



Lightweight rolling around the world

Lightweight rolling of greens has shown benefits in the U.S. and Sweden.



Perhaps the single largest change to putting green management in the past decade has been the increased frequency of lightweight rolling on the putting surface. Reasons for the uptick in popularity can be traced to lightweight rolling studies performed at Pennsylvania State University (2), North Carolina State University (3) and Michigan State University (5). Combined, these studies indicate that rolling at a frequency of three times per week can produce a noticeable increase in greens speed six days per week with no measurable increase in soil compaction (6). Additionally, the Michigan State study included unexpected results such as a decrease in dollar spot, localized dry spot, broadleaf weeds and brown patch when greens were rolled.

As weekly rolling became increasingly popular, most courses embraced mowing daily and rolling three days per week. Assuming that rolling

was here to stay, Michigan State researchers began investigating different mowing/rolling frequency programs in 2004. The mowing/rolling frequency programs that produced the most intriguing results were: alternating mowing and rolling on a daily basis, and rolling every day with mowing every other day.

Intrigued by results from Michigan State, I identified mowing/rolling research golf courses in Michigan, Sweden and Florida to test the programs on-site. This article shares results from those courses.

Treatments

In 2006 I asked Mike Morris, CGCS at Crystal Downs Country Club in Frankfort, Mich., if he would consider conducting a mowing/rolling frequency study at his golf course. Morris was an obvious choice because he and I have been co-instruct-



To accommodate turfgrass growth and golfers' expectations, innovative superintendents are rolling more and mowing less depending on the growing conditions, crew size and budget. The photo shows Crystal Downs CC, Frankfort, Mich. Photo by Mike Morris

Thomas A. Nikolai, Ph.D.

ing the “Taking Control of Greens Speed” seminar at the GCSAA Education Conference since 2003. Morris initiated his study on Aug. 9, 2006, and ran it for 11 days on an annual bluegrass (*Poa annua*)/creeping bentgrass (*Agrostis stolonifera* L.) nursery green. The green was maintained at a 0.135-inch (3.4-millimeter) mowing height with a Jacobsen walk-behind mower, and rolling was performed with a Tru-Turf roller. The Crystal Downs study included four treatments listed in Table 1. Morris obtained daily greens speed measurements from the plots with a Stimpmeter in a manner consistent with USGA recommendations (8).

Sweden

In 2007 I was invited to Sweden by the Swedish Golf Federation (SGF) to give a presentation on putting green management. The lightweight rolling research was the hit of the conference, which led agronomist Göran Hansson of the federation to inquire about performing similar studies in his country. Tru-Turf donated a roller, and Hansson set up a study on a green at his home course, Flommen Golf Course in Skanör, Sweden.

The treatments Hansson chose to investigate are listed in Table 2 and are variations on Morris’s treatments in Michigan. However, unlike Morris, Hansson was unable to roll greens on the weekend.

The study was initiated in May 2008 and concluded October 2009 on a red fescue (*Festuca rubra* L.)/*Poa annua* putting green. The green was maintained at a 0.157-inch (4-millimeter) height of cut, and greens speed measurements were obtained weekly with a Pelzometer. The plots were maintained by golf course superintendent Stephan Hylen and greens speed measurements were taken by Hansson.

Florida

Whenever cool-season turfgrass researchers present data to warm-season grass superintendents, there is an air of skepticism in the audience. In regard to my greens speed presentations, the No. 1 question from superintendents in southern climates has been, “How will these mowing/rolling frequency programs work on warm-season grasses?” The truth was no one knew the answer to that question because research was lacking.

