FACTORS INFLUENCING THE SPEED OF PUTTING SURFACES

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The "speed" of the putting surface is one of the most important factors influencing the playing quality of golf greens. On a slow surface that five foot downhill putt may look relatively easy, but on a fast putting surface misjudgment of the line can easily mean that the ball finishes four feet past the hole. Faster greens undoubtedly increase the challenge for the golfer and do help identify the better players. As such, faster greens should be an objective in turf management but not at any price. Too often pressure is put on greenkeeping staff to reduce cutting height in the quest for faster greens when turf conditions are not suitable for closer mowing.

In this article I would like to consider some of the factors that influence green speed in the light of research results from around the world. If we can identify the main turf characteristics controlling the speed of putting surfaces we can use this information in our management strategies without the recourse to substantial reductions in cutting height which, in the long term, will do far more harm than good.

MEASUREMENT OF GREEN SPEED

Several methods have been used to measure green speed including pendulum arrangements, in which an arm is released from a fixed height so that it strikes the ball in a similar manner to the golfer's putter, and also a variety of ramps. Usually the distance rolled is measured. The international "standard" however has become the Stimpmeter. Originally developed in the 1930's as a wooded ramp by E.S. Stimpson, the current version consists of an aluminium bar 0.91m long with a 145° V-shaped groove extending its entire length. It has a ball-release notch 0.76 m from the tapered end which rests on the ground. In use, the ball is placed in this notch and the angle of the Stimpmeter is gradually increased until the ball starts to roll. The ball-release notch is designed so that the ball will always be released when the Stimpmeter is raised to an angle of 20° to the horizontal.

To use the Stimpmeter it is best to find as flat an area near to the centre of the green as possible then to roll at least three balls in one direction followed by the same number of balls in the opposing direction. If the green is flat you can calculate the green speed from the average distance travelled in each direction. If however the green is sloping and downslope reading is more than about a third higher than the upslope value, use of a straightforward average of the upslope and downslope readings will exaggerate green speed. To compensate for the effects of slope, green speed can be calculated as:
Green speed = 2 x Upslope reading x Downslope reading Upslope reading + Downslope reading

FACTORS INFLUENCING GREEN SPEED

■ **Grass type** There is work from the United States to show differences in green speed in relation to species and cultivar selection and in work at the STRI we have found similar effects. Tests, averaged over five dates, indicated that ball roll distance ranged from 1.57 m for annual meadow-grass to 1.96 m for slender creeping red fescue (Fig 1). Chewings fescue, which also has fine needle-like leaves, also gave high values of ball roll while browntop and highland bent gave intermediate values.

■ **Rootzone composition** Rootzone composition has little direct effect on green speed and work on a trial at Bingley with different rootzone mixtures showed no significant effect of rootzone composition except during wet conditions. In wet weather distance rolled on those mixes with the highest content of soil (50% soil: 50% sand) was 10-15% lower than on mixtures with 95% sand or more, mainly because of the slow clearance of surface water.

The indirect effects of rootzone composition may be more significant. There is a better chance of maintaining a fine bent/fescue sward on for example a links course than on a heavy clay soil which is likely to become dominated by annual meadow-grass. The difference in grass type associated with the contrasting rootzone materials may well have implications on green speeds that can be achieved.

■ **Fertiliser input** Succulent growth associated with high nutrient levels will inevitably slow down a golf hall. On an STRI trial with topsoil, USGA and pure sand rootzones, ball roll in July 1990 for example decreased from 1.62 m to 1.27 m on the topsoil area as nitrogen application increased from 35 to 635 kg/ha per year. On the pure sand rootzone the roll length decreased from 1.82m to 1.33m as the nitrogen input changed from 35 to 410 kg/ha per year, but there was a slight increase in distance rolled at higher nitrogen rates, possibly because the turf was weakened at these very high rates of fertiliser application.

The effect of other nutrients are likely to be smaller and are less well documented. However in the same trial described above we found some reduction in green speed on sand constructions as phosphate levels

