FOUNDATION NEWS

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PRESIDENT'S MESSAGE

Research Is the Answer

Research has long been essential to the turfgrass management industry. If you consider the great strides made in our industry over the past 40 to 50 years, you'll see that research has played a critical role. It's through research that turfgrass managers have learned to overcome a variety of debilitating turfgrass pests and challenges and discovered the most effective products and approaches to producing quality turf.

Now, in the face of a shrinking economy—and shrinking golf course budgets—research plays an even more vital role.

Scott Niven, CGCS
Tri-State Turf Research Foundation President

With fewer dollars to spend, turfgrass managers can't afford a trial-and-error approach to *any* aspect of their maintenance operations. When a new turf disease or pest problem arises, they need a concrete, definitive plan of action . . . the kind that only well-funded research can provide.

A LITTLE SUPPORT GOES A LONG WAY

Since 1992, the Tri-State Turf Research Foundation has supported research pertinent to turf issues in the tri-state area. These studies have yielded turf-saving insights and information on such devastating turf pathogens and insects as summer patch, anthracnose, white grubs, and the annual bluegrass weevil. They've taken the guesswork out of selecting appropriate putting green root zone mixes, microbial and organic-based nutritional products, moss and earthworm controls, and fairway renovation programs.

Looking at this 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. Fortunately, we have no shortage of talent at Rutgers, Cornell, University of Connecticut, and University of Rhode Island—the universities we rely on to conduct our research.

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URI and Rutgers Offer Promising New Insight Into ABW Monitoring and Control

Golf course superintendents can rest a bit easier knowing that two teams of researchers—one from Rutgers, the other from University of Rhode Island—have been hard at work, investigating more efficient and effective monitoring methods and controls for the highly destructive annual bluegrass weevil (ABW).

Technically known as *Listronotus maculicollis,* this pest is particularly troublesome on close-cut annual bluegrass *(Poa annua)* in the northeastern United States. ABW trouble begins when young larvae tunnel the grass plant's stems, causing the central leaf blades to yellow and die, while the older larvae feed externally on crowns and roots, sometimes completely severing the stems from the roots.

The most severe ABW damage normally is caused by first generation older larvae around late May/early June in the New York metropolitan area. Damage from the second generation larvae, in early to mid-July, is usually less severe and more localized.

With funding from the Tri-State Turf Research Foundation, both the URI and Rutgers research teams have come infinitely closer to providing golf course superintendents with a concrete plan for reigning in this seemingly unstoppable pest.

In the pages that follow, you'll find the researchers' most up-to-date findings and recommendations for taking the edge off the ABW threat.

URI Researchers Seek New Plan of Attack on Pyrethroid-Resistant Weevils

For years, preventive applications of pyrethroids allowed superintendents to protect their turf from ABW damage. By 2005, that all began to change. With some courses making up to six preventive pyrethroid applications per year, the annual bluegrass weevil began to show signs of resistance to this once highly effective insecticide class.

With $30,000 in funding from the Tri-State Turf Research Foundation, University of Rhode Island researchers Dr. Steven Alm and Darryl Ramoutar have been hard at work evaluating the efficacy of commonly used controls for the annual bluegrass weevil, while pursuing more effective alternatives.

In 2007, their trials took them to golf courses in Connecticut, Rhode Island, and Massachusetts where they were able to confirm their suspicions: ABW populations on the high-pyrethroid-use golf courses did, in fact, develop resistance to both bifenthrin and λ-cyhalothrin.

In 2008, the researchers determined that several insect enzyme systems are involved in pyrethroid resistance: cytochrome P450s, glutathione s-transferases, and carboxylesterases. Each ABW population tested had low, moderate, or high resistance to pyrethroids, suggesting that the use of synergists may assist in overcoming resistance. This information will also prove useful in tracking whether the pyrethroid-resistant populations are resistant to other classes of insecticides as well.

In 2009, the researchers will use their third, and final, year of Tri-State funding to:

» Explore the use of synergists like piperonyl butoxide (PBO) to overcome pyrethroid resistance

» Conduct field trials on new chemistries—e.g. Provaunt®, Conserve®, Acelepryn®—to evaluate their ability to combat the annual bluegrass weevil

» Track ABW populations with degree-day monitors

What follows are the researchers' latest conclusions and recommendations for breaking through the pyrethroid resistance barrier.

OVERCOMING PYRETHROID RESISTANCE IN THE ADULT ABW

To combat pyrethroid resistance and ensure significant mortality of overwintered adults, the researchers emphasize the importance of well-timed applications. Their recommendations:

» Ensure applications coincide with peak adult abundance by carefully monitoring adult activity. The best method: a soapy flush in which 2 ounces of lemon-scented dish liquid is combined with 2 gallons of water and then poured over an 8-square-foot

URI Researchers Seek New Plan of Attack on Pyrethroid-Resistant Weevils

area. The soap irritates the adult weevils lying deep within the turf thatch layer, causing them to rise to the surface within 5 minutes.

» Apply pyrethroids late in the afternoon since weevils prefer to feed in the dark, and some pyrethroids are less effective at high temperatures and break down in sunlight.

