



Getting Back to the Cutting Edge

Former greenkeeper and current lecturer, Jonathan Knowles, raises an old question: Is greenkeeping horticulture, agriculture or ecology?

Is greenkeeping horticulture, agriculture or ecology? Not my question, but a consideration that was raised around 20 years ago. It was suggested in a paper at the Proceedings of the World Scientific Congress of Golf 1990 that greenkeeping management has much in common with functional approach of ecology.

It's an interesting point isn't it? Canaway (1990), additionally offered a succinct golf greenkeeping management plan that centred on playing quality. The playing quality was defined as a study of the ball roll, ball impact behaviour (spin),

and green hardness.

Not long after, Canaway & Baker (1992) tested five common turfgrass species and tested which grasses provided the 'fastest' paced greens. A sward of *Festuca rubra* ssp. *Litoralis* was the fastest surface, while *Poa annua* consistently was the slowest in the trials.

A few years later, a large study was carried out (Baker et al., 1995); in part they investigated what grass species inhabit UK golf greens. More than half the greens were dominated by *P. annua*. The *Festuca* spp. was found on the Links and Heathland. *Agrostis* spp. had around a third coverage on more than half the greens. Young estab-

lishing greens were also included, and this, for me, is where the study is very interesting. The largest proportion of *Festuca* spp. was found in greens less than 5 years old, and the dominance diminished over the age of the greens with the ingress of *P. annua*. Moreover, a later study (Hagley et al., 2002) found that older greens greater than 70 years were populated with the perennial *P. annua* var. *reptans*.

I believe most greenkeepers will agree and will have experience in seeing a newly established green whether turf or seeded go from high a content of *Festuca* spp. to an apparently very low representation. Why is there a diminishing of the



Festuca over the time, while weeds ingress? Should this be a question of greenkeeping practices and is this related to a holistic management principle, as suggested?

While I accept that greenkeeping and the condition of a golf green is subject to many, many variables, the aims of my research was to evaluate whether cutting heights can have a negative effect on the sward, viz. encouraging *P.annua*, disease, and slow putting speeds etc.

In the research, more than two-thousand grass identifications were made across twelve different golf courses of England and Scotland. An understanding of the mowing practices was needed from each site, this involved looking at the bench setting and the effective height of cut.

The bench setting is the set up by adjustment of the mowers rollers to the bottom blade and the effective height cut is simply the height at which the grass stands following a mow a TORO Turf Evaluator was used for this, see Plate 1.

It was then important to compare and test the two methods, especially as they were found to be different. The effective height of cut was generally greater by 1 mm. How is this important? Well, we all read texts and research on recommended

heights of cut for the golf green. However, it is not usual for authors to state whether it is an effective height or a bench setting measurement. If it is a bench setting being recommended then the variables of soil moisture content, grass coverage, grass type, and machine type/weight need to be equated so that the resulting effective height is optimum for health and play.

The species composition of the green was then measured using an Optical Point Quadrat, with the species being recorded at a random hundred per green, see Plate 2. This also allowed an opportunity to delve into the head greenkeeper's mind, and compare their perception of the composition with the findings of the Optical Quadrat. A third of the head greenkeepers considered *P.annua* to be less than 65% coverage, however most perceived it to have high ground coverage.

The observations did show that there were cases of very high *P.annua* content greater than 93% coverage, but *Agrostis tenuis* is well represented with a third of the greens making up more than a half of the counts. During the study, most head greenkeepers were surprised by the counts of the *Agrostis* spp. species and, likewise, the lower counts of *P.annua*. It was apparent that there was an

ABOVE: The TORO Turf Evaluator for measuring the effective height of cut

inaccurate perception of the sward composition by an inspection of a 'walk over' compared with the Optical Quadrat.

How does this matter? Well, in consideration, how can the effectiveness of an over-seeding program be measured, without an accurate starting point or a measure for the present coverage? Then, the natural progression is to be able to value the maintenance regime that is implemented, for example, is the regime causing a positive or negative effect on the establishment of the desired species?

