Update on university turf-related research projects

***Editor's note:** Following are reports from some leading turfgrass researchers in the US on their current studies.*

Cal Poly State University

1. Tall fescue cultivar trial. Evaluation of 18 top tall fescue cultivars for use on the central California coast. Testing for establishment success, texture, density, color, spring green-up, and persistence.

2. Buffalograss/fine fescue mixes for year round green color. Testing whether one can establish either seeded or vegetative (plugs) buffalograsses into existing fine fescue (red, sheep, and hard) plots. These two grasses are very drought tolerant and perform well during different times of the year.

3. Wetting agent trials for effective water management on a bentgrass green. Tested 13 wetting agents for efficacy and phytotoxicity on a Penncross creeping bentgrass/*Poa annua* green in the central California coast. Funded by Aquatrols, Precision Labs, and Milliken.

4. Correlating lab tested soil moisture conditions on a bentgrass green with the use of a hand held soil moisture meter to evaluate the effectiveness of using a field meter to determine irrigation schedules. Our goal is to provide turfgrass practitioners with techniques to instantly evaluate soil moisture content and ultimately, irrigation needs.

5. Green roofs for the central California coast. Examining three different growing media and five different plant species (including some grasses) for use in green roofs for the central California coast climate.

6. Traffic wear trials. Testing simulated sports shoe traffic (wear) on various new perennial ryegrass and tall fescue cultivars developed. Funded by Barenbrug USA Seed.

7. Presently have a fine fescue NTEP trial to examine the establishment success and persistence of 25 new fine fescue species (red, chewings, hard, and sheep) as well as various cultivars of each to our area.

8. Slated for spring 2010: Trials to test cultural, nutritional, and chemical management tools for two new cultivars of kikuyugrass (*Pennisetum clandestinum*) for golf course fairways in coastal regions of California. Initial trials will test performance under different nutrition, cultivation, and plant growth regulator management strategies. Prep will begin this winter.

9. Slated for late spring 2010: Buffalograss adaption trial in conjunction with Dr. Bob Shearman, University of Nebraska-Lincoln. Prep will begin this winter.

10. Slated for summer 2010: Cutting Strategies for managing tall native and ornamental grasses. Testing the best cutting management schedules for a combination of 30 species and/or cultivars of tall native and ornamental grasses that can be used in the central California region and how these grasses can be established as cover, buffers and wildlife habitat. Specifically, I wish to determine the latest date these tall grass species can be cut back and still produce acceptable flowering and aesthetic quality. Field prep is underway.

Terry L. Vassey, Assistant Professor
Horticulture and Crop Science Department
tvassey@calpoly.edu

Michigan State University

Differences in blends and monostands of Kentucky bluegrass varieties. Traditionally for athletic field construction, the blending of turfgrasses will provide advantages over single-cultivar stands in highly stressed environments. Whether these environments include high trafficked areas, disease pressure, or weed interactions, turfgrass blends out perform monostands. However, due to recent advancements in breeding technology, single cultivars breed for disease resistance, aggressive tillering, and herbicide resistance may be used in place of a blend, which was previously necessary to provide all of these characteristics.

A series of experiments were designed to examine *Poa pratensis* (Kentucky bluegrass) varieties. New and old varieties were selected based on traffic tolerance, disease resistance, bispyribac-sodium (Velocity) resistance, and aggressive tillering. Furthermore, these varieties were planted as single cultivars and then in blends to determine if there are still advantages provided by using a blend of multiple cultivars.

Four field experiments were designed and initiated on September 15th 2009, to address each of the following objectives individually:

Observe the effects of traffic simulation on single-cultivar plantings and blends of the selected Kentucky bluegrass varieties established on native soil.

Observe the effects of topdressing and traffic simulation on single-cultivar plantings and blends.

Evaluate the differences between single-cultivar plantings and blends with inoculation of turf disease pathogens.

Evaluate the effectiveness of selective, specific herbicides on single-cultivar plantings and blends.

Special thanks to our corporate sponsors: Barenbrug Inc.; Turf Seed Co.; Valent Inc.; Schaafsma Sod Farm; and Graff's Turf Farms.

