

# TURFGRASS TRENDS

Volume 9, Issue 2 • February 2000

## GENETICS

### Poa Annua-Free Turf A Dream or Newfound Reality?

By Crystal Rose-Fricker, Turf-Seed Inc.

**W**e all struggle with the never-ending battle with annual bluegrass (*Poa annua*). From the grass seed grower and sod farmer trying to produce a clean turfgrass product, to the homeowner, golf course superintendent, and sports turf manager. Ugly light green patches with short prolific seed heads cropping up year round plague the grass seed grower, the professional turfgrass manager and the homeowner. The homeowner works for the seemingly unattainable perfect, weed-free lawn. He or she crawls on hands and knees pulling weeds to have "the best lawn on the block." Golf course and sports turf professionals work towards a pristine turf environment for clients to enjoy. It's no wonder that we fight a perennial problem with a life cycle of 38 days from germination to the next generation of seed. Annual bluegrass seems virtually unstoppable — or is it?

A new avenue of control is now available in two species of turfgrass and on the horizon for other species of turfgrass. After ten years of natural plant breeding tolerance to low rates



Pure Gold tall fescue and Aurora Gold hard fescue (in rows) have exhibited superior tolerance to glyphosate in trials. Off-types between rows dead after application.

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of glyphosate (Roundup) are evident in grass seed production trials and turf trials in Oregon. With the banning of field burning, grass seed growers need another tool to help control weed problems such as annual bluegrass and annual ryegrass in seed production fields.

Over the past several years, research has been ongoing to evaluate two new glyphosate (Roundup) tolerant varieties—Pure Gold tall fescue and Aurora Gold hard fescue. Trials in seed production fields were very promising with 85 percent control of poa annua and 90 percent control of annual ryegrass in pure Gold tall fescue with one application of 12 oz. per acre glyphosate sprayed in the fall. A 95 percent control rate of annual bluegrass in Aurora Gold production fields was also achieved with one application of 16 oz. (1 pint) per acre of Roundup in the winter.

Aurora Gold hard fescue has shown significantly higher turf quality ratings in turf than other fine fescue varieties when sprayed with 16 ounces of glyphosate in a turf trial in Oregon. Seed yields and germination rates were not significantly reduced with up to 16 ounces of glyphosate per acre sprayed in one application anytime from

November through February. Adequate weed control was achieved with 8 ounces of glyphosate per acre with little crop damage.

Pure Gold tall fescue also shows significant tolerance to 16 ounces of glyphosate sprayed 8 May 1998 in a turf trial in Oregon. Seed yields of Pure Gold were not significantly damaged at 8 ounces/acre when applied in November, December, January or February after a fall planting. A 16-ounce/acre rate was not detrimental when sprayed November or January for seed yield. Germination percentages of Pure Gold from field trials were not reduced by applications of up to 32 ounces of glyphosate per acre from November through April.

The savings to growers and the ability to produce higher quality seed lots of Pure Gold and Aurora Gold is but one benefit that also trickles down to the consumer in cleaner seed available to purchase for sod growers, homeowners and golf course superintendents. A seed production label has been approved by the EPA (with assistance from Monsanto) to allow grass seed growers to spray up to 1 pint of glyphosate on their production fields of Pure Gold and Aurora Gold.

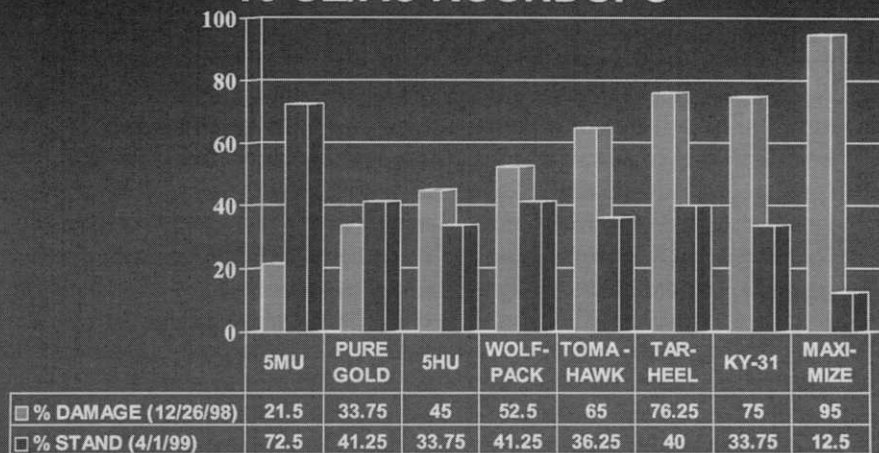
## Pure Gold Tall Fescue Glyphosate Damage Ratings Sprayed 10/29/98

