The UNSTOPPABLE Poa Annua

A Spring Sports Turf Program for Broadleaf Weed Control

The Dreaded Artillery Fungus

Plus, Special Inside — Western PA Turfgrass Conference, February 25–27, Program & Details
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PTC Membership Application

By joining PTC, your club or company, or you as an individual, become part of an organization dedicated to promoting professionalism in all aspects of the turfgrass industry and support of the Center for Turfgrass Science at Penn State.

- PTC provides educational opportunities for practitioners in all turfgrass-related industries;
- PTC provides grants and other support for education and research programs at Penn State University;
- PTC encourages future industry leadership by granting scholarships and awards;
- PTC acts as a liaison for the green industry by promoting open dialogue with government agencies, private institutions, and the general public.

Membership Categories (Check One)

☐ Individual -- for the green industry professional who wants to be part of the Council and support its activities. $50 annually

Name

Position/Title

Company or Club

Mailing Address

City State Zip

Phone Fax

Email address

☐ Sustaining -- for the business or turf professional who takes an active role in promoting the profession of turfgrass management, professional development, and educational opportunities in the turfgrass industry. $200 annually

☐ Partner for Growth -- for the business or club desiring a stronger affiliation with the Council and the Penn State Turfgrass Science Program. $400 annually

Company or Club

Mailing Address

City State Zip

Primary Contact Individual

Position/Title

Phone Fax

Email address

Organization Website

Payment Method

The membership year is July 1 through June 30.

Total Payment Enclosed for Membership $ ________

TO MAIL payment send check or money order payable to PA Turfgrass Council with Membership Application form to:

PA Turfgrass Council
PO Box 550
Boalsburg, PA 16827
Phone: 814-237-0767
Email: info@paturf.org

OR FAX the application form with credit card payment noted below to:

PA Turfgrass Council
Fax: 814-237-0767

Credit Card Information: ☐ Visa ☐ MasterCard

Name on card (print) __________________________

Account Number __________________________

Exp. Date Sec. Code Signature

Our Federal ID #: 24-6025307

PTC Database Information

Please define your area of interest by checking the appropriate box.

☐ Golf Course ☐ Lawn Service
☐ Athletic Field ☐ Sod Industry
☐ Landscape/Nursery ☐ Grounds Maintenance
☐ Supplier Representative

☐ Other ___________________
Open Letter to All Turf Owners

I address this letter to all who own turfgrass, including those of you who own the property on which turfgrass exists. More specifically, I address property owners to whom the appearance and/or playability of that turf matters. More specifically still, I address those of you who have entrusted the care of said turf to a steward. Furthermore, I address those of you who have ever criticized your steward’s capability to provide said appearance and/or playability without first understanding the dynamics of the challenges. For those of you to whom this category applies, I offer this letter to respectfully suggest that you contemplate the challenge of turf care prior to criticizing the results.

Now, before you either prepare your armor and chain mail or, worst yet, put down this publication, please allow me to elaborate. I address this letter not to attack your logic or degrade your intellect, but rather to offer a different perspective on the topic.

It is important to understand the role of the steward. The online Macmillan Dictionary offers several definitions of steward; however, the most applicable version reads this: someone who takes care of something and protects it. Stewards of turf often have different titles, ranging from Groundskeeper to Director to Superintendent to Manager to Lawn Care Specialist, and the list certainly continues.

Regardless of title, these stewards all share one common goal, which is to care for and protect the turfgrass for which you do not have either the time and/or skill set to care for yourself. Remember, we have already established that the appearance and/or playability of the turf are important to you; you therefore entrust the care and protection of the turf to a steward. The simple fact that you must entrust this to someone is an indication that inherent challenges exist.

Please allow me to now describe the challenges to turf. Unfortunately, owners typically focus solely on appearance and/or playability — not on plant health. Many of you may correctly assume that one cannot have appearance and/or playability without health, and largely that is true. While it is most definitely feasible to sacrifice turf health in exchange for a temporary and incremental increase in appearance and/or playability, unfortunately this practice is unsustainable in the long term. All too often, I know of examples in which this very barrier is requested or, in some instances, demanded. Generally speaking, I have found that those owners who care to learn about and concern themselves with the health of their turf are ultimately more informed regarding turfgrass science and therefore less likely to criticize.

The only true manner to ensure the long-term appearance and/or playability of turf is to first prioritize turf health. Only truly healthy turf will exhibit those characteristics in a beneficial and long-term manner. Sacrificing the health of your turf for a temporary and incremental improvement in appearance and/or playability is unwise and, in many instances, is the eventual cause for dead turf.

 Granted, in the format of this letter, there is no conceivable manner in which I can describe to you all of the challenges to turfgrass health; textbooks and graduate-level courses exist on that topic. Please allow me instead to describe these challenges to you as simply and concisely as I can.

Imagine, if you will, that you are the turfgrass. You are the turfgrass in the sense that you will experience the daily routine and challenges that your turf often does. Come along with me, then, for a day in the life of your turf…

You cannot move. You are eternally trapped in the same place. You rely on your steward to routinely provide you with the crucial life-sustaining elements and water essential to your existence, without which you will slowly and torturously wither away. Every day, or every few days, one of your appendages is lopped off. Granted your appendages will grow back in time; however, upon each slice, you are left with a gaping wound exposed to the external elements of weather and the risk of infection by bacterial, fungal or viral means. Your wound heals quickly only if your steward adeptly sharpened and honed the blade expertly enough to cut cleanly.

Despite your wound having healed, the pestilence of disease envelops you in waves, day after day and night after night. You rely on your steward to intu-
itively decipher often-cryptic weather forecasts to determine those that can be trusted to accurately predict the conditions that foster the greatest chance for infectious outbreak and provide you with the proper medical treatments to prevent the disease. All the while, you know that disease can literally wipe you out overnight. You can be healthy in the evening and pestilent in the morning.