These findings were consistent with Baker et al., (1995) where a significant proportion of the head greenkeepers distinguished a poor green from a quality one by the number of bare areas, and not the species composition or playing quality.

Stimpmeter readings were taken at each green, again this was to affirm any trends and compare with the earlier studies of grass species and ball roll. The readings were calibrated to the USGA recommendations for regular play.

With the effective heights of cut categorised as low (2-3 mm), medium (4-5 mm) and high (>6 mm) it was possible to analyse the data of the three most common species (*P. annua*, *Agrostis* spp. and



about the author

Jonathan Knowles has been involved in Greenkeeping for 17 years, first as a greenkeeper and latterly at Myerscough College. Recently he has been working on a research project that discusses the effects of cutting height on the grass species in golf greens and the associated trends for adapted ecological methods for greenkeeping.

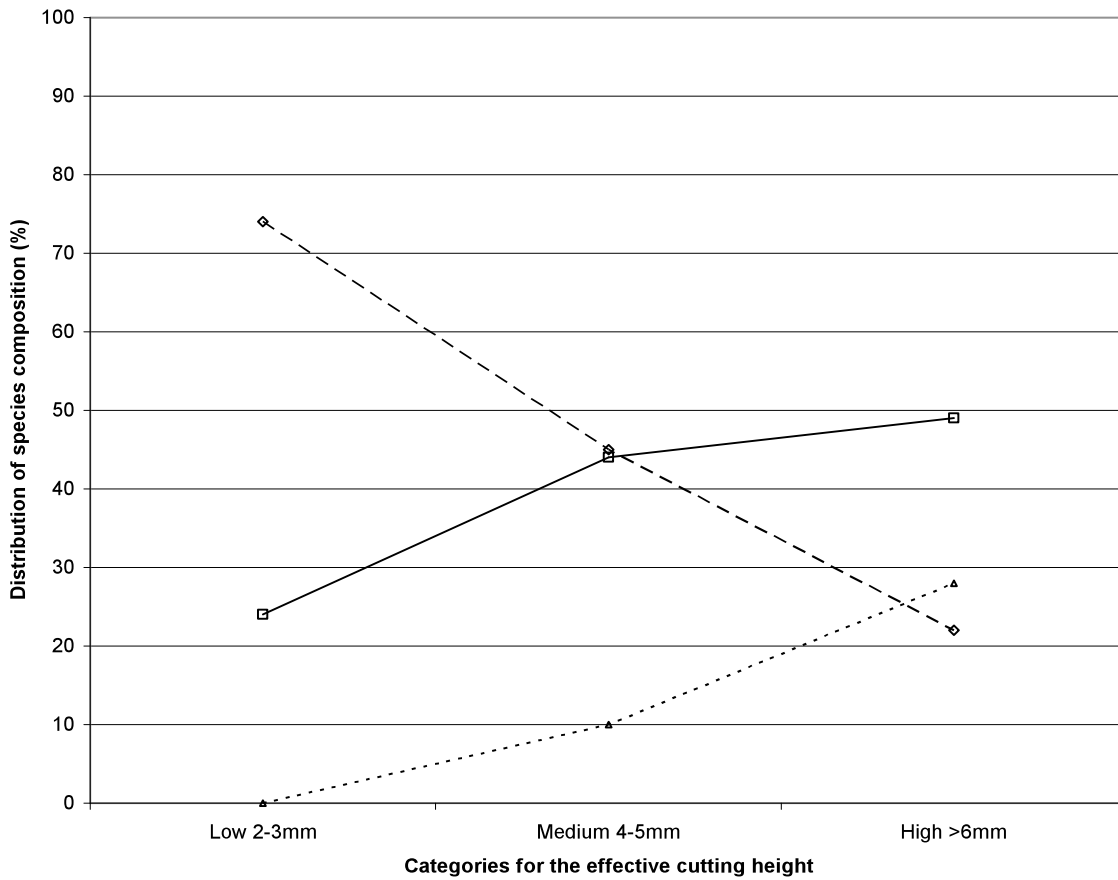


Figure 1. Linear trends in the species decline and ingress over the changes in the categories for the effective height of cut.

