UNIVERSITY TURFGRASS RESEARCH UPDATE

Editor's note: *In our December 2009 and February 2010 issues we published reports from some leading turfgrass researchers in the US on their current studies. For this issue we asked the same academics to update us on those projects and inform on new ones.*

NORTH CAROLINA STATE UNIVERSITY

Athletic Field Turf Paint Impacts Light Spectral Quality and Turfgrass Photosynthesis. Doctoral graduate student Casey Reynolds has been investigating chronic declines in turfgrass health and quality from repeated applications of athletic field paint. Studies have evaluated photosynthesis response to paint as well as the transmission, reflectance, and absorption of light based on paint color, dilution, and thickness. Results have proven that paints will differentially reduce photosynthesis based on color and dilution. This research has allowed us to rank common paint colors along a scale that shows their potential to reduce photosynthesis.-Grady Miller and Casey Reynolds, Crop Science Department.

Evaluation of Athletic Field Paint Application Methods. Master of Science student Drew Pinnix initiated his research in fall 2011 with the primary objective to determine if he can influence paint and turfgrass performance using different paint application techniques. A series of studies have been designed to test several hypotheses related to application pressures, directional application, paint thickness, various additives, timings, and products. Many of these trials conducted over the next 2 years will use information gained from previous work on spectral quality and photosynthesis.-Grady Miller and Drew Pinnix, Crop Science Department.

As a follow-up project from a few years ago, we are planning another **broad-based screening of green turf colorants as an alternative to overseeding warm-season turfgrasses**. We evaluated 12 green turf colorants on dormant grasses a few years ago with great results. In the past 3 years at least a dozen new products have been released on the market. Drew Pinnix and Scott Brinton will be screening these new products alongside the old products on athletic field height of cut and putting green height of cut. Several new data points will be collected this time around, including more detailed look at application timing and color-fastness of these products.-Grady Miller, Drew Pinnix, and Scott Brinton, Crop Science Department

Compiled by Dr. Grady Miller

AUBURN UNIVERSITY

Research in turfgrass nutrition has focused on pathways of N loss in fertilized turfgrass. Because of the ever-increasing interest in the potential of nutrient loss from fertilized turfgrass we have conducted many studies that examine the loss of N via downward movement, or leaching. If fertilized correctly (both rate and source) we rarely find significant nitrate-N loss from fertilized turfgrasses. Another path of N loss is volatilization, which is the loss of applied N as ammonia to the atmosphere. Our work using large-scale plots has shown reduced N loss from volatilization when N sources other than urea are used. Last, we continue to conduct work in the area of foliar fertilization, focusing on both sources and application rates.-Dr. Beth Guertal

I am doing work on Roundup tolerant ryegrass, known as Gly-Rye, a product of Jacklin Seed. We are finding that these cultivars have a significant degree of glyphosate tolerance. Utilizing these cultivars would allow for use of glyphosate to control *Poa annua* and other weed species. There is potential to apply 0.5 to 1.0 lb ae/a of glyphosate with little to no injury to ryegrass and excellent *Poa* control. Timing is critical for control and I am currently trying to address the need to tank-mix with other herbicides to potentially prevent herbicide resistance development.

I am also researching other herbicides for *Poa annua* control. Two primary herbicides are amicarbazone and methiozolin. These herbicides must be timed properly for appropriate turfgrass safety and *Poa* control. I am seeing a lot of positive things from both of these products and they will greatly benefit the turf industry in the future.-Dr. Scott McElroy

UNIVERSITY OF MASSACHUSETTS

The University of Massachusetts Turf Program conducts a wide range of research at both the UMass Joseph Troll Turf Research Center as well as at various field sites throughout the northeast. Our goal is to enhance the functional use of turfgrasses while reducing the environmental impact of turf management practices. Presented below are summaries of selected projects of particular interest to sports field managers. Items were compiled by Mary Owen, extension turf specialist.