	12/11/98 (43 DAYS)			1/14/99 (77 DAYS)			2/12/99 (106 DAYS)			3/12/99 (134 DAYS)			3/30/99 (154 DAYS)		
ROUND-UP RATE (OZ./AC.)	CROP	AR	AB	CROP	AR	AB	CROP	AR	AB	CROP	AR	AB	CROP	AR	AB
4	4.3	2	6.3	2.5	3	5.3	0.8	1.0	0	0.8	1	0	0	--	--
8	5.5	3	6.8	5.3	5	7.0	2.8	5	6.3	2.8	6	7.3	0.3	--	--
12	6.8	3.8	7.0	7.0	7.5	7.0	4.0	7	7.3	4.0	8	8.3	1.3	--	--
0 = NO CONTROL      10 = COMPLETE CONTROL															

Tall fescue tests results.



## TALL FESCUE % DAMAGE & STAND RATINGS SPRAYED NOV. 19, 1998 16 OZ/AC ROUNDUP®



*Fall applications of glyphosate at 16 oz. per acre revealed natural tolerance.*

Trials with these two glyphosate tolerant varieties have been exciting to say the least. Annual bluegrass infested turf with a 90 percent reduction of annual bluegrass after one application of Roundup are possible; with a light rate (4 oz. to 16 oz. per acre) application of Roundup most annual bluegrass is eliminated within the first year. Fall and spring 4 oz. to 8 oz. per acre applications of Roundup can be the answer to annual bluegrass free turf.

Being able to spray with low rates of Roundup several times is a much safer and economical way to solve the annual bluegrass problem. On a golf course, eliminating annual bluegrass on roughs and fairways will help cut down on the amount of annual bluegrass seed tracked onto greens and tees.

Natural phenotypic selection for tolerance to herbicides such as Roundup is a long and sometimes frustrating process. Ninety-nine percent of the plants we work with are very sensitive to Roundup. For many years (cycles of selection) the survival rate was 1-2 percent of the population sprayed. Different rates sprayed at different growth stages over a span of 8 to 10 years

resulted in populations of over 90 percent survival at 16 oz. of glyphosate per acre.

Natural Roundup tolerance in Pure Gold and Aurora Gold appear to be controlled by several minor recessive genes which were gradually "uncovered" each generation or year of selection and compiled in an additive

manner in a population. By applying appropriate selection pressure we were able to discover natural resistance already inherent in a few plants in a population. This differs from transgenic breeding for herbicide resistance where a single dominant gene is introduced in a plant

usually from a different organism such as bacteria. The resistance of a transgenic variety to a herbicide will usually tolerate very high rates up to 10 times the labeled rate. The exception to this is when multiple copies of the gene occur in the transformed

*By applying appropriate selection pressure, we were able to discover natural resistance already inherent in a few plants. This differs from transgenic breeding for herbicide resistance where a single dominant gene is introduced in a plant.*



*Breeding projects to develop herbicide-tolerant creeping bentgrass, Colonial bentgrass, perennial ryegrass, Kentucky bluegrass, tall fescue and fine fescue varieties will revolutionize the way we deal with weeds in turf.*

plant and gene silencing occurs. This occurs when a biolistic gene is used to put the gene into a plant. This results in progeny or seeds produced by the transformed plant, which die when sprayed with the herbicide.

Naturally tolerant Aurora Gold and Pure Gold can be killed with high rates of Roundup such as 2 quarts/A. When these two varieties out cross to non-tolerant grasses, they will not easily spread via pollen to create other Roundup tolerant varieties or weeds. When transgenic, open pollinated crops out cross to neighboring fields or weeds, they can create herbicide resistant plants unless a male sterility system (no fertile pollen) is used.

The solutions to all our turf management problems are not available yet but with continued research they appear to be coming. Annual bluegrass free turf is quickly becoming a reality as a label for turf use of Roundup on Aurora Gold hard fescue and Pure Gold tall fescue is in process.

For the future, many research projects are underway at several universities and private grass seed companies. At Pure Seed

Testing, Inc., we are working with both conventional breeding and Biotech techniques to develop turf and forage grass varieties with naturally inherited and/or transgenic resistance to herbicides. Breeding projects to develop herbicide tolerant creeping bentgrass, Colonial bentgrass, perennial ryegrass, Kentucky bluegrass, tall fescue and fine fescue varieties will revolutionize the way we deal with weeds in turf. Cooperative programs between universities, chemical companies and grass seed companies are allowing major strides in the advancement of new technologies combined with conventional techniques to produce varieties with the ability to perform above and beyond past expectations.

