Mowing Height, Mowing Frequency, and Rolling Frequency Affect Putting Green Speed

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Photo by Mike Richardson

Application of rolling treatments

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Summary. Rolling putting greens may allow turf managers to decrease mowing frequency or increase mowing height without losing green speed. Such mowing practice adjustments could be beneficial in minimizing summer stress on creeping bentgrass putting greens in Arkansas and throughout the transition zone. The objective of this study was to determine the effects of mowing and rolling frequency and mowing height on turf quality, green speed (ball roll distance), water infiltration, and the susceptibility to algae on a sand-based putting green. This study contained eight combinations of mowing and rolling treatments, which were applied over an entire growing season. Turf quality was rated weekly, water infiltration measurements and algae ratings were conducted twice during the season, and ball roll distance was measured twice weekly. Rolling treatments increased ball roll distance, while causing very little harm to the putting surface. With rolling treatments, golf course superintendents can mow less frequently or at a higher height to minimize summer stress and maintain desired green speeds.

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Light-weight rolling of putting greens is a cultural practice that dates back over 100 years. However, in the 1920s rolling practices declined due to fears that putting green soils would compact, resulting in drainage and aeration problems (Piper and Oakley, 1921). The practice of rolling greens was mostly abandoned for the next 70 years. However, in the early 1990s, when the demand for faster greens grew, rolling putting greens re-emerged as a viable cultural practice (Nikolai, 2002). Most new putting greens are built according to either United States Golf Association (USGA) specifications (USGA, 1993) or with other techniques that include a predominantly sand rootzone, which makes them less susceptible to compaction than previous soil-based putting green rootzones. The technology of rollers has also improved significantly and new rollers are designed particularly for rolling golf course putting greens.

A recent putting green rolling study concluded that most greens rollers increase green speed by over one foot on the day rolling is applied and retain over 6 inches of that increase the day after rolling (Nikolai, 2003). If greens rolling can improve green speeds for as long as 48 hours, daily mowing may not be necessary. This could reduce stress to the putting green surface, especially during hot, humid conditions. The objective of this research is to determine the effects of various combinations of mowing and rolling frequency and mowing height on a USGA putting green with regard to ball roll distance, overall quality, water infiltration, and algae incidence.

Materials and Methods

This research was conducted at the Arkansas Agricultural Research and Extension Center in Fayetteville, Ark. on a 6-yr-old 'L93' creeping bentgrass (*Agrostis stolonifera*) putting green that was constructed according to USGA specifications (USGA, 1993). Fertilizer, growth regulator and pesticide application, aerification, irrigation, and topdressing were uniform across the experimental area throughout the study and were consistent with typical golf course putting green management practices.

In this study, there were eight different mowing and rolling treatments, each replicated three times for a total of 24 plots (4.5 by 18 ft). The treatments, summarized in Table 1, were chosen to compare the effects caused by different mowing heights, mowing frequencies, and rolling frequencies on putting green speed and turf quality. Treatment applications began 14 April 2008 and continued until 7 Nov 2008. All mowing treatments were applied using a walk-behind greens mower (Toro Greensmaster 1000, Toro Company, Bloomington, Minn.). After the plots were mowed, rolling treatments were applied using a commercially available greens roller (RS48-11C Golf Roll 'n' Spike, Tru-Turf Rollers, Ernest Junction, Queensland, Australia). Rolling was applied as a single pass across appropriate plots. Putting green speed was evaluated by measuring ball roll distance with a Pelzmeter (Nikolai, 2005). On each plot, three golf balls were rolled in opposite directions and the six resultant ball roll distances were averaged. Ball roll measurements were collected twice per week, once on a day in which all rolling treatments were applied and once on a day when only plots that were rolled six times per week were treated. Turf quality was measured weekly by rating each plot on a scale from 1-9, with 1 being poor, 6 being minimum acceptable quality, and 9 being exceptional. Water infiltration measurements were done on 25 June 2008 and 12 November 2008 using a double-ring infiltrometer (Turf-Tec Double-Ring Infiltrometer, Turf-Tec International, Tallahassee, Fla.) and a mariotte siphon (Gregory, 2005). The mariotte siphon was used to maintain constant pressure in the center ring of the infiltrometer. Algae ratings were done on 10 July 2008 and 9 September 2008 following heavy rain periods that produced algae outbreaks across the experimental area. Each plot was rated on a scale from 1-9, with 1 being no algae and 9 being completely infested with algae.

