POA ANNUA CONTROL: WHERE ARE WE NOW

Continue to learn

Nick Christians, University Professor, Iowa State University, gives an update on where we are in the battle to rid our courses of the old enemy.

Annual bluegrass (Poa annua L.) is one of the most widely distributed weed problems that Course Mangers' and greenkeepers' face. It can be found in greens, tees and fairways throughout the world in both cool-season and warm-season regions. This species has proven over the years to be one of the most difficult weeds to control. While some headway can be made in reducing it, Poa annua always seems to have a way of winning the ultimate battle.

Poa annua is a cool-season grass that can be identified by its boat-shaped leaf tip, folded vernation, and prominent membranous ligule (Christians, 1998). Botanic texts generally class it as a winter annual and as a bunch grass. Those who have worked extensively with this species, however, know that this can be misleading. A true winter annual should germinate from seed in the late summer to early autumn, live through the winter as a mature species, produce a seed crop in the spring and then die. While Poa annua is capable of acting in this way, it is also commonly observed to germinate almost any time during the season and may act more like a perennial than an annual. There are also many types that are capable of producing stolons and its designation as a bunch type is not always accurate.

There are a number of factors that make this such a difficult species to control selectively in golf-course turf. It is a highly productive seed producer. This gives it huge competitive advantage over grasses like Agrostis stolonifera. The seed can live for years in the soil and will geminate when it is exposed by a ball mark or divot. While Poa annua is not very competitive with other grass species at higher mowing heights, it is highly competitive at low mowing heights and can even be observed to produce seed at mowing heights as low as 0.254cm (0.1in). This gives it a big advantage over Poa pratensis which is poorly adapted to mowing heights below 4cm.

Its greatest competitive advantage, however, comes from its genetic diversity. While this grass is identified as a single species, it is really a compilation of hundreds, if not thousands, of biotypes, each with their own distinct characteristics. There are annual bluegrasses termed Poa annua var. annua L. Timm.(Beard, 1978) that are bunch grasses that act as true winter annuals. There are also types known as Poa annua var. reptans (Hauskn) Timm. (Timm, 1965) that act as weak perennials and may have stolons. Between these two extremes are the other biotypes, some closer to the annua types and some closer to the reptans.

Conversion to Roundup ready creeping bentgrass. The process began with core aerification

On older courses, it is not unusual to find distinct biotypes that are common to fairways, others that are common to greens, and yet others to tees (Lush 1989). It is common to also observe variable biotypes under each of these management regimes (Cline, 2001; Wu, 1991). Variations in colour, texture and time of seedhead production are often observed on the same green. This diversity of biotypes helps explain the variations in response to herbicide treatment that are often reported.

In 1996, I spent several weeks looking back at over 85 years of research on attempts to control annual bluegrass in golf course turf. My findings were later published in a Golf Course Management article titled 'A historical perspective of annual bluegrass control' (Christians, 1996). The history of attempts to control this troublesome grass has been one of temporary excitement about new herbicides or plant growth regulators in early testing stages, followed by disappointment once the material hit the market.

That doesn't mean that all attempts at control have met with failure. Some have provided limited, usually regional, success in selective control. Ethofumesate (Prograss), for instance, has proven to be quite effective at removing Poa annua from perennial ryegrass fairways and tees in the Midwestern United States. When used in other species and other locations, however, its use has been less successful.

Fenarimol, marketed as the fungicide Rubigan in the US, has been a very successful postemergence control of the annual types of Poa annua along the Gulf Coast in the Southern US, but has been shown to be much less effective on perennial types in the rest of the country. Plant growth regulators such as flurprimidol (Cutless) and paclybutrazol (TGR and Trimmit) have also shown positive results in some situations and some environments and have been less effective in others.

The problem, again, can generally be related to the genetic diversity of the target species. I have conducted research on experimental herbicides that effectively killed Poa annua in both Agrostis stolonifera and Poa pratensis fairways. When the same material was applied to other biotypes, however, 12 times the rate of the herbicide would not even discolour the treated Poa annua.

Little has changed in the seven years since the Golf Course Management article. There are new materials such as rimsulfuron (TranXit GTA), that is showing some promise as a control of Poa annua in Cynodon spp turf in the Southern US (Walker et al. 2003).

Another experimental herbicide, bispyribac-sodium (Velocity), has also met with some success as a selective control in Agrostis stolonifera fairways. If these materials follow the history of earlier herbicides, however, they will likely be effective in limited situations and only certain biotypes of Poa annua.

I ended the 1996 article with the statement that I did not believe that a single 'magic bullet' herbicide would ever be developed that would be the final answer to the Poa annua problem. Nothing in the past seven years has changed my mind. However, there is some new technology on the horizon that may greatly impact the science of weed control. That is the developing science of biotechnology and genetic transformation. The most promising example of this new technology in the turf industry, is the recent development of Roundup ready creeping bentgrasses (Agrostis stolonifera).

Roundup (glyphosate) is a nonselective, systemic herbicide that has been used since the late 1970's to control a variety of grasses and broadleaves. It is very effective on all of the major cool-season and warm-season turfgrasses and is often used in the renovation process where all existing vegetation is to be