Wear Trials in Perennial Ryegrass and Kentucky Bluegrass Maintained Under Close Height of Cut, by J. Scott Ebdon, PhD. These are new trials that

include a perennial ryegrass test established in the fall of 2010 to assess the wear tolerances among 88 perennial ryegrass entries maintained under close height of cut (0.375 inch). In 2011, the following perennial ryegrass entries provided the best wear tolerance: 2NJK, APR-2036, BAR Lp 10970, DLF LGD-3022, GO-PR60, IS-PR 479, JR-192, and PST-2A G4. Many of the more wear tolerant entries exhibited higher shoot densities and better overall turfgrass quality under close height of cut. This wear study will continue over the next three growing seasons. A new wear trial was also established in the fall of 2011 to assess the wear tolerance of 82 Kentucky bluegrass cultivars. These entries will be assessed for their wear tolerance over the next four growing seasons beginning in the spring of 2012. Sponsor: National Turfgrass Evaluation Program

Efficient Irrigation for Recreational Turf in New England: Evapotranspiration and Crop Coefficients, by J. Scott Ebdon, PhD and Michelle DaCosta, Ph.D. This is a relatively new test that was planted in the fall of 2009 to measure evapotranspiration (ET) losses from pure stands of Kentucky bluegrass (Touchdown) and perennial ryegrass (Exacta) maintained at sports grass height of cut (1.25 and 2.5 inch), and creeping bentgrass (Memorial) maintained at fairway (0.375 inch) and greens height (0.125 inch). Different N fertility rates including 2 and 4 pounds per 1,000 ft2 are also being compared. Daily and monthly crop coefficients (Kc) derived from reference ET values from weather stations and actual turf ET are being measured during the summer irrigation season. Crop coefficients are values used to estimate ET rates for specific crops, in this case, for various turfgrass species and cultivars.

After 2 years of study the effect of N and height of cut within the species had little influence on ET and Kc values. However, Kentucky bluegrass as a species exhibited significantly higher ET and higher Kc values than perennial ryegrass, and in turn, perennial ryegrass exhibited higher ET rates and Kc values than golf turf. In other words, Kentucky bluegrass used more water than perennial ryegrass which used more water than creeping bentgrass.

When the study is completed in 2013, these results should provide reliable Kc values that can be used to assist turf managers in applying irrigation water more efficiently to sports and golf turf in the cool-humid New England region. Sponsors: New England Regional Turfgrass Foundation and the United States Golf Association.

Improving Winter Hardiness of Perennial Ryegrass, by Michelle DaCosta, Ph.D. and J. Scott Ebdon, PhD. Perennial ryegrass is a cool-season turfgrass species that is widely used on athletic fields due to its rapid establishment and superior traffic tolerance. Compared to other cool-season turfgrasses, however, perennial ryegrass can be susceptible to freezing injury in northern climatic regions. In one study, we evaluated different perennial ryegrass accessions with varying levels of freezing tolerance, and identified specific protective compounds that were associated with better freezing tolerance. Based on this research, we have conducted additional studies to exploit the accumulation of protective compounds during cold hardening in perennial ryegrass. For example, we determined that exposing plants to mild drought stress

through application of wilt-based irrigation could induce the production of beneficial compounds during cold hardening, such as sugars and proteins. As a result, wilt-based irrigation also resulted in improved freezing tolerance of some perennial ryegrass cultivars. Additional research is underway to improve management practices aimed at improving freezing tolerance of perennial ryegrass. Sponsors: New England Regional Turfgrass Foundation, USGA, O.J. Noer Research Foundation, Adirondack Golf Course Superintendents Association.

This technology is capable of removing fertilizer, pesticide and hydrocarbon residues from wash water, thus allowing it to be reused or safely released back into the environment.

The Use of Constructed Wetlands for Reclamation of Wash Water for the Turf Industry, by Lesley Spokas, PhD, Michelle DaCosta, PhD and J.S. Ebdon, PhD. There is increased pressure on the turf industry to use more environmentally sustainable approaches in turf management. To that end, constructed wetlands have the capacity to remove significant amounts of organic matter, nutrients, heavy metals, and pesticides through chemical, physical, and biological processes. In 2011 we constructed an artificial wetland onsite at the UMass Turf Research Center for the primary purpose of remediating wash water used on turf machinery. Because the surface of the constructed wetland is composed of sand with selected vegetation, equipment such as mowers and sprayers will be washed down directly on the wetland area. This technology is capable of removing fertilizer, pesticide and hydrocarbon residues from wash water, thus allowing it to be reused or safely released back into the environment. Treatment wetlands have few if any electrical or mechanical parts and are either carbon neutral or have a "positive" carbon footprint since plants consume carbon dioxide and produce oxygen while treating the waste. The information gathered over the next several years during grow-in and field use will be used as part of a larger set of best management practices for minimizing the impact of pesticide and nutrient use on water and soil quality.