Jeff Dunne, Alexander Kowalewski, John Rogers III
Crop and Soil Sciences @ MSU

Penn State

Effects of Trinexapac-ethyl Applications on the Divot Resistance of Kentucky Bluegrass on Soil-Based Fields. In the January 2009 issue of *SportsTurf*, we presented the results of a study evaluating the effects of trinexapac-ethyl (TE) applications and cultivation practices on the divot resistance of Kentucky bluegrass grown on a sand-based rootzone. We found that by applying TE monthly from May through July and then stopping applications once the season began, divot size was reduced by up to 20%. Based on our results, applications of TE can serve as a pre-stress conditioning treatment before the football season by getting the turf ready for play through increases in tiller density and root mass.

We are currently conducting a follow-up study to see if the same effects occur on a silt-loam soil rootzone. Initial results indicate similar effects from TE applications; however, improvements are less than those observed in the sand-based rootzone trial. Applying TE from May through July decreased divot size by approximately 5% on silt-loam soil. Continuing applications of TE through October neither increased nor decreased divot resistance. A combination of vertical mowing and core cultivation in the spring was found to be as effective at improving divot resistance as TE applied from May through July.

Nine cultivars of Kentucky bluegrass were also included in the trial so that we could evaluate the divot resistance of cultivars commonly used on athletic fields. 'Julia' and 'Princeton 105' (P105) were the most divot resistant cultivars, with divot size approximately 15% smaller than the most divot prone cultivar, which was 'Cabernet'. Divot resistant cultivars in the original sand-based study were 'Limousine', 'P105', and 'Rugby II', while the most divot prone cultivar was Midnight. Based on the results of both studies, divot resistance on fields used only in the fall can be improved by applying TE in the months leading up to the season and by selecting divot resistant cultivars.

Thomas Serensits, Andrew McNitt, and Dianne Petrunak, Crop and Soil Sciences

Synthetic Turf Research at Penn State's Center for Sports Surface: Beginning in the spring of 2010, Penn State's Center for Sports Surface Research will embark on a comprehensive series of studies focusing on the safety and playability of synthetic turf. With support from FieldTurf, research will focus on current issues related to synthetic turf such as surface temperature and injury prevention.

A multi-disciplinary team of experts from several world-renowned Penn State research departments such as biomechanics and toxicology will play an active role in the research process and provide scientific, unbiased results. Additionally, athletic trainers from Penn State will serve as a valuable resource, bridging the gap between research and the athletes themselves. Graduate students from both agronomy and kinesiology will be assigned projects, allowing for collaboration between disciplines.

Playability parameters such as traction and field hardness will be evaluated and compared to a number of natural turfgrass systems, such as sand-based and soil-based fields containing Kentucky bluegrass, perennial ryegrass, and bermudagrass. Because of the widespread popularity of synthetic turf and a lack of extensive research, information obtained from the various studies that will take place will offer consumers current information that would otherwise be unavailable. Information about the Center for Sports Surface Research at Penn State as well as up-to-date synthetic turf and natural turfgrass research conducted at Penn State can be found at http://ssrc.psu.edu/.

Andrew McNitt, Thomas Serensits, and Dianne Petrunak, Crop and Soil Sciences

Ohio State

The turfgrass program at OSU is lucky in that we have tremendous financial, product and equipment support from both the turfgrass industry and also our state turf associations (Ohio Sports Turf Managers, Ohio Turfgrass Foundation, and Ohio Lawn Care Association). One of the most important things our state associations did recently was to undertake a survey to see what the turfgrass industry is worth to the state of Ohio:

- The key findings of that survey were:
- 3 billion dollars in direct economic output
- 4.6 billion dollars in total economic output
- Over 41,000 employed
- Over 4 million acres of turfgrass maintained
- 841 million dollars spent on turfgrass maintenance supplies
- 639 million dollars in labor costs, payroll taxes
- 338 million dollars in contracted services

These findings have given our industry a big boost and just recently the Ohio Senate has recognized our industry further by voting to designate the last week of May "Ohio Turfgrass Week."

