Putting Green Speed: Variables and Consequences

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Seven years of observations made in a long-term study entitled "Performance Driven Putting Green Management Systems" provide the basis for this article. The variables in the study are three creeping bentgrass cultivars, 'Penncross', 'Providence', and 'Crenshaw', each mowed at three heights and growing on sand and native soil putting greens. The study required frequent measurements of speed with the Stimpmeter and subsequent adjustment of mowing heights to maintain speeds of around 8 feet, around 9 feet, and consistently greater than 10 feet.

To set the stage for the discussion that follows, I want to quote from the second edition of Dr. James B. Beard's book "Turf Management for Golf Courses." The quote, taken from pages 112 and 113, is as follows:

"A green speed of 8 to 9 feet represents a typical norm now used on golf courses for regular play, while slower speeds of 6.5 to 8.5 feet are enjoyed on golf courses played primarily by less skilled players. Speeds for USGA Championships usually are from 9.0 to 11.5 feet. The green speed selected is affected by the degree of slope on the greens, the wind velocity and direction, and the capability of golfers in the event.

Excessively fast greens cause putting to become more like a game of chance, and the turf of certain cultivars may be significantly thinned by extraor- dinarily close mowing with the resultant invasion of moss, algae, and annual bluegrass. Excessively fast greens also require more skill to play, which can lead to slower play. Attempts to maintain championship quality greens for more than a 2- to 4-week period can lead to serious deterioration, as few golf courses have the climate, soil conditions and resources needed to sustain championship quality greens on a daily seasonal basis."

Data from the present study have clearly and consistently shown that the dominant factor controlling putting green speed is mowing height. Occasionally there were bentgrass cultivar differences. Whenever this happened, the plots populated by the more horizontally growing 'Penncross' were faster than those with the more erect growing 'Providence' and 'Crenshaw'. The sand green tended to be slightly faster than the native soil green, primarily because the sand green was not capable of maintaining as high a grass density as the soil green.

The relationship between mowing height and putting green speed that evolved over the 7 years of this study is shown in Figure 1. The line depicts the long-term average relationship. According to this line, consistently mowing at 0.240, 0.174, or 0.145 inch can result in speeds of 8, 9, and 10 feet, respectively *for pure bentgrass putting greens*. But note the spread in the data points around each mowing height. Depending on factors such as time of year, weather, time of fertilizer application and topdressing, etc., the speed can vary by as much as 11 inches from the long-term average value. This fact needs to be pointed out to anyone insisting that you maintain a constant putting green speed day after day throughout the season. Maintaining a reasonably constant putting green speed requires much more than just mowing at the same height from opening to closing for the year.

Depending on type of putting green construction and mowing height, week-to-week putting green speeds can vary by as much as 12 inches (Table 1). These data also point out the fact that weekly variation in putting green speed increas-

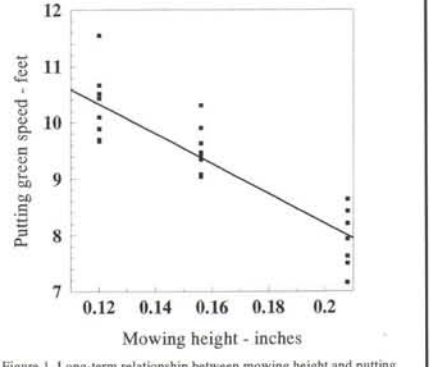

Figure 1. Long-term relationship between mowing height and putting green speed when averaged over three bentgrass cultivars and two types of putting green construction.

es as mowing height decreases and sand greens exhibit more variation in speed over time than do native soil greens. In other words, the effort required to maintain constant putting greens over time is greatest for the modern sand greens mowed at 0.120 inch or so. The task is much easier on native soil greens where speeds of 8 to 9 feet are acceptable.

Putting green speed varies with time of season as well over periods of days. This is illustrated by the data in Table 2. As a general rule, putting greens get faster when progressing from spring to mid- to late-August, but slow down as more favorable growing conditions return in the fall. This is an inherent trend in putting green speed in climates such as ours.

