilled fertilizer, custom blended especially for turf applications with a special micronutrient package and a high concentrate of calcium and soluble silicon in the form of calcium and magnesium silicates. The product is proven to strengthen turf and enhance root mass as well as turf resiliency. Benefits also include: improved drought resistance, disease suppression, better high traffic wear, pest resistance and improved availability of other essential nutrients.

Excell Minerals/866-401-5700

For information, circle 058 or

see <http://www.oners.ims.ca/5903-058>



- McCallie School - Chattanooga, TN
- Clifton Central Community High School Unit 4 - Clifton, IL
- Capitan Municipal Schools - Capitan, NM
- Casady School - Oklahoma City, OK
- Stonehill College - Easton, MA
- Farragut Community Schools - Farragut, IA
- West Ashley High School - North Charleston, SC
- Reicher Catholic High School - Waco, TX
- Somersworth High School - Somersworth, NH
- Angleton I.S.D. - Angleton, TX
- Hayesville High School - Hayesville, NC
- Bowling Green State University - Bowling Green, OH
- Thornton Fractional North High School - Calumet City, IL
- Fort Worth I.S.D. - Fort Worth, TX
- Gaffney High School - Gaffney, SC
- Centerville High School - Centerville, OH
- Lincoln County High School, Fayetteville, TN
- Quincy Public Schools - Quincy, IL
- Floral High School - Floral, AL
- Fremont High School - Fremont, IN
- Seaman U.S.D. #345 - Topeka, KS

**Pioneer**<sup>®</sup>  
 "The Striping People"  
 (800) 877-1500  
[www.pioneerathletics.com](http://www.pioneerathletics.com)



**Field of Excellence**<sup>®</sup>

Circle 121 on card or [www.oners.ims.ca/5903-121](http://www.oners.ims.ca/5903-121)





## ARBORJET ACE-JET ACEPHATE PRODUCT

ACE-jet is a broad-spectrum insecticide with nutritional properties, fast-acting, and low cost. ACE-jet can be used with all Arborjet tree injection systems and is effective for caterpillars, mites, aphids, scale, emerald ash borer, hemlock woolly adelgid, winter moth, Gypsy moth, leaf miners and many more insect pests.

Arborjet/866-272-6758

For information, circle 056 or

see <http://www.oners.ims.ca/5903-056>

## MAUGET VIGOR 53 TREE FERTILIZER

Vigor 53 is the latest injectable fertilizer product offered by the JJ Mauget Company. This new nutritional supplement promises fast results coupled with ease of application. Ornamental trees quickly exhibit better color and stronger growth, while fruit trees yield larger and higher quality crops. The key element, phosphorus, is an important and often-overlooked nutrient that can increase tree health and survival under stressful conditions. Although phosphorus is often present in the soil in sufficient quantities, trees are unable to absorb this critical element. Upon injection, Vigor 53 is taken up directly by the tree's vascular system. Phosphite ions can be used by the tree, plus the tree can convert the phosphite ions into phosphate ions, resulting in quick improvement of the tree's appearance and health. Vigor 53 has been shown to benefit ornamental trees, conifers, apricots, peaches and more. Palms, avocados, citrus and olives have also shown dramatic results after treatment.

JJ Mauget Co./800-873-3779

For information, circle 054 or

see <http://www.oners.ims.ca/5903-054>



# THE NEW STANDARD IN NATURAL INFIELD CONDITIONERS! **RED DIAMOND CONDITIONERS**

- Promotes Safety
- Professionally Sized Conditioners
- Provides Superior Moisture Management
  - Enhances Surface Coloration
  - Assist in Proper Field Drainage
- Reduces Rain Delays and Eliminates Rainouts
- 100% Natural Earth Product.



**A QUANTUM LEAP  
TO A SUPERIOR  
ATHLETIC FIELD**

**QUANTUM**  
TURF TECHNOLOGIES



Toll Free (800) 264-5826 • [www.moltan.com](http://www.moltan.com)

Circle 124 on card or [www.oners.ims.ca/5903-124](http://www.oners.ims.ca/5903-124)



# FIELD SCIENCE



GameDay Grass XPe doesn't need a rest between periods, quarters, or muddy Friday nights. That's because it uses Thiolon's most durable synthetic fiber in combination with the latest technology, which is engineered to go toe-to-toe with your heaviest linebacker or quickest goalie. Whatever the sport or activity, GameDay Grass XPe handles the torture with grace and dignity seven days a week, 365 days a year.

Game on.

**GAME DAY XPe**  
GRASS



GENERAISPORTS  
**TURF**  
SYSTEMS

[www.generalsportsturf.com](http://www.generalsportsturf.com)

1 877 TURF HELP

Circle 134 on card or [www.oners.ims.ca/5903-134](http://www.oners.ims.ca/5903-134)

## SOLAR GREEN BLUEGRASS

Scotts Proseed and its partner Landmark Seed have introduced Solar Green, a new variety in the Scotts Hybrid Bluegrass Series. Developed to meet a wide range of turf management challenges, Solar Green has proven its ability to thrive under normal professional turf maintenance programs in the South, as well as under low to medium-input maintenance in traditional cool-season Kentucky bluegrass areas. Solar Green is characterized by a rich green color, finer texture than tall fescue, and resistance to brown patch and pythium.

The Scotts Company LLC/937-644-7396  
For information, circle 085 or  
see <http://www.oners.ims.ca/5903-085>



## AGRONOMIC SYSTEMS DESIGN'S BIO PORE

Oxygen and microbes are now available in one package in a newly formulated product marketed as bio Pore. The product combines ASD's PermO 2 Pore porous ceramics with bio's proprietary blend of living microorganisms to give turf managers a product with advanced technology that is easier to apply. PermO 2 Pore has been used in golf course applications for a number of years to improve physical, chemical and biological balances in soil and sand-based root zones.

Agronomic Systems Design/800-650-2009  
For information, circle 060 or  
see <http://www.oners.ims.ca/5903-060>



## ROOTS' 1>2>3 PREMIX PLUS

With the addition of high-impact microbes from Novozymes Biologicals, Roots 1>2>3 Premix Plus is an enhanced formulation of the market-leading biostimulant product from the Roots(r) Plant Care Group. 1>2>3 Premix Plus is a low-analysis fertilizer with Novozymes' patented growth enhancement technology and proprietary chelated micronutrients. Also tank-mix compatible, this product establishes deeper roots, greater root mass development, and greener color without rapid growth and improved overall turf health.

Roots/800-342-6173  
For information, circle 086 or  
see <http://www.oners.ims.ca/5903-086>