It has been most exciting to see the yellowing of weeds in turf and field production trials next to bright green, healthy Roundup-tolerant varieties. Imagine how the turf consumer will feel to finally get the upper hand in the war against weeds!

Certified seed of both Pure Gold and Aurora Gold are now available through Turf-Seed, Inc. Utility patent application number 09/098,691 has been issued for Pure Gold tall fescue and Aurora Gold hard fescue.

*Crystal Rose-Fricker is director of research-West for Pure Seed Testing, Inc. of Hubbard, OR.*



*The author in research fields in Oregon.*

# Fertigation Offers Advantages In Environmental Safety

By Bruce Shank, Managing Editor

**F**ertigation makes so much sense it's amazing that it isn't found more often in the golf and sports turf maintenance business. Gentle feeding, less labor, smaller growth spurts and maximum turf performance, who doesn't want these things?

Environmental issues of runoff and groundwater contamination actually favor fertigation. But all these benefits occur only when sprinkler coverage and uniformity are known and under control. Injecting fertilizer into a main line that distributes it through all zones makes control difficult. Isolating key stations for fertigation allows the superintendent more certainty that overspray won't gather on paved surfaces and enter storm drains.

The ultimate advantage of fertigation is that extremely little nitrate is on the surface or in soil solution. There are no granules or complex chains of slow-release nitrogen exposed to surface runoff or maximum percolation during major rain events. A dilute amount of nitrogen is contained in the irrigation water. So little, in fact, that it is consumed by the turf in a matter of hours. The plant uses it for metabolism and carbohydrate production. Once in the plant, the nitrogen can't be dissolved in rain water, even as clippings.

## Contamination Sources

The primary potential source of nitrogen from fertigation is water from sprinklers running into culverts and catch basins and from there into storm drains or lakes. This can be prevented by controlling the sprinkler patterns of heads used for fertigation. Heads in the range of culverts, cart paths and catch basins should not be used for fertigation.

Another is leakage from a fertilizer storage tank connected to the fertigation injector. Precautions should be taken to catch

any leak, such as a concrete or plastic liner for the area surrounding the tank. These tanks should be protected from vandalism.

With computer-operated central control systems, nutrient applications can be precisely applied and recorded. Tissue samples can confirm plant nutrient levels to prevent overapplication. Computers can track the performance of multiple fertigation pumps in carefully designed contamination-free irrigation zones.

Seasonal adjustments for moisture will probably change the amounts and frequency of fertilizer applications. The shorter the irrigation cycle, the more uniform the sprinklers in fertigation zones need to be. Sprinkler spacing might need adjustment, pressure might need to be regulated or boosted in some zones and nozzles must be matched for precipitation. All these things should be done regardless of fertigation for the maximum uniformity of water application.

Since most fertigation pump manufacturers tend to be smaller, they need the interest and involvement of superintendents to reach their full potential. They might not have large development budgets to sponsor university research like larger companies. You might need to make the first move to improve the way fertigation can help your course.

Another limitation to fertigation can be the availability of fertilizer solutions in your area. Agricultural suppliers might be your best bet. Many agricultural crops, both sprinkler and drip irrigated, are fertilized by irrigation systems.

Fertigation needs to be taken much more seriously than it is today for fertilizing large turf areas. Golf courses and sports fields often represent a major percentage of watershed in urban areas. Planners do not take lightly the chance for contamination. You can reduce the chance for contamination and improve your turf by borrowing a tool from agriculture: fertigation.

# Green Industry Websites of Interest

## Our Site

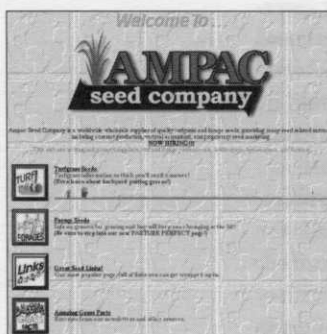
▼ [www.landscapegroup.com](http://www.landscapegroup.com) - Landscape Management, TurfGrass Trends, Golfdom, Athletic Turf magazines. You can access industry links and TurfGrass Trends abstracts here.



## Turf

[www.scgt.oz.au/turfgrass](http://www.scgt.oz.au/turfgrass) - From Australia, but with numerous worldwide links covering all things horticultural.

▼ [www.ampacseed.com](http://www.ampacseed.com) - Great seed links covering turfgrass, weeds, etc.



[www.lib.msu.edu/tgif](http://www.lib.msu.edu/tgif) - From Michigan State University, it's the Turfgrass Information Center containing much information and links to other sites.

[www.bahiagrass.com](http://www.bahiagrass.com) - All about bahiagrass, with links to other southern grass sites.

