

ADDRESSING CENTURY OLD CONCERNS REGARDING LIGHTWEIGHT GREENS ROLLING

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Akin to mowing, rolling is one of the oldest routine cultural practices utilized in the maintenance of golf course putting greens. In 1901 Walter Travis wrote, “From May until October each green should be rolled daily with a light roller, rather than once or twice a week with a heavy one” (14).

Greens keeper Horace G. Hutchinson undoubtedly agreed that weight was important as he wrote in 1906, “We used to roll them with iron rollers, blasting down the soil so that no grass could grow through it, no ball would stop on it, and no putting was possible on it. All putting was reduced to trickling, and the golfer who followed the gallant old maxim of “going for the back of the hole” would run nearly off the green unless he caught the back of the hole very fair and square indeed”. Since these faster greens were not desirable Hutchinson suggested “Frequent rolling with light rollers” which he defined as “a hundredweight to a hundredweight and a half” (7).

In 1921 Agronomists Piper and Oakley observed, “A heavy rolling in the spring is nearly always necessary. Thereafter rather frequent rollings are better than occasional heavy rollings”. They further hypothesized that “excess of rolling is practically impossible on sandy or sandy loam soils” (11).

Shortly thereafter, the practice of frequent rolling ceased attributed to turfgrass research showing a link between high levels of soil compaction and turf root growth. However, no studies were performed at that time regarding roller weight and/or frequency that correlated green rolling with compaction.

In the early 1990’s the practice of green rolling was resurrected, attributed to the demand for fast green speeds. However, frequency of use was still in question as superintendent Daugherty wrote in 1993, “For tournament preparations, the new rollers are outstanding; many superintendents report increased putting speeds of 2 feet or more. For regular play, roller use should be restricted to maybe once a week (or less)” (2).

Clearly, there was a need for research to investigate roller frequency the potential for above ground turfgrass problems associated with continual season-long turf rolling and the possibility that pathogens may invade crushed tissues, leading to diseased turf (1).

To address these concerns the United States Golf Association (USGA) funded a lightweight green rolling study at Michigan State University on greens constructed with three different root zone mixes. The root zone mixes were an 85% sand 15% mixture built to USGA specifications; an 80% sand 10% peat 10% soil mixture built with subsurface drainage; and a

native “push-up” sandy clay loam textured soil green. Each plot was mowed six days per week with a walk behind greens mower and half of the plots were rolled three days per week (M, W, and F) from May through September. The study was initiated in 1995 and concluded in the fall of 2000. The objectives of the study were to evaluate the effects of season long lightweight green rolling on green speed, turfgrass quality, and soil physical properties on three putting greens constructed by different methods.

Additionally, other turfgrass researchers initiated lightweight green rolling studies addressing the frequency of rolling as a way of maximizing its benefits (primarily increasing green speed) without introducing any negatives (decreases in turf quality attributed to an increase in compaction). The following article will consider similarities and apparent discrepancies in lightweight green rolling research in an effort to answer century old concerns regarding roller frequency and weight.

FREQUENCY AND COMPACTION

Over the past decade three studies have considered the impact of season-long green rolling on soil compaction. At Penn State University (PSU) both USGA and native soil plots were rolled 0, 1, and 2 times per week resulting in no change in turfgrass quality, soil bulk density, or water infiltration (4). Michigan State University (MSU) rolled USGA and native soil bentgrass greens 0 and 3 times per week resulting in no significant change in turf quality, soil compaction, or water infiltration (10). At North Carolina State University bentgrass greens were rolled 0, 1, 4, and 7 times per week. Once again, plots rolled once per week resulted in no reduction in turfgrass quality. However, rolling 4 and 7 times per week decreased turfgrass quality on both USGA and native soil greens (6). Furthermore, compaction increased on the native soil greens rolled 4 and 7 times per week during the first year of the study.

It is noteworthy that the decreases in quality attributed to lightweight rolling 4 and 7 times per week were not immediate. The reduction in turfgrass quality at a frequency of 7 days per week took three to four weeks to manifest.

GREEN SPEED

Most rolling studies have considered the immediate and residual effect rolling has on green speed. All have concluded rolling noticeably increases green speed on the day rolling is applied. The amount of increase ranged from day to day, attributed to other management or environmental factors, but in general rolled plots were approximately one foot faster than non-rolled plots on the day they were rolled.

The residual effect that rolling has on green speed is not as clear-cut. Several studies report a residual effect of up to 48 hours, while others report the increase lasts no more than one day. A thorough investigation of the research indicates that there are four factors that may account for this apparent discrepancy. These factors are statistical significance, roller weight, roller type, and roller frequency.

Statistical significance is the basis for the claim that the residual impact on green speed lasts up to 48 hours. These claims are scientifically valid and attest to the meticulousness of the researchers and the precision of the Stimpmeter. However, the 48 hour increases in speed are usually three inches or less (10). Golfer surveys indicate that most golfers could not detect differences in green speed of 6 inches or less (8). Thus, the 3-inch difference is valid scientific reporting, but from a real-world aspect the greens would be noticeably slower two days after rolling to the golfer.

