



**Figure 3.** Granular fertilizer sources are a prudent means to supply ample nitrogen quantities to sports fields.



**Figure 4.** Good turf cover in high traffic sports field locations like goal creases can be achieved by routine overseeding of perennial ryegrass during the sports season.

bluegrass and tall fescue, making it an ideal choice for overseeding during the fall and early spring sports seasons.

Fields badly damaged resulting from summer sports can be core cultivated to a 4 inch depth in late summer. Following core re-incorporation using a tow-behind drag, a blend of two-to-five perennial ryegrass varieties can be sown using a slit-seeder operated in two directions at a minimum of 5 lbs seed/1000 ft<sup>2</sup> per direction (i.e. total of 10 lbs seed/1000 ft<sup>2</sup>). Application of a starter fertilizer and maintaining moisture at the soil (i.e. seedbed) surface will increase the probability of successful establishment.

During the sports season, prior to games and practices, perennial ryegrass overseeding can be performed using a rotary spreader and allowing athletes to “cleat-in” the seed to achieve necessary seed-to-soil contact. In the midst of the sports season, the same rotary spreader can be used to apply seed prior to games and is preferential to repeated use of a slit-seeder as the vertical blades on these machines can potentially injure new seedlings resulting from previous overseeding efforts.

Applying a sufficient quantity of seed is important to achieve overseeding success. A reasonable starting strategy would be to apply 6 lbs seed/1000 ft<sup>2</sup> between the hash marks of the football field prior to every home game. This area on a standard Canadian football field is 16830 ft<sup>2</sup> (330 x 51 ft). To apply 6 lbs seed/1000 ft<sup>2</sup> to this area, it will require two 50 lb bags of seed. If after several games, and potentially other events, turf cover is still diminishing and new seedlings are not establishing, the seeding “rate” can be increased to one or more additional 50 lb bags.

### Conclusions

At minimum, turfgrass requires mowing, fertilization, and water. Regular mowing with efficient equipment, supplying adequate fertility, and avoiding the temptation to rely simply on the program “clock” to apply irrigation are basic refinements to primary cultural practices. To maintain turf cover on highly trafficked sports fields, the integration of cultivation and overseeding into existing primary cultural practices will better ensure success. •

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*Brad Park is Sports Turf Education & Research Coordinator, Rutgers, The State University of New Jersey; a member of the Sports Field Managers Association of NJ (SFMANJ) Board of Directors since 2003; and Editor, SFMANJ Update newsletter.*

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## FIELD DAY HIGHLIGHT

Presented September, 2012  
Vaughan, Ontario.

Photo: Peter Purvis, Guelph Turfgrass Institute

# Maintaining Turfgrass Coverage Under High Traffic Conditions

K.L. Dodson, F. Tardif, K.S. Jordan,  
E.M. Lyons, University of Guelph

One of the greatest challenges for sports turf managers is to maintain good playing quality throughout the play season. Although there is some question as to how exactly playing quality is defined, Bell and Holmes (1988) found that a player's perception of quality correlates positively with high rates of ground cover regardless of the ground cover population. Bell and Holmes' study indicates that bare ground is the driving factor of the player's perception of reduced quality of the field. If players are just looking for ground cover then why do managers worry about the composition of the field? While some believe the perception of weeds in the sward is purely aesthetic, others argue certain weeds can lead to an increase in injury to players (Larsen and Fischer, 2005a; Sachs, 2004; Raikes et al., 1994). Some weeds of major concern on sports fields are prostrate knotweed, plantain and white clover. White clover in a turf stand can pose a slipping

hazard when the field is wet (Sachs, 2004), while knotweed grows in long stems with no anchoring roots that can lead to tripping hazards for athletes. Preliminary results from research conducted at the Guelph Turfgrass Institute in collaboration with the Orthopaedic Neuromechanics Laboratory at York University have shown that plantain species in a stand reduce stability and may lead to increased risk of knee injuries. These weeds are typically indicator species of other underlying problems of the field. White clover for example, indicates low nitrogen availability, while knotweed and plantain often indicate compacted rootzones. Some factors that contribute to bare ground and weed invasion are the construction of the underlying rootzone, the local climate, the amount of play on the field, and how and when maintenance practices are performed (Larsen and Fischer, 2005a).