Results and Discussion

Ball roll distance data were averaged over the 2008 growing season, for both the day-of-rolling and day-after-rolling evaluations (Fig. 1). Turf mowed at 1/8 inch produced significantly faster green speeds compared to plots mowed at 5/32 inch when rolling was not applied. Decreasing the mowing height from 5/32 to 1/8 inch increased green speed by an average of eight inches. This increase is marginally greater than the increase at which the average golfer can detect differences in speed on adjacent putting greens (6 inches) (Karcher et al., 2001). Therefore, decreasing the mowing height from 5/32 inch to 1/8 inch produced noticeably faster green speeds.

Rolling three times per week resulted in an increase in ball roll distance of approximately one foot on the day all rolling treatments were applied compared to the non-rolled plots. On the day after rolling treatments were applied, there was an increase of 5 to 6 inches, compared to the non-rolled plots, demonstrating that rolling did have a residual effect on green speed (Fig. 1). Plots that were rolled six times per week had significant increases in green speed over those rolled three times per week. Plots mowed at 1/8 inch and rolled six times per week resulted in an additional increase in green speed of approximately six inches on the day all rolling treatments were applied and 14 inches on the day only daily (6x) rolling treatments were applied, compared to those plots rolled three times per week (Fig. 1). At the 5/32-inch mowing height, plots that were rolled six times per week had ball roll distances 6 to 8 inches longer than plots rolled three times per week on days that all plots were rolled. And on days when only six-times-per-week rolling was applied, the daily rolling plots had ball roll distances of approximately 1 ft greater than plots rolled three times per week (Fig. 1). In summary, plots mowed at 5/32 inch and rolled every other day had green speeds just as fast as the 1/8-inch, non-rolled plots. Additionally, plots mowed at 5/32 inch and rolled daily produced faster green speeds than the 1/8-inch, non-rolled treatment. Collectively, these data demonstrate that lightweight rolling does improve putting green speed, but the amount of increased speed is related to the amount of additional rolling.

At the 1/8-inch mowing height, decreasing mowing frequency to three times per week increased ball roll distance 6 inches when plots were rolled on alternate days and by 1 ft when plots were rolled every day compared to the 1/8-inch mowing height control, which received no rolling (Fig. 1). Therefore, when mowing at 1/8 inch, it is possible to mow every other day and increase green speeds with regular rolling compared to mowing every day with no rolling.

Turf quality data were averaged over the 2008 growing season (Fig. 2). All turf quality ratings for each treatment stayed above the minimum acceptable quality rating of 6. Plots mowed daily at 1/8 inch that received a rolling treatment had lower quality than treatments mowed at 5/32 inch; however, they remained above an acceptable level.

Water infiltration evaluations were conducted in June and November (Fig. 3). On the June evaluation date, there were no statistical treatment differences at the 0.05 probability level; however, treatments that were rolled 6 times per week and the 1/8-inch treatment rolled 3 times per week had lower infiltration rates than treatments with no rolling ($P = 0.07$). In addition, it was apparent during a heavy rain event that water infiltrated into the rootzone slower on the plots receiving daily rolling treatments compared to control plots that received no rolling (Fig. 4). On the November evaluation date, there were still no significant treatment differences, but the infiltration rates were much slower compared to the rates from the June evaluations (Fig. 3). The November infiltration rates were marginally acceptable for a USGA sand-based putting green (>6 inches per hour) (USGA, 1993). On the November evaluation date, the experimental area had not been core aerified for seven months. These results suggest that regular core aerification is important on sand-based putting greens, even when the turf is not rolled regularly, to manage organic matter accumulation and maintain acceptable water infiltration rates.