What’s worse, every hour of every day, you are ogled by a long list of creatures and organisms equipped with various methods for either extracting your blood or burrowing into your flesh to deposit their offspring, only to hatch in a number of days and feast on you from the inside out. Your only defense against such defilement rests in the astute skill of your steward to examine weather patterns and pest-migration patterns to dose you with preventative treatments in a timely manner. Finally, and perhaps worst of all, you are relentlessly trampled, time and time again, by creatures and equipment weighing thousands of times your own mass.

Imagine all of that inflicted upon you. Now, imagine that your steward is the only guardian you have to mitigate these enormous challenges. [It is worth noting that many stewards must also carefully balance the cost of these numerous mitigating treatments so as not exceed budgetary constraints as well.]

Truthfully, this is a day in the life of the turf you own. I hope that this example sheds light on the challenges that the steward of your turf combats daily. Please accept my apology for the vivid nature in which I described those challenges. Unfortunately, it is with those often-brutal consequences that turf is challenged on a daily basis. Any one of these challenges can cause severe enough damage to compromise the appearance and/or playability — better yet, health — that you desire.

Thank you sincerely for reading this open letter. Finally, if I may respectfully make a few simple requests of you, they are as follows: Please kindly remember that turf health trumps both appearance and playability. Prior to criticizing your steward for the one or more challenges that affected your turf, please instead consider the many foes successfully vanquished previously. Lastly, please consider the substantial effort your steward invests to navigate the myriad of challenges facing your turf, and take solace in knowing that although not all challenges are successfully vanquished every time, in your stead, the steward in which you trust carries the burden of those foes every day.

Respectfully,
Jason M. Hurwitz
2013 PTC President
WESTERN PENNSYLVANIA TURFGRASS CONFERENCE
February 25–27, 2014 • Four Points Sheraton Pittsburgh North • Mars, PA
Presented by the Pennsylvania Turfgrass Council and Pennsylvania State University

TUESDAY, FEBRUARY 25

Registration Open: 8:00 a.m. – 3:00 p.m.
Trade Show Open: 8:00 a.m. – 5:00 p.m.
Silent Auction Open: 8:00 a.m. – 5:00 p.m.

GCSAA Education Points
(full-day attendance): 0.55

LANDSCAPE & ORNAMENTAL MORNING SESSION
9:00 a.m. – 12:00 p.m.
Session Chair: Mr. Darrin Batisky, Jacobsen — a Textron Company
9:00 a.m. – 10:00 a.m.
Why Warm-Season Grasses in the North?
   Dr. David Huff, Penn State University
10:00 a.m. – 11:00 a.m.
Brown Marmorated Stink Bugs: Recent Research, Agricultural and Ornamental Implications, and Impacts on Homeowners
   Mr. Steve Jacobs, Penn State University
   2 Pesticide Credits in Cat. 6, 18, 23, PC
11:00 a.m. – 11:30 a.m.
Proper and Safe Use of PPEs and Spill Kits
   Ms. Susan Boser, Penn State Extension
   2 Pesticide Credits in Core 00

LANDSCAPE & ORNAMENTAL AFTERNOON SESSION
1:00 p.m. – 3:00 p.m.
Session Chair: Chase Rogan, PureTurf Consulting
1:00 p.m. – 2:00 p.m.
Current Developments in Pesticides and Turf Science: How to Inform the Client
   Mr. Chris Brown
   2 Pesticide Credits in Cat. 7, 18, 23, PC
2:00 p.m. – 3:00 p.m.
Concepts in Turfgrass Drainage Design and Pesticides Use
   Dr. Andy McNitt, Penn State University
   2 Pesticide Credits in Cat. 7, 18, 23, PC

GOLF MORNING SESSION
9:00 a.m. – 11:30 a.m.
Session Chair: Mr. Toby Kiggins, Green Oaks C.C.
9:00 a.m. – 9:30 a.m.
Presidents’ Turfgrass Update
   Mr. Neil Gartland, Sinking Valley C.C.; Mr. Ian Hoffman, Rolling Rock Club; and Mr. Carl Michael, Down River G.C.
10:00 a.m. – 11:00 a.m.
PGRs and Sports Turf at Heinz Field
   Mr. Chris Ecton, Heinz Field
   1 Pesticide Credit in Cat. 7, 18, 23, PC
10:30 a.m. – 11:30 a.m.
Pesticide Emergencies and Cleanup
   Mr. Jeff Fowler, Penn State Extension
   2 Pesticide Credits in Core 00

GOLF AFTERNOON SESSION
1:00 p.m. – 3:00 p.m.
Session Chair: Ian Hoffman, Rolling Rock Club
1:00 p.m. – 2:00 p.m.
The Population Biology of Putting Green IPM
   Dr. David Huff, Penn State University
   2 Pesticide Credits in Cat. 7, 18, 23, PC
2:00 p.m. – 3:00 p.m.
Aquatic Plant ID and Management
   Ms. Susan Boser, Penn State Extension
   2 Pesticide Credits in Cat. 9, 23, PC

RECEPTION
Immediately after conclusion of afternoon sessions.
Beverages and snacks provided by the PTC.

WEDNESDAY, FEBRUARY 26

Registration Open: 8:00 a.m. – 3:00 p.m.
Trade Show Open: 8:00 a.m. – 4:00 p.m.
Silent Auction Open: 8:00 a.m. – 1:00 p.m.

