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In 2008, Virginia Polytechnic Institute and State University researchers conducted research at Cavalier Golf and Yacht Club in Virginia Beach, VA to document the effects of two mowing heights (0.120 and 0.140 inches) with (2-3 times per week) and without rolling on putting green speed, quality, and disease severity of 'Penn A-4' creeping bentgrass. Significantly different putting speeds were observed between the mowing heights and the rolled and unrolled plots, with the lower mowing height and the rolled plots having greater speeds by nearly one foot. Little to no differences between treatments were observed in disease severity.

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The purpose of *USGA Turfgrass and Environmental Research Online* is to effectively communicate the results of research projects funded under USGA's Turfgrass and Environmental Research Program to all who can benefit from such knowledge. Since 1983, the USGA has funded more than 350 projects at a cost of \$29 million. The private, non-profit research program provides funding opportunities to university faculty interested in working on environmental and turf management problems affecting golf courses. The outstanding playing conditions of today's golf courses are a direct result of ***using science to benefit golf.***

### Editor

Jeff Nus, Ph.D.  
1032 Rogers Place  
Lawrence, KS 66049  
jnus@usga.org  
(785) 832-2300  
(785) 832-9265 (fax)

### Research Director

Michael P. Kenna, Ph.D.  
P.O. Box 2227  
Stillwater, OK 74076  
mkenna@usga.org  
(405) 743-3900  
(405) 743-3910 (fax)

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# The Effects of Mowing Height and Rolling on Ball Speed, Quality, and Disease Severity of Creeping Bentgrass

Brandon J. Horvath, Adam E. Nichols, and Matthew A. Cutulle

## SUMMARY

In 2008, Virginia Polytechnic Institute and State University researchers conducted research at Cavalier Golf and Yacht Club in Virginia Beach, VA to document the effects of two mowing heights (0.120 and 0.140 inches) with (2-3 times per week) and without rolling on putting green quality and disease severity of 'Penn A-4' creeping bentgrass. Preliminary results include:

- Significantly different putting speeds were observed between the mowing heights and the rolled and unrolled plots, with the lower mowing height and the rolled plots having greater speeds by nearly one foot.
- The rolled plots displayed significantly greater speeds by 7.5 to 12 inches on five more rating dates.
- During the three-month period that data were taken, little to no differences were observed in either the percentage of disease or quality as affected by the mowing height or rolling.
- Although not statistically significant, the higher mowing height treatment trended toward less disease and greater quality than the lower mowing height treatment.

The question of green speed arose in the mid-1970s when the USGA introduced the Speedstick, a variation of Edward Stimpson's Stimpmeter. This new tool measured how fast a ball would roll on a particular green. The goal of the USGA in introducing the Speedstick was to give golf superintendents a tool that would assist them in creating consistent putting conditions across the entire golf course (5).

Since the inception of the stimpmeter, golf course superintendents have used a variety of cultural and chemical practices in an attempt to obtain firmer, faster greens. These practices include lowering mowing heights, double-cutting,