With traditional herbicides no longer

being tools in a turf manager's toolbox, emphasis must be placed on cultural practices and their effects on weed control. Larsen and Fischer (2005b) found that verticutting produced a short-term reduction on weed populations on fairway turf when combined with fertilizers. But in general there have been relatively few studies on how to culturally control weeds in turf (Busey, 2003).

One important cultural practice that may help in maintaining turf coverage during the play season is overseeding. Simply put, overseeding refers to the practice of adding desirable turfgrass seed into an existing sward. The purpose of overseeding is to thicken the stand and increase the total turf population thus increasing the ability of the turf to outcompete weeds and decrease the amount of bare ground and weed coverage on the field.

## Why Overseed?

Overseeding athletic fields with perennial ryegrass (PR) or annual ryegrass (AR) has been shown to aid in creating a thicker stand of turf while reducing bare patches (Elford, 2008; Minner et al., 2008; Rossi, 2004). The use of an annual turfgrass seed may indeed aid in maintaining turf during the play season; however if time and money are being spent to overseed it may make more sense to choose a perennial species that has greater staying power. The purpose of our study at the Guelph Turfgrass Institute (GTI) has been to evaluate a potential new species of turfgrass for overseeding, while exploring the effects of overseeding frequency and mowing height on turfgrass coverage, weed populations and bare ground coverage.

Perennial ryegrass is a relatively inexpensive turfgrass that has a rapid germination rate (approximately 7 days) making it the number one perennial turfgrass choice for overseeding in Canada's climatic zone. However with the long Canadian winters, the low winter survival rate of PR can lead to increased bare ground coverage in early spring. Adding a slower germinating species into the sward may help ensure long-term turfgrass coverage.

For this study supina bluegrass (*Poa supina*) was chosen as the companion species to overseeding with PR. Supina bluegrass (SB) is native to the European Alps, and has been bred and used as a turfgrass in Germany since the 1930s (Stier, 1998). It has a great ability to thrive under high wear conditions, but its lime green colour and numerous dark seed heads in the spring do not fit with the North American preference for dark green cultivars. However, its stoloniferous growth habit, aggressive growth rate, relatively late fall dormancy and early spring green-up make it an ideal candidate for competing with early germinating spring weeds. Unfortunately the cost of supina bluegrass is high with an average price of \$12-15/kg (\$25-35/lb). Therefore it is practical to look at the minimum amount of SB that is required to be beneficial in a companion PR overseeding regime. Our companion overseeding trial

has been evaluating five seeding rates that include a no overseeding control, an overseeding with perennial ryegrass alone at 6 kg/100 m<sup>2</sup> and then in combination with supina bluegrass at 0.5 kg/100 m<sup>2</sup>, 1 kg/100 m<sup>2</sup>, 2 kg/100 m<sup>2</sup>, and 4kg/100 m<sup>2</sup> (Table 1).

