Effects of Winter Foot Traffic on Annual Bluegrass Putting-Green Quality in Western Oregon

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In the coastal northwestern United States, annual bluegrass (Poa annua L.) is the dominant golf putting surface. These regions experience mild winters that remain cool and wet for long periods of time. The weakness of annual bluegrass lies in its poor cold tolerance, unlike the other regionally popular option for putting green surfaces, creeping bentgrass (Agrostis stolonifera L.) (USGA, 2015). The mild winters yield continued golf play, which can lead to accumulated damage because the tolerance of annual bluegrass to traffic and its recuperation is minimal. Wet winter soils combined with consistent traffic increases the chance of injuring the turf blades, crown, and upper root systems through abrasion and soil displacement (Harivandi, 2002). This effect is less severe in sand-based soils though, due to increased drainage and decreased soil displacement, but it is still a major concern (Carrow and Petrovic, 1992). In winter, increased cloud cover, shade from evergreen trees, and decreased solar radiation because of the lower position of the sun in the sky greatly decreases the amount of radiation the turf canopy receives (Beard, 1973). Due to increased traffic and other factors during the winter, turfgrass quality diminishes, affecting current and future management by superintendents. Therefore, the objective of this study was to document the effects of foot-traffic rates, identify a traffic threshold these greens can tolerate in the winter, and observe when the quality of turfgrass improves over time.

Field research was initiated February 2015 on a mature annual bluegrass putting green constructed within United States Golf Association (USGA) guidelines at Oregon State University Lewis-Brown Horticulture Farm in Corvallis, OR. Experimental design was a randomized complete block with four replications. Factors included year (2015 and 2016) and traffic rate (control, low, moderate, and high). Repeated measures were explored, and the model with the lowest Akaike Information Criterion score was selected. Traffic treatments were foot-applied using soft spiked, Footjoy golf shoes at rates equivalent to 110, 220, and 440 rounds per day, compared with a control that did not receive foot traffic. Traffic was applied for a total of 10 weeks from mid-January to late March of 2015 and 2016. Traffic rates and timing were derived using methodology.
defined by Hathaway and Nikolai (2005) and were applied 5 days per week, with 1 day simulating heavy traffic around the hole. Individual plots (7.3 m²) were walked on for a total of 4.75 min (110 rounds), 9.5 min (220 rounds), or 19 min (440 rounds) per week, corresponding to the respective rounds of golf per day. The traffic rate of 110 rounds per day was based on average winter golf rounds at Trysting Tree Golf Club in Corvallis, then doubled to represent an extremely busy course (220 rounds), and quadrupled to show what unabated traffic might do (440 rounds). Turf color and quality data were visually collected weekly based on National Turfgrass Evaluation Program (NTEP) ratings on a scale of 1 to 9, with 6 or greater generally being considered acceptable. Turfgrass color was collected visually, with 1 being straw brown or no color retention, and 9 being dark green. Turfgrass quality was obtained using the NTEP quality scale, with 1 being poorest quality or dead, and 9 being a perfect, or ideal, grass. Quality ratings are based on the “combination of color, density, uniformity, texture, and disease or environmental stress” (Morris 2002). Temperature data were collected using a Remote Automated Weather Station (Campbell Scientific, Logan, UT) on site. Data were analyzed using SAS 9.3 Proc Mixed (SAS Institute, Cary, NC), and mean separations were obtained using Fisher’s LSD at the 0.05 level of probability. Significant differences between years and an interaction between year and traffic rate were significant for both turf quality and color data; therefore, the data were analyzed and presented by year separately.

In 2015 foot traffic applied at the high rate (440 rounds per day) produced the greatest reduction in turf quality, followed by the moderate traffic rate, and finally the low rate, while the control produced the highest turf quality ratings throughout the study (Table 1; Fig. 1). Most of the lowest ratings occurred in February, when the mean temperatures were 56.2°F (high) and 41.7°F (low). At this time only the high traffic produced unacceptable ratings (<6). During March a substantial number of days exceeded a high of 60°F and a low of 40°F. All traffic rates improved throughout this period, but the high traffic rate did not reach acceptable levels (≥6) until the end of March. Research conducted by Hoffman et al. (2014) found the threshold temperature required to reduce the freeze tolerance of annual bluegrass to be 39°F. The deacclimation from freezing conditions at this temperature may be an indicator of a minimum temperature requirement for annual bluegrass growth.

In 2016, the high traffic rate produced the greatest reduction in turf quality, followed by the moderate traffic rate (Table 1). The quality of turfgrass in plots receiving the low traffic rates was not significantly different than in the control. The greatest reduction in quality was observed during March 2016, but in only a couple weeks reached unacceptable levels for the high traffic rate (Fig. 2). Turfgrass showed improved quality for all traffic rates in the last week of March, when a substantial number of days exceeded a high of 60°F and a low of 40°F. Since the turf quality and color data were similar, the turf color data are not presented.

Findings suggest that traffic should be limited to 220 rounds per day to prevent unacceptable turf color and quality from developing during winter months (February and March) or when the daily high and low temperatures do not support turfgrass growth. Golf rounds could be increased in number when annual bluegrass is able to recover from traffic, or when daily temperatures exceed 60°F (high) and 40°F (low). More research needs to be conducted to explore the relationship between annual bluegrass growth and the increasing temperatures from the winter-to-spring transition. Additional research could more accurately pinpoint the amount of winter traffic annual bluegrass can sustain while maintaining acceptable quality and could identify periods when traffic should be further limited. This information can be used by golf courses to maximize playable golf rounds while protecting the integrity of putting greens during the offseason.
Fig. 1. Effects of traffic rate on annual bluegrass quality in Corvallis, OR, during 2015. Traffic treatments were initiated 16 Jan. 2015. Error bars denote Fisher’s LSD at 0.05.

Fig. 2. Effects of traffic rate on annual bluegrass quality in Corvallis, OR, during 2016. Traffic treatments were initiated 20 Jan. 2016. Error bars denote Fisher’s LSD at 0.05.

Literature Cited