Another variable in putting green speed is time of day. In the present study, we were able to see how much daytime changes in speed were influenced by mowing height, bentgrass cultivar, and type of putting green construction. We found that the changes in daytime speed were greater on native soil than sand greens, were greater for 'Penncross' and 'Providence' than 'Crenshaw', and were greatest when speeds were near their seasonal peaks in late summer. Measurements taken at 11:00 am, 2:00 to 3:00 pm and again at 6:00 pm resulted in the time-of-day influences on green speed shown in figure 2. Note that essentially no change in speed occurred between 11:00 am and 2:00 pm. After 2:00 pm, putting green speed declined sharply. The average decline was 8.6 inches, but ranged from 7.5 inches for sand greens to 9.6 inches for native soil greens.

Plant growth regulators are viewed as a means for increasing putting green speed and maintaining more consistent speed throughout the day. In this study, Primo was applied monthly at the rate of 0.24 oz/M to one-half each plot. Use of the product did increase green speed somewhat, but varied with bentgrass cultivar, mowing height, and type of putting green construction. Greens populated with 'Penncross' and 'Crenshaw' gained 3 to 4 inches in speed, while speed of the 'Providence' greens were not affected by application of Primo. Primo increased green speed at the two lowest heights of cut, but not where the greens were mowed to maintain a speed of about 8 feet. The speed of the native soil greens benefitted more than that of the sand greens, but the difference was not statistically significant. Application of Primo under any conditions did not significantly reduce daytime reductions in putting green speed.

Now the issue is what is the most

effective means for temporarily increasing green speed for a tournament or other special event. Rolling is certainly an option, but requires ownership of or access to a roller. Thus, other options – wet vs. dry mowing and double cutting – were explored. Dry mowing becomes an option when you are faced with a noon-time shotgun start. The speed gained in this study by dry mowing varied with mowing height. The increase was an insignificant 2.4 inches at the 0.120-inch mowing height but increased to 6 inches at a 0.218-inch height of cut. The effect of mowing height on the amount of speed gained by double cutting was just the opposite of dry vs wet mowing. Double cutting at 0.120 inch increased putting green speed an average of 10.6 inches. Double cutting at 0.218 inch increased speed a mere 4.2 inches. The gain in speed achieved with double cutting also depended on bentgrass cultivar. The 'Penncross' greens benefitted the least (8 inches on average). The 'Crenshaw' greens gained the most speed – 13.3 inches on average. 'Providence' greens were intermediate, picking up 9.8 inches of speed when double cut.

Before you get obsessed with tinkering around with putting green speed next season, let's try to put things into perspective. Data analysis in this 7-year study consistently indicated that green speed differences of less than 4 inches are seldom statistically significant. In other words, changes of this magnitude are random, naturally occurring, and inherent in even the seemingly flat putting greens used in this study. Second, recent research has shown that even low handicap golfers cannot detect green speed differences of less than 6 inches. The bottom line then is that you should not get excited when you see the speed of your greens suddenly change by 4 to 6 inches.

Finally, as pointed out by Dr. Beard, consistently keeping greens at tournament speeds has costs that few golf courses have the resources to deal with or consequences that golfers will tolerate. The consequences in this study of mowing at heights required to consistently maintain putting green speeds above 10 feet are summarized in Table 1. Increasing the mowing height did increase clipping weights, at certain times by 15% or more, but over the duration of the study the

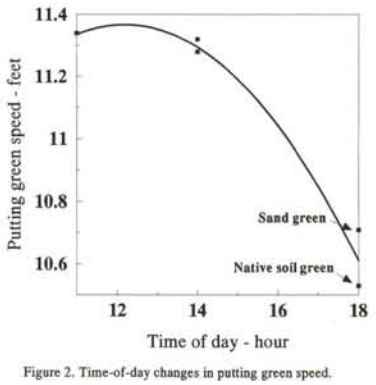

Figure 2. Time-of-day changes in putting green speed.

Table 1. Weekly variation in putting green speed at constant mowing heights.

