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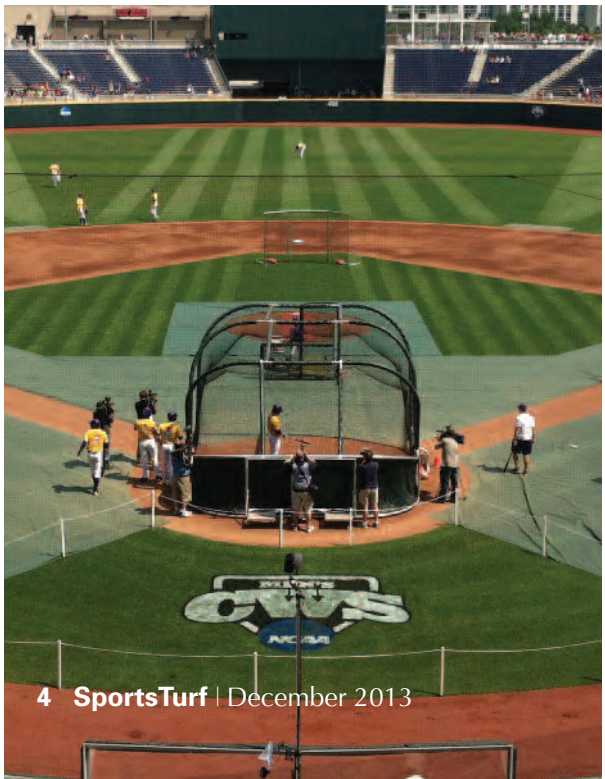

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Tiger Park, Louisiana State University, Baton Rouge, won the 2012 College Softball Field of the Year Award from the Sports Turf Managers Association.

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From the Sidelines

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Turfgrass goes to Washington

GROUND WAS BROKEN last month for a new exhibit at the US National Arboretum called "Grass Roots," the centerpiece of a 4-year initiative that focuses on the environmental, economic, aesthetic, and recreational benefits of turfgrass in athletic fields, landscapes, and golf courses. Turfgrass scientist and professor Frank Rossi, PhD from Cornell University delivered the keynote address. No word yet whether Ted Cruz will try and defund the project.

The National Arboretum, operated by the Department of Agriculture's Agricultural Research Service, and the National Turfgrass Federation have collaborated in developing this new public exhibit to highlight modern uses of turfgrass. The exhibit is "committed to helping citizens, including national decision-makers, understand new and emerging science underlying our nation's beautiful lawns, athletic fields and gardens," according to National Arboretum Director Dr. Colien Hefferan.

The project will feature a website accompanying the exhibit, professional and scientific symposia, and homeowner-focused workshops and demonstrations, directed to audiences ranging from children to policymakers, to showcase the value of turf to the environment and the importance of research to continue to leverage that value.

According to Dr. Hefferan, the interactive outdoor exhibit will highlight the results of turfgrass research and communicate that managed turf landscapes are essential in conserving soils, retaining and filtering water, offering a venue for socialization and recreation and enhancing the aesthetics of a property. The exhibit will be thematically linked over the nearly 450 acres of the National Arboretum by displays and gardens. For more info see http://www.usna.usda.gov.

STMA members Michael Sullenberger and Jimmy Rodgers, CSFM, were at the ceremony; their comments here are courtesy of STMA's new public relations firm, Buffalo Communications:

"This exhibit will benefit STMA members because the organization will do a great job of getting out information about the Grass Roots Exhibit to our membership and updates as they occur over the next four years," Sullenberger said.

"Anytime you have a spotlight on the science of our industry happening now in Washington, D.C., only good things can happen, not only for the association but for the industry of turfgrass," Rodgers said.

Sullenberger added, "Without the STMA, I wouldn't be in the field that I'm in today. I grew up working on a sod farm and that was my hobby. Now, my hobby is my dream job and the association has helped develop it."

"STMA was the first professional organization I joined in 1996. It was the only place that I knew of where I could sit around and talk about something I was really passionate about with other people who were doing the same thing in other points of the country," Rodgers said. ■

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President's Message

Dr. Mike Goatley

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Help us help you in PR campaign

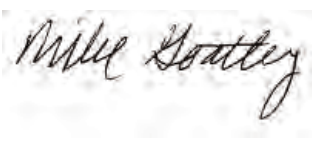
THERE ARE LOTS OF IMPORTANT INITIATIVES underway within STMA, with a particular focus for your Board being on enhanced recognition by the public at large about the jobs and importance of sports turf managers. Our goal is to apply this recognition to ALL sports turf managers, and not just those at our most visible venues, although these facilities will certainly be featured because of their levels of maintenance and the expectations associated with the playability and performance of these sports surfaces. For those coming to Conference in January, you will see our new "Spotlight On" video, a short, professionally produced video clip that will soon be airing nationwide on public broadcasting stations.

The Board also just had its first meeting with our new public relations firm (Buffalo Communications) that will lead us in the development and implementation of new PR strategies. If you are in San Antonio, you will have a chance to meet the representatives from BC that will lead these efforts, and they want you to introduce yourself and tell them more about what you do and why you do it. Read more about this initiative inside this issue on page 43. Whether you speak to them in person in Texas or contact them directly by a call or e-mail, they wish to hear about any sports turf-related story of personal interest that you can share. Please help them help us!

The turfgrass industry lost four pioneers in the past few months with the passings of Charlie Wilson, Dr. Jim Watson, Dr. Joe Duich, and Dr. AJ Powell, Jr. Let me share a little more about my mentor and dear friend, AJ, because for better or worse, he is responsible for my being in this business. AJ was a longtime supporter and educator of STMA and devoted a large part of his career as Kentucky's Extension Turfgrass Specialist to improving the quality and safety of sports fields across the transition zone. Although retired from UK, he remained active in STMA and was serving as Chair of our Standards and Criteria Committee and president of the KySTMA chapter when he passed. If you attended one of his presentations, you left knowing more than when you arrived, and you were entertained by one of this industry's best story tellers.

Bart Prather, sports turf manager at Mississippi State University, sent me a text that I was pleased to share with AJ's wife, Janie, and children Julie and Jeff: "Even though I never had the privilege of having Dr. Powell teach me a class in person, I felt like he instructed me many times over by having you lead class, Dr. G." I will never be as effective as AJ, but his legacy as a communicator will carry on with me as I continue to share with my students and audiences a little bit of the wit and wisdom that I gleaned from Dr. Powell.

I wish you the very best for the holidays and leave you with a favorite seasonal phrase of mine delivered by Linus Van Pelt… "And on earth, peace and good will toward men." ■



SPORTS TURF PROFESSIONALS: what do you want for Christmas?

Editor's note: *For fun we asked a swath of professionals working in the sports turf industry what they would like for Christmas that they could use in their jobs. Here are the anonymous responses:*

Dear Santa,

What I want for Christmas is no *Poa annua*, no summer patch, and perfect weather (timely rains, bluebird sky game days, and no wind when I need to spray). Yup, that's all I want for Christmas.

My two main wishes are for more growth mats for ryegrass establishment (reason being cost) and two more full-time employees for our ever-expanding responsibilities around campus.

That is an easy one: a Toro Sand Pro Edger attachment. They are awesome!

Ha…sure. I would ask for no PFP's (Pitchers Fielding Practice).

Hands down—a new boss.

I have to be generic and vague by asking for a larger budget! What kid doesn't want money for Christmas? I can then use it for whatever expenses come my way!

One thing I would like for Christmas is to re-crown/re-grade the stadium field.

If I could get one thing it would be $10,000 to add to my materials budget. It would help me get a few more needed things to bump my field up to the next level.

A 60-inch Renovator with a seed box from 1st Products.

For Christmas, I want my very own tractor with a 3 point hitch.

I want Jolly ol' Saint Nick to drop more funding in the overall budget to give the staff a well deserve raise and toys to make the job more efficient and environmentally friendly.

I would like an open ended checkbook so that no matter the price, I could have the ability to buy or do anything to my athletic fields.

Man, I would like a few cute and agreeable little elves to come and live in my office and, at night while I am home sleeping, tame my out-of-control email for me!

I would like a plate compactor and a 5 gang reel mower.

I look forward to relaxing and spending time with family and friends at Christmas. And: fields that have better soil structure, density, and porosity (not as high clay content); an irrigation system properly designed to ensure 100% coverage; more pay to seasonal staff.

All I want for Christmas is for people outside the industry to understand that we as turf professionals do more than just now grass and paint lines.

We would love to have a 10,000 sq ft. auxiliary field for speed and agility training!

I'm asking Santa Claus for a raise. I've had enough of furloughs and added expectations.

I would like to have Santa to remove the plastic form my football game field and replace it with natural grass.

Much needed rest/mental break from work.

I would like a glycol heating system please.

I am sure when I interned my boss said the same thing, but I wish for an intern who is eager to learn, one who can communicate properly, one who doesn't complain about the hard work, and isn't afraid to leave their parents or significant other for 3 ½ months. And of course we all deserve a raise, right? ■

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Phosphorus availability in turfgrass rootzones after organic and synthetic N fertilizer apps

ORGANIC FERTILIZERS have increased in popularity over the past 10 years due to the belief they are more environmentally sound to use than synthetic fertilizers. Most fertilizers derived from organic materials contain phosphorus as well as nitrogen, so use may be affected in states that legislate the application of P to lawns. States are considering exempting organic fertilizers from their zero-P legislation, as Wisconsin did, because it is thought that P from organic sources is less likely to be lost in leachate or runoff.

Fertilizers are applied on turfgrasses as needed based on N form and content. Many organic fertilizers contain as much P as N in their formulations, and therefore similar amounts of P and N are applied with each application. Soil tests in native soil and a fairway sand and peat mix used in the Pacific Northwest showed that organic fertilizers applied at rates to provide adequate N for acceptable turf increased soil Bray-1 P levels from 16 to 18 mg/kg to 23 to 66 mg/kg within 3 years. Oxalate extractable Fe, Al, and P was determined for all treatments in both soils and used to calculate phosphorus saturation (PSI). PSI values from sand treated with one organic fertilizer source were significantly higher than measured in other treatments, indicating future risk of P loss with repeated applications of this organic fertilizer.

Because of concerns about phosphorus effects on eutrophication of surface waters, local and/or state governments New Jersey, Maine, Florida, Wisconsin, Minnesota, and Washington have adopted restrictions on residential use of phosphorus-containing fertilizers. Urban and suburban lawns pose a specific concern for potential P loss, because managed turfgrass often abuts impermeable surfaces such as sidewalks, driveways, and curbs, which provide a direct conduit for P transport to storm drains and surface water.

Increased recycling of organic waste streams into organic slow-release fertilizers has led to increased availability and popularity of these materials. Many homeowners and professional landscapers use these natural organic slow-release fertilizers to limit the loss of nutrients from lawns through leaching and runoff.

Some phosphorus-restriction legislation is considering exempting organic fertilizers based on the premise that risk of P loss is reduced with these materials. However, many natural organic-based fertilizers (particularly manures and municipal biosolids) supply an excess of P when applied at rates to meet plant N needs. When high-P organic fertilizers are applied repeatedly, excess P accumulates in soil, potentially increasing the risk of runoff and leaching loss.

The risk of loss of P from natural organic sources depends on the availability as well as the concentration of P in those sources. Although P from organic sources is generally less available to leaching and runoff than synthetic P sources, P availability varies widely by source. Biosolids P tends to be less available than manure P, but even among biosolids sources P availability can vary widely.

Understanding the effect of repeated applications of natural organic lawn fertilizers on soil test P can provide guidance for the suitability of these materials in P sensitive areas. If P availability is low enough in organic fertilizers, it could be possible to use them without increasing the risk of water quality degradation. Evidence shows that the risk of soluble P loss occurs at much higher soil test levels than those needed for agronomic sufficiency.

Researchers have proposed alternative soil tests to assess environmental risks, such as phosphorus saturation (PSI), dissolved P index, or water extractable P. No environmental soil P test is widely recognized and in common use.

Agronomic tests also have some value as environmental indicators. Another factor is the effectiveness of P fertilizers in changing

▼ **Table 1.** Fertilizer products applied to soil and sand root zones at WSU-Puyallup, RL Goss Research Facility in Puyallup, WA, 2008-2011.

Fertilizer product	Rate	Fertilizer formula	Ingredients
Organic 6-7-0	1×	6-7-0[a]	Biosolids, 75% insoluble N
Organic 6-7-0	1.5×	6-7-0	Biosolids, 75% insoluble N
Organic 8-3-5	1×	8-3-5	Feather, meat, blood, fish, poultry and bone meals, 90% insoluble N
Organic 8-3-5	1.5×	8-3-5	Feather, meat, blood, fish, poultry and bone meals, 90% insoluble N
PCSCU 20-5-10	1×	20-5-10	Proforma, 60% of N as PCSCU, mono-ammonium phosphate, potassium sulfate

[a] Organic 6-7-0 was originally labeled as 5-4-0, but analysis form 2008-2010 showed that it consistently contained 6% N and >7% P_2O_5. The label was changed to 6-7-0 to reflect that analysis in 2010.

soil test P (17), with greater effectiveness indicating more rapid change in soil test P per unit of fertilizer P applied (poorer buffering), and greater long term risk of P loss. The objective of this study was to determine how repeated N-based applications of organic fertilizer sources to established turfgrass affected soil test P and P saturation in native soil and a sand-based rootzone mixture under field conditions.

FERTILIZER APPLICATIONS AND MEASUREMENTS

For this study, fertilizers were applied on an N basis, using natural organic and synthetic fertilizer sources on perennial ryegrass plots on two rootzone media over 3 years (July 2008-June 2011). Soil samples from the plots were analyzed to determine changes in P availability in each treatment area after three years of applications. Application rates of the fertilizers were based on their N content for the original experimental design; therefore, P levels were not equalized among treatments.

▼ **Table 2.** Annual nitrogen (N) and phosphorous (P_2O_5) application rates for soil and sand root zones.

Fertilizer product	Soil	Sand	Soil	Sand
	kg N/ha/yr		kg P_2O_5/ha/yr	
Organic 8-3-5 1×	147	245	55	92
Organic 8-3-5 1.5×	221	368	83	138
Organic 6-7-0 1×	177	294	206	343
Organic 6-7-0 1.5×	265	441	309	515
PCSCU 20-5-10	147	245	37	61

Perennial ryegrass was grown on both a Puyallup fine sandy loam native soil (coarse-loamy over sandy, isotic over mixed, mesic Fluventic Haploxerolls) and a USGA sand/peat 90/10% rootzone mixture in the Puyallup Valley of western Washington, south of Seattle. The plots on the native soil were maintained at 62.5 mm as a home lawn and the plots on the sand/peat mixture were maintained at 12.5 mm as a golf course fairway. All grass clippings were returned to the plots. The experimental design for each site was a randomized complete block with five fertilizer treatments and four replications. Plot size was 1.5 m by 3 m.

