FOUNDATION NEWS

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PRESIDENT'S MESSAGE

We Hold the Key to Future Success

Research. Imagine life as a turfgrass manager without it. Diseases like the once-unknown and incurable summer patch or anthracnose would run rampant on our golf courses with little recourse. Not a pretty sight.

Fortunately, for the past two decades, Met area superintendents have had the benefit of the Tri-State Turf Research Foundation's support in funding research aimed at protecting—and enhancing—our golf courses and environment.

In addition to the devastating turf pathogens, summer patch and anthracnose, these projects have yielded turf-saving insights into managing such insects as white grubs and the annual bluegrass weevil. They've aided in the selection of moss and earthworm casting controls, putting green root zone mixes, and microbial and organic-based nutritional products for optimal putting green performance.

These and other successful research efforts have benefited *all* Met-area golf clubs. Yet sadly, only 25 percent of Met-area clubs currently contribute to this essential endeavor.

If you have not yet contributed to the Tri-State Turf Research Foundation, please don't let the year go by without sending in your $200 donation to this worthwhile cause. It's such a small price to pay when you consider that the research you receive in return could save you thousands—by sparing you a costly trial-and-error approach to managing new turfgrass ills or maintenance challenges that invariably arise. When you contribute to the Tri-State Turf Research Foundation, you, ultimately, contribute to your success as a turfgrass manager. And for that, $200 truly *is* a small price to pay!

John Carlone, CGCS, President
Tri-State Turf Research Foundation

YOUR CONTRIBUTIONS AT WORK

In this issue of *Foundation News,* you'll read about four projects we've funded with the generous support of Met-area golf clubs, vendors, and foundation friends. One, spearheaded by Rutgers' Dr. Bruce Clarke and Dr. Jim Murphy, has focused on improving anthracnose control with well-timed applications of both soluble and granular nitrogen fertilization. Completing their two-year commitment with the Tri-State Turf Research Foundation, the research team has developed a series of best management practices for anthracnose disease on annual bluegrass putting greens that you'll, no doubt, find useful.

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Preventing Anthracnose From Gaining a Foothold in Putting Green Turf

Rutgers Researchers Draw Closer to Completing List of Best Practices for Anthracnose Control

Anthracnose, caused by *Colletotrichum cereale,* remains one of the most dreaded and destructive diseases of annual bluegrass putting green turf throughout the United States.

Despite researchers' attempts over the past decade to uncover a tried-and-true method of control, the frequency and severity of anthracnose outbreaks over the past decade have continued to escalate.

With $16,000 in funding over two years, the Tri-State Turf Research Foundation supported Rutgers' Drs. Jim Murphy and Bruce Clarke and graduate students Charles Schmid, James Hempfling, and Joseph Roberts in their pursuit of a control for this seemingly unstoppable disease.

Scrutinizing a variety of cultural and management practices, the researchers are able, now, to point the finger at several culprits in the disease's occurrence and offer new hope for those battling anthracnose on the their greens.

RESEARCH FOCUS

In a three-year field trial that began in 2007, the researchers focused their efforts on evaluating what they suspected would play a major role in anthracnose control: nitrogen fertility. In the course of their other studies over the past six years, they also examined the role of plant growth regulators, irrigation, lightweight rolling, topdressing, foot traffic, and mowing height on anthracnose severity in annual bluegrass putting green turf.

Not surprisingly, they concluded that nitrogen fertility and mowing height were the two practices most influential in anthracnose activity. N-deficient turf and lower mowing proved to not only predispose turf to anthracnose, but also compromise its ability to recuperate from disease damage.

What follows are the outcomes of the researchers' trials, along with their prescriptive advice for preventing anthracnose from gaining a foothold in putting green turf.

ON NITROGEN FERTILIZATION

WITH SOLUBLE N

From 2007 through 2009, the researchers conducted field trials to identify the optimum rates and frequency of soluble-N fertilization in suppressing anthracnose disease during the summer months.

During the course of their studies, they confirmed that an annual nitrogen program that includes frequent low-rate applications during summer months will reduce anthracnose incidence and severity. More specifically, they found:

» Nitrogen applied at low rates and short intervals—0.1 lbs. / 1000 sq. ft. every 7 days—or 0.2 lbs. / 1000 sq. ft. every 14-days—reduces anthracnose severity compared to less frequent applications.

