FOUNDATION NEWS

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PRESIDENT'S MESSAGE

The Heightened Value of Supporting Research

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

INSIDE THIS ISSUE

What a year since my last President's Message! At this time last year, we were just beginning to understand the grip the Coronavirus would have on us and people all over the world. It has been a year filled with uncertainties and challenges, not the least of which have been on the golf course.

Would there be severe budget cuts? How many staff members would be allowed to return? Would we lose staff members to Covid or quarantine requirements? Could we manage those loses during a time when disease pressure could be the highest? These challenges had me turning to colleagues and researchers for consult and support in meeting them head-on.

What I quickly learned is that if we can all communicate with one another, then we can get through anything. I want to take this moment to thank all the university professors who stepped up to share their knowledge with us, whether it was through webinars, Zoom calls, or even personal phone calls. We knew it was going to be a spring like no other, and having these professionals provide us with solutions and Best Management Practices to guide us through this maze of uncertainties was key to our success.

It's times like these that remind us why it is so important to support our researchers! Our university researchers are the people who have been by our side, helping us find solutions to many of our most troublesome diseases and pest problems. And they stand ready to offer counsel and solutions to some of our most perplexing day-to-day turf issues.

YOUR SUPPORT MATTERS

The Tri-State Turf Research Foundation has been supporting the work of turfgrass researchers in the tri-state area since 1992. Our goal has always been to keep our finger on the pulse of any new disease and pest pressures affecting superintendents and then support research that seeks viable solutions. This has been and will always be a team effort, with support from the MetGCSA, New Jersey GCSA, Connecticut AGCS, Long Island GCSA, Hudson Valley GCSA, and the MGA along with donations from individual clubs and vendors. With this funding, we have been able to support the talented researchers at such universities as Rutgers, Cornell, UConn, URI, UMass, Penn State, and others. Just like being a golf course superintendent, being a researcher requires significant effort daily in the lab or in the field, which means they rely heavily on our support to provide them with the staffing they need to see their studies through to completion.

I want to thank all who are longtime supporters of the Tri-State Turf Research Foundation, as well as those who are newly onboard. I urge all superintendents and vendors to join our list of contributors to ensure our researchers remain at the ready. A donation of $250 is truly a small price to pay for the valuable research and assurance you receive by supporting our researchers. Please take a moment to complete the donation form inserted in this issue of *Foundation News* or available on our website at www.tristateturf.org.

(continued on page 2)

TRI STATE TURF RESEARCH FOUNDATION

The Heightened Value of Supporting Research

We never know, after all, when the next major catastrophe will come our way. Gathering the resources, now, to support our researchers' work is essential to our operations, our turf, and our ability to do our job in the most effective way possible.

THE BOARD AT WORK

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 is these reps who work to determine which research will be most beneficial to our area golf facilities. We sent out a survey a couple of years ago to get a reading on our members' needs, but we always welcome fresh ideas, so please don't hesitate to reach out to one of your chapter representatives with any turfgrass issues or concerns you would like to see addressed.

As a board, we are always trying to enhance our exposure. When the MGA Green Chairman event is in session, we attend and speak about our research efforts and how they are designed to provide great conditions in the most environmentally friendly way possible. We also send out the *Foundation News*, which we hope you will share with your golfers so they can see our efforts at work and better understand what it takes to keep their courses alive and well. Equally enlightening is our website, which offers a look at research past and present, as well as superintendent profiles covering an agronomic topic written by a Tri-State board member. These profiles are sent out with the MGA's monthly HDCP mailings that go to all MGA members.

WHERE YOUR RESEARCH DOLLARS GO

In this Issue of the *Foundation News*, you will see your contributions at work with some fantastic research that is in process or newly funded.

Rutgers Drs. Bingru Huang and Jim Murphy are in their final year of a three-year research project studying 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. I'm sure a lot of the same will hold true for bentgrass, so this research is extremely valuable for all turfgrass managers trying to provide championship greens under extreme conditions.

At UConn, Drs. John Inguagiato and Thomas Morris are working to complete their investigation of the effects of manganese (Mn) applications on summer patch. Mn has already proved effective in suppressing take-all patch, and they are finding similar results for summer patch as well. With a goal of reducing our dependency on fungicides, especially in large areas like the rough, it is nice to know Mn may be another tool to help suppress not only take-all patch, but summer patch as well.