Roller weight and type appear to be linked together. It would seem logical to assume heavier rolling machines would result in greater increases in green speed for a longer period of time. However, results from a study at MSU indicate roller type must be considered with roller weight. In the study, a triplex attachment roller (single roller per attachment) weighing approximately 1,300 pounds and a sidewinder roller (three rollers traversing the same area) weighing about 950 pounds were included in the study. Both increased green speed approximately 1 foot on the day they were applied compared to non-rolled plots. However, the day after rolling the triplex, rolled plots were approximately 3 inches faster than the check while the sidewinder rolled plots were approximately 6 inches faster than the check (10).

Let's further consider this 6-inch residual green speed the day after rolling. As previously mentioned, most golfers cannot detect a difference in green speed of 6 inches or less as measured on a Stimpmeter. Consequently, if a rolling treatment results in a 1 foot increase in green speed and only 6 inches of that are lost the next day, then the golfer would not be able to detect the difference in speed the day after rolling as compared to the day of rolling.

Roller frequency and duration (length of time adhering to the same roller schedule) apparently has an effect on residual green speed too. This is most apparent when comparing mowing height green speed studies performed at the University of Arizona (U of A) and MSU. Both universities researched the premise that it may be possible to raise mowing heights and with the aid of rolling retain green speeds identical to lower heights of cuts that are not rolled. The difference in mowing heights was identical (.03 inch), but the roller frequencies differed in that the U of A study rolled two times per week while the MSU study rolled three times per week.

Results of the U of A experiment suggest that non-rolled, low-cut turf is faster than the rolled, high-cut bentgrass (9). At MSU the non-rolled, low-cut turf plots were also initially quicker than the rolled high-cut plots. However, after two weeks of rolling the high-cut plots retained the same green speed as the non-rolled, low-cut turf on the day of and the day after rolling treatments were applied (10).

ADDITIONAL OBSERVATIONS

Golf course superintendents have been justifiably concerned that rolling may lead to diseased turf. Dollar spot is a turfgrass disease spread primarily by maintenance equipment that carries the mycelium and infected plant tissue from green to green (13). Given this mechanical form of spreading it is reasonable to assume rolling would increase the severity of this disease. However, dollar spot severity decreased on MSU research greens rolled three times per week for five straight years. It is hypothesized that these positive results were obtained because of the timing of the mowing and rolling.

Synonymous with most golf courses, the research greens were mowed at dawn and rolled within an hour after rolling. This timing is believed to be important because early a.m. mowing may exacerbate the release of guttation droplets due to turgor pressure that remains at that time of day. These guttation droplets are used as a nutrient supply by fungal pathogens. Rolling after an early a.m. mowing may disperse concentrated guttation water, thus reducing the severity of disease symptoms.

Debris (excess leaf tip clippings that miss the bucket) also adheres to the rollers and is transported back to the wash-pad. This debris is not only a possible nutrient source for the pathogens, but may also contain black cutworm eggs. In 1998, Dr. Potter from the University of Kentucky reported black cutworm moths lay nearly all their eggs on the tips of leaf blades and that many eggs survive passage through the mower blades and will later hatch (12). On a green rolling research site at MSU, bird activity highly coincided with numerous black cutworms being observed on the site. While no attempt was made to quantify the amount of cutworms on the site, significantly less bird beak intrusions were observed on greens that were rolled (10). Considering debris adheres to green rollers and is transported to the wash-pad, it is conceivable that rolling could have decreased the amount of cutworms per green by removing eggs with the excess debris.

Though not as clearly understood, other benefits of rolling on the MSU plots included reductions in moss (primarily on the push-up greens), reductions in broadleaf weed growth, and reductions in brown patch (only observed one season during the duration of the study).

The only negative observed on plots rolled (under four times per week) compared to non-rolled plots is on one occasion MSU reported rolled plots displayed more *Microdochium* patch symptoms in the late spring than non-rolled plots (10).

CONCLUSIONS

After 100 years of dispute, researchers are just beginning to give superintendents answers regarding the frequency and weight for a safe season-long green rolling program. From the aforementioned results it seems prudent to initiate a season-long green rolling program at a frequency of no more than three times per week to avoid decreases in turfgrass quality attributed to mechanical stress and possibly soil compaction.

Additionally, since higher rolling frequencies took several weeks to manifest, reductions in turfgrass quality it is probably safe to roll at durations of more than three times per week for short durations.

Roller weight is dependent upon the roller type, but results indicate it is safe to operate a sidewinder roller (with three rollers) weighing up to 960 pounds three times per week. Triplex attachment rollers with one roller per attachment (there are currently some with three smaller rollers per attachment) can probably weigh more because there is less weight being applied on each roller. This may be the reason there was less residual green speed with the triplex attachment rollers. Unfortunately, I found no evidence of studies that utilized vibrating rollers.

With a three times per week frequency the superintendent can expect to achieve up to six days of increased green speeds, though this may depend upon the roller type and the number of rollers on the unit traversing the same area. This frequency may also allow the superintendent the flexibility of raising the cutting height up to .03 inches during the heat stress months and retain the same green speeds as the non-rolled shorter height of cut.

The research is clear that rolling after an early a.m. mowing decreases dollar spot severity and may pick-up excess turfgrass leaf litter resulting in fewer black cutworms. If this research can be collaborated further, the cultural practice of green rolling may prove to be more important than just a green speed accelerator.

I will close with what may be the prophetic insights of W.S Harban from 1922. “To sum up, I do not believe in rolling as a mere fad, but do think there are times when it is indispensable to make, keep, and protect a proper turf and surface on greens” and “I can not conceive how a perfect putting surface can be developed or maintained without rolling”.

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