[www.lawnseed.com](http://www.lawnseed.com) - The webmaster calls himself "The Sodfather," and provides information on selecting/blending grass seed varieties — includes southern lawns.

[www.aggies-horticulture.tamu.edu/plantanswers/turf](http://www.aggies-horticulture.tamu.edu/plantanswers/turf) - Guide to turfgrass species.

<http://www.msu.edu/user/karcherd/turflinks/> "The Ultimate Turfgrass Links Page" lists hundreds of useful turf-related sites. This started as a graduate project and has mushroomed nicely into an incredibly useful and comprehensive turf site.

[www.cru1.cahe.wsu.edu/turf/links](http://www.cru1.cahe.wsu.edu/turf/links) - Superb collection of links to many turf-

grass-oriented websites — very complete guide.

[www.guiaverde.com](http://www.guiaverde.com) - Turfgrass guide in Spanish.

[www.rapidturf.com](http://www.rapidturf.com) - Grass grown via a plastic medium.

<http://ext.agn.uiuc.edu/wssa> - The Weed Science Society of America has a virtual compendium of information about weeds and weed control.

<http://www.floridaturf.com> - A site that is essentially a huge library of information on warm-season turfgrasses.

[www.edis.ifas.ufl.edu](http://www.edis.ifas.ufl.edu) - The Florida Agricultural Information Retrieval System for warm-season grasses.

<http://www.turf.uiuc.edu> - The University of Illinois Turfgrass Program has the best collection of links to help lawn care and turfgrass professionals.

[www.texasturf.com](http://www.texasturf.com) - Texas Turfgrass Association.

## Arborcare

[www.treeview.com](http://www.treeview.com) - Plants and large trees with plenty of data.

[www.treelink.org](http://www.treelink.org) - Media accounts, news, views, tips and links all about tree care.

[forestry.miningco.com](http://forestry.miningco.com) - A search site with many links to tree care-related websites.

[www.teleport.com/~pnwisa/tree-care](http://www.teleport.com/~pnwisa/tree-care) - "Landscape Tree Care 101," it supplies tips on pruning and other tree-related assignments.

[www.ag.uiuc.edu/~isa](http://www.ag.uiuc.edu/~isa) - From the Interna-





— parks, etc.; very thorough, it covers site selection to IPM.

**www.opei.mow.org** - It's called Cyber-lawn, with information and links regarding power equipment and turf.

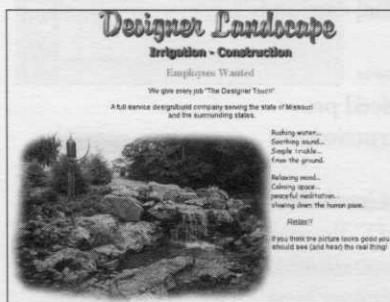
**www.horticulture.com** - Called "The Horticultural Web," this search engine covers an array of ag issues.

**www.greenlink.org** - Environmental activists focused on the Midwest, it provides links to ecology-oriented sites, including aquacultural techniques for ponds.

**www.broccologroup.com** - Tips and links from Green Industry veteran Laurie Broccoli.

**www.128.227.103.58/txt/fairs/3635** - Information on groundcovers and numerous links through the Florida Agricultural Information Retrieval System.

▼ **www.designerlandscape.com** - Displays design elements and supplies several links.



## Water

**www.tiac.net/users/lakes** - Extensive information here; management tips for ponds and lakes.

**www.irri-gate.com** - A search engine developed by the Irrigation Association.

**www.wateright.org** - Look here for an irrigation scheduling program for heavy turf, agricultural and homeowner applications.

## Snow

**www.articsnowplows.com** - Commercial site for snow removal equipment.

## Equipment/Suppliers

**www.tmn.com/tisc** - From the Tire Industry Safety Council, everything you need to know about using/selecting tires and related equipment.

**www.turf.com** - From Lofts Seeds, information on turf and wildflowers.

**www.turfzone.com** - "The Resource Site for the Turf Industry," it provides links to industry suppliers.

**www.mathesquarry.com/products** - Excellent guide to stone products ranging from sand to boulders.

**expo.mow.org** - International Lawn, Garden and Power Equipment Expo.

## Information

**www.coaps.fsu.edu/lib/elinolinlinks** - Site covers weather-related issues and horticultural impacts.

**www.ace.ace.orst.edu/info/nptn** - From the National Pesticide Telecommunications Network; an extensive resource of information and links, including government agencies.