The researchers' trials also linked pyrethroid resistance to enzymatic insecticide metabolic detoxification. Translation: The ABW produces a group of enzymes—the cytochrome P450s—that essentially inactivate pyrethroids before they can do their job.

Further investigation revealed:

» The cytochrome P450 enzymes can be blocked by using an insecticidal synergist called piperonyl butoxide (PBO).

» Kicker®, a Bayer Environmental Science product that contains both PBO and pyrethrins may have potential as a P450 blocker when used in combination with a pyrethroid. Alone, pyrethrins—natural chemicals from which synthetic pyrethroids were modeled—are excellent for knockdown, but they do not provide a high level of mortality. The researchers plan to put the Kicker®/pyrethroid combination to the test next season. One caution: PBO breaks down rapidly in sunlight and may not stay around long enough to exert the synergistic effect.

» Dursban® may also be used for adult control. Unfortunately, it's no longer being sold for use on turf, and Dow AgroSciences will maintain only current state registrations through 2009.

» Applications of these products should be made during peak adult activity.

IF ADULT CONTROLS FAIL TRY, TRY AGAIN

If insecticide applications 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 and roots, is more damaging and can lead to extensive turf loss. The progression:

» The first three larval stages feed inside plant stems, while the 4th and 5th stages attack plant crowns.

» Because they feed outside the stem, larvae in the last two stages are most vulnerable to contact insecticides. The time to target these late-stage larvae is from mid-May through early June for the first generation; late July and early August for the second generation; and again, in late September to early October for the third generation.

The researchers are quick to point out, however, that populations vary considerably depending on location. Monitoring, therefore, is essential to determine precisely when and where to apply insecticides for optimal control.

Larvae can be monitored by cutting a wedge of turf with a knife or by using cup cutters to remove plugs and then searching the turf crowns, thatch, and soil for the creamy white, legless late-stage larvae. (See Tri-State-supported research on new ABW sampling technique on page 4.)

PRODUCTS THAT SHOW PROMISE

The researchers looked at several options for larval control, including Conserve® SC, Dylox® 80 S, Provaunt® 30 WDG, and Aloft® SC. Here's what they found:

» All the products tested offered 80 to 96 percent control at labeled rates.

» Conserve® performed well, but it was not as consistent as the other chemicals tested.

» Of all the Dylox® options, the 80 S formulation proved most effective because it offers increased coverage.

» Colleagues at the University of New Hampshire who had researched Provaunt® noted that making two applications five to seven days apart may be the best approach when using this chemical.

» Aloft® is composed of two products: bifenthrin (pyrethroid) and clothianidin (systemic neonicotinoid). In some trials, an application of Aloft® made in April proved effective in suppressing adult (bifenthrin) and larval (clothianidin) activity for the entire season. By themselves, however, the neonicotinoids have not shown a high level of control in several studies. Therefore, before the researchers can widely recommend this product for its synergistic effect, more testing will be needed. Keep in mind, too, that Aloft® is *not* registered for use in Nassau and Suffolk counties in New York.

» Acelepryn®, a new product, also works well against larvae, providing greater than 80-percent control. Moving in the transpiration stream of

(continued on page 11)

Getting the Bugs Out of New ABW Monitoring Program

Rutgers Researchers Look to Perfect Method for Predicting Larval Damage

Rutgers entomologists Dr. Albrecht Koppenhöfer and Benjamin McGraw have fulfilled their one-year agreement with the Tri-State Turf Research Foundation. With $5,500 in support, Dr. Koppenhöfer and Benjamin McGraw have worked to perfect a nondestructive sampling method for forecasting larval damage from one of the most dreaded golf course insect pests in the Northeast, the annual bluegrass weevil (ABW).

Koppenhöfer and McGraw are among the first to seek a practical and reliable sampling protocol for assessing both the presence of ABW adults and the threat of damage by their offspring. Their objective: to help superintendents reduce unwarranted insecticide use by enabling them to pinpoint precisely when and where applications are needed.

Current sampling methods either rely on unrelated plant indicators to time applications or require soil core sampling, which is both labor-intensive and destructive to the turf. Koppenhöfer and McGraw have developed a method of vacuum sampling, using a common leaf blower (reverse-air), to detect adults on playing surfaces and correlate their numbers to future larval densities and, ultimately, the threat of turf loss.

Here's a look at their latest work in developing a more effective—and efficient—program for monitoring and managing ABW populations that threaten close-cut annual bluegrass *(Poa annua)* on golf courses.

VACUUM SAMPLING PUT TO THE TEST

From 2007 to 2008, the researchers evaluated the viability of vacuum sampling in detecting ABW adults on the fairways of three separate golf courses in central and northern New Jersey. Beginning late March, early April, the researchers used their vacuum sampler weekly, collecting the emerging adult weevils from fairway turf surrounding short-mown playing surfaces. They continued sampling until mid-October, through the end of the third-generation larval cycle.

The process:

» The researchers fitted the vacuum sampler with a mesh basket to capture adults as they entered the nozzle.

» After vacuuming a section of fairway for 10 seconds, they emptied the basket onto a tray and recorded the number of adults collected.

» To gage the effectiveness of the vacuum sampling method, the researchers also employed the traditional soil core sampling process to collect adult weevils. This required using a turf plugger (5.5 cm diameter) to collect the samples and then saline extraction in the laboratory to free the adult weevils from the soil cores.