» Applying greater cumulative amounts of soluble-N in a light, frequent program—up to 1.2 lbs N / 1000 sq. ft.—during the summer months can reduce anthracnose *(Figure 1).* Interestingly, when higher N rates—0.4 and 0.5 lbs. N / 1000 sq. ft.—were applied every week, there was an *increase* in anthracnose severity *(Figure 2).*

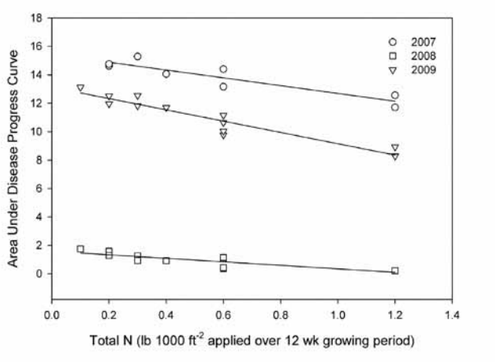

FIGURE 1
Anthracnose severity (area under the disease progress curve, AUDPC) response to total N applied to annual bluegrass in 2007, 2008, and 2009.

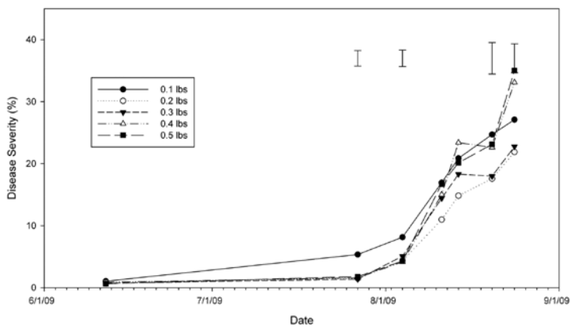

FIGURE 2
Anthracnose severity response to weekly applications of soluble N fertilization of annual bluegrass turf mowed at 0.135 inch in North Brunswick, NJ, during 2009.

Preventing Anthracnose From Gaining a Foothold in Putting Green Turf

» Beginning light, frequent soluble-N treatments prior to disease development—as early as mid-May—will provide better anthracnose suppression during the summer than N treatments started in mid-June, after the disease has gained a foothold.

WITH GRANUALAR N

The researchers initiated a larger nitrogen program study in September 2008 that continued into 2009 to examine the N-rate effect of spring and autumn granular fertilization on anthracnose severity and whether granular fertilization alters the effect of frequent low-rate soluble-N fertilization on the disease during the summer *(Table 1).* The N source they used for granular fertilization was 100 percent IBDU (isobutalenediurea). Preliminary data analysis from 2009 indicated that:

» Granular N fertilization was more effective in reducing disease severity when applied during the spring than in the autumn. However, the season of fertilization was not important at the lowest rate of granular N fertilization: 1.5 lbs. / 1000 sq. ft.

» Generally, greater N rates applied by granular fertilization reduced disease severity compared to lower N rates *(Figure 3).* However, the N rate for autumn fertilization needed to be 4.5 lbs. / 1000 sq. ft. to reduce disease severity, and the impact was not evident until late in the summer. Only 3.0 lbs. / 1000 sq. ft. of N were needed for the spring granular program (two-thirds of which were applied in the spring and one-third the previous autumn) to reduce disease severity, and the effect was evident earlier in the summer.

While greater soluble-N rates during the season reduced disease severity, it did seem to interact with the granular N rate. Though further analysis is necessary, it appears that disease severity can be suppressed with lower total amounts of N if a portion of the total N is applied as soluble-N during the season.

A second year of data collection in 2010 should clarify how much of the N should be applied as soluble-N during the season versus granular N fertilizer during the spring or autumn to effectively reduce disease severity.

ON MOWING

When it comes to one of the prime factors in anthracnose incidence, mowing height, you can't be too careful. The researchers recommend that you:

» Avoid mowing below 0.125-inch with fixed-head reel mowers. Note: The critical height for flex-head mowers has not been determined.

» Raise the cutting height as high as 0.141-inch. Slight increases in mowing height—as little as 0.015-inches—can significantly reduce the severity of this disease.

(continued on page 4)

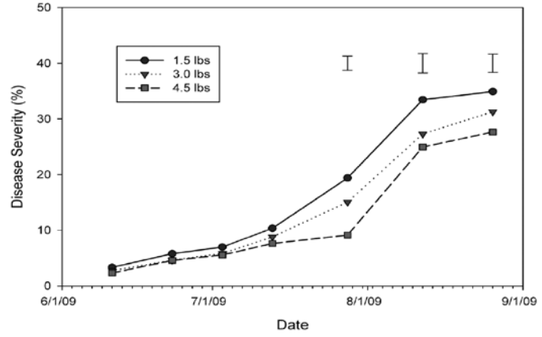

FIGURE 3
Anthracnose severity response to yearly granular N fertilization of annual bluegrass turf mowed at 0.135 inches in North Brunswick, NJ, during 2009.