Tolerance of Kentucky bluegrass Cultivars to the Herbicide Velocity-Bispyribac-Sodium, by J. Scott Ebdon, PhD and Prasanta Bhowmik, PhD. This study assessed Kentucky bluegrass tolerance to the herbicide Velocity, which is a useful compound in the control of annual bluegrass. In this test 110 cultivars maintained at 1.25 inch height of cut were evaluated for their herbicide tolerance. Velocity was applied at 0.05 ounces per acre on 29 June, 2011. Visual injury was assessed weekly (using a 1 to 9 rating scale with 9=no injury) following treatment, with the greatest injury occurring 4 weeks after treatment (4WAT). Injury ratings at 4WAT ranged from 2.0 to 8.7. The following cultivars exhibited good tolerance to Velocity (ratings of 6 and higher) at 4WAT: Aries, Bewitched, Blueberry, Everglade, Hampton, Midnight and Mystere. Sponsor: National Turfgrass Evaluation Program

In addition, the UMass faculty and staff are conducting a number of other research projects spanning the gamut of disciplines within the field of turf management. These include: management of dollar spot and snow mold; fungicide resistance management; breeding for disease resistance; effects of wetting agents on drought resistance and recovery; various weed management trials; annual bluegrass weevil, oriental beetle and turf damaging nematode management; reducing pesticide exposure to turf users; and protection of water resources from turf management materials. For more information on these and other projects, visit the UMass Turf Program website at www.umassturf.org and click on Research.

PENN STATE

At Penn State's Center for Sports Surface Research, we continue to focus on both natural and synthetic turf research. We have a number of exciting projects underway and look forward to new projects that are already planned for the spring. The research section of our website includes links to many of our studies along with other related research (http://cropsoil.psu.edu/ssrc/research).

Natural Turf Research Projects: Trinexapac-ethyl on sports turf. Since our last research update, we have completed our second study evaluating the effects of trinexapac-ethyl (TE) applications on the divot resistance of Kentucky bluegrass athletic fields. Our results showed that applying TE monthly from May through July improved divot resistance in the fall by up to 20%. TE improved divot resistance most on a high-sand rootzone, but benefits were also found on native soil. Results from our studies indicate that the application TE throughout the spring and summer serves to "pre-stress condition" the turf before fall play by increasing tiller density and rooting. Our studies simulated fall-only turf use, such as on a stadium field. A TE program is not recommended for high-use fields under continuous play.

The new tall fescue—a viable option for sports turf?

The current generation of turf-type tall fescue may offer an acceptable alternative to perennial ryegrass and/or Kentucky bluegrass on athletic fields in certain situations. We are investigating summer establishment methods that maximize turf coverage at the end of the fall playing season. We are looking at various seeding rates (6 to 18 lbs/1000 ft2) and several nitrogen rates (2 to 7 lbs /1000 ft2). Initial results show that for a short establishment period (10 weeks before use), a low seeding rate and a high nitrogen rate maximize turf coverage later in the fall (after fall field use). For a longer establishment time, higher seeding rates and lower nitrogen rates provided the greatest turf coverage in late fall. We have also observed that tall fescue was less traffic tolerant than perennial ryegrass when traffic was initiated 10 weeks after seeding. However, when traffic was initiated 14 weeks after seeding, all turf-type tall fescue exhibited greater traffic tolerance than perennial ryegrass.

Perennial ryegrass traffic tolerance. As part of the NTEP program, we are evaluating the traffic tolerance of all perennial ryegrass cultivars in the current trial. While we are excited to see how each cultivar per-

forms, we are especially interested in the traffic tolerance and recoverability of the new stoloniferous ryegrasses.

Synthetic Turf Research Projects: Surface temperature. In the June 2011 edition of this magazine, we published the results of our study examining the effects of various synthetic turf components and systems on surface temperature. We tested various infill types, infill colors, and fiber colors and found little evidence of significant cooling with any of the tested materials. In addition to the laboratory study that was discussed in the article, we collected surface temperature data this summer at our outdoor research facility. We found very similar results when comparing the laboratory and outdoor data. Unfortunately, we still do not have an answer to this problem, but we continue to test new methods and hope to find a solution soon.

Fiber Wear Testing. With help from field managers and owners, we have collected samples of various synthetic turf products from new field installations and tested fiber wearability under simulated field use. This is an ongoing project and the progress report on our website is updated regularly (http://cropsoil.psu.edu/ssrc/documents/lisport-report.pdf). We continue to invite field managers and owners to contact us about submitting synthetic turf samples from new field installations.

