

***Poa annua* at Ballarat Golf Club**

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Following an inspection of the greens at Ballarat Golf Club on 20th September 2012, I have been asked to present information to assist the club in its future greens strategies. I have over 30 years of experience in turf management as a researcher and educator, starting with my research work at the Australian Turfgrass Research Institute (Sydney) in 1981-84, followed by 25 years teaching turf agronomy at trade and Diploma level. From 1997-2008 I conducted various research trials for the Victorian Golf Association Turf Research Board, which included fairway grass trials at the old course at Ballarat Golf Club. At present I am in the final stages of a PhD study at Ballarat University on sportsground grasses, and also doing some trial work for the Victorian Golf Course Superintendents Association and for the seed company PGGWrightson Turf, although there is no connection or conflict in that role with the information provided in this report. My field of expertise is turfgrass agronomy across a wide range of surfaces. However I am not a turf consultant and don't have the appropriate professional indemnity insurance to make specific recommendations, nor am I charging for this report. The information is presented simply to assist the Superintendent and committee in their own decision-making regarding grasses on greens.

As I understand it, the issue is what strategy the club should adopt regarding the greens, whether to continue the policy of keeping them pure creeping bent (*Agrostis stolonifera*), or allow the incursion of *Poa annua* to a certain acceptable target (eg. 70:30 or 50:50 bent:Poa), or allow the greens to convert to pure *Poa annua* over time. I suggest you keep an open mind when reading the following information, but at some time your current policy needs to be either confirmed or changed, and communicated again to the Superintendents so that his actions over the full year are consistent with that policy. Some clubs spend half the year trying to kill Poa and the other half trying to get it back, which is an inefficient form of management.

Understanding *Poa annua*

The species *Poa annua* covers a wide range of genotypes with different growth habits and life-cycles. Although the plant itself is short lived, the key to its success is prolific seed production. It is able to produce viable seed even at mowing heights of 2mm on greens. In a detailed research project in the early 1980s, Dr. Mary Lush found a 'seed bank' with an average of around 200,000 seeds per square metre (20 seeds/cm²) on Melbourne *Poa* golf greens. These seeds sit in place until an opportunity arises to germinate, mainly by exploiting a gap in the sward from pitch marks or renovation disturbance. Dr. Lush's research identified two *Poa* life-cycle types, as discussed below:

Type 1: Synchronised *Poa annua* on fairways

In areas with low irrigation input such as couch fairways the species adopts a synchronised, winter annual life-cycle. Seed germinates in a pulse in late autumn, followed by vegetative growth over winter, seedhead and seed production in spring, and population death in early summer. The seed then sits in a dormant state in the soil through the summer until triggered to germinate in a pulse again in autumn after exposure to suitably cold temperatures. Control of this type is relatively simple. Newly germinating seeds are very easy to kill, and soil-residual herbicides with pre-emergent activity such as Exporsan (bensulide), Tramat (ethofumesate), Pendulum (pendimethalin) or Dimension (dithiopyr) can be extremely effective. These herbicides last in the soil for 1 – 3 months, so if they are applied in late April and the seed all germinates in a pulse in May, the herbicide can easily have a 100% kill.

Type 2: Non-synchronised *Poa annua* in golf greens

The *Poa* in greens, however, is different. Greens offer plentiful irrigation and good pesticide protection against summer insects and diseases, so the predominant greens *Poa* life-cycle is as a non-synchronised annual, not locked into the winter cycle. This form can germinate at any time during the year when there is a gap in the sward. Each *Poa* plant that gets a chance to germinate will grow, set seed and die within a one year period, but because the population is not synchronised you are not able to see the plant turnover, and the green can look the same all year round, and over many years. So it is often (mistakenly) assumed that the *Poa* on greens is perennial, whereas in fact the life-cycle of the individual plant is still annual. To

confuse the issue, true perennial *Poa annua* types have been found on golf greens the US. Investigations in Melbourne (Neylan & Peart, 2009) suggested perennial *Poa annua* may exist on greens in Melbourne, but the evidence is inconclusive.

The question of whether the type of *Poa* on your greens is perennial or a non-synchronised annual is largely academic, as in either case it is extremely difficult to control those greens types with herbicides. The pre-emergent herbicides listed earlier that work so well on synchronised *Poa* on a fairway are largely ineffective on a non-synchronised *Poa* on a green, as there is no pulse of seed germination to target. In theory a pre-emergent herbicide with 3 month residual activity such as Exporsan could be applied four times per year, so that the whole year is covered and all germinating *Poa* plants are killed regardless of the time of year. Exporsan was recommended on new bentgrass greens by Neylan and Peart in their 2009 report, but there are two limitations with this herbicide. First, the presence of pre-emergence herbicide in the soil prevents your ability to oversow with new bentgrass seed, as it will also be killed as it germinates. Second, most pre-emergent herbicides are absorbed by roots and can have a root pruning effect on the bentgrass. This can be especially damaging during the main spurt of bentgrass root development in the spring. The bentgrass damage may not be visible, but spring root pruning reduces summer heat and drought stress tolerance.

