Golf Club Selection and Golfer Influence Divot Size in Bermudagrass Fairways

Aaron Patton[1], Jon Trappe[1], Doug Karcher[2], and Mike Richardson[2]

Additional index words: tee

Patton, A., J. Trappe, D. Karcher, and M. Richardson. 2010. Golf club selection and golfer influence divot size in bermudagrass fairways. Arkansas Turfgrass Report 2009, Ark. Ag. Exp. Stn. Res. Ser. 579:165-168.

Photo by Aaron Patton

A golfer getting ready to hit a tee show on a heavily divoted par 3 tee box.

Summary. While a great deal of research has attempted to quantify divot recovery of various species and cultivars, very little research has attempted to quantify divot injury. The objective of this study was to quantify the divot size and type in a bermudagrass fairway as influenced by golf club selection. Divot severity and volume varied by club with lofted wedges creating the largest divots. Severity and volume varied by golfer, but there were no correlations between these measurements and golfer ability (handicap). Based on this average size of a divot, it is estimated that 0.5 acres of bermudagrass are removed from divots on fairways on a golf course receiving 32,000 rounds of golf per year.

Abbreviations: GW, gap wedge; LW, lob wedge; PW, pitching wedge; SW, sand wedge

[1] University of Arkansas, Cooperative Extension Service, Department of Horticulture, Fayetteville, Ark. 72701
[2] University of Arkansas, Department of Horticulture, Fayetteville, Ark. 72701

The result of a golfer's stroke in an attempt to strike a golf ball commonly displaces an area of turf and soil that is referred to as a divot. Divots created by a golf stroke are a natural occurrence on a golf course fairway or tee. The amount, size, and length of time divots exist on a tee or fairway can be dependent on species, cultivar, and management (Beard, 1973). Karcher et al. (2005) examined the divot recovery of numerous bermudagrass cultivars in a field study, and this report is useful for selecting cultivars with good divot recovery. Fry et al. (2008) published work comparing devices used to make divots. Although data on divot recovery and divoting devices are published, there is no information in the literature on the average size of a divot created by an actual golf swing.

The main objective of this study was to quantify the divot size, type, and severity (Table 1) in warm-season turf as influenced by golf club selection and golfer. Secondary objectives to the study were to 1) determine the frequency each golf club was used during a round of golf, 2) quantify the number of divots taken in an average round of golf, and 3) develop a method for rapid assessment of divot injury.

Materials and Methods

Survey. A survey was conducted among a group of golfers playing in a local superintendent fund-raiser. A divot survey was provided to each golfer (n = 84) prior to the start of the round and thirty-four surveys were returned. Golfers were asked to record which golf club they used for each shot and the total number of divots taken from the fairway or tee. It was assumed that divots were only taken with irons and not woods (although a wood can take a divot).

Field study. A field study was conducted at the University of Arkansas Agricultural Research and Extension Center at Fayetteville, Ark. Using eleven different irons (3, 4, 5, 6, 7, 8, 9, PW, GW, SW, and LW golf clubs), fifty-five shots were hit by eight golfers from 'Rivera' bermudagrass grown in a Captina silt loam and mown at 0.5 inch. Five shots were taken at a time with each club by each golfer. The order that the clubs were used was randomized for each golfer. To ascertain divot injury, divots were classified into three types and five severities (Table 1) depending on the level of damage from each club. After a visual rating was recorded, each divot was then filled with sand until the sand was level with the soil surrounding the divot. The sand used to fill the divots was dried prior to use. Bulk density was calculated for the sand as being 1.53 g cm^{-3}. The amount of sand needed to fill the divot was calculated by subtracting the weight of container plus sand before filling the divot and the weight of the container plus sand after filling. The volume of each divot was then determined using the bulk density of the sand and the weight of sand needed to fill each divot. Immediately after filling with sand, a 11 in. by 5 in. frame was centered around each divot and a digital image was taken (Karcher et al., 2005). Images were analyzed for percent green turf coverage using SigmaScan Pro, and the surface area of each divot was calculated.

Results and Discussion

Survey. The survey indicated that the average number of times each golf club was used during a round of golf varied by club and ranged from 0.7 times per round for a 3-iron to 2.5 times per round with a sand wedge (Fig. 1). A range of wedges (pitching wedge (PW), gap wedge (GW), sand wedge (SW), and lob wedge (LW)) are used by each golfer. Gap wedge, SW, and LW were all pooled together and termed SW in Fig. 1. The survey also indicated that a divot was taken (soil and grass removed) 67% of the time the golfer made a stroke for an average of 13 divots per round.