**www.usda.gov** - The United States Dept. of Agriculture.

**www.cdc.gov** - Centers for Disease Control; information on pest-borne illnesses and other health issues.



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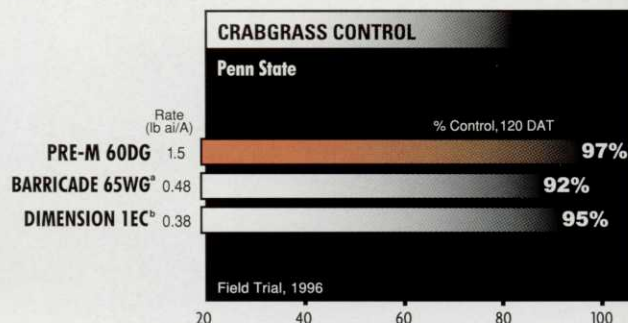
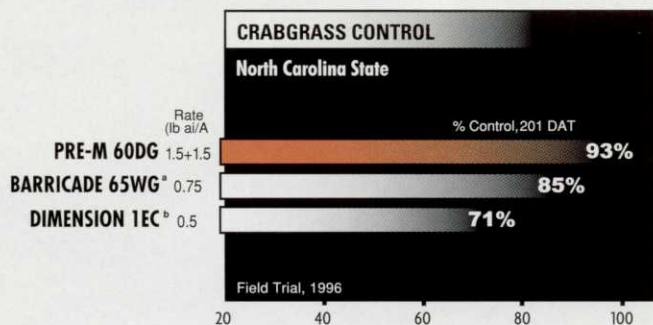
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PRE-M	H	H	H	M	H	M	H	H
BARRICADE <sup>a</sup>	H	M	M	M	MH	M	H	H
DIMENSION <sup>b</sup>	H	M	H	M	H	M	M	M
TEAM <sup>c</sup>	H	M	M	M	M	M	NR	NR
RONSTAR <sup>d</sup>	M	H	NR	M	M	NR	NR	NR
SURFLAN <sup>c</sup>	H	H	H	M	MH	M	H	H
Level of control	Medium		Medium-High		High		Not Registered	

a™ Novartis    b™ Rohm and Haas Co.    c™ Dow AgroSciences    d™ Rhône-Poulenc

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- Granular: over 20 standard combination products available featuring LESCO POLY PLUS® coating process, ensuring the right product for any program
- Single-Rate Application—full rates provide long-term results
- Split-Rate Application—increases residual control for optimum performance

\*Source: Kline & Company Report, US Acre Treatments by Turf Management.



# Field techniques

## Understanding soil test reports

By Christopher Sann

Soil test reports vary considerably from one testing lab to another. Rather than use a particular lab's test report as an example, we have incorporated features from several labs' reports for the following sample report.

Each test result is listed with its unit of measurement and a recommended action for each result. There is a key explanation at the end with a brief description of each result.

### Explanation of a typical soil test report

1. Soil pH is the active acidity of the sample. It measures the hydrogen ion concentration in the soil solution, and it allows you to estimate the availability of all nutrients and the distribution of the major cations held on exchange sites.

2. Buffer pH is the reserve acidity of the sample. It measures the hydrogen ion concentration on the exchange sites and indicates how resistant the soil is to pH change.

3. C.E.C. or cation exchange capacity is a numerical expression of the quantity of

### TYPICAL SOIL TEST REPORT

XYZ Soil Testing Laboratory  
123 Main Street • Anytown, USA

Run For: Al Ways Ready, Supt.  
14th Lost Ball Road  
Big Swing, PA

Site name: 9th & 10th Fairway  
Species: Bentgrass

Test	Result	Units	Range	Recommendations
1. Soil pH	5.9*		6.3-6.5	30 lbs. calcitic limestone/1000 ft.2/year
2. Buffer ph	6.8*		6.9-7.1	See soil pH recommendations
3. C.E.C.	12.3	meq/100g	3.0-40+	Loamy to sandy
4. Phosphorus	22*	ppm	28-32	1.0 lb. P2O5/1000 ft.2/year
5. Potassium	65*	ppm	120-200	2.5 lbs. K2O/1000 ft.2/year
6. Magnesium	215	ppm	varies by C.E.C.	see soil pH recommendations
Calcium	850*	ppm	varies by C.E.C.	See soil pH recommendations
Sodium	32	ppm	>50	none
7. % H Base Saturation	30.5*	%	>5%	See soil pH saturation recommendations
% K Base Saturation	01.8	%	varies by C.E.C.	See potassium saturation recommendations
% Ca Base Saturation	45.5*	%	65-75%	See soil pH saturation recommendations
% Mg Base Saturation	20.0	%	15-20%	None
% Na Base Saturation	02.2	%	0-5%	None

#### \*Needs addressing

meq/100g = milli-equivalents per 100 grams per soil

ppm = parts per million

cations held in the soil matrix. C.E.C. measures the soil's nutrient holding capacity and is a strong indicator of soil texture and fertility.