Human Performance and Safety. We recently completed a study in conjunction with Penn State's biomechanics laboratory examining human performance and safety on various playing surfaces. Data was gathered from human subjects performing various athletic maneuvers while wearing several types of footwear. We are currently combining these results with data obtained with our traction tester (Pennfoot) to further improve our understanding of how the playing surface affects performance and safety.

Surface Characteristics – Hardness, traction, and abrasion. We continue to measure and track various characteristics of synthetic turf playing surfaces such as hardness (Gmax), traction, and abrasion. Results from our multi-year study comparing these characteristics on various synthetic turf systems can be found on the research section of our website (http://cropsoil.psu.edu/ssrc).

Baseball Research Projects. We also continue to evaluate baseball infield mixes and how components of infield mixes influence playability characteristics such as ball bounce and traction.

-Compiled by Tom Serensits

PURDUE UNIVERSITY

The turfgrass science program at Purdue continues to work to provide information to turf managers in the Midwest, the US, and internationally. Seven faculty members have active turf research programs that are supported by our many industry partners and the Midwest Regional Turf Foundation. Our research efforts are complimented with an active extension program in order to maximum the benefit and value to turfgrass managers.

Pest management studies. Weed biol-

ogy and control of various annual and perennial weeds using herbicides is ongoing with specific projects evaluating herbicides for the control of annual bluegrass, broadleaf plantain, crabgrass, dandelion, goosegrass, ground ivy, wild violet, and others. This research includes work with novel and existing herbicides. Work is also ongoing looking into strategies for dormant seeding athletic fields with Kentucky bluegrass safely while simultaneously removing unwanted perennial ryegrass or annual bluegrass. Additional research on how mowing practices affect weed control is being explored.

Entomology research on the biology, ecology and management of insects associated with turfgrass environments is being conducted as well. This work aims to improve the sustainability of turfgrass insect management by 1) improving integration of cultural and biological controls, 2) enhancing basic understanding of insect biology and ecology, 3) developing novel insecticide chemistries and usage strategies, and 4) providing a framework for turfgrass managers to evaluate and implement alternative management programs.

Research with fungal endophytes and entomopathogenic nematodes provides a unique platform for studying the integration of cultural and biological controls and provides a scientific approach for incorporating these tools into sustainable turfgrass management programs. Applied research focuses on improving the effectiveness of existing insecticide chemistries, evaluating new insecticide chemistries for usage in turfgrass environments, and enhancing insecticide formulations by incorporating plant-stress-mediating compounds. Because a combination of biological, aesthetic and economic factors will ultimately determine how readily alternative pest management strategies will be adopted, our research is also working to clarify how the incorporation of scouting influences the economic bottom line for turfgrass managers.

Turf diseases are among the most important and least understood constraints to maintaining healthy, high-quality turf in the eastern and Midwestern U.S. A main goal of the **turf pathology research** at Purdue is to enable turf managers to make disease management decisions from a more informed perspective thereby improving their capacity to effectively and efficiently mitigate disease-related damage utilizing a variety of control options. The general objective of program is to increase the depth of knowledge of factors that influence the establishment, spread, and management of infectious diseases on amenity turf. Specific projects are addressing the 1) deposition, depletion, and maintenance factors that influence fungicide performance against diseases affecting high quality turf and 2) environmental factors that promote outbreaks of diseases important to the lower Midwest including dollar spot, brown patch, anthracnose, *Rhizoctonia* large patch on zoysiagrass, and spring dead spot on bermudagrass.

Sustainability. As an industry we continue to strive for "sustainable turfgrass systems"; in other words, turfgrass areas that require fewer inputs, namely water, fertilizer, mowing and pesticides. In order to do this we must select and properly establish an adapted species/cultivar or species mixture/blend. Research at Purdue is evaluating various cool and warm-season turfgrass species for their adaptation to the cool-humid region. Special interest is focused on grasses that require fewer cultural inputs (water, fertilizer and mowing). Research is re-evaluating conventional wisdom related to lawn nitrogen management programs; nitrogen sources and timings, phosphorus needs and potential loss during establishment, and also soil organic matter accumulation with respect to soil carbon levels and golf green surface firmness. Additional research is being initiated on grasses that are bred for their ability to retain their green color during drought periods in cooperation with the Turfgrass Water Conservation Alliance.

A better understanding of how turfgrasses respond to stress conditions and mechanisms of stress tolerance benefits genetic improvement and management of turfgrass. Research on the **characterization of the physiological mechanisms influencing turfgrass stress tolerance and adaptation** is ongoing. This research impacts management programs by: 1) selecting adequate cultivars for growing turf on soils subjected to flooding; and 2) improving site-specific irrigation management and water conservation through mapping turfgrass water status and utilizing low-maintenance grass.