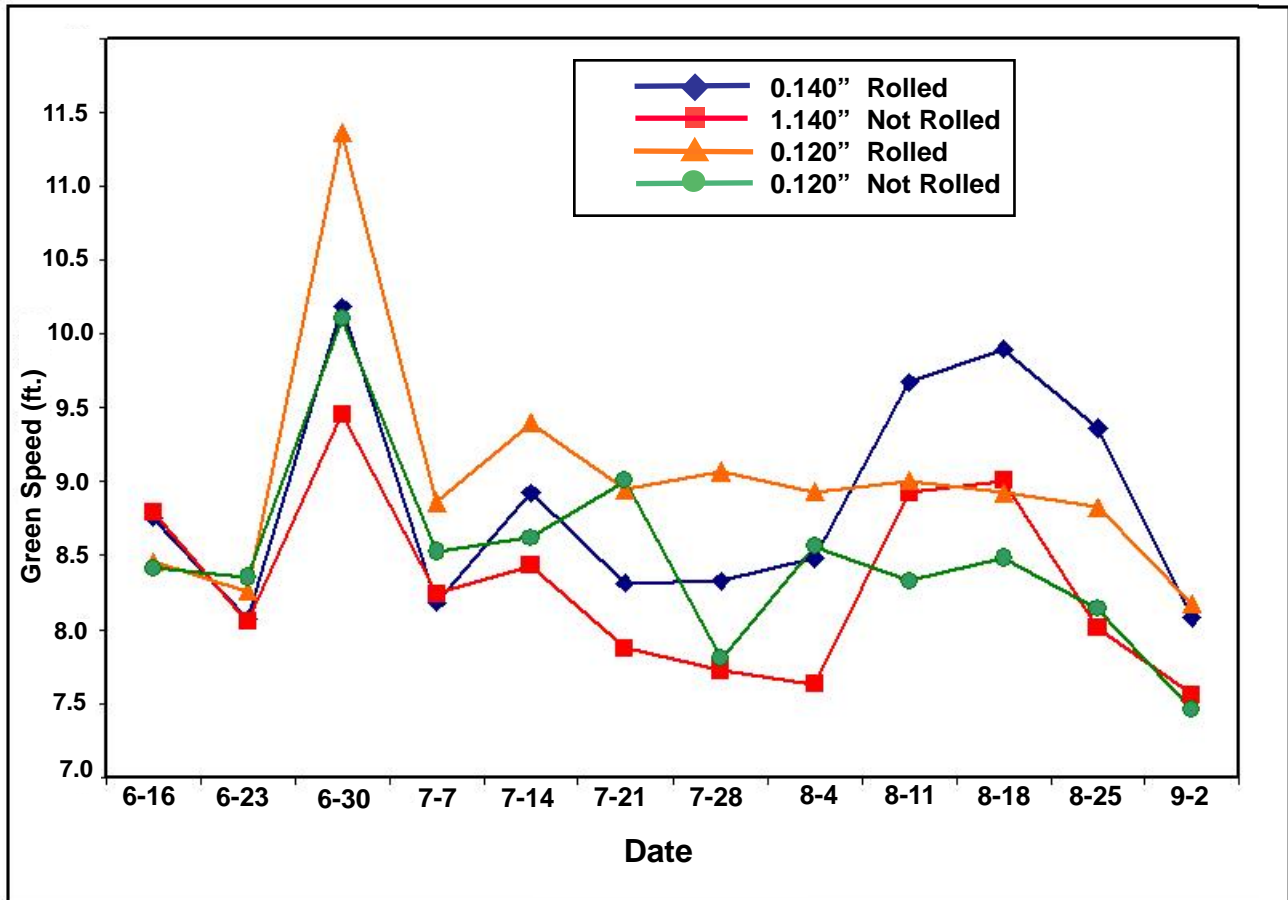
rolling, use of plant growth regulators, reducing fertility, and reducing irrigation (7, 9, 11, 13). Often the implementation of the practices is detrimental to the health and quality of the turfgrass on the putting green (2, 10). The stress caused by these practices is at times unnecessary as the average golfer cannot detect a difference in green speeds of six inches or less (1). These practices can also cause a decrease in ball speed as the surface becomes disrupted due to a loss turfgrass density (3, 4) which may be especially true in hot, humid climates where creeping bentgrass is grown.

The purpose of this study was to investigate the effects of mowing height and rolling on the quality and disease severity of 'Penn A-4' creeping bentgrass grown on a practice green on a golf course in Virginia.



This trial was conducted on the a six-year old creeping bentgrass (*Agrostis stolonifera* cv. 'Penn A-4') putting green constructed according to USGA specifications and located on the nursery/practice green at the Cavalier Golf and Yacht Club in Virginia Beach, VA.

BRANDON J. HORVATH, Ph.D., Assistant Professor; ADAM E. NICHOLS, Research Assistant; and MATTHEW A. CUTULLE, Graduate Student; Department of Plant Pathology, Hampton Roads AREC, Virginia Polytechnic Institute and State University; Virginia Beach, VA.



**Figure 1.** Mean green speed (ft.) of 'Penn A-4' creeping bentgrass in Virginia Beach, VA from June 16 through September 2, 2008 for the four treatment combinations of two mowing heights (0.120 and 0.140 inches) and rolled and not rolled.

### Materials and Methods

This trial was conducted on the a six-year-old creeping bentgrass (*Agrostis stolonifera* cv. 'Penn A-4') putting green constructed according to USGA recommendations (12) and located on the nursery/practice green at the Cavalier Golf and

Yacht Club in Virginia Beach, VA. The experimental design utilized a split-plot treatment arrangement with mowing height as main plots and rolling treatments as sub-plots. One side was mowed to a height of 0.120 inches while the other was mowed to a height of 0.140 inches. Individual sub-plots measuring 15 ft. x 5 ft. were

Stimpmeter Measurements (ft.)												
	June 16	June 23	June 30	July 7	July 14	July 21	July 28	August 4	August 11	August 18	August 25	Sept. 2
<b>Mowing Height</b>												
0.140"	8.78 <sup>Z</sup>	8.06	9.82b	8.21	8.68	8.09b	8.03	8.06b	9.30a	9.46a	8.69	7.82
0.120"	8.43	8.31	10.73a	8.69	9.01	8.98a	8.43	8.74a	8.67b	8.70b	8.49	7.81
<b>Rolling</b>												
Rollled	8.61	8.16	10.77a	8.52	9.16a	8.63	8.70a	8.70	9.34a	9.41	9.09a	8.13a
Not Rolled	8.60	8.20	9.78b	8.39	8.53b	8.44	7.76b	8.09	8.63b	8.75	8.08b	7.51b

<sup>Z</sup> Values are means of three replicates. Means within a sampling date followed by different letters are significantly different using the Least Significant Difference test (P=0.05).