Rolling into his second year, Dr. Joseph Roberts from Clemson University is working closely with the team at Rutgers to find solutions to bacterial etiolation. Though we all know this condition comes and goes, we have not been able to put a finger on the chemical or cultural strategies that keep it controlled all year long. While fungicides work well on fungi pathogens, they offer little to no control for bacterial pathogens, so the researchers are looking at all options to manage etiolation, including nutrient deficiencies, growth regulators, soil moisture, chemical applications, and cultural control methods. Dr. Roberts received a good number of etiolation samples last fall, but would appreciate new samples this spring. Please refer to the sidebar on page 11 for sampling information.

Last but not least, we will be supporting a new research study with Dr. Albrecht Koppenhöfer from Rutgers who will be looking at optimizing the use of the annual bluegrass weevil to control annual bluegrass in creeping bentgrass fairways. With the resistance to and loss of many control options with the likelihood of more to come, it is important that we develop the most comprehensive Best Management Practices available to reduce our dependence on these products. Combined with his previous research of reducing *Poa* in fairways using paclobutrazol, this project will provide crucial information necessary for the transformation of a major insect pest of golf course fairways into a biological weed management plan.

Wishing you all a more sane and trouble-free year. But know that should issues arise, the foundation, and the researchers we support, will be here to provide practical solutions and assistance.

Blake Halderman, CGCS
President
Tri-State Turf Research Foundation

Rutgers Researchers Take Their Trials to the Field

Dr. Bingru Huang and Dr. James Murphy Close in on Controls for Summer Decline of Annual Bluegrass

Once looked on as a weed to eradicate on putting greens, *Poa annua* has become regarded by many as a turfgrass to cultivate. One of the major issues with growing *Poa*, however, is its poor heat tolerance, which results in summer decline in turf quality and root growth. Management strategies that enhance *Poa* tolerance to heat stress will greatly benefit superintendents whose courses are predominantly *Poa* or who maintain *Poa*/Bentgrass greens.

Many golf courses use plant-health products on a regular basis 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. The effects of these products, however, has not been well documented.

With funding from the Tri-State Turf Research Foundation, Rutgers University's Dr. Bingru Huang and Dr. James Murphy have completed year two of their three-year study, taking their trials to the field where they continued their pursuit of an effective method for managing *Poa* summer decline.

OBJECTIVE IN 2020

During the summer of 2020, the researchers took their trials to the field where they delved further into the effects of plant-health products on summer performance of annual bluegrass on putting green conditions.

Here is a look at how the study unfolded:

METHODOLOGY

Plot Maintenance

The experiment was conducted on Rutgers University research plots managed under putting green conditions.

» The field sites were established with mixed biotypes of *Poa annua* originally collected from Rutgers University Golf Course and Plainfield Country Club.

» The *Poa* turf was maintained at a cutting height of 0.125 inches with adequate irrigation and fertilization, as well as curative and preventive programs for disease control that included:

- Weekly application of Dollar Spot control (Emerald – Curalan), Brown Patch control (Prostar), Summer Patch control (Heritage TL)
- Growth Regulation (Primo Maxx 0.125 fl. oz./1000 ft.^{2})
- Fertilizer (0.1 N).

Plant-Health Product Applications

Three types of plant-health products were examined for their effects on *Poa* heat tolerance. The chemical treatments in the chart below were applied by foliar spray to field plots with a carrying volume of 2 gal./1000 ft.^{2}

Untreated control	Biotimulants	PGRs	Fungicides
Water (2 gal/1000 ft^2)	Amino acids (AAA, 60 mM / 1000ft^2)	Primo Maxx (trinexapac-ethyl, 0.1 fl oz / 1000 ft^2)	Daconil Action (3.5 fl oz / 1000 ft^2) (DacAc)
	Hormone (AAB, 44 µM / 1000 ft^2)	Proxy (ethephon) (2 fl oz / 1000 ft^2)	Appear II (6 fl oz / 1000 ft^2) (AppII)
	Combined AAA and AAB (AAC)	Primo Maxx + Proxy (PP)	Daconil Action + Appear II (DAppII)
	Seaweed-based SWA 12 fl oz / 1000 ft^2		Daconil Action + Appear II + Primo (DAIIP)
	Seaweed-based SWB 15 fl oz / 1000 ft^2		Signature XTRA StressGard (4.0 fl oz / 1000 ft^2) (Sig)

