Factors Affecting Green Speed

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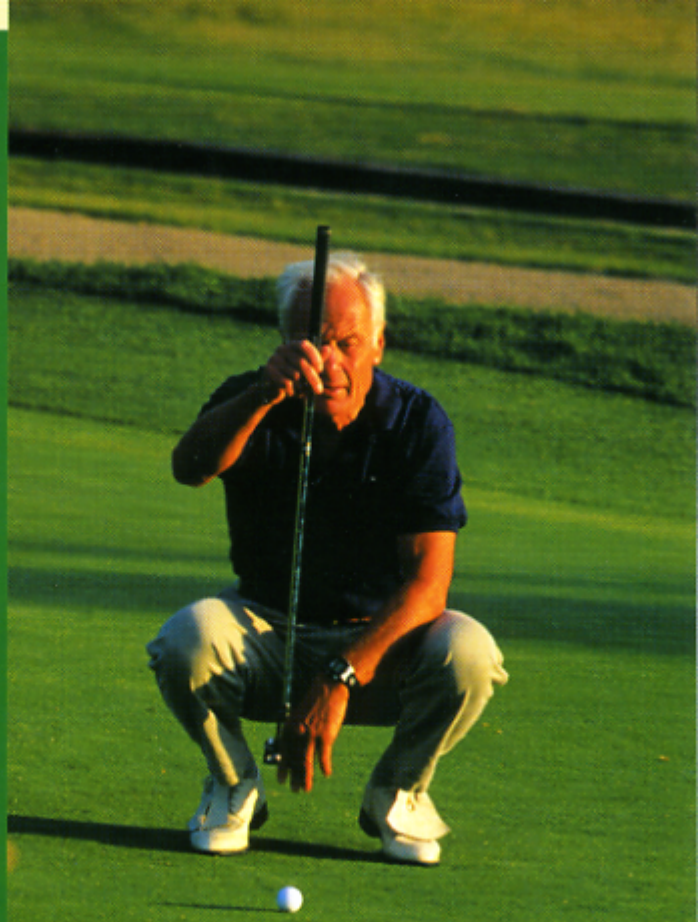

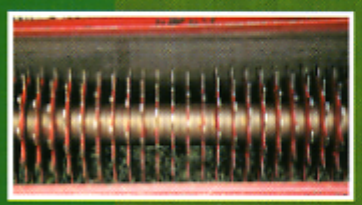

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Introduction

In golf, successfully managed greens are often associated with speed. Speed alone, however, does not symbolize a good or healthy golf green. The ultimate fast green would be as hard as a rock, smooth as glass, and void of grass. No golfer would want to play on this type of surface. The green would have no "feel" or "touch" and making a putt would be a function of luck.

Several components are essential to an ideal putting surface and influence green speed. Resiliency, uniformity, smoothness, and firmness contribute to overall green speed. Resiliency is the capacity of the turf to absorb shock and affects the ability of a putting green to hold a properly struck golf shot.

Uniformity implies that each green on a course and all areas of each green putt the same. Nothing is more discouraging than playing a round of golf on putting greens of variable speed. Variation in location, construction, microenvironment, and grass species makes perfect uniformity among greens nearly impossible. Even uniformity within a green is difficult to achieve. This variability is often the case when dealing with complex biological systems that are not easily separated into simple components.

The second major component affecting green speed is smoothness. A smooth surface generates less friction, and thus, causes less resistance to ball roll. On a rough green, the friction created quickly reduces speed.

Firmness refers to the hardness of the green. The firmer the surface, the faster the green speed. Difficulty arises in maintaining greens firm enough to promote speed, yet soft enough to accept a well-struck golf shot. A small amount of mat or thatch is desirable since it provides some resiliency and cushion to golf balls struck onto the green; however, too much thatch can be detrimental to putting green speed and smoothness.

A Stimpmeter measures ball roll distance (BRD) and is used to quantify green speed. Although the Stimpmeter is a much maligned device, used properly it can be a helpful tool in keeping green speeds consistant. The United States Golf Association (USGA) classification of green speed is based on Stimpmeter measurements (Table 1).