Synthetic/artificial turf. Methicillin-resistant *Staphylococcus aureus* (MRSA) is a disease-causing bacterium that is associated with approximately 19,000 deaths and 300,000 debilitating infections yearly in the US. In 2005, a survey published by a National Football League physicians group reported that MRSA infected 3.5% of professional football players. While this rate dropped to 1.9 % infection rate three years later, it still exceeded the infection rate of the general population (0.03%) by 63-fold, suggesting that despite improvement in MRSA surveillance and control, unidentified reservoirs still exist. Of the many risk factors identified for acquiring MRSA, several are of considerable relevance to athletes participating in contact sports, and professional football in specific. Since mounting evidence exists supporting the role of synthetic turf fields in harboring and potentially transmitting MRSA to humans, research at Purdue is focusing on the general microbial ecology of artificial turfgrass and the prevalence, distribution and fate of MRSA on artificial turf football fields. Completion of the current research can help categorize the role of one potential MRSA reservoir, the playing surface, as a source for the bacteria.

Carbon sequestration. Reducing the amount of atmospheric CO2 via carbon sequestration has become one of the most researched topics in the past decade. Interestingly, one of our most intensively managed and rapidly growing agroecosystems, the urban environment, has received the least study. Understanding carbon movement in turfgrass systems will strengthen our understanding of carbon sequestration and improve our ability to adjust management practices to increase sequestration. Greater understanding of the turfgrass system's influence on atmospheric carbon will ultimately shape public policy and assist in communicating the benefits of turf.-Compiled by Aaron Patton for Cale Bigelow, Yiwei Jiang, Ron Turco, Rick Latin, Doug Richmond and Tim Gibb: Departments of Agronomy, Botany and Plant Pathology, and Entomology at Purdue.

OHIO STATE

These are challenging times for land grant institutions like Ohio State that provide research, teaching and outreach services. Reductions in funding have meant tuition fee increases for students and programs within the university having to become self-sufficient. Big changes are also afoot at Ohio State in that we are switching from quarters to semesters in summer 2012 and we are changing the major to "Sustainable Plant Systems" with a turfgrass science option. In keeping with the new major, the focus of our research at Ohio State has also been more focused on the issue of sustainability and IPM practices.

Dr. John Street and Deb Holdren were recently awarded a major Specialty Crops Grant to investigate the integration of microclover and turfgrass as an environmentally viable turfgrass ecosystem. In addition, many of the pest control products we evaluate are organic or biorational (non-toxic) in nature. We also continue to look at composts, organic fertilizers and low maintenance turfgrass varieties and species, such as tall fescue.

>> **OHIO STATE** was recently awarded a major Specialty Crops Grant to investigate the integration of microclover and turfgrass as an environmentally viable turfgrass ecosystem.

From an agronomic standpoint, we have done a lot of work with The Andersons over the past 4 years, evaluating their advanced dispersible granular technology. One of these products has been the granular version of the plant growth regulator trinexapac-ethyl, which could be a useful tool for reducing mowing frequencies while improving turf quality. For the past several years we have been working with the stoloniferous ryegrasses and this year we evaluated drought and heat tolerance of those cultivars. In what is considered to be one of the hottest and most humid summers on record, with sand rootzone temperatures well over 100 F, there were a couple of cul-

tivars that did considerably well, even at 5/8 mowing height, so watch out for those!

New this fall we have established a Kentucky bluegrass trial that includes common types, compacts, hybrids, monostands and blends. With some pretty intense management at the onset, we were able to go from "seed to play" in about 7 weeks and we will be evaluating wear tolerance in the spring of 2012. Also new this winter is an overseeding study that we will continue as long as the ground isn't snow-covered. We are looking at germination of annual, perennial and tetraploid ryegrasses during the winter months.

Lastly, we are very fortunate to have a great relationship with the Director of Sports Medicine, Dr. Tim Hewett, who has joined forces with us on some grants and research projects. His specialty is ACL injury, so his input on traction research is invaluable. We recently acquired a pneumatic foot that can simulate athlete maneuvers like starting, stopping and cutting. The beauty about this equipment is that we do not have to have plots of turf installed at the turf facility at cost to a sponsor, as we can test small samples in the lab.