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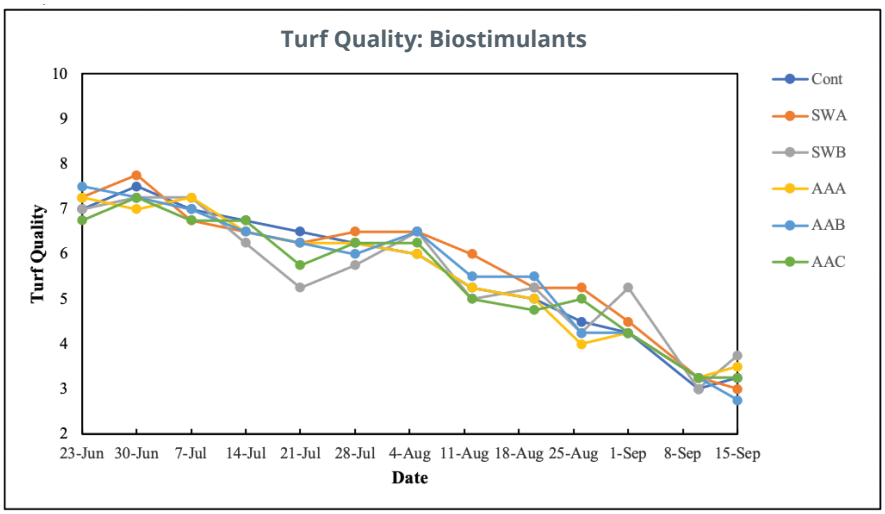
Rutgers Researchers Take Their Trials to the Field

1A



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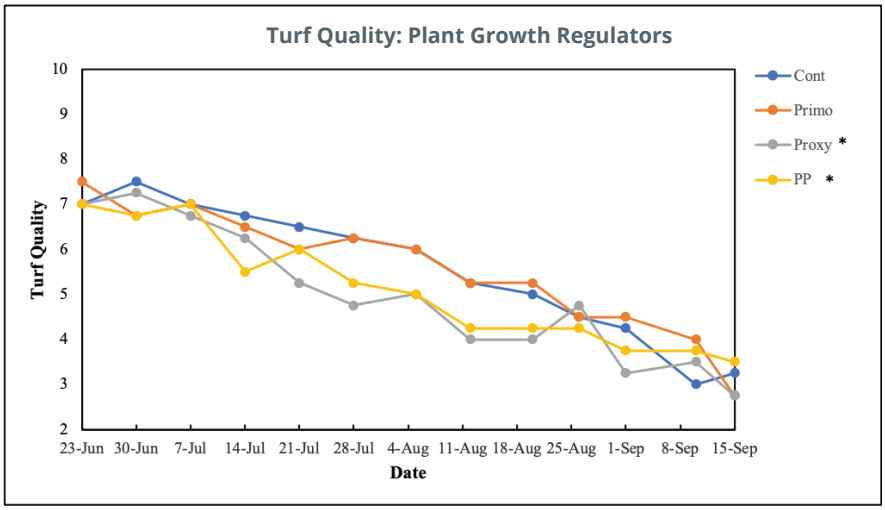

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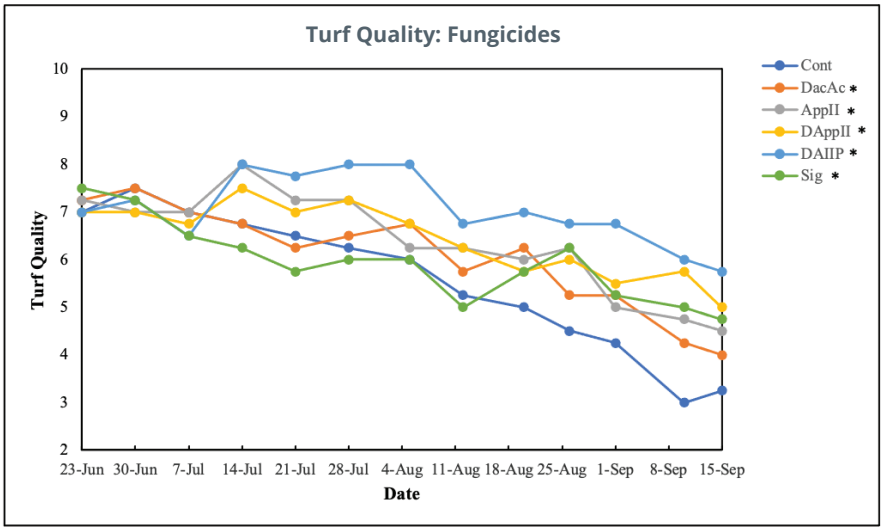

All treatments were applied to 3' x 4' field plots (4 replicates each) every 14 days between July 23 to September 1.

» The following measurements were taken weekly based on weather conditions:

- Turf quality was visually rated.
- Normalized Difference Vegetation Index (NDVI), Stress Index (SI), and Leaf Area Index (LAI) were evaluated using a multispectral radiometer (CropScan).
- Regular photos were taken to measure the percent green canopy cover and Dark Green Color Index (DGCI) using imaging analysis programs.
- Canopy temperature was measured by taking thermal pictures and using FLIR image analysis software.