Treatments mowed at 1/8 inch had significantly more algae than treatments mowed at 5/32 inch (Fig. 5). This is likely due to the healthier and denser canopy found on plots with the higher mowing height. The implementation of rolling did not increase the prevalence of algae. In some instances, less algae were seen on rolled plots compared to control plots that were not rolled.

In summary, rolling treatments were effective at increasing putting green speed. In fact, ball roll distances measured on plots mowed at 1/8 inch that received no rolling were reached and surpassed when plots at 5/32 inch were rolled at three and six times per week. So, faster green speeds may be achieved without lowering the mowing height. In addition, green speeds were increased by rolling even when mowing frequency was reduced to every other day. Therefore, during the hot, humid periods of a transition zone summer, golf course managers may be able to mow less frequently or at a higher height to minimize summer stress and also maintain the desired green speeds.

Literature Cited

Karcher, D., T. Nikolai, and R. Calhoun. 2001. Golfer's perceptions of greens speeds vary. Golf Course Manage. 69(3):57-60.

Nikolai, T.A. 2002. More light on lightweight rolling: Research is shedding light on rolling as a season-long maintenance practice. USGA Green Sec. Rec. 40(1):9-12.

Nikolai, T.A. and T. Vanloo. 2004. 2003 Michigan Turfgrass Foundation funded research report: [Lightweight rolling of golf greens]. p. [1-4]. In 74th Annual Michigan Turfgrass Conference Proceedings. January 19-21, 2004, Lansing, Mich. East Lansing, Mich.: Michigan State University.

Nikolai, T.A. 2005. Putting Green Speed. Jon Wiley & Sons, Inc., Hoboken, N.J.

Piper, C.V. and R.A. Oakley. 1921. Rolling the turf. Bulletin of the Green Section of the U.S. Golf Assoc. 1(3):36.

USGA Green Section Staff. 1993. USGA recommendations for a method of putting green construction. USGA Green Section Record 31(2):1-3.

Table 1. Summary of mowing and rolling treatments.

Treatment no.	Mowing frequency	Mowing height	Rolling frequency	Treatment ID
	(days / wk)	(in)	(days / wk)	
1	6	1/8	6	1/8
2	6	5/32	6	5/32
3	3	1/8	6	1/8 R3x
4	6	1/8	3	1/8 3x R6x
5	3	1/8	3	1/8 3x R3x
6	6	1/8	6	1/8 R6x
7	6	5/32	6	5/32 R6x
8	3	5/32	6	5/32 R3x

