FOUNDATION NEWS

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PRESIDENT'S MESSAGE

Research: The Key to Our Success

Blake Halderman, CGCS, President of Tri-State Turf Research Foundation

INSIDE THIS ISSUE

If you, a family member, friend, or coworker have ever been touched by a serious illness, you know that, thanks to research, there is generally a course of treatment or medication ready and waiting to overcome what ails you. As I write this, there is a deadly virus, the coronavirus, which started in China and has begun infecting people in our own country. Right now, there is no cure. But we have researchers hard at work trying to uncover a viable treatment and solution. We have hope that a cure will be found.

Though I understand that saving human lives is far more essential than curing turfgrass ills, we too, put our trust in those researchers working diligently to find solutions to our most troublesome and, often deadly, turfgrass pests and diseases—diseases that degrade the turf that our livelihood depends on.

But whether we are searching for a rare virus cure or controls for a persistent and deadly turfgrass ill, our ability to secure the best and brightest teams of scientists and researchers to combat these diseases depends on our support. Nothing can happen without it.

YOUR SUPPORT MEANS EVERYTHING

Since 1992, the Tri-State Turf Research Foundation has been committed to the ongoing support of research targeted at helping area turf professionals overcome a variety of debilitating turfgrass pests and challenges and discover the most effective products and approaches to producing the best conditions possible.

Now, nearly three decades later, I feel we have succeeded. But we have not done this alone. We've had the support of six affiliated associations—the MetGCSA, New Jersey GCSA, Connecticut AGCS, Long Island GCSA, Hudson Valley GCSA, and the MGA—plus thousands of donations from individual clubs over the course of those 30 years. With this funding, the Tri-State has been able to secure the help of talented researchers at such universities as Rutgers, Cornell, UConn, URI, UMass, and Penn State. And when a problem arises that another university's research can help, we have been able to reach out to them as well for solutions to turf issues plaguing our area superintendents.

Looking at the history of research projects, it's clear our work will never be done. There will always be a turf pest or agronomic practice that requires the study and counsel of a turfgrass scientist. The foundation's resources are not limitless, they require your ongoing support to allow us to continue our work in funding research essential to area superintendents and golf courses.

As a board, we are trying to enhance our exposure by attending and speaking at the MGA Green Chairman Series each year. We also send out the *Foundation News* that we hope you will share with your golfers so they can see our funding at work and perhaps better understand what it takes to keep their courses alive and well. But whether you are directly or indirectly involved with the foundation, you can do your part by donating $250 to the Tri-State Turf Research Foundation this year. It is

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TRI STATE TURF RESEARCH FOUNDATION

Rutgers Researchers Make Strides in Search for Controls for Summer Decline of Annual Bluegrass

Dr. Bingru Huang and Dr. James Murphy Join Forces in Battle Against Summer Decline of Poa annua

Though *Poa annua* has been considered a weed to eradicate rather than cultivate on putting greens, it has proved difficult, if not impossible, to completely eliminate and has become a dominant grass on many golf courses.

One of the major limitations of growing *Poa* is summer decline in turf quality and root growth due to its poor heat tolerance. Management strategies that enhance *Poa* tolerance to heat stress will greatly benefit superintendents who choose to use *Poa* as a desirable turfgrass or who maintain *Poa*/Bentgrass greens.

Many golf courses use plant-health products on a regular basis, particularly on creeping bentgrass putting greens, to combat summer stress. There is increasing evidence supporting the positive effects of foliar applications of PGRs, biostimulants, and fungicides in promoting turfgrass abiotic stress tolerance in various turfgrass species. However, the physiological mechanisms controlling *Poa* summer decline and effective plant health products for promoting *Poa* stress tolerance are not well documented.

With funding from the Tri-State Turf Research Foundation, Rutgers University's Dr. Bingru Huang and Dr. James Murphy have completed year one of their three-year study to uncover an effective method for managing *Poa* summer decline.

