Research *You Can Use*

Ball Marks on Bentgrass: Blame the Golfer, Not the Cultivar

Contrary to popular belief, ball marks are not necessarily the cultivar's fault.

BY JAMES A. MURPHY, T. J. LAWSON, AND JOSEPH CLARK

Growth of the game of golf and advancements in turfgrass breeding have led to the construction of new putting greens or resurfacing of existing greens with new and improved bentgrass cultivars. In general, the newer bentgrass cultivars possess finer leaf texture, greater shoot and root density, and improved tolerance to pests and environmental stress relative to earlier-released cultivars, many of which are still commercially available. Nonetheless, it is common to hear superintendents who now manage the newer cultivars say that they would prefer growing older, longstanding cultivars like Penncross. Why is this so? One of the most common reasons given is that the newer cultivars are perceived to be less aggressive with regard to growth habit and recovery from divots or ball marks. Poorly repaired or not repaired at all, ball marks are a major factor that limits turf quality and playing conditions on putting greens.

Field experience and research are scarce when it comes to the durability and recuperative ability among the newer cultivars of bentgrass, especially as it relates to ball marks. Although observations about growth rate and recuperative ability on the golf course may be accurate, interpretations and conclusions based upon these observations can be confounded by a number of other factors beyond the scope of the cultivar itself. Important factors that can contribute to the severity of ball mark

Dr. Jim Murphy demonstrates the ball mark simulator during the Rutgers University Turfgrass Field Day.

Table 1

Ball mark damage ratings on a sand putting green marked on August 14 and October 20, 2001.
Entries are ranked according to recovery rating 74 days after initial marking.

Cultivar	Initial Damage 8/14/01	Damage Rating (Days After Marking)			Initial Damage 10/20/01	Damage Rating (Days After Marking)
		7	32	74		7
	Rating (9 = least damage, 1 = greatest damage)					
G-2	6.4	4.2	6.6	8.1	5.1	3.1
A-4	5.9	3.7	6.9	8.1	4.2	2.2
Century	5.6	3.7	6.8	7.9	4.7	2.9
SR 7200	6.1	4.8	6.8	7.8	5.3	2.5
L-93	4.7	3.5	5.8	7.7	5.0	2.5
Cato	5.5	3.7	6.6	7.7	5.3	2.8
Southshore	5.6	4.0	6.6	7.7	5.4	2.5
MVB	6.2	4.0	6.2	7.4	4.7	2.8
SR 1020	4.6	3.6	6.0	7.4	5.9	2.6
Putter	4.5	3.6	6.1	7.3	4.6	1.8
SR 1119	5.1	3.7	5.8	7.2	6.1	2.7
Pennlinks	5.1	3.8	5.9	7.1	6.4	2.3
Penneagle	4.7	4.0	5.9	6.8	6.3	2.8
Providence	4.6	3.4	6.0	6.7	5.5	2.3
Penncross	3.9	3.4	5.6	6.4	6.3	2.3
$LSD_{0.05}$	0.9	0.8	0.8	0.9	1.3	NS
TRAFFIC						
None	5.9	3.8	6.4	7.7	—	—
Compaction	6.0	4.1	6.8	7.9	5.5	2.6
Wear & Compaction	3.8	3.4	5.6	6.7	5.3	2.5
$LSD_{0.05}$	1.3	NS	NS	0.7	NS	NS
CV%	18.4	21.0	13.4	13.0	20.3	34.8

Cultivars in **boldface** print are velvet bentgrass species. All other cultivars are creeping bentgrass species.

$LSD_{0.05}$ = Least Significant Difference. There is a ≥ 95% probability that the difference between two means is due to cultivar effects if it is ≥ the LSD value.

NS = Not Significant. There is a ≤ 5% probability that the difference between two means is due to cultivar effects.

