Effects of traffic stress on bentgrass putting green and fairway turf

When maintained as putting greens and fairways, velvet bentgrasses performed better than many of the creeping bentgrasses studied under compaction and wear stress.

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Wear and compaction are two of the most common components of traffic stresses on greens and fairways (6). Creeping bentgrass (*Agrostis palustris*) is considered less tolerant of wear and stresses resulting from soil compaction than many other turfgrass species (8), but genetic-based differences in traffic tolerance occur within as well as across species (5,11,13), and species compositions of swards can change in response to traffic (4).

The ability of bentgrass cultivars to maintain a dense turf cover and recover from traffic stresses can influence resistance to invasion by weeds (7) such as annual bluegrass (*Poa annua*). The relative dominance of bentgrasses in a sward mixture with annual bluegrass under traffic has not been reported.

Creeping bentgrass has been more extensively studied for golf course turf (2,12) than velvet bentgrass (*Agrostis canina*) (7). Velvet bentgrass produces a very high-density turf (1) but is reputed to be soft (9) with a strong thatching tendency (1), characteristics that may influence traffic tolerance.

The objective of this research was to assess the performance of creeping and velvet bentgrass cultivars in a sward mixed with annual bluegrass when subjected to wear and/or compaction on simulated putting green and fairway turf.

Materials and methods

Two trials using split-plot designs were situated on sandy loam at a research facility in North Brunswick, N.J. One study was managed as a putting green and the other as a fairway. Wear factors at two levels (no wear and wear) and compaction at two levels (no compaction and compaction) were randomly assigned to main plots (5 feet × 55.8 feet [1.5 meters × 17.0 meters]).

In the putting green study, 12 creeping bentgrass cultivars (L-93, Penn A-4, Penn G-2, Century, SR 1119, Providence, Southshore, SR 1020, Penneagle, Putter, PennLinks and Penncross) and three velvet bentgrass cultivars (SR 7200; 7001, an experimental selection from the New Jersey Agricultural Experiment Station; and MVB, later released as Vesper) were randomly assigned to subplots (5 feet × 3 feet [1.5 meters × 0.9 meter]). The same cultivars were evaluated in the fairway study except that Penn G-1 creeping bentgrass was substituted for Vesper because of a seed shortage.

The putting green study was replicated four times and the fairway study three times.

Before the bentgrasses were seeded in each trial, the entire plot area was topdressed with soil cores taken from putting greens of Plainfield (N.J.) Country Club that contained seeds of annual bluegrass. Cores were stockpiled for a year to kill bentgrass vegetation and then spread onto the soil surface and incorporated into the soil.

Creeping bentgrass cultivars were seeded at 32.1 pounds/acre (3.6 grams/square meter) and velvet bentgrass at 18.7 pounds/acre (2.1 grams/square meter). An unseeded subplot was included; volunteer emergence of bentgrass in the unseeded subplots was negligible.

Irrigation was applied only to prevent wilt stress and to water-in fertilizer. Fungicides were applied as needed to avoid disease stress. The ini-

tial soil pH value was 6.0, available (Mehlich 3) phosphorus was 4.5 pounds/1,000 square feet (22.2 grams/square meter) and available potassium was 7.5 pounds/1,000 square feet (36.5 grams/square meter).

Putting green study

The trial was seeded and fertilized on Sept. 30, 1998. Turf was fertilized and managed as a typical putting green throughout the study. Mowing was initiated on Nov. 7, 1998, at 0.6 inch (15.7 millimeters), and the height was gradually lowered to 0.14 inch (3.6 millimeters) on June 12, 1999, and 0.12 inch (3.1 millimeters) on March 23, 2000. Turf was mowed six times per week with clippings removed. The study was topdressed eight times from April to December 1999 with medium-sized sand conforming to USGA recommendations. Two topdressings were applied each in 2000 and 2001. Solid-tine cultivation was performed before topdressing on Dec. 10, 1999, and vertical mowing (to a depth of 0.18 inch [4.5 millimeters]) was performed before and after topdressing in July 2001. Traffic treatments were initiated July 21, 1999.

Fairway study

The fairway trial was seeded and fertilized on Nov. 10, 1998. Turf was fertilized and managed as a typical golf course fairway throughout the study. Mowing was initiated on Dec. 14, 1998, at 0.6 inch (15.7 millimeters) and was gradually lowered to 0.5 inch (13.5 millimeters) on Oct. 21, 1999, and 0.4 inch (10.3 millimeters) on March 23, 2000. Turf was mowed three to four times per week with clippings removed. Traffic treatments were initiated July 22, 1999.