Mowing Height

Ball roll increases when the mowing height is reduced (Fig. 1). Lower mowing heights tend to promote smoother, more uniform surfaces; however, reducing the mowing height below the optimum height for a species or variety can result in a loss of shoot density, root growth and production, decreased carbohydrate synthesis, and

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increased susceptibility to environmental and biotic stresses. All of which contribute to reduced turfgrass wear tolerance.

Mowing heights should always be within the tolerance range of the variety being maintained. When reducing mowing height, the height of cut should be gradually lowered over time. A rapid reduction in mowing height often results in scalping.

Over the last 40 years, mowing heights for putting greens have decreased from 0.25 inches to as low as 0.10 inches. An acceptable mowing height for a putting green varies and is influenced by a number of factors including: (1) golfer expectation, (2) amount of play, (3) budget, (4) climate, (5) microclimates, and (6) turfgrass species or variety. Generally, the acceptable range for cutting height for creeping bentgrass and mixtures of creeping bentgrass and annual bluegrass is 5/32 (0.156) to 3/16 (0.187) of an inch.

Mowing Frequency

Frequent mowing promotes high shoot density and vertical leaf growth that results in a smooth putting surface. Research has shown that changes in mowing frequency can result in a temporary loss of green speed. Interruptions in mowing frequency are usually caused by wet conditions that limit mowing in poorly drained areas. Thus, adequate drainage can indirectly influence green speed by minimizing disruptions in mowing frequencies.

Multiple mowings per day, such as double cutting, can significantly increase ball speed (Fig. 2). Double cutting normally consists of mowing the green in one direction, then mowing again perpendicular to the first mowing. In our studies, double cutting usually increased green speed compared to a single cutting. When double cutting was used in conjunction with other practices such as grooming, significant increases in ball roll occurred (Fig. 2); however, daily double cutting can result in reduced stress tolerance and significant wear damage.

Table 1 USGA classification of green speed.

	Membership Play	Tournament Play
Fast	> 8'6"	> 9'6"
Medium	7'6"	8'6"
Slow	< 7'6"	< 8'6"

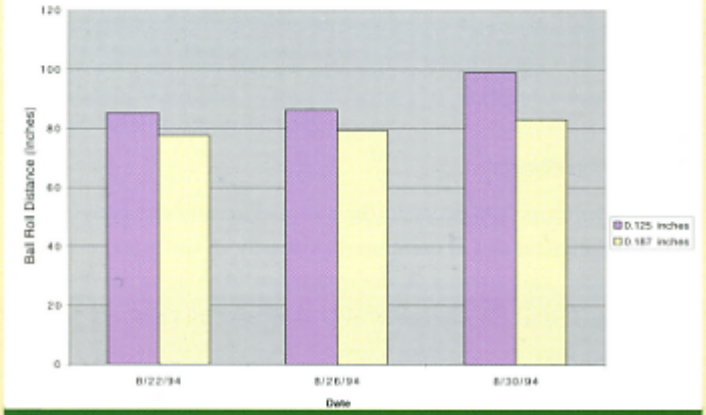


Fig. 1 Cutting height effects on ball roll.

Two different heights were evaluated on "Penncross" creeping bentgrass turf maintained under putting green management conditions. Stimpmeter measurements were taken within 1 hour after mowing (Danneberger et al., 1988).

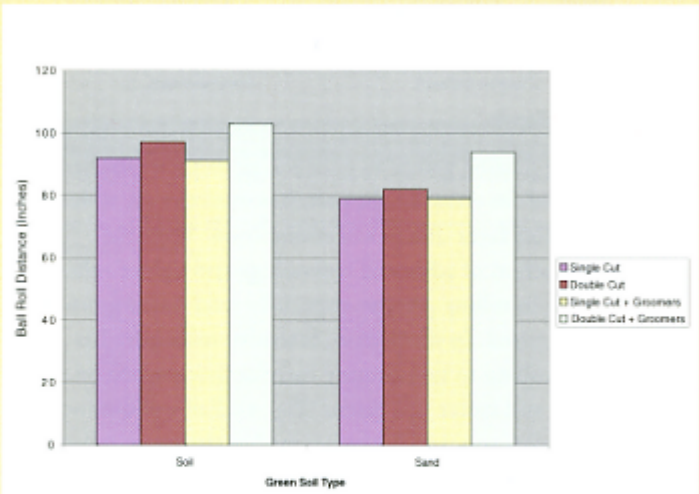


Fig. 2 The effect of double cutting and groomers on ball roll.