The outcome:

» Both methods detected adults arriving on fairways and were effective at determining the peaks in adult abundance.

» Vacuum sampling, however, proved superior to soil sampling because it's not destructive to the turf; it takes less time per sample (under 1 minute); and it provides an instant, in-field estimate of population density.

ARE ADULT COUNTS PREDICTORS OF FUTURE LARVAL DENSITIES?

While putting their vacuum sampler to the test, the researchers worked to determine whether larval densities could be correlated to the number of adults captured.

Conducting trials on two golf courses in northern New Jersey, the researchers collected adult weevils between the start of adult emergence from overwintering through the egg-laying period.

The process:

» The researchers drew samples from 6' x 6' plots laid across six fairways on each of the two courses.

» After the adult weevils were no longer laying eggs, the plots were sampled for larvae.

» The larvae collected were then compared to the number of adults captured throughout the entire sampling period.

The outcome:

» The first adults were detected on fairways in the first week of April at all sites. In 2007 and 2008, two peaks in adult abundance were observed, with the first peak occurring around April 20 and the second peak around May 5.

» Larval densities were most consistent with adult counts during the second peak of abundance but also correlated with the cumulative adult counts during the study.

These correlations suggest that, while egg laying occurs over an extended period of time, the majority of eggs

Getting the Bugs Out of New ABW Monitoring Program

are deposited following the second peak in abundance.

The Net: Pest managers may well be able to accurately judge the threat of turf loss by sampling only during periods surrounding the second peak in adult abundance.

SEQUENTIAL SAMPLING PLAN SHOWS PROMISE

Understanding the link between adult weevil populations and future larval densities, the researchers set out to help pest managers more easily—and accurately—monitor ABW densities and the threat of larval damage through the use of sequential sampling plans.

Sequential sampling is a monitoring technique that allows turf managers to estimate pest densities based on taking a limited and variable number of samples. The process, in short:

» After a minimum number of samples are taken, the pest density is calculated and compared to a damage threshold.

» If the threshold is exceeded, action is taken to control pests.

» If the pest density is below the threshold, turf managers have several options: Take additional samples to gain a more definitive estimate; sample again at a later date to see if the population has increased; take no action because the pest population is so low.

For this study, researchers created a computer-generated sequential sampling plan, which aided them in determining the number of samples and time required to most accurately estimate pest densities.

What they learned in the process:

» As few as 15 samples—or approximately 20 minutes of sampling—may be required per location to determine ABW adult density over a wide range of potential thresholds.

» The density of adults can then be correlated to the predicted densities of larvae, and the likelihood of damage can be weighed.

The Net: The results of the analysis are encouraging, but they will require further validation in the field.

WHAT'S NEXT

During the course of the study, Koppenhöfer and McGraw were able to determine, conclusively, that:

» Vacuum sampling can be an effective monitoring tool for estimating ABW adult density.

» Counts of adults on fairways are correlated to future larval densities.

» Sequential sampling plans show great promise in helping pest managers rapidly determine adult density and assess the likelihood of larval damage. The researchers stress, however, that the sampling plans require further validation before they can be adopted by the practitioner.

Though the Tri-State funding has come to a close, the researchers hope to continue work to:

» Determine adult ABW density thresholds

» Identify optimal timing for curative controls once adult thresholds have been crossed

» Determine the number of locations around the golf course that require sampling

The researchers' ultimate goal is to provide superintendents with a reliable ABW monitoring system that will enable them to replace large-area applications of insecticides with more effective as-needed, small-area applications.

For further information on the research and future progress, you can reach Dr. Albrecht Koppenhöfer and Benjamin McGraw at koppenhofer@AESOP.rutgers.edu.

Adult Annual Bluegrass Weevil

UConn Researchers Still Wrestling With Algae Cure and Control

Algae. It's yet another complication of the ever-increasing demand for faster, more-competitive putting surfaces. Combine low heights of cut with an environmental stress or two—excessive soil moisture, shade, poor air movement, extended periods of leaf wetness—and your greens are primed for an algae infestation and a host of other turfgrass disorders.

Appearing on greens as a scum or crust layer that ranges in color from green to brown or black, this prokaryotic organism often referred to as cyanobacteria, disrupts the playing surface and creates a soil medium that just won't grow grass.

Though the triggers of this tough-to-manage turf ill are clear, a reliable control continues to elude researchers. In the past, such fungicides as chlorothalonil (e.g., Daconil) and macozeb (e.g., Fore) have been shown to suppress algae, but these products must be applied on relatively short intervals before the symptoms appear and, even then, their efficacy varies.

Further complicating the use of fungicides is that chlorothalonil has been banned in certain regions of New England. Even in areas where the fungicide is still legal, new label restrictions limit the total amount of product that can be applied and require increased time between applications. This drastically limits superintendents' ability to control algae over the course of an entire season.

In 2007, with Tri-State Turf Research Foundation support, researchers at the University of Connecticut began work to determine the best management practices to control algae on golf course putting greens. Preliminary findings led the researchers to believe that the application of select phosphonates and wetting agents could prove viable as a means to suppress algae. There was also some indication that identifying just-the-right nitrogen and phosphorus levels could offer help in keeping chronic algae problems at bay.