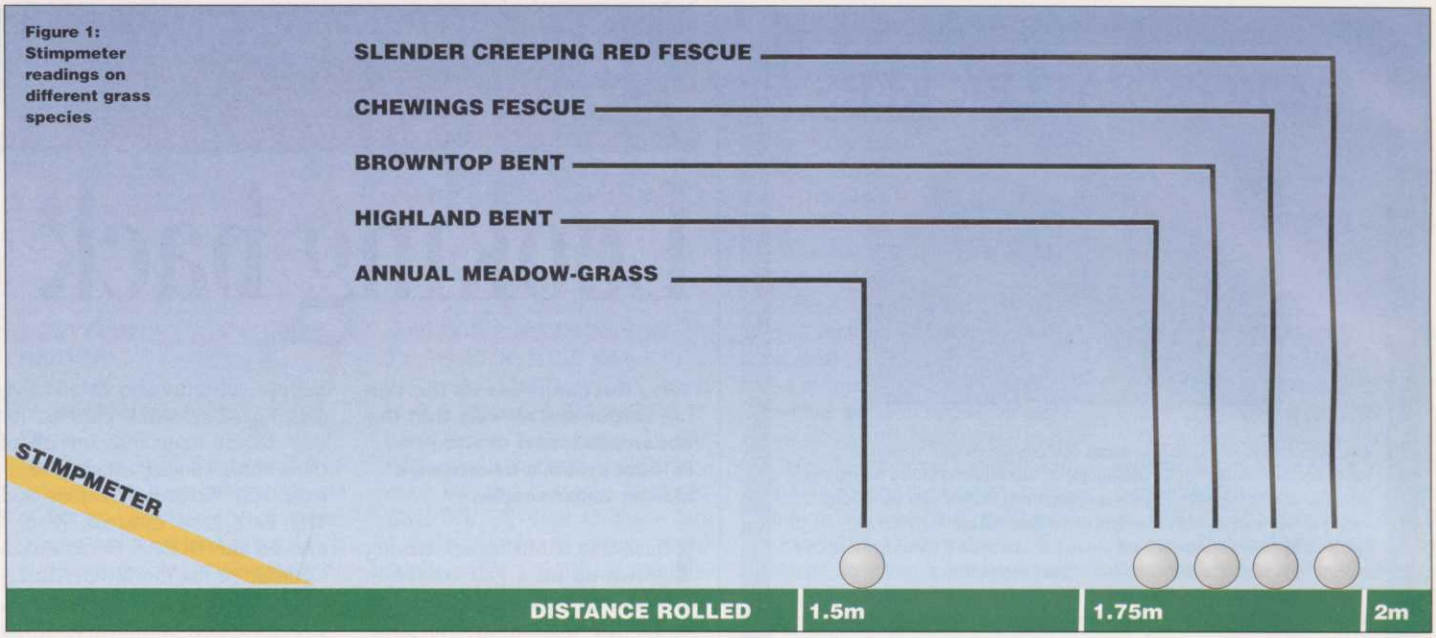

Figure 1: Stimpmeter readings on different grass species

increased from zero to 50 kg/ha per year but differences were only statistically significant when nitrogen levels were more than 200 kg/ha per year This effect did not occur on the topsoil or USGA constructions and almost certainly reflects less vigorous grass growth on the pure sand rootzone where phosphate had not been applied.

■ **Effects of cutting height** It is inevitable that ball roll should increase as the turf is cut more tightly, but very little work on the effects of cutting height on ball roll has been published in the United Kingdom, so I have to refer to American studies to assess the magnitude of the effect. Work from the New Jersey Agricultural Experimental Station and the USGA showed that reducing cutting height from a quarter of an inch. (6.4 mm) to three sixteenths of an inch. (4.8 mm) increased distance rolled by 13% for upslope putts and a massive 57% for downslope putts. Their results also showed that ball roll measured in the direction of cutting was between 7-15% greater than roll length against the direction of cut.

Research from Penn State University published a year later showed that mowing at three thirty seconds of an inch (2.4 mm) increased distance rolled by about one third compared with mowing at three sixteenths of an inch 4.8mm). They also found that mowing seven times per week, instead of thrice weekly, increased distance rolled by about 15%.

■ **Effect of other maintenance practices** There appears to be very little published work on the effects of other management practices on green speed. A recent trial at Bingley showed that although variations of irrigation rate from up to 40% above and below the theoretical evapotranspiration demand had major effects on hardness and ball impact properties, the effects on ball roll were small.

American work from the University of Rhode Island in 1981 showed some differences associated with varying top dressing programmes and for example turf receiving a sand-soil mix based on loamy, coarse sand every four weeks had significantly lower green speeds than turf receiving twice yearly top dressing treatments.

Light rolling can also increase green speed without the need to reduce cutting height and many tournaments now have rolling as part of the preparation programme e.g. the use of a Turf Iron. Work from Penn State University published in 1994 showed that light-weight rolling increased Stimpmeter readings by an average of 38 cm. The effect was short-lived (less than 24 hours) and the amount of thatch present may have an effect on how much green speed is increased. The results from Penn State showed no significant effects on infiltration rates or bulk density but this perhaps needs to be examined over a wider range of soil types and in studies of longer duration than their 95 day project.

There appears to be very little work on the effects of mechanical treatments such as verticutting and scarifying on green speed. This is perhaps surprising in the light of the fact that thatch accumulation is often listed as one of the main factors responsible for slow green speeds.

KEEPING THE GREENS UP TO SPEED

In a recent study – *Greenkeeper International* March 1997 – we concluded that Stimpmeter values between 1.6 m and 2.8 m were normal for the United Kingdom and that values below 1.5 m were too slow. A practical upper limit of 3.0 m was suggested because it is felt that with current technology and grass types available in this country sustaining ball roll values above 3 m would have long term consequences on the quality of the putting surface.

Nevertheless it should be an objective to achieve firm, fast putting surfaces and the research summarised in this paper suggests that there are a number of ways to accomplish this without recourse to major reductions in cutting height.

Firstly ensure that greens are not over-fertilised. For the majority of soil dominated greens around 100-200 kg/ha of nitrogen are needed on an annual basis to sustain reasonable growth and for sand dominated rootzones this figure rises to about 250 kg/ha of nitrogen. For phosphate and potassium levels the key is to keep values on the low side.

Secondly, do not over-water. In hot, dry weather around 20-25 mm of water will be required to replace evapotranspiration losses. In cooler conditions this figure will fall substantially and allowance must also be made for natural rainfall. If there are any localised dry areas it is better to rely on hand watering, selective spiking and the use of wetting agents, rather than risk over watering the entire green.

Finally, although there is perhaps little research evidence on this point it is essential to control thatch development. Moderation of fertiliser and irrigation inputs discussed above will certainly help in this respect but a good aeration programme and regular grooming and verticutting will help deal with procumbent, matted growth.

Measurement of green speed on a rootzone trial using an inclined ramp