A GRASS FOR ALL SEASONS

Do bentgrasses know what time of year it is?

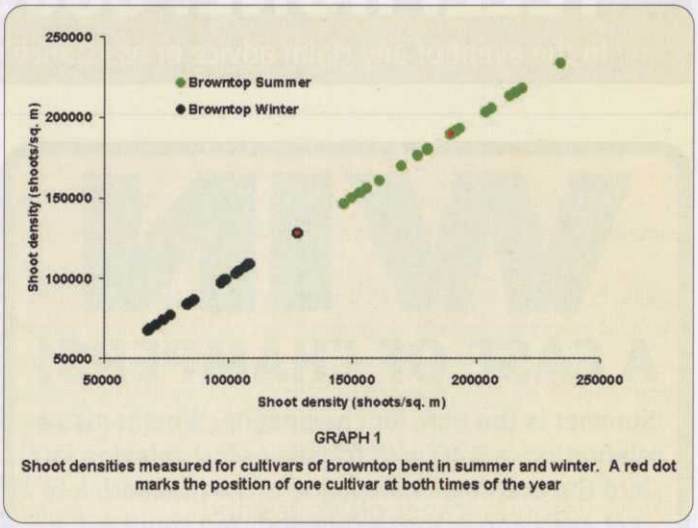
Andy Newell describes the techniques he used to answer the question

We have a long history of testing grasses for golf at the STRI. Indeed, our first trial was sown in August 1929. You would think that, after nearly 75 years, we would have the evaluation of grasses down to a fine art. I think we have but a fine science would be a better description. In many respects, we can sum up the overall performance of different grasses in a few numbers. But is this enough? Are there important differences hidden within these overall numbers?

An important area to consider here is seasonal differences. I think we all recognise that grasses differ from one season to the next, generally looking at their best in summer, as long as there has not been a drought, and at their worst in winter. However, the question I wish to address is: Are there seasonal trends among grasses and can we prove it? This is where I need to get all statistical and talk about populations of grasses and the positions of individual grasses within the population. Before I do this, I should set the scene a little more. I have no intention of describing all grasses in this article; I am going to restrict my discussions to bentgrass species and cultivars. Further to this, I am only going to consider the use of these grasses in very fine turf for golf greens. However, the points I make below could well apply to other grass types and uses.

Returning to our populations of bentgrass species and cultivars, we accept that the overall performance will change with the seasons but are there other important differences hidden within these changes? More specifically, does the position of particular grasses within the population change from one season to the next? There are some common perceptions here; creeping bentgrasses are comparatively poor in winter, 'Highland' browntop is good in winter and velvet bentgrasses are very good in summer. These observations suggest that the position of individual grasses or groups of grasses do change relative to one another at different times of the year. Given these views, I have attempted to examine seasonal relationships in more detail. I wanted to see if I could put numbers to them. However, before I could make any progress, there was a need to separate the overall seasonal variation from the relative variation among grasses. As an example of this problem, I include a graph showing the overall measured differences in shoot density among cultivars of browntop bent in summer and winter (see graph 1).

For these grasses the number of shoots in winter ranged from roughly 70,000 to 130,000 shoots per square metre for the 21 cultivars in trial. In summer, the range was from 150,000 to 220,000. So, there were large differences among cultivars and between seasons. I have also marked a particular cultivar (red dot). This shows its position in winter and summer. In the summer, it was fairly average and in the middle of the pack. In winter, it stood out, and had by far the highest shoot density. Therefore, the position of this particular grass relative to other cultivars of the same



GRAPH 1

Shoot densities measured for cultivars of browntop bent in summer and winter. A red dot marks the position of one cultivar at both times of the year

species moved between exceptional in winter and average in summer. This is the point where a little bit of statistical skulduggery is called for to remove the overall seasonal variations but retain the relative differences among grasses. As luck would have it, there is a technique that standardises variation between subsequent measurements (or seasons in this case) while retaining relative differences among individuals within the population being sampled. I don't want to get into too much detail here but, for the statisticians, I would use Z-scores (this is usually covered somewhere between chapters 1 and 3 in most good statistics books). Once this technique is applied, average grasses would have a score of zero, below average grasses negative scores and above average grasses positive scores. Usually these scores will fall in a range of –3 to +3. To demonstrate the effects of this calculation, I have transformed the shoot density information presented previously (see graph 2). This new graph demonstrates how the statistical technique employed removes the overall differences in scale but retains the relative variation among individual grasses (note that the position of the red dot varies between summer and winter but the overall differences between seasons has disappeared).