**Table 1.** Mean Stimpmeter measurements (ft) from June 16 through September 2 as affected by mowing height and rolling.

Turfgrass Quality (1-9)												
	June 16	June 23	June 30	July 7	July 14	July 21	July 28	August 4	August 11	August 18	August 25	Sept. 2
<b>Mowing Height</b>												
0.140"	7.0	6.8	7.0	7.5	6.4b	6.1	5.8	6.0	6.6	5.2	5.3	6.3
0.120"	7.0	6.7	7.0	7.5	7.0a	6.3	6.3	6.2	6.2	4.7	5.0	5.5
<b>Rolling</b>												
Rolled	7.0	6.8	7.0	7.5	6.7	6.3	5.9	6.0	6.3	5.0	5.1	6.1
Not Rolled	7.0	6.8	7.0	7.5	6.8	6.2	6.2	6.2	6.4	4.8	5.3	5.7
<sup>z</sup> Values are means of three replicates. No differences between treatments were observed except on the July 14 rating date where the 0.140-inch mowing height resulted in significantly lower quality (P = 0.05) than plots mowed to 0.120 inches (P = 0.05).												

**Table 2.** Mean quality of 'Penn A-4' creeping bentgrass in Virginia Beach, VA as affected by mowing height and rolling.

randomly assigned within each main plot and either rolled two to three times per week or left unrolled. Each treatment combination was replicated three times.

Mowing occurred six to seven times per week, while rolling treatments were applied at least twice per week, but no more than three times per week with a Salsco® roller. Weekly stimpmeter readings were taken starting on June 16 and continued through September 2 by rolling three balls from a Stimpmeter from a marked point and repeating this procedure from a marked point on the other side of the sub-plot. The six numbers were recorded and averaged for each sub-plot.

Weekly visual quality ratings were taken as well where 9 was equal to the best possible quality and 6 was acceptable. Visual disease severity percentage ratings were taken July 14

through August 25 when disease was present. Estimates were made for the area of the plots (%) that exhibited disease symptoms during that time.

## Results

At the initiation of the trial, the Stimpmeter readings averaged between 8.5 ft. and 9 ft. (Figure 1). The following week, an increase in green speed occurred with ball roll ranging from 9.5 ft to 11.5 ft. Significantly different putting speeds were observed between the mowing heights and the rolled and unrolled plots, with the lower mowing height and the rolled plots having greater speeds by nearly one foot (Table 1). The lower mowing height continued to have increased Stimpmeter readings of eight to twelve inches on

Dollar Spot Severity (%)							
	July 14	July 21	July 28	August 4	August 11	August 18	August 25
<b>Mowing Height</b>							
0.140"	1.08a	1.00	0.67	0.50	0.75	2.25	0.92
0.120"	0.50b	0.75	0.67	0.58	0.67	3.00	1.42
<b>Rolling</b>							
Rolled	0.83	0.83	0.67	0.58	0.67	2.92	1.33
Not Rolled	0.75	0.92	0.67	0.50	0.75	2.33	1.00
<sup>z</sup> Values are means of three replicates. No differences between treatments were observed except on the July 14 rating date where the 0.140-inch mowing height resulted in significantly higher dollar spot severity (P = 0.05) than plots mowed to 0.120 inches.							

**Table 3.** Dollar spot (*Sclerotinia homoeocarpa*) severity of 'Penn A-4' creeping bentgrass in Virginia Beach, VA as affecting by mowing height and rolling.

two more rating dates throughout the study compared to the plots that were mowed at the higher height of cut. The increase in green speed obtained by lower mowing heights have also been shown in other studies (3, 9, 13).

The rolled plots displayed significantly greater speeds by 7.5 to 12 inches on five more rating dates and these increases are consistent with other studies (6, 7). On August 11 and 18, the higher mowing height displayed significantly greater green speed than the lower mowing height by 7.5 to 9 inches. This was due to damage caused by dollar spot (*Sclerotinia homeocarpa*) creating a non-uniform surface in the lower mowing height plots. During the three-month period that data were taken, little to no differences were observed in either the percentage of disease or quality as affected by the mowing height or rolling (Tables 2 and 3).

However, during the hot and humid periods of August, a trend was observed between mowing-height treatments. The higher mowing height displayed less disease and greater quality than the lower mowing height. The quality trend coincides with research performed by Kussow (2), where lowest mowing height not only decreased quality, but also reduced tiller counts and root mass. Though not significant, more disease appeared present in the rolled plots versus the unrolled plots. This is contrary to previous research (4) conducted at Michigan State University where rolled plots saw significantly less dollar spot activity than unrolled plots.

In summary, mowing at a lower mowing height will give greater green speeds, but can be detrimental to the health of the turfgrass. Frequent rolling and higher mowing heights are options for maintaining green speeds and healthy turf.

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