4. Phosphorus is the amount of plant-available phosphorus in the sample at the reported soil pH. Phosphorus may be held in other unavailable and insoluble forms in the soil matrix, but plant-available is the only important number.

5. Potassium measures the amount of potassium that is plant-available in the soil solution and held on the exchange sites. Like phosphorus, potassium can also be held in other nonavailable forms.

6. Magnesium, calcium and sodium report the amounts of each of these elements in soil solution and held on exchange sites. These elements are the main components of the alkaline portion of the soil, and, although you can estimate pH from this information, a better picture can be obtained by looking at the percent base sat-

uration for these elements.

7. Percent (%) Base Saturation (P.B.S.) for hydrogen, potassium, magnesium, calcium and sodium represent the distribution of each element relative to the total cation exchange capacity. These five major elements — combined with the minor elements — represent the total exchange capacity of the soil. From a practical standpoint, P.B.S. indicates how efficiently the plant-available forms of these elements are becoming available for plant use.

8. Soil pH recommendations (see tables below) are actually based on the buffer pH readings. The actual material recommended will depend on the balance that exists between calcium and magnesium. The amounts of these elements that are available at differing C.E.C. levels is less important than the ratio of calcium to magnesium.

Since magnesium is a stronger alkaline material than calcium, and calcium is more necessary than magnesium both for plant

## Correcting pH and related deficiencies

### 1. LIMING RECOMMENDATIONS

If buffer pH is...	Add calcitic limestone*	Or hydrated lime
6.7-6.8	25 lbs./1000 ft.2	12.5 lbs./1000 ft.2
6.5-6.6	50 lbs./1000 ft.2	25 lbs./1000 ft.2
6.3-6.4	75 lbs./1000 ft.2	37.5 lbs./1000 ft.2
6.1-6.2	100 lbs./1000 ft.2	50 lbs./1000 ft.2
5.9-6.0	125 lbs./1000 ft.2	62.5 lbs./1000 ft.2
<5.8	150 lbs./1000 ft.2	75 lbs./1000 ft.2

\* If percent base saturation magnesium levels are less than 10, use dolomitic limestone.

### 2. CORRECTING MAGNESIUM DEFICIENCIES

#### ...WITH SOIL PH GREATER THAN 6.0, USING EPSOM SALTS

If % Mg base sat. is...	Add lbs. magnesium*	Timing
<10%	1.0 lb./1000 ft.2	spring and fall
10-15%	0.5 lb./1000 ft.2	spring and fall
>15%	0	not applicable**

\*Actual pounds of epsom salts applied per 1000 ft.2 will vary, depending on the percentage of magnesium in the epsom salts.

\*\* Usually with soil pH greater than 6.0 but less than 7.0, low calcium levels require gypsum applications.



### 3. CORRECTING CALCIUM DEFICIENCIES

...WITH SOIL PH GREATER THAN 6.0, USING GYPSUM\*\*

If Ca base sat. is... And %Mg base sat. is... Add gypsum

<800 ppm 20% 10-15 lbs.

<600 ppm 20% 15-25 lbs.

<500 ppm 20% 25 lbs.\*

\*May require multiple applications and should be monitored closely.

\*\* Corrective application can be made anytime two weeks prior to, or after, a fertilizer application.

### 4. CORRECTING HIGH SOIL PH

...GREATER THAN 7.0, USING SULFUR

If soil pH is ...	And turf length is ...	Add sulfur ...	Timing
> 7.0	very short	100-200 lbs./A	spring and fall**
>7.0	short-tall	200-400 lbs./A*	spring and fall**

\* Do not exceed 200 lbs./acre per application on sandy soils.

\*\* Make multiple applications if necessary, and monitor soil pH two to four weeks after application.

Do not apply during a period two weeks before or after a fertilizer application, as a rapid pH change can cause some nitrogen sources to volatilize.

Reprinted from TurfGrass Trends, November-December 1992.

nutrition and soil stability, a ratio of 6-8 parts calcium to one part magnesium is desirable. Soils low in soil pH, calcium and magnesium will require a dolomitic limestone. Soils low in soil pH and calcium, but with good magnesium levels will require calcitic limestone or hydrated lime applications. Soils with

good soil pH, but low in either calcium or magnesium will require gypsum or epsom salts applications respectively.

—Editor's note: This is reprinted from TurfGrass Trends, November/December 1992.

# Forget the Tea Leaves, Read the Soil Cores Instead

**W**hen you are taking soil samples, take a few minutes to take the next step: Examine the soil cores that you have taken and record your observations. If you take the soil samples at the same time each year and you make and record the same observations each year, you will develop an ongoing data source that will give you a strong indication of the effectiveness of your soil chemistry monitoring and correction activities, the success or failure of your thatch control strategies and the outcome of your efforts to grow and protect your turf's root structure.