Enter Bob Bittner, CGCS at The Club Pelican Bay in Naples, Fla., who offered his nursery green and the time of his crew and assistant superintendent Dan Cruse. As a result of our conversation, Bittner and Cruse performed a mowing/rolling frequency study on the nursery green at Pelican Bay. To initiate the study I instructed Cruse on

Average change in greens speed, Michigan

Treatment	Average change	Comments
1. Mowed daily, never rolled (check)	—	
2. Rolled daily; mowed every other day	+15 inches	On mowing days, the average green speed was 16 inches farther than check; on days the green was not mowed, the average was 13 inches farther than the check.
3. Daily alternate mowing and rolling	+4 inches	On mowing days, the average was 4 inches less than the check; on rolling days, the average was 9 inches farther than the check.
4. Rolled and mowed daily	+16 inches	

Table 1. Mowing/rolling data from a *Poa annua*/creeping bentgrass green at Crystal Downs Country Club, Frankfort, Mich. Data are the average change in greens speed compared to a check plot that was not rolled (treatment 1).



Agronomist Göran Hansson of the Swedish Golf Federation conducted a lightweight rolling study on his home course, Flommen GC in Skanör, Sweden, from May 2008 to October 2009. Photo courtesy of G. Hansson



Average change in greens speed, Skanör, Sweden

Treatment	2008	2009
1. Mowed daily; never rolled (check)	—	—
2. Rolled Monday-Friday; mowed daily	+15 inches	+18 inches
3. Rolled Monday-Friday; mowed Tuesday, Thursday, Saturday, Sunday	+8 inches	+18 inches

Table 2. Mowing/rolling frequency data from a red fescue/*Poa annua* green at Flommen Golf Club, Skanör, Sweden. Data are the average change in greens speed compared to a check plot that was not rolled (treatment 1).



Superintendent Bob Bittner (right) and assistant Dan Cruse of The Club Pelican Bay used their nursery green to dial in information for putting green mowing/rolling frequency on warm-season grass. Photos courtesy of B. Bittner

how to set up a statistically valid study with three treatments and three replications of each treatment. Cruse collected all the necessary data and sent it to me, and I ran the statistics.

The Pelican Bay mowing/rolling frequency greens speed study was initiated on Sept. 16, 2009, on a bermudagrass TifEagle nursery green. The study ran for approximately 10 continuous weeks with the final greens speed measurement obtained on Nov. 27, 2009. Encouraged by the results, Pelican Bay decided to run the study again from Jan. 31 to April 27, 2010. The three mowing/rolling frequency treatments included in the study are shown in Table 3.

All plots were mowed at 0.115-inch (2.9 millimeters), and rolling was performed with a Tru-Turf roller. Greens speed measurements were obtained with a Stimpmeter approximately five hours after plots were mowed or rolled. In 2009, a total of 12 greens speed measurements were obtained on days when treatments 2 and 3 were not mowed, and a total of 15 greens speed measurements were obtained on days treatments 2 and 3 were mowed. In 2010, a total of 10 greens speed measurements were obtained on days treatments 2 and 3 were not mowed, and a total of 13 greens speed measurements were obtained on days treatments 2 and 3 were mowed.

Results

Roll daily, mow every other day

The data from Crystal Downs CC, Flommen GC and The Club Pelican Bay are presented in Tables 1, 2 and 3, respectively. Data from Crystal Downs and Flommen are considered observations because the treatments were not replicated; that is, there was only one plot for each mowing/rolling frequency treatment. The project at Pelican Bay was designed as a statistically valid research experiment that allowed for statistical comparison of means.

At Crystal Downs CC there was only a 1-inch average difference between rolling and mowing daily (Table 1, treatment 2) and rolling daily and mowing every other day (Table 1, treatment 4). Rolling daily and mowing every other day is the exact opposite of the most common practice employed by superintendents, which is to mow daily and roll every other day. The results from Crystal Downs are especially intriguing because there was only a 3-inch difference in speed from days the plot was mowed and not mowed.