CV% = Coefficient of Variation (expressed as a percentage). Provides an indication of the degree of variability in measurements among cultivars at each rating date.

damage and rate of recovery include the age of the turf (maturity of the thatch and mat layers), rootzone mix and its physical properties, topdressing material, cultural management, growing environment, and turfgrass cultivar. A sound assessment of each factor, independent of the other factors, is needed to properly conclude which contributes to damage and recuperation from ball marks on putting greens.

The objective of this project was to evaluate the rate of ball mark recovery among 13 creeping bentgrass and two velvet bentgrass cultivars without the confounding effects of age, construction, topdressing medium, cultural management, and growing environment.

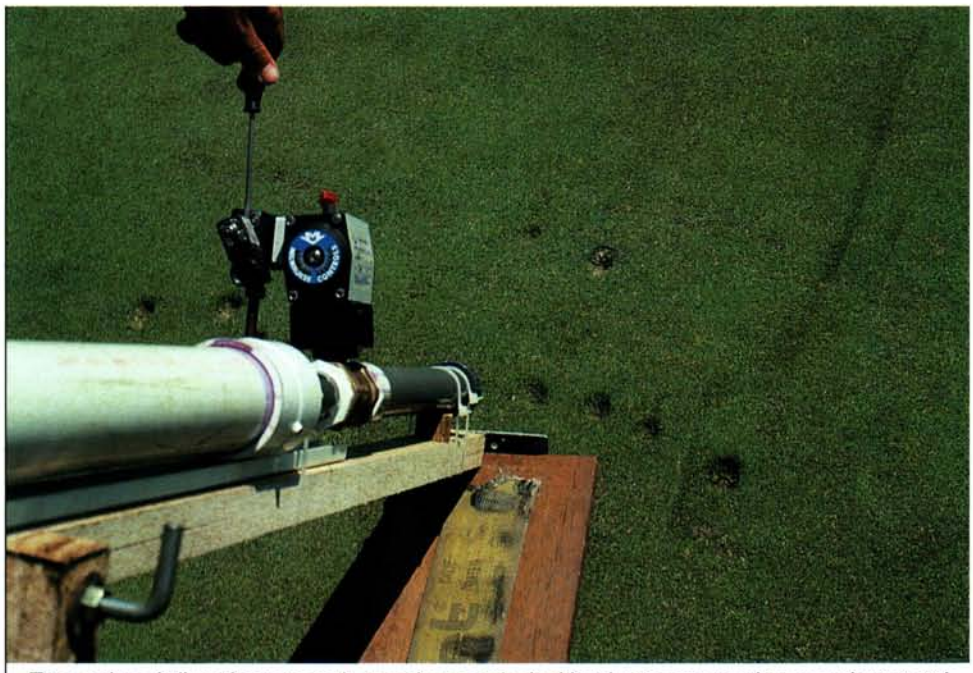
STUDY CONDITIONS

This study was conducted during 2001 and 2002 on a sand-based putting green located at the Rutgers Horticultural Research Farm II in North Brunswick, N.J. The putting green was constructed in 1998 according to USGA recommendations using a mix consisting of 85% sand and 15% peat (by volume). Creeping bentgrass cultivars were seeded in May 1999 at a rate of .75 lb. per 1,000 sq. ft. The velvet bentgrass entries, SR 7200 and MVB, were seeded at .44 and .88 lb. per 1,000 sq. ft., respectively. During the study, turf was mowed six to nine times per week at .115" and fertilized with 3.9, 2.8, and 2.9 lbs. of N, P_2O_5, and K_2O per 1,000 sq. ft., respectively, in 2001 and 1.8, .6, and .6 lbs. of N, P_2O_5, and K_2O per 1,000 sq. ft. in 2002. The plots were cultivated with solid tines once or twice and topdressed three to five times

per season with a medium sand. Some layering of topdressing and thatch was evident, but this did not produce management or performance problems related to excessive puffiness, scalping of the turf, poor water infiltration, or rooting of the green. The combined thickness of the thatch and mat layers was less than one inch during the evaluations reported here. Irrigation and fungicides were applied as needed to avoid drought and disease stresses.