Traffic treatments

Wear was applied using a 2.6-foot-wide (0.8-meter) wear simulator constructed from a modified walk-behind power broom (3).

Compaction treatments were applied using either a 2-foot-wide (0.6-meter), 952-pound (432-kilogram), water-filled turf roller or a 2.6-foot-wide (0.8-meter), 2,586-pound (1,173-kilogram) vibratory pavement roller. Wear and compaction treatment consisted of two passes of the wear simulator and/or compaction roller applied twice a week (four passes per week) from mid-May through September. Once every two weeks, two passes were made with the vibratory roller instead of the water-filled roller to ensure adequate compactive force was applied.

Data collection and analysis

In 1999, 2000 and 2001, plots were evaluated in early spring, late spring, summer and fall for quality and in spring and late summer for density. Plots were rated on a scale of 1-9, where 1 is least desirable, 9 is best and 5 is minimally acceptable. A line-intersect grid-count method (10) provided 209 observations per plot for determining the bentgrass population in spring, summer and fall of 1999, 2000 and 2001.

Four undisturbed core samples (3 inches [76 millimeters] in diameter) were randomly taken from the 0- to 2-inch (0- to 51-millimeter) surface soil depth of unseeded subplots of traffic plots in October 2001 to assess physical properties. The turf in these plots was predominantly annual bluegrass. Saturated water conductivity and air-filled porosity were determined for each core sample.

A wear simulator constructed from a modified walk-behind power broom was used to apply wear to putting green and fairway trials. **Photos by J. Murphy**

Results: Soil physical properties

Putting green study

Bulk densities of the surface 0-2 inches (0-51 millimeters) (thatch/mat and soil layers) of the plots were relatively low (data not shown) because of the high organic matter content within the thatch/mat layer. This organic matter added resiliency, which limited the damaging effects of the compaction treatments (data not shown). Plots that received traffic (wear and compaction) treatments had higher bulk density than plots that did not. Traffic treatments did not affect capillary porosity or saturated hydraulic conductivity.

Compaction increased bulk density and

Compaction was simulated by making passes on the turf plots with a 952-pound, water-filled turf roller.

decreased air-filled porosity of plots that did not receive wear treatment, but had no effect on plots that did receive wear (data not shown). Similarly, wear did not affect bulk density and air-filled porosity in the presence of compaction; however, wear increased bulk density on plots without compaction treatment. It is possible that repeated wear reduced turf resiliency, which allowed the wear simulator to make the surface more dense.

Putting green turf quality

Bentgrass cultivar	2000 turf quality† Wear × Compaction × Cultivar: No wear No comp	No wear Comp	Wear No comp	Wear Comp	2001 turf quality† Compaction × Cultivar: No comp	Comp
Vesper‡	8.2	8.1	7.3	7.4	7.7	7.5
7001‡	7.5	7.0	6.9	7.0	7.2	7.0
SR 7200‡	7.5	7.5	7.3	6.4	6.5	6.0
Penn A-4	8.5	8.5	7.6	7.8	6.8	7.0
Penn G-2	8.3	8.7	7.2	7.4	6.1	6.5
Century	7.5	7.6	6.6	6.6	6.1	5.7
L-93	7.3	6.6	6.3	5.6	5.4	5.0
SR 1119	6.5	6.8	5.4	6.0	4.6	4.7
Providence	6.8	5.5	5.0	4.0	4.6	3.7
Southshore	5.8	5.3	5.6	5.0	4.1	3.7
SR 1020	5.6	6.0	4.3	4.9	3.9	4.1
Putter	5.3	4.9	3.8	3.8	4.2	3.9
Penneagle	5.1	4.5	4.3	4.0	3.4	3.3
Pennlinks	4.5	4.5	3.6	2.9	3.2	3.0
Penncross	4.2	3.9	3.1	3.4	2.8	2.8
LSD§	0.7				0.8	

†Turf quality was rated on a scale of 1 to 9, where 9 represents the best average annual turf quality and 5 represents the minimally acceptable rating.
‡Velvet bentgrass cultivar; all others are creeping bentgrass.
§LSD, least significant difference.

Table 1. Interaction effects of wear × compaction (Comp) × cultivar in 2000 and compaction × cultivar in 2001 on average annual turf quality in a putting green trial grown on sandy loam.