OBJECTIVES IN 2019

During the course of their trials this past year, the researchers conducted two controlled-environment experiments to address the following objectives:

1: Evaluate physiological responses and turf performance of *Poa* under heat stress.

2: Identify effective plant-health products and application rates for controlling *Poa* summer decline or improving heat tolerance.

Here is a look at how the two trials unfolded:

TRIAL 1: EVALUATION OF HEAT PERFORMANCE FOR *POA* ECOTYPES

A collection of *Poa* ecotypes from states in the Northeast, including New Jersey, New York, Vermont, New Hampshire, and Maine, were examined to determine variability in *Poa* heat tolerance.

TRIAL I: METHODOLOGY

» A total of 35 ecotypes from this collection were planted in plastic containers filled with sand in the greenhouse at Rutgers University.

» Uniform-sized plants (5 containers for each ecotype) were transferred to a controlled-environment growth chamber and subjected to heat stress at day/night temperatures of 95/86° F for 18 days.

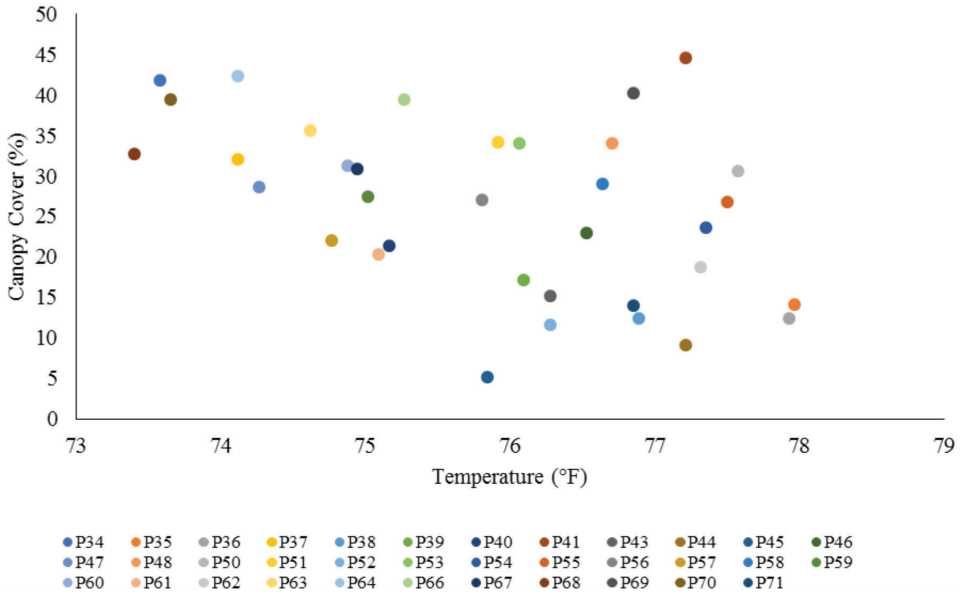

FIGURE 1

Poa Heat Screening: Inverse relationship between temperature and canopy cover at 18 days of heat stress.

Rutgers Researchers Make Strides in Search for Controls for Summer Decline of Annual Bluegrass

» Other environmental conditions of the chambers were controlled using a 14-hour photoperiod and artificial light levels to foster photosynthetically active radiation at the canopy level.

» Plants were watered twice a day to maintain adequate soil-water content and fertilized weekly with half-strength Hoagland's nutrient solution to supply adequate nutrition during the heat-stress period.

» Heat performance of different ecotypes was examined by evaluating canopy cover and canopy temperature. At 6, 12, and 18 days of heat stress, regular photos and thermal images were taken to evaluate canopy cover and canopy temperature, respectively, using imaging analysis programs. The relationship between canopy cover and temperature was analyzed using linear regression and correlation procedures in SAS version 9.4.

TRIAL I: RESULTS

» Canopy cover declined as canopy temperatures increased during heat stress at different levels across 35 ecotypes of *Poa* collected from the Northeastern states, suggesting there existed variations in *Poa* performance in response to heat stress. However, whether the phenotypic variations in different ecotypes in heat responses is due to genetic variations or differences in environmental conditions where the ecotypes were collected are still unclear.