Traffic treatments were initiated in October 1999. Wear and compaction treatments were applied four times per week using a modified walk-behind Sweepster and a Brouwer water-filled turf roller, respectively, from May through September. Compaction treatments also were applied using a one-ton Wacker pavement roller that occasionally was operated with vibration applied to the rollers.

The experimental design consisted of a split-plot factorial arrangement of treatment combinations: four levels of traffic (no traffic, wear, compaction, and wear plus compaction) represented the main plots, and 15 bentgrass cultivars represented the sub-plots, with three replications of each combination.



Two or three ball marks were made in each research plot. Visual ratings were taken to evaluate initial severity and subsequent recovery over time.

Ball marks were simulated by pneumatically ejecting golf balls from a PVC cylinder at a static pressure of 6, 8, or 10 p.s.i. Two or three marks were made in each plot. Visual assessments were made for initial severity as well as recovery of ball marks.

Results showed that ball mark injury and recovery were exacerbated by simulated wear using a modified walk-behind Sweepster.

RESULTS

Significant differences in ball mark damage and recovery were found among the bentgrass cultivars grown on sand on most rating dates in 2001 (Table 1). In general, less damage and more rapid turf recovery occurred on the newer bentgrass cultivars, notably A-4 and G-2, which are being increasingly used on golf courses in the Northeast and throughout North America. Contrary to common perceptions, the velvet bentgrass cultivars SR 7200 and MVB also ranked among the best in regard to injury and recovery. On the other hand, older cultivars like Penncross incurred the most damage from ball marks and also took the longest time to heal.

Not surprisingly, ball mark injury was more severe and recovery time was slower on turf that received a combination of wear and compaction. Interestingly, cultivars that received only compaction treatment did not respond differently to ball marking compared to non-trafficked cultivars, indicating that

Table 2

Ball mark damage ratings on a sand putting green marked on July 13 and 26, 2002. Entries are ranked according to recovery rating 27 days after final marking.

Cultivar	Initial Damage 7/13/02	Damage Rating (Days After Marking)			Initial Damage 7/26/02	Damage Rating (Days After Marking)		
		7	25	41		11	19	27
	Rating (9 = least damage, 1 = greatest damage)							
Century	3.9	5.8	8.3	8.7	4.7	6.1	6.8	7.5
MVB	5.6	6.4	8.2	8.1	5.8	6.8	7.1	7.3
A-4	5.0	6.1	8.3	8.3	4.7	5.9	6.5	7.0
SR 7200	5.2	6.7	8.0	8.2	5.0	5.7	6.3	6.8
L-93	3.9	5.0	8.5	7.8	4.6	5.4	5.9	6.8
Cato	2.7	3.8	7.9	7.3	4.7	5.3	5.3	6.3
G-2	4.9	6.1	8.7	8.6	5.0	5.3	5.5	6.1
Penncross	3.2	5.0	7.6	7.3	3.8	4.5	4.9	5.9
SR 1119	3.5	4.8	8.1	8.3	4.6	5.3	5.7	5.8
Putter	2.9	4.6	8.0	7.9	3.4	4.8	5.0	5.8
SR 1020	3.8	5.5	8.5	7.8	3.6	4.8	4.9	5.7
Southshore	4.8	5.6	8.2	7.8	4.3	4.6	4.9	5.7
Pennlinks	3.0	3.8	7.5	7.3	4.0	4.1	5.2	5.5
Penneagle	3.8	4.7	7.6	6.3	4.0	4.7	4.6	5.5
Providence	3.3	4.7	8.1	7.4	4.3	4.9	5.1	5.4
$LSD_{0.05}$	1.6	1.5	NS	NS	0.7	0.8	0.7	0.7
TRAFFIC								
None	—	—	—	—	4.5	6.5	7.1	7.7
Wear	—	—	—	—	4.8	5.4	5.6	6.4
Compaction	—	—	—	—	3.7	5.2	5.8	6.8
Wear & Compaction	—	—	—	—	4.7	3.9	3.9	4.1
$LSD_{0.05}$	—	—	—	—	NS	NS	NS	NS
CV%	28.1	19.1	7.1	12.9	15.2	15.0	11.4	11.2