We continue to test & look at synthetic turf hardness in relation to Gmax and Head Injury Criteria (HIC) and we would like to further investigate critical fall heights in relation to sports like rugby and football, to make sure our playing surfaces do not contribute to concussions. There are many projects we'd like to do, we just need the funding! For more info on our Sports Turf Program, see our website: Buckeyeturf.osu.edu or visit us on Facebook (Buckeye Turf) and Twitter (Osuturf).-by Pam Sherratt, sports turf extension specialist

>> **THIS PNEUMATIC FOOT** can simulate athlete maneuvers like starting, stopping and cutting, and Ohio State researchers can test small samples in the lab rather than having to install costly plots.

Title of Research Study, Ohio State	Principle Investigator
The use of FeHEDTA herbicides as biorational broadleaf weed controls	Dr. David Gardner & Emily Horner
Timing of application of Cavalcade PQ for post/Pre emergence control of crabgrass	
Herbicide programs for seeding/overseeding	
Broadleaf weed control products	
Microclover and turfgrass ecosystems	Dr. John Street & Deb Holdren
Dispersible granular technology	All turfgrass science team
The effect of various cultural practices on putting green firmness	Arly Drake (MS) & Dr. T. Karl Danneberger
Athletic field protection systems	Matt Williams (PhD) & Dr. T. Karl Danneberger
Turfgrass physiology in shade	Aneta Studzinska (PhD) & Dr. T. Karl Danneberger (completed 2011)
Impact of dew on turf health	Dr. T. Karl Danneberger
The effect of enhanced ultraviolet light on turfgrass physiology	Ed Nangle (PhD) & Dr. David Gardner
The effects of compost topdressing on native soil health and sports turf playing quality	Marcela Munoz (MS) & Dr. John Street (completed 2011)
Models to measure carbon sequestration in the landscape	Gina Zirkle (MS) (completed 2011)
Ecologically sustainable turfgrass	Andrew Muntz (MS) & Dr. David Gardner
Drought resistant perennial ryegrass	Pam Sherratt & Dr. John Street
Natural and synthetic fertilizers	
Granular plant growth regulators	
Winter over-seeding with annual, perennial, and tetraploid ryegrasses	
Kentucky bluegrass establishment and wear tolerance	
Effects of surface characteristics on the traction and hardness of synthetic and natural turf	
Fungicide efficacy trials	Joe Rimelspach & Todd Hicks
Bacterial wilt	
Insecticide efficacy trials	Dr. Dave Shetlar & Jen Andon

RUTGERS UNIVERSITY

The following is a synopsis of ongoing and future sports turf research projects at Rutgers.

Traffic stress research concluded on the 2006 National Turfgrass Evaluation Program (NTEP) Tall Fescue Trial at Rutgers Hort. Farm II in North Brunswick, NJ in 2011. Wear and compaction were applied to the trial in Spring 2009 and 2011; Summer 2008 and 2010; and Fall 2007 and 2009. Wear stress was applied with the Rutgers Wear Simulator, a modified M24C5A Sweepster in which the steel brush on the unit was replaced with rubber paddles. The rotational movements of the paddles causes wear. The simulator allows control of both forward operating speed as well as paddle rpm. Compaction was applied with a 1.5-ton roller.

Results suggest that attention should be given to tall fescue variety selection for

sports fields scheduled for fall use; entry differences were more pronounced after traffic in Fall 2009 than Spring 2009 and Summer 2010. In addition to traffic stress data, turfgrass quality and brown patch susceptibility were assessed in the absence of wear since the inception of the test. Data are currently being summarized for a Rutgers Cooperative Research and Extension Fact Sheet. Data are also available at www.ntep.org and in the Rutgers Turfgrass Proceedings (See http://turf.rutgers.edu/research/reports/index.html).

Wear tolerance research was initiated on one-hundred-four entries comprising the 2010 Cooperative Turfgrass Breeders Test (CTBT) at North Brunswick, NJ. The machine described previously was used to apply 16 wear passes during 3 weeks in July 2011. Turf quality and brown patch were assessed in the absence of wear. Wear tolerance will again be assessed in 2012. Data will be available at www.ctbt-us.info.

Seeded in September 2010, wear was applied in fall 2011 to four Kentucky bluegrass varieties and selections, four tall fescue varieties, and mixtures of the two species seeded at 90% tall fescue and 10% Kentucky bluegrass (by weight). Recovery from wear will be evaluated in Spring 2012. The performance of individual Kentucky bluegrass and tall fescue entries, as well as mixtures, during wear stress will continue to be evaluated in 2012.