Each plot was fertilized with one of five treatments. The treatments included two natural organic fertilizer sources at a 1× and a 1.5 × N rate and a synthetic slow-release product at a 1× N rate. The target annual N

rate (1×) for the native soil plots was 147 kg/ha , consistent with recommendations for home lawns, while the target annual N rate (1×) for the sand/peat plots was 245 kg/ha, consistent with golf course fairway management. Fertilization was split into three equal applications per year on the native soil plots and five applications per year on the sand/peat plots. The 1.5× rate treatments received 50% more fertilizer on each application date.

The organic fertilizer sources were Organic 6-7-0, made from anaerobically digested and heat-dried municipal biosolids, and a commercially available Organic 8-3-5, made from mixed animal by-products. In the field, the Organic 6-7-0 N application rate was slightly higher than the Organic 8-3-5 rate. This was because the product was originally labeled as 5% N (5-4-0), but subsequent analysis showed it to be 6-7-0. Based on the fertilizers applied to each treatment on an N basis, the amount of P added per year in the organic fertilizers ranged from 55 to 138 kg P O /ha for the Organic 8-3-5 and from 206 to 515 kg/ha for the Organic 6-7-0. The synthetic slow-release control N source was a 20-5-10 formulation containing polymer-coated, sulfur-coated urea (PCSCU). The P in this formulation was monoammonium phosphate. It was applied at the same N rate as Organic 8-3-5. Phosphorus rates for this material were 37 kg P O /ha/year for native soil managed as home lawn and 61 kg/ha/year for sand managed as a golf course fairway.

For the native soil plots managed as a home lawn, fertilizer application dates were August and October 2008; May, June, and Oct 2009; April, August, and October 2010; and April 2011. For the sand-based plots managed as a golf course fairway, fertilizer application dates were August, October, and November 2008; April, June, July, September, and November 2009; March, May, August, September, and November 2010; and March and May of 2011.

In July of 2011, six to eight 25-mm-diameter soil cores were removed to a 100-mm soil depth from each plot. Unfertilized control samples were taken at the same time from untreated areas surrounding the plots. Verdure and thatch were discarded. Samples were mixed, placed in paper bags, moved to a greenhouse, and allowed to air dry for 1 week. After drying the samples, they were analyzed for Bray 1-P and ammonium oxalate extractable Fe, Al, and P. This data was used to determine phosphorus saturation (PSI) in each treatment in each soil type. We also compared the effectiveness of the P fertilizers in changing Bray-1 P, calculated as the slope of the linear regression of Bray-1 P vs. total fertilizer P applied. All data were analyzed using SAS PROC ANOVA, with means separation by least significant difference following a significant F-test.

Phosphorus saturation was calculated as: PSI = P / [Fe + Al], where P, Fe, and Al are the molar concentrations of oxalate-extractable phosphorus, iron, and aluminum in the soil.

A similar oxalate extraction and calculation was done on the two natural organic fertilizers to determine the relative degree of P binding with Fe and Al in each material.

PHOSPHORUS LEVELS AND POTENTIAL LOSSES

Values for Bray-1 extractable P were significantly higher in most of the Organic 6-7-0 treatments when compared to the PCSCU fertilizer treatment. In the native fine sandy loam soil managed as home lawn, the plots receiving Organic 6-7-0 1.5× treatments were significantly higher in extractable P than the PCSCU treatment, and in the sand-based fairway soil, both sets of plots receiving Organic 6-7-0 treatments were significantly higher in extractable P than the PCSCU treatment.

The plots receiving Organic 8-3-5 treatments showed a trend for higher Bray 1-P than the plots receiving synthetic fertilizer, but differ-

▼ **Table 3.** Bray 1-P saturation (PSI_{ox}) in the soil root zone after three years of fertilizer application, 2008-2011.

Fertilizer product	Soil Bray 1-P	Soil test level[a]	PSIox[b]
	mg/kg		
PCSCU 20-5-10	19.3 B[c]	low	0.13
Organic 8-3-5 1×	22.8 B	medium	0.12
Organic 8-3-5 1.5×	21.3 B	medium	0.13
Organic 6-7-0 1×	35.0 A	medium	0.13
Organic 6-7-0 1.5×	38.5 A	medium	0.14
LSD	6.8	–	NS

[a] Low = < 20 mg/kg; medium = 20-40 mg/kg; high = 40-100 mg/kg; excessive = >100 mg/kg. Hor neck et al. (7).
[b] Phosphorous saturation index = P_{ox}/ [Fe_{ox} + Al_{ox}]
[c] Means followed by the same letter are notsignificantly different. *P* = 0.05. Mean of four samples. Control Soil Samples (untreated areas surrounding plots) Bray-1P Test = 18mg/kg.

▼ **Table 4.** Bray 1-P and P saturation (PSI_{ox}) in the sand root zone after three years of fertilizer application, 2008-2011.

Fertilizer product	Sand Bray 1-P	Soil Test Level	PSI_{ox}[a]
	mg/kg		
PCSCU 20-5-10	23.5 B[b]	medium	0.09 C
Organic 8-3-5 1×	27.3 B	medium	0.10 C
Organic 8-3-5 1.5×	28.0 B	medium	0.11 BC
Organic 6-7-0 1×	66.3 A	high	0.12 AB
Organic 6-7-0 1.5×	75.3 A	high	0.13 A
LSD	12.8	–	0.02

[a] Phosphorous saturation index = P_{ox}/ [Fe_{ox} + Al_{ox}]
[b] Means followed by the same letter are not significantly different. *P* = 0.05. Mean of four samples. Control Soil Samples (untreated areas surrounding plots) Bray-1P Test = 16mg/kg.

ences were not significantly different in either soil. Bray-1 test levels were in the low range in the pre-fertilization control soils and the PCSCU treatment in native soil, but were in the medium or high ranges following 3 years of application of natural organic fertilizers. In the Pacific Northwest, turfgrass shows little or no response to added P in soils that test in the medium or high range (> 20 mg P/kg soil).

To determine if the potential risk of soluble P loss had increased, oxalate extractions of Al, Fe, and P were run to determine if the fertilizer applications had affected P saturation (PSI) for each treatment and soil type. The results of these calculations showed no significant difference between PSI values for any of the fertilizer treatments on native soil after 3 years of fertilizer applications. However, on sand, both Organic 6-7-0 treatments had significantly higher PSI values than the other fertilizer treatments.

The change in Bray-1 P was much greater than the change in PSI, reflecting that the soils had exceeded the upper threshold for plant response to P, but had not yet reached a level of concern for soluble P loss. The PSI of the fertilizers alone was 16.6 for the Organic 8-3-5 compared with 3.8 for the Organic 6-7-0 biosolids product. The PSI of Organic 8-3-5 is similar to that of chicken manure (PSI = 15) as reported by Elliot et al., while the PSI for Organic 6-7-0 was higher than reported for a range of biosolids products (PSI = 0.47 to 1.4). The Organic 6-7-0 applications had a greater influence on Bray-1 P and soil PSI than the Organic 8-3-5, despite having a greater P binding capacity, because nearly four times as much P was applied in the Organic 6-7-0 than in Organic 8-3-5. Organic 6-7-0 applications added six to nine times as much P each year as the synthetic control, resulting in a large excess of applied P when products were applied to meet N needs.

We also calculated the relationship between the change in Bray-1 P applied for both natural organic fertilizers in both soils to compare the effectiveness of the fertilizers in raising soil test P. The change in Bray-1 P averaged 0.057 mg/kg for every kg/ha fertilizer P applied in the native soil, with no significant differences between the 8-3-5 and 6-7-0 fertilizers. In the sand/peat root zone mix the P effectiveness averaged 0.105 mg/kg Bray-1 P for every kg/ha fertilizer P applied, also with no differences between fertilizer sources. This suggests that the organic fertilizers had similar effects on soil test P per unit P applied, despite differences in the PSI of the two materials. Soil appeared to have a greater influence on P effectiveness than fertilizer, with the sand mix having a greater P effectiveness (less buffering) than the native soil. This is consistent with conclusions reached by Sneller and Laboski in agricultural soils fertilized with different types of manure. Because each experiment had only one synthetic P treatment, we could not calculate the P effectiveness of the synthetic P fertilizer in our soils.

The sand/peat experiment can be considered a worst case for soil response to P application, because the coarse-textured soil is poorly buffered and P application rates were higher than those used for home lawns. When organic fertilizer with high P concentration and high PSI was applied to the sand/peat plots, significant increases in both Bray-1 P and soil PSI were observed after 3 years. Although it would take longer, similar changes would occur in the native soil, eventually increasing the risk of leaching and runoff loss of P.

These results show the importance of evaluating fertilizer sources for the amount and availability of P. The soil test results show that Bray-1 P was higher when using P-rich organic fertilizer, compared with synthetic fertilizer containing P, because of the greater P application rate from the organic fertilizer when applied at rates to meet N needs. The greatest increase in Bray-1 P occurred in the sand-based fairway treatment. Changes in soil PSI were smaller, indicating only small changes in P saturation and the risk of P loss from the soil over the 3-year duration of this study.

Some organic fertilizers could have sufficiently low P concentrations and PSI values that they could be used for years without risk of increasing P loss from soil, but that did not appear to be the case for the fertilizers used in this study. Our results suggest that use of high-P organic fertilizers to meet turf N needs would not likely lead to increased risk of P loss in the short run, but repeated use in the long run could increase future P loss risk. This information can provide guidance for legislation regarding turf fertilizer sources, fertilization practices, and water quality. ■

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Entomology 101

Safe and effective management of shade tree pests

▲ **WEBWORMS** — All photos provided by Rainbow Treecare Scientific Advancements

INSECTS ARE ONE OF THE MOST SUCCESSFUL GROUPS OF ORGANISMS ON THE PLANET. For hundreds of millions of years, insects and plants have co-evolved, sometimes antagonistically, sometimes to the benefit of both parties. Insects are also of considerable concern to arborists, but we are long past the days in which we just spray indiscriminately and hope we kill the bad ones. Insect management today requires knowledge of biology, ecology, tree physiology, phenology, and chemistry so we can protect trees with minimal impact on beneficial insects and the rest of the ecosystem. So what are the basics we need to know to safely but effectively manage shade tree insect pests?

First, we need to wrap our heads around the sheer number of insects and their diversity. The current count is more than one million named species, representing about half of all animal species alive on the planet today. The estimates of not-yet-named species is anywhere between six and 10 million species; so if you have an interest in discovering and naming new species, entomology may be the field for you. Insects are grouped with other invertebrates such as spiders, millipedes and lobsters, but have some distinguishing characteristics. Like these other arthropods (from the Greek word for "jointed leg"), insects have, of course, jointed appendages, exoskeletons made from chitin, and segmented body parts. Every organism classified into the Class Insecta will have six legs, two antennae, a three-part body consisting of a head, abdomen, and thorax, and two pairs of wings.

All insects go through some form of metamorphosis, but not all of them do it the same way. Some insects go through a complete metamorphosis (known as "holometabolis"), where the immature insect looks nothing like the adult. Look no further than the differences between a caterpillar and a butterfly to understand this process. Other examples would be grubs, maggots, and whatever you call those cool looking ladybug larvae — all of them start life with one body type, then go through a pupa stage where they emerge looking like something else altogether. The adults and their offspring not only look different, they often have completely different diets, and, often, completely different relationships to plants. As larvae, an insect may be a plant parasite eating the leaves and disfiguring the appearance, but, as an adult, they may be an important pollinator of their flowers.

Depending upon the source, North America has roughly 30 Orders of insects, 600 Families, 12,500 Genera, and, oh, let's say about 86,000 Species.

The other type of metamorphosis insects may undergo doesn't change their appearance much, just their size. Known as incomplete metamorphosis, or "hemimetabolis" if you prefer the Latin sound, these insects look pretty similar at all stages of life. Unlike the insects that undergo complete metamorphosis, you can often find hemimetabolic adults and immatures (called "nymphs") feeding right next to each other on the same leaf. As they grow, their rigid exoskeletons must be shed to make room for the next, larger exterior. Each time they go though one of these molting cycles, we call that an "instar." Some species may go through four to five instars before reaching maturity. This has some management implications, as certain treatments that may be effective on early instars are not as effective on more mature insects.

Depending upon the source, North America has roughly 30 Orders of insects, 600 Families, 12,500 Genera, and, oh, let's say about 86,000 Species. As noted earlier, insects are mind-boggling in their numbers and diversity, but, fortunately for arborists, not all of them are required reading. Due to their tremendous variety, it is easiest to lump them together and consider insects at the Order level. Of the dozens of recognized Orders, it really boils down to five that are of considerable concern for tree care. Just understanding the differences of these groups, and their management strategies, will go a long way toward successfully managing insects on shade trees.

Order: Coleoptera
Translation: "Sheath wing" Holometabolis
Key tree pests: Bark beetles, leaf beetles, flathead borers, roundhead borers, weevils

When it comes to variety and diversity, no one is bigger than the beetles. With more than 400,000 recognized species, beetles make up nearly half of all known insects. Although there are certainly beetles than beneficial to trees (like the much-loved ladybug), the ones that are tree pests can be serious or even fatal health concerns. Beetles can be secondary pests, such as bark beetles affecting stress-weakened trees, or they can be primary pests, as in the case of emerald ash borer or Asian longhorned beetle. Management tools include sprays (bifenthin, pyrethroids), systemic treatments (imidacloprid, dinotefuran), and tree injection (emmamectin benzoate, imidacloprid).


Japanese Beetles


Ladybug

Order: Hymenoptera
Translation: "Membrane wing" Holometabolis
Key tree pests: Sawfly larvae, leafminers, gall-forming wasps, carpenter ants

While bees and wasps are certainly not widely considered to be tree pests, other close relatives in this Order can do damage to trees. Sawfly larvae, often confused with caterpillars, have an appetite for pine needles, and many common leafminers are found in this Order as well. Similar to the Coleopteran pests, management tools include sprays (bifenthin, pyrethroids), systemic treatments (imidacloprid, dinotefuran) and tree injection (emmamectin benzoate, imidacloprid).

Sawfly

Order: Lepidoptera
Translation: "Scale wing"
Holometabolis
Key tree pests: Gypsy moth, winter moth, bagworms, clear-wing borers

The Order of moths and butterflies contains many common tree pests, but they tend to only be pests as larvae. Caterpillars are one of the most common leaf-feeding insects in the world. Most do insignificant damage and require no control efforts, but some — especially introduced species — can defoliate a full-size tree in just a few days. Lepidopteran larvae are mostly thought of as leaf-feeding caterpillars, but there are a few, such as the clear-winged moths, whose larvae are wood-boring pests that can be confused with other species and are considered difficult to control. Management tools include sprays (spinosad, pyrethroids, Bt), systemic treatments (acephate), and tree injection (emmamectin benzoate, acephate).