As a result, the researchers—under the direction of Dr. John Kaminski, now assistant professor of turfgrass science at The Pennsylvania State University—set out to:

» Determine the ability of various phosphonates and wetting agents to prevent, even cure algae.

» Determine the influence of various N-sources on algae growth.

» Develop best management practices for season-long suppression of algae on golf course putting greens.

TAKING ALGAE TRIALS TO THE FIELD AND GREENHOUSE

During the summer of 2008, three field studies were initiated on a native-soil putting green established at the UConn Plant Science Research and Education Facility. Among the specifications on the care and feeding of the green:

» It was topdressed routinely with sand conforming to USGA guidelines.

» The underlying soil was a loam with a pH of 5.9 and 5.8 percent organic matter.

» Turf was mowed approximately five times per week to a height of 0.125 to 0.140 inches with a walking mower.

» For all field studies, products were applied with a CO^2-pressurized (40 psi) backpack sprayer equipped with a flat-fan nozzle and calibrated to deliver 2 gallons of water per 1000 sq. ft.

» Plot size measured 2.5 ft. x 5 ft. or 2 ft. x 5 ft., and all were arranged in a randomized complete block with three or four replications.

To encourage algae development on the plots:

» Overhead irrigation was programmed to run for two to three minutes, three times during the day and two times during the night.

» The areas were fertilized every two to three weeks with 20-20-20 fertilizer, which in other trials, appeared to promote the development of algae.

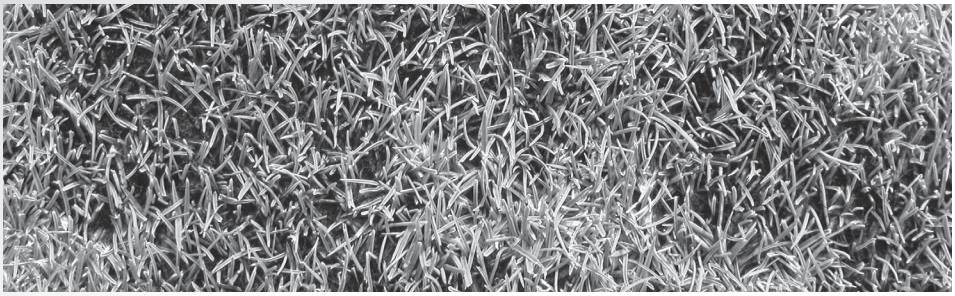
Two of the three studies were designed to investigate the ability of various phosphite and traditional fungicides to provide preventive and curative suppression of blue-green algae. The third study was designed to determine the influence of various fungicides and wetting agents on algae control.

A final trial was conducted inside the university's greenhouse to determine the influence of various N-sources on algae growth.

IN TRIAL ONE: PHOSPHITES AND FUNGICIDES FAIL TO PREVENT ALGAE GROWTH

Although treatments were initiated in June, irrigation to promote algae did not begin until the third treatment cycle in July. By mid-August, algae began to develop. When plots were

UConn Researchers Still Wrestling With Algae Cure and Control



first examined on September 8, the results were somewhat promising:

» Most phosphite treatments reduced algae populations when compared to the untreated control.

» Exceptions to phosphite success: PK Fight and Magnum, which provided only moderate suppression when compared to the untreated plots.

Shortly after September 8, however—one month after the last application—the trials took a turn for the worse: Algae populations began to increase. Another application of all phosphite and fungicide treatments was made on September 18 but to no avail.

The Net: In the end, algae increased within all plots, with no observable differences among treatments or untreated controls. Results suggest that routine preventive applications of phosphites are necessary to maintain adequate algae suppression.

IN TRIAL TWO: PHOSPHITES AND FUNGICIDES PROVE LESS-THEN-EFFECTIVE AS CURE

The phospite/fungicide combinations couldn't put a stop to the test plots' algae problems. Beginning with an average of 10 percent (with a range of 5 to 15 percent) algae per plot, the researchers made a single curative application of products on September 18, which failed to reduce or even slow algae development. In fact, algae increased on each plot, regardless of the type of treatment, by an average of 15 to 43 percent.

The Net: A single curative application it appears, will provide little, if any, control. Multiple applications of phosphites and/or effective fungicides may be necessary to suppress the cyanobacteria.

IN TRIAL THREE: WETTING AGENTS AND FUNGICIDES SHOW PROMISE

Like the first two trials, treatments were initiated on June 25 and irrigation practices designed to encourage algae development were started in late July. When plots were first examined on September 8:

» Those with the least amount of algae were treated with Insignia + Magnus • Daconil + Revolution • Daconil alone.

» Those with moderate algae populations were treated with Insignia + Revolution • Protect + Dispatch • Trinity + Magnus • Daconil + Duplex • Protect + Duplex.

» No other treatment provided a reduction in algae when compared to the untreated control plots on September 8.

After treatments were stopped, algae began to increase in the plots. As a result, a final application of all treatments was made on September 18, and plots were rated again on October 16.

» On this date, plots treated with Insignia + Magnus (4.7%) • Daconil + Revolution (5.3%) • Insignia + Revolution (6%) had the least amount of algae and were the only products that significantly reduced algae when compared to the untreated control plots (33.3%).