Primary Season of Fertilization	N Fertilizer Rate by Month				Annual N
	Sept. 2008	Oct. 2008	Mar. 2009	Apr. 2009	
	lb 1000 sq. ft.				
None	0	0	0	0	0
Spring	0.5	0	0.5	0.5	1.5
Autumn	0.5	0.5	0.5	0	1.5
Spring	0.5	0.5	1.0	1.0	3.0
Autumn	1.0	1.0	0.5	0.5	3.0
Spring	0.75	0.75	1.5	1.5	4.5
Autumn	1.5	1.5	0.75	0.75	4.5

TABLE 1
Summary of treatment combinations (1st and 2nd factors) for granular-N fertilization. Same treatment combinations used in autumn 2009 and spring 2010 (second year of trial).

Preventing Anthracnose From Gaining a Foothold in Putting Green Turf

ON ROLLING

Interestingly, the researchers' trials revealed that rolling does not increase anthracnose severity, in fact:

» Rolling annual bluegrass putting green turf with either sidewinder or vibratory rollers can subtly reduce anthracnose severity compared to nonrolled turf under moderate disease pressure.

» Rolling every other day, regardless of roller type, can result in a subtle decrease in anthracnose severity.

» Rolling and double-cutting can be used to maintain acceptable green speed when raising the height of cut to reduce anthracnose severity.

PLANT GROWTH REGULATORS

According to the researchers' trials:

» Routine trinexapac-ethyl use, even at high rates and short intervals, should not intensify, and may actually reduce, anthracnose severity by enhancing plant health and improving turf tolerance to low mowing.

» Mefluidide and ethephon can be used to suppress seed-head formation in annual bluegrass turf without increasing anthracnose.

» Mefluidide or ethephon applied in March or April at label rates with subsequent applications of trinexapac-ethyl at 0.125 fl. ozs. / 1000 sq. ft. every 7 to 14 days or 0.1 fl. ozs. / 1000 sq. ft. every 7 days should not intensify, and may actually reduce, anthracnose severity while providing the best turf quality.

IRRIGATION

When it comes to irrigation, the researchers found you can get too much—or too little—of a good thing.

They noted:

» Increased anthracnose can result when annual bluegrass is consistently subjected to either wilt stress or excessively wet conditions.

» Irrigating to replace 60 to 80 percent of evapotranspiration and hand watering as needed to minimize drought stress will provide quality playing conditions and reduce anthracnose severity.

» In addition, anthracnose tends to thrive in overly wet conditions.

SAND TOPDRESSING

Over the past few years, the researchers launched several field studies to determine topdressing's effect on anthracnose severity. Though some of their results are preliminary, data analysis indicated:

» Summer topdressing has a greater and more consistent effect on lowering disease severity than spring topdressing. But even spring topdressing reduced disease severity compared to no topdressing.

» Weekly or biweekly sand topdressing at 1 or 2 cubic ft. / 1000 sq. ft. respectively, provides a protective layer of sand around the crown, which, in effect, raises the height of cut and, ultimately, reduces the incidence of anthracnose.

» Anthracnose does not appear to be affected by different sand incorporation techniques, so methods that best incorporate sand without severely damaging the turf should be selected. Foot traffic, when uniformly applied to turf, can reduce anthracnose, regardless of sand topdressing. And the benefits of sand topdressing in reducing disease severity are not negated when applied in the presence of daily foot traffic.

PLANS FOR 2010

The Rutgers research team plans to:

» Repeat their nitrogen fertilization trials to verify results compiled in 2009.

» Conduct additional research to determine how nitrogen source affects disease severity.

The researchers plan to incorporate results from all studies into a comprehensive set of best management practices for control of anthracnose.

For further information on the researchers' trials and future progress, you can reach Dr. Murphy at murphy@aesop.rutgers.edu or Dr. Clarke at clarke@aesop.rutgers.edu.

Anthracnose basal rot infection on individual annual bluegrass tiller.