» On September 8, four root cores were taken at a depth of 5cm from each plot to analyze root characteristics.

» Treatment effects on different parameters were determined by analysis of variance according to the general linear model (GLM) procedure of the SAS program.

» Significant effects of each individual treatment was compared to the untreated control at p = 0.05.

FIGURE 1 (A,B,C)

Turf quality of *Poa* putting green as affected by different treatments.
*Indicates treatments significantly different from the control at p = 0.05.

Rutgers Researchers Take Their Trials to the Field

RESULTS

The following summarizes the main findings of this study:

» *Poa* plots with applications of Daconil Action, Appear II, Daconil Action + Appear II, Daconil Action + Appear II + Primo, and Signature XTRA StressGard had significantly higher turf quality *(Figure 1A)*, percent green canopy cover *(Figure 2)*, and NDVI (indication of turf density), but lower stress index during most of the summer months from July to September.

» *Poa* treated with the combination of Proxy and Primo had lower turf quality *(Figure 1B)* and NDVI but a higher stress index during July and into mid-August.

» Among the biostimulant treatments, SWA-treated plots appeared to have higher visual turf quality *(Figure 1C)*, NDVI, as well as a lower stress index compared to the untreated control plots during the summer months, although the differences were not statistically significant (p = 0.05).

» Despite implementing methods to control anthracnose disease, the trial plots began showing signs of infection in mid-September. Plots with Daconil Action, Appear II, Daconil Action + Appear II, Daconil Action + Appear II + Primo, and Signature XTRA StressGard had a lower incidence of anthracnose than the control *(Figure 3)*.

PLANS FOR 2021

The researchers plan to repeat the experiment in the research farm and on golf course putting greens in 2021. The future replication of the experiment with more affective anthracnose control over all plots may serve to confirm if improved performance is due specifically to improved heat tolerance.

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

SIDEBAR

The Takeaway on Trial Results

» Application of Daconil Action, Appear II, Daconil Action + Appear II, Daconil Action + Appear II + Primo, and Signature XTRA StressGard effectively enhanced *Poa* turf performance managed under putting green conditions during the summer months.

» The combined treatment of Daconil Action + Appear II or Daconil Action + Appear II + Primo was more effective in improving *Poa* summer turf growth and health than each individual treatment alone.

» The combination of Proxy and Primo suppressed *Poa* growth and caused leaf yellowing during summer months.

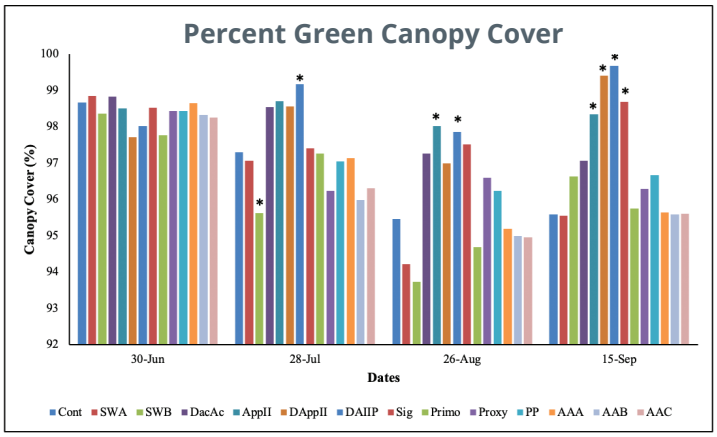

FIGURE 2

Percent green canopy cover of *Poa* putting green as affected by different treatments.
*Indicates treatments significantly different from the control at p = 0.05.

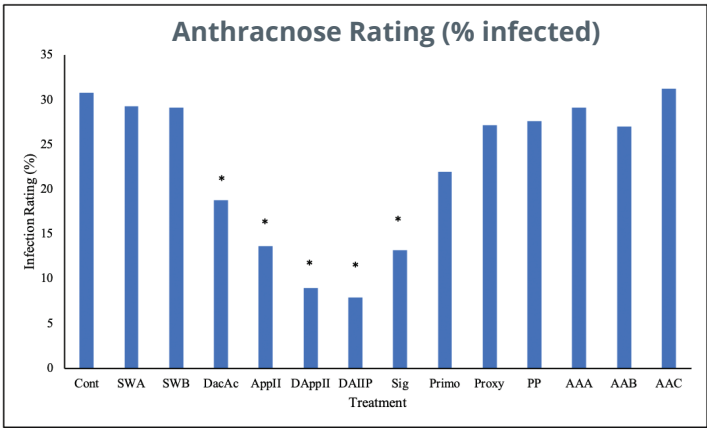

FIGURE 3

Anthracnose infection rate in *Poa* putting green as affected by different treatments.
*Indicates treatments significantly different from the control at p = 0.05.