Dispersible Granular Technology. This year we have worked a lot with The Andersons Group on their new dispersible granular technology. One of the products we have worked with is "Governor," which is a granular form of the plant growth regulator trinexapac-ethyl (TE). The purpose of developing a granular form of TE is to make it more available to turf managers that don't have spray equipment. The research has been undertaken to evaluate application methods and efficacy of the product. Results so far have been very favorable, especially using the formulation that includes a 4-0-0 fertilizer. Even under drought conditions, the product has suppressed growth ~50% while maintaining healthy turf and promoting color and density, like the liquid versions of TE.

Organic and Synthetic Fertilizers. Two issues we are looking at with regard to turf fertilizers are the removal of phosphorus (P) from maintenance fertilizers and the trend towards using natural sources of fertilizer, such as manures and composts. We started a study in 2008 in collaboration with The Ohio Lawn Care Association to evaluate14 sources of fertilizer (synthetic, natural and combined), with some of the fertilizers containing no P. Overtime we are measuring soil organic content, nutrient status and turf health. The study will also address cost of nitrogen source versus turf quality. For example, corn gluten meal costs $4.50/lb N versus $1.25/lb N for urea, but factors to consider include soil health and turf quality obtained by these nitrogen sources over time.

Stoloniferous Ryegrass. Another company we collaborate with is Barenbrug Inc. and over the years we have evaluated grass cultivars, blends and mixes in relation to establishment and quality and stress tolerance. In 2007 we established a new study looking at several perennial ryegrass cultivars that have aggressive tillers and stolons. While the term "stoloniferous ryegrasses" probably makes a few eyes roll, we did in fact find that to be the case. In addition to the stolon counts, the cultivars were mowed at three different heights (1-inch, 1.5 inch and 2-inch) and subjected to intense traffic. I'm sure Barenbrug will be releasing the data soon.

Seed to Play in 4 Weeks. In addition to the spreading ryegrasses, we also looked at Barenbrug cultivars that germinate and established rapidly. In conjunction with Syngenta we did a study to see what the minimum timeframe would be from seed to play for perennial ryegrass, tall fescue and Kentucky bluegrass. In short, the study was conducted on native soil and Tenacity herbicide (Mesotrione) was applied to the bare soil at the time of seeding in June. An identical study with no Tenacity applied showed that spring and early summer seedings fail and quickly become infested with crabgrass, goosegrass and yellow nutsedge. Turf was considered playable when there was 100% ground cover and adequate traction (determined by the lateral TST and Canaway Rotational Shear testers). Results showed that it is possible for perennial ryegrass to be playable in four weeks, with tall fescue and Kentucky bluegrass playable in six weeks. The application of Tenacity at the time of seeding prevented any weeds from coming in and provided a clean seedbed for the duration of the study. This was by no means a low-maintenance program and required irrigation, applications of starter fertilizer and regular mowing. In fact, one of the key practices for quick establishment is mowing as soon and as often as possible after germination.

Fungicides that Improve Turf Health. In collaboration with Syngenta a study was repeated in 2009 that we were fairly excited about in 2008. What we found in 2008 was that applications of Subdue fungicide had "non target" effects on turfgrass establishment. Subdue was applied to half of the study as a preventative for pythium seedling disease, with the other half receiving none. No pythium was observed on either side of the study but the Subdue had a positive effect on establishment speed, color, density, height and % tissue nitrogen. The study in 2009 included both Subdue and Heritage fungicides and the same results were observed. These non-target effects are significant and could be used by a turf manager to quickly enhance establishment and quality.

For more info on our Sports Turf Program, see our website: Buckeyeturf.osu.edu

Our annual field day report is at: http://buckeyeturf.osu.edu/pdf/ 2009_Field_day_book.pdf

Pamela J. Sherratt & Dr. John R. Street, Horticulture and Crop Science

Clemson University

Optimizing the Spring Transition with Cultural and Trifloxysulfuron Treatments. Bermudagrass is often overseeded with perennial ryegrass to hide its dormant brown color and improve its winter playability. However, prolonged overseeding cover shades and potentially deteriorates the bermudagrass base.

Cultural treatments are often implemented to aid in providing a desirable spring transition back to the bermudagrass base. Though, without a favorable climate, cultural treatments alone often fail to consistently provide a desirable spring transition.