Decreased air-filled porosity caused changes in bulk density without affecting saturated hydraulic conductivity, which further illustrates the resiliency of the turf.

Fairway study

In the fairway trial, bulk densities of the surface 0-2 inches (0-51 millimeters) were lower than in the putting green trial (data not shown) because the sand topdressing added sand to the thatch/mat layer of the green. Surface bulk density of fairway plots was increased by compaction and wear, but no interaction was observed (data not shown). Compaction decreased air-filled porosity and increased capillary porosity, but wear only decreased air-filled porosity. Wear did not reduce saturated hydraulic conductivity, but compaction did. Despite lower bulk densities, fairway turf cover was not as resilient to traffic as turf in the putting green trial, which had been topdressed.

Results: Cultivar response to traffic

The effects of wear and/or compaction on cultivars were more noteworthy than any change in the ranking of cultivars within a specific level of wear and compaction. Thus, our discussion focuses on the effect of wear and/or compaction on cultivars.

Putting green study

Generally, wear decreased turf quality, but response to compaction was relatively small (data not shown).

Turf quality. In 2000, at one or both levels of compaction, wear decreased turf quality of nearly all cultivars except 7001, which showed no response to wear (Table 1). Wear also did not affect turf quality of SR 7200 and Southshore in plots without compaction and Penncross in plots with compaction.

Compaction did not affect the turf quality of most cultivars, but it decreased turf quality of Providence in no-wear plots and of SR 7200, Providence and Southshore in wear plots. In 2001, compaction only decreased turf quality in Providence (Table 1). Vesper, 7001 and Penn A-4 had the best turf quality in 2001, and Penneagle, PennLinks and Penncross had the poorest turf quality (Table 1). Velvet bentgrass cultivars had better turf quality than most of the creeping bentgrass cultivars studied, regardless of the level of wear or compaction.

Turf density. In 2000, compaction did not affect turf density, but wear decreased turf density of all cultivars except 7001, SR 7200 and Penn A-4 (data not shown). An immediate reduction

of turf density in 2000 caused by wear would be expected because wear damage is acute, causing immediate thinning of turf, whereas compaction is a chronic stress (6). In 2001, wear continued to decrease turf density regardless of the level of compaction, whereas compaction only reduced density in the presence of wear (data not shown).

Vesper was the densest cultivar across all levels of wear and compaction in 2001; 7001 and Penn A-4 exhibited the next-densest turf, and PennLinks and Penncross were the least dense. Our data indicate that cultivar differences in turf density exhibited under conditions without traffic should also be evident under trafficked conditions.

Fairway study

Turf quality response in the fairway trial was more varied than in the putting green trial. More cultivars were affected by compaction treatments, as would be expected from the cultivar responses in the fairway trial for soil physical properties described above (data not shown). The three-way interaction among wear, compaction and cultivar for turf quality and density was found in both years (data not shown).

Turf quality. Wear reduced turf quality of 10 cultivars in no-compaction plots and 12 cultivars in compaction plots in 2000; PennLinks was the only cultivar not affected by wear at both levels of compaction (Table 2). Conversely, compaction did not alter turf quality of 12 cultivars in no-wear plots and nine cultivars in wear plots during 2000. However, compaction decreased turf quality of SR 7200 at both levels of wear. Wear decreased turf quality of nearly all cultivars in 2001; only SR 7200 was not affected at both levels of compaction. Compaction did not alter turf quality of 12 cultivars in no-wear plots and nine cultivars in wear plots in 2001. However, compaction did reduce quality of SR 7200 at both levels of wear.

Turf density. In 2000, wear reduced turf density of fewer cultivars (nine cultivars in no-compaction plots and seven in compaction plots) (Table 3) than in the putting green trial (data not shown). At both levels of compaction, wear reduced density of Penn G-2, Penn G-1, Providence and SR 1020, but it did not affect SR 7200, PennLinks and Penncross (Table 3). Compaction decreased turf density of six cultivars in both no-wear and wear plots in 2000; of those, compaction reduced density of Penn G-1 and SR 1020 at both levels of wear. Wear reduced turf density of nine cultivars in no-compaction plots and 11 cultivars in compaction plots in 2001; cultivars not affected by wear with and without compaction were 7001 and Penncross. Compaction decreased turf density of