The limitations of the pre-emergent herbicides on greens *Poa* means that chemical control is mainly based on post-emergent herbicides, which try to kill existing *Poa* plants that are already up and growing. They just don't work very well, and have their own set of problems. The biggest problem with the post-emergent herbicides such as bispyribac (Nominee) and Poachek (endothal) is that they can also damage bentgrass. The aim of these herbicides is to selectively damage *Poa* more than bentgrass, and sometimes they do that quite well, but on some occasions the bentgrass can suffer excessive damage, sometimes visible and obvious, or at other times not so obvious but resulting in weakened bentgrass plants. As yet there is no magic bullet herbicide that will easily take *Poa annua* out of creeping bentgrass. Nominee was hyped as the magic bullet around two years ago, but its performance has not lived up to expectations, and there have been several cases of bentgrass damage. The next magic bullet is supposed to be methozolin, and early trialling of this product at Metropolitan GC has looked good, but this is a new and experimental herbicide which may never reach the turf market, or might take several years to do so. A further problem with magic bullets is that herbicide resistance can occur over time, but that is a problem that can be dealt with if and when it happens – at present, the situation is that there simply is no magic bullet.

I have looked through the list of herbicides that your Superintendent has used over the last year or so, which includes dithiopyr, endothal, paclobutrazole, bispyribac, ethephon, trinexapac and oryzalin. I can't think of any product to control Poa in bent that hasn't been included in his program except perhaps exporsan (Bensulide). As noted earlier, John Neylan suggests Exporsan could be included for new greens like this, where Poa numbers are still relatively low. I would only recommend Bensulide as a late autumn application so that it doesn't cause root pruning in spring. Paclobutrazole (Cultar, Shortstop) is another valuable product, and the recent application on Ballarat's greens show how effective it is. It is a growth retardant, not a herbicide, and works by dramatically slowing *Poa annua* growth, while only slowing bentgrass growth to a minor extent. It can make greens a little bumpy, however, due to its effect on Poa. It can be used several times per year, and many clubs rely on it as their sole Poa control product.

Poa on greens can also be reduced by cultural management. Conventional renovation consisting of scarifying and hollow tyne coring can open gaps for Poa to move into, so the approach now is for aggressive dusting to reduce the need for scarifying, and solid tyning instead of hollow tyning. Your Superintendent is already following that strategy, although my inspection of the greens profile indicates that the dusting program should be more frequent and more aggressive, as there is a moderate thatch layer present that is holding excessive moisture. Dusting is not popular with golfers but is an extremely effective way to manage thatch and ensure firm, smooth greens. An effective dusting program should apply a clean medium sand at a rate around $0.06\text{m}^3/100\text{m}^2$ every 2-3 weeks while the bentgrass is actively growing, totalling something like 20 dustings per year. Your Superintendent has a copy of the VGA report on dusting listed in the references if you require it. In conjunction with dusting, periodic solid tyning can be done for aeration as the disruption from this is minimal. These renovation methods are cultural controls of Poa because they reduce the gaps in the sward that allow Poa to get started.

Cultural control of Poa can also be enhanced by low fertility and increased mowing height (eg. 4mm) and it appears these two strategies are already in place. I think nutrient testing from tissue tests can provide good information to guide fertilizer applications, especially when fertility is kept quite low like this. Another cultural control method is periodic oversowing with bentgrass seed. Oversowing bent at a rate of $5\text{g}/\text{m}^2$ adds around 75,000 seeds per square meter to the green, which can compete with the Poa seed that is being walked onto the green. Again, it appears your Superintendent is already doing that.

Comparison of creeping bentgrass v *Poa annua*

All of the modern creeping bents are US-bred. Most of these new varieties are selected for higher heat tolerance to allow their use in southern climates such as South Carolina, Georgia and Texas and to replace their traditionally-grown couchgrass greens. The A and G bents (eg. A1, G2, G6 etc), for example, were bred from parent material sourced from Augusta Georgia, which has a climate reasonably similar to Sydney. Very few of these new bents are bred for superior winter performance in cold climates, and in fact many are semi-dormant over winter with their main growth and vigour occurring through the warmer months. Creeping bentgrass growth is favoured over *Poa annua* during the warmer months, and when fertility and pH are very low and when greens mowing height is high.

There are actually very few golf courses in Victoria with pure bentgrass greens. Many of the newer courses are pure bent for the same reason that Ballarat GC is – the *Poa* population and seedbank takes several years to accumulate, and *Poa* populations increase relatively slowly over time by seed finding its way to the greens from fairways, or from other courses on golfer's shoes and buggies. Of the older courses, Royal Melbourne, Metropolitan and Kingston Heath are the only ones I know of with pure bent greens. Those clubs have high staff numbers (around 20 staff per 18 holes) and low numbers of golf rounds per year. The low traffic allows them to maintain very low fertility. In Sydney the situation is much the same, only a very few elite courses have pure bent greens despite the warmer climate. Apart from low pH and fertility, control of *Poa annua* on these courses is largely reliant on hand weeding and spot spraying with endotal in a hand-sprayer, which is labour intensive. The approach at Metropolitan GC has also been to re-surface three greens per year, so that any green is never more than 6 years old. This was done specifically for *Poa* control, as even hand weeding and herbicide use could not keep *Poa* from building up over time.

