FIELD DAY HIGHLIGHT

Presented September, 2012 Vaughan, Ontario.

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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.

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. 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.

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

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 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

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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.