GCSAA Education Points
(full-day attendance): 0.55

LANDSCAPE & ORNAMENTAL MORNING SESSION
9:00 a.m. – 12:00 p.m.
Session Chair: Mr. Rich Bryce, Advanced Turf Solutions
9:00 a.m. – 10:00 a.m.
Basics of Weed Control in Landscape Turf
   Mr. Steve McDonald, Turfgrass Disease Solutions
   2 Pesticide Credits in Cat. 7, 18, 23, PC
10:00 a.m. – 11:00 a.m.
Key Diseases of Ornamentals in 2013
   Dr. Gary Moorman, Penn State University
   2 Pesticide Credits in Cat. 7, 18, 23, PC
10:00 a.m. – 11:30 a.m.
Growth Regulation and Fertilization, Surface Conditioning and Turf Health: Which Comes First?
   Mr. Keith Happ, USGA Green Section
   1 Pesticide Credit in Cat. 7, 18, 23, PC
11:30 a.m. – 12:00 p.m.
Welcome to the Jungle: Microbial-Based Products for Pest Control and Plant Nutrition
   Dr. Peter Landschoot, Penn State University
   1 Pesticide Credit in Cat. 7, 18, 23, PC
**LANDSCAPE & ORNAMENTAL AFTERNOON SESSION**
1:30 p.m. – 3:30 p.m.
Session Chair: Mr. Rick Catalogna, Walker Supply

- Silent Auction Concludes 1:00 p.m.
- 1:30 p.m. – 2:30 p.m.
  **Clearwing Borers on Trees and Shrubs: Their Diagnosis and Effective Management Strategies**
  **Mr. Greg Hoover,**
  Penn State University
  2 Pesticide Credits in Cat. 5, 6, 18, 23, PC

2:30 p.m. – 3:30 p.m.
**IPM: Common-Sense Pest Control**
**Ms. Sandy Feather,**
Penn State Extension
2 Pesticide Credits in Core 00

**MORNING GOLF SESSION**
9:00 a.m. – 11:30 a.m.
Session Chair: Mr. Jason Hurwitz, Fox Chapel Golf Club

9:00 a.m. – 9:30 a.m.
**Review of 2013 Turfgrass Issues**
**Mr. Keith Happ,** USGA Green Section
1 Pesticide Credit in Cat. 7, 18, 23, PC

9:30 a.m. – 10:00 a.m.
**An Innovative Approach to Dollar Spot Disease Management**
**Dr. Wakar Uddin,**
Penn State University
1 Pesticide Credit in Cat. 7, 18, 23, PC

10:00 a.m. – 10:30 a.m.
**Some Key Arthropod Pests of Eastern White Pine: Their Diagnosis & Management**
**Mr. Greg Hoover,**
Penn State University
1 Pesticide Credit in Cat. 5, 6, 18, 23, PC

10:30 a.m. – 11:30 a.m.
**The Latest and Greatest Pigmented Products for Turf**
**Mr. Steve McDonald,**
Turfgrass Disease Solutions
2 Pesticide Credits in Cat. 7, 18, 23, PC

**AFTERNOON GOLF SESSION**
1:00 p.m. – 3:00 p.m.
Session Chair: Mr. Rick Pagett, CGCS, Penn State Golf Courses

- Silent Auction Concludes 1:00 p.m.
- 1:00 p.m. – 2:00 p.m.
  **Using Insecticide More Effectively by Targeting Multiple Species with the Right Rate at the Right Time**
  **Dr. Albrecht Koppenhofer,**
  Rutgers University
  2 Pesticide Credits in Cat. 7, 18, 23, PC

2:00 p.m. – 2:30 p.m.
**Important Plant Diseases of Ornamentals Around the Clubhouse**
**Dr. Gary Moorman,**
Penn State University
1 Pesticide Credit in Cat. 5, 6, 18, 23, PC

2:30 p.m. – 3:00 p.m.
**Mode of Action of Herbicides Used on Golf Courses**
**Dr. Peter Landschoot,**
Penn State University
1 Pesticide Credit in Core 00

**MORNING BUSINESS SESSION**
9:30 a.m. – 11:00 a.m.
Session Chair: Mr. Clay Alexandrowicz, Nature’s Best Lawncare

9:30 a.m. – 11:00 a.m.
**Customer Communications and Relations**
**Mr. Chris Brown**
GCSAA credits will be issued.

**AFTERNOON BUSINESS SESSION**
1:00 p.m. – 3:30 p.m.
Session Chair: Mr. Clay Alexandrowicz, Nature’s Best Lawncare

- Silent Auction Concludes 1:00 p.m.
- 1:00 p.m. – 2:00 p.m.
  **Starting Up Your Own Business While Balancing Your Current Job**
  **Mr. David Sines**

2:00 p.m. – 2:30 p.m.
**Planning for Your Financial Future, Part 1**
**Mr. Keith Smith**

2:30 p.m. – 2:45 p.m.
**Planning for Your Financial Future, Part 2**
**Mr. Keith Smith**
GCSAA credits will be issued.

**THURSDAY, FEBRUARY 27**

Registration Open: 8:00 a.m. – 10:00 a.m.
No Trade Show Hours
Pesticide Credits (full-day attendance required)
2 credits in Core 00
4 credits in Cat. 7, 18, 23, PC
GCSAA Education Points (full-day attendance): 0.30

**GOLF SESSION**
9:00 a.m. – 12:00 p.m.
Session Chair: Mr. John Yakubisin, Carlisle Country Club

9:00 a.m. – 10:00 a.m.
**Annual Bluegrass Weed Control**
**Dr. Albrecht Koppenhofer,**
Rutgers University

10:00 a.m. – 10:30 a.m.
**Tank-Mixing and Pesticide Compatibility**
**Dr. Mike Agnew,** Syngenta

10:30 a.m. – 11:00 a.m.
**Fairway Topdressing**
**Dr. Andy McNitt,**
Penn State University

11:00 a.m. – 12:00 p.m.
**Love It or Hate It: Poa annua — Manage It or Control It**
**Mr. Steve McDonald,**
Turfgrass Disease Solutions
### Upcoming Events