Royal Melbourne GC is a special case, as it uses *Agrostis tenuis* (browntop bent) on its greens, specifically bred for RM from bentgrass colonies from the old greens. Browntop bent is tolerant to the herbicide amitrole, which is in the magic bullet class I mentioned earlier. It controls *Poa* on greens very effectively, and although the browntop is discoloured by the amitrole, it soon recovers. Royal Melbourne is the only golf club in Australia with browntop greens, but there is no reason other clubs couldn't follow their lead and I see good potential for browntop greens in cooler climates. Conversion of existing greens to browntop, however, would take a complete greens resurfacing program, it couldn't just be overseeded.

Straight *Poa annua*, on the other hand, is entirely capable of providing high quality greens. It is the predominant grass on some of the world's most elite courses, and most US Opens played in the past 15-20 years have been played on Poa greens rather than bentgrass (to quote Dr. David Huff, turfgrass breeder at PennState University). In comparison to creeping bent, *Poa annua* has a better tolerance to very low mowing and much higher shoot density, and an upright growth habit that doesn't suffer from spiking or grain. It has a higher growth rate than creeping bentgrass in cold temperatures, and is more adapted to high soil fertility. These last two factors contribute to greater ability to recuperate from wear, especially winter wear. The general perception is that Poa greens will handle very high traffic, and that greens on courses such as Ringwood GC (over 100,000 rounds per year) probably couldn't survive if they were bentgrass. Traffic aside, several elite courses such as Victoria GC, Barwon Heads GC, Eastern GC, Kew GC and Yarra Yarra GC have Poa greens of excellent quality and renown. The main negative with pure Poa greens is from the presence of seedheads in the springtime, but this can be reduced by 90% through a single application of ethephon. There is a perception that Poa has lower drought and heat tolerance than creeping bentgrass, and possibly suffers more problems with insects and diseases, but all these can be effectively managed through good greenkeeping practices. As with bentgrass greens, the quality, health, firmness and smoothness of Poa greens can be extremely good when an effective dusting program is used.

Other clubs such as Kingswood GC, Spring Valley GC, Woodlands GC and Peninsula GC have excellent greens consisting of a mix of bent and Poa, varying through the year from perhaps 20:80 in winter through to 50:50 in summer and autumn. The two grasses are compatible with each other and blend almost invisibly when near these ratios. A suitable bent:Poa blend is maintained by giving bentgrass an advantage at any time possible (eg. by fertilizing more in the summer and less in the winter) and reducing Poa's competitiveness by lifting mowing heights and applying growth regulators such as Primo (trinexapac), paclobutrazole and ethephon to slow the Poa growth and/or inhibit seedhead production. Herbicides such as endothal are also used, not so much to kill out Poa but to restrict its dominance through winter.

The Australian Turfgrass Management article 'The Pulse: Don't mention the war' has a neat summary of Poa strategies from various Superintendents, and is well worth a read.

Concluding remarks

There is no magic bullet herbicide to eliminate Poa out of creeping bentgrass, and Poa control herbicides can damage bentgrass and reduce greens quality. Successful control of Poa on the few clubs with pure bent greens takes very high inputs of labour, combined with low fertility. I can't suggest anything significant that your Superintendent isn't already doing, although Exporsan could perhaps be added as an autumn treatment, and I think a more aggressive dusting program is warranted. I suggest the club investigate the greens grasses used on other courses and see what results they are achieving, to assess whether a pure bent policy is the best solution for Ballarat. Some clubs, of course, will claim they have bentgrass greens when in fact they don't, so the Superintendents should be involved to accurately assess what grasses are present. Ballarat GC must also consider the price it is willing to pay to maintain a pure bentgrass policy, when a mixed bent:Poa sward or even pure Poa greens can provide excellent surfaces more simply and at a lower cost. The objective, surely, is to provide the best year-round surfaces for putting, as measured by pace, smoothness and uniformity. If more discussion is required, I suggest you get an opinion from two people from the Australian Golf Course Superintendents Association (9548 8600), John Neylan on the general principle of Poa vs bent and Poa control, and John Geary, who is doing a project on benchmarking greens quality, which includes assessing pace etc. of various Poa, Poa/bent and pure bent greens. I hope this information has been useful, I'm happy to provide further input and reference material if required. Your Superintendent is able to provide the following three references as pdf files for those who are interested.

Regards Phillip Ford, University of Ballarat

Further Reading:

Ford, P. and Nickson, D. (2003): Dusting of golf greens in Victoria. Victorian Golf Association Turf Research Board report.

Neylan, J. and Peart, A. (2009): A life-cycle approach to the control of Poa annua in bentgrass putting greens. Horticulture Australia project TU06003.

www.turfaustralia.com.au/documents/item/54

The Pulse (2012): Don't mention the war. Australian Turfgrass Management, Vol 14.4 (May-June) pp 40-43.