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.