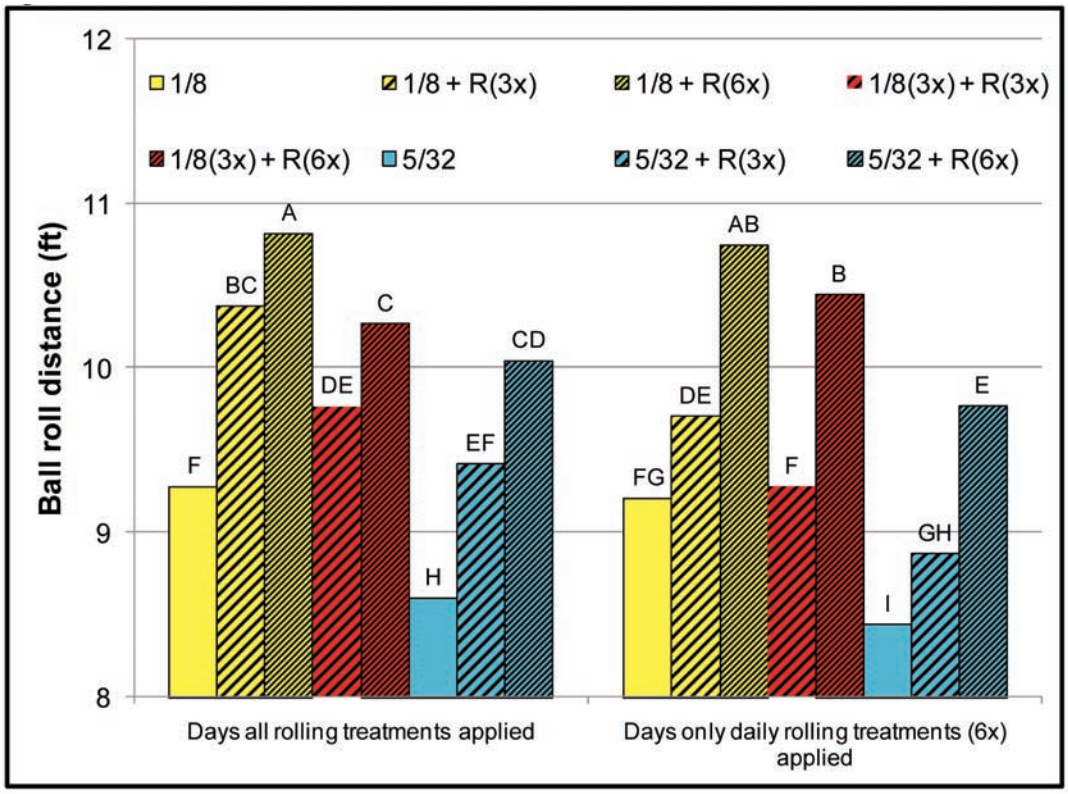

Fig. 1. Effect of mowing and rolling treatments on ball roll distance on days all plots were rolled and on days that plots rolled six times per week were rolled. Within days, bars sharing a letter are not significantly different according to Fisher's least significant difference test (α = 0.05).

