Sports Turf Research Report

Forward Motion

Evaluation of various athletic field rootzone inclusions

by Andrew McNitt

In this study, we wanted to determine whether various soil inclusions affect physical properties and/or playing surface quality in soils with high sand content.

Physical properties include texture (percent sand, silt, and clay), bulk density (weight per unit volume of soil), and water infiltration rate. These directly affect the soil's ability to exchange air and water, which turfgrass roots need to survive.

Playing surface quality can be defined as the suitability of a surface for a particular sport, as measured in terms of the interactions between the surface and players. A player interacts with a surface in two ways: through impact or through player to shoe to surface interaction (traction).

Our study

We established field plots at the Joseph Valentine Turfgrass Research Center at Penn State University. The plot area consisted of an underdrained gravel layer approximately six inches deep, overlaid by a 2.5-inch intermediate layer of fine gravel and coarse sand. Over the intermediate layer, we installed four inches of 90-percent sand/10-percent sphagnum peat (by volume) rootzone mix.

We filled a series of 10-foot by 10-foot by six-inch frames with mixed soil inclusion/rootzone treatments. After removing the frames, we seeded the plots with SR 4200 perennial ryegrass. We applied nutrients and water as needed, and mowed the turf to a height of 1.5 inches twice a week with a reel mower.

We split the treatment plots into three subplots, and added different levels of wear to each. Some subplots received no wear, medium wear approximated three NFL games per week, and high wear simulated seven games per week.

We collected turfgrass density, soil bulk density, soil water, traction, and hardness data on six dates over two years.

Preliminary results

The **Summary Table** shows how the experimental treatments differed from the control on the six rating dates of the study. Results appear to vary depending on the size, shape, and application rate of the inclusion. They also vary based on whether the inclusion is newly manufactured or recycled.

Netlon, Turfgrids, and Sportgrass are products manufactured for use as soil inclusions. DuPont Shredded Carpet and Nike Inclusions are recycled products.

Sportgrass is unique because it is an oriented soil inclusion that lies exclusively at the soil surface. All of the other inclusions are randomly oriented, and occupy the top six inches of soil.

The recycled products tended to reduce soil bulk density, which translates to lower soil compaction. On the other hand, manufactured products produced higher Gmax values than either the control or the recycled product treatments on each rating date over both years of the test.

All of the treatments outperformed the control on the divot test. The presence of inclusions added some shear strength to the turf's surface, reducing divot length. This was most evident after the turf was exposed to wear.

None of the treatments produced consistent differences in field traction.

Results for the other observed properties were mixed. Individual product performance data follows.

DuPont Shredded Carpet

Adding DuPont Shredded Carpet to the sand root zone significantly reduced soil bulk density. Although this trend was evident when no wear was applied, it became greater as the wear level increased. This indicates that the material lowers bulk density, and it resists compaction as wear increases.

At the three-percent rate, DuPont Shredded Carpet always provided lower surface hardness values than the control, and all rates reduced divot length when compared to the control. There was a slight increase in turfgrass density, especially in the high-wear plots. The product produced no consistent change in traction or soil water content over the control.

Netlon

Netlon significantly reduced divot length when compared to the control. It increased surface hardness on all rating dates over the two-year study. The 0.5-percent rate produced a bulk density that measured significantly higher than the control on five of the six rating dates.

Overall, Netlon had no consistent effect on traction, infiltration, turfgrass density, or soil water content under the conditions of the study.

Nike Light and Heavies

These two products produced similar results for some properties and different results for others.

They both reduced soil bulk density on five out of six rating dates, and both showed greater wear resistance than the control on more than half of the rating dates.

Nike Light measured lower in soil water content than the control on four dates, while Nike Heavies measured lower on only one.

Sportgrass

On average, Sportgrass reduced divot size more than any other treatment. It was the only treatment to measure higher traction than the control.

Sportgrass was significantly higher in surface hardness than the control on all six rating dates, and it had lower soil water content than the control on five rating dates. It also had a lower turfgrass density than the control on three rating dates.

Turfgrasses

Turfgrasses 0.3 percent and 0.5 percent both reduced divot length after wear was applied. Turfgrasses 0.5 percent was the only treatment to reduce divot length when no wear was applied.

Both Turfgrasses treatments tested higher in surface hardness than the control on all rating dates. The 0.3-percent variety had lower traction values than the control on two of the six dates.

Turfgrasses had no consistent effect on soil bulk density or turfgrass density.

Summary Table. Number of rating dates (max 6) that a treatment main effect mean is significantly different (higher or lower) than the control. Divot length was measured only once. The mean divot length is listed in the table.

Turfgrass Density (wear resistance)		Soil Bulk Density (compaction resistance)		Soil Water Content		Surface Hardness		Traction		Divoting (length)	
Treatment	# rating dates	Treatment	# rating dates	Treatment	# rating dates	Treatment	# rating dates	Treatment	# rating dates	Treatment	cm
Nike Lights	5	DuPont S. C. 3%	6	Turfgrasses 0.5%	4	DuPont S. C. 3%	6	Sportgrass	1	Sportgrass	15.2
Nike Heavies	4	DuPont S. C. 1%	5	Turfgrasses 0.3%	3	Nike Lights	6	↑ Higher CONTROL ↓ Lower		Turfgrasses 0.5%	16.6
DuPont S. C. 2%	2	DuPont S. C. 2%	5	DuPont S. C. 1%	2	DuPont S. C. 2%	4	DuPont S. C. 2%	1	DuPont S. C. 3%	18.2
DuPont S. C. 3%	1	Nike Heavies	5	DuPont S. C. 0.5%	1	DuPont S. C. 1%	1	Nike Heavies	1	Turfgrasses 0.3%	18.6
Turfgrasses 0.3%	1	Nike Lights	5	DuPont S.C. 2%	1	Nike Heavies	1	Nike Lights	1	DuPont S. C. 2%	20.0
↑ Higher CONTROL ↓ Lower		DuPont S. C. 0.5%	3	↑ Higher CONTROL ↓ Lower		↑ Softer CONTROL ↓ Harder		Turfgrasses 0.5%	1	Netlon 0.5%	20.8
Sportgrass	3	Turfgrasses 0.3%	1					Turfgrasses 0.3%	2	DuPont S. C. 1%	22.5
		Turfgrasses 0.5%	1	DuPont S. C. 0.5%	1	DuPont S. C. 0.5%	1			Netlon 0.3%	23.3
		↑ Lower CONTROL ↓ Higher		Nike Heavies	1	Netlon 0.3%	6			Nike Light	23.4
				DuPont S.C. 3%	2	Netlon 0.5%	6			DuPont S. C. 0.5%	24.4
		DuPont S. C. 0.5%	1	Netlon 0.5%	2	Sportgrass	6			Nike Heavies	24.5
		Turfgrasses 0.5%	1	Turfgrasses 0.5%	2	Turfgrasses 0.3%	6			CONTROL	29.4
		Netlon 0.5%	5	Nike Lights	5	Turfgrasses 0.5%	6			lsd	3.0
				Sportgrass	5						

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