**Upcoming Event *continued***

**CONFERENCE REGISTRATION**

**Advance Attendee Registration Fees — by February 11**

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<th>Per Non-Member</th>
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**Advance Attendee Registration Fees — After February 11**

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<td>Full Conference (3 or more registrants)</td>
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<td>One-Day Registration</td>
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**IMPORTANT REGISTRATION INFORMATION**

- Lunch is included in Full and Two-Day registrations.
- To be eligible for the Multi-Member discount, all members must be from the same club/company.
- Name badges are required for admission to the Educational Sessions and Trade Show and will be available on site.
- Although registration fees are waived for those over 65 years of age, for the spouses of paid attendees, and for students, these individuals must be registered to receive a name badge. Registrants whose fees are waived may purchase tickets for the lunch buffet for $30 per person per day.
- All cancellations must be received in writing. No refunds will be issued for cancellations after February 11, 2014.

**To Register or Reserve a Table**

Go to — [http://paturf.org/events/view/12](http://paturf.org/events/view/12)

For more information, contact — Info@paturf.org

Early Registration deadline — **February 11, 2014**

Deadline for discounted room rate ($105 per night) at the Four Points Sheraton — **February 13, 2014**

**JANUARY 7–8, 2014**

**2014 Eastern Pennsylvania Turfgrass and Ornamentals Conference and Trade Show**

Crowne Plaza Hotel
King of Prussia, PA

- Keynote Speaker: Beasley Reece, former NFL player and currently Philadelphia CBS 3 sports anchor.
- Educational sessions for:
  - Golf
  - Lawn & Landscape
  - Sports Turf
  - Trees and Shrubs
- Notable Topics
  - USGA Year-in-Review
  - Review of the 113th U.S. Open at Merion Golf Club
  - Earthworm Management
  - The Biology and Management of Annual Bluegrass
  - Weed, Disease and Insect Control in Turf
  - Pest Management of Ornamentals
  - The Business Side of Turf
  - Stormwater Management
  - Pesticide Safety
  - ...and much more!
- Pesticide Credits for PA, NJ, DE and MD
- GCSAA CEUs
- Trade Show
- Silent Auction
- Lunch

For more information: [www.paturf.org](http://www.paturf.org)
JANUARY
30, 2014

2014 Northeastern Pennsylvania Turfgrass Conference and Trade Show
Woodlands Inn • Wilkes Barre, PA

Please email Dr. Andy McNitt for information at asm4@psu.edu.

FEBRUARY
25–27, 2014

2014 Western Pennsylvania Turfgrass, Ornamental and Landscape Conference
The Four Points by Sheraton Pittsburgh North • Mars, PA

New to the conference this year will be a reception in the trade show area after Tuesday’s sessions. Also new this year will be a business session on Wednesday, offering information geared to help with finance, business and customer service for those in the turf, ornamental and landscape industries. Our traditional trade show will feature a wide range of vendors and products. The reception, trade show and Tuesday and Wednesday’s lunches are included in the attendance price. So, please save these dates, and join us for the Western PA Turfgrass, Ornamental, and Landscape Conference.

- More than 40 Pennsylvania pesticide update credits available in categories 6, 7, 9, 10, 23, Core and PC.
- GCSAA update credits will be provided.

For more information, contact:
Kim Pagett, (814) 237-0767

GCSAA update credits will
be provided.

For more information, contact:
Kim Pagett, (814) 237-0767
For good or bad, *Poa annua* (or annual bluegrass) has been part of the golf industry for more than 100 years. During this time, a few golf course superintendents have successfully managed to propagate unique, perennial strains of *Poa annua* that possess unbelievably high turf quality. In fact, most U.S. Open tournaments played in the past 50 years have been on greens that are predominately *Poa annua* rather than creeping bentgrass, which is the industry’s preference for putting surfaces in the north.

This preference for creeping bentgrass has led most superintendents to focus their efforts, over the past century, on eliminating *Poa annua* from their putting surfaces. In the 1960s, they used heavy metal arsenate herbicides. In the 1970s, Endothal was hailed as the cure-all for eliminating the highly invasive *Poa*. Over the past 20 years, a combination of plant growth regulators and newer herbicides employing some novel chemistry has been the go-to solution. Last year, FMC Professional Solutions held a “Toughest Weed” competition at the Golf Industry Show in Las Vegas. The hands-down winner, from 328 voting superintendents from over 40 states was, you guessed it, *Poa annua*.

Today, all hope of ultimately controlling *Poa annua* rests on a new Korean herbicide called “PoaCure” (Methylazol 2 EC). Not too long ago, Dr. Nick Christians (Iowa State University) wrote an interesting article in which he reviews the past 90 years of *Poa annua* herbicide control and concludes that such control typically is limited to certain regions and/or specific types of *Poa annua*. In his article, Dr. Christians places his ultimate hope of *Poa* control in the genetically modified, glyphosate-resistant creeping bentgrasses. Last year, however, even glyphosate-resistant *Poa annua* was reported by researchers at the University of Tennessee.

Not all *Poa* control efforts are herbicide based. Approximately every few years or so, low phosphorous fertility, low nitrogen fertility, restricted irrigation regimes, etc., are demonstrated in the scientific literature to suppress *Poa annua* growth and, thus, if used judiciously, should ultimately control the beast. Even breeding improvements in creeping bentgrass cultivars — including higher shoot density and a more upright growth habit, which incidentally are characteristics possessed by the unique perennial strains of *Poa* at top courses — are touted as controlling *Poa* invasion.