» It is worth noting that there was an inverse relationship between canopy cover and canopy temperature *(Figure 1)*, indicating that *Poa* ecotypes with greater canopy density could be better in heat tolerance by maintaining lower canopy temperature through active transpirational cooling.

Further research will determine physiological traits associated with heat tolerance by comparing heat-tolerant to heat-sensitive ecotypes or cultivars of *Poa*.

TRIAL 2: EFFECTS OF PLANT HEALTH PRODUCTS ON *POA* HEAT TOLERANCE

In the second trial, *Poa* plugs (2" in diameter) were collected from the research putting green plots at Rutgers Hort Farm 2 and transplanted into plastic containers filled with sand.

» Plants were established in a greenhouse for three weeks.

» Uniform-sized plants were transferred to a controlled-environment growth chamber.

TRIAL 2: METHODOLOGY

Three types of plant-health products were examined for their effects on *Poa* heat tolerance. The following chemical treatments were applied by foliar spray of plants:

1: Untreated Control: Plants were sprayed with water in the same volume as the chemical treatments (10 mL) to saturate turf canopy.

2: Biostimulants: Amino acids (AA) (60 mM); seaweed-extracts (SWE): SWEA (6 fl. oz.), SWEB (6 fl. oz.), SWEC (6 fl. oz.).

3: Plant Growth Regulators (PGRs): Primo Maxx (trinexapac-ethyl) (0.1 fl. oz.), Proxy (ethephon) (5 fl. oz.), Primo Maxx (0.1 fl. oz.) + Proxy (PP) (5 fl. oz.).

4: Fungicides: Signature XTRA StressGard (2 fl. oz.) (SIG); Daconil Action (2 fl. oz.) (DacAc); and Appear II (3 fl. oz.) (AppII).

» Each treatment had 6 replicates (containers), and all treatments were applied:

1: 8 days prior to the initiation of heat stress

2: The day before the initiation of heat stress

3: Every 7 days during heat stress

» Plants (6 containers for each chemical treatment) were subjected to heat stress at day/night temperatures of 95/86° F.

» Nonstress control plants were maintained in a growth chamber with the temperature controlled at 72/63° F.

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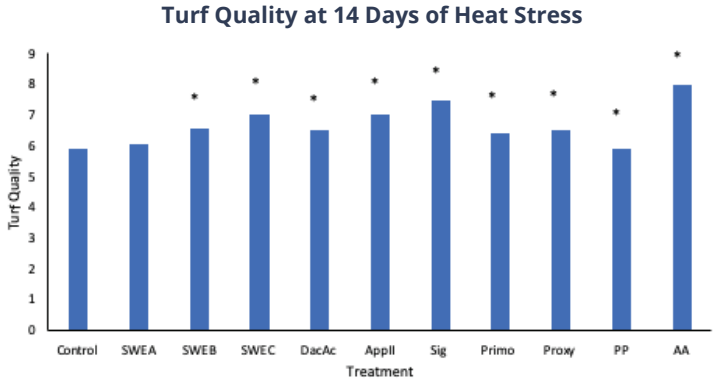


FIGURE 2

Turf quality as affected by different treatments for *Poa* exposed to heat stress. Treatments marked with * were significantly different from the control at p = 0.05.

Rutgers Researchers Make Strides in Search for Controls for Summer Decline of Annual Bluegrass

» Other environmental conditions of the chambers were controlled using a 14-hour photoperiod and artificial light levels to foster photosynthetically active radiation at the canopy level.

» Plants were watered twice a day to maintain adequate soil-water content and fertilized weekly with half-strength Hoagland's nutrient solution during the heat stress period.

» Effects of different plant-health products on *Poa* performance under heat stress were examined by evaluating canopy cover and canopy temperature. Regular photos and thermal images were taken to evaluate canopy cover and canopy temperature, respectively, using imaging analysis programs.