- ◇- Poa annua
- Agrostis tenuis
- △- Festuca rubra

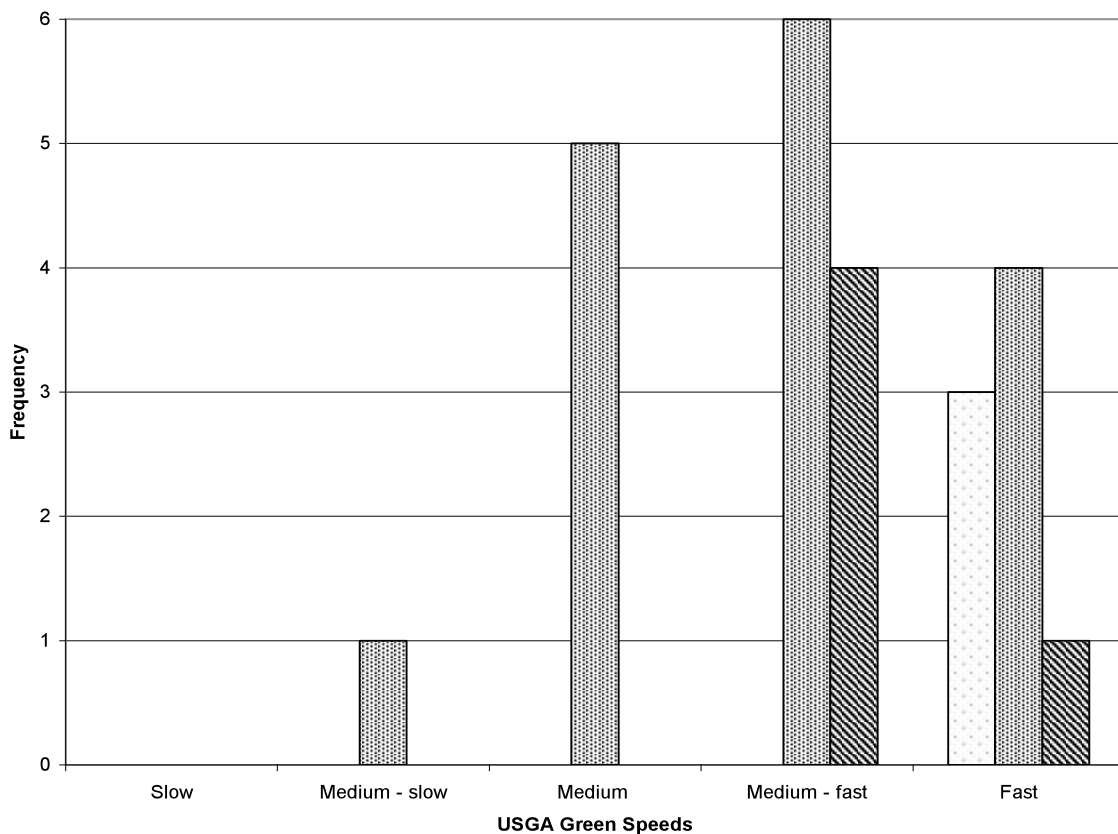


Figure 2. Green speeds and the frequency of occurrence for the different heights of cut. The green speeds have been calibrated for 'regular play'. The highest heights of >6 mm has provided the fastest surfaces, cutting at a range of 4-5 mm has occurred in most speed categories, while cutting at a 2-3 mm has only provided fast surfaces.

- Low 2-3mm
- ▤ Medium 4-5mm
- ▨ High >6mm

Festuca spp.) and the composition within each category and overall, see Figure 1.

It was found that there was a significant relationship between the effective height and the sward composition. In the low category, *P.annua* had the greatest population, and *Festuca* had nil.

In the high category, *P.annua* was comparatively diminished against the *Agrostis* and *Festuca* spp.