URI Researchers Continue Search for New-and-Improved ABW Controls

Despite years of study, the annual bluegrass weevil (ABW) continues to threaten the health and welfare of golf course turf across the Northeast. Known among researchers as *Listronotus maculicollis,* this pest is particularly troublesome on close-cut annual bluegrass *(Poa annua)* and begins to wreak havoc on your turf when young larvae tunnel into the grass plant's stems, causing the central leaf blades to yellow and die. Older larvae feed externally on crowns and roots, sometimes completely severing the stems from the roots.

At one time, superintendents were able to maintain ABW densities below damaging levels with one or two preventive pyrethroid applications. More recently, some superintendents have had to make as many as six applications a year. The result: The ABW has shown signs of resistance to this once highly effective insecticide class.

Recognizing the need for a new, more reliable approach to ABW control, the Tri-State Turf Research Foundation became involved in this effort, offering University of Rhode Island researchers Dr. Steven Alm and Darryl Ramoutar funding for a three-year study of the efficacy of commonly used controls for the ABW, while pursuing more effective alternatives.

With still more work to be done, the Tri-State has agreed to extend their support for another three years, until 2012. Joining Dr. Alm's research effort are two new researchers, Nick Cladarelli and Patrick McNiece; Darryl Ramoutar, has left the team after completing his Ph.D.

Over the past year, the URI research team has focused its efforts on possible synergism of pyrethroids with demethylation inhibitor fungicides and gibberellin inhibitor plant growth regulators, as well as optimal timing of various controls.

Here's what they discovered.

FIRST THINGS FIRST: ABW MONITORING TO DETECT ADULTS

To combat pyrethroid resistance and ensure significant mortality of overwintered adults, the researchers continue to emphasize the importance of well-timed applications by carefully monitoring weevil activity.

As a result, one of the focuses of their studies has been to look more closely at tracking ABW populations with degree-day monitors. There have been some degree-day studies in the past that use the maximum and minimum temperature for each day (starting March 1) and use the formula "Degree Days = $Temp_{max}$ – $Temp_{min}$/2 – $Temp_{base}$ (where base Temp = 50° F)" to calculate approximately when weevils will be in various stages of development. The researchers are working to validate these models by analyzing data from various locations throughout the weevils' distribution. They're attempting to do this in conjunction with DuPont's Weevil Trak program (http://www.weeviltrak.com/).

In addition, the researchers hope to determine how degree days relate to various plant indicators for weevil activity.

The indicators they've traditionally relied on:

» Forsythia to Dogwood full bloom to indicate the primary migration period of overwintering adults to tees, greens, and fairways

» *Rhododendron catawbiense* full bloom to indicate when first-generation larvae emerge from stems

Since Forsythia may be in bloom nearly the entire month of April, the most reliable method of monitoring adult activity remains the soapy flush in which 1 ounce of lemon-scented dish liquid is combined with 1 gallon of water and then poured over a 4-square-foot area. The soap irritates the adult weevils lying deep within the turf thatch layer, causing them to rise to the surface within 5 minutes.

The question remains, however, how many adult weevils do you have to have before applying a chemical control?

» Dr. Alm has seen 15 weevils per square foot cause extensive damage, while Dr. Albrecht Koppenhöfer's studies at Rutgers have shown that as few as 10 larvae per square foot can cause noticeable damage.

» Dissections of females have revealed that they can produce as many as 50 eggs each. Laboratory rearing, however, has shown that females produce an average of 11.4 eggs each (Vittum et al, 1999).

THE NET

Given these statistics, you would need only one female laying an average number of eggs per square foot to cause noticeable damage.

NEXT LINE OF DEFENSE: EARLY-STAGE LARVAL CONTROL

If you fail to curb adult populations, then larval control is crucial. While adult weevils chew notches on grass blades and at the juncture of leaves and stems, their feeding has little effect on plant vitality. Larval feeding, which is concentrated inside the plant's stem, is more damaging and can lead to significant turf loss.

The next chance for reasonable control is when the first-, second-, and third-stage larvae are feeding inside the plant stems. Because they feed inside the stem, they're

(continued on page 8)

Special Thanks to Our 2009/2010 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 5)

URI Researchers Continue Search for New-and-Improved ABW Controls

susceptible only to systemic insecticides, such as imidacloprid (Merit), clothianatin (Arena), thiamethoxam (Meridian), and chlorantraniliprole (Acelepryn). With the exception of chlorantraniliprole—a anthanilic diamide—these insecticides are neonicotinoids, which act on the central nervous system of insects. Acelepryn, on the other hand, works on the disruption of calcium regulation of muscles.

In their trials with these two classes of insecticides, the researchers discovered:

» When applied alone, the neonicotinoids provided only about 50- to 60-percent control of the first-generation larvae *(Figure 4)*.