TRIAL 2: RESULTS

The results from the controlled-environment trial suggest that the plant-health products tested in this experiment have potential for improving heat performance of *Poa* during summer months in the Northeast.

» Application of amino acids, seaweed extract-based biostimulants, and fungicides with plant-health benefits improved turf quality *(Figure 2)* and maintained greener turf *(Figure 3*) and higher leaf membrane stability (shown as lower electrolyte leakage) *(Figure 4)* in *Poa* plants exposed to 14, 21, and 28 days of heat stress.

» Primo or Proxy *alone* also improved *Poa* performance at 14 days of heat stress.

» The *combined* Primo and Proxy treatment reduced visual turf quality and suppressed *Poa* growth under normal temperature and heat stress.

The researchers will be looking more closely at the effective treatments for improving *Poa* heat performance in their golf course field trials in 2020.

For further information, you can reach Dr. Bingru Huang at huang@sebs.rutgers.edu or Dr. James Murhpy at Jamurphy@NJAES.Rutgers.edu.

SIDEBAR

Quick Take on Trial Results

» *Poa* ecotypes with greater canopy density maintained lower canopy temperature.

» Several products, including amino acid- or seaweed-based biostimulants, PGRs, and fungicides with plant health benefits could effectively enhance *Poa* performance under heat stress (95/86° F, day/night).

» Improved *Poa* performance under heat stress with different plant-health products was associated with the maintenance of greener turf canopy and more active turf growth, as well as greater leaf cellular membrane stability.

» The combination of Primo and Proxy suppressed *Poa annua* growth and reduced visual quality while either product alone improved *Poa* performance.

FIGURE 3

Dark green color index (DGCI) as affected by different treatments for *Poa* exposed to heat stress. Treatments marked with * were significantly different from the control at p = 0.05.

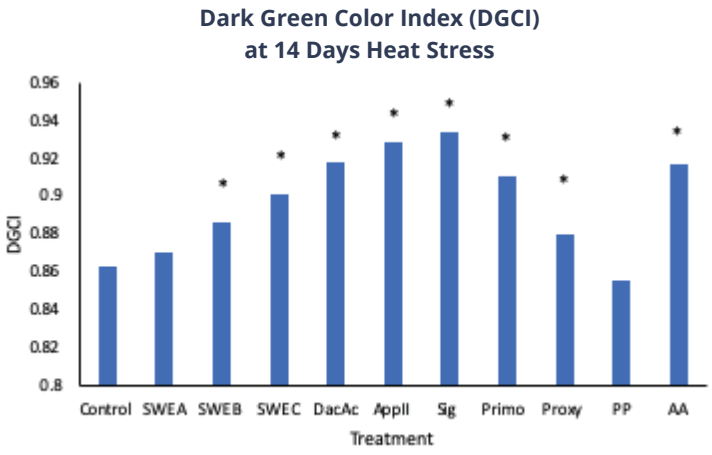
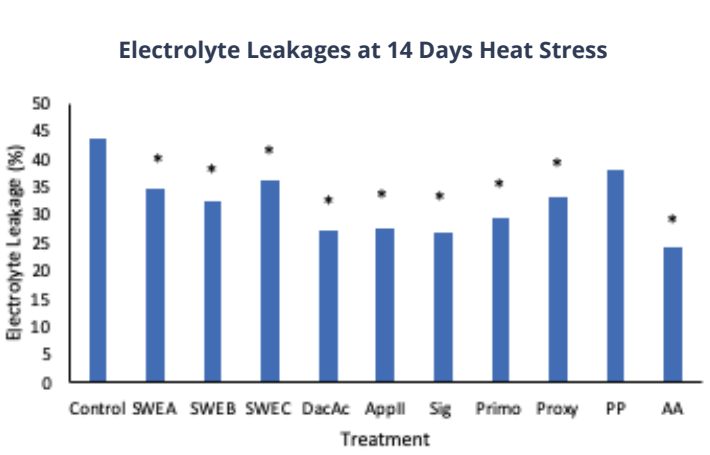


FIGURE 4

Leaf electrolyte leakage as affected by different treatments for *Poa* exposed to heat stress. Treatments marked with * were significantly different from the control at p = 0.05.