Fairway turf quality

	2000 turf quality†				2001 turf quality†			
Bentgrass cultivar	No wear No comp	No wear Comp	Wear No comp	Wear Comp	No wear No comp	No wear Comp	Wear No comp	Wear Comp
7001‡	8.8	8.5	8.6	6.9	9.0	8.5	8.4	7.1
SR 7200‡	8.1	7.0	7.5	5.9	7.9	6.3	7.2	5.5
Penn A-4	8.4	8.3	7.3	6.6	7.9	7.7	6.3	5.8
Penn G-2	8.5	7.2	7.1	6.3	8.1	6.7	5.9	5.3
Penn G-1	8.3	7.7	7.2	5.7	7.7	7.3	6.1	4.7
Century	6.5	6.2	5.4	4.9	6.7	5.9	5.3	4.5
L-93	7.1	5.9	5.5	4.9	6.9	5.9	5.4	4.2
SR 1119	7.1	6.5	5.8	5.3	6.7	5.9	5.1	4.5
Providence	6.3	4.9	4.5	3.8	5.9	4.6	3.8	3.1
Southshore	5.9	5.8	4.6	4.6	5.8	5.4	4.1	3.9
SR 1020	5.9	5.3	4.8	3.4	5.9	5.3	3.9	2.6
Putter	6.0	6.3	5.1	4.1	6.1	5.4	5.0	3.3
Penneagle	5.4	5.3	4.3	4.0	5.5	5.7	4.1	3.2
Pennlinks	5.0	4.4	4.4	3.6	4.9	4.2	2.9	2.8
Penncross	4.4	4.1	4.4	3.2	4.7	3.9	3.7	2.5
LSD§	1.0				1.0			

†Turf quality was rated on a scale of 1 to 9, where 9 represents the best average annual turf quality and 5 represents the minimally acceptable rating.
‡Velvet bentgrass cultivar; all others are creeping bentgrass.
§LSD, least significant difference.

Table 2. Interaction effects of wear × compaction (Comp) × cultivar on average annual turf quality in a fairway trial grown on sandy loam in 2000 and 2001.

Fairway turf density

	2000 turf density†				2001 turf density†			
Bentgrass cultivar	No wear No comp	No wear Comp	Wear No comp	Wear Comp	No wear No comp	No wear Comp	Wear No comp	Wear Comp
7001‡	8.8	8.8	8.7	7.5	9.0	8.3	8.5	7.3
SR 7200‡	8.0	7.5	7.3	7.0	8.5	6.7	7.5	6.0
Penn A-4	8.3	8.2	7.5	7.0	8.2	8.1	7.0	5.8
Penn G-2	8.7	7.5	7.0	6.2	8.0	6.5	6.0	5.8
Penn G-1	8.2	7.3	7.2	6.0	8.0	7.2	6.7	4.8
Century	7.5	6.2	5.3	5.7	7.8	6.2	5.5	4.7
L-93	6.8	5.8	5.5	5.3	7.5	5.7	5.2	4.3
SR 1119	6.3	5.8	5.3	5.5	6.7	6.0	5.5	4.3
Providence	6.0	4.7	4.0	3.2	6.3	4.2	3.5	2.8
Southshore	5.7	5.5	4.3	4.8	6.0	5.7	3.8	3.5
SR 1020	6.0	5.0	4.7	3.3	6.5	5.0	3.8	1.8
Putter	5.5	5.3	5.0	3.7	6.0	5.7	4.3	3.2
Penneagle	5.0	4.3	4.2	3.8	5.3	4.5	3.5	3.0
Pennlinks	4.5	3.8	4.3	3.2	4.8	3.7	3.0	2.8
Penncross	3.7	3.5	3.7	2.7	5.0	3.3	3.7	2.7
LSD§	0.8				1.0			

†Turf density was rated on a scale of 1 to 9, where 9 represents the best average turf density and 5 represents the minimally acceptable rating.
‡Velvet bentgrass cultivar; all others are creeping bentgrass.
§LSD, least significant difference.

Table 3. Interaction effects of wear × compaction (Comp) × cultivar on average annual turf density in a fairway trial grown on sandy loam in 2000 and 2001.