Order: Hemiptera
Translation: "Half wing"
Hemimetabolis
Key tree pests: true bugs, leafhoppers, scales, aphids, adelgids, cicadas, psyllids

This Order has been split, lumped, and reworked more than any other in the past decade, so exactly who is now in the

Boxelder bugs

Hemiptera these days depends on the source, but many well-known tree pests are generally included. With a wide variety of body types, mouth parts, and feeding preferences, this group has many easy-to-control, and difficult-to-control members, so be sure you have properly identified your target for launching any control campaign. Management tools include sprays (bifenthin, pyrethroids), systemic treatments (imidacloprid, dinotefuran) and tree injection (emmamectin benzoate, imidacloprid).

Order: Thysanoptera
Translation: "Fringed Wing"
Holometabolis
Key tree pests: thrips

Thrips, a name derived from the Greek word for "wood louse," can be disfiguring and damaging to tree leaves. In rare cases, a thrip infestation may be heavy enough to cause the death of a plant, but more often they are just damaging the leaves, buds, and flowers of trees. Although thrips are tiny, they are a well-documented vector of certain viruses that cause death to plants, particularly in agricultural or greenhouse settings. Management tools include sprays (bifenthin, pyrethroids), and systemic treatments (imidacloprid, dinotefuran).

Other Orders of insects than impact plants, but not considered prominent tree pests, include Isoptera (termites), Diptera (flies, mosquitoes), Phasmida (walkingstick) Orthoptera (grasshoppers), Odonata (dragonflies, damselflies), Mantodea (mantids) and Dermaptera (earwigs). ■

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JOHN MASCARO'S PHOTO QUIZ

John Mascaro is President of Turf-Tec International

Can you identify this sports turf problem?

Problem: Uneven playing surface
Turfgrass area: High school football field
Location: Southern United States
Grass Variety: 419 bermudagrass

Answer to John Mascaro's Photo Quiz on Page 33

Background illustration courtesy of istockphoto.com

The use of hygroscopic humectants in managing soil moisture

Editor's note: *The author is president of BioPro Technologies; president and owner, Spindler Enterprises; agronomist and partner, Ecologel Solutions; and agronomical and research director, OJ Noer Turfgrass Research Foundation.*

MOST TURFGRASS MANAGERS are familiar with the use of wetting agents, or surfactants, and super absorbent polymers in managing water movement and retention in soils. However, there is another class of chemistry that is gaining acceptance in the management of turfgrass and ornamental soil moisture. This class of chemistry is referred to as hygroscopic humectants.

Before discussing hygroscopic humectants, it is important to understand how they differ from other water management technologies. First, wetting agents are chemicals that "reduce surface tension of water, allowing the water molecules to spread out." Another definition is "any compound that causes a liquid to spread more easily across or penetrate into the surface of a solid by reducing the surface tension of the liquid." Therefore, a wetting agent is a material that allows water to more easily penetrate into soil and/or flow through (infiltrate) the soil. These materials are valuable when soils have become hydrophobic and will not wet easily.

Super absorbent polymers, another type of water management technology, are "materials that can absorb and retain extremely large amounts of liquid relative to their own mass." These materials are utilized to absorb large amounts of rainfall or irrigation to be used by the plant at a later date. These materials are commonly used in greenhouse and nursery industries, as well as in some agricultural settings.

However, the use of polymers in turfgrass is difficult for two reasons. The first is that polymers are difficult to incorporate into the soil profile. The second is that, as they absorb water, they expand, and can disrupt the soil and turfgrass surface. However, there are some new developments in polymer technology that may overcome these challenges.

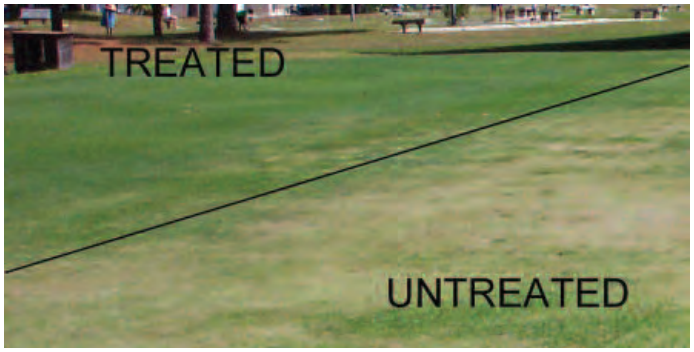
Hygroscopic humectants are materials that attract water vapor (the gas phase of water) from the atmosphere within the soil, condense it back into a liquid form, and retain the liquid for the plant to absorb. According to Merriam Webster's dictionary, a hygroscopic material is any material that "readily takes up and retains moisture." Most turf managers are more familiar with hygroscopic materials than they may realize. For instance, many fertilizer ingredients are hygroscopic. It is the hygroscopic nature of some fertilizers that cause them to "cake" or form chunks in the package.

The definition of a humectant is "a substance that promotes retention of moisture" (Merriam-Webster). These are substances that absorb, or help another substance to retain moisture. These types of materials are commonly used in the food and cosmetic industry. For example, humectants will help keep food from drying out and becoming stale. In cosmetics they help keep different types of make-up pliable so they may be applied to the skin in an even fashion without causing dryness.

The key to successfully using hygroscopic humectants to manage soil moisture is by using the right combination of raw ingredients. Some raw materials will attract moisture and condense it, but will hold it too tightly, not releasing the water to the plant. On the other hand, some raw materials may compete with the plant for soil moisture and be detrimental to plant health. Finally, some raw materials will be broken down in the soil by microbes too quickly, and have a short lived effect.

The best combination of raw ingredients are those that will attract soil water vapor to itself, condense it into a droplet, and then allow the plant root to remove that droplet for use in its metabolic activities. Another vital factor in the success of a hygroscopic humectant product is to have a certain resistance to microbial degradation. Many of the raw ingredients used in a hygroscopic humectant are organic in nature, and can be used by soil microbes as a food source. We see the same types of challenges in pesticide formulations.

Hygroscopic humectants have a variety of uses in the management of turf and landscapes. For example, they may be used in combination with wetting agents to relieve



localized dry spots. The wetting agent will allow the water to penetrate into the hydrophobic area causing the dry spot, eliminating the hydrophobic effect. Then, the hygroscopic humectant will prevent the area from drying out again, since it will be continually condensing water vapor into water droplets.

Using hygroscopic humectants is an excellent way to reduce overall landscape water use. When applied to large turf or landscape areas and watered into the rootzone, these products will allow plants to more effectively use any water they receive through rainfall and irrigation. When water is applied to the soil, it has one of three fates. First, it can be pulled down by gravity deeper into the soil and eventually added to the ground water. Secondly, it may evaporate and escape the soil back into the atmosphere above the soil. Finally and most favorably, it can be used by the plant. Hygroscopic humectants effectively minimize the loss of soil water to evaporation by condensing the escaping water vapor back into liquid form for the plant to use. In fact, these products have been documented to reduce overall water use by as much as 50%.

When seeding, hygroscopic humectants are a valuable tool to optimize seed germination and establishment. When applied over the seed and into the seedbed, these products will reduce the drying effects in between irrigation and rainfall events. Therefore, the seed is able to germinate more rapidly, and then establish and develop due to more favorable moisture conditions. This effect is also experienced in hydroseeding and sprigging.

The establishment and maintenance of trees, shrubs and ornaments are an ideal use for hygroscopic humectants. The water capturing capability of these products will allow plants to establish quickly, and survive drought conditions more successfully. The use of hygroscopic humectants in potted plants is especially valuable in reducing watering events from every day during hot, dry periods to every other or every 2 or more days. This application not only saves water, but labor as well.

Hygroscopic humectants are a valuable tool for turf managers. Used alone or in combination with other technologies, these products are valuable in reducing overall water use on all parts of the landscape. ■

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Best fertilizer management: a blueprint for success

Editor's note: *The author is a technical representative for Grigg Brothers.*

WHETHER YOU ARE MANAGING MUNICIPAL FIELDS or big league stadiums, the correct nutrient management programs will provide a blueprint for vigorous turf and prepare you—if you have not dealt with it already—if or when fertilizer use laws limit your resources. Nutrient management is one important cultural practice that forms the foundation for successful turf management; however the interpretation of soil test/water quality data, and selecting the appropriate source, timing, and rate of fertilizer is often overlooked. Many chapters in textbooks have been written on the topic of fertilizer source, selection and use so consider this short piece as a resource to help optimize your fertilizer programs and allow you to think "broad brush" about how you approach your role as a sports field manager.

UNDERSTAND PLANT COMMUNITY

First and foremost, a comprehensive understanding of the site will guide your fertilization approach. Clearly identify the turf(s) use, or function and its associated expectations. Consider safety improvements carefully. What grass(es) exist and what are their strengths, weaknesses, biology, and cultural requirements? What plants are unwanted? Soil physical and chemical properties and the time of year determine the source and frequency of fertilizer applications. For example, soil *texture* influences drainage, extent of compaction, firmness, all important factors for playability, but it also affects nutrient holding capacity and subsequently the potential effectiveness of fertilizer programs.

EXISTING OR PENDING FERTILIZER LEGISLATION

Get started now to determine how current or pending fertilizer use laws will affect your ability to manage turf in your state. New Jersey, New York, Wisconsin, Minnesota, Florida, Connecticut and Pennsylvania have or are cur-

▲ **Figure 1: IN STATES** where phosphorus (P) applications are banned, one exception is the ability to use P fertilizers on sites to establish turfgrass.

rently in the process of regulating fertilizer inputs such as nitrogen (N) and phosphorus (P) source and timing of application (see Figure 1). In Connecticut, schools and municipalities are moving toward an organic program mandate. Natural organic fertilizer sources have effectively escaped regulation in many states because the P cannot be removed from manure or compost. Source ingredients and the manufacturing process of natural organic fertilizers differ, so you should familiarize yourself with the benefits and potential disadvantages of these formulations before making a purchasing decision. Interestingly, many existing and future laws are not based on science, but perception. Poorly written laws produce unintended consequences such as reduced turf vigor and subsequently more leaching, weeds, soil erosion, and runoff. If possible, get involved! Find out what laws may be in the pipeline in our local community and fight for what you believe in; you can take it as far as you see necessary or have the available time to pursue.

SOIL TESTING

I recommend soil testing regularly (at least once a year) to determine if any major chemical problems exist. The pH should fall within a fairly wide range of 5.5 – 7.3. Most calibration and correlation data exists for *exchangeable* nutrient cations, so interpret this data to select fertilizer inputs. Sand sites often contain less calcium (Ca), magnesium (Mg), and potash (K) and hold fewer nutrients in general. If applicable, test the irrigation water. Many chemical problems such as high sodium (Na) and chlorine (Cl) or bicarbonate (HCO_3-) arise due to poor irrigation water quality, or construction/amendment with high lime or calcareous sands. Importantly, soil tests should be used as a rough guideline and your observation equally important. Become a keen observer by carefully assessing turf vigor and how its response to a fertilizer application and/or recovers from mechanical stress, lack of water, and/or divoting?

CONCEPTS OF BEST FERTILIZER MANAGEMENT

Beyond understanding the broad plant/soil community and collecting soil test data, best fertilizer management (BFM) includes selecting the correct fertilizer and applying it at the correct time. The concepts focus on fertilizer use and fate with the goal to maximize plant use of nutrient and minimize loss to the environment. Like everything else in our lives, efficiency is better. This starts with developing a master plan, staying fluid, and making good choices. BFM *requires* an integrated approach and using all available options.

Fortunately, turf mangers now have technologically advanced fertilizer options, from slow release granule formulations that can be applied at higher rates, to highly efficient liquid, or foliar, options generally applied frequently and in low doses. The latter, referred to as "spoon feeding," allows turf managers the ability to "meter" nutrient inputs. More athletic field mangers now use this approach particularly where resources exist to supplement a granular fertilizer program. Foliar fertilizers can increase the speed of establishment, maximize vigor, enhance recuperative capacity, improve wear tolerance, or maximize aesthetics (see Figure 2). These effects are more pronounced on sand soils, during environmental stress, or when root growth is compromised. The correct use of efficient foliar fertilizers and slow release granule carriers will improve nutrient use by turfgrass plants, maintain a high level of vigor needed to fill voids; and thus limit weed germination and growth, and minimize nutrient losses. Enhancing nutrient uptake efficiency provides an agronomic, environmental, and economic benefit.

▲ **Figure 2: THE USE OF** efficient foliar fertilizers will maximize color and provide added control of nutrient inputs.

A final, yet critically important concept of BFM includes calibration. With so much out of our control, why not fine tune every other aspect of a fertilizer application? Calibration ensures that you apply the correct amount of nutrient, not too little so that turf vigor

suffers or too much so that you waste money or potentially cause pollution. Most fertilizer programs start with N because plants require it in the highest amounts, and it should be the focus of a successful Best Fertilizer Management Program.

SELECTING A FERTILIZER

Ratio and Grade: A fertilizer ratio determines the relative amounts of N, P, K, or primary macronutrients in fertilizer, for example 3-1-2, 7-1-3, or 1-0-1. Choose a ratio based on N and K requirements, and/or soil type. The grade refers to the fertilizer analysis and you can attain the desired ratios with different grades. For example, both 21-3-9 and 28-4-12 have the same 7-1-3 ratio. Many fertilizers also contain secondary macronutrients including Ca, Mg, and S and minor nutrients. Generally, I recommend a balanced and complete fertilizer such as the examples above for general maintenance. Synthetic organic sources generally have a higher nutrient analysis and more soluble nutrient compared to natural organic sources, which are used effectively on sandy soils, as a dormant feed, or where laws prohibit P applications to turf.

PHYSICAL CHARACTERISTICS

You have the choice of dry or liquid (foliar) fertilizer and this may be determined solely on the equipment available. Foliar fertilizer use represents a supplement to an existing granular program and liquids can also be an effective soil targeted application because the nutrients tend be highly soluble. Many also contain a wetting agent which increases uniformity of application. Among other things, particle size affects ease and distribution of application and rate of nutrient availability for slow release N sources.

Nitrogen Release Characteristics/Burn Potential. Most general maintenance granular fertilizers contain some slow release N (SRN), many ≥ 50% SRN. A variety of SRN formulations are available including those where N is released by temperature, water, or microbial activity. As a consequence, soil physical properties influence the release of N (See Soil Type below). The most common soluble N sources, in the order of high to low burn potential, include *urea, potassium nitrate, ammonium sulfate, di-or monoammonium phosphate*. Focus on the plant community (dominant grass and stage of growth) to determine annual N requirements. Correctly formulated foliar fertilizers contain soluble nutrients with low burn potential.

Soil Type/Reaction Effects. Native soils often contain high levels of residual N, allowing a turf manager the option to cut back on N inputs during certain times of the year, saving money. How can you tell? Conduct a tissue test and target ≥ 5% leaf N. In addition, fewer N inputs will limit excess biomass production, decreasing organic matter and thatch production. Conversely high sand soils drain well, but promote nutrient leaching, such as K and nitrate-N (NO_3-). In this situation, a turf manager might select more foliar fertilizer, use slow release sources of N and K, and not apply too much soluble N in a granule form, particularly during periods of slow growth or prior to heavy rainfall.