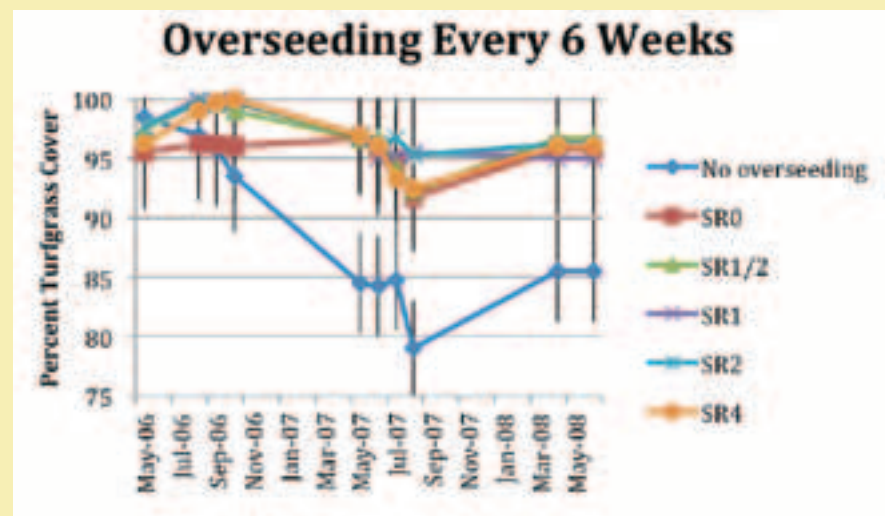
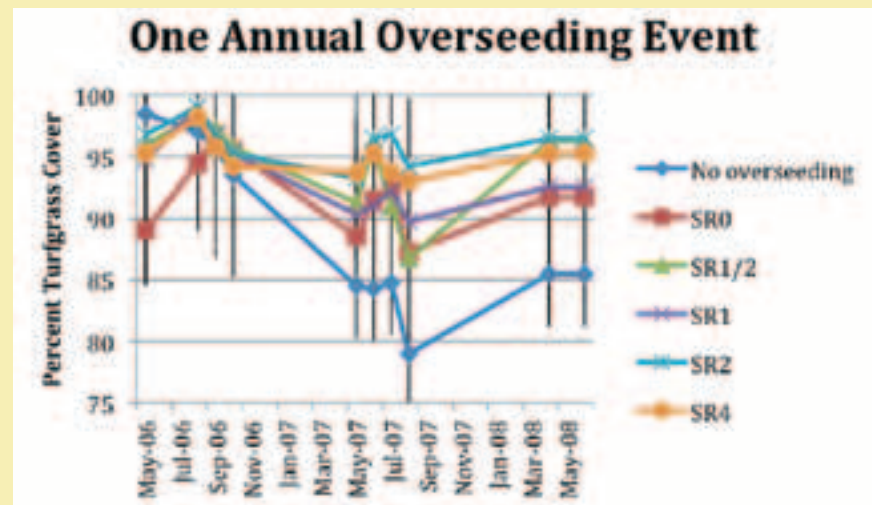
In addition to examining the effects of adding SB into a PR overseeding program

the frequency of overseeding was also explored. We compared applying all the seed in one application versus applying 1/3 of the total seed three times throughout the play season. What we found was that applying smaller amounts of seed every 6 weeks during the growing season resulted in greater turfgrass coverage throughout the play season.

**Table 1. Overseeding rates of Perennial ryegrass and Supina bluegrass.**

Seeding Rate	Perennial ryegrass	Supina bluegrass
SR0	6 kg/100 m <sup>2</sup>	0 kg/100 m <sup>2</sup>
SR1/2	6 kg/100 m <sup>2</sup>	0.5 kg/100 m <sup>2</sup>
SR1	6 kg/100 m <sup>2</sup>	1 kg/100 m <sup>2</sup>
SR2	6 kg/100 m <sup>2</sup>	2 kg/100 m <sup>2</sup>
SR4	6 kg/100 m <sup>2</sup>	4 kg/100 m <sup>2</sup>

**Figure 1. Turfgrass coverage over time with 5 different seeding rates (Table 1) and a control (No overseeding). LS means calculated using ANCOVA.**



## Mowing Height

For most people, basic turf care is mowing. As Turgeon (2002) states “mowing is the most basic of all turfgrass cultural practices.” The ability to tolerate regular mowing is a common trait of all turfgrasses, however the ideal height of cut does vary among species (Beard, 1973). The cool season grasses that are commonly planted for athletic fields here in Canada are Kentucky bluegrass (*Poa pratensis*) and perennial ryegrass (*Lolium perenne*), both of which can be mowed at a medium height (40 – 60 mm or ~1.5 – 2.5 inches) (Sheard, 2008). By maintaining an ideal height of cut for each species, you ensure a healthier stand of turf that will resist weed encroachment and other stresses. The appropriate frequency of mowing depends on many factors such as the time of year, moisture availability

and fertility. In general, following the one-third rule will ensure that the plant will be able to recover relatively quickly from the stress of mowing. Therefore when planning a mowing schedule it is important to be flexible and willing to adapt to the conditions that have arisen due to weather, fertility, and use. Mowing typically takes up approximately 30 – 40% of a field’s maintenance budget, so it is important to understand the simple basics of why mowing is important to athletic field sward continuity (Sheard, 2008).