UConn Researchers Tout Agronomic Approach to Summer Patch Management

Dr. John Inguagiato and Dr. Thomas Morris Add Manganese to the List of Potential Summer Patch Controls With New Research Ahead

Managing turfgrasses in the Northeast offers no shortage of disease control challenges, from anthracnose and dollar spot to the meddlesome patch diseases. Given the right conditions, almost any disease can cause damage that reduces playability and gives even the most experienced superintendents an agronomic and financial headache. Some of the most challenging diseases to control, however, are those affecting turfgrass roots: patch diseases such as summer patch. Summer patch control is difficult for a number of reasons; effective management of this disease must focus on maintaining a healthy, robust root system. One might consider summer patch disease as a turfgrass war of attrition between roots and pathogen infection. You likely cannot save all the roots, but the more roots you start with, the greater the potential of the turf stand to withstand some root loss and still provide water and nutrient uptake to the turf canopy above.

Summer patch primarily affects annual bluegrass and Kentucky bluegrass in the Northeast and is caused by the soil-borne fungus *Magnaporthiopsis poae*. This same pathogen may also cause disease on fine fescues, but more often, these symptoms are associated with a new fungus, *Magnaporthiopsis meyeri-festucae*, a pathogen specific to fine fescues. Symptoms often appear in July as wilting spots or patches that turn to straw-brown blighted turf, 3 to 24 inches in diameter. The pathogen overwinters in infested root and crown tissue, and therefore, symptoms often reoccur in the same locations each year, expanding 3 to 8 inches annually.

THE CHALLENGE

A major challenge with the disease is that, like an iceberg, observation of the aboveground symptoms is relatively insignificant compared to the damage the fungus has caused turfgrass roots below months earlier *(Figure 1)*. The pathogen begins infecting and degrading roots in the spring when sustained soil temperatures reach approximately 65°F. The effects of summer heat and drought stress on turf with compromised root systems results in the development of aboveground symptoms during July and August. Recovery from symptoms during summer months is unlikely until soil temperatures cool to favor turfgrass regrowth during late summer and fall. Therefore, preventive action, including cultural and chemical control, is critical to successful summer patch management.

COMPACTION A CLEAR CULPRIT

Compacted soils contribute to increased summer patch problems, particularly in high-traffic areas where cart and equipment traffic are concentrated and in sites with poor soil structure *(Figure 2)*. Turfgrasses grown in these areas suffer from restricted rooting (i.e., fewer roots) and reduced ability of roots to acquire

FIGURE 1

Kentucky bluegrass plug from active summer patch. Left side of plug contains green foliage and healthy roots; right side of plug shows blighted turf and the absence of roots.

FIGURE 2

Summer patch infestation on front edge of fairway walk-up where cart, equipment, and foot traffic are concentrated resulting in soil compaction and disease.

UConn Researchers Tout Agronomic Approach to Summer Patch Management

water and nutrients. When the summer patch pathogen is present, turfgrasses with limited root systems in these areas are often severely affected. Another challenge with compacted areas is they could affect fungicide efficacy by restricting efficient movement of fungicides into the rootzone to protect roots against the summer patch pathogen.

Hollow- and solid-tine aerification can alleviate soil compaction and reduce summer patch. It's essential, however, to avoid repeatedly cultivating to the same depth, particularly with solid-tines, as doing so can contribute to a subsurface compacted zone (i.e., pan layer) that has been associated with increased summer patch. Cultivation activities should be scheduled to coincide with periods of active root growth (spring and late summer/fall). Core cultivation during late spring or early summer has been associated with increased summer patch potentially due to a reduction in root density, as increasing soil temperatures at this time are less favorable for root growth. Manage compaction to maximize rooting, water and nutrient availability, and fungicide movement and to reduce summer patch severity.

MANAGING MOWING HEIGHT, FERTILIZATION, AND IRRIGATION

Root depth and mass are influenced by mowing, fertilization, and irrigation practices. Summer patch tends to be more severe at lower mowing heights. Consider this Kentucky bluegrass green surround seeded with the same cultivar under the same management regime, except turf in the first step cut shows more intense summer patch symptoms compared to the taller maintained turf to the left *(Figure 3)*. The photo supports similar research observations regarding the effect of mowing height on summer patch. Increasing the height of cut increases photosynthetic productivity and generally increases rooting depth and mass.