Soil pH affects microbial activity and nutrient solubility, for example high pH or alkaline soils limit minor nutrient availability. In addition, high pH soil or water increases urea volatilization, particularly at high pH (≥ 7.3). Soil test P data usually fall in the 'above optimum' category, however P complexes with calcium (Ca) (high pH), Al or Fe (low pH), or clay minerals rendering it unavailable to the plant. With routine fertilizer additions that contain a small amount of P, plants are likely receiving adequate P nutrition. To know conclusively, conduct a tissue test.

▲ **Figure 3: COOL SEASON** root growth can be compromised by high soil temperatures rendering soluble granular sources ineffective with a high burn potential.

Seasonal Adjustments/Timing. For cool season grasses, the optimum timing for higher rates of soluble N is in the spring and fall, ideally fall. Conversely for warm season grasses, the optimum timing for higher rates of soluble N is in the summer months; however this also represents the rainy season in the some southern states like Florida so caution must be used when deciding on how much soluble N to apply at any one time during the summer. Supplement with liquid/foliar fertilizers when plant roots are compromised by temperature stress or on high sand soils due to lower nutrient holding capacity and high leaching potential (see Figure 3).

ADDITIONAL BFM STRATEGIES SPECIFIC FOR SPORTS TURF MANAGERS

Water Management: Do you have access to irrigation or rely on natural rainfall? If you irrigate, how is the water quality? Many fertilizers require post application irrigation to ensure safety, release nutrient, and increase uniformity of coverage. Do not over water. Many granule or liquid products need only 6-8 minutes of irritation to effectively water them in. If you are fortunate enough have to ability to control water inputs, you have the advantage to control soil moisture and speed establishment by supporting microbial activity and nutrient release (see Figure 4).

Wear tolerance/Increase Rooting: Do not over apply N; shoot growth at the expense of root growth, particularly in the spring of the year for cool season turf will negatively affect turf vigor and summer stress tolerance. Cultural practices such as aeration and sand topdressing, and the use soil targeted Ca and N will help wear tolerance and rooting. When you have the opportunity to cultivate, do it aggressively! Calcium supplied to growing root tips will increase overall root depth. For cool season turf, supply

▲ **Figure 4: A SOPHISTICATED IRRIGATION SET UP** provides the ability to control water inputs to the root zone, cool plants, and water in fertilizer.

low dose of soluble N (≤ 0.25 lbs/M) in the mid fall to increase carbohydrate storage in the roots and increase winter hardiness. For warm season turf like bermudagrass raise the height of cut going into winter. Maintain a balanced fertilization program in the fall and limit N fertilization. Be careful in the spring and do not try to push bermudagrass with heavy doses of soluble N; this can have a dramatic negative affect if you encounter extreme cold in late March or April.

IMPLEMENT THE PLAN

Develop a rough yet integrated fertilizer use plan based on your evaluation of the site, resources, and expectations and use it as a template for your agronomic plan. Consider fertilization a critical cultural practice along with water management, cultivation, seeding, and mowing which forms the foundation for turf vigor.

Get involved with state legislatures and understand existing or pending laws regarding fertilizer use. If necessary, begin to experiment or even implement programs to meet the requirements of these law(s). Given that you might as a consequence have to use more natural organic fertilizers, understand the benefits and limitations of these materials.

Education is the key to procuring the resources needed to provide safe, functional, and aesthetically pleasing turf for sports use. For fertilization, choosing the correct source, time and rate of N applications, (based on species) will have the biggest impact on rooting, turf vigor and recuperative capacity. Maximize efficiency and minimize environmental losses by supplementing soil targeted slow release fertilizer applications with low dose and soluble foliar nutrition. Use quickly available sources with low burn potential to speed recovery and during establishment. Evaluate new organic fertilizer technologies and always look for research to back up any claims. And lastly, become a keen observer and trust what you see! ■

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Healthy chloroplasts for healthy sports turf

Plant chloroplasts are large organelles that, like mitochondria, are bounded by a double membrane called the chloroplast envelope. In addition to the inner and outer membranes of the envelope, chloroplasts have a third internal membrane system, called the thylakoid membrane. The thylakoid membrane forms a network of flattened discs called thylakoids, which are frequently arranged in stacks called grana. Because of this three-membrane structure, the internal organization of chloroplasts is more complex than that of mitochondria. In particular, their three membranes divide chloroplasts into three distinct internal compartments: (1) the intermembrane space between the two membranes of the chloroplast envelope; (2) the stroma, which lies inside the envelope but outside the thylakoid membrane; and (3) the thylakoid lumen.

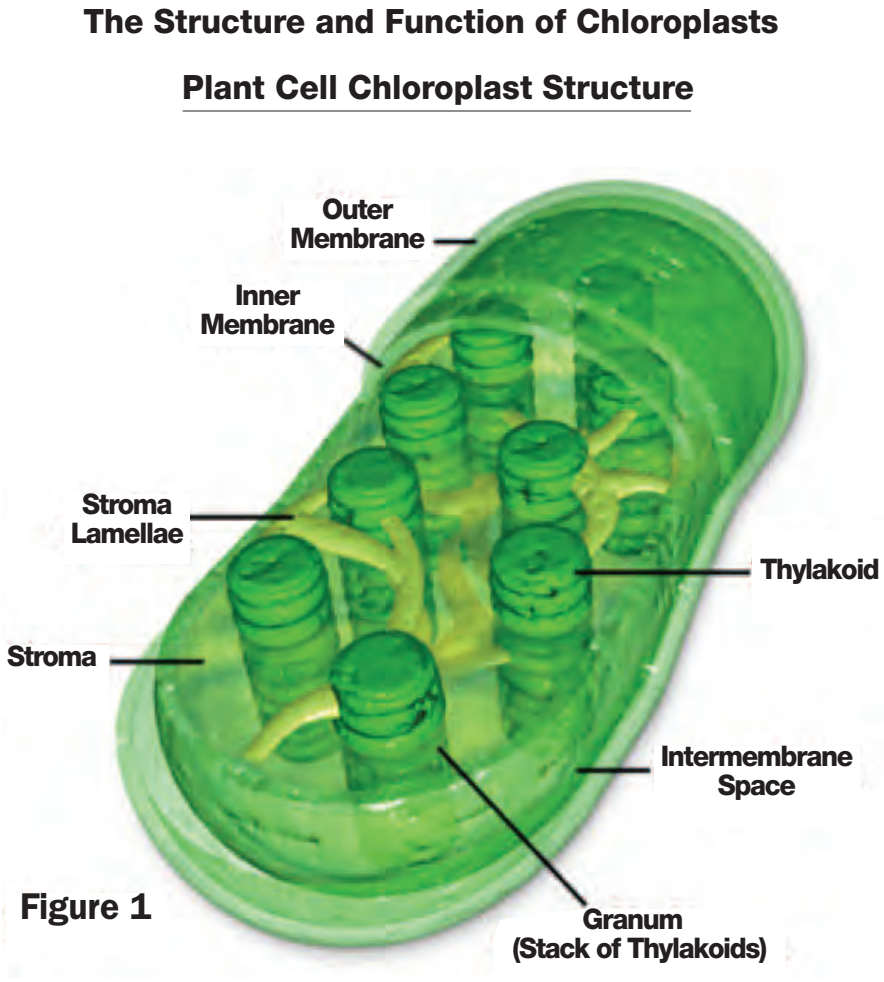


Figure 1

In addition to the inner and outer membranes of the envelope, chloroplasts contain a third internal membrane system: the thylakoid membrane. These membranes divide chloroplasts into three internal compartments.

The major difference between chloroplasts and mitochondria, in terms of both structure and function, is the thylakoid membrane. This membrane is of central importance in chloroplasts, where it fills the role of the inner mitochondrial membrane in electron transport and the chemiosmotic generation of ATP. The inner membrane of the chloroplast envelope (which is not folded into cristae) does not function in photosynthesis. Instead, the chloroplast electron transport system is located in the thylakoid membrane, and protons are pumped across this membrane from the stroma to the thylakoid lumen. The resulting electrochemical gradient then drives ATP synthesis as protons cross back into the stroma. In terms of its role in generation of metabolic energy, the thylakoid membrane of chloroplasts is thus equivalent to the inner membrane of mitochondria.

THE CHLOROPLAST GENOME

Like mitochondria, chloroplasts contain their own genetic system, reflecting their evolutionary origins from photosynthetic bacteria. The genomes of chloroplasts are similar to those of mitochondria in that they consist of circular DNA molecules present in multiple copies per organelle. However, chloroplast genomes are larger and more complex than those of mitochondria, containing approximately 120 genes.

The chloroplast genomes of several plants have been completely sequenced, leading to the identification of many of the genes contained in the organelle DNAs. These chloroplast genes encode both RNAs and proteins involved in gene expression, as well as a variety of proteins that function in photosynthesis. Both the ribosomal and transfer RNAs used for translation of chloroplast mRNAs are encoded by the organelle genome. These include four rRNAs (23S, 16S, 5S, and 4.5S) and 30 tRNA species. In contrast to the smaller number of tRNAs encoded by the mitochondrial genome, the chloroplast tRNAs are sufficient to translate all the mRNA codons according to the universal genetic code. In addition to these RNA components of the translation system, the chloroplast genome encodes about 20 ribosomal proteins, which represent approximately a third of the proteins of chloroplast ribosomes. Some subunits of RNA polymerase are also encoded by chloroplasts, although additional RNA polymerase subunits and other factors needed for chloroplast gene expression are encoded in the nucleus.

IMPORT AND SORTING OF CHLOROPLAST PROTEINS

Protein import into chloroplasts generally resembles mitochondrial protein import. Proteins are targeted for import into chloroplasts by N-terminal sequences of 30 to 100 amino acids, called transit peptides, which direct protein translocation across the two membranes of the chloroplast envelope and are then removed by proteolytic cleavage. As in mitochondria, molecular chaperones on both the cytosolic and stromal sides of the envelope are required for protein import, which requires energy in the form of ATP. In con-

trast to the pre-sequences of mitochondrial import, however, transit peptides are not positively charged and the translocation of polypeptide chains into chloroplasts does not require an electric potential across the membrane.

Protein import into the chloroplast stroma: Proteins are targeted for import into chloroplasts by a transit peptide at their amino terminus. The transit peptide directs polypeptide translocation through the Toc complex in the chloroplast outer membrane. Proteins incorporated into the thylakoid lumen are transported to their destination in two steps. They are first imported into the stroma, as already described, and are then targeted for translocation across the thylakoid membrane by a second hydrophobicsignal sequence, which is exposed following cleavage of the transit peptide. The hydrophobic signal sequence directs translocation of the polypeptide across the thylakoid membrane and is finally removed by a second proteolytic cleavage within the lumen.

The goal of every turfgrass manager is to provide a playable surface and aesthetically pleasing green turfgrass. Achieving the latter involves a reciprocal balance between soil, fertility, moisture, temperature, humidity, grass species, mowing techniques, cultural practices and cooperation from Mother Nature. All these aspects have to be working in sync for turfgrass to perform properly and be appealing color wise.

Protecting and strengthening chloroplasts would seem like the logical action to take because this is where chlorophyll, a pigment that gives turfgrass its green appearance, is developed.

The most important characteristic of turf plants is their ability to photosynthesize: to make their own food by connectinglight energy into chemical energy. This process is carried out in specialized organelles called chloroplasts. A photosynthetic cell contains anywhere from one to several thousand chloroplasts. The electrons from chlorophyll molecules in photosystem II replace the electrons that leave chlorophyll molecules in photosystem I.

Located inside the chloroplast are thylakoid membranes where light reactions take place. This is where chlorophyll is found, therefore, there's a synergistic relationship between keeping the chloroplasts and the thylakoid membranes as healthy as possible.

There are events that can be harmful to chloroplasts and thylakoid membranes, as well as necessary components that can prevent damage to them.

FREE RADICALS

One event that can damage chloroplasts is the development of free radicals. Typically, free radicals are stable molecules that contain pairs of electrons. When a chemical reaction breaks the bonds that hold the paired electrons together, free radicals are produced. They contain an odd number of electrons, which make them unstable, short-lived and highly reactive. As they combine with other atoms that contain unpaired electrons, new radicals are created, and a chain reaction begins.

This chain reaction or accumulation of reactive oxygen species, in turf plants is generally ascribed to several possible sources: cell-wall-bound perxidases, membrane-located NADPH oxidases, amine oxidases, xanthine oxidase, chloroplastic electron transport chains, mitochondrial electron transport chains, and peroxisomal fatty acid B-oxidation, which includes the H_20_2-generating argyl-coenzyme A oxidase steps. These sources can be attributed to environmental causes such as drought, heat, and ultraviolet light, or chemicals such as herbicides.

Accumulation of reactive oxygen species is central to plant response to several pathogens. One of the sources of reactive oxygen species is the chloroplast because of the photoactive nature of the chlorophylls. The free radicals, or reactive oxygen species, are singlet, hydroxyl, superoxide and hydrogen peroxide.

LIGHT

When photosynthetic organisms, such as turf, are exposed to ultraviolet radiation, significant, irreversible damage to important metabolic processes within the cell might occur (such as lesions in DNA and inhibition of photosynthesis). Through these reactions and others, radical forms of oxygen are often created. Many reports suggest this damage is because of oxidative stress resulting from UV-A exposure.

Photosynthetic light absorption and energy usage must be kept in balance to prevent formation of reactive oxygen species in the chloroplasts. Drought causes stomatal closure, which limits the diffusion of carbon dioxide to chloroplasts and thereby causes a decrease of carbon dioxide assimilation in favor of photorespiration that produces large amounts of hydrogen peroxide. Under these conditions, the probability of singlet oxygen production at photosystem II and superoxide production of photosystem I is increased. These can cause direct damage or induce a cell suicide program.

It has been known for a long time wavelengths in the ultraviolet-B region of the spectrum are effective in inactivating photosynthesis, and the molecular target is photosystem II. An excess of light brings about the inactivation of oxygenic photosynthesis, a phenomenon known as photoinhibition, and the molecular target of photoinhibition is photosystem II, a thylakoid multisubunit pigment-protein complex. The major effect of ultraviolet-B light on the thylakoid proteins is the breakdown of the reaction centre D1 protein.

SENESCENCE

Senescence results in massive levels of cell death, but the purpose of senescence isn't cell death; rather death only occurs when senescence has been completed. Senescence occurs in two stages. The first stage is reversible, and the cells remain viable throughout. The second stage results in cell death.

The key enzyme in the pathway to chlorophyll degradation during senescence appears to be pheophorbide-a-oxygenase. The activity of pheophorbide-a-oxygenase increases dramatically during senescence, implicating this enzyme as a control point in the process. Light absorption by pheophorbide-a-oxygenase also is believed to cause the production of singlet oxygen, which is a free radical.