Mowing height	Type of green	Putting green speed Wk 1	Wk 2	Wk 3	Wk 4	Wk 5	Wk 6	Wk 7
inch		feet						
0.120	Sand	10.2	11.0	10.9	10.9	10.6	11.6	11.1
	Soil	10.5	11.0	10.8	11.1	10.6	11.2	11.1
0.156	Sand	9.0	9.6	8.9	9.5	9.2	9.7	9.6
	Soil	8.9	9.1	8.7	9.3	9.0	9.5	9.4
0.208	Sand	8.0	8.2	8.1	8.0	7.9	8.2	8.2
	Soil	8.1	8.1	8.0	8.2	8.2	8.0	8.2

Table 2. Time of year influences on putting green speed.

Target speed	Putting green speed 1996 May	1996 August	1997 June	1997 August	1998 June	1998 August	1999 June	1999 July
feet	feet							
8	7.5	8.4	7.2	7.6	7.6	8.6	7.9	8.2
9	9.1	9.9	9.0	9.5	9.6	10.3	9.3	9.4
>10	9.9	10.7	9.7	10.1	10.5	11.6	9.7	10.4

Table 3. Consequences of mowing to maintain putting green speeds consistently >10 feet rather than around 8 or 9 feet.

Putting green property	Change at a speed of: 9 feet	8 feet
Clipping weight	+ 1%	+ 5%
Stand density	+ 10%	+ 12%
Rooting depth	+ 29%	+ 53%
Root weight	+ 25%	+ 52%
Algae invasion	– 87%	– 94%
Dollar spot	+452%	+559%
Traffic tolerance	– 45%	– 54%

increases were less than 5% – hardly great enough to say that an increase in mowing height significantly impacted on costs arising from greater clipping production. Bentgrass stand densities averaged only 10 to 12% greater in greens maintained at speeds of 8 to 9 feet as compared to those maintained at greater than 10 feet. But look at the impact this grass stand reduction and low mowing had on algae invasion. Increasing the mowing height by just 0.036 inch, from 0.120 to 0.156 inch, reduced the percentage of plot area invaded by algae an average of 87%, even when all plots received the equivalent of about 30,000 rounds of golfer traffic per season. Contributing to algae invasion was the 45 to 54% reduction in traffic tolerance of bentgrass mowed to maintain tournament speed.

Another cost of tournament speeds occurs below ground. Bentgrass rooting depths and root weights were reduced substantially, by 25 to 50% or more (Table 3) regardless of bentgrass cultivar. The native soil greens maintained much better root systems than the sand greens, but the percentage reductions due to reduced mowing heights were nearly the same in both. In the sand green, late summer rooting depth often declined to less than 4 inches when mowed to maintain a greater than 10 feet green speed, while depths of 7 to 8 inches were common in greens with speeds of around 8 feet. This difference in root growth can easily trigger an escalation in putting management costs. Typical sand putting greens do not retain enough water in the top 4 inches to prevent bentgrass from wilting on a hot, sunny day. Hand watering to prevent wilting and to treat localized dry spot that now requires use of wetting agents becomes a costly but vital management practice.

The single positive impact of mowing at 0.120 inch or so was on the severity of dollar spot (Table 3). This can be attributed to the impact of mowing height on the amount of leaf tissue where infection can occur. Owing to the great susceptibility of 'Crenshaw' to dollar spot, the 400 to 500% increases in dollar spot at the 8 and 9 feet target green speeds are somewhat misleading. For 'Penncross' and 'Providence', the increases in dollar spot severity were more on the order of 36 to 47%, but still high enough to signal the need for a more intensive use of fungicides.

Clearly, there are many costs associated with maintaining putting greens at tournament speeds. As pointed out by Dr. Beard, few golf courses have the necessary resources. Perhaps even more important is the fact that many golf courses don't have greens whose properties are such that a quality playing surface can be maintained at very low mowing heights regardless of the cultural practices employed. For those of you that are being pressured to move your putting green speeds into the tournament range and keep them there, may this article be of value to you.