Nearly all of these scientific studies typically look at controlling/suppressing *Poa* over a relatively short time frame, generally two years, three at the most. However, the reaction of *Poa annua* to control methods in its arms race with superintendents is carried out over the long term. Even for herbicidal-control programs, sub-lethal applications are often recommended in order to prevent the occurrence of too many dead spots all at one time on a putting surface. Such practices have to give an edge to *Poa annua*’s long-term evolutionary strategy in overcoming such short-term control efforts. In our experience, the best *Poa* control method involves kneepads and a sharp knife, which, if used religiously, can guarantee 100% *Poa* control.

Over the past 17 years, our breeding program of greens-type *Poa annua* has, like the Christians article, given us a relatively long-term perspective on the evolutionary abilities of *Poa annua*. And one of our unanswered questions has been, “How can *Poa annua* be so diligent and overcome such a variety of control methodologies?” The essence of this question is, “What makes *Poa annua*, *Poa annua*” or in other words, “Where did *Poa annua* come from?” Perhaps, by answering this question, we can gain some valuable insight into why *Poa annua* is so unstoppable.

**Poa’s parentage**

One way to answer this question is to find out who are the parents of *Poa annua*. We all know from growing up that different families tend to exhibit different traits. Some families all have red hair and freckles. Other families seem to produce amazing lineages of superior athletes. Well, maybe the same is true for *Poa annua*.

Over the years, several different family lineages have been proposed for *Poa annua*. Back in the 1930s, it was a toss-up between *Poa supina* (supine bluegrass) and *Poa infirma* (weak bluegrass) as to who served as the parents of *Poa annua*. We do know that *Poa annua* is a...
As evidenced by this links green near Melbourne, Australia, *Poa annua* is one of the most widely distributed plant species in the world, as well as a major component of the golf industry worldwide, even though there have been decades of effort to eradicate the species.

Polyplod species, meaning that it has more than one set (ploid) of chromosomes, which are packets of DNA inherited from parent to progeny. One scenario suggested that *Poa annua* was simply a doubling of *Poa infirma* chromosomes (known as an autotetraploid), while another scenario demanded that it was a hybrid between *Poa supina* as the mother and *Poa infirma* as the father (known as an allotetraploid). The most recent proposal, made in 1989, was that *Poa annua* was an allotetraploid hybrid between *Poa supina* as the mother and *Poa trivialis* (rough-stalked bluegrass) as the father. However, the cytogeneticist (a person who studies the shape and sizes of chromosomes) Koshy, demonstrated back in 1968 that the shapes and sizes of *Poa annua*’s chromosomes do not fit any of these scenarios, and so he suggested that one of these parental species may be correct but that the other parent may be an unknown, or perhaps extinct, species.

Our [the authors’] recent molecular research has positively, absolutely confirmed that *Poa infirma* served as the mother and *Poa supina* served as the father of *Poa annua* and that, sometime during this process of origin, *Poa annua*’s chromosomes experienced a substantial restructuring event.

Now let’s take a look at what this new information means. *Poa infirma* is a true annual species that inhabits the hot, dry Mediterranean coastline. It is called weak bluegrass because, even as an annual species, *Poa annua* has a remarkable ability to invade the close mowing heights of golf course putting greens and, in doing so, evolves unique strains known as greens-types that are perennial. As a result of proper management, the greens-type forms of *Poa annua* have evolved many traits that are highly desirable for putting surfaces, including high shoot density, dark green color, environmental stress tolerance and disease resistance.
under optimal growing conditions, it lives for only 8 to 12 weeks, wherein it produces seed and then dies. Poa supina, on the other hand, is a true perennial species inhabiting the cold, forested mountainous regions of central and northern Europe. Profusely stoloniferous, Poa supina is widely planted for soccer fields and golf course fairways in Germany. Thus, in terms of adaptability, Poa annua has some very diverse parents, and it seems to be able to utilize either of these diverse lineages to become one of the most widely distributed plant species in the world.

Industry relevance
What this means for superintendents is that Poa annua can behave either as an annual or as a perennial, depending on the situation at hand. Thus, when an herbicide or other control method reports a 70% rate of control, the question becomes, “Did the treatment eliminate just the annual types or just the perennial types, or was it equally effective in controlling both types?”

Another trait that Poa annua received from its parents was the ability to set viable seed beneath mowing heights of less than 1/10”. This trait not only enables Poa annua to rapidly recover from chemical control methods but also to recover from ice damage, disease devastation or even when greens are mowed too low in August for PGA tournaments. Not only does Poa annua recover, but also the same strains come back that were originally present before the devastation. This is why many superintendents who have Poa greens sleep better at night, because they know that no matter what happens, their Poa will always come back.

Interestingly, however, neither of Poa annua’s parents was the ability to set viable seed beneath mowing heights of less than 1/10”. This trait not only enables Poa annua to rapidly recover from chemical control methods but also to recover from ice damage, disease devastation or even when greens are mowed too low in August for PGA tournaments. Not only does Poa annua recover, but also the same strains come back that were originally present before the devastation. This is why many superintendents who have Poa greens sleep better at night, because they know that no matter what happens, their Poa will always come back.

Our extensive molecular research has shown that Poa annua originated relatively recently from the hybridization between Poa infirma as the maternal parent and Poa supina as the paternal parent, followed by a whole genome-doubling event.
We believe that this remarkable ability of *Poa annua* is the direct result of its chromosomal rearrangements between its parental chromosomes. Furthermore, we believe (based on evidence from model plant species like Arabidopsis, rice and wheat) that *Poa annua*’s chromosomal rearrangements are fundamental to its ability to overcome control methods and, ultimately, to its ability to adapt to ever-changing environmental conditions, including our management programs.