Because senescence is reversible, it suggests that fully developed chloroplasts retain enough genetic information to support re-greening and chloroplast reassembly.

CALCIUM AND POTASSIUM

From a nutritional standpoint, there are various nutrients and compounds that can be applied in the process of strengthening and defending chloroplast damage.

Because the chloroplasts and thylakoid membrane are located inside the plant cell, the first line of defense would seem to be to strengthen the plant cell by keeping calcium and potassium at optimal levels. Calcium plays a key role in strengthening the cell walls of the turf plant, while potassium helps strengthen cell walls inside the turf plant, which makes it harder for physiological problems to occur inside the cell wall.

AMINO ACIDS

Amino acids are the building blocks of proteins. Under optimal conditions, proteins are able to perform the normal physiological function to synthesize amino acids, but intensively manicured turfgrass, such as golf courses and athletic fields, are rarely operating under optimal conditions because of stress caused by low mowing heights and traffic.

To date, 154 proteins in the turfgrass plant have been identified – 76 (49 percent) are integral membrane proteins. Twenty-seven new proteins without known functions, but with predicted chloroplast transit peptides, have been identified – 17 (63 percent) are integral membrane proteins. These new proteins are likely to play an important part in thylakoid biogenesis.

The application of amino acids plays an extremely important part in developing the proteins specifically designed to help chloroplasts, thylakoid membranes, photosystem I and photosystem II to function properly. These proteins are known as D1, D2 CP43, CP47 and cytochrome b559. Of special

Working with your distributor

Little League World Series groundskeeper appreciates advice

SETH WHITEHILL, head grounds-keeper for the Little League World Series (LLWS) complex in South Williamsport, PA, for several years has been working with distributor's rep Phil Easton of Direct Solutions, a division of Agrium Advanced Technologies. The complex holds more than 75-80 games in the 3-week tournament; there are six fields on 80 acres including two stadiums. Whitehill takes care of the fields on his own during the spring and fall, but during the weeks leading up to and the during the World Series, volunteers (organized by the Keystone Athletic Field Managers Organization, the state's STMA chapter) come in from all over to help with the fields' maintenance.

"We didn't have a consistent growth rate throughout this year, and 2012 was hell," Whitehill said. "Clay is the native soil at the LLWS complex and there are sand slit drains cut through the fields. Wetting agents are crucial so you don't look and see the dry spots across the entire field. This year we had a large amount of rain during the beginning of the summer months, following a hot spell."

Whitehill said he has never seen a worse disease problem than he did during 2013. Neighboring facilities were experiencing a lot of dollar spot, brown spot and summer patch and pythium, with some of the diseases surfacing two or three times in certain areas. With Easton's help, Whitehill got a step ahead of the game and his turf remained disease free.

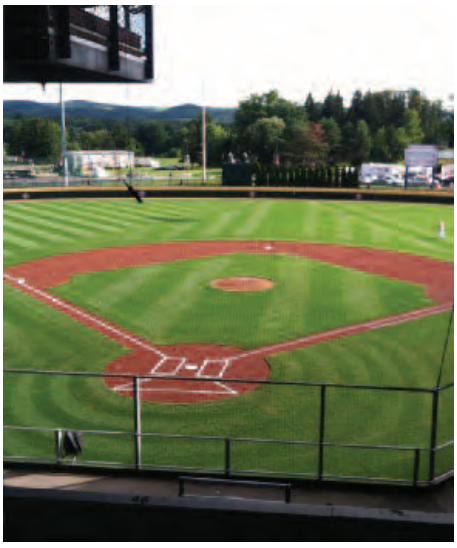
"When I started with Little League we had an existing relationship with a distributor but I didn't see eye-to-eye with them, so we had a bidding process to find a new one. Jeff Fowler (of Penn State Extension and STMA Board member) and I worked together to draw up a maintenance plan and then asked three bidders to tailor their bids to that plan, and we then selected the most cost-effective bid," Whitehill said.

"Phil Easton has become a good friend of mine. He is a great reference; he is really good with diseases and he loves to fix a problem. He likes the challenge of fixing problems. I consult with him regularly, for example on fungicide products when a period of extreme heat is expected. We also developed a granular and foliar fertilizer program.

"He knows what to look out for and what products to use so we don't get into any trouble. During the weeks leading up to the World Series, from May-September, foliar applications were made every other week. Easton also worked in a liquid for color and a root builder into the management program.

"Phil comes here 5-6 times a year and we walk around to discuss what's working or not. He has a real good grasp of the sites here at Little League, and we use soil tests regularly to see how we might improve it, and also to tailor the next year's plan to alleviate any possible issues," Whitehill said.

"Every field is different; my job is to recommend the correct products to fix problems," Easton said. In Williamsport, there is a lot of wear and some rooting problems so we had to work to get the turfstand to withstand the pressure. My job is to try and find out what turf managers are trying to accomplish first, and then supply some supporting data to back up my recommendation and earn the trust of the turf manager."



"I don't have a big staff here, I'm grinding it out every day, so to have someone I can call up and talk about what I'm seeing, and what he's seeing, is important. If I call Phil he calls me back within 15 minutes to talk about what we can do. He can really save my butt."

Whitehill said, "I call Phil several times a month to update him on what's happening here and to talk about what diseases or other problems he's seeing in this area. Developing this kind of relationship with a distributor can be such a beneficial tool for turf managers; he knows what others are seeing in the region and so talking with him regularly makes my life a heckuva lot easier. We are great friends now and I didn't even know him a few years ago.

"I don't have a big staff here, I'm grinding it out every day, so to have someone I can call up and talk about what I'm seeing, and what he's seeing, is important. If I call Phil he calls me back within 15 minutes to talk about what we can do. He can really save my butt."

"What my job really is not salesman; it's consultant. My job is to help the turf manager figure out what his or her field needs, then put together a program within the available budget," Easton said. "'What can we do for what you can spend?' is the question that needs answered.

"For Seth, I recommended a silica product and it's really helped with the wear; he has a better stand now. I've found that sports turf managers are not as familiar with foliar products as golf superintendents. Seth's attitude is to do everything correctly; he has excellence built in and wants his fields to be the best they can be, and he's willing to work the hours necessary to make that happen. He is also open to new ideas; his attitude is 'let's see what happens'." He is the reason the LLWS fields looked as good as they did this year," Easton said.

"Many of our volunteer staff have bee helping with field preparations and for 17 consistent years. This year, feedback Seth received from volunteers was that the fields look better than they ever have," Whitehill said. "Even the ESPN camera crew noticed how nice the fields looked this year.

"We have a break room at Lamade Stadium with a TV in it so during games sometimes we are in there watching. There is about a 10-second delay on the broadcasts, so we'll hear the crowd roar and then guess what happened, " Whitehill said. "TV helps us out because you can't see any spots that are thin or beat up, where we might have used grass clippings to hide any brown spots. There are 38 games on the two stadium fields over the 2 weeks and there isn't much time to get much done except the between game fixes on the mounds and batters boxes, dragging the infields, and of course putting down fresh lines." ■

Soil stabilization
important for synthetic fields

BEAUTY CAN BE DECEIVING especially when a new synthetic field is completed. School administrators look at the pristine green surface, take their first steps on it and imagine the thrilling games it will host and the immense value it will provide as recruiting tool. But for many, it can also lead to heartache when imperfections begin to show more and more prominently; a portion of the turf puckering here, a persistent pool of water there, and humps or divots mysteriously materializing. All are generally signs of one thing: an improperly stabilized soil sub-base.

The most common mistake high schools, colleges and other organizations make when planning an artificial surface is failing to realize the importance of the sub-base. How important? It is not only essential to ensuring lasting value over a synthetic turf's 10-year life span, but a properly stabilized sub-base can last three synthetic turf life spans, 30 years. It's one reason why Byrne & Jones Sports recommends allocating $50,000 to $100,000 of a budget to fixing potential soil issues.

> When considering an investment of a $1 million or more in a new athletic field and subsequent replacement surfaces that will be needed every 10 years or so, it makes eminent sense to invest in a good sub-base.

One of the more common missteps in athletic field installations is becoming too enamored with compaction as a "catch all" solution to sub-base issues. Compaction is not a substitute for the stability of soil. You can compact a soil, test it to confirm all the air in the soil has been voided and still wind up with a mud bog. It is one of the more common issues we encounter when contacted to evaluate turf imperfections on surfaces we didn't install.

The ideal soil for synthetic fields is found in the northern states of Midwest farm country and is comprised of silt and top soil. In some areas, like Gary, IN the surface can appear to be the ideal silt/soil combination until you probe deeper and find that it's all sand 8 inches below the surface. Otherwise, clay soils tend to be most common problem. Clay will retain water and impede effective drainage. Water that persistently pools on a

field can be a sign of an improperly treated clay soil base.

Solutions to soil issues will vary as much as the soil itself and include:

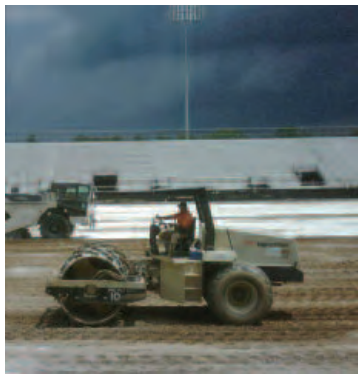
• Undercutting the soil and bringing in better dirt or rock. This is one of the more common solutions for clay soils. In most cases, rock will generally compact better to enhance stability.

• Introducing lime to stabilize clay soil and reduce its plasticity and moisture-holding capacity. Using a cement material to improve sand and silt soils. If properly applied, the cement will mesh with the on-site soil to act as a lean concrete slab.

• Using fly-ash material in the same way as cement and lime. In all cases, the intent is to induce a chemical reaction with the soil to improve the compressive and shearing strength. A geotechnical engineer should be consulted to determine the best product given the existing soil condition.

When considering an investment of a $1 million or more in a new athletic field and subsequent replacement surfaces that will be needed every 10 years or so, it makes eminent sense to invest in a good sub-base. A thoughtful approach to stabilizing the soil will support the field and replacement surfaces over generations of use. ■

Jameson Sheley, CFB-S, CTB, is a certified field builder and certified track builder and project manager for Byrne & Jones Sports, which for more than three decades has installed more than 1,000 athletic surfaces. www.byrneandjonessports.com



In memoriam:

The life and legacy of industry legend Dr. James R. Watson

IMAGINE, if you will, a bright, warm day in Pennsylvania in the spring of 1950. A young man named James R. Watson walked across the stage at Penn State to receive his Ph D in agronomy. Just 5 years earlier, this young man was in the 8th Air Force, where he received a Purple Heart for action over Berlin during the Second World War. The future seemed much brighter now, on that brilliant, vernal day, than it had before.

Then a professor at Penn State, James, or "Dr. Jim," as he would become affectionately known, was hired by The Toro Company in September of 1952 as Director of Agronomy. David Lilly, president of Toro from 1950-1968, believed that the company needed an agronomist, but wasn't quite sure what to do with one, so Dr. Watson had to work with Mr. Lilly to build his own job description. That same year, the company opened a new 24,000-square foot research and development building on the 25+ acre plot of land on which the company's corporate headquarters now resides.

Leading a team of 25 researchers, Dr. Watson established 50 test plots, some with underground heating cables and others in climate controlled green houses, encompassing more than 10 acres of land; this facility is now known as the Dr. James R. Watson Research & Development Proving Grounds. Research was conducted on a wide variety of grasses, seeds, yields, the type and nature of soil conditions best suited to different varieties of grass, optimal fertilization and watering practices and the best approaches to controlling unwanted grasses, disease and pests. This was pioneering research that set the global stage for the future of the turf industry.

Dr. Watson spent the next 46 years with Toro, where he continued to pioneer turf and water management research that had an increasing global impact. Many of the world's leading golf courses, parks and sports facilities frequently sought Watson's advice and counsel. Throughout his career, Dr. Watson was held in the highest regard throughout the industry for his kindness, knowledge, and professionalism.

Dr. Watson remained active in the industry following his retirement from Toro in 1998, serving as a consultant to both the company and the industry at-large, as well as serving on a number of prestigious turf and water management boards, organizations and research efforts.

While Dr. Watson had received countless awards and recognition for his years of research and accomplishments, his true goal was the advancement of the industry. Today, people have Dr. Watson to thank for many of the scientific innovations that have contributed so significantly to their enjoyment of beautiful, healthy, thriving, environmentally-friendly green spaces around the world.

Dr. James R. Watson passed away peacefully on October 1 of this year. A loving family man and a devoted scientific pioneer, Dr. Watson's life and good works touched countless lives. As a man of science, Dr. Watson was undoubtedly familiar with the First Law of Thermodynamics, which tells us that energy can neither be created, nor destroyed. Perhaps, in a poetic way, it also tells us that even though he is no longer with us, his life and legacy are quite literally all around us. ■

Biographical timeline:

- Born, December 24, 1920 in Leesville, LA
- 1943-1945, bombardier with 8th Air Force over Europe
- Received Purple Heart and Silver Star for action over Berlin, March 1945
- BS in Agronomy 1947 from Texas A&M University
- PhD in Agronomy 1950 from Penn State under Dr. H. Burton Musser
- 1950-1952, Professor Texas A & M University
- 1952-1998, Vice President of Agronomy, The Toro Company
- 1998-onward, Consultant to The Toro Company and the industry

Awards and Recognition:

- Fellow American Society of Agronomy
- Fellow Crop Science Society
- 1967 Turf consultant to professional football's first Super Bowl – a relationship Toro continues to enjoy to this day
- 1976 United States Golf Association's Green Section Award for distinguished service to golf through work with turfgrass
- 1977 American Society of Agronomy's Agronomic Service Award
- 1979 Elected to the Board of the International Turfgrass Society
- 1982 Appointed to United States Golf Association's research committee
- 1983 Golf Course Superintendents Association of America's Distinguished Service Award
- 1983 Appointed adjunct professor in the Horticultural Science and Landscape Architecture Department of the University of Minnesota.
- 1985 Elected Director of National Golf Foundation
- 1985 Elected Director to the Board of the Freshwater Foundation
- 1986 Landscape Management's Man of the Year
- 1986 Landscape and Irrigation's Man of the Year
- 1987 First recipient of the Crop Society of America's Fred V. Grau Turfgrass Science Award
- 1988 Elected to the Board of the Sports Turf Managers Association
- 1989 Minnesota Golf Course Superintendents' Distinguished Service Award
- 1989 Appointed to the Board of the Landscape Architecture Foundation
- 1991 Appointed to the Executive Board of the Landscape Architecture Foundation as Vice President of Research
- 1991 Sports Turf Management Association's Harry Gill Award
- 1993 Appointed to the Planning Council of the Irrigation Association and Water Science and Technology Board Committee on "The Future of Irrigation"
- 1994 Served as agronomic coordinator for nine of the World Cup venues
- 1994 Donald Ross award from Golf Architects Society of America
- 1995 Golf Course Superintendents Association of America's highest honor – the Old Tom Morris Award
- 1998 Texas A & M University, College of Agriculture and Life Sciences' Outstanding Alumni Award
- 1998 United States Golf Association's Green Section's Piper and Oakley Award
- 1999 Honorary Member of the Sports Turf Managers' Association
- 1999 Inducted into the Minnesota Golf Hall of Fame
- 2002 Appointed to the Board of Trustees of the Agronomics Science Foundation
- 2007 American Society of Irrigation Consultants' Ray Williams Memorial Award
- 2009 United States Golf Association's Ike Grainger Award

JOHN MASCARO'S PHOTO QUIZ

Answers from page 17

ALTHOUGH the uneven playing surface on this high school football field could have been caused by an angry herd of pigs, this photo is actually man-made. This school district located in the southern United States had rebuilt this field about 8 years previously to when this photo was taken. The resulting renovated field had a good soil mix however cutbacks in the school maintenance program as well as cutbacks in manpower had left the field in disrepair. Severe compaction as well as some marching band ruts and some low spots had formed from intensive use by the high school. Instead of the long, normal road to recovery, the maintenance director opted to flag the irrigation heads and rototill the entire field down to a depth of 8 inches. After this process, the field was laser graded and then rolled, leaving the tilled bermudagrass in the root zone. The field was then irrigated on a schedule similar to sprigging and within 30 days, the entire field was grown back in and ready for play. This process was deemed successful enough that they did this process to several other fields the following year. ■

Photo from John Mascaro's collection.