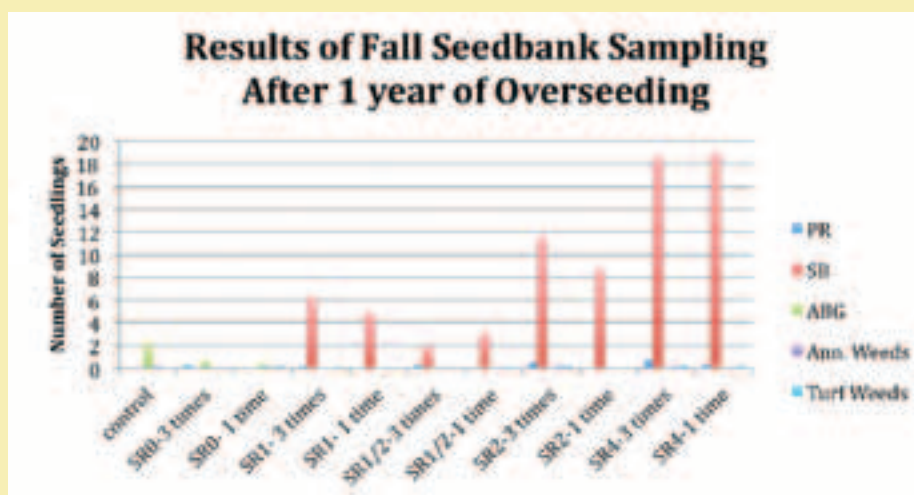
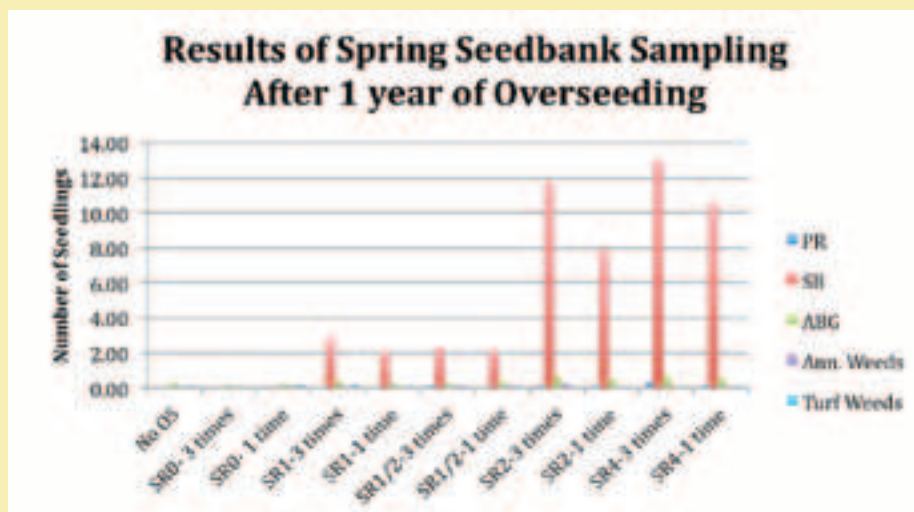
Our research experiment also examined what height of cut would optimize an overseeding program. We compared two mowing heights within our overseeded plot - 3.8 cm (1.5 inches) and 7.5 cm (3 inches). To maintain the lower height of cut the 3.8 cm plots were mown every 4 – 5 days, while the higher

height of cut plots were mown only once a week. While there were no statistical differences between the two heights of cut for turfgrass coverage, there was a difference in smoothness of the plots. The plots that were maintained at the shorter mowing height had a higher quality playing surface when compared with the higher mowing height. Our rating of quality was based on a visual rating that reflected both functional and aesthetic attributes like density, uniformity, smoothness, growth habit and colour (Morris and Shearman, 1998). Whether the observed higher quality is directly linked to mowing height or to frequency and quality of cut is not known from this study, however it does imply that mowing more frequently has a positive effect on turfgrass quality.