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wear damage, more than compaction, exacerbates the problem of ball mark damage. This suggests that the management practice of rolling for increased ball roll would only exacerbate ball mark damage when the turf was experiencing aggressive damage from wear. Cultivars receiving wear treatment only were not assessed in 2001.

The ball mark experiment on sand was repeated two additional times in 2002 (Table 2). Relative injury and recovery among cultivars was similar to 2001; however, results from 2002 suggest that an additional year of turf maturation narrowed differences among cultivars and helped to expedite recovery from ball marks. Although fewer significant differences were found with respect to the effects of traffic on ball mark injury and recovery, general trends once again indicated that ball injury and recovery time are exacerbated by the presence of both wear and compaction stress. Thus, management efforts to substantially reduce either wear or compaction should improve turf tolerance to ball marking as well as recuperation.

CONCLUSIONS

Currently, some golf course superintendents and architects are reluctant to use improved and better-adapted cultivars of bentgrass because of unsubstantiated field observations and conclusions that these newer cultivars are less aggressive and slower to recuperate when compared to earlier-released cultivars like Penncross. Thus, they continue to choose older cultivars largely because of the comfort of knowing their growth habit and performance characteristics. While turf vigor and recuperative

ability are no doubt related to the cultivar genetics, it appears that other factors including turf maturity are more responsible for field observations of severe ball marking problems.

Today, newer cultivars are established on rooting media that contain a high percentage of sand. In most cases, these greens have not had time to mature (develop a mat layer) to the point where performance and play are similar to older sand- or soil-based greens that superintendents are accustomed to managing. Furthermore, superintendents should consider the possible role that annual bluegrass plays in their perception that older cultivars (e.g., Penncross) were more aggressive than the newer monostands of cultivars they now manage, especially during the spring when annual bluegrass growth is considerably more aggressive than bentgrass. Furthermore, observations of rapid healing of ball marks on older Penncross putting greens may be due to the rapid invasion of annual bluegrass seedlings into the damaged ball marks rather than healing from the bentgrass cultivar itself.

Age of a putting green turf is probably the most important confounding factor affecting people's perception of newer bentgrass cultivars. The highly attractive cover of a newer bentgrass cultivar on a recently established green may provide a false sense of maturity occurring under that turf cover. In reality, it likely will require two or more complete growing seasons before the subsurface mat layer and rootzone stabilize and become resistant to the forceful impact and spin of a golf ball. This stability and impact resistance is largely a function of the soil structure that develops from the growth of crowns, stolons, and roots in the upper surface layers of the putting green. Over time, these parts of the grass plants become integrated with the rootzone and topdressing material applied to the surface. Subsequently, as this interwoven mixture of grass and soil develops, a structure analogous to a fiber mat is formed, adding strength and stability to the putting surface. Much lecturing and discussion is focused on how to manage excessive layering of this mat relative to the health of the turf, when in fact the contribution of the mat layer to the durability of a putting green is often overlooked.

In summary, whether you're contemplating or currently managing newer bentgrass cultivars, recognize that time and patience are needed for maturation of new putting greens, and realize the cultural management that worked for older cultivars like Penncross may not be what's best for cultivars that are finer textured and considerably more dense. One only has to look at the National Turfgrass Evaluation Program on-site putting green trials (http://ntep.org/-onsite/ost.htm) to see how advancements in breeding have produced bentgrass cultivars with improved turf quality characteristics and tolerance to stress. Last, but certainly not least, did we fail to mention that it would be extremely helpful if golfers repaired their own ball marks?