Transition aid chemicals are often needed to ensure sufficient bermudagrass recovery time. Unfortunately, chemical treatments alone often yield spring transitions with unacceptable lapses in turf quality.

Therefore, combining cultural and chemical control options appears to be the best approach to achieving a desirable spring transition while sustaining acceptable turf quality.

The objective of this research was to evaluate combinations of mowing height, fertilizer rate and application timing and rate of trifloxysulfuron (Monument, Syngenta) to determine which practices would optimize the spring transition and ensure continuous acceptable turf quality.

A 12-week study was conducted from mid-April to July 2006 and repeated in 2007 on an established stand of Tifway 419 hybrid bermudagrass overseeded with a perennial ryegrass blend at 7 pounds/1,000 square feet pure live seed.

Cultural treatments 0.5 or 1.0 inch mowing heights and 0.375 or 0.75 pound nitrogen/1,000 square feet/week fertility rates were initiated on April 11, 2006 and 2007. Trifloxysulfuron (Monument 75WG) was applied at 0.1 or 0.3 ounce/acre in mid-April or mid-May of each year with a nonionic surfactant added at 0.25% by volume.

Turf quality, percent perennial ryegrass/bermudagrass, clipping/root weights, and bermudagrass shoot counts were taken throughout the study.

Both years, cultural practices alone failed to provide an acceptable transition to the bermudagrass base and had to be coupled with trifloxysulfuron to achieve a complete, timely spring transition. Although there was not a consistent treatment over both years, plots treated with the low rate of trifloxysulfuron in May (0.1 ounce/acre) at 0.5-inch mowing height and fertility treatments of 0.75 pound nitrogen/1,000 square feet/week maintained acceptable turf quality and spring transition throughout 2007.

Raymond K. McCauley, Bert McCarty, Ph.D, Haibo Liu, Ph.D, Joe E. Toler, Ph.D

North Carolina State

Evaluating the effects of athletic field paint on turfgrass growth processes. This study is covering many of the basic growth aspects such as photosynthesis and water relations, as well as practical aspects associated with painting turf. Data indicates there are some marked differences due to paint color and dilution. Study conditions include a combination of control-chamber work and field evaluations. We believe data generated in these studies will allow us to make recommendations on paint use as it relates to turfgrass health.

Grady Miller, Casey Reynolds, and Scott Brinton, Crop Science Department

Another current research area includes **evaluating the use of green turf colorants as an alternative to overseeding warm season turfgrasses**. A recently concluded field study conducted in Raleigh, NC evaluated the effects of 12 green turf colorants on dormant bermudagrass and zoysiagrass. This study aimed to not only determine the effectiveness of the 12 turf colorants to provide acceptable green color when applied to dormant warm season turfgrasses, but also determine the longevity of these colorants.

Visual turf color ratings were taken as well as digital photographs of treatments and color matching was conducted using Pantone® PMS numbers. The 12 different color brands provided varying color and longevity when applied to the turfgrass. The Pantone PMS number data illustrated how some products tend to change color over time. This research indicates that some turf colorant products can offer an aesthetically pleasing and cost effective alternative to overseeding. A journal article has been submitted for publication consideration with the results of this study.

As a compliment to this concluded study, we have several additional studies planned for 2009-2010 involving green turf colorants. These studies include a look at several turfgrass and environmental parameters that may impact the application, effectiveness and longevity of green turfgrass colorants.

Grady Miller, Scott Brinton, Kyle Briscoe, NCSU Crop Science Department

University of California, Riverside

Evaluation of Bentgrass Cultivars for Putting Greens in Southern California

The objective is to evaluate 19 creeping bentgrass cultivars and one velvet bentgrass cultivar on a sand based putting green under simulated championship conditions. The green was mowed at 0.135 in, Primo Maxx applied, rolled daily, and a traffic simulator used to apply metal spike traffic. Highest rank cultivars in the study were L-93, Brighton, Mariner, Dominate Plus, Penn G-6, Seaside II, and Penncross.

James Baird, Botany and Plant Sciences

Assessment of Turfgrass Water Management Systems.