Special Thanks to Our 2019 Contributors

We'd like to thank our contributors for their generous show of support to the Tri-State Turf Research Foundation. Your contributions go a long way toward helping the foundation continue its mission "to provide turfgrass research for better golf and a safer environment." We hope those of you on the list will continue to support the foundation's work. We also hope you will encourage more of your fellow turfgrass professionals to add their names to the growing list of contributors.

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NEW RESEARCH

Tri-State Supports Fourth Edition of the *Compendium of Turfgrass Diseases*

As part of our commitment to providing turfgrass managers with the most up-to-date information on turfgrass diseases and disorders, the Tri-State Turf Research Foundation has agreed to support Dr. Lane Tredway of Syngenta, Dr. Bruce Clarke of Rutgers University, Dr. Maria Tomaso-Peterson of Mississippi State University, and Dr. Jim Kerns of North Carolina State University in their endeavor to create a Fourth Edition of the *Compendium of Turfgrass Diseases*.

Originally written by R.W. Smiley and published in 1983, the first three editions have provided an indispensable resource for turf professionals seeking to identify turfgrass pathogens quickly and accurately. When a disease symptom occurs, infected areas of the turfgrass can be matched to one of the book's hundreds of illustrations, while the accompanying text provides information about the symptoms, causes, cycles, and control of the disease identified.

Now, with funding from the Tri-State and other turf organizations throughout the country, this resource will be updated once again to reflect recent advances in turfgrass pathology, with an expanded focus on diseases of warm-season turfgrasses and many new, high-quality images.

A practical reference for anyone involved in the culture of fine turf, the Fourth Edition of the *Compendium of Turfgrass Diseases* is due to launch in mid-2021 and will be offered to Tri-State Turf Research Foundation contributors at a 40-percent discount. Watch for the launch date next year!

UConn Researchers Put Manganese to the Test as Viable Summer Patch Control

A fair amount is known about the environmental factors that predispose turfgrasses to summer patch and cultural practices that can help minimize the disease. However, summer patch continues to be problematic for superintendents throughout New England. Caused by *Magnaportheopsis poae*, summer patch is a serious disease affecting Kentucky bluegrass, annual bluegrass, and fine fescues on golf course turf areas ranging from rough and fairways to putting greens.

At sites where the disease is a perennial challenge, a combination of cultural and chemical controls are often required to maintain acceptable control. Where fungicides are used, three to four preventative applications at high label rates are typically recommended.

This type of fungicide use, however, may not be practical, particularly where large acreages make the cost prohibitive, or where pesticide use is restricted under state or municipal law. Moreover, fungicides may fail to control summer patch when appropriate cultural practices are not implemented and when environmental conditions favoring disease are optimal.

In an attempt to find a reliable and cost-effective method for controlling this devastating disease, the Tri-State Turf Research Foundation has granted the University of Connecticut's Dr. John Inguagiato and Dr. Thomas Morris funding for a two-year investigation of manganese's role in controlling summer patch on Kentucky bluegrass turf.

According to the researchers, manganese (Mn) has already proved effective in suppressing take-all patch in turfgrass. Manganese, after all, is used by plants in the production of lignin and phenolics, which are compounds synthesized by the plant to produce physical and chemical barriers to resist fungal infection by the take-all pathogen. Preliminary field studies have indicated that manganese shows promise in suppressing summer patch as well, but data from these early studies do not adequately address interactions that exist between soil types, soil pH, and their influence on soil-available Mn.

More research is needed, therefore, to determine optimal rates of Mn fertilization to suppress summer patch in turfgrass. It is likely that Mn requirements will vary based on soil organic matter content and soil pH. During their study, the researchers intend to identify optimal Mn application rates to suppress summer patch on different soils amended to acidic or basic pH.