FIGURE 3

Typical "frog-eye" summer patch symptoms in step cut of Kentucky bluegrass, with less severe symptoms apparent in same turf maintained at a higher mowing height to the left. Creeping bentgrass to the right is unaffected.

Nitrogen fertility stimulates foliar growth at the expense of roots. Excessive N application during spring months, particularly with water-soluble sources, can inhibit the development of a robust root system at a critical time prior to infection by the summer patch pathogen and the onset of summer stress. Use slow-release N sources or light-frequent applications of soluble-N to avoid imbalanced turf growth.

Irrigate thoroughly and infrequently, or as necessary, to avoid excessively wet conditions which may also restrict rooting.

SOIL PH A KEY PLAYER

Soil pH greater than 6.5 is known to enhance summer patch outbreaks. Soils throughout the Northeast generally range between pH 4 to 6. Local soil pHs, however, may be affected by various inputs to reach levels favorable for summer patch development. Lime, calcium hydroxide, and other products are beneficial soil amendments to increase soil pH and improve nutrient availability. However, their application, particularly when applied infrequently at high rates, can result in a zone of high pH that may promote summer patch activity.

When applying high lime rates, split the recommended amount over spring and fall to moderate the change in pH. Some sand topdressing sources may contain minerals that contribute to increased pH. Where summer patch is a concern, inquire about topdressing pH and avoid using it if it is greater than 6.0. Municipal or ground water irrigation sources may commonly have a pH greater than 7. During prolonged periods with little natural rainfall, frequent irrigation may result in temporary periods of increased soil pH that might further influence summer patch.

(continued on page 9)

Special Thanks to Our 2020 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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RESEARCH UPDATE (CONTINUED FROM PAGE 7)

UConn Researchers Tout Agronomic Approach to Summer Patch Management

Lastly, fertilizers containing nitrate will cause a temporary increase in rhizosphere pH as roots take up the N source, and have been shown to enhance summer patch symptoms. Conversely, ammonium sulfate has the opposite effect, temporarily reducing the rhizosphere pH and suppressing summer patch. Low rates of ammonium sulfate applied alone or with summer patch fungicides during the spring or curatively can help minimize the disease. It is important, however, to water-incorporate the fertilizer to avoid foliar tip burn.

MANGANESE A PROMISING SUMMER PATCH CONTROL

Manganese has shown promise at suppressing summer patch in preliminary field studies at UConn. It is used by turf in the production of lignin and phenolics, compounds synthesized by plants to produce physical and chemical barriers to resist fungal infection by pathogens. Monthly applications of Mn applied at 2 lbs. Mn per acre as manganese sulfate reduced summer patch symptoms. Mn availability, however, is often dependent on soil pH and organic matter content. Questions remain regarding optimal application rates to maximize Mn effects on summer patch suppression on different soil types.

Research sponsored by the Tri-State Turf Research Foundation to address these questions was initiated at UConn. Unfortunately, the university response to COVID-19 delayed the research activities this past year. Progress has resumed with the first round of greenhouse trials beginining this winter 2020-21. As we finalize our research, we look forward to sharing our results with superintendents throughout the region and expanding the scope to further examine Mn application strategies to improve summer patch control. ■

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

Pursuing Solutions to Bacterial Etiolation of Cool-Season Fine Turf

Clemson Researchers Seek to Eliminate Troublesome Turf Woe

Etiolation, the abnormal elongation of turfgrass stems and/or leaves of turfgrasses, is a phenomenon that has plagued turfgrass stands for decades. While etiolation can occur at all heights of cut, golf course putting greens, surrounds, tees, and fairways are most commonly affected *(Figure 1)*.

Over the past several years, etiolation has emerged as a recurring issue for superintendents in the tri-state area. Hoping to discover an effective method for managing or eliminating this troublesome turfgrass phenomenon, the Tri-State Turf Research Foundation granted Clemson University's Dr. Joseph Roberts funding in 2020 for a one-year study to examine the causes and options for managing etiolation on cool-season fine turf.

With the Covid-19 pandemic affecting the U.S. and the researchers' ability to gather appropriate samples and data, the project has been extended into 2021. What follows are the preliminary results of their 2020 research.

WHAT IS KNOWN

» There are currently three known bacterial pathogens of turfgrass with variable infection levels with individual species of turfgrass:

- *Xanthomonas translucens* is a known pathogen of annual bluegrass, creeping bentgrass, and perennial ryegrass.
- *Acidovorax avenae* bacteria is a known pathogen of creeping bentgrass and has also been shown to infect annual bluegrass.
- *Pantoea ananatis* bacteria have also been shown to infect creeping bentgrass and perennial ryegrass

» Previous research on bacterial diseases has shown that cultural management options can vary according to bacterial species causing infection; therefore, accurate diagnosis is critical to successful control.