If you would like to submit a photograph for John Mascaro's Photo Quiz please send it to John Mascaro, 1471 Capital Circle NW, Ste # 13, Tallahassee, FL 32303 call (850) 580-4026 or email to john@turf-tec.com. If your photograph is selected, you will receive full credit. All photos submitted will become property of *SportsTurf* magazine and the Sports Turf Managers Association.

F.O.Y.

Field of the Year

TD Ameritrade Park Omaha

- Level of Submission: College
- Category of Submission: Baseball
- Head Sports Turf Manager: Dan Blank
- Title: Turf manager
- Education: Associate's degree, horticulture and turf management
- Experience: Internships with St. Paul Saints ('04) and Milwaukee Brewers ('05); Assistant Groundskeeper for Louisville Bats ('06); Head Groundskeeper for Birmingham Barons ('07) and Buffalo Bisons ('08-'10); Turf Manager at TD Ameritrade Park Omaha ('10-present).
- Full-time staff: Eric Williams, assistant turf manager
- Original construction: 2011
- Turfgrass variety: Original sod from Graff's Turf Farms. Currently: 85% Kentucky bluegrass/15% perennial ryegrass
- Overseed: Compared to 2011, we tried to ramp up our overseeding program for 2012. Because of the variety of events we host throughout the season and its constant use, overseeding is definitely part of our regular maintenance plan. Rates and frequency of seeding are as follows: 1 lb /1,000 bluegrass at least once a month; 1/2 lb/1,000 ryegrass every other month
- Drainage: Corrugated plastic drain tile. 24" to 18" main line running down center of field (centerfield to home plate). 6" lateral lines every 10. Also have SubAir system; heated air forced through drainage system.

CHALLENGES

TD Ameritrade Park Omaha opened in 2011 with the intent of being a multi-use facility. That being said, management has certainly held up their end of the bargain in the short amount of time that the facility has been in use. Aside from being the home of the NCAA Men's College World Series, we also host Creighton University baseball, the College Home Run Derby, RedSky music festival, Omaha Nighthawks football, and in February 2013, hockey! Just the sheer variety of events held at the stadium creates challenges in terms of trying to develop, schedule, and implement an annual management plan for the field.

When the College World Series moves in, the stadium is transformed top to bottom. On our end, we are challenged with coordinating our routine field maintenance around all the extra practices, run-throughs, meetings, and additional setup that occurs on the field before the tournament. In particular, we assist ESPN with installing in-ground microphones at home plate and the pitcher's mound. Once those are in the ground, our crew has to be careful not to purposely rake or drag over them as we prepared the field for the games.

The summer of 2012 was absolutely brutal. Like much of the nation, we were faced with intense heat and drought conditions for much of June, July, and August.

The RedSky Music Festival is about the worst-case scenario you can imagine for a sports field. In mid-July, two-thirds of the field was covered with protective plastic flooring for 10 days. Additionally, a large stage was built in centerfield, and temperatures averaged around 98 degrees for the duration of the event. Needless to say, the field took a severe beating.

The Omaha Nighthawks of the United Football League also call our place home. The league has been plagued by financial problems for the last two years, and quite frankly, we weren't sure until September if they were going to play or not. From our stand point, we did as much as we could to the field to prepare despite the uncertainty.

This coming February, we are hosting an outdoor hockey event on our field. Although some of the details aren't completely worked out yet, we have a basic understanding on the logistics on building the rink and general set up. However, perhaps the most obvious challenge that remains is how the weather will be for the event, and what measures we need to take to protect the turf. After the event, we will have one month to get the field ready for Creighton baseball in March.

SportsTurf: What channels of communication do you use to reach coaches, administrators and users of your facility? Any tips on communicating well?

Blank: For Creighton University games and practices, I deal directly with the coaching staff and also receive information from our Event Manager for the stadium.

During the College World Series, every day I speak often with NCAA committee members and again am frequently in contact with the Event Manager.

For any other event, I get most of my communications from the Event Manager.

We use the standard forms of communications; cell phones, emails, two-way radios, but the most effective is face to face.

ST: What are your specific job responsibilities? What do find most enjoyable? What task is your least favorite and why?

Blank: My primary responsibility is to provide the best possible baseball field that I can for the biggest stage in college baseball. One that looks great, but more importantly, plays flawlessly. Far and away, any baseball game is my favorite event, and the College World Series is the most chaotic and the most enjoyable. My least favorite task is, without a doubt, snow removal. I used to look forward to a good blizzard or two during the winter months but assisting the maintenance staff with snow removal has pretty much taken all the joy out of it.

ST: How did you get started in turf management?

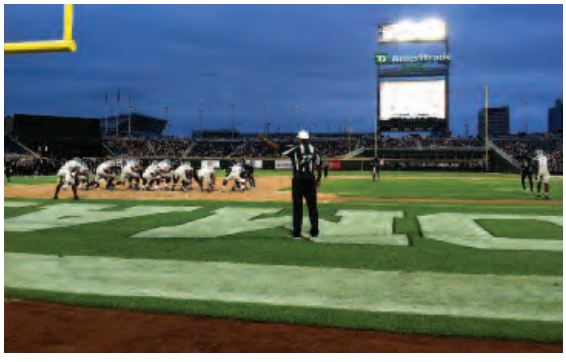
Blank: I got a late start in this industry. I received my bachelor's degree in an unrelated field and spent seven years as a manager of operations in the hospitality industry in the Minneapolis area. Being born and raised in Minnesota, I have always been a big Twins fan and maybe even a bigger fan of the game of baseball itself. In the early 2000s I knew in my heart that the Twins would soon be getting a new outdoor stadium and if I wanted to be a part of that crew I would need to get after it. While continuing to work full time, I returned to school and received my Associate Degree is Sports Turf Management. I began my climb in this industry with internships with the St. Paul Saints and the Milwaukee Brewers followed by my biggest break of all, heading down to Louisville, KY to spend a season with Tom Nielson at Louisville Slugger Field. Following that summer in Louisville, I became the Head Groundskeeper for the Birmingham Barons (through Southern Athletic Fields) for a season. Then the Buffalo Bisons came calling, and I spent three fun seasons in western New York. In the fall of 2010, the opportunity to be the Turf Manager at TD Ameritrade Park Omaha came up and between taking over a brand new facility and returning to the Midwest, it was too good to pass up. Three seasons under my belt and looking forward to many more.

▼ **CREW MEMBERS;** Kyle Poljanac, Alex Sindelar, Joe Morgan, and Brandon Cutler painting the CWS logo.

▲ **LSU takes** the field during the College World Series practice and media day.

▼ **Top: THE OMAHA NIGHTHAWKS** of the UFL called our field home for the 2011 and 2012 seasons.

▼ **Bottom: FLOODING OF HOCKEY RINK** in preparations for the Mutual of Omaha's Battles on Ice.



ST: How do you balance your work and personal time?

Blank: During an event such as the CWS, there is not much of a balance. My wife and kids actually move back to Wisconsin for those two weeks in June. For Creighton games and other events that we host, I am fortunate to be able to have my family come down and spend time with me during the events themselves.

ST: What changes are you planning to make or have you made to your maintenance plan for 2013, if any?

Blank: The biggest change we made was the addition of a continuous seeding program. We slit seeded the entire field with Kentucky Bluegrass three times this season at a rate of about 3.5 lbs./mft2. We also went out twice a week with a broadcast spreader in the areas that would show wear in an effort to always have new turf coming up.

ST: Are you yet involved in sustainable management practices? If so, what are you doing?

Blank: We perform the more traditional practices such as returning clippings, the application on humus in some of our fertilizers, regular aeration and topdressing, annual soil testing to determine next year's fertilizer requirements, and the use of foliar fertilizer applications to increase the plants uptake while using less as compared to a soil feeding.

ST: How do you see your job changing in the future?

Blank: I see pressures being put on Turf Managers in general to get more involved with the previously mentioned "sustainable" management practices. I also feel that water use issues will become more and more of a hot topic in the coming years.

As far as TD Ameritrade Park Omaha, who knows? It makes me a little nervous for my turf when I think about the kind of events a creative sales staff can come up with but exposure of the ballpark to a greater audience is never a bad thing. ■

REV new humic compound from Dakota

REV PTF6000, from Dakota, is an all-natural, organic humic compound that dramatically improves plant health while increasing the longevity of fertilizer and fungicide performance. REV assists in disease suppression and enhanced soil biology as well. REV easily tank mixes with most products and can be used in conjunction with granular applications for longer lasting results. REV has been proven to decrease turf operating costs by 30% or more. REV uses the world's highest quality all natural materials and compounds in its formulations.

Dakota

Sweeper cuts maintenance time on synthetics

The 3-three-wheel Broce Turf Boss sweeper can groom a typical turf field in a single pass, with full 8' brush contact, reducing field maintenance time by up to two-thirds. Its reversible brush rotation, included as standard equipment, can double productivity by allowing the operator to sweep in both directions without turning around. Turf Boss sweeper's hydraulics are engineered to deliver more power to the brush, which enables full brush-turf contact for faster field maintenance. To combat overheating issues on turf fields, its radiator is designed to operate in 140°F ambient temperatures. It is the only sweeper of its kind to incorporate a hydraulic oil cooler as standard equipment. Comes standard with turf-specific 12-inch wide tires that tread lightly on turf.

Broce Manufacturing Co.

Self-priming centrifugal pumps

Griswold Pump Company says that its H Series high head self-priming centrifugal pumps have been designed with key features and options that make them ideally suited for a wide variety of water applications, including turf irrigation where greater flows and higher heads are needed. Unlike standard end suction centrifugal pumps, the H Series is able to maintain its prime even when check valves or foot valves have failed. Since the suction line on the H Series is located higher on the pump housing than conventional centrifugal pumps, it keeps the impeller and mechanical seal covered with water at all times eliminating the need to re-prime the pump and protects the seal from running dry resulting in costly replacements.

Griswold Pump Company

Katana herbicide Early Order and Bundle Bonus program

Professional sports turf managers can get a head start on next year's maintenance plans while conserving valuable budgets with an early order incentive and product bundle bonus program, available from PBI-Gordon Corporation, for its Katana Turf Herbicide. The program includes different opportunities to save: Katana Incentive, with a minimum purchase of eight bottles or two cases of Katana, you can receive a $100-per-case rebate. Katana is packaged with four 3-ounce bottles per case (receive $100 per case with each additional case after minimum is met). Also Bundle Bonus Rebate, add 10 gallons of SpeedZone and/or SpeedZone Southern to each case of Katana ordered and earn an additional $2.50 per gallon rebate on the SpeedZone products. Early delivery bonus also available.

PBI Gordon

Bayer CropScience introduces Specticle plus Fertilizer

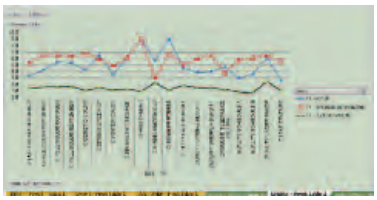
Environmental Science, a division of Bayer CropScience LP, has launched Specticle plus Fertilizer, an herbicide that provides warm-season turf managers up to 8 months of residual control at low use rates. The characteristics of Specticle deliver excellent weed prevention and fertility. Specticle plus Fertilizer is available in two different concentrations and a variety of fertilizer blends to provide for increased flexibility that meets the needs of warm-season turfgrass professionals. Specticle is a unique class of chemistry that offers an environmentally responsible solution and helps address weed resistance. Specticle plus Fertilizer delivers extended residual pre-emergent control of more than 75 broadleaf and grassy weeds, including annual bluegrass, goosegrass, crabgrass and annual sedge. The easy-to-use Specticle plus Fertilizer helps streamline turf management practices and simplify application.

Bayer

Tool to aid in seed variety choice

WinField is committed to providing turf managers with the tools they need to stay at the top of their game. Case in point: its proprietary new Turf Tech Tool that helps efficiently choose the best seed varieties for your sites. The Turf Tech Tool, part of the WinFieldInsights Tech Kit, combines data from the National Turfgrass Evaluation program into one convenient database that makes the seed selection process easier. This industry-exclusive tool allows users to quickly pinpoint the best turf seed for their specific conditions. Features university evaluations of six turf species and more than 1,000 turf varieties. Allows users to compare varieties based on 150 attributes. Includes charting and sorting capabilities to evaluate varieties on national, regional and state levels. Quickly matches the optimum turf seed to specific environmental and playing conditions.

WinField



Get rid of geese

Canada Goose deterrent company Away With Geese has a new product: the Sports Cage. The Sports Cage protects the Sports Unit, a unit designed to avert theft in public spaces, from vandalism. The two together get rid of Canada Geese from any public area, while also averting theft and vandalism of the unit. All Away With Geese products feature a solar-powered light that is scarcely noticeable to humans but is very disruptive to the sleep of the geese, causing them to find another habitat after just a few restless nights. Like all Away With Geese units, they are maintenance free; once placed and secured, they require no upkeep and are guaranteed to rid the area of Canada Geese.