The time you use to take soil samples is an excellent time to monitor the success of

your other turf management efforts. Recording observations on the health of your soil and the plants that grow in it can pay major benefits in as little time as a year. You can examine the core samples for thatch depth, condition and level of decomposition, root mass, distribution and health, soil layering, compaction and pan formation and soil structure, particle size and distribution, and pore space size and quantity.

These observations of the current physical soil conditions combined with the results of the soil testing should give you valuable data for making a decision.

—Editor's note: This is reprinted from *TurfGrass Trends*, November/December 1992.

## CORE SAMPLE OBSERVATION FORM

SITE \_\_\_\_\_ FACILITY \_\_\_\_\_  
LOCATION \_\_\_\_\_ STREET \_\_\_\_\_  
DATE \_\_\_\_\_ CITY \_\_\_\_\_  
TAKEN BY \_\_\_\_\_ STATE \_\_\_\_\_

### ► Thatch

Depth \_\_\_\_\_ (mm/in.) Condition dry \_ normal \_ wet \_  
Root invasion none \_ light \_ medium \_ heavy \_  
Decomposition none \_ 25% \_ 50% \_ 75% \_ 100% \_

### ► Roots

Mass thin \_ medium \_ dense \_  
Depth \_\_\_\_\_ (mm/in.)  
Distribution poor \_ fair \_ good \_  
Color white \_ tan \_ dark \_  
Health vigorous \_ static \_ damaged \_

### ► Soil structure

Compaction starts at \_\_\_\_\_ (mm/in.) ends at \_\_\_\_\_ (mm/in.)  
Compaction density: light \_ medium \_ heavy \_  
Layering: starts at \_\_\_\_\_ (mm/in.) ends at \_\_\_\_\_ (mm/in.)  
Layering material: stone \_ clay \_ organic \_  
Layer density: light \_ medium \_ heavy \_  
Pan formation: starts at \_\_\_\_\_ (mm/in.) ends at \_\_\_\_\_ (mm/in.)  
Particle size: fine \_ medium \_ coarse \_  
Particle distribution: uniform \_ migrating \_ stratified \_  
Pore space size: small \_ medium \_ large \_



# Sites on the Web

## Reviews you can use

### Extonet Pesticide Profiles

**http://ace.orst.edu/info/extonet/pips/ghindex.html**

**http://ace.orst.edu/info/extonet/pips/ghindex.html**

**Overview:** This is a reference-type site created through the cooperative efforts of five universities that lists many commonly available pesticides and their information profiles (PIP). PIPs provide specific information regarding potential health and environmental consequences involved in the use of or exposure to specific pesticides.

**Pros:** The information provided closely parallels that provided on many MSDS fact sheets, but in considerably more detail. The PIPs list trade/common names, use, and regulatory status, as well as information on formulations, toxicological effects, ecological effects, environmental fate, physical properties, exposure guidelines and manufacturer(s).

**Cons:** None found

**Reviewer:** Christopher Sann, Contributing Editor, *TurfGrass Trends*

### 1999 Directory of Extension Plant Pathology and Nematology Specialists

**http://www.scisoc.org/opae/extdir.htm**

**www.scisoc.org/opae/extdir.htm**

**Overview:** This is a reference-type site hosted by the Office of Public Affairs and Education of the American Phytopathological Society that lists many of the USDA/CSREES affiliated plant pathologists and nematologists by state. Each listing includes name, address, organization/institution, phone and fax number, e-mail address, % of work devoted to extension and areas of responsibility.

**Pros:** This is an extensive listing of specialists who can be used as excellent

resources to help readers deal with difficult diagnostic problems. If a local expert is not available or known, a specialist in your area of need can be contacted. Knowing what % of the specialist's assignment is extension based can be an additional way of zeroing in on help.

**Cons:** Clicking on the "responsibility" link on the listing causes a new window to appear and deactivates the back arrow icon commonly used for navigation. To get back to the previous page or listing, close the new window by clicking on the X box in the upper right corner of the window.

**Reviewer:** Christopher Sann

### Northern Light's search engine

**http://www.northernlights.com**

**www.northernlight.com**

**Overview:** A resource-type website that provides extensive and deep searches of multiple information sources (the Web and in-house documents and journals). It provides for simple, power, business, investment, stock quotes and news searches.

**Pros:** Northern Light's search engine is like a normal Web search engine on steroids. Unlike most other engines, it not only lists the top rated responses but it organizes all of the search results into Custom Search Folders where similar results have been grouped.