» By contrast, Acelepryn *(Figure 4)* provided 80-percent control or greater in 47 trials conducted between April 15 and May 17, 2009.

» When applied between May 18 and June 10, two trials revealed a drop to 65-percent control with Acelepryn. It appears that in some years with a long cold wet spring, the Acelepryn may not last long enough inside plants to control larvae that develop during an extended egg-laying and larval period. Or it may be that Acelepryn is just not as effective on larger larvae, which are present from May 18 to June 10. *(See DuPont's website for 2010 recommendations.)*

LAST CHANCE: TREATING LATE-STAGE LARVAE

If you are not successful in getting the majority of overwintering adults or the first three larval stages, you will need to monitor for the fourth- and fifth-stage larvae, which will be developing in mid-May to mid-June. Note: This timing is based on conditions in Rhode Island. In the tri-state area, you may be one or more weeks earlier than these dates, depending on your location.

Because these later stage larvae attack plant crowns, they're far more damaging and can lead to extensive plant death. Monitoring, therefore, is essential to determine precisely when and where to apply insecticides at this stage, especially since populations vary considerably depending on location (i.e., microclimates on your particular course).

Two methods the researchers recommend for late-stage larvae detection:

» Cut a wedge of turf with a knife or by using a cup cutter to remove plugs; then search the turf crowns, thatch, and soil for the creamy white, legless late-stage larvae.

» Make up a saturated salt solution: 4.5 cups of salt to a gallon of water. Pull plugs, break them up, and submerge them in the salt solution. If you have larvae, they will float to the surface.

Both fourth- and fifth-stage larvae and adults will surface using this method. This is not as reliable a detection method, however, for first- through third-stage larvae because

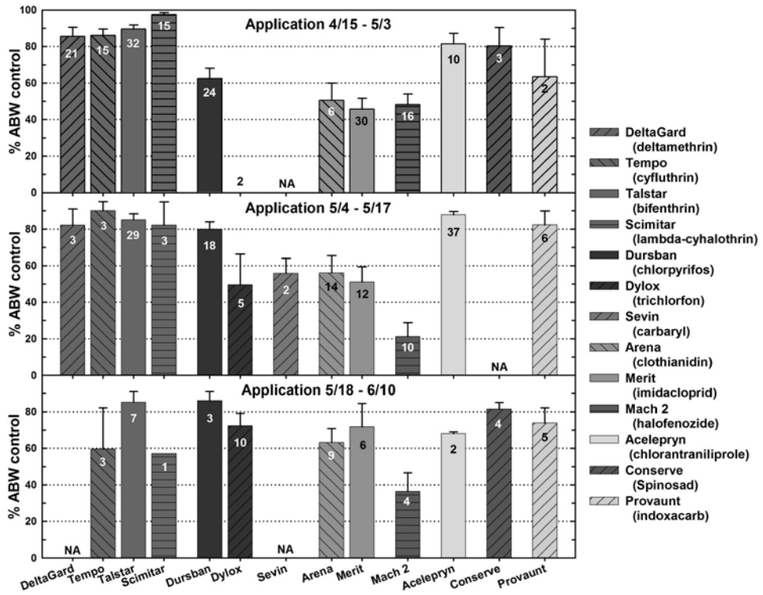

FIGURE 4
Efficacy of various insecticides at three different timings for annual bluegrass weevil control. The number inside the bar indicates how many trials made up the average % control.

Data complied by Albrecht Koppenhöfer from all Northeast turfgrass entomologists.

RESEARCH UPDATE (CONTINUED)

URI Researchers Continue Search for New-and-Improved ABW Controls

they feed within the plant stems, and a large percentage may not make it out of the plants to come to the surface.

Unlike the first three larval stages, the fourth- and fifth-stage larvae of ABW are most susceptible to contact insecticides.

» Choices for control include: Dylox, Conserve, Dursban, Provaunt, and all pyrethroids.

» Aloft is composed of two products: bifenthrin (pyrethroid) and clothianidin (systemic neonicotinoid). According to the label, the application of Aloft can be made in April to suppress adult (bifenthrin) and larval (clothianidin) activity for the entire season. But the researchers caution that you still should take care to monitor for adults and larvae to prevent damage. See the Aloft guarantees at http://www.arystalifescience.com/default.asp?V_DOC_ID=1734.

» Allectus is also a combination product (bifenthrin and imidacloprid).