The Rutgers Center for Turfgrass Science acquired a Brinkman Traffic Simulator and initiated studies comparing this machine, the Cady Traffic Simulator, and Rutgers Wear Simulator in 2011. These studies examined the effects of the three machines on tall fescue, Kentucky bluegrass, and perennial ryegrass. Additional studies comparing the three machines are slated for 2012.

In addition to research conducted at North Brunswick, the Rutgers Turfgrass Breeding Program evaluates varieties and experimental selections for wear tolerance as well as screens new turfgrass collections specifically for wear tolerance at Rutgers Plant Science Research and Extension Farm, Adelphia, NJ. A second Rutgers Wear Simulator was constructed and is used to apply wear at Adelphia. In 2011, cool-season sports turf species including Kentucky bluegrass, perennial ryegrass, and tall fescue were evaluated. The wear tolerance of fine fescues was also examined. This research will continue in 2012. Data generated from these trials is available at the CTBT website as well as in the Rutgers Turfgrass Proceedings.

Research is sponsored by the National Turfgrass Evaluation Program, Rutgers Center for Turfgrass Science, and New Jersey Agricultural Experiment Station.

Rutgers research personnel include: Brad Park, Sports Turf Research & Education Coordinator; Dr. James Murphy, Extension Specialist in Turfgrass Management; Bill Dickson, Research Farm Supervisor; Joe Clark, Research Technician; Dr. Bruce Clarke, Director, Center for Turfgrass Science; and Dr. William A. Meyer, Associate Director, Center for Turfgrass Science. ■

>> **APPLYING FIRST COAT** of colorant to dormant bermudagrass.

Turning fields green using turf colorants

It has been called "instant overseeding"—the practice of applying a green turf colorant to dormant grass. Turf managers in the southeastern United States have traditionally overseeded dormant bermudagrass fields to have a green field during the winter and early spring months.

But the spring transition from overseeded grasses to bermudagrass is often problematic due to drought resistant cool-season grass varieties and extended cool and wet conditions in late spring. Applying colorant to semi-dormant to dormant bermudagrass fields provides an alternative to overseeding, while still providing an attractive, playable field surface. Before you start painting, it is important to research to find the pros and cons of the practice because the practice may not be a good fit for everyone.

One benefit associated with colorants rather than overseeding is affordability. A gallon of turf colorant will run from $30 to $75, with most distributors giving volume discounts. The average cost of colorant needed for a 2-acre field using the higher recommended application rates would be about $600, with a range of $400 to $1,000 an application, depending on the colorant brand and application rate. Overseeding establishment can costs can easily top $1,000 (not including season-long maintenance costs). So colorant can be a less expensive alternative. And with seeding, there are all the issues with picking your seed, ground preparation, seeding, watering, fertilizing, mowing, pest control, spring transitioning, etc.

The painting process can be boiled down to pick/purchase a colorant, add water plus colorant to your sprayer, and begin spraying. If the color is not even or dark enough, you can go over the area again. There is some clean-up, but no season-long care like with overseeding.

Of course with anything good, there are also some downsides. The biggest issue is that it does not provide a wearable playing surface like an overseeded grass. Once the dormant bermudagrass tissue is worn away, there is no regeneration until spring. So, the "wear factor" must be considered. And while the unknowing observer may be fooled looking at a painted field, to a field manager it will be easy to notice the duller finish from painting versus the nicely stripped, shiny surface of a freshly mown, overseeded field.

Over the last few years, we have conducted numerous studies at North Carolina State University to evaluate various colorant products. Our first detailed studies were applied to putting greens in fall 2008 and 2009. Subsequent trials have included evaluations on bermudagrass mowed at heights similar to those commonly used on athletic fields.

Colorant brands that were used in the original trails included: Green Lawnger (Becker Underwood), LESCO Green (John Deere Landscapes), Mtp Turfgreen (Missouri Turf Colorant,), Titan

If the color is not even or dark enough, you can go over the area again. There is some clean-up, but no season-long care like with overseeding.

>> **NUMEROUS STUDIES** at North Carolina State University have evaluated various colorant products, including use on bermudagrass mowed at heights similar to those commonly used on athletic fields.

>> **SMALL SPRAYER COLORANT APPLICATION** on semi-dormant bermudagrass athletic field.

Table 1. The progression of colorant color using Pantone® Color chips following colorant treatment.