THE OBJECTIVES

During the course of their trials in 2020, the researchers sought to:

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

2: Examine the impact of chemical control methods for etiolation on cool-season fine turf caused by *Pantoea ananatis.*

PRELIMINARY RESULTS

OBJECTIVE 1: IDENTIFY BACTERIA ASSOCIATED WITH ETIOLATION

Throughout 2020, the Clemson Turfgrass Pathology Laboratory at Pee Dee Research and Education Center in Florence, SC, accepted samples for diagnosis of bacterial etiolation. Sample submissions were received during the early fall months when bacterial etiolation typically develops in cool-season turfgrasses.

» To date, the lab has identified 17 bacteria from 6 locations in Connecticut (1), Maryland (1), New Jersey (3), and New York (1).

» Bacteria isolated include known plant pathogenic bacteria (i.e., *A. avenae, P. ananatis,* and *X. translucens*), but the scant number of sample submissions to date limit the researchers' ability to determine which bacteria are most frequently associated with bacterial etiolation occurring in the tri-state region *(Figures 2 & 3).*

» Similar to previous research, *A. avenae* was found in creeping bentgrass exhibiting etiolation while *X. translucens* was isolated from *Poa annua* samples.

With the pandemic impacting the U.S. and limiting sample submissions, the Clemson turf lab has extended sample submissions through 2021. The researchers are hoping that an additional year of collection will allow for a better representation of locations in the tri-state region and a more accurate depiction of bacteria associated with etiolation occurring in the region. Please see the sidebar on page 11 for instructions on how to submit samples.

FIGURE 1

Golf course fairway turfgrass composed of annual bluegrass and perennial ryegrass exhibiting etiolation symptoms.

OBJECTIVE 2: IMPACT OF CHEMICAL CONTROLS ON COOL-SEASON FINE TURF ETIOLATION

While antibiotics are not a viable option for control of etiolation, previous research has shown that plant growth regulators (PGRs) can have a significant impact on symptom development and that PGR response is contingent on the bacterial species present. Current research is underway at Clemson to examine potential control measures for etiolation, caused by *P. ananatis*, on perennial ryegrass turf. However, previous research has provided some information in managing symptoms related to *A. avenae* and *X. translucens* infection.

» Experiments with *A. avenae* on creeping bentgrass have shown that frequent (i.e., 0.125 fl. oz. 1000 $ft.^2$ every 7 days) or high rate (i.e., 0.250 fl. oz. 1000 $ft.^2$ every 14 days) applications of Primo Maxx (trinexapac-ethyl) resulted in *increased* etiolation compared to the untreated control.

Pursuing Solutions to Bacterial Etiolation of Cool-Season Fine Turf

» The same treatments reduced etiolation associated with *X. translucens* infection on creeping bentgrass.

» Additional projects have shown mixed responses related to fertilization practices and, therefore, warrant further research.

FUTURE PLANS

The researchers are hopeful that results obtained this year can be used to develop more long-term management projects to reduce etiolation in the future. They currently have underway a greenhouse trial to examine potential control methods for limiting etiolation development.

In addition to the PGRs Aneuw and Primo Maxx, the researchers are evaluating Banner Maxx, Magnesium Sulfate, and Iron Sulfate for possible control of etiolation caused by *P. ananatis* on cool-season fine turf. Watch for results in the next issue of *Foundation News*.

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

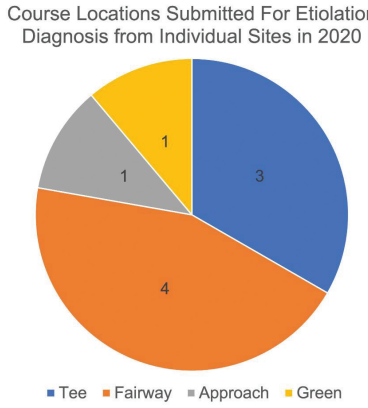

FIGURE 2
Locations identified by course when submitting sample(s) for characterization of etiolation. Note that submissions from a single course could include multiple locations (i.e., green and approach).