## What Happens to the Seed?

One question that is often posed to researchers is, what is happening to the seed that is being applied through overseeding? Does it all germinate? If it doesn’t all germinate does that mean it dies? Many of us know about the ubiquitous nature of annual bluegrass and the ability of its seed to maintain viability in the seedbank for more than 6 years (Turgeon et al., 2009); however, very little is known about the survivability of our turf-type turfgrasses in seedbanks. We evaluated the soil seedbank to determine the fate of the seed that we added each season. Soil samples were collected from the research plots using a soil probe both in the fall of 2010, in the spring and fall of 2011 and in the spring of 2012. Plots that received the higher amounts of total seed had more seed surviving in the seedbank. However, in the treatments where both species were overseeded, the dominant species in the seedbank was supina bluegrass. Interestingly the amount of PR that was able to survive in the seedbank increased with increasing amounts of SB overseed (Figure 2). Spring sampling had lower amounts of PR seedlings than the fall sampling, suggesting that in order to get an accurate prediction of what seed in the seedbank may be affecting your field for the upcoming playing season it is better to sample in the spring than the fall.

**Figure 2.** Seedbank analysis results after 1 year of companion overseeding with 6 kg/100 m<sup>2</sup> of PR, and 4 rates of SB (Table 1). LS means calculated using ANOVA.



## Wrapping It All Up

When deciding on when and how to overseed, frequency appears to play a more important role than total amount. Figure 1 exemplifies the importance of adding small amounts of seed more frequently. Looking at the perennial ryegrass overseeding example (SR0) shows that with the frequent overseeding there was a greater than 95% turfgrass coverage, while the one time SR0 seeding was at 91% turfgrass coverage. The addition of SB as an overseeding companion did not affect overall effectiveness of overseeding, but appears to play a dominant role in the soil seedbank. That said, it is important on non-irrigated fields to time your overseeding applications so there is enough precipitation to aid in germination if you are overseeding with PR alone. In general, overseeding appears to help in maintaining turfgrass coverage (Figure 3). Also in a non-irrigated environment adding SB into the overseeding mix results in a faster recovery time after periods of long drought. The non-irrigated field at the GTI (Figure 3) recovered faster on the half with SB when compared to the half of the field that had PR alone. Mowing height plays an important role in maintaining turfgrass quality as well, but whether this is due to mowing frequency or height of cut or a combination of both factors is not determinable from the presented data. Seedbank data suggest that overseeding with perennial ryegrass alone does not feed the seedbank; therefore timing of overseeding should occur when environmental conditions are favorable for seed germination.



**Figure 3.** Non-irrigated field at the Guelph Turfgrass Institute. Left side has been overseeded 3 times with either 0.5kg/100m<sup>2</sup> SB (back half, lime green colour) or 3kg/100m<sup>2</sup> perennial ryegrass (front half), while the right side of the field had no overseeding.

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## FIELD DAY HIGHLIGHT

Presented September, 2012  
Vaughan, Ontario.

Tom Serensits, Penn State's Center  
for Sports Surface Research

# Synthetic Turf: Research Answers to Common Questions

As the number of infilled synthetic turf athletic fields continues to rise, research related to this newest generation of synthetic turf is becoming increasingly available to consumers. In the early days of infilled synthetic turf, consumers often had to rely solely on turf sales people for information. Unfortunately, not all of the information was accurate and scientific data was often not available. Fortunately, unbiased, scientific research is beginning to address many of the issues and concerns associated with infilled synthetic turf. This article gives an overview of some of the research that we have done at Penn State's Center for Sports Surface Research as well

as research done by other agencies. Links to all of the research studies mentioned, along with many other studies, can be found on the research section of our website: [ssrc.psu.edu](http://ssrc.psu.edu).

### Injuries

When we think about synthetic turf and risks, increased injury risk is typically the first thought that comes to mind. While it is true that athletes playing on older styles of synthetic turf (i.e. "traditional AstroTurf") suffered more injuries than those playing on natural grass, the majority of injury studies involving infilled synthetic turf do not follow that same trend. Researchers

have tracked injuries in football, soccer, and rugby and compared the number of injuries occurring on natural grass and infilled synthetic turf. The majority of the results from these studies show that while certain types of injuries may be more common on one surface than the other, overall injury risk is similar.