Note: Neither Aloft nor Allectus is registered for use in Nassau and Suffolk counties in New York.

BEST DEFENSE AGAINST CHEMICAL RESISTANCE

The results of the researchers' trials in 2009 also indicated that:

» Demethylation inhibitor fungicides (Rubigan and Banner MAXX) and gibberellin inhibitor plant growth regulators (Primo MAXX and Cutless) acted as synergists to Talstar. More field trials are necessary to confirm these preliminary results.

» When careful monitoring uncovers ongoing larval activity, the methods of control—i.e., Pyrethroids, Aloft, Allectus, Acelepryn, Dylox, Conserve, Dursban, Provaunt—can be repeated during the summer as new generations emerge.

The researchers caution that because the ABW has at least three generations per year in some locations, it is a pest that has the potential to develop resistance to any chemicals used to combat it. It still holds true that the more applications made of the same chemistry, e.g. pyrethroids, the quicker the insect will develop resistance.

In the end, monitoring both adult and larval weevil activity is critical in effectively controlling the ABW. By applying chemicals only when and where they're actually needed, you will reduce the chance of developing chemical resistance, reduce effects on beneficial predators and, ultimately, ensure more consistent control of the annual bluegrass weevil.

Dr. Steven Alm is available to answer any of your questions concerning his research or your insect control plans. He can be reached at stevealm@uri.edu.

PRESIDENT'S MESSAGE (CONTINUED FROM PAGE 1)

We Hold the Key to Future Success

Other research, guided by Dr. Jim Murphy and Dr. Stephen Hart, is still in progress and drawing closer to developing a tried-and-true method for improving the uniformity of golf course fairway turf.

The third project involves the ongoing work of University of Rhode Island's Dr. Steven Alm to uncover new methods for combating the pyrethroid-resistant annual bluegrass weevil.

Last, but not least, is the ongoing work of the University of Connecticut's Dr. Jason Henderson to develop a fairway topdressing program that ensures the best use of our valuable resources: time, labor, and materials.

After reading about the research we've supported this past year, I hope you'll come away with more than just an action plan for enhancing your golf course turf.

My hope is that you'll see, all the more clearly, the value of supporting these studies—and others in the future—that are pertinent to turfgrass issues on our golf courses, in the tri-state area.

I want to thank all who have added their name to the List of Contributors in 2009 and 2010 and look forward to our list growing to record numbers in the coming year!

Rutgers Researchers Continue Trials to Free Fairways of Mixed-Species Turf

As golf courses age, their fairways can lose their uniformity, becoming a collection of turfgrass species that can vary in growth habit and rate, density, color, susceptibility to pests, and a variety of other important traits. Aside from creating a mixed bag of maintenance challenges, mixed-species fairways can vary in appearance and, more troublesome, in playability at different times of year.

In an effort to help superintendents improve uniformity of their golf course fairway turf, the Tri-State Turf Research Foundation has offered Rutgers' Dr. James Murphy, Bradley Park, and Dr. Stephen Hart $10,000 in support for a two-year study designed to uncover a reliable method for reducing the variability and inconsistencies of mixed-species fairway turf.

IN YEAR ONE

Trials conducted in 2008 and 2009 were targeted at:

» Determining the feasibility of using the herbicide Corsair (chlorsulfuron) in conjunction with creeping bentgrass overseeding to replace perennial ryegrass in mixed-species fairway turf

» Studying soil acidification's role in reducing annual bluegrass in mixed-species stands

Here's what the researchers discovered.

ON PERENNIAL RYEGRASS REMOVAL

Trials confirmed that the herbicide Corsair, applied at the label rate of 1 to 2 ozs. per acre, will remove perennial ryegrass from turf mixed with annual bluegrass and creeping bentgrass. However:

» Some phytotoxicity was observed on annual bluegrass while creeping bentgrass typically had little to no phytotoxic response to chlorsulfuron in the trials.

» Once the perennial ryegrass began to respond to the chlorsulfuron, the turf deteriorated rapidly, well before surrounding annual bluegrass or creeping bentgrass could fill in the voids.

Knowing golfers and superintendents would prefer a gradual loss of perennial ryegrass and transition to annual bluegrass and creeping bentgrass, the researchers examined applying chlorsulfuron at rates of ⅛, ¼, ⅓, ½, and ⅔ oz. per acre. The researchers also assessed applying the herbicide at two different times during the growing season: June and September.

The results to date:

» All rates of the herbicide have resulted in a rapid kill of perennial ryegrass; although the ⅛-oz. rate appeared to be less aggressive. The researchers plan, therefore, to assess rates below ⅛ oz. in 2010.