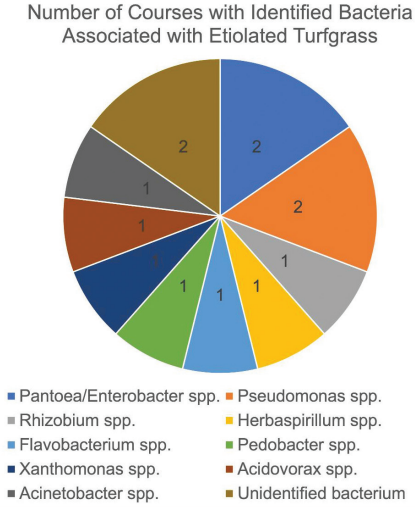

FIGURE 3
Numbers represent the frequency of bacteria genera associated with samples submitted for diagnosis of bacterial etiolation on cool-season turfgrass. Note that samples submitted can possess more than a single bacterium.

SIDEBAR

Disease Diagnostic Sample Collection

Dr. Joseph Roberts at Clemson University in conjunction with the team of researchers at Rutgers is looking at all options to manage etiolation, including but not limited to nutrient deficiencies, growth regulators, chemical applications, and cultural control methods. **However, we need your help**. It is vitally important for Dr. Roberts to receive samples from across the tri-state region with ETS on different grass varieties and on different surfaces. If you could please send a few samples to Clemson following the instructions provided here it would be greatly appreciated.

INSTRUCTIONS
Please take a sample from the symptomatic turfgrass along the leading edge of the area that is impacted. If the affected turf area includes patches of symptomatic turf, the sample can be collected so that ⅔ to ¾ of the sample is affected and the remaining turfgrass is healthy. The sample should be wrapped around the base with aluminum foil and shipped overnight to the following address:

Dr. Joseph Roberts
Clemson Pee Dee REC
2200 Pocket Road
Florence, SC 29501

When sending a sample, please send an email to Dr. Roberts at jar7@clemson.edu with shipping information. Due to recent restrictions with Covid-19, shipping delays are possible and having tracking information will ensure that samples are not lost in the mail. In the email, it is also beneficial to include turfgrass species, cultivar, date of when symptoms were first observed, and recent cultural and chemical applications.

Rutgers Team Investigates Biological Control for Annual Bluegrass in Creeping Bentgrass Fairways

Annual bluegrass is one of the most problematic and difficult-to-control weeds of creeping bentgrass fairways. Infested fairways often fail to produce quality playing conditions during the heat of the summer, and annual bluegrass proves especially competitive with older creeping bentgrass varieties, such as Pencross and Pennlinks, which are common on fairways.

Unfortunately, ridding creeping bentgrass fairways of this problematic turf is often challenging at best. Herbicides such as ethofumesate, bispyribac-sodium, and amicarbazone are not widely used for annual bluegrass control because they can cause injury to creeping bentgrass and can cause overly rapid decline of the annual bluegrass turf leaving large voids in the turfgrass canopy. Though the recently registered herbicide Methiozolin is effective against annual bluegrass with safety to creeping bentgrass, the high cost will likely limit its use on fairways.

Superintendents commonly use plant growth regulators (PGRs), such as flurprimidol and paclobutrazol, to suppress annual bluegrass. Research on putting greens and fairways has shown that annual bluegrass control from PGR programs is inconsistent likely due to different annual bluegrass biotypes and lack of complementary cultural practices. However, research on biological or natural agents for annual bluegrass control has been very limited.

ABW'S ROLE IN ANNUAL BLUEGRASS MANAGEMENT

The annual bluegrass weevil (ABW) is known to be one of the most problematic pests of annual bluegrass, while creeping bentgrass, a less preferred host for the ABW, can tolerate three to four times higher densities of ABW larvae.

In one study, Dr. Albrecht Koppenhöfer and his team from Rutgers discovered that annual bluegrass can be effectively reduced in creeping bentgrass-annual bluegrass fairways with a combination of the PGR paclogutrazol and a threshold control approach of ABW. It was the first attempt at using a turfgrass pest for the management of a turfgrass weed.

In hope of determining the viability of threshold-based ABW management for annual bluegrass control in creeping bentgrass fairways, the Tri-State Turf Research Foundation has agreed to fund Dr. Albrecht Koppenhöfer and his Rutgers research team in their work to transform a major insect pest of golf course fairways into a biological weed management agent.

In addition to reducing insecticide and PGR use, this approach would greatly improve the environmental stewardship of superintendents and the image that much of the public has of the golf course industry.

Watch for the outcomes of year one of the Rutgers research team's trials in the next issue of *Foundation News*. ■

For further information, you can reach Dr. Koppenhöfer at a.koppenhofer@rutgers.edu.

FOUNDATION NEWS STAFF
EDITOR Ken Lochridge
MANAGING EDITOR Pandora Wojick

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49 Knollwood Road, Elmsford, NY 10523-2819
TEL: 914-347-4653 FAX: 914-347-3437