Moreover, the researchers plan to establish a critical value for a Mn availability index for turfgrass based on soil pH and extractable Mn. Researchers will use the Mehlich 3 soil test, which is the most popular soil extracting solution in the U.S. This Mn availability index has already been used to predict the likelihood that Mn fertilization will suppress take-all patch disease on bentgrass.

THE OBJECTIVES

More specifically, during the course of the study, the researchers are working to:

1: Evaluate the effect of Mn fertilization on the severity of summer patch.

2: Identify optimal Mn fertilization rates for suppression of summer patch.

3: Characterize how optimal Mn fertilization rate varies across soil type and pH for summer patch suppression.

4: Determine a critical value for soil responsiveness to manganese fertilization of turfgrass across soil types using the Mn+2 availability index.

CURRENT RESEARCH ACTIVITY

The researchers will collect various data throughout the duration of the study to characterize the soils studied and assess treatment effects on turf growth and disease severity. Here is what they've been up to:

» Soils differing in organic matter (OM) content and texture (i.e., high OM vs. low OM; sand vs. sandy loam) have been collected for use in the study.

» The pH of these soils will be adjusted to 5.6, 6.6, or 7.6 by incubating them with aluminum sulfate or calcium hydroxide to establish a range of Mn reactivity levels for the experiment.

» Preliminary soil incubation trials are underway to determine the amount of aluminum sulfate or calcium hydroxide necessary to reach the target pH for both soils.

» Based on the rate of soil pH reaction observed in these preliminary trials, the researchers anticipate it will take approximately one month of incubation to achieve target pHs.

In 2020, Drs. Inguagiato and Morris will complete two greenhouse trials at UConn's Floriculture Greenhouse Facility in Storrs, CT. They are beginning each run with pots seeded with Kentucky bluegrass. Once established, they will administer Mn treatments and inoculate the turfgrass with *Magnaportheopsis poae*. They will then treat the turfgrass and, finally, measure and record the results of the trial. By year-end, the UConn researchers expect to shed light on the effect of Mn treatments on summer patch development. ■

For further information, you can reach Dr. Inguagiato at john.inguagiato@uconn.edu or Dr. Morris at thomas.morris@uconn.edu.

Clemson Researchers Seek Solutions to Bacterial Etiolation Plaguing Cool-Season Fine Turf

Etiolation, the abnormal elongation of turfgrass stems and/or leaves of turfgrasses, is a phenomenon that has been observed for decades. The symptoms can be transient with the prevailing weather patterns. Its effects are varied, sometimes developing into a persistent problem that requires more frequent mowing (i.e., twice daily) and in other cases, going so far as to result in the decline of high-value turfgrass stands, such as putting green turf. While etiolation can occur at all heights of cut, golf course putting greens, surrounds, and fairways are most commonly affected, with putting greens raising the most concern with widespread decline.

WHAT RESEARCHERS KNOW TO DATE

Many have speculated that etiolation was caused by nutrient deficiencies, soil water, chemical applications, or inadequate lighting. Over the past decade, however, researchers have confirmed multiple bacterial pathogens as the culprit of etiolation in cool-season grasses.

» While working at Michigan State University in 2010, Paul Giordano and others published the first report of *Acidovorax avenae* as the culprit in bacterial decline of creeping bentgrass, while Clemson's Dr. Joseph Roberts and others confirmed *Xanthomonas translucens* and *Pantoea ananatis* on the same grass just a few years later on projects performed at North Carolina State University (2014; 2017).

» Additional reports by Giordano (2015) and Roberts (2017) have shown *Xanthomonas* and *Pantoea* bacteria to infect perennial ryegrass as well.

While the researchers have a thorough understanding of cultural and chemical considerations for *fungal* turf pathogens, they have not adequately researched cultural management of *bacterial* diseases in turfgrass, and as you might expect, most fungicides that work well against fungi offer little to no control of bacterial pathogens.

Several years ago, Roberts and others at North Carolina State University were able to illustrate the impact of plant growth regulators (PGRs) on etiolation development and severity (2015; 2016).