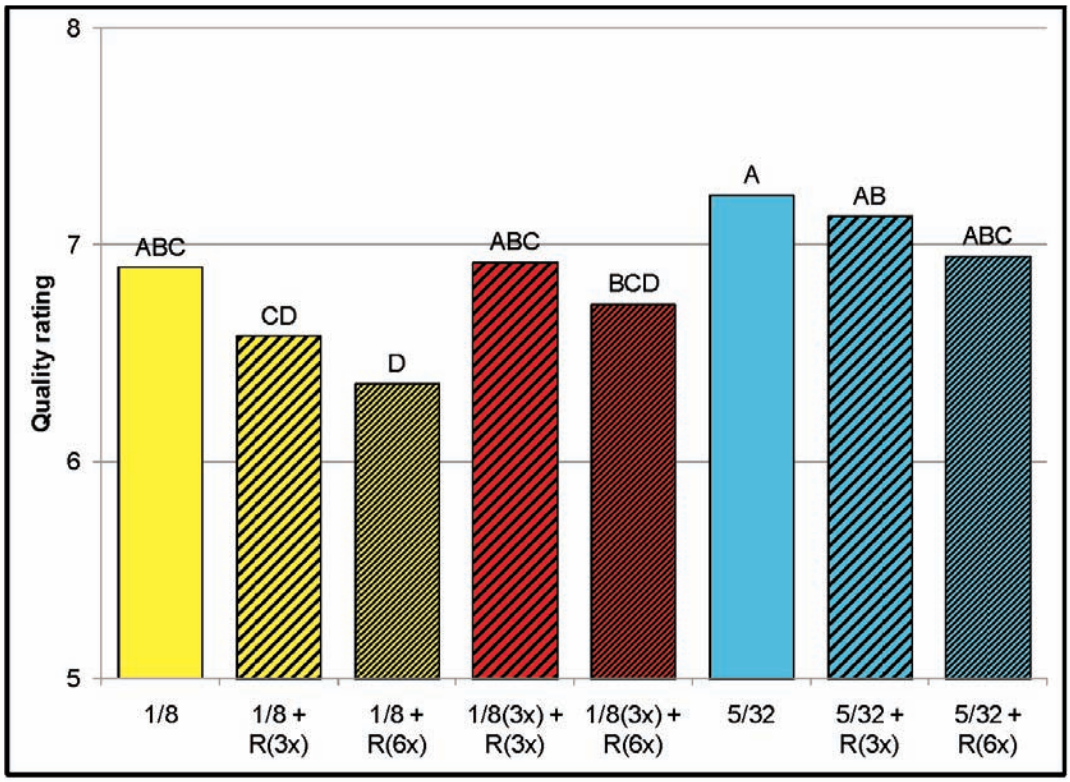

Fig. 2. Effect of mowing and rolling treatments on visual turf quality, averaged across the 2008 growing season. Bars sharing a letter are not significantly different according to Fisher's least significant difference test (α = 0.05).