At Flommen GC, rolling daily and mowing every other day (Table 2, treatment 3) was tweaked to rolling weekdays (Monday-Friday) and mowing Tuesday, Thursday, Saturday and

Sunday, which resulted in an average increase in greens speed of 8 inches farther than the check plot in 2008 and 18 inches farther than the check plot in 2009. Unfortunately, the data from Flommen does not distinguish between days the treatment was mowed, rolled or both. However, it is interesting to note that rolling weekdays/mowing daily (Table 2, treatment 2) at Flommen resulted in a 7-inch longer ball roll in 2008 and no difference in ball roll in 2009, which is similar to the results obtained at Crystal Downs CC.

At The Club Pelican Bay, treatment 2 (Table 3) was rolling seven days per week and mowing Tuesday, Thursday, Saturday and Sunday. This scenario resulted in greens speeds 6 inches longer than the greens speed on the check plot on days the plots were not rolled in 2009 and 11 inches longer than the check in 2010. On days the treatment was rolled and mowed, greens speed increased 12 inches in 2009 and 14 inches in 2010.

Daily alternate mowing and rolling

Alternating mowing and rolling was tested at Crystal Downs CC and The Club Pelican Bay. At Crystal Downs, alternating rolling and mowing resulted in an average increase in greens speed of 4 inches. Interestingly, the average was obtained with an increase in greens speed of 9 inches on the days the treatment plot was rolled and a 4-inch decrease in greens speed on days the treatment plot was mowed.

At Pelican Bay, alternating rolling and mowing resulted in the same greens speed whether the plots were rolled or mowed in 2009. In 2010, there was only a 3-inch difference in greens speed between the days the plots were rolled and mowed.

Conclusions

Research has shown that golfers cannot determine differences in greens speed of 6 inches or less on side-by-side plots (4). Therefore, at each site, the treatments tested for rolling daily and mowing every other day (or less often) resulted in noticeable increases in greens speed compared to mowing daily. Additionally, data from Crystal Downs and Flommen in 2009 show no detectable differences in greens speed between rolling daily and mowing less often compared to daily rolling and mowing. (Note that daily rolling in Sweden was rolling Monday-Friday.) At Crystal Downs and The Club Pelican Bay, no noticeable differences in greens speed were found between mowing daily (treatment 1) and mowing and rolling on alternate days (treatment 3).

From a practical point of view, it is important to consider that the data from Michigan were col-

Average change in greens speed, Florida

Treatments	Average change in greens speed			
	When treatments 2 and 3 were rolled, not mowed		When treatments 2 and 3 were mowed	
	2009	2010	2009	2010
1. Mowed 6 days/week, never rolled (check)	—	— b	— b	— c
2. Rolled 7 days/week; not mowed Monday, Wednesday, Friday	+6 inches a	+12 inches a	+11 inches a	+14 inches a
3. Rolled, Tuesday, Thursday, Saturday; mowed Monday, Wednesday, Friday without being rolled	+2 inches a	+3 inches b	+2 inches b	+6 inches b

*Treatment means in columns followed by the same lowercase letter are not significantly different from one another.

Table 3. Mowing/rolling frequency data from a bermudagrass TifEagle green at The Club Pelican Bay, Naples, Fla. Data are the average change in greens speed compared to a check plot that was not rolled (treatment 1).



At the Club Pelican Bay, mowing and rolling data were collected from bermudagrass during a very cool winter.



The research says

→ Observations on the effects of mowing and rolling frequency on greens speed were made on golf courses in Michigan and Sweden, and a study was carried out in Florida.

→ Rolling daily and mowing every other day (or less often) noticeably increased greens speed compared to daily mowing.

→ In 2009, the courses in Michigan and Sweden found no detectable differences in greens speed between rolling daily and mowing less often and daily rolling and mowing.

→ The courses in Michigan and Florida found no noticeable change in greens speed between mowing daily and alternating daily mowing and rowing.