The medium category was very interesting, especially as it was the most popular category. This could be defined as the transitional zone for *Festuca* ingress and *P.annua* egress. *Agrostis* was shown to be in equal population between the low and medium height. However, in the high category, *Agrostis* out-competed the *P.annua* by 3:1. Indeed, in the high category, the combined *Festuca* and *Agrostis* out-competed *P.annua* by almost 4:1. Whereas, in the low category *P.annua* was out-competing *Agrostis* by 3:1.

This not only showed that the most popular effective height of cut was 4-5 mm, it also showed that *Festuca* inhabits where *P.annua* does not and vice versa. It also showed that *Agrostis* almost maintains a consistent status through the changing heights, although it's very difficult to conclude that raising the height of cut will lead to greens with higher proportions of *Festuca* and *Agrostis* and much of this possibly relates to the multivariate practices of greenkeeping and geological location etc.

Importantly, however, it has been possible to prove that a lowered effective height of cut will have a *P.annua* composition, as shown in Figure 1.

Again, it's worth noting the intersection of *P.annua* and *Agrostis* at the medium category and the opposite values of *Festuca* and *P.annua* in the low category.

The greens cut at an effective height of cut between 2-3 mm had proven to provide Stimpmeter readings for a fast putting surface see Figure 2. Again, this reflects a very large study that was carried out in the U.S (Throssell, 1981) indicating that low cut greens provide a fast surface. Greens cut at between 4-5 mm varied greatest in speeds between medium-slow, medium, medium-fast and fast. Greens cut at >6 mm, varied between medium-fast and fast see Figure 2. This reflects the findings of the Canaway & Baker (1992) as we know that the turfgrass genii they concluded as fastest are in this category, the 1992 study also details the height of



cut used as 5 mm (more than likely bench set, so the effective height would be around 6 mm).

So then, what is it to be: horticulture, agriculture or ecology? Well, in conclusion there is a trend for adapted holistic and functional ecological principles in turf management. For example, as greenkeepers we recognise the Power Rule or Self-Thinning (Danneberger, 1993 cited in Lush, 1990). In turf culture, this can be interpreted as an increase in the cutting height increases the leaf area and as the height of cut is reduced, the density of the biomass increases. Again, a recent example is the Disturbance Theory (Bechelet & Windows, 2007), which originates from an ecological study of British Species (Grime et al, 1988), whereby the intensity of a stress is multiplied by the intensity of the disturbing environment, leading to vegetation that is governed by the environmental stresses. Specifically mentioned is mowing pressures, these are identified as one of the variable disturbance pressures governed by the mowing height, quality and frequency. Indeed, a raised height of cut is identified as a less intensive pressure on the turf (Bechelet, 2008).

The confirmation here is that changing the height of cut has a relationship with the species composition of the sward. Of course, there is a relationship with cutting very low and having fast greens, however, this research suggests this will be a predominance or even

a monoculture of *P.annua* and the associated problems with the troublesome weed are well documented (Adams & Gibbs, 1994 and Hagley et al., 2002). But, fast greens are achievable with perennial sustainable species. The cost of reaching the objective of the fast putting perennial surface is to provide the turf environment for *Festuca* to thrive, in turn causing *P.annua* to egress, and the *Agrostis* spp. can play nurse. Remember, by cutting at an effective height in the region of 6 mm is one of the multivariate maintenance practices. The overseeding of *Festuca rubra* spp. with *Agrostis* spp. preferable tenuis at the optimum time with the general renovation program should also be considered. As identified (and it could go without saying), there are many variables to affect the golf greens' composition, so adjustments to nutrient input and the management of the precipitation and infiltration rate will also need consideration. Nevertheless, I do realise how important these factors are; the research revealed these were seemingly less influential on the sward composition than the cutting height.

Finally, remember to monitor the sward composition and ingress as accurately and as practically as possible, at least randomly sample the species composition of the greens. It is at this point that true management of sward composition is borne, and remember, a 'walk over inspection' will not cut it!

ABOVE: Plate2: The Optical Point Quadrat