Field study. Results from the field study indicated that divot severity and divot volume varied by golfer and by golf club, with lofted, short irons (8, 9, PW, GW, SW, LW) taking larger divots than long irons (3, 4, 5 iron) (Fig. 2). Although divot volume and severity varied by golfer there was no correlation between golfer handicap (skill level) and divot volume or divot severity (data not shown). Visual severity ratings were closely related ($r^2 = 0.75$; $P = 0.0057$) with volume measurements indicating the usefulness of visual ratings for rapid assessment of divot injury (data not shown).

The average size of each divot (type = 3) using digital image analysis was calculated as 7.94 in^2 (51.2 cm^2) or 0.055 ft^2 which is approximately 2 in. by 4 in. Based on this average size of a divot and that the average golfer takes 13 divots per round, then it could be calculated that 22,926 ft^2 (0.53 acres) of bermudagrass are removed from divots on fairways on a golf course receiving 32,000 rounds of golf per year. Furthermore, the average size of a golf course fairway is 30 acres (Anonymous, 2007), which means that 1.8% of the turf from the average golf course with bermudagrass fairways is removed each year from golfer divoting. Although, the average golf course in the U.S. receives 32,000 rounds of golf/year (NGF, 2003), golf courses that receive more rounds of golf/year could expect more damage. Additionally, we estimated the size of divot on a native silt loam soil, but other soil types such as sandy loams or areas heavily topdressed with sand such as driving range tees may be more conducive to divot injury resulting in larger divots and more turf removed. Additionally, other turfgrass species such as creeping bentgrass used on fairways in locations north of Arkansas may be more susceptible to divot injury resulting in more damage annually.

Literature Cited

Anonymous, 2007. Golf Course Environmental Profile: Property Profile and Environmental Stewardship of Golf Courses. Volume I. [Online]. Full report available at: http://www.eifg.org/programs/GCRPfullreport.pdf

Beard, J.B. 1973. Turfgrass science and culture. Prentice Hall, Inc., Englewood Cliffs, N.J.

Fry, L.R., M.D. Richardson, and D.E. Karcher. 2008. An improved method for simulating divot injury on turfgrass. Crop Sci. 48:2459-2462.

Karcher, D. E., M. D. Richardson, J.W. Landreth, and J.H. McCalla Jr. 2005. Recovery of bermudagrass varieties from divot injury. Online. Applied Turfgrass Science doi:10.1094/ATS-2005-0117-01-RS.

National Golf Foundation (NGF). 2003. Rounds Played in the United States - 2003 Edition. National Golf Foundation, Jupiter, Fla.

Table 1. Rating scale used to characterize divot type and severity.

Divot type	Divot severity
1= no turf removed	1 = none to very small divot or turf surface disruption
2= turf removed	2 = small divot or turf surface disruption
3= both turf and soil removed	3 = moderate divot size or turf surface disruption
	4 = large divot or turf surface disruption
	5 = very large divot or turf surface disruption