Treatment/rate	Bermudagrass	
	Day 0	Day 56
Green Lawnger 80 gpa	PMS 354	PMS 358
LESCO Green 80 gpa	PMS 347	PMS 351
Mtp Turfgreen 80 gpa	PMS 7481	PMS 7464
Titan Green Turf 80 gpa	PMS 7482	PMS 636
Turf in a Bottle 80 gpa	PMS 346	PMS 344
Regreen 80 gpa	PMS 347	PMS 311
Wintergreen Plus 80 gpa	PMS 340	PMS 344
Ryegrass 80 gpa	PMS 374	PMS 372
Ultradwarf Super 80 gpa	PMS 363	PMS 577
Ultradwarf Plus 80 gpa	PMS 362	PMS 577
Bermudagrass 80 gpa	PMS 7481	PMS 344
Bermuda Green 80 gpa	PMS 340	PMS 290
Green Lawnger 160 gpa	PMS 355	PMS 360
Turf in a Bottle 160 gpa	PMS 354	PMS 358
Ultradwarf Super 160 gpa	PMS 364	PMS 362

Green Turf (Burnett Athletics), Turf in a Bottle (US Specialty Coatings), Regreen (Precision Laboratories), Wintergreen Plus (Precision Laboratories), Ryegrass (Pioneer Athletics), Ultradwarf Super (Pioneer Athletics), Ultradwarf Plus (Pioneer Athletics), Bermudagrass (Pioneer Athletics), and Bermuda Green (J.C. Whitlam Manufacturing).

It is worth noting that by the time this article is in print, we will have initiated new trials that will include most of these colorants plus at least thirteen others. Manufacturers/Distributors that have provided products (to date) for these trials include the companies listed above, plus products from D. Ervasti Sales, Enviroseal, Geoponics, Harrell's, Milliken, Poulenger USA, Solarfast, and World Class Athletic Surfaces. Some of the colorants we will be testing were from existing product lines but many are newly introduced colorants. The rapid increase in new products is in response to the growing interest in using colorants.

In the earlier studies we applied colorant treatments to completely dormant turfgrass in late October to early November using a boom sprayer calibrated at 40 gallons per acre (gpa). Each plot was sprayed in two directions to provide uniform coverage, resulting in application rates of 80 gpa for each colorant. A few of the colorants were applied at alternative rates due to their label recommendations and to verify the influence of rate and longevity. Applied to bermudagrass, colorant increased turf color from 38 to 67 percent relative to the control at the time of painting. Of course there was some variation in how the color was judged over time. But remember the saying, "beauty is in the eye of the beholder."

We felt that at 56 days after treatment the colorants Ryegrass, Ultradwarf Plus, Bermudagrass, and Bermuda Green failed to provide acceptable colorant color when applied to dormant bermudagrass. Only Turf in a Bottle had acceptable color 56 days after treatment on bermudagrass. This illustrates that most of these products will have a date in which they will need to be re-applied to get season-long green color.

In another study applied to semi-dormant turfgrass, the

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products performed much better due to the greater background color at the time of application. This is a very important point. Subsequent tests have proven that some background color goes a long way. Applied to semi-dormant turfgrass, the color will look better and may last longer. For optimum results, do not wait until the turfgrass is straw brown.

Some of the colorant-treated turf took a bluish tint over time (56 days after treatment). Regardless of application volume, Regreen had the greatest propensity to turn a bluish tint. Titan Green Turf also turned bluish when applied to dormant turf. Furthermore, Bermuda Green turned a bluish gray to blue on both grasses. These products may not be as color-stable over time compared to others but if the product is reapplied, even at a lighter rate, this may not be a significant issue. So, it may be important to think about how you want to use these products before selecting the product. Some field managers like to put lighter rates on their field more frequently. If that is the case, then color stability is less an issue.

Applying the colorants at 160 gpa provided turf color increases up to 44 percent greater than the 80 gpa treatments. Applying colorants at rates above 80 gpa also resulted in increased color longevity over the winter season. We did not expect to see such a significant rate response in longevity of the products. More research is needed in this area to fully understand how to best use this information.

I often get asked, what is the best colorant? But in fairness, no one turf colorant was clearly superior on both grasses in terms of natural green color at the time of application and 56 days after application. Results from our earlier studies generally indicated that the colorants with the best natural green color did not generally last as long as some of the others. And with almost double the number of products available to field managers today versus just a few years ago, I can hardly wait to see how some of the newer products compare to some of the industry standards. There is no doubt, some turf colorant products can provide an attractive green putting surface at a reduced cost compared to overseeding. ■

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