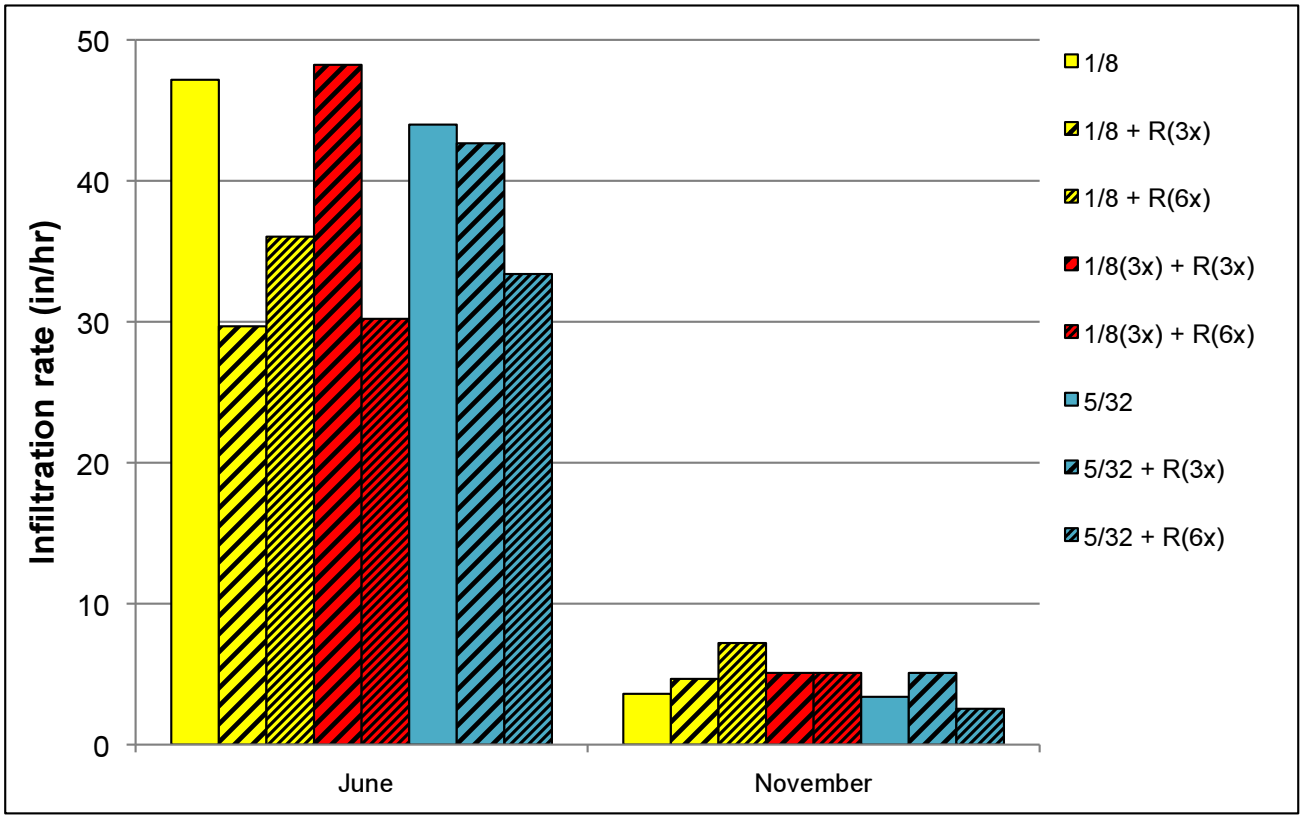

Fig. 3. Effect of mowing and rolling treatments on water infiltration rate in June and November of 2008.

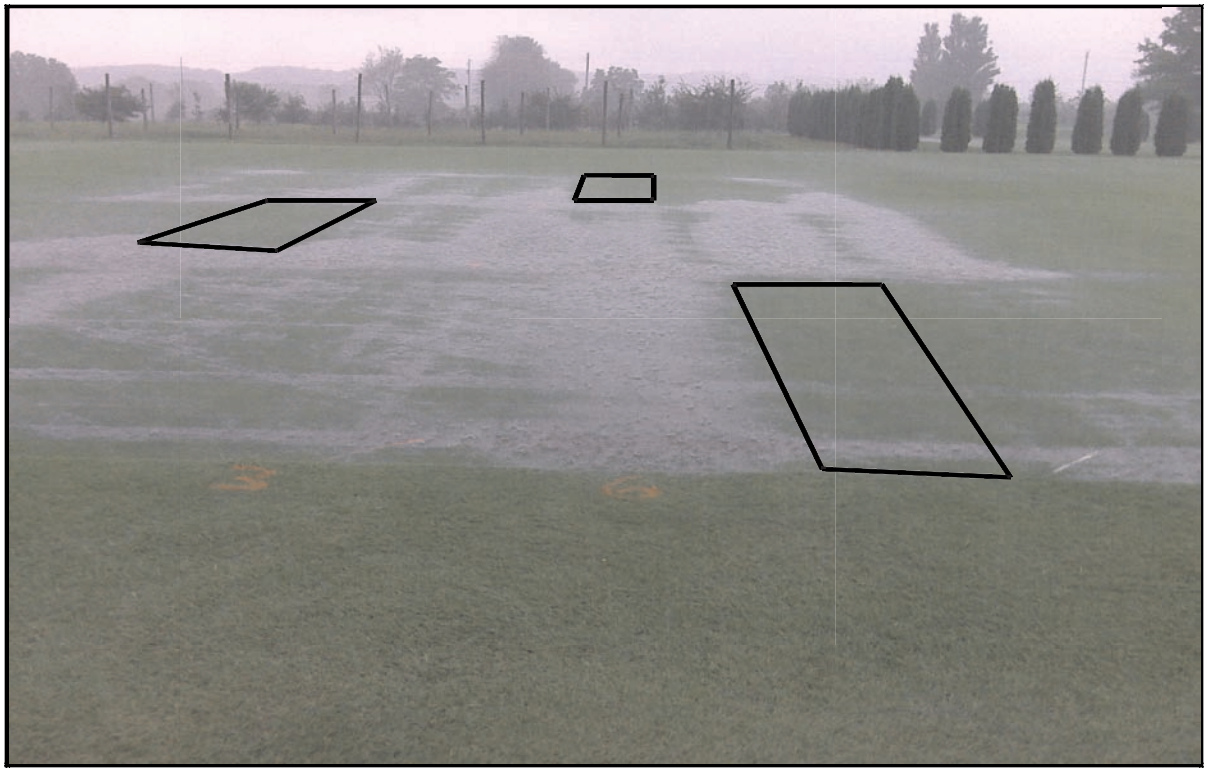

Fig. 4. Experimental area during an intense rain event in August of 2008. Three plots that did not receive rolling treatments and had more rapid water infiltration are highlighted.