Of the 13 published scientific studies comparing injury rate on infilled synthetic turf and natural grass, 11 have concluded that there is no difference in overall injury rate between the two surfaces. Of the studies that found a difference, one conducted on NCAA college football players reported a lower overall injury risk

WHY ARE ATHLETES  
LESS LIKELY TO SUFFER  
INJURIES WHEN  
PLAYING ON INFILLED  
SYNTHETIC TURF  
FIELDS COMPARED TO  
EARLIER VERSIONS OF  
SYNTHETIC TURF?

**Figure 1.** We conduct surface temperature research both outdoors and using the laboratory set-up shown here

on synthetic turf while the other found a higher rate of anterior cruciate ligament tears on synthetic turf for NCAA college football players. Links to each of these studies can be found on our website: [ssrc.psu.edu](http://ssrc.psu.edu). As more of these types of studies are published, we will gain an even better understanding of injury risk on synthetic turf and hopefully a better understanding of the mechanisms that lead to injury and how injuries can be prevented.

Why are athletes less likely to suffer injuries when playing on infilled synthetic turf fields compared to earlier versions of synthetic turf? To answer this question, we must examine what makes infilled synthetic turf different from the earlier generations of synthetic turf. The sandpaper-like surface of those older turf systems tended to “grab” the cleats of a player’s shoe and not allow the cleats to “release” as the player’s leg turned or rotated. This high amount of rotational traction places a great deal of torque on the ankle and knee, potentially leading to a serious injury. The combination of longer

fibers and granular infill material allows for easier “release” of an athlete’s cleats from the surface of infilled synthetic turf, lessening the torque placed on the ankle and knee.

At Penn State, we measure rotational traction using a device called Pennfoot. Pennfoot consists of a surrogate leg and foot that can be outfitted with any type of shoe. Over the past seven years, we have measured rotational traction, along with a number of other characteristics, on multiple infilled synthetic turf products along with traditional AstroTurf. You can find the results from our studies on our website: [ssrc.psu.edu](http://ssrc.psu.edu).

### Chemical Exposure

One of the most common concerns voiced by parents groups and the like is the potential exposure to harmful chemicals from both crumb rubber infill and carpet fibers. A number of scientific studies, including an extensive study by the City of New York, addressed these concerns by testing for contaminants that may pose a threat to field

users through inhalation, skin contact, or ingestion. These tests found the presence of some contaminants; however, the vast majority of studies concluded that there is no elevated health risk associated with playing on infilled synthetic turf. While low levels of contaminants were occasionally present, in most cases, the levels were no different from “background” levels, which are areas tested away from the field that are used to compare with field levels. These results agree with a recent Environmental Protection Agency study that concluded that the concentrations of chemicals in crumb rubber are below levels considered to be harmful to humans.

With the discovery of high lead levels in the fibers of a synthetic turf field in New Jersey several years ago, the presence of lead in synthetic turf has received considerable attention. A closer look at the New Jersey findings shows that the turf on the field tested was an aged traditional AstroTurf surface. However, the study prompted the United States Consumer Products Safety Commission (USCPSC) to test for lead



  
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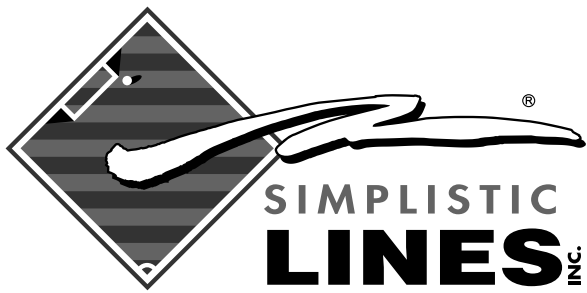
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in infilled synthetic turf carpet fibers. The USCPSC concluded that field users were not at risk of exposure to lead because lead levels were very low or undetectable. Additionally, synthetic turf manufacturers have agreed to remove virtually all lead from their products in the future.

### Skin Infections

Another health concern that has been in the news over the past several years is the potential to contract skin infections from synthetic turf. Outbreaks of staph infections, specifically methicillin-resistant staph infections (MRSA), have been blamed on synthetic turf as some have argued that the surface of the turf provides a breeding ground for the bacteria. As a result, many fields are being treated with anti-microbial agents on a regular basis, often at great expense.