IN GREENHOUSE TRIAL: FERTILIZER EFFECTIVENESS INCONCLUSIVE

In this leg of the study, researchers conducted greenhouse trials to test various nitrogen sources' ability to suppress algae growth on creeping bentgrass.

» Pots containing the bentgrass were subjected to routine irrigation from overhead misting to encourage algae, which developed quickly.

» Treatments were applied at a rate of 0.1 lbs. N/1000 sq. ft. on a weekly basis.

» Pots were rated visually on August 18, with several products showing promise in significantly reducing algae: Ammonium sulfate (21-0-0) • Calcium nitrate (15.5-0-0) • Ammonium nitrate (34-0-0).

In the End: Fertilizer treatments were continued, but when plots were rated in October, algae populations had not decreased any further. The researchers suspect that the intensity of conditions promoting algae development may

(continued on page 15)

Special Thanks to Our 2008 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 in 2009. 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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Rutgers Researchers Dig Deeper for Solution to Earthworm Casting Activity

Earthworms—also known as night crawlers, garden worms, and red worms—play a vital role in the development of soil structure, fertility, and nutrient recycling. They can wreak havoc, however, on fine turf areas when they excrete digested soil and organic matter as castings on the surface of the soil.

Those battling the ill effects of earthworms on their courses know well that their castings not only blemish the uniform appearance of turf, but also interfere with playability and ball roll, smother grass, dull mowers, and provide ideal seedbeds for germination of weeds that are deposited or brought up to the surface in the castings. Certain earthworm species can deposit up to a quarter-inch of topsoil at the surface per year. What's more, earthworms' predators—moles, skunks, and other animals—can damage turf while foraging for these tasty soil-dwellers.

STUDY IN PROGRESS

Over the course of three years, Rutgers' Dr. James Murphy and his team of researchers have worked long and hard to identify a cause—and solution—for earthworm casting activity. After collecting 1,514 earthworms from seven golf courses in the New Jersey/New York metropolitan area, they identified the most meddlesome earthworm population, *Lumbricus terrestris*, more commonly known as the night crawler. They also initiated trials on two tri-state area golf courses to evaluate the effect of various cultural management practices on earthworm casting.

Though Dr. Murphy's commitment with the Tri-State ended last year, he and his team of researchers were kind enough to share the outcomes of their ongoing research on the effect of cultural management practices on earthworm-casting activity. Here's a look at their latest trials and results.

CULTURAL MANAGEMENT PRACTICES: WHAT WORKS, WHAT DOESN'T

After identifying earthworm species, the researchers conducted trials at The Meadow Brook Club in Jericho, NY, and Knollwood Country Club in Elmsford, NY.

Knollwood Country Club represented a site where earthworm casting was very active, while the trials at The Meadow Brook Club represented a site where earthworm casting had been a problem but casting was currently limited (that is, there was a potential for casting to become active).

The researchers looked, in particular, at the influence of:

» three categories of fertilizers

» liming

» elemental sulfur applications

» sand topdressing

» sand topdressing combined with sulfur applications

Here's what they discovered:

About Fertilizers: The researchers evaluated three types of fertilizers—organic, synthetic slowly available, and synthetic water-soluble—using three fertilizers of each type in the trials.

The fertilizers' effect on casting appeared to be related to the initial level of casting at the trial site.

» At Meadow Brook, where casting was initially very low, fertilizer effects were not evident until the third season of the trial, when organic fertilizers doubled the number of castings while the synthetic fertilizers had little effect.

» At Knollwood, where casting was already very active, the researchers found no consistent difference in casting among fertilizer types.

The Net: On sites where earthworms are present but casting activity is low, fertilizer selection appears to be more critical.

About Liming: Lime applications seemed to have little to no effect on casting activity.

» In the trails at Meadow Brook, liming produced such a small increase in castings that golfers and even superintendents would be hard-pressed to detect it.

» At Knollwood, where casting was already very active, liming had absolutely no effect on casting.

The Net: Casting seems more likely to be stimulated with the use of organic fertilizers than with liming.

About Topdressing: Topdressing seems to have a notable impact only on courses where casting activity was already high. Not surprising, then:

» Topdressing had no effect on casting at Meadow Brook, which already had very low casting activity.

» Earthworm casting was reduced by about 50 percent after three seasons

Rutgers Researchers Dig Deeper for Solution to Earthworm Casting Activity

of topdressing at Knollwood, where casting was very active.

About Elemental Sulfur: Elemental sulfur applications had the most rapid and dramatic effect, reducing earthworm casting within the first season of application at both Meadow Brook and Knollwood.

» Sulfur applications reduced casting activity by as much as 97 percent, compared to untreated plots.

The potential to scorch turf is the major concern with applications of elemental sulfur. As a result, the researchers initiated trials to identify the maximum rate of sulfur that can be applied without risk of scorching the turf. Although still preliminary, it appears:

» Sulfur can be applied at a rate of 3 pounds elemental sulfur (90 percent) per 1,000 square feet in a single application during spring or late summer without damaging fairway turf.

A shift in the population of fairway turf species was a notable side effect observed in some of the sulfur trials.