» Over the course of three years, the researchers found that the combination of *Acidovorax avenae* bacteria causing etiolation and frequent, high-rate applications of the PGR trinexapac-ethyl (i.e., 0.125 fl. oz./1000 ft.$^{-2}$ wk-1 or 0.250 fl. oz./1000 ft.$^{-2}$ 2wk-1) *increased symptoms* on creeping bentgrass compared to areas where no growth regulators were applied (2016).

» Interestingly, however, when *Xanthomonas translucens* were present and causing etiolation symptoms on creeping bentgrass, areas that had received applications of the PGR trinexapac-ethyl had *lower etiolation symptoms* compared to plots receiving no trinexapac-ethyl.

» Outside of plant growth regulators, there are only a few reports of successful chemical control with most success in products that contain acibenzolar-S-methyl or fosetyl-Al (2014).

Over the past several years, etiolation has emerged as a recurring issue for superintendents in the tri-state area. In hope of uncovering an effective method for managing or eliminating this meddlesome turfgrass phenomenon, the Tri-State Turf Research Foundation has granted Clemson University's Dr. Joseph Roberts funding for a one-year study that will delve into both the causes and options for managing etiolation on perennial ryegrass turf.

THE OBJECTIVES

More specifically, during the course of their trials in 2020, the researchers will:

1: isolate and identify bacteria associated with etiolation symptoms observed in the tri-state region.

2: perform initial growth chamber assessments to examine possible control methods effective on *Pantoea* etiolation in perennial ryegrass turf.

OBJECTIVE 1: IDENTIFY BACTERIA ASSOCIATED WITH ETIOLATION

In order to mitigate etiolation symptoms of cool-season turf, the researchers are first setting out to secure a thorough understanding of bacteria associated with symptom development.

With that in mind, they are encouraging tri-state area superintendents who are experiencing etiolation concerns to submit turfgrass samples for diagnosis throughout the 2020 growing season. Please prepare samples in accordance with standard submission to plant diagnostic labs. Cup cutter plugs of affected turf should be wrapped in aluminum foil and packaged

Clemson Researchers Seek Solutions to Bacterial Etiolation Plaguing Cool-Season Fine Turf

securely so that they do not move significantly in shipment. Samples should be sent to Dr. Joseph Roberts, 2200 Pocket Road, Florence, SC 29506 via overnight parcel to preserve and enhance possible identification of plant pathogens.

» After performing a series of diagnostic tests on these samples, the researchers will isolate and identify the most prevalent bacteria occurring on symptomatic tissue.

» Bacterial colony growth will be examined for differences in morphology, and the three most prevalent morphologies will be transferred to plates for identification and long-term storage.

» Once bacteria have been isolated from turfgrass tissue, identification will take place through genetic sequencing.

» All sequences and identities will be cataloged into a database that includes collection date, location, turf species, and soil base.

OBJECTIVE 2: IMPACT OF CHEMICAL CONTROLS ON PERENNIAL RYEGRASS ETIOLATION

Research to examine possible chemical control methods for etiolation will be performed using controlled growth facilities at Clemson University Pee Dee Research and Education Center. Perennial ryegrass will be established in small pots using a sand-based rootzone conforming to USGA specifications.

NONTREATMENT TURF MANAGEMENT PRACTICES

For this segment of the research, potted perennial ryegrass turf will be maintained by:

» trimming one time per week with scissors at ~¼ inches

» irrigating as needed to support turfgrass growth

METHODS FOR EXPERIMENTAL FACTORS

To examine the effect of chemical controls on etiolation:

» The potted perennial ryegrass plants will be grown and maintained for eight weeks before treatments are initiated.

» The turf will be treated with FeSO4, MgSO4, propiconazole, prohexadione calcium, and trinexapac-ethyl and then compared to an untreated pot.

» The turf pots will be arranged in a randomized complete block design with four replications.

» Two rates of each treatment will be examined for impact on symptom development.

» Each replicate will be inoculated 14 days following the first treatment application using inoculated scissors.