Single and double cutting alone or in combination with groomers were evaluated for ball roll on a "Penncross" creeping bentgrass turf maintained under putting green conditions. Stimpmeter measurements were taken within 1 hour after mowing (Danneberger et al., 1988).

Frequent mowing promotes high shoot density and vertical leaf growth that results in a smooth putting surface.

Grain Control

Grain refers to a condition when turfgrass plants lie horizontally in one or more directions. The result is a non-uniform green with nonuniform putting speed. Putting "with the grain" results in significantly longer ball rolls than putting "against the grain." In our studies, we have found as much as a 24 to 30 inch difference in ball roll when putting with, versus against, the grain. However, the closer a green is mown, the less effect grain has on the roll of the ball.

To minimize grain, cultural methods that promote or encourage upright growth should be practiced. These practices include:

- *Mowing in different directions from day to day.* For example, if greens are mowed east and west on Monday, on Tuesday they should be mowed north and south.
- *Verticutting.* Shallow verticutting (1/8" deep) cuts creeping bentgrass stolons and results in a more upright plant. In addition, verticutting removes excessive tissue. During active plant growth, a light verticutting may be done weekly.
- *Brushing.* Brushing lifts turfgrass plants before they are mowed. This promotes a more upright and less leafy putting surface. Avoid brushing during periods of stress.
- *Grooming.* Grooming (1/16" deep) works similar to light verticutting although groomers have more closely spaced blades. Groomers are available for most greensmowers.
- *Using grooved rollers.* Grooved or Wiley rollers stand turfgrass plants up before being clipped by the reel. Grooved rollers should only be used during periods of minimal stress. During the summer when environmental stress occurs, switch to solid rollers to reduce the additional mechanical stress induced by grooved rollers.

Rolling putting greens to enhance green speed has been practiced for years.

Fertility

Fertilization, primarily nitrogen application, influences green speed. When nitrogen is reduced, leaf blades become thinner and less succulent, resulting in a less dense turf stand. The loss in density reduces resistance from turfgrass plants, and theoretically, should increase green speed. In our research, we found that nitrogen levels did not significantly affect ball speed under normal nitrogen regimes. When nitrogen levels were compared to controls receiving no additional nitrogen, significant reduction in ball roll was observed (Fig. 3) in the treatment with no nitrogen. The benefits of increased green speed due to a deficient nitrogen fertility program need to be weighed against the reduced density of the turf that will become more susceptible to annual bluegrass and moss invasion.

Thatch

Thatch occurs between the soil surface and the green vegetation and is composed primarily of turfgrass roots, stems, and crowns. A slight amount of thatch provides a "mat" that improves the wear tolerance of a putting green, and thus, is desirable. Thatch also adds resiliency to the turf and provides a cushion for golf shots. The result is increased holding capacity. Excessive thatch, however, can negate management practices intended to increase ball roll. In our studies comparing mowing and grooming practices on thatchy turf, we found that increased thatch tended to (1) minimize ball roll, and (2) reduce the effectiveness of management practices targeted at increasing speed. Today's newer creeping bentgrass varieties tend to have more mat thatch to be managed.

Rolling

Rolling putting greens to enhance green speed has been practiced for years. In the past, however, the use of heavy rollers lost favor due to soil compaction. With the introduction of advanced technology and lighter rollers, interest in rolling greens—especially sand-based greens—has increased. In short-term, intensive-rolling studies, we found rolling to significantly increase green speed on both USGA and native soil greens (Fig. 4). Ball roll distance on rolled plots was 5 to 11 inches farther than non-rolled plots on a USGA sand green. As the study progressed, a general increase in putting green speed was observed. On a native soil green, roll was also greater for the rolled treatment. Ball roll was 5 to 13 inches farther on the rolled plots. However, on the native soil green, only 3 of 7 Stimpmeter readings were significant ($P = 0.05$). On greens constructed to USGA guidelines, 6 of 7 Stimpmeter readings were significant.