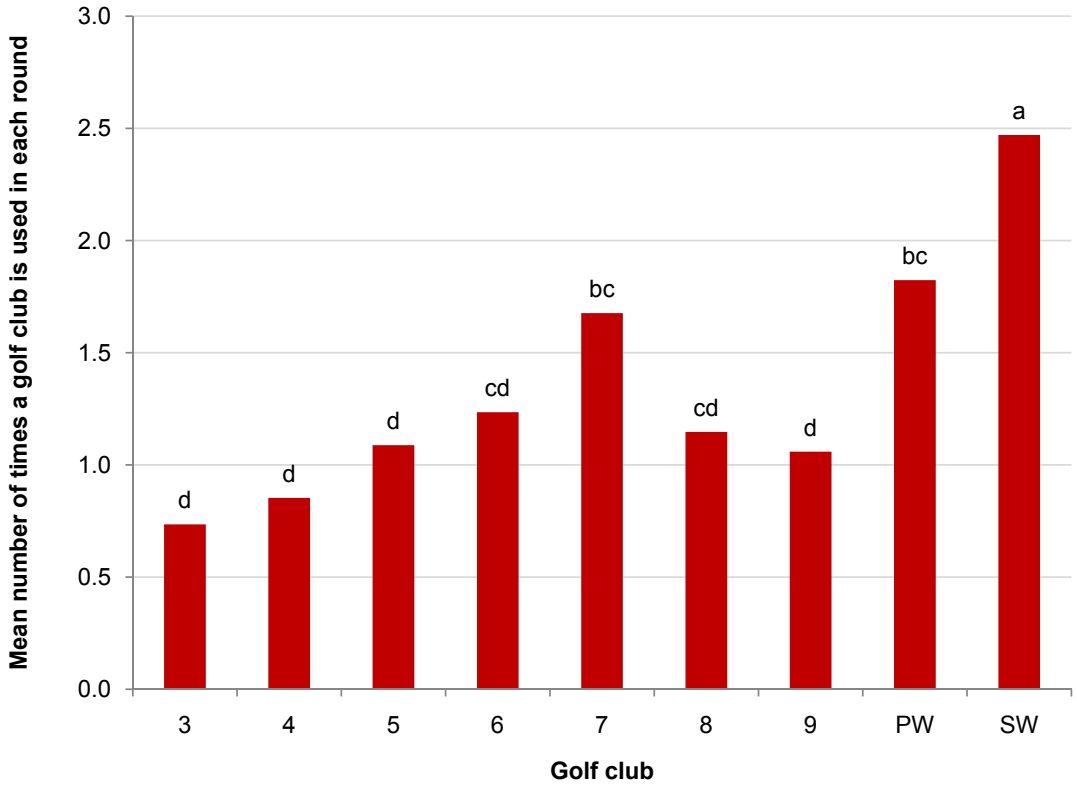

Fig. 1. The average number of times each golf club was used during a round of golf (n = 34). Means followed by the same letter are not significantly different according to Fisher's protected LSD, α = 0.05.

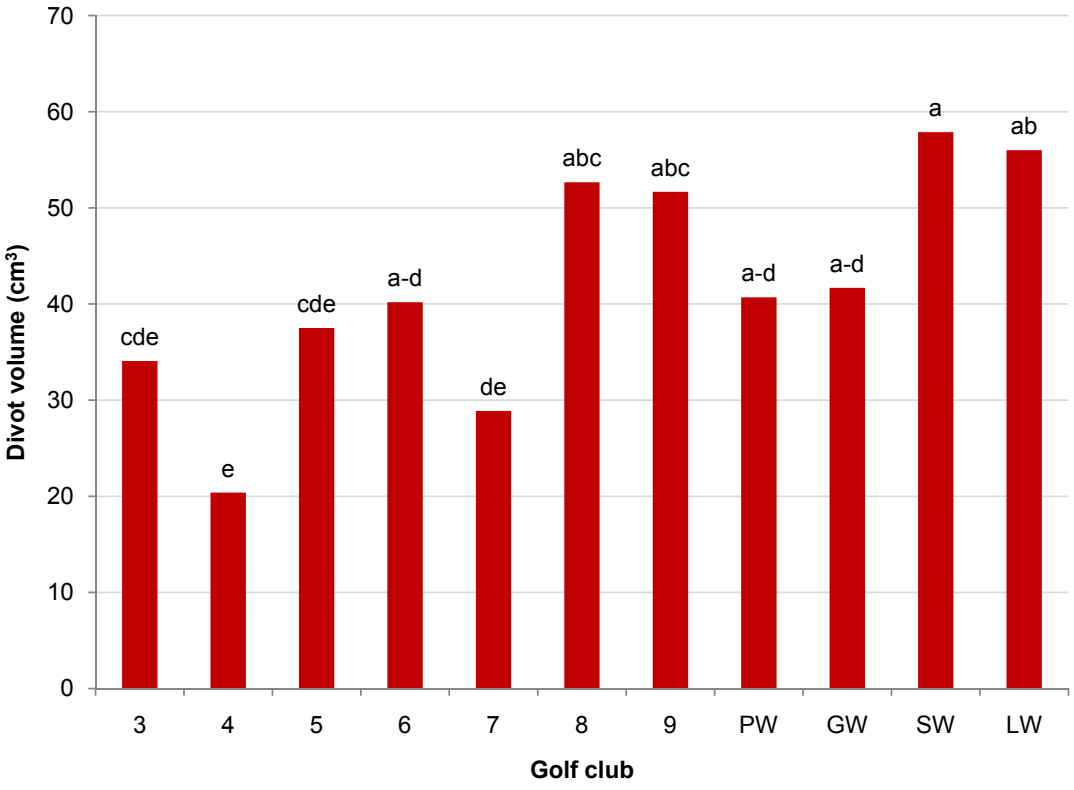

Fig. 2. Divot volume varied by golf club (n = 40, 8 golfers, five subsamples per club). Means followed by the same letter are not significantly different according to Fisher's protected LSD, α = 0.05.