» A known causal agent, *Pantoea ananatis*, will be cultured on nutrient agar.

» Bacterial colony growth on nutrient agar will be placed in suspension and quantified.

» The suspension will then be used to inoculate healthy pots of perennial ryegrass with the bacteria by dipping sterile scissors into the suspension and then using the scissors to trim the turf similar to weekly maintenance practices.

» Each pot will receive four cuts with scissors dipped in between each cut.

» The remaining suspension will be filtered to remove grass blades and then applied to the freshly cut turfgrass as a foliar spray.

» Turf will then be maintained under high humidity necessary to promote bacterial growth.

DATA COLLECTION

Turf will be assessed regularly for etiolation symptom development following inoculation.

» Etiolation will be quantified as number of symptomatic plants per treated replicate.

» Turf will also be assessed for changes in turf quality and color using scales previously developed under the National Turfgrass Evaluation Program.

» The experiment will be repeated over time to confirm results.

TARGET OUTCOMES

Results from this research will provide an understanding of the potential turfgrass bacterial pathogens associated with etiolation outbreaks in recent years. In seeing the rise in reports associated with *Pantoea ananatis*, the results from Objective 2 will assist in developing a larger field trial aimed at finding field-based solutions. Future field trials will be developed in subsequent proposals with collaborators at Rutgers University. ■

For further information, you can reach Dr. Roberts at jar7@clemson.edu.

Research: The Key to Our Success

such a small price to pay for the valuable information you receive in return. It's with your support that we are able to fund research essential to your operation, your turf, and your ability to do your job in the most efficient and effective way possible. Please take a moment to visit our website www.tristateturf.org to view our past and present research or to make a donation.

YOUR CONCERNS MATTER

Directing the Tri-State Turf Research Foundation's activities is our Board of Directors, which is made up of three members from each of the six affiliated associations. It's these three reps from your association who work to determine which research will be most beneficial. They have your concerns in mind, so please don't hesitate to reach out to any one of them at any time. We sent out a survey encouraging everyone to voice their turfgrass issues and concerns, and we are doing our best to take those research requests into consideration, funding those projects that we feel will benefit the greatest number of golf facilities.

WHAT FUNDING CAN DO

High on the list of concerns among survey respondents was bacterial etiolation. In response, we reached out to Dr. Joseph Roberts who is now at Clemson University but is working closely with the team at Rutgers on this research. While fungicides may work well on fungi pathogens, they offer little to no control for bacterial pathogens. The researchers will be looking at all options to manage etiolation, including but not limited to nutrient deficiencies, growth regulators, soil water, chemical applications, and cultural control methods.

In this issue of *Foundation News*, you will also see your contributions at work in finding a chemical alternative to current summer patch controls. At UConn, Drs. John Inguagiato and Thomas Morris are in their second and final year researching the effects of manganese (Mn) applications on summer patch. According to the researchers, Mn has already proved effective in suppressing take-all patch and shows promise in suppressing summer patch as well. Hopefully, Mn fertilizer applications will prove an effective summer patch control and allow us to reduce our dependency on fungicides, especially on large-acreage areas like the rough.

Rutgers Drs. Bingru Huang and Jim Murphy are in the second year of their three-year research project searching for controls for summer decline of annual bluegrass. They are evaluating physiological responses and turf performance of *Poa* under heat stress and then identifying plant-health products aimed at reducing summer decline and improving *Poa's* heat tolerance. Similar to the great work done at Rutgers to create the BMPs for anthracnose, I would expect that Drs. Huang and Murphy will come up with the best possible formula for those growing *Poa* under extreme conditions.

Last but not least, we supported the new Fourth Edition of the *Compendium of Turfgrass Diseases,* which will hit the bookstores in 2021. As a result of our support, we will be able to provide our members with a discounted rate. A lot has changed in the turf world since the Compendium's last edition, so you will certainly want to grab a copy and keep it among your go-to turf resources. Watch for your discounted-rate offer next year!

Blake Halderman, CGCS
President
Tri-State Turf Research Foundation

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