Away With Geese

New spreader/sprayer with electric features

TurfEx introduces the RS7200E spreader/sprayer with advanced features to maximize the efficiency of lawn care professionals. The new unit boasts an electric start, adjustable electric spray pump, and a hand-held spray wand. The RS7200E is driven by a 7-horsepower Subaru EX210 engine with electric start and a 0.95-gallon fuel tank. Its heavy-duty transmission has two forward gears, neutral and reverse. A hand-operated transmission disc brake and foot-controlled sulky band brake allow smooth, confident operation of the unit, and the machine's low center of gravity further increases the safety of the RS7200E. A 17-gallon tank system has a single port for easy filling and a balanced design for enhanced stability. To apply the liquid, the RS7200E includes a front-mounted boomless nozzle, which can spray between 3 and 11 feet wide, as well as a professional-duty spray wand.

TurfEx

F.O.Y.

Field of the Year

▶ **PRE-GAME** Prep

Tiger Park, Louisiana State University

- **Level of Submission: College**
- **Category of Submission: Softball**
- **Head Sports Turf Manager: Eric Harshman (now with University of Kentucky)**
- **Title: Assistant Sports Turf Manager**
- **Education: Bachelor's Degree in Marketing**
- **Experience: Started off in the golf industry in 2005. In 2007 started working for the Louisville Bats. Spent one season on the game day staff, one season as seasonal full-time and two seasons as first assistant. In June, 2011 moved to Baton Rouge and became the assistant sports turf manager at LSU.**
- **Full-time staff: Matt Mitchusson, Caleb Hatcher**
- **Other crew to recognize: Paul Wedig, Jake Wilson**
- **Original construction: 2009**
- **Turfgrass variety: Celebration bermudagrass**
- **Overseed: Perennial Ryegrass is applied to the playing field and grassed seating area beyond the outfield wall in late October at a rate of 14 lbs/1000.**
- **Drainage: Herringbone drainage system, 4" drain line, 15' off center.**

CHALLENGES

Saying that Tiger Park is overused is an understatement. From September 2011 to July 2012, 56 games were played at Tiger Park. Our fall season consisted of 12 games in the month of October. Because we reside in southeast Louisiana we have the luxury of living in a warmer climate and because of that, our season starts a bit earlier than most. Practices start in January just like everyone else, but we are hosting tournaments starting the first weekend in February. Tiger Park and LSU hosted three separate tournaments this past season that consisted of 22 games. Sixteen of those were non-LSU softball games; 24 home LSU games were played at Tiger Park and 40 games total for the 2012 season. Just as the season came to an end in early June, it was time for softball camps to begin. Three separate camps took place at Tiger Park. Each camp had in average of 116 participants. LSU's head softball coach, Beth Torina, is also the coach for the USSSA Florida Pride of the National Pro Fastpitch league. A four-game series was played between the Carolina Diamonds and the USSSA Pride in early July which brought some great exposure to LSU and Tiger Park. We got a short, and much needed break in the month of August, just to have fall softball start up again in September to repeat the process.

We are very fortunate that our softball team helps with the tarping of the field. Our grounds staff and the softball coaching staff have been able to work out a system that benefits everyone. The team is responsible for tarping the field after practice if needed and they help our staff during games. In the morning and during the day all tarp duties fall on the grounds staff. At last count the grounds staff had the team outnumbered in tarp pulls with 13 to their measly five tarp pulls. I joke, but again I am very fortunate to have the help from the team with this. Though we had the team out numbered in tarp pulls, those five times saved our staff some major headaches.

In 2012 the entire coaching staff entered their first season at LSU. With new coaches means learning their expectations and gaining their trust. There is a fine line of balancing the needs of the team with the needs of the facility. I make it a point to stop by their offices regularly and see how everything's going and letting them know that if they need anything to not hesitate, but ask. This has helped build a working relationship with the coaching staff. Teamwork was the key to success in 2012.

SportsTurf: What attracted you to a career in sports turf management?

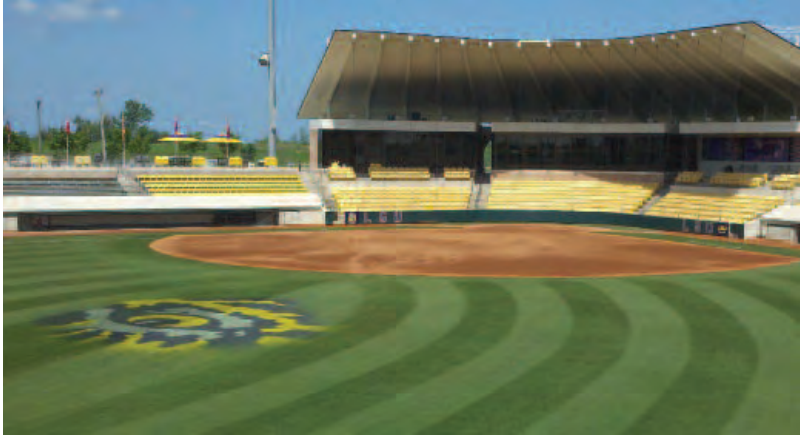
Harshman: The appeal of being around sports every day and working outside.

ST: What are your specific job responsibilities? What do find most enjoyable? What task is your least favorite and why?

Harshman: I managed and maintained the day-to-day operations at both the LSU Soccer Complex and Tiger Park. I scheduled maintenance programs for the playing fields and landscape, and managed and instructed crews on game and non-game days and kept an open line of communication with coaching staffs/liaisons, marketing, and game management personnel regularly.

When not at Soccer/Softball I would assist where needed, for example.

• Tiger Stadium (Football) - Paint end zones/game prep and assist in maintenance program



▲ **MID-SEASON**

• Alex Box (Baseball) – Game prep, assist in maintenance program

• Practice Football Facility – (3 natural grass fields) (1 synthetic outdoor field) (Indoor facility) Assist in maintenance program

• Helped maintain two High School fields (Baseball, Football/Soccer)

• Track & Field – Paint sector lines for shot, discus & javelin. Make necessary repairs to throws field (patch divots, irrigation breaks)

• Concert and event prep

Most Enjoyable: I really enjoy opening day (for any sport) The nervous excitement sets in and you have that moment of satisfaction, knowing that all the hours the crew and I put into getting the field ready has paid off.

Least Enjoyable: Inclement weather and living and dying by weather sources. I use multiple weather sources via the internet and more often than not none of them are accurate. Percentages are different, radar maps are different. I try to go with my gut instincts and learning the weather patterns has been very beneficial.

ST: What was your first sports turf job?

Harshman: After spending several years working in the golf industry I made the transition into sports turf working with the Louisville Bats and head groundskeeper, Tom Nielsen. I spent four seasons in Louisville starting off as game day help, to a full time seasonal position and finally as the first assistant for two seasons. After leaving Louisville I have been blessed with the opportunities to work at both Louisiana State University & the University of Kentucky, serv-

▲ **PAINTING** the Tiger Eye - Done twice a week during the season

ing as the assistant sports turf manager working with CSFMs Eric Fasbender and Marcus Dean.

ST: What advice would you offer when relocating to begin a new Turf Management job, both personally and professionally?

Harshman: Personally: If married/family, make sure to talk out any detail imaginable. Be considerate of your spouse and family. Make sure everyone is on board. The decision you make will not only have an impact on you, it will impact your family!

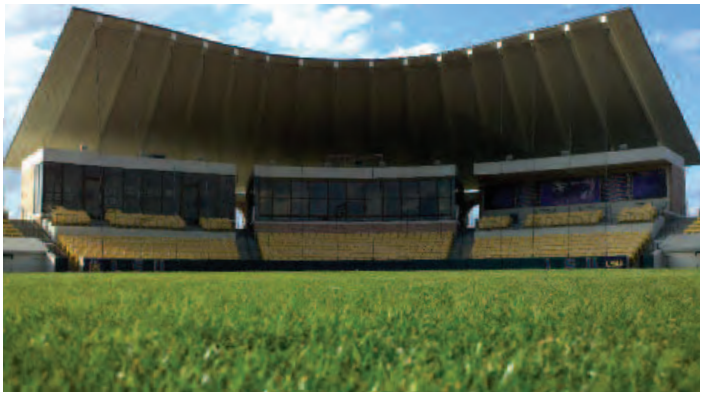
Professionally: First and foremost, look to challenge yourself and broaden your horizons. Be confident in your abilities, but look toward others when advice is needed. Know that mistakes are going to be made and that you can learn from them. Relocating can be exciting and can be very stressful if you allow it to consume you. Control the controllable!

ST: What channels of communication do you use to reach coaches, administrators, and users of your facility? Any tips on communicating well?

Harshman: I use a wide variety of communication methods (e-mail, phone calls, texts). I find that the best way of communication is in person and to the individual/individuals looking for answers. By going straight to the source you eliminate any concerns/questions that may be lost in translation via texts or even with e-mail.

ST: How do you see your job changing in the future?

Harshman: The sports turf managers job is ever-changing. Cultural practices and the means to apply them change at a rapid rate. Doing research on the latest products (equipment, fertilizers etc.) is a constant. I believe that turf managers are now being asked to do more than manage the playing surfaces. We are now taking on the responsibilities of facility director, stadium operations and event managers. ■



▲ **PRE-GAME** Water

▼ **TIGER INVITATIONAL** Eight game weekend tournament

Membership Application

SportsTurf
MANAGERS ASSOCIATION

Experts on the Field, Partners in the Game.

Fax to: (785) 843-2977

Or mail with payment to:
Sports Turf
Managers Association
P.O. Box 414029
Kansas City, MO 64141

Name _____ Title _____

Employer/ Facility _____

❑ Business ❑ Home

Address _____

City _____ State _____ Zip _____

Home phone _____ Work _____ Cell _____

Fax _____ Email _____

Signature _____

Direct Supervisor Name _____

Membership Category:

❑ Sports Turf Manager	$110
❑ Sports Turf Manager Associate* (Additional member(s) from the same facility)	$75
Please select the primary facility type where you are employed:	
❍ Professional Sports ❍ Higher Education ❍ Schools K-12 ❍ Parks and Recreation	
❑ Academic	$95
❑ Student (verification of enrollment)	$25
❑ Commercial	$295
❑ Commercial Associate* (Additional member(s) from the same commercial company)	$75
❑ Affiliate (Person who is indirectly or on a part-time basis, involved in the maintenance/management of sports fields)	$50
❑ Retired	$50
❑ Chapter Dues (contact headquarters for amount) Chapter name) _____	$_____
❑ Contribution To SAFE Foundation (research, education and scholarship)	$_____
Total Amount Enclosed:	$_____

Payment Method:

❑ Check ❑ Money Order ❑ Purchase Order #: _____

Credit Card: ❑ Mastercard ❑ Visa ❑ American Express ❑ Discover

Name on Card _____

Card #: _____ Exp. Date: _____

Signature: _____

*There must already be a national sports turf member from your facility or commercial member from your company before you may sign up in the Associate category.

Phone: 800-323-3875 **www.STMA.org**

New Members*

As a new members, you receive a FREE conference registration, value $375, to be used within 3 years! Just indicate your status on the conference registration form.

Did someone refer you to STMA? We would like to thank them, and reward them with an STMA $100 voucher.

Person who referred you:

_____

Facility name:

_____

*Not been an STMA national member since 2000. New student and affiliate memberships do not qualify for the free conference registration. However, all members are eligible to receive the $100 voucher for referring a new qualifying member.

Optional events enrich Conference experience for attendees

CELEBRATE STMA'S 25TH CONFERENCE & EXHIBITION in San Antonio with all the exceptional sessions, seminars, and workshops you've come to expect from the industry's premier sports field association. Explore the rich culture, cuisine and character of a city that has proven to be one of our nation's most endearing travel destinations and benefit from the ultimate learning event of the year!

Besides the numerous educational opportunities available to attendees, the conference features many optional activities that are sure to enrich every attendee's experience.

SAFE GOLF SCRAMBLE
TUES., JAN. 21, 9 AM – 4 PM

The SAFE Golf Tournament will be held at The Republic Golf Club, 10 minutes from the STMA host hotel. The course routing follows Salado Creek as it winds through heavily wooded areas, making each hole completely secluded. The terrain is mostly flat and has player-friendly features such as wide fairways with generous landing areas and open approaches. Republic has four sets of tees that allow players to adjust the game to their skill level. Transportation, lunch, hole-in-one and other prizes are included. Rental clubs are available. Pre-registration is required. Fees are donations to The SAFE Foundation, a 501 (c)(3) charity of the Sports Turf Managers Association. Proceeds from the tournament go directly to fund scholarships and educational outreach.

NEW THIS YEAR – THE SAFE FOUNDATION 5K RUN OR WALK!
FRI., JAN. 24, 3 PM.

Join your peers in this inaugural event! For your entry fee of $35, you get a great 5K course, an event managed by professionals and a high quality shirt that will definitely become a keepsake. Start training now to take top honors and to help SAFE achieve its goals. Pre-registration is required.

SEMINAR ON WHEELS TOUR
TUES., JAN. 21
FULL DAY TOUR, 7 AM – 5 PM

The tour begins at the STAR soccer complex, a 13-field natural grass complex located in the former Longhorn Quarry. STAR is home to the San Antonio Scorpions, a new professional soccer team playing in the North American Soccer League (NASL). Tour stops also include Texas State's Jim Wacker Football Field in Bobcat Stadium, which recently had a $20 million renovation, and its softball and baseball fields. The baseball field has a special infield mix that reduces the need for tarping. Participants will stop next at the Park West Athletics Complex that holds a new International Association of Athletics Federations (IAAF) track and Fédération Internationale de Football Association (FIFA) soccer field at the University of Texas–San Antonio. These facilities opened in August, each seat 1,000 people, and were built through a unique partnership with the university, the City of San Antonio, and Bexar County. The final stop is at Oak Hills Country Club, one of the oldest private country clubs in the country, to tour the renowned tennis centre. It has a rare combination of three court surfaces including grass, clay and hard surface. Transportation and lunch included. Pre-registration and additional fee required.

SEMINAR ON WHEELS TOUR
FRI., JAN. 24
HALF DAY TOUR, 1 – 5 PM

Participants will see the baseball, softball, soccer, football and intramural fields at Trinity University. These fields are in an urban setting and are closely located by each other. Trinity has no practice fields. The next stop is The Park at St. Mary's University, a new sports complex that has baseball, softball and soccer. The new 2200-seat baseball stadium, renamed Dickson Stadium for its benefactor, is built on the steel structure of the previous stadium. The final stop is at Nelson Wolff Stadium, the oldest ballpark in the Texas League and home to the Missions, AA minor league baseball team. Many high schools and colleges play at Nelson Wolff including the UTSA Roadrunners. Transportation provided. Pre-registration and additional fee required.

RIVERWALK HORTICULTURAL TOUR
FRI., JAN. 24
TWO DEPARTURES: 2 – 3 PM
AND 2:30 – 3:30 PM

Board a barge and take a tour of the world-famous Riverwalk. Hear how all of the plant materials are managed in a 100 percent organic program from the horticulturists for the Riverwalk. Pre-registration and additional fee required. Each tour is limited to 25 people, so sign up early.