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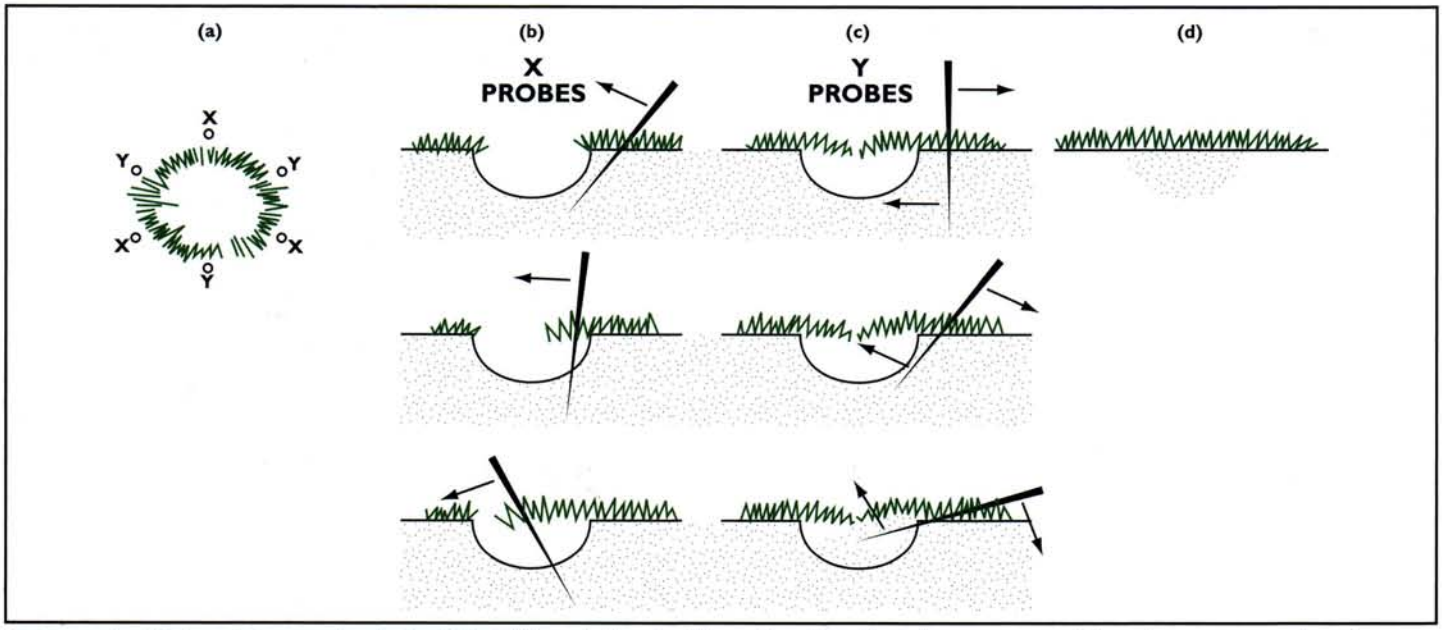

Proper repair of ball marks is more than just quickly stabbing a ball mark with a golf tee. By taking a few moments to follow the proper procedure, the number of ball marks found on putting greens would be reduced considerably. Procedure for repair of ball marks on putting green: a) X-marks indicate probe penetration to stretch the turf over ball mark; Y-marks indicate probe penetration to loosen and raise the soil. b) Stretch turf by inserting the sharp probe into the soil at a 45° angle and 0.5" outside the perimeter of the ball mark and moving the probe toward the ball mark and down. c) Loosen soil beneath the ball mark by inserting the probe vertically into the soil at 0.5" outside the perimeter and pressing away from the ball mark and down. d) Firm turf with a putter, the palm of the hand, or a shoe. (*Turf Management for Golf Courses*, James B. Beard, 2002, page 148).