The objective is to evaluate a series of new technologies for potential water savings while maintaining quality turf. Weighing lysimeters

Continued on page 43 »

FieldScience By Barry Stewart, PhD

Study results:
use of natural siliceous mineral on turf

This study was conducted to examine the properties of Lassenite Soil Amendment (LSA) for use in golf course fairways to improve water relations and examine plant water relationships with water that is fairly high in soluble salts.

The LSA improved water holding capacity (field capacity) compared to other amendments, when blended with sand at 10% by volume.

Material	Field capacity water (% water by mass)
Sand	21.9
LSA	27.8
Calcined Clay (fine)	26.4
Calcined Clay (coarse)	24.7
Calcined diatomite	23.3
Zeolite	22.2

Materials were tested using a modified double wash cation exchange capacity (CEC) procedure to determine the CEC of each material using sodium (Na) as the ion being exchanged. Since Na would probably be the ion of interest, the usual magnesium for calcium procedure was not used. Instead the samples were saturated with Na and then potassium (K) was used as an exchanging ion.

Material	CEC cmol+/ kg material
Sand	0.3
LSA	25.9
Calcined clay (fine)	2.7
Calcined clay (course)	7.2
Zeolite (fine) (clinolite)	68.6
Zeolite (course) (source not known)	10.4
Calcined diatomite	10.5

The LSA had a higher CEC than was anticipated, after examining a chemical analysis provided by Western Pozzolan, entrained sodium and soluble sodium components were ruled out. It is speculated that the source of the CEC is amorphous (without form) minerals present in the pozzolan. Amorphous materials are common in volcanic deposits. Amorphous materials also have been shown to have significant CEC values. This could be a good thing (the amendment provides some nutrient holding) or not so good (the amendment becomes saturated with Na and this hurts the plants). Further CEC testing may be warranted to better define this property.

Plant growth

Seashore Paspalum variety SeaDwarf was established on 6 inch (diam) pots filled with sand mixed with no amendment (control), 10% (v/v) LSA (LSA), or 10% (v/v) clinoptile zeolite (Z). The variety Seadwarf was used and the pots were established using washed sod. Sixteen pots of each treatment were established. After one month of growth to get acclimated the pots were broken into four water regime treatment groups (12 pots per group) with four pots of each soil amendment per treatment. The water regime treatments were: tap water—plants maintained at field capacity (no stress); tap water—plants watered when they showed drought stress; salt water (1000 ppm Na)—plants watered to field capacity; and salt water—plants watered when plants showed signs of drought stress.

Plants watered with salt water at field capacity looked the best. These plants had better color and few if any brown leaves compared to other treatments. It appears that some sodium is essential for this seashore paspalum cultivar to have its highest quality.

Figure 1. The best pots (out of 4) for the salt water field capacity pots. C = control, P = LSA, Z = zeolite

Figure 2. The best pots (out of 4) for the tap water field capacity pots. C = control, P = LSA, Z = zeolite

Figure 3. The best pots (out of 4) for the salt water drought pots. C = control, P = LSA, Z = zeolite

Figure 4. The best pots (out of 4) for the tap water drought pots. C = control, P = LSA, Z = zeolite

Rooting Study:

After more than 3 months of growth in 6 inch pots in the greenhouse the pots were dismantled to examine root growth. There were 3 factors being evaluated in this study. Water timing—maintaining water at field capacity by watering every day or watering just before the plants began to wilt—was determined to be every 2 to 3 days depending on sunlight conditions. We found that water timing did not have a significant influence on root mass in this study. Water quality effects were also examined and we found that 1000 ppm salt (as NaCl) produced a small but significant decrease in root mass per pot (Table 1). The decrease was 1.4 grams per pot.

Soil amendments were also evaluated and found to significantly affect rooting across water timing and water quality (Table 2). The control pots (straight USGA sand) had the highest root mass but did not produce a significantly different root mass than a 90% USGA sand/ 10% LSA (LSA) mix. The 90/10 zeolite amendment produced a statistically lower root mass than did the other treatments. It is logical that the

Table 1. Soil amendment effects on mean root mass of seashore paspalum.

Treatment	Root mass (g) in 6 inch pot
Control (USGA Sand)	10.4 a
LSA (90:10 mix with USGA sand)	9.2 a
Zeolite (90:10 mix with USGA sand)	6.6 b

Means followed by same letters are significantly different at the α = 0.05 level of significance.