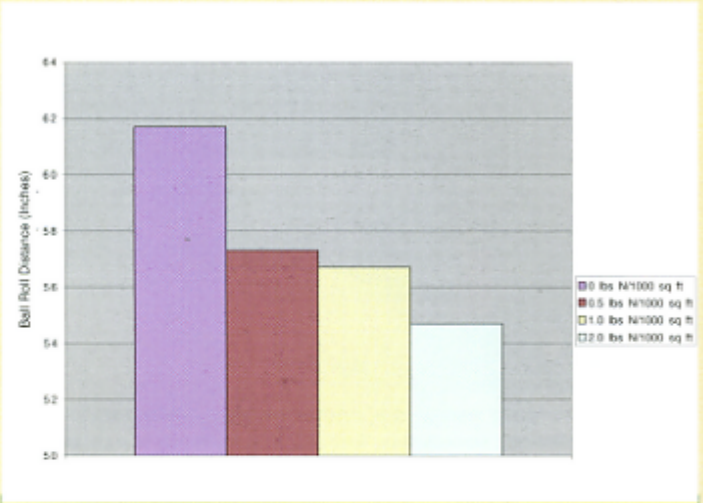


Fig. 3 Nitrogen effects on ball roll.

Nitrogen was applied at the given rate on a monthly basis. Treatments were evaluated on a "Penncross" creeping bentgrass turf maintained under putting green conditions (Danneberger et al., 1986).

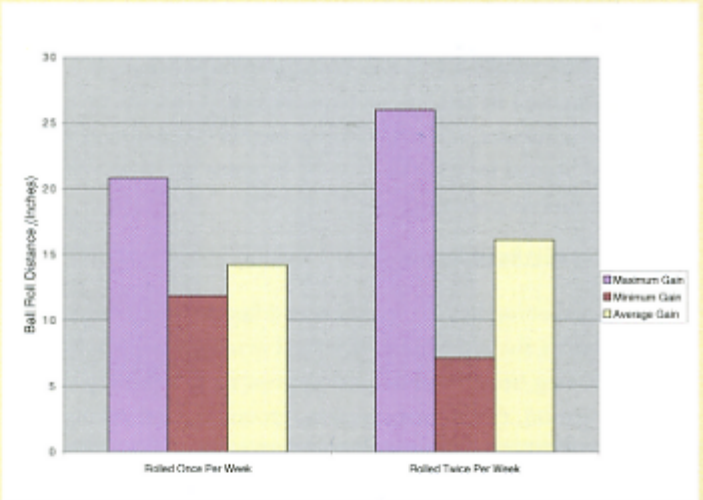
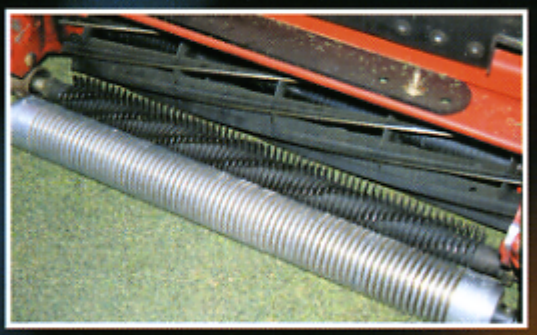
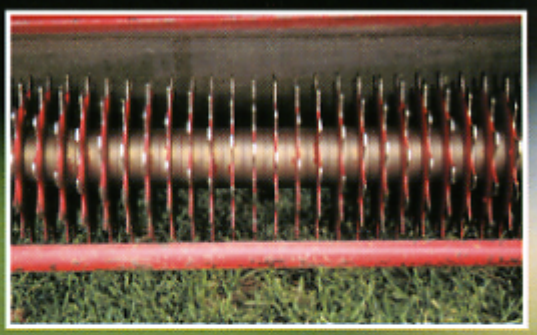


Fig. 4 The effect of lightweight rolling on green speed.

A mixture of "Penncross" creeping bentgrass and Poa annua maintained as a putting green was rolled once or twice a week with a Smooth Roll roller. Rolling occurred for 13 weeks, and daily treatment means were averaged for that period (Hamilton et al., 1994).