% putting green bentgrass populations

Bentgrass cultivar	July 28, 2000				Aug. 13, 2001			
	No wear No comp	No wear Comp	Wear No comp	Wear Comp	No wear No comp	No wear Comp	Wear No comp	Wear Comp
	Bentgrass population (% cover)†							
Vesper‡	95.7	94.1	94.3	92.6	99.0	96.9	97.7	94.7
7001‡	95.3	95.6	93.5	93.1	99.0	96.7	96.2	93.7
SR 7200‡	94.3	93.3	92.7	89.3	96.7	93.7	92.9	85.2
Penn A-4	95.3	94.6	92.3	93.5	91.5	91.6	79.4	81.2
Penn G-2	95.6	95.6	91.7	90.2	90.3	90.8	75.9	79.8
Century	91.5	93.7	92.7	89.2	86.7	84.6	84.1	73.6
L-93	91.0	90.1	87.9	87.7	81.5	73.4	64.4	69.5
SR 1119	91.9	90.0	82.8	86.5	77.6	71.5	60.4	47.8
Providence	89.2	88.9	86.8	83.3	73.0	76.1	60.9	67.5
Southshore	89.6	91.5	87.4	85.4	81.5	70.7	53.1	55.4
SR 1020	89.5	90.0	84.8	83.3	80.1	70.7	65.0	54.1
Putter	92.7	85.9	85.9	90.7	82.7	74.6	64.7	68.4
Penneagle	89.5	88.6	85.8	83.3	78.0	74.6	68.9	53.1
Pennlinks	90.4	89.6	85.4	84.9	68.3	73.6	53.1	64.4
Penncross	88.8	86.1	86.4	84.1	64.0	66.1	54.1	48.4
LSD§	3.8				10.7			

†Cover measured as the percent of 209 line-intersect observations of bentgrass (remainder was annual bluegrass) over 14.5 square feet (1.35 square meters) of each plot.
‡Velvet bentgrass cultivar; all others are creeping bentgrass.
§LSD, least significant difference.

Table 4. Interaction effects of wear × compaction (Comp) × cultivar on bentgrass populations in a putting green trial grown on sandy loam in 2000 and 2001.

% fairway bentgrass populations

Bentgrass cultivar	Aug. 7, 2000				Aug. 22, 2001			
	No wear No comp	No wear Comp	Wear No comp	Wear Comp	No wear No comp	No wear Comp	Wear No comp	Wear Comp
	Bentgrass population (% cover)†							
7001‡	99.2	96.5	96.3	90.1	99.8	99.0	98.1	92.5
SR 7200‡	96.7	91.9	91.4	88.7	99.4	94.7	92.8	82.9
Penn A-4	98.2	93.3	91.4	87.4	99.2	95.7	91.2	82.6
Penn G-2	97.6	87.6	87.8	76.9	97.8	84.8	89.3	72.4
Penn G-1	97.6	93.5	91.2	88.2	98.6	95.2	90.9	79.3
Century	96.2	89.3	86.9	82.0	96.2	89.0	85.0	71.5
L-93	94.1	86.3	83.7	73.7	95.2	82.9	78.3	65.9
SR 1119	93.1	85.3	82.8	77.5	91.4	83.6	73.0	63.9
Providence	92.7	84.5	80.9	73.0	93.1	77.4	74.3	60.9
Southshore	94.6	88.2	79.4	78.5	93.8	83.3	75.4	72.6
SR 1020	92.0	76.9	75.4	70.5	92.3	77.2	74.8	60.9
Putter	95.7	89.0	84.8	80.2	96.5	91.1	81.8	73.7
Penneagle	92.3	86.8	83.9	76.7	92.8	83.7	76.1	63.6
Pennlinks	92.0	80.0	80.7	75.6	87.4	74.0	74.8	68.3
Penncross	91.1	78.5	77.0	73.0	88.0	70.8	72.7	59.2
LSD§	5.3				6.8			

†Cover measured as the percent of 209 line-intersect observations of bentgrass (remainder was annual bluegrass) over 14.5 square feet (1.35 square meters) of each plot.
‡Velvet bentgrass cultivar; all others are creeping bentgrass.
§LSD, least significant difference.

Table 5. Interaction effects of wear × compaction (Comp) × cultivar on bentgrass populations in a fairway trial grown on sandy loam in 2000 and 2001.

seven cultivars in no-wear plots and only three cultivars in wear plots in 2001; cultivars affected by compaction with and without wear were SR 7200 and SR 1020.

Results: Bentgrass populations

Bentgrass population data (Tables 4, 5) were presented for mid-season because it represents a key time of the growing-playing season for golf course turf. These data were representative of populations measured at other times of the year. Generally, as the study progressed, bentgrass populations decreased and annual bluegrass encroached. Decreases in bentgrass population were particularly evident for lower-density cultivars and for plots that received wear treatment (Tables 4, 5).