» In trials at Knollwood Country Club, creeping bentgrass populations increased from 60 percent on nonsulfur plots to 77 and 83 percent on plots treated with elemental sulfur at 4.5 and 9 pounds per 1,000 square feet, respectively.

» In trials at Forest Hill Field Club in Bloomfield, NJ, annual bluegrass populations decreased by August from 51 percent on untreated plots to 20 percent on plots treated with elemental sulfur at 9 pounds per 1,000 square feet in March.

Further evaluations of sulfur rate effects on species populations and scorch are needed before concrete recommendations can be made.

About Topdressing Combined With Sulfur: The combination of sand topdressing and elemental sulfur was usually the most effective treatment in these trials. By 2008, however, the sand topdressing's effect on casting at Knollwood Country Club was masked by the effect of the sulfur application; in others words, the sulfur application reduced casting so much that the sand topdressing had no visible effect. Topdressing did, however, improve turf quality.

Stay tuned: Dr. Murphy and his team plan to continue their earthworm trials. Feel free to contact Dr. Murphy with any questions concerning his research. He can be reached at: murphy@aesop.rutgers.edu.

RESEARCH UPDATE (CONTINUED FROM PAGE 3)

URI Researchers Seek New Plan of Attack on Pyrethroid-Resistant Weevils

annual bluegrass, the insecticide targets larvae that are feeding inside plant stems. The recommended application time and rate for this product: *Forsythia ½ green / ½ gold at a rate of 12 to 20 fluid ounces per acre.* Acelepryn® is so new that it may not be registered yet in your location.

When careful monitoring indicates ongoing larval activity, the methods of control—i.e., Conserve®, Dylox®, Provaunt®, Acelepryn®—can be repeated during the summer as new generations emerge.

Monitoring both adult and larval ABW activity, the researchers emphasize, is critical in successful control of the annual bluegrass weevil.

Dr. Alm and Darryl Roumator plan to continue their ABW trials and are available to answer any questions concerning their research or superintendents' personal insect control plans. They can be reached at dramoutar@mail.uri.edu or stevealm@uri.edu.

UConn Researchers Gain Ground on Viable Fairway Topdressing Program

A relatively new cultural practice, fairway topdressing has gained favor among superintendents hoping to enhance playing conditions. Some have reported improved drainage, lower incidence of disease, and firmer fairways—but these benefits come at a high price. Fairway topdressing remains a costly investment—in time, labor, and materials.

In an effort to help superintendents make the most of their topdressing dollars, the University of Connecticut's Dr. Jason Henderson and his research team have devoted the past three years to developing a viable fairway topdressing program.

THE INITIAL CHALLENGE

Everyone knows that sands used in constructing—and topdressing—USGA putting greens are topnotch. After all, they've been thoroughly researched to optimize macroporosity while maintaining sufficient water holding capacity.

The problem: Due to the strict specifications, these sands are prohibitively expensive—especially in the quantities needed to topdress acres of fairway. As a result, superintendents are resorting to sand selections based more on hearsay than science, knowing only that the sand should not be too fine or too coarse. Topdressing materials that are too fine may retain excess moisture, while sand that is too coarse may predispose a large portion of the course to moisture stress. Superintendents who have taken the plunge into topdressing fairways may have also proceeded without fully understanding the short- and long-term effects of topdressing native soils.

Trying to ensure superintendents make informed decisions about their topdressing materials and approach, Dr. Henderson and his team have 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.

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

Though the UConn researchers have fulfilled their commitment with the Tri-State Turf Research Foundation, they plan to dig deeper into topdressing material selection, application rates, and the turfgrass management implications as the topdressing layer accumulates. Here's what they've accomplished to date.

FIELD TRIALS: PAST AND PRESENT

In an effort to quickly answer some of the more pressing questions concerning fairway topdressing, lysimeters were constructed to simulate several years of topdressing. The research began in 2006 by extracting large undisturbed soil cores from a golf course fairway containing fine-textured, poorly drained soils. To complete construction of the experimental lysimeters, researchers compacted three different sands—fine sand, USGA sand, and coarse sand—at three depths on top of the native soil cores to simulate 4, 8, and 12 years of topdressing. Creeping bentgrass was established on all lysimeters in the greenhouse, and moisture retention by depth and soil temperature data were collected. Unfortunately, this research showed no significant differences between treatments due to sample variability, an inherent risk with field samples.

Complementing this study were field trials initiated during the summer of 2007 on an L-93 creeping bentgrass stand managed as a golf course fairway at the University of Connecticut Plant Science Education and Research Facility. In this portion of the study, the researchers evaluated two factors:

1: Sand Type: fine, USGA, and coarse

2: Application Rate: 4 cubic ft./1000 sq. ft., 8 cubic ft./1000 sq. ft., 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 from May through November.

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 data weekly, the researchers are evaluating volumetric soil moisture, soil temperature, soil penetration

UConn Researchers Gain Ground on Viable Fairway Topdressing Program

resistance, and turfgrass cover, color, and quality.

WHAT THEY'VE LEARNED

After examining the results of their 2007 and 2008 field trials, Dr. Henderson and his team of researchers have reached the following conclusions to date:

ABOUT TURFGRASS COLOR, QUALITY, AND COVER . . .