Grooming improves the quality of cut.



Verticutting reduces horizontal growth.

Increasing green speed with successive rollings was not observed on the soil green. Weather may account for some of the variation (conditions ranged from hot and humid to cold and dry). Comparison of Stimpmeter readings of the rolled plots versus control plots immediately preceding the rolling treatment revealed no difference in green speed on both the USGA and native soil greens. From these data, it appears the effect of rolling on green speed is short lived (less than 24 hours). Infrequent rolling (once or twice a week) will enhance ball roll on the days of rolling with little affect on soil compaction (Fig. 4).

We also conducted a study to measure the longevity of the increase in ball roll using various rolling devices. The increase lasted at least 8 hours. Further studies revealed the increase in ball roll was maintained for 48 hours after rolling (Fig. 5). The 48-hour duration is longer than previously reported. However, the second study was done in the fall when turfgrass growth was slow and few clippings were removed. This lack of growth may have been a major factor in the sustained ball roll. Thus, seasonal changes in turfgrass growth influence the effect of rolling. During periods of active turfgrass growth, the effects of rolling are short term; but during periods of minimal growth, rolling effects can last much longer. As in the previous study, no difference in water infiltration was detected. The frequent use of rollers (up to twice weekly) resulted in no apparent wear damage during this study.

Golf Shoe Tread Type

New golf shoe treads and spikes are being developed to minimize the damage to putting green surfaces. Changes in spike design and materials have significantly increased the number of tread types that are commercially available.

Conventional 8-mm metal spikes have been banned from many golf courses because of their effect on putting green quality. Metal spikes, or any spike that causes plant tissue damage, can cause significant turf wear. Spikes that lift up turf plants or create depressions will affect green speed (Fig. 6).

Treads and spikes also respond differently as surface characteristics change. Some spikes are good for uniform surfaces where thatch is present, while other types of spikes are good for firm greens with high sand content rootzones. Research and on-course spike evaluations should be part of any shoe tread control policy.

Many turfgrass management practices such as topdressing influence the uniformity, smoothness, firmness, and resiliency of a putting green.

Summary of Management Practices That Influence Green Speed

Many turfgrass management practices influence the uniformity, smoothness, firmness, and resiliency of a putting green. The premise of this report is the effect of management on ball roll. Management practices are influenced by changes in temperature, humidity, light, and biotic stresses. In turn, all these factors can influence ball roll. Actual increase or decrease in green speed may vary on conditions present.

Conclusion

Maintaining healthy turfgrass and fast putting greens requires the integration of several management practices. Mowing height and frequency, grass type, fertilization, irrigation, thatch management, grooming, and rolling can all contribute to putting green speed. The effects of many of these practices are interrelated and are sometimes dependent on other external factors. In addition, some practices can effect the turf stand. All these factors need to be considered to maintain a healthy putting green with adequate speed.

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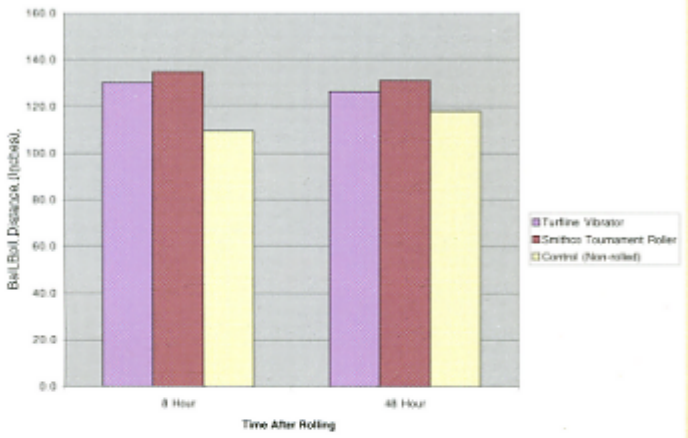

Fig. 5 The effect of rolling and time on green speed.