Our research also indicates that the original hybridization events that led to the origin of *Poa annua* can essentially be considered as present day in evolutionary terms. This means that *Poa annua* is a remarkably young species that has covered planet Earth in a very short amount of time. It can be found in northern arctic meadows and in volcanic ash; it is the most abundant species in Antarctica, and it is an invasive weed on hiking trails of Mount Kilimanjaro on the equator. Given *Poa annua*’s extensive ability to spread via migratory waterfowl, ocean-going mammals and humans and its ability to establish in a wide variety of environmental conditions, the unstoppability of *Poa annua* on golf course putting greens does not seem all that remarkable (or at least puts it in perspective).

This most recent research of ours was funded through PTC’s Growing the Game and through the Stanley J. Zontek Turfgrass Endowment, and so it seems fitting to leave with a quote of Stan’s from 1973:

“No matter what species or combination of grass species grown on a golf course, it is the good management practices exercised by the superintendent that help the grasses survive and provide the excellent playing surface that the membership wants... Therefore, good management should provide good turf, which should result in better golf.”

Stanley J. Zontek
USGA Green Section Record

References


Landscaper’s Corner

The DREADED Artillery Fungus

By Mike Fidanza, Ph.D., Professor of Plant and Soil Science, Penn State – Berks Campus, and Don Davis, Ph.D., Professor of Plant Pathology, Dept. of Plant Pathology and Environmental Microbiology, Penn State – University Park

Landscape mulch is commonly used to decorate the base of trees, shrubs, flowerbeds and other ornamental plantings. Mulch helps maintain soil moisture, suppress weeds and enhance the aesthetic beauty of the landscape. Who doesn’t like a neat, evenly applied layer of mulch to provide the impression of a well-maintained and highly valued property? In the southeastern region of Pennsylvania alone, more than three million cubic yards of mulch are used annually for residential and commercial landscapes. With all this mulch, a new nuisance arrived in the form of the dreaded “artillery fungus.”

Modern mulches

In the past, landscape mulch was comprised mostly of tree-bark waste products obtained from sawmills. Today, mulches are mainly formulated from wood, rather than bark, and include byproducts from pallet-recycling facilities, scrap wood from sawmills, and stumps, soil and stones mixed in large tub-grinders from land-clearing operations. Also, today’s mulches are double- and triple-ground to a finer texture, which enhances the visual appearance and increases moisture-holding capacity, and dyes are even added (i.e., black, deep brown or red) to satisfy customer demand. Bark, as opposed to wood, contains compounds that inhibit fungi, whereas modern mulches derived from wood favor the growth of the artillery fungus.

What grows in mulch?

Some strange and fascinating fungi and molds commonly grow in mulch, and these should not be identified as the artillery fungus. The bird’s nest fungus (usually species within the genera Crucibulum, Cyathus or Nidularia) is named because of its resemblance to a miniature bird’s nest complete with egg-like spores (Photo 1). It is a “splash cup” fungus that uses the passive action of rainwater to expel its spores, but it is not the same as the artillery fungus. The “stinkhorn” (usually species of Phallus) can be a bit offensive looking, and its foul odor attracts flies, but it’s relatively harmless (Figure 2, page 16). The “dog vomit” mold (Fuligo septica) resembles just that — dog vomit (!) — and often colonizes mulch surfaces. However, it is the artillery fungus growing in landscape mulch that is responsible for damage to property such as to the sides of houses, as well as to the sides of automobiles parked in close proximity to mulched areas.

The artillery fungus

The artillery fungus is the common name of Sphaerobolus stellatus (or S. iowensis), a white-rot or wood-decay fungus that colonizes and thrives in moist landscape mulch (Photo 3). The genus Sphaerobolus (Greek for “sphere thrower”) is common throughout the U.S., but especially in the eastern and Mid-Atlantic regions.

The fungus is a basidiomycete, so it’s actually a “cousin” of the fairy ring fungi. Unlike fairy ring-causing fungi that produce visible mushrooms or puffballs in turfgrass, the artillery fungus produces fruiting bodies about 1/10” in diameter and, thus, are extremely difficult to see in mulch.

The name “artillery fungus” refers to the fact that this organism actively (uses its own energy) propels its gleba (or spore mass) like an artillery cannon. The gleba are relatively heavy and therefore travel only a short distance, but wind can carry them much further, even reaching up the sides of a two-story house. Artillery fungi “shoot” their gleba towards sunlight or reflective objects such as light-colored plant leaves, house siding and parked cars, literally “peppering” surfaces with very small, sticky, tar-like black specks (Photo 4). Once dry, the gleba are extremely difficult to remove from many surfaces, and they leave behind an impossible stain and residue that warrants costly repair and material replacement.
Thus, the artillery fungus has created emotional stress and financial issues for homeowners, landscape contractors, insurance companies, garden centers and mulch producers and distributors. Who gets to pay for replacement of house siding or a new coat of paint on a car? Have you checked your homeowner’s insurance policy lately? It most likely excludes mold and mildew, as well as the artillery fungus.

For more information on the artillery fungus, including home remedies for removing those stains (but many don’t really work without a lot of “elbow grease”), do a Google search on “Artillery Fungus – Frequently Asked Questions,” which is the artillery fungus website maintained by Dr. Don Davis of Penn State’s Department of Plant Pathology and Environmental Microbiology.

Controlling the artillery fungus

The artillery fungus is more active in mulches facing a northerly direction, presumably because north-facing mulch retains more moisture and dries out slowly (increased moisture favors the growth of artillery fungi) as compared to mulch on a south-facing, dry slope. Therefore, pruning trees and shrubs may help improve air movement and surface drying within those mulched areas of the landscape. The fungus is most active during the spring and fall (the cooler, wetter parts of the year) and is less active during the hot, dry parts of the summer. Also, the artillery fungus is more active in wet years such as 2013, when much of Pennsylvania received higher than normal rainfall.