CSFM TESTING
TUES., JAN. 21, 3:30 – 7:30 PM &
SAT., JAN. 25, 8 AM – 12 PM

Pre-qualification and pre-registration by Dec. 15 is required for those who wish to take the exam. If you test on Tuesday and do not pass all of the sections, you may be able to retest on those sections on Saturday. To find out if you qualify for the certification program, call STMA at 800-323-3875.

ASBA TESTING
SAT., JAN. 25, 8 AM – 1 PM

The American Sports Builders Association (ASBA) offers three certifications for field builders and will be offering these tests during the STMA Conference. To find out if you qualify to test, go to www.sportsbuilders.org. The deadline to apply to test is Dec. 15. Those testing must register for the STMA conference, purchasing a one-day package at a minimum. Questions? Contact ASBA, 866-501-2722.

CHAPTER OFFICERS TRAINING – FOR CHAPTER BOARD MEMBERS

Tues., Jan. 21, 6 – 9 pm (Dinner provided)

Chapter board members are invited to attend a chapter networking and brainstorming session to address the challenges of strengthening your chapter with a focus on how to fundraise and your role as a volunteer leader. Preregistration is required.

NEW TIME!
WOMEN'S FORUM LUNCH
WED., JAN. 22, 12 – 2 PM

Celebrating its seventh year, all women at the conference are invited to participate in a facilitated discussion and enjoy lunch. ■

STMA engages public relations firm

AT ITS FALL MEETING, the STMA Board of Directors approved the hiring of Buffalo Communications to help gain recognition for members and the profession. Buffalo is headquartered outside Washington, DC, and has offices in New York, Boston, Miami, Minneapolis, Pinehurst (NC) and Phoenix.

Buffalo presented to the Board a proposal and scope of work to help grow STMA's membership and overall influence through a comprehensive publicity and media relations program. The Board met with Buffalo in early November and, within 2 days, they had lined up a television interview and articles in four print publications, such as the Denver Post and *Stadia* magazine.

A division of Billy Casper Golf, Buffalo Communications has a client base of top golf, sport and lifestyle brands. Some of these include World Golf Foundation, LPGA Tour, Fila and ECCO Sport.

"Buffalo's deep connections in the sports industry played a role in our Board's selection of them," says STMA President James Michael Goatley, PhD.

One of Buffalo's main charges is to elevate the perception of the work of the individual member with their employers.

"Our members tell us that their employers often don't understand the complexity, technical knowledge and expertise that is needed to manage sports fields," says Goatley. "Buffalo will help educate these employers by getting media attention for sports turf managers at all levels, particularly for our schools and parks members," Goatley says.

Rich Katz, Managing Director of Buffalo is impressed with STMA's membership.

"STMA is a tightly-knit and highly-engaged organization of talented professionals who consistently employ best practices in the art and science of sports field management," says Katz. "We have a unique opportunity to tell countless stories, nationally and locally, about STMA members."

Although Buffalo's role will primarily focus on proactively reaching out to the media, they will also help STMA when it is necessary to react to a field situation.

"We know that Buffalo will be a great resource to help us to more quickly and efficiently respond on behalf of our membership regarding crises and unforeseen problems that arise on sports fields," says Goatley.

Buffalo will be attending STMA's national conference to interact with members and to gather story ideas. They will present their strategies during the STMA Annual Meeting, Thursday, January 23, at noon. STMA will be regularly reporting on this campaign's progress in *SportsTurf* and *News Online*. For 24/7 access to information, check STMA's Media Tab at STMA.org.

STMA Affiliated Chapters Contact Information

Sports Turf Managers Association of Arizona: www.azstma.org

Colorado Sports Turf Managers Association: www.cstma.org

Florida #1 Chapter (South): 305-235-5101 (Bruce Bates) or Tom Curran CTomSell@aol.com

Florida #2 Chapter (North): 850-580-4026, John Mascaro, john@turf-tec.com

Florida #3 Chapter (Central): 407-518-2347, Scott Grace, scott@sundome.org

Gateway Chapter Sports Turf Managers Association: www.gatewaystma.org.

Georgia Sports Turf Managers Association: www.gstma.org.

Greater L.A. Basin Chapter of the Sports Turf Managers Association: www.stmalabasin.com.

Illinois Chapter STMA: www.ILSTMA.org.

Intermountain Chapter of the Sports Turf Managers Association: http://imstma.blogspot.com/

Indiana - FORMING - Contact Clayton Dame, Claytondame@hotmail.com or Brian Bornino, bornino@purdue.edu or Contact Joey Stevenson, jstevenson@indyindians.com

Iowa Sports Turf Managers Association: www.iowaturfgrass.org.

Kentucky Sports Turf Managers Association: www.kystma.org.

Keystone Athletic Field Managers Org. (KAFMO/STMA): www.kafmo.org.

Michigan Sports Turf Managers Association (MiSTMA): www.mistma.org.

Minnesota Park and Sports Turf Managers Association: www.mpstma.org

MO-KAN Sports Turf Managers Association: www.mokanstma.com.

Nebraska Sports Turf Managers Association: sphillips4@unlnotes.unl.edu

New England STMA (NESTMA): www.nestma.org.

Sports Field Managers Association of New Jersey: www.sfmanj.org.

Sports Turf Managers of New York: www.stmony.org.

North Carolina Chapter of STMA: www.ncsportsturf.org.

Northern California STMA: www.norcalstma.org.

Ohio Sports Turf Managers Association (OSTMA): www.ostma.org.

Oklahoma Chapter STMA: 405-744-5729; Contact: Dr. Justin Moss okstma@gmail.com

Oregon STMA Chapter: www.oregonsportsturfmanagers.org oregonstma@gmail.com

Ozarks STMA: www.ozarksstma.org.

Pacific Northwest Sports Turf Managers Association: www.pnwstma.org.

Southern California Chapter: www.socalstma.com.

South Carolina Chapter of STMA: www.sc-stma.org.

Tennessee Valley Sports Turf Managers Association (TVSTMA): www.tvstma.com.

Texas Sports Turf Managers Association: www.txstma.org

Virginia Sports Turf Managers Association: www.vstma.org.

Wisconsin Sports Turf Managers Association: www.wstma.org.

importance is the D1 protein because it exhibits the highest turnover rate of all the thylakoid proteins, and is highly vulnerable to singlet oxygen, a free radical.

ANTIOXIDANTS

The antioxidants a-tocopherol (vitamin E), ascorbic acid (vitamin C), carotenoids (B-carotene), vitamin B6 and mannitol in some biostimulants play a vital role in scavenging free radicals and helping protect chloroplasts, thylakoid membranes inside the chloroplasts, photosystem I and photosystem II.

In terms of its antioxidant properties, carotenoids can protect photosystem I and photosystem II in one of four ways: by reacting with lipid peroxidation products to terminate chain reactions; by scavenging singlet oxygen and dissipating the energy as heat; by reacting with triplet or excited chlorophyll molecules to prevent formation of singlet oxygen; or by dissipation of excess excitation energy through the xanthophyll cycle.

Xanthophylls function as accessory pigments for harvesting light at wavelengths that chlorophyll can't and transfer the light energy to chlorophyll. But, they also absorb excess light energy and dissipate it to avoid damage in the xanthophyll cycle.

A-TOCOPHEROL (VITAMIN E)

A-tocopherol (vitamin E) is considered a major antioxidant in chloroplasts in at least two different but related roles. It protects photosystem II from photoinhibition and thylakoid membranes from photooxidative damage. The antioxidant properties of vitamin E are the result of its ability to quench singlet oxygen and peroxides.

ASCORBIC ACID (VITAMIN C)

It's generally believed maintaining a high ratio of ascorbic acid is essential for the scavenging of free radicals and is needed in high concentrations in the chloroplasts to be effective in defending the turfgrass against oxidative stress. Although ascorbic acid can directly scavenge the free radicals superoxide and singlet oxygen, the main benefit ascorbic acid plays in the prevention of free radicals is that it's an excellent scavenger of the hydroxyl radical. The hydroxyl radical is dangerous to turfgrass because it can inhibit carbon dioxide assimilation by inhibiting several Calvin cycle enzymes.

VITAMIN B6

Apart from its function as a cofactor, vitamin B6 is also thought to act as a protective agent against reactive oxygen species,

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SportsTurf ADVERTISERS' INDEX

such as singlet oxygen. Vitamin B6 is also the master vitamin in processing amino acids and plays an important role in developing proteins specifically designed to help chloroplasts, thylakoid membranes, photosystem I, and photosystem II to function properly.

MANNITOL

The antioxidant mannitol has the ability to protect and quench two damaging free radicals: singlet oxygen and hydroxyl. Singlet oxygen is damaging because it can react with proteins, pigments and lipids and is thought to be the most important species for light-induced loss of photosystem II activity, as well as the degradation of the D1 protein. It has been demonstrated that when mannitol is present in the chloroplasts, it can protect plants against oxidative damage by the hydroxyl radicals.

MANGANESE AND MAGNESIUM

Both of these nutrients are attached to the chlorophyll molecule that's located inside the chloroplasts. These two nutrients play a part in making turfgrass greener by helping develop chlorophyll. They also transport other vital nutrients and are responsible for many enzymatic functions and help prevent chlorophyll degradation in the cells.

CARBON

There's new evidence carbon plays a role in the development of the turfgrass plant leaf, and that a reduction in carbon reduces photosynthetic activity, which reduces carbohydrate availability to the turfgrass plant. There's also new evidence to suggest proper development of the turfgrass plant can't occur without proper amounts of carbon in the chloroplast. There's more evidence to suggest that, if there's an abundant source of carbon in the thylakoid membranes inside the chloroplasts, it can be mobilized for use as an energy source during senescence.

HUMIC ACIDS

Humic acids are another compound that contain antioxidant properties that promote the scavenging of free radicals. The added benefits of humic acid are that they increase the availability of micronutrients, phosphate and potassium to the plant and enhance the chlorophyll content of turfgrass.

Humic acids also stimulates root initiation because of the auxin-like activity they contain, which is most likely because of their ability to inhibit indoleacetic acid oxidase breakdown. ■

Jeff Haag is sports turf specialist at John Carroll University, University Heights, OH.

Q&A

Bermudagrass dance

BY DR. DAVID MINNER

Professor, Iowa State University

Questions?

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I was watching a Philadelphia Eagles home game and I was shocked to hear the announcer say they had bermudagrass on the field, especially since it looked so good. I thought it was a southern grass. Can I use it at my high school field here in Ft. Wayne, IN?

The Philadelphia Eagles do in fact have "Patriot" bermudagrass growing on their stadium field and head sports turf manager Tony Leonard is one of those creative agronomists that started pushing the use of bermudagrass beyond the upper limit of the transition zone that runs just to the north of Interstate 70. It's important to remember that Tony along with some of the other professional and college teams have many resources, like a subsurface heating system, at their disposal to successfully grow bermudagrass beyond its normal limit. They also have the backing to replace the field with sod if the bermudagrass does not perform as expected.

There are also a few examples of bermudagrass used in the north on native soils without any modified heating system. In Ames, IA at latitude 42° N we first started seeding bermudagrass in 1998 on difficult practice fields in the summer to produce at least some vegetation for the start of the playing season in August and September. Bare soil, irrigation, nitrogen feeding, and a hot sunny summer were critical for successful and rapid growth. Back then we were using varieties like "Yukon" and "Princess" while "Riviera" is a more popular type now. We did not expect the varieties to overwinter and mostly they disappeared from winter kill.

In the past 5 years however we have been seeing patches of bermudagrass, which must have come from these seeded types, popping up all over our turfgrass research farm in Ames. In fact, we are starting to get samples of bermudagrass coming to us from lawn care companies throughout Iowa.

If you are considering bermudagrass I suggest sprigging or sodding a vegetative type to insure better coverage and improved turf quality. Seeded bermudagrass will only establish where the soil is completely bare; it will not establish when seeded into an existing stand of cool season grass.

At the STMA Field Day in 2009 Steve Bush sprigged 5000 sq. ft. of Tim VanLoo's Iowa State University practice football field with "Patriot" bermudagrass and it has survived at 42° N with no winter kill and no covering or supplemental heating. At the University of Illinois, Urbana-Champaign, (42° N) John Donehoe has successfully grown bermudagrass for several years without supplemental heating. Based on this it would seem possible that you could grow bermudagrass successfully in Ft. Wayne, IN at 41° N. In fact, I would like to find the most northern location where bermudagrass has been successfully grown and even where it has been attempted and not been successful.

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These few examples lead me to give you a big "maybe" recommendation and certainly I would not use bermudagrass on my main competition field until I had successfully grown it on a practice or demonstration area. Here are a few other considerations when contemplating bermudagrass use in northern climates: Start with a test plot at your facility of at least 1000 sq. ft.; better yet try it on two or three locations around your facility. If it fails you don't want it to be on your main competition field.

Turfgrass breeders and growers in the heart of the transition zone are constantly aware of winter kill and they select and manage for improved winter hardiness. Winter kill can occur directly from lethal low temperatures after the bermudagrass has gone dormant or it can occur from brief cold snaps before the grass hardens off or just as it is waking up in the spring. The chance for this to occur in northern climates is much greater than in the transition zone. As you go north the growing season for bermudagrass shortens and it is more difficult to have it recover from traffic. Fall nitrogen fertilizer is commonly practiced on cool-season grasses but it will greatly increase the chance of winter kill on bermudagrass. I would not recommend it if you plan on playing fall football and spring soccer. That is just too much pressure on the grass surface when it is dormant and not growing. It has been most successfully used on college and pro practice fields during late summer and early fall from August through September. The team can then move to another cool-season field once the bermuda goes dormant. So my recommendation with bermudagrass in the north is, she can be a real sweetheart but take her to your high school prom and learn to dance before you say I do. ■

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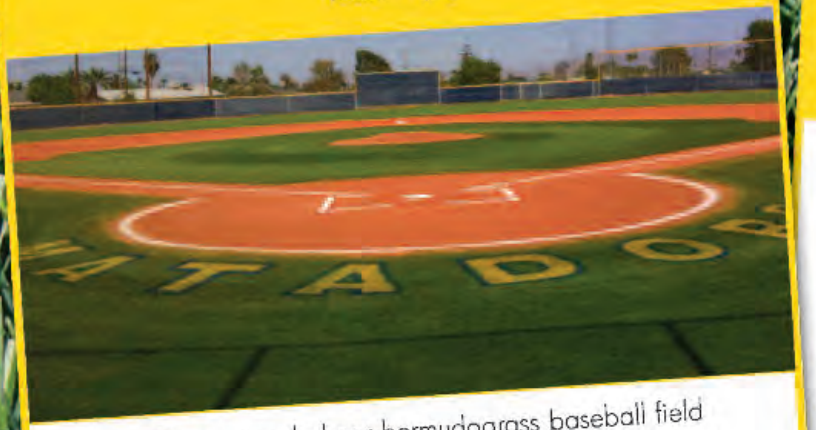

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