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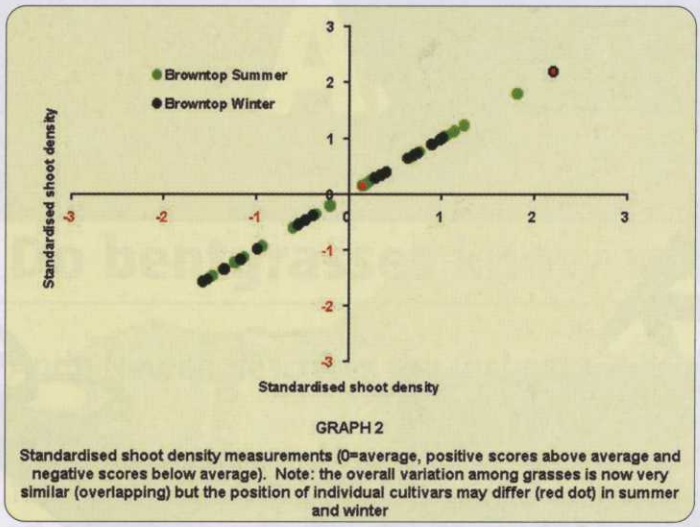

GRAPH 2

Standardised shoot density measurements (0=average, positive scores above average and negative scores below average). Note: the overall variation among grasses is now very similar (overlapping) but the position of individual cultivars may differ (red dot) in summer and winter

Hopefully I have now demonstrated an approach that can be used to examine relative changes in grass performance at different times of the year. The next step is to see what happens when it is used. I applied the technique to monthly measurements made during 2000 on our 1998 sown bentgrass trial. I then plotted the scores for individual grasses against time. These showed if the performance of particular grasses were static (always good, poor or average) or changed at different times of the year relative to the other grasses. In effect, I was plotting the position of one grass within the whole population (all grasses) at different times of the year. Importantly, the various plots showed that no grasses remained static and, very importantly, it was evident that there were distinct patterns. The creeping bentgrasses tended to perform poorly in winter (negative scores); 'Highland' browntop was relatively good in winter; and velvet bentgrasses tended to be at their best in summer. I was fairly pleased with myself at this point, but all this did was demonstrate what we already knew. That said, I was still pleased with myself (no-one had turned it into a graph before).

There were also other patterns that had not been obvious beforehand. In this regard, cultivars of creeping bentgrass tended to show a peak in performance during the spring/early summer. However, the most fascinating discovery was that cultivars of browntop bent (Agrostis capillaris or A. tenuis in old money) tended to fall within one of two groups, winter performers and summer performers.

I think one more graph is called for here; this shows the relative changes in the performance of two cultivars of browntop bent (A and B). I hope it is fairly clear that I have selected examples from the two types (peak performance in summer and peak performance in winter). The graph itself shows the position of each of these grasses relative to the population as a whole (all grasses in trial) for each month of the year. When examining this plot it should be noted that the position of each grass relative to all others being tested would be in the middle of the range (average performance) where the score was zero (better than average with positive scores but worse with negative scores).

Having found the contrasting seasonal differences among cultivars of browntop bent, the first question that came to mind was why? Here we have different varieties of the same species, which in performance terms are diametrically opposed. I suspect this variation may relate to the origin of the material. I found a clue to this in the behaviour of material from New Zealand, which were all part of the winter performing group. My theory here is that the mild winters in New Zealand, and other maritime climates like the UK, would create selection pressures for grasses to compete during the winter months. In contrast, if material was selected from areas with very cold winters, there would be little selection pressure for growth in the winter. However, there would be pressures to make the most of the summer.

The important question to ask is: Can we make use of this information? I think so, but I would like to complete further research, particularly with contrasting cultivars of browntop bent. Top of my research list would be to investigate the performance of mixtures containing grasses that performed particularly well in winter and summer.

Turning to the bigger picture I feel there is some benefit and knowledge to be gained from viewing differences among grasses in terms of population dynamics. It is also obvious that there could be important information hidden within the overall ratings that we produce.

If you want to know more about the bentgrasses described here (glutton for punishment) the work was written up more fully in the 2001 Journal of Turfgrass Science.

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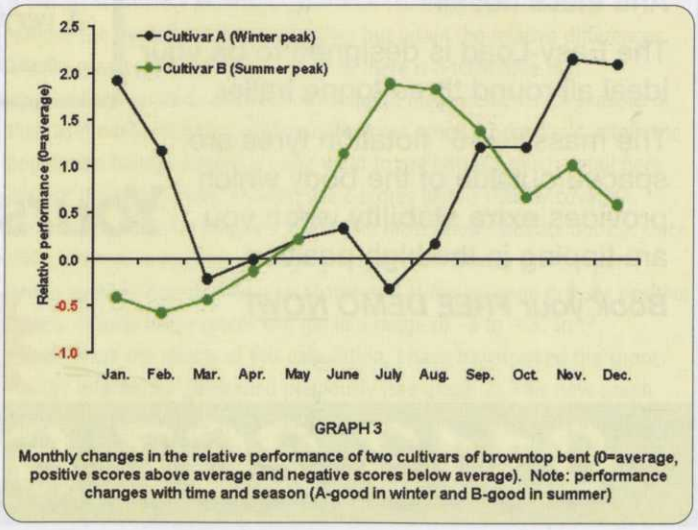

GRAPH 3

Monthly changes in the relative performance of two cultivars of browntop bent (0=average, positive scores above average and negative scores below average). Note: performance changes with time and season (A-good in winter and B-good in summer)