No fungicide is currently labeled to control artillery fungi in landscape mulch. Some recommendations to
help manage or contain the artillery fungus are as follows:

- Re-apply mulch in the spring of each year.
- Remove old, infested mulch, and replace it with mulch that is less susceptible to the artillery fungus (i.e., large pine-bark nuggets and aged mushroom compost).
- Plant a groundcover such as pachysandra in the mulched areas (to provide a vegetative cover above the mulch to “block” the gleba).
- Use stone rather than bark/wood mulch, or use artificial (i.e., rubber) mulch.

Another control option

However, another sustainable solution would be to apply landscape mulch that has been thoroughly mixed with fresh mushroom compost (MC). MC is the organic, growth-substrate byproduct of Pennsylvania’s white button mushroom (Agaricus bisporus) industry. In Pennsylvania, more than 3.5 million cubic yards of MC are generated each year. “Fresh” MC is steam-pasteurized and obtained directly from a mushroom farm, whereas “aged” MC is passively stored outdoors for several months, thus “collecting” weed seeds.

A four-year study revealed that a mix of approximately 75:25 to 50:50 mulch:MC resulted in a significant reduction in artillery fungus gleba production or sporulation (Figure 1). A mix of 60% mulch and 40% MC resulted in 95% control of artillery fungus sporulation compared to 100% mulch only (Figure 2). The exact mechanism for control has not been determined, but it could be related to nutrition, population dynamics or warfare at the microbial level, with microbes in the mulch competing for resources and space.

Also, the four-year study evaluated only fresh MC, so the ability of other composts or compost products mixed with landscape mulch to suppress the artillery fungus is unknown. In practice, landscape mulch is typically applied once per year in Pennsylvania, usually in the spring. However, garden centers in southeastern Pennsylvania now offer fresh MC, as well as pre-mixed mulch/MC for homeowners and landscape contractors. Therefore, MC or the premix can be applied at any time during the growing season.

Summary

In conclusion, mixing landscape mulch with fresh mushroom compost is the best sustainable solution to controlling the artillery fungus, and it will prevent or dramatically reduce the appearance of those annoying, sticky glebas.
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Spring of the year and weed control — where do you start? There are two concepts to control broadleaf weeds: preemergence and postemergence. Both of the strategies need to be constructed to fit the specific sports-turf site’s needs. The manager must consider how much play will be on the field during this time. Different types of sports fields take different types of weed management.

For example, football is typically a fall sport, and there may be a window of opportunity to control weeds in the spring if the field is not being heavily used. When one considers the field use with respect to baseball, since it is a spring and summer sport, the spring of the year may not be the best time to control weeds. Not only is the time of the year the sport is using the field important, the type of wear the field gets is also tied to the type of sport. The wear level may impact the herbicides that can be applied.

Bottom line, there are many things specific to your situation to be considered in the spring when trying to control broadleaf weeds.

The preemergence option
Let’s start with a preemergence program approach. There are many great preemergence products available to the sports turf manager in the Mid-Atlantic region of the country. In the case of preemergence control for broadleaf weeds, the field of products becomes a bit more narrow.

The issue of preemergence control is that many times in the spring there is a need to overseed the desirable turfgrass. Some of these preemergence materials will not allow the overseeded turfgrass to germinate if these practices are done in tandem. Tenacity (ai mesotrione) is one product that will allow some turfgrass species to germinate and still prevent broadleaf weeds from germinating.

Again, when using any product, there may be reasons that prohibit its use. Mesotrione can bleach the chlorophyll from the grass plant that is growing and a white haze (Photo 1) may appear for a short time. The desirable turfgrass will not be harmed when used properly.

Pre-M, Team, Ronstar, Dimension and Tenacity also control the annual grassy weeds that may also be germinating on the site in the spring of the year. A sports turfgrass manager has many choices to make when it comes to using a preemergence control program.

The postemergence option
Postemergence control of broadleaf weeds is no less complicated for the manager. There are many outstanding products available that will provide great control. Many of these products need to be applied to actively growing broadleaf weeds. This means the weed may be in the turfgrass sward for a longer period of time than desired.

Another concept to consider is the fertility levels of the site in the spring. Not only will a well-crafted fertility program benefit the desirable turfgrass,
but it may also assist in the weed-control program. Fertility will make the weeds develop into an “actively growing” stage so that control products may be applied. Additionally, the turfgrass will become denser and will better compete with the weed population in the future.

Remember: if the weed has not germinated and the material you are using must be absorbed by an actively growing plant, the weed may survive or germinate after the application. In the spring, broadleaf weeds tend to be in a juvenile growth stage (Photo 2). Young plants are easier to eradicate. A more correct statement would be that young annual plants are easier to eradicate. For example, a newly germinated annual broadleaf weed such as purslane will not have a fully developed (thick) waxy cuticle. Hence, the control products can more easily penetrate the leaf surface to eradicate the plant. Conversely, if a perennial plant such as dandelion has little emerging green tissue at the time of application, control will be reduced. In this case, the product may have been applied too early. At this time (early applications in the spring), there may not be enough green leaf surfaces to collect the product and translocate it to the growing point. If you want to control dandelions that have a large developed taproot (Photo 3), the pesticide needs to be translocated to that taproot.

So, several things must be considered for a spring broadleaf weed control concept to be successful:
- Do not apply materials too early if the broadleaf weed you are trying to eradicate is a perennial with an extensive root system.
- If the broadleaf weed is a summer annual (these plants germinate in the spring), apply materials after the germination period of the plant, but before the weed is fully mature.
- Juvenile annual plants tend to have an under-developed root system and can be easier to eradicate.

Finally, no matter if you implement a preemergence or postemergence program, always read and follow the label directions of all pesticides to be used.
Incorporating Plant-defense Activators in Managing Turfgrass Diseases

The incorporation of plant-defense activators is an innovative approach to developing an integrated strategy for the management of turfgrass diseases. We evaluated the effects of salicylic acid (SA), benzothiadiazole (BTH), jasmonic acid (JA) and ethephon on the development of gray leaf spot (GLS) in perennial ryegrass caused by *Magnaporthe oryzae*.