Members of our Center for Sports Surface Research conducted a survey of 20 infilled synthetic turf fields and tested them for the presence of staph bacteria. No staph bacteria were present on any field. As part of our study, we also tested other surfaces athletes commonly come into contact with, such as locker rooms and training areas. Staph bacteria were found on blocking pads, weight equipment, used towels, and a stretching table. This tells

**WHILE HIGH SURFACE TEMPERATURE HELPS KILL BACTERIA ON THE TURF'S SURFACE, IT ALSO POSES A POTENTIAL HEALTH THREAT TO FIELD USERS.**

us that athletes are indeed being exposed to staph bacteria, but that exposure is not coming from synthetic turf.

In a follow-up study, we placed live staph bacteria onto the surface of infilled synthetic turf and monitored its survival over time. On outdoor fields, nearly all bacteria were dead within three hours. Interestingly, more bacteria survived on Kentucky bluegrass than synthetic turf over the course of the study. On indoor fields, the bacteria survived for several days. The difference in survival rate between outdoor and indoor fields is most likely because of higher surface temperatures and UV light exposure on outdoor fields. We also tested the effectiveness of anti-microbial sprays marketed for use on synthetic turf. SportsClean anti-microbial spray and Tide liquid detergent were both equally effective at reducing bacteria survival time on indoor fields (no live bacteria after 24 hours). The overall effectiveness of these products could not be determined on outdoor fields because under sunlight and high surface temperatures, the bacteria died quickly, regardless of whether or not a treatment was applied.

### Surface Temperature

While high surface temperature helps kill bacteria on the turf's surface, it also poses a potential health threat to field users. When surface temperatures reach extreme levels, field users may suffer from heat related illnesses, such as dehydration and heat



stroke. On clear, sunny days during the summer, surface temperatures of infilled synthetic turf can reach up to 93° C. A common misconception is that the black crumb rubber infill is to blame for the hot surface. In reality, the carpet fibers are substantial contributors to heat build-up. Our research shows that the surface of traditional Astroturf (no infill) gets just as hot as infilled synthetic turf. We also tested a number of “alternative” infill products and fiber colors and found only small differences in surface temperature when compared with the traditional green carpet infilled with black crumb rubber.

Unfortunately, there is currently no way to cool the surface of synthetic turf for an extended period of time. Watering synthetic turf drops the surface temperature rapidly; however, temperatures begin to rebound in as little as 10 minutes and reach nearly pre-watering levels within several hours. After all, a properly functioning turf system is designed to drain water rapidly; therefore, the cooling effects of any water applied will only last for as long as there is moisture present at the surface.

Several alternatives to crumb rubber infill along with fiber coatings claim to lower surface temperature. Our testing has yet to prove that any currently available product provides a significantly cooler surface than a standard infilled synthetic turf field.

Many questions and concerns have been raised as the popularity of infilled synthetic turf continues to increase. These questions have prompted research studies that have attempted to seek out whether or not the concerns are warranted. Scientific research has debunked several of these questions, while other concerns, such as surface temperature, remain valid and require attention. As additional research related to today’s

generation of synthetic turf is released, consumers will benefit by having more access to scientific research, allowing them to make more informed decisions. •

**Figure 2.** We test traction using Pennfoot - a device that allows us to compare traction levels on playing surfaces using various types of shoes.



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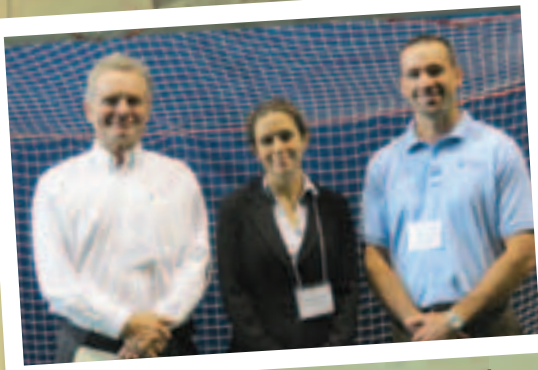
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Our thanks for your participation in our 25<sup>th</sup> Annual Field Day... making it our 25<sup>th</sup> annual success!



Event Chair Andrew Gaydon (L) with Speakers Kathleen Dodson and Thomas Serensits



Session Chair Tennessee Propedo (L) with Speaker Ted Chudleigh



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