Table 2. Comparison of the effects of 1000 ppm NaCl water and tap water on the mean rooting mass of seashore paspalum.

Treatment	Mean root mass (g) in 6 inch pot
Tap water	9.44 a
1000 ppm NaCl	7.98 b

Means followed by same letters are significantly different at the α = 0.05 level of significance.

straight sand might produce the highest amount of root mass as it was the droughtiest treatment (always the first to show signs of water stress). This would stimulate root growth to keep up with water demand. The salt treatment always resulted in a decrease in rooting across all treatments, but this difference was not always statistically different. The zeolite pots showed larger decreases in root mass than did the other soil treatments (Table 3).

It appears that the WPSA adsorbs less sodium than the zeolite and its incorporation has less effect on root mass in salty conditions than zeolite. LSA also enhances water holding so treated areas would require less water compared with straight sand.

To gain further insight into the plant growth, the amount of salts held in the pots at the end of the experiment was examined.

Table 3. Comparison of all treatment combinations for mean root mass of seashore paspalum.

Treatments	Mean root mass (g) in 6 inch pot	
DWP	10.9	a
FCWP	10.9	a
FCWC	10.7	a
DWC	10.5	a
FCSC	10.3	a
DSC	10.1	ab
DSP	7.9	abc
DWZ	7.1	bc
FCSP	6.9	c
FCWZ	6.6	c
DSZ	6.5	c
FCSZ	6.2	c

D = drought, FC = field capacity, W = tap water, S = 1000 ppm NaCl, C = control (USGA sand), P = 90:10 mix of USGA sand and LSA, Z = 90:10 mix of USGA sand and zeolite. Means followed by same letters are significantly different at the α = 0.05 level of significance.

Soil amendments were also evaluated and found to significantly affect rooting across water timing and water quality.

The grass and pots were dried down and soil samples were taken. The grass roots and rhizomes were extracted from the soils samples by hand. For Electrical Conductivity (EC) determination 20 grams of soil was mixed with 20 ml of isopure water, stirred and allowed to stand for 30 minutes. The electrical conductivity was measured with a Field Scout conductivity meter (Table 4). The 1:1 soil to water ratio is reported to produce results similar to saturated paste conductivity. No treatment showed an EC value that would affect plant growth of salt tolerant plants.

Since the LSA held more water at field capacity it seems logical that when the pot was dried down more salt would be present in that soil and therefore it would have a higher EC value. The sand would have the lowest water holding capacity and little CEC, therefore its EC readings should be low and they were. It is interesting that the 10% LSA pots under drought conditions (watered every 3 days) fell into this group. The 10% zeolite pots show identical readings for field capacity and drought treated pots. We think we saw equilibrium with the exchange complex in these pots, and the EC value represents the 1000 ppm salt solution we were watering with, coming to equilibrium with cation exchange of the zeolite. If the EC of the droughted LSA pots represents equilibrium then it is at a lower level indicating that LSA does not hold onto salts as strongly as the zeolite amendment.

Conclusion

There did not appear to be any drawback to using the Lassenite Soil Amendment (LSA) under these conditions: a sand fairway watered with 1000 ppm salts (as NaCl) water. As long as the soil on the site is able to drain away excess water the seashore paspalum should perform well. If drainage were to be poor and the water began to move upward in the profile rather than downward a salt accumulation could affect the grass. The LSA increased the water holding capacity of the soil and that resulted in needing to be watered less frequently than sand alone pots. The difference was that the sand pots needed water every 2 days while the LSA and zeolite amended pots needed water every 3 days. It the field these intervals would more likely be 3 days for sand and 4 to 5 days for the LSA. This would be a significant change in the amount of water needed to maintain turf on a yearly basis. ■

Dr. Barry Stewart is associate professor at Mississippi State University, brs40@msstate.edu.

Table 4. Electrical conductivity values of various treatments. EC was determined using a 1:1 soil to water ratio.

Treatment	EC reading (mS)
LSA Field Capacity	1.56 a
Zeolite Field Capacity	1.22 b
Zeolite Drought	1.22 b
Control Drought	1.06 bc
LSA Drought	1.00 bc
Control Field Capacity	0.87 bc