» The chlorsulfuron appeared to remove perennial ryegrass more quickly in September than in June; although loss of perennial ryegrass cover was extensive during both periods.

During the trials, the researchers also attempted to replace the perennial ryegrass by overseeding with creeping bentgrass in September. Their attempt was unsuccessful.

The fairways in these trials had limited irrigation for seedlings because of play and had also been treated with a preemergent herbicide in the spring.

The researchers first suspected Corsair's potential for residual soil activity as the culprit in preventing the bentgrass from becoming established. But because the bentgrass also failed to establish in plots that were not treated with herbicides, the researchers felt that the lack of success was due as much to other difficulties with overseeding fairways.

The researchers will evaluate the trial plots in 2010 to observe whether perennial ryegrass regrowth occurs in the herbicide-treated plots. They will also look at whether low-rate applications of chlorsulfuron might produce a more acceptable, gradual loss of perennial ryegrass and transition to annual bluegrass and creeping bentgrass.

ON ACIDIFICATION WITH ELEMENTAL SULFUR

During trials to reduce earthworm casting activity in fairway turf, the researchers discovered that applying sulfur to acidify the soil not only reduced earthworm casting, but also resulted in shifts in turf species populations.

In experimenting with elemental sulfur applications, the researchers also noted:

» A wettable powder formulation of sulfur will react more rapidly in the soil than a dispersible micro-granular. This faster reaction is due to the much smaller particle size of the wettable powder formulation. Smaller particles of sulfur (oxidize to sulfate) reacted more rapidly by soil microbes than the larger particle (granular) formulation.

» It's best to avoid large-granule formulations of elemental sulfur, which have a greater potential for highly localized and intense acidification. The larger granules can burn the turf in small spots immediately surrounding the granule, and injury can be confused with dollar spot disease.

» Previous trials at Knollwood Country Club indicated that sulfur applied at 1 lb. / 1000 sq. ft. is safe, while greater than 4 lbs. can produce some scorch.

In future trials, the researchers will attempt to determine if 2 and 3 lbs. of sulfur can be applied without producing scorch on a consistent basis.

Watch for an update in the 2011 issue of *Foundation News*.

UConn Researchers Draw Closer to Identifying Viable Fairway Topdressing Program

University of Connecticut researchers Dr. Jason Henderson and Nathaniel Miller will continue their studies to find the ultimate fairway topdressing program with an additional two years of funding from the Tri-State Turf Research Foundation.

Though fairway topdressing is becoming more prevalent at many golf courses, there's still limited information about sand selection, the frequency and rate of application, and the turfgrass management implications as the topdressing layer accumulates.

Given that fairway topdressing remains a costly investment—in time, labor, and materials—Dr. Henderson and his team have spent the past two-and-a-half years working to ensure superintendents make informed decisions about their topdressing materials and approach. In a series of field trials, they've sought to:

1: Determine whether particle size distribution and/or application rate will affect turfgrass color, quality, and cover, as well as disease incidence and earthworm activity.

2: Quantify the effects of particle size distribution and topdressing layer depth on moisture retention, soil temperature, and resistance to surface displacement.

Use the resulting data to make recommendations to improve the practice of fairway topdressing.

FIELD TRIALS IN PROGRESS

Field trials were initiated during the summer of 2007 on an L-93 creeping bentgrass *(Agrostis stolonifera)* stand managed as a golf course fairway at the University of Connecticut Plant Science Research and Education Facility.

In this portion of the study, the researchers evaluated two factors:

1: Sand Type: fine, USGA, and coarse (Table 2).

2: Application Rate: 4 cubic ft. / 1000 sq. ft., 8 cubic ft. / 1000 sq. ft., and 12 cubic ft. / 1000 sq. ft.

A control that receives no topdressing applications was also included.

Still ongoing, topdressing applications have been applied at a constant rate once a month. In 2007, the process began in July and ended in November; in 2008, it ran May to November; and in 2009, it ran from May through September.

This process allows the researchers to compare each sand type applied at each of the three rates. The three different rates also enable the development of three different depths of topdressing over time.

Collecting the data weekly, the researchers continue to evaluate volumetric soil moisture, soil penetration resistance, and turfgrass cover, color, and quality.