Disease incidence and severity were significantly decreased when plants were treated with SA, BTH and ethephon, but not by JA, prior to inoculation. Exogenous application of SA to perennial ryegrass reduced GLS incidence and severity by 31% and 35%, respectively, BTH (Acibenzolar-S-methyl) also reduced GLS incidence by 50% and disease severity by 70%. Alternately, the application of a low concentration of ethephon provided significant suppression of disease, while higher application rates did not.

This study indicates that SA-mediated defense response plays a role in protecting perennial ryegrass against gray leaf spot. Microscopic observations of leaves inoculated with *M. oryzae* revealed higher frequencies of callose deposition at the penetration sites in SA- and BTH-treated plants compared to the control plants treated with water. These results suggest that early and higher induction of these genes by systemic resistance inducers may provide perennial ryegrass with substantial advantage to defend against infection by *M. oryzae*.

*Update submitted by Alamgir Rahman, Ph.D. candidate, and Wakar Uddin, Ph.D., Professor of Plant Pathology.*

Center for Sports Surface Research Continues Natural and Synthetic Turf Research

A number of research projects focusing on safety and playability of athletic fields are currently underway at the Center for Sports Surface Research. Graduate student Evan Mascitti is well into his study examining management practices that affect in-season resodding of football fields. Evan is researching how management practices occurring at the sod farm (such as fertilizer timings, topdressing and mowing heights) affect playing surface characteristics after the sod has been harvested and installed onto a football field. In addition to his research plots at Penn State, Evan is also repeating his study at Tuckahoe Turf Farms, located in Hammonton, NJ.

We also recently hosted a round-robin surface hardness (Gmax) testing event in which various testing companies collected Gmax data using a variety of devices on our research plots. The data collected allows us to compare the various testing devices and evaluate how each device performs across a variety of turf surfaces.

Our new traction database is now available on our website (ssrc.psu.edu). This database includes traction data from 30 shoes on Kentucky bluegrass, bermudagrass and FieldTurf. The database will be regularly updated as new shoes are released.

*Update submitted by the Penn State Sports Surface Research Center.*
ubiquity of creeping bentgrass and annual bluegrass cohabited putting greens warrants evaluation of how late-season plant growth regulator and nitrogen (N) fertilizer combinations influence winter hardiness and spring growth. Fall 2012 studies were initiated on such putting greens in University Park and Butler, PA. Trinexapac-ethyl, TE (as 11.3% EC, Syngenta), was foliarly applied at a 0, 0.1+0.1, or 0.2 fl. oz./1,000 ft² rate in combination with soluble N at 0.6 lbs./1,000 ft². Centered in mid-October, each location’s 30-year average first frost period, applications were made every 7±2 days as treatment ‘timing’ levels. A preventative snow mold treatment (pyraclostrobin) was applied to the University Park plots in late November. Winter injury ratings and multiple clipping yields were collected April 2013.

Winter injury was absent to limited at either location and bore no statistical relation to fall treatments. Repeat applications of 0.1 fl. oz. product, made 5 to 8 days apart in fall, provided more consistent spring growth regulation than single 0.2 fl. oz. applications. Spring growth response, modeled by growing degree days accumulated from application date, shows duration of regulation to be inversely related to winter temperatures (accumulated degree days). As such, spring postregulation growth enhancement, i.e. “rebound,” resulted from early October application of TE. Thus, superintendents must consider the sensitive nature of late-fall TE timing when planning such treatments.

Update submitted by Chase Rogan, alumnus (B.S. Turf ’07, M.S. Agro ’11), and Max Schlossberg, Ph.D., Assoc. Prof. of Turfgrass Nutrition.
Penn State Turf Updates

Tom Burrows (Cert. '60) is now retired.

Drew Chevaux (B.S. ’10) is now an application specialist at Baltusrol Golf Club in Springfield, NJ.

Brandon Crim (Cert. ’09) is currently an assistant superintendent at Roundhill Country Club in Alamo, CA.

Corey Forbes (B.S. ’10) is currently the assistant superintendent at RiverCrest Golf Club and Preserve located in Phoenixville, PA.

Jake Leadbetter (B.S. ’13) is now an assistant in training at Edgewood Country Club in Pittsburgh, PA.

Dan Mausolf (World Campus Cert. ’04) is now the superintendent at Radrick Farms G.C. in Ann Arbor, MI.

Tim Palko (Cert. ’04) is now the grounds superintendent at the Boulder Country Club.

Derek Pruyne (B.S. ’11) has been named the first-place winner of the Golf Course Superintendents Association of America (GCSAA) 2013 Student Essay Contest.

Matt Rayman (B.S. ’98) is now Territory Manager at Walker Supply, Inc.

Penn State News

Calendar of Events

January 7–8
2014 Eastern PA Turfgrass Conference and Trade Show
Crowne Plaza Hotel
King of Prussia, PA

January 21–24
STMA Conference and Exhibition
Grand Hyatt Hotel
San Antonio, TX

January 30
2014 Northeastern PA Turfgrass Conference and Trade Show
Woodlands Inn
Wilkes Barre, PA

February 3–6
Golf Industry Show
Orange County Convention Center
Orlando, FL

February 20–21
Chesapeake Green 2014 — A Horticulture Symposium
Maritime Institute & Conference Center
Linthicum Heights, MD

February 24–28
TPI Midwinter Conference
(Turfgrass Producers Intl.)
Disney’s Contemporary Resort
Orlando, FL

February 25–27
2014 Western PA Turfgrass Conference and Trade Show
Sheraton Four Points North
Mars, PA

November 2014
Penn State Golf Turf Conference
Nittany Lion Inn
State College, PA

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