→ The observations in Michigan and Florida were taken when the grasses were growing at their slowest rate; results would have been different during peak growing season.

lected on *Poa annua* in August and the data from Naples, Fla., were collected on bermudagrass during a very cool winter. In other words, both sites ran their experiments during the time of year their respective turfgrass species were growing the slowest. Obviously, we would expect different results had the experiments been run during a time of year that each species was under the most favorable growing conditions.

Innovative superintendents are rolling their greens more and mowing them less when it is advantageous to do so. For example, this past summer most of the country was unseasonably hot with heavy sporadic rainfall. These weather conditions resulted in cool-season grasses needing more energy than they could produce, making it an ideal time to roll more (to keep the golfers happy) and mow less (to keep the turfgrass happy).

The impact of rolling/mowing frequency studies may best be summed up by comments from Hansson, who wrote:

"When Thomas Nikolai first came to Sweden in 2007 talking about rolling as a technology to get better greens speed and green quality, rollers were not very common in Sweden. [Golf courses that] had a roller used it now and again — but never in a program. Today, four years later, most golf clubs have a roller, and they use it as a tool in the daily management. The green quality has improved considerably, and today we have both faster and more even greens than before. Today rolling is a natural part of the Swedish greenkeeper's training, and many clubs are ... using alternating mowing and rolling on a daily basis."

The best way to find out which mowing/rolling program works for you is to take daily greens speed measurements from at least one green. If you have a target greens speed (a 1-foot range is best), you can modify your putting green mowing/rolling frequency to fit your season, budget and turfgrass health. For additional information on the observations and research presented in this article, compare other mowing/rolling frequency studies performed at various universities that have yielded similar results (1,7,9).

Acknowledgments

I would like to thank Tru-Turf for donating a roller to Göran Hansson for the Swedish trial. Thanks to everyone that collected data and took the time to share the information with our industry, and special thanks to Dan Cruse from The Club Pelican Bay for his commitment to this project. I also thank the Michigan Turfgrass Foundation for continuing support of this research.

Literature cited

1. Golembiewski, R., T. Blankenship and B. McDonald. 2011. Can annual bluegrass putting greens be healthy and fast? *USGA Green Section Record* 49(5):1-3.
2. Hamilton, G.W., Jr., D.W. Livingston and A.E. Grover. 1994. The effects of lightweight rolling on putting greens. *Science and Golf II*:425-230.
3. Hartwiger, C.E., C.H. Peacock, J.M. DiPaola et al. 2001. Impact of light-weight rolling on putting green performance. *Crop Science* 41(4):1179-1184.
4. Karcher, D., T.A. Nikolai and R. Calhoun. 2001. Golfer's perception of greens speeds vary. *Golf Course Management* 69(3):57-60.
5. Nikolai, T.A., P.E. Rieke, J.N. Rogers III and J.M. Vargas Jr. 2001. Turfgrass and soil responses to lightweight rolling on putting green root zone mixes. *International Turfgrass Society Research Journal* 9(2):604-609.
6. Nikolai, T.A. 2005. The superintendent's guide to controlling putting greens speed. John Wiley & Sons, Hoboken, N.J.
7. Richards, J., D. Karcher, T. Nikolai et al. 2009. Mowing height, mowing frequency, and rolling frequency affect putting greens speed. Arkansas Turfgrass Report 2008, Arkansas Agriculture Station Research Service 568:86-92.
8. USGA Green Section Staff. 1996. Stimpometer instruction booklet. USGA Golf House, Far Hills, N.J.
9. Zarco Pérez, P., and T.A. Nikolai. 2009. Optimización del rulado para la velocidad de greenes (Optimization of rolling for greens speed). *Greenkeepers Enero* 30:52-55.

GCM

Thomas A. Nikolai (nikolait@msu.edu) is the turfgrass academic specialist at Michigan State University. At GCSAA's 2012 Education Conference in Las Vegas, he will be co-teaching "Taking Control of Green Speed" with Mike Morris, CGCS, and "Turfgrass by the Numbers" with Roch Gaussoin, and he will be hosting the Turfgrass Talk Show.