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-