A simple search for "Brown patch" resulted in 2,412 items, which were grouped into 14 folders ranging from current news, fungicides, fungi, to pesticides, golf, and others. Clicking on the "fungicide" folder reveals 218 items from 92 sources arranged in 13 sub folders.

A search using a competitive search engine resulted in over 11,000 sites/pages, but the list of results was peppered with

items that had no relation to turfgrass/plant management such as a patch on a brown cable and a hand bag described as having a brown patch.

**Cons:** Download times can be slow on high traffic ISP sites. This may be due to the extensive nature of the results or just high traffic at the search site. Also, some items from their special collection (often journal articles) can cost from \$1 to \$4.

**Reviewer:** Christopher Sann

### **Irrigation Association's site**

**www.irrigation.org**

**Overview:** To make accurate and reliable information about irrigation available from a not-for-profit, objective source.

**Pros:** Among many features, one of the most valuable is a link to irri-gate.com, a single subject search tool for anything that has to do with irrigation. It saves hours of time compared to searching irrigation on a general search engine. The irrigation.org site also features an on-line version of the association's magazine and a member finder (for manufacturers, designers, consultants, contractors, government personnel and university specialists). You can find dates and locations of irrigation training, certification information and industry standards for product types. An excellent overall tool when you need information on irrigation.

**Reviewer:** Bruce Shank, BioCom

### **Turfgrass Producers International**

**www.turfgrasssod.org**

**Overview:** TPI has gathered a wide assortment of information, largely for homeowners and turf amateurs.

**Pros:** While it is a useful locator of sod producers, the site also provides a wealth of information about turfgrass species, beneficial aspects of turfgrass and how to install and maintain sod. This site also includes the Turf Resource Center, a collection of general research about the turf industry, and links with The Lawn Institute, another gatherer of turfgrass

information for more than 30 years. You can use The Lawn Institute link to hook up with the websites of major seed growers. You can easily spend hours on this site.

**Reviewer:** Bruce Shank, BioCom

### **International Society of Arboriculture site**

**www2.champaign.isa-arbor.com**

**Overview :** To promote the correct selection, care and management of trees.

**Pros:** A great tool for a turf specialist who faces a tree problem, the ISA site goes deep into subjects such as pruning, diseases, fertilization and proper planting. ISA publications include the technical Journal of Arboriculture and the more day-to-day Arborist News. Covers both institutional and private tree care perspectives. Also a member finder to help with contacting a local expert. Chat rooms provide interesting communication and debate.

**Reviewer:** Bruce Shank, BioCom

### **Plant Health Care Inc.**

**www.planthealthcare.com**

**Overview:** To allow an open discussion of beneficial organisms in the planting and maintenance of landscape plants.

**Pros:** This site delivers an in-depth explanation of mycorrhizal fungi, beneficial bacteria and other natural products for plant health. The site also provides a good calendar of industry events, links to other important sites and a sophisticated on-line magazine covering the industry as a whole. Chat rooms will soon open up. Learn why it's not voodoo science at all but nature at work. Start understanding biotechnology better on this site.

**Cons:** Many facets still under construction but watch this space.

**Reviewer:** Bruce Shank, BioCom



## Keep Searching for the Facts

This is my last issue as managing editor of TurfGrass TRENDS. It seems strange that this fill-in job for Maria Haber turned into a four-year project. But I happen to find turf research very interesting and have enjoyed every minute.

The people behind TGT are unique. Founder Chris Sann is still active and participates in article acquisition and all conference calls. His mind is still full of ideas only a hard-core turfie could devise. Many times we have talked on the phone when it's 1 am in Maryland (where he is) and 10 pm out here in California. He reminds me of other Mid-Atlantic geniuses like Fred Grau, Tom Mascaro and Eb Steinegger.

Maria Haber, the second owner, is busy with Washington, DC real estate, but she still keeps in touch. The authors, especially Dick Hull, Pat Vittum and Rick Brandenburg are wonderful people and great writers. They believe in the concept of TGT. Maria had a lot to do with building that commitment.

Your new editor is Curt Harler, an ag journalist like me. In fact, we both started out as punks at Harvest Publishing in the 1970s. Harvest is now Advanstar, after more than one metamorphosis. Curt

resides in Pennsylvania today and telecommutes.

Thanks for putting up with me. I hope some of the things I did made research reports more interesting. Remember, if you don't have the facts, there is always some place you can find them. You just have to make the effort to look. TGT is intended to make your search easier.

— Bruce Shank

### In Future Issues

- How Pesticides are Produced
- Management Forum
- Drainage System Troubleshooting
- The Image of Golf Courses as Wildlife Habitat

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