» Topdressing applications resulted in enhanced spring green-up and turfgrass quality and cover, with plots receiving higher rates of application earning higher overall ratings, regardless of sand type.

» Mid-October was an exception. Plots topdressed at high and medium rates had *lower* turfgrass quality than those topdressed at the low application rate. The researchers attribute this changes in response to the decreased growth rate of the turfgrass at that time of year, which results in more sand remaining at the surface and, in turn, reduces the overall appearance of the turfgrass.

ABOUT DOLLAR SPOT COUNTS . . .

» The severity of dollar spot was reduced by sand topdressing.

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

ABOUT EARTHWORM CASTINGS . . .

» Earthworm castings were reduced by sand topdressing. (See Figure 1.)

» 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 TEMPERATURE . . .

When all was said and done, it appeared that sand topdressing helped to moderate soil temperatures at a 2-inch depth, slightly reducing root zone temperatures in the summer and slightly increasing root zone temperatures in the fall.

ABOUT SOIL PENETRATION . . .

» Topdressed plots had higher resistance to penetration and a 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 hold more water than the coarse sand treatments.

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

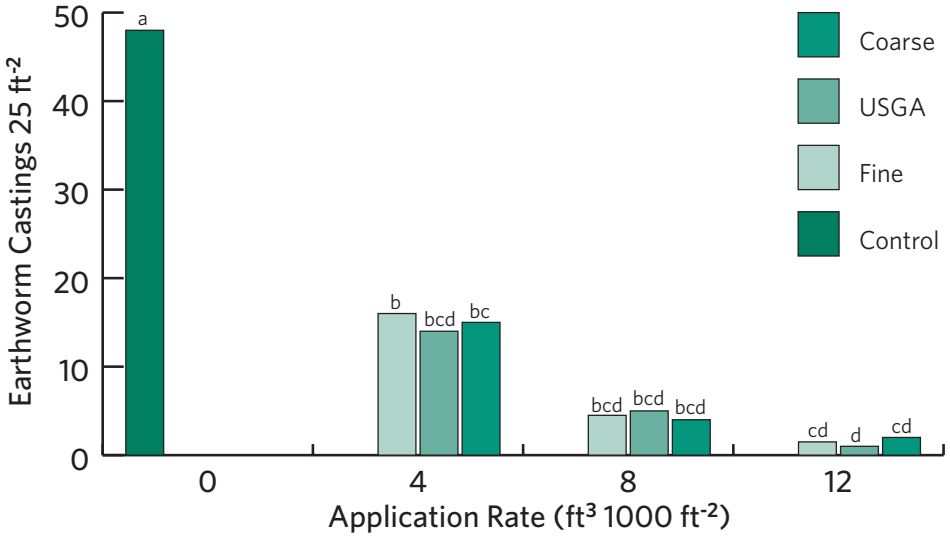
GOING FORWARD

Though the results of this study are preliminary, given the data collected to date, it's apparent that there are many positive effects associated with the practice of fairway topdressing, including increased turfgrass color,

(continued on page 14)

FIGURE 1

THE EFFECT OF TOPDRESSING TREATMENTS ON EARTHWORM CASTINGS



Is Nitrogen the Key to Anthracnose Control?

Anthracnose, one of the most dreaded and devastating of turf diseases, has been a prime target for study among researchers seeking a tried-and-true formula for preventing the disease from gaining a foothold in golf course turf. The Tri-State Turf Research Foundation has supported a variety of trials over the past decade that have brought us closer to understanding what works—and what doesn't—in the disease's prevention and control. But more is needed.

With $16,000 in funding from the Tri-State, Rutgers' Dr. Bruce Clarke, Dr. Jim Murphy, and graduate students Chas Schmid and James Hempfling, are continuing the anthracnose research the university began years before with Tri-State support. After examining the effects of growth regulators, myriad fungicides and cultural practices, the researchers have shifted their focus now to nitrogen fertility's role in anthracnose control.

QUESTIONS RAISED

Through preliminary studies, the researchers have reason to believe that frequent low-rate soluble-N fertilization during the middle of the growing season *may* work to suppress anthracnose disease on annual bluegrass putting turf. But there are many questions left unanswered:

» What is the optimum frequency for soluble low-rate N fertilization relative to the severity of anthracnose?

» Does late- or early-season higher-N-rate granular fertilization play a role in anthracnose severity?

» How does the timing of granular-N fertilization influence the frequency of low-rate soluble-N fertilization during the growing season?

» Is there any credence to recent marketing that touts low-rate soluble-N fertilization over higher-rate granular-N fertilization?

THE OBJECTIVES

Seeking answers to these and other questions surrounding anthracnose control, the researchers will devote the next two years to:

» Identifying an optimum frequency for low-rate soluble-N fertilization for suppressing anthracnose disease.

» Evaluating the effect of late- or early-season granular-N fertilization on anthracnose severity.

» Determining whether late- or early-season granular-N fertilization alters—or interacts with—the effect of frequent low-rate soluble-N fertilization on anthracnose during mid-season.

Trials are currently being conducted on two separate annual bluegrass plots established at the Rutgers Turf Research Farm in North Brunswick, NJ. Watch for an update on the researchers' progress in the next issue of *Foundation News*.