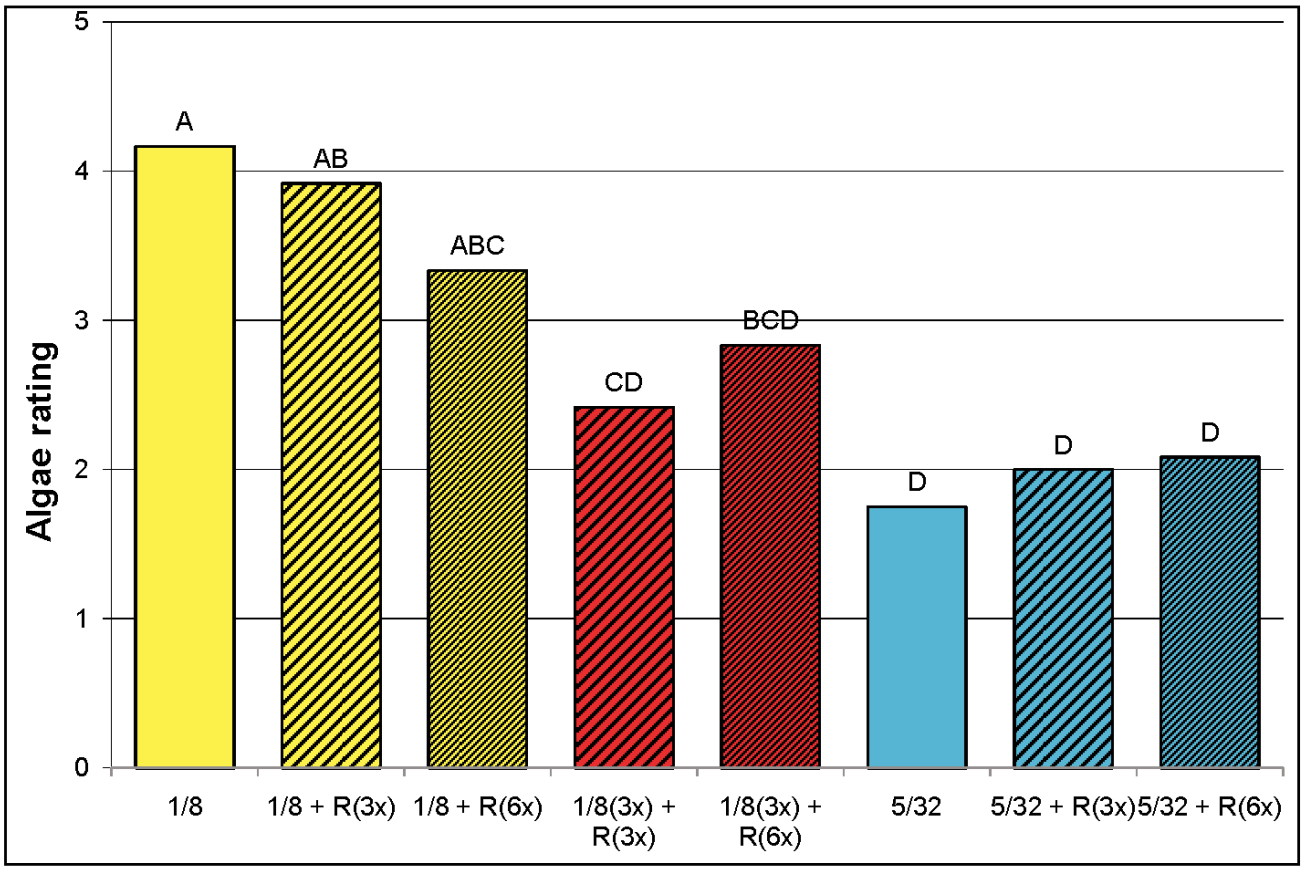

Fig. 5. Effect of mowing and rolling treatments on visual algae incidence, averaged across two evaluation dates in 2008. Bars sharing a letter are not significantly different according to Fisher's least significant difference test (α = 0.05).