A comparison between two rollers regarding ball roll was conducted on a "Penncross" creeping bentgrass turf. The study was conducted during the autumn. Greensrolling was conducted twice weekly between October 10 and November 7, 1994. Stimpmeter measurements were taken periodically. (Danneberger et al., 1994)

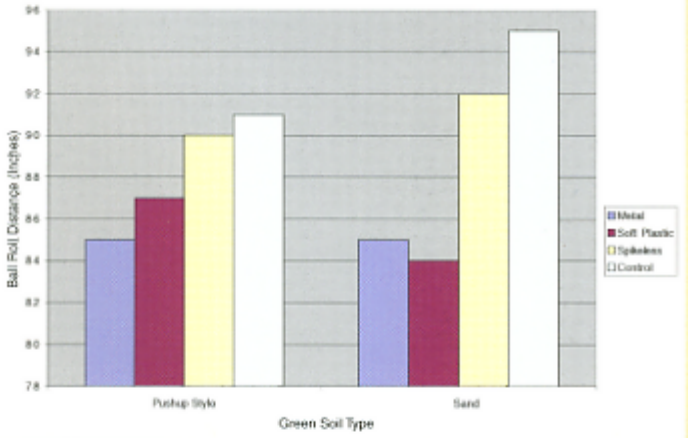

Fig. 6 The effect of shoe tread type on green speed.

Traffic treatments were applied to a mixture of "Penncross" creeping bentgrass and Poa annua maintained under putting green conditions. Traffic was applied for 12 weeks and totaled 1200 traverses (Hamilton et al., 1998).

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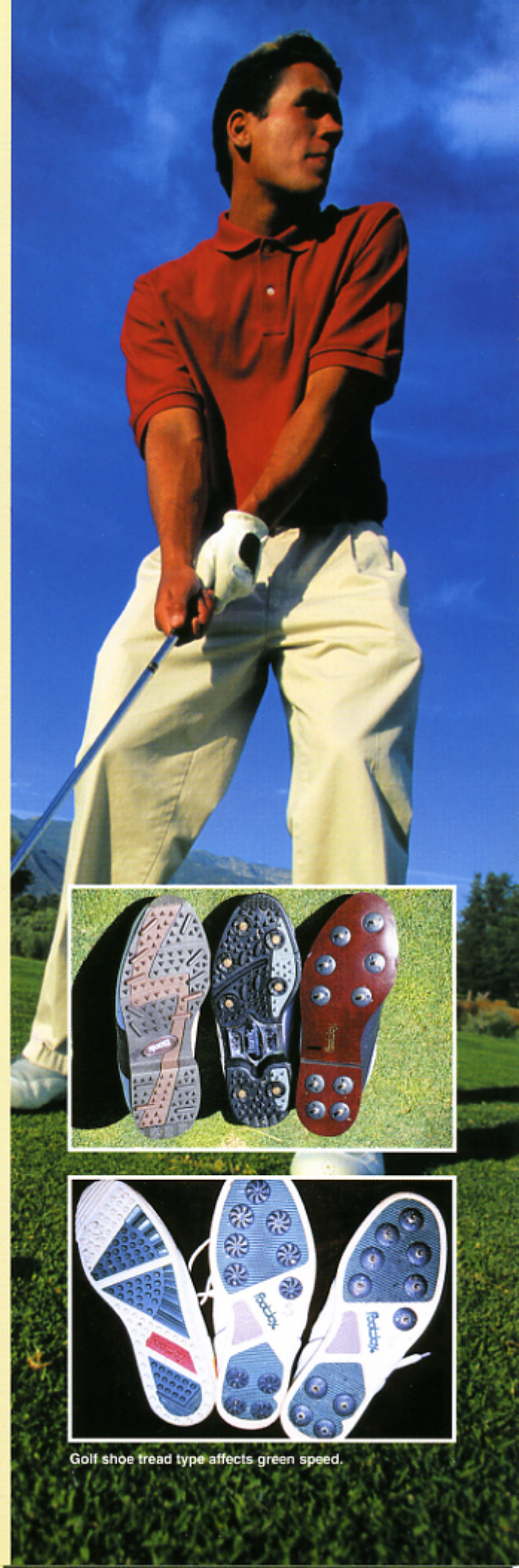

Golf shoe tread type affects green speed.

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