Putting green study

Wear decreased the bentgrass population of five cultivars in no-compaction plots and seven cultivars in compaction plots on July 28, 2000 (Table 4). Compaction decreased the bentgrass population of only two cultivars: Putter in no-wear plots and SR 7200 in wear plots (Table 4). Bentgrass populations in Vesper, 7001, Penn A-4 and L-93 did not change regardless of the level of wear or compaction in 2000. Vesper, 7001 and Penn A-4 maintained bentgrass populations of 92% or more over all levels of wear and compaction.

In 2001, wear decreased the bentgrass population of nine cultivars in no-compaction plots and seven cultivars in compaction plots (Table 4). Compaction decreased the bentgrass population of only four cultivars: Southshore in no-wear plots and SR 1119, SR 1020 and Penneagle in wear plots. The velvet bentgrasses Vesper and 7001 were not significantly affected by wear or compaction and had populations levels of 93% or more.

A positive correlation was observed between cultivar density and bentgrass population in August 2001, which was consistent with other reports (10). Compaction treatment in our study unexpectedly increased bentgrass population of some plots of Putter and PennLinks, suggesting another, yet unidentified, factor could influence population dynamics.

Fairway study

Generally, wear and compaction affected the bentgrass population of more cultivars in the fairway study than in the putting green study. Wear decreased bentgrass populations of most cultivars on Aug. 7, 2000. Only four cultivars were not affected by wear: 7001 and SR 7200 in no-compaction plots and SR 7200, Penn G-1 and PennLinks in compaction plots. Compaction decreased the bentgrass

population of 11 cultivars in no-wear plots and of five cultivars in wear plots. Although some level of wear and/or compaction decreased the population of every bentgrass cultivar by Aug. 7, 2000, bentgrass population did not fall below 90% for 7001, 89% for SR 7200, 88% for Penn G-1 and 87% for Penn A-4.

Wear decreased bentgrass population of nearly all cultivars on Aug. 22, 2001, except 7001 and SR 7200 in no-compaction plots and 7001 and PennLinks in compaction plots. The only cultivar that did not lose bentgrass population because of compaction with and without wear was 7001, which maintained a population range of 93% to 99.8% across all traffic treatments. Of the creeping bentgrass cultivars, the highest bentgrass populations were maintained by Penn A-4 (83%) and Penn G-1 (79%) under wear plus compaction (Table 5). As in the putting green study, a positive correlation between bentgrass population and turf density was observed in August 2001.

Summary

Compaction from rolling produced greater detrimental soil physical and turf responses in the fairway trial than in the putting green trial, most likely because topdressing the putting green turf resulted in more surface resiliency in the thatch/mat layers.

Turf quality, turf density and bentgrass populations for most cultivars were typically more susceptible to wear stress than to compaction, particularly in the putting green trial. Thus, compared to practices for managing compaction, traffic control and other management strategies that alter wear damage (thinning) may have a greater impact on turf quality and bentgrass populations in mixed stands, particularly on well-drained soil.

Velvet bentgrasses performed better and were more resistant to the spread of annual bluegrass than most cultivars of creeping bentgrass. High-density cultivars studied in these trials performed well under both putting green and fairway conditions: Vesper and 7001 velvet bentgrass and Penn A-4 creeping bentgrass had the best overall performance of cultivars. The turf quality of SR 7200 and Penn G-2 was consistently susceptible to compaction stress in the fairway trial, and Penn G-2 was consistently susceptible to wear stress in both trials. In both trials, Providence showed susceptibility to compaction. Regardless of the type of traffic, PennLinks and Penncross were ineffective at maintaining large bentgrass populations, particularly in the putting green trial.

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Researchers evaluated the performance of creeping bentgrass and velvet bentgrass in mixed swards of annual bluegrass under traffic stresses.

The research says

→ A putting green and fairway study evaluated the performance of creeping and velvet bentgrass cultivars under traffic in mixed swards with annual bluegrass.

→ Wear was typically more stressful than compaction treatment, particularly in the putting green trial.

→ Cultivars forming dense turf generally performed best under traffic stresses and had lower annual bluegrass populations; velvet bentgrasses performed better than most creeping bentgrass cultivars.

→ Older cultivars of creeping bentgrass with low turf density were ineffective at excluding annual bluegrass from plots, particularly in the putting green trial.