WHAT THEY DISCOVERED

The field trials conducted in 2009 confirmed much of what the researchers had learned in trials over the past year. One aspect of the trials that became more evident in 2009, however, was sand topdressing's effect on soil temperatures at a 2-inch depth:

» In 2008, soil temperatures appeared to be moderated by sand topdressing—that is, soil temperatures increased in the spring and fall and decreased in the summer.

» In 2009, data clearly indicated that sand topdressing increases soil temperatures—across the entire growing season. No adverse effects of the increase in soil temperature have been observed to date.

Otherwise, the study yielded the following results:

ABOUT TURFGRASS COLOR, QUALITY, AND COVER

» Topdressed plots showed a faster spring green-up response than the untreated control plots, regardless of sand type.

» Plots that received higher rates of application exhibited a greater greening response than plots that received lighter rates of application.

» Soil temperature data indicate this greening response is likely related to higher soil temperatures at a 2-inch depth on plots receiving higher topdressing rates.

(continued on page 12)

	Soil Separate %				% Retained					
Treatment	Sand	Silt	Clay	No. 10 Gravel 2 mm	No. 18 VCS 1 mm	No. 35 CS 0.5 mm	No. 60 MS 0.25 mm	No. 100 FS 0.15 mm	No. 140 VFS 0.10 mm	No. 270 VFS 0.05 mm
Fine Sand (Desiato Mason)	97.3	1.3	0.6	0.8	4.4	11.0	31.6	31.1	12.1	7.1
USGA Sand (Holliston #40)	99.3	0.1	0.5	0.1	2.6	20.2	52.3	20.6	2.7	0.9
Coarse Sand (AA Will Mat. 2mm)	99.5	0.0	0.4	0.1	11.0	31.5	42.0	13.0	1.6	0.4
USGA Rec. for Putting Grn Const.		≤ 5%	≤ 3%	≤ 3% Gravel ≤ 10% Combined		≥ 60%		≤ 20%	≤ 5%	

TABLE 2
Particle size analyses of sand types. USGA recommendations for putting green construction are included for reference only.

UConn Researchers Draw Closer to Identifying Viable Fairway Topdressing Program

ABOUT DOLLAR SPOT COUNTS

» Topdressed plots exhibited a lower incidence of dollar spot than untreated plots.

» Plots that received higher rates of topdressing had a lower incidence of dollar spot than plots that received lower rates of topdressing, regardless of sand type.

ABOUT EARTHWORM CASTINGS

» Topdressed plots exhibited fewer earthworm castings than untreated plots.

» Plots that received higher rates of topdressing had fewer earthworm castings than plots that received lower rates of topdressing, regardless of sand type.

ABOUT SOIL PENETRATION RESISTANCE

» Topdressed plots had higher resistance to penetration and firmer surface than the untreated control plots.

» The fine sand had the greatest resistance to penetration, followed by the medium sand and the coarse sand.

» Plots receiving higher rates of topdressing exhibited greater firmness than plots receiving the lower rates.

ABOUT VOLUMETRIC SOIL MOISTURE

» Untreated controls had the highest volumetric soil moisture content in the top 2 inches of the playing surface compared to all topdressing treatments.

» The fine and medium sand treatments held more water than the coarse sand treatments.

» Regardless of sand type, the higher the rates of application, the less water is held in the top 2 inches of the playing surface.

FUTURE PLANS

Given the data collected to date, the researchers can safely say that there are many positive effects associated with the practice of fairway topdressing, including increased turfgrass color, quality, and cover, reduced surface moisture retention, and firmer surfaces.

This practice, however, remains expensive, labor-intensive, extremely time-consuming, and rough on equipment. The good news is that sand type seems to have little impact on the effect of the topdressing applications. This could, therefore, result in a significant cost savings associated with sand purchases. Although a USGA sand does not appear to be necessary for implementing a successful fairway topdressing program, it is highly recommended that superintendents work closely with accredited laboratories in selecting topdressing materials.

Topdressing treatments will continue in 2010, with the following objectives in mind:

1: Determine if topdressing applications continue to result in favorable responses related to turfgrass color, quality, cover, moisture retention, and firmness

2: Assess any potential negative responses as the topdressing layer continues to accumulate, such as low moisture stress, localized dry spots, and ant infestations

3: Evaluate the long-term effects of sand topdressing on disease incidence and earthworm activity

For further information on the research and future work, you can reach Dr. Jason Henderson at Jason.henderson@uconn.edu.

In the meantime, plan to attend the second biennial UConn Turfgrass Field Day on July 20 to see firsthand the results of the topdressing and other research trials conducted at the university. For further information about the event, log on to www.turf.uconn.edu.

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