RESEARCH UPDATE (CONTINUED FROM PAGE 13)

UConn Researchers Gain Ground on Viable Fairway Topdressing Program

quality, and cover, reduced surface moisture retention, firmer surfaces, and root zone temperature moderation.

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 influence on the effect of the topdressing applications. This could, therefore, result in a significant cost savings associated with sand purchases.

The researchers hope to obtain additional funding to continue their work. The turfgrass management implications as the topdressing layer continues to form will hopefully offer more insight into this promising cultural practice. Please continue to work closely with your accredited laboratory to conduct all the appropriate testing procedures when selecting your topdressing materials.

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

Putting Uniformity Back Into Mixed-Species Fairways

Managing long-established golf course fairway turf comes with its fair share of challenges. The trouble begins when, over time, fairways become a collection of not one but two or more turfgrass species that vary considerably in growth habit and rate, density, susceptibility to pests, color, and a host of other important traits.

Recognizing the difficulty in managing mixed-species fairway turf, the Tri-State Turf Research Foundation has agreed to support Rutgers' Dr. James Murphy and Stephen Hart in their pursuit of a method for improving the uniformity of golf course fairway turf.

THEIR OBJECTIVES

With $10,000 in funding over two years, the researchers plan to:

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

» Conduct further studies on soil acidification's role in reducing annual bluegrass in mixed-species stands.

WHAT THEY KNEW TO START

In informal trials on several golf course fairways, the researchers discovered that:

» Corsair had the potential to remove perennial ryegrass from mixed-species fairways, but at the same time, demonstrated some phytotoxicity to the species they were trying to maintain: the annual bluegrass and creeping bentgrass.

» Corsair applications must be timed properly with overseeding since Corsair is known to have residual soil activity on seedlings.

» Soil acidification treatments demonstrated the potential to result in shifts in turf species populations. (This was discovered during trials on earthworm casting activity in fairway turf.)

The researchers will be looking for suitable sites—i.e., golf courses with mixed-species fairway turf—to conduct their future trials. Stay tuned. The results of their first round of trials will appear in the next issue of *Foundations News.*

RESEARCH UPDATE (CONTINUED FROM PAGE 7)

UConn Researchers Still Wrestling With Algae Cure and Control

have inhibited the fertilizers' ability to suppress algae to acceptable levels.

PLANS FOR 2009 AND BEYOND

UConn researchers, now under the direction of Dr. John Inguagiato (Bruce Clarke's former Ph.D. student), will continue their algae trials through March 2010, with an extension from GCSAA. A leg of the study will also be conducted by Dr. John Kaminski at The Pennsylvania State University.

Currently underway at UConn:

» Further phosphite/fungicide testing is being conducted in the greenhouse. Pots planted with creeping bentgrass are being subjected to conditions promoting algae development and then treated with phosphite/fungicide products. The researchers' goal: to determine the ability of these products to provide *curative* suppression of algae after multiple—rather than just single—applications.

» Lab studies are being conducted to assess the ability of phosphorous acid products to inhibit the growth of several algae species in-vitro.

Data is currently being collected for these studies and will be reported in 2010 in the pages of *Foundation News.*

Research Is the Answer

And furthermore, we, on the Tri-State Turf Research Foundation board, are committed to the ongoing support of research targeted at helping area turf professionals manage their operations—and turf—in a more cost-effective and efficient manner.

All we ask is that you continue to support the foundation's efforts with your donation of $200. It's a small price to pay—only a .00016 portion of the average Metropolitan-area golf course budget—for the valuable information you'll receive in return.

THE FRUITS OF OUR FUNDING

In this issue of *Foundation News,* you'll see your contributions at work. At URI and Rutgers, your support has enabled us to fund research targeted at uncovering improved methods for both monitoring and controlling the highly destructive annual bluegrass weevil. At UConn, one team of researchers is putting fairway topdressing programs to the test, while a second is researching environmentally friendly methods of control for algae-plagued putting greens. Last but not least are the results of the Rutgers-based earthworm study, which is closing in on a tried-and-true remedy for earthworm casting activity on fairway turf.

This year, the foundation plans to support three projects. We will continue to fund URI's Dr. Steven Alm as he puts 12 different products to the test in his search for the top performers in annual bluegrass weevil control. We will also support Dr. Bruce Clarke, Dr. James Murphy, and a small team of scientists at Rutgers in their quest to improve anthracnose control with well-timed applications of granular nitrogen fertilizer. Finally, we plan to support Rutgers' Dr. James Murphy and Stephen Hart in their work to develop a program to improve fairway uniformity by controlling ryegrass with Corsair (sulfonylurea) herbicide and overseeding with bentgrass.

I'm sure the results of these research projects will hold great value to many of us here in the tri-state area. Be sure to watch for the outcomes in the next issue of *Foundation News.*

In closing, I hope that, as you read this issue, you gain a better understanding of the importance of the foundation's work. I also hope that, if you haven't sent your contribution yet, you'll feel compelled to add your name to the list of contributors (see pages 8-9) who are helping us make a difference.

Here's to a trouble-free 2009. But rest assured, if a problem *does* arise, research is the answer, and thanks to your support, the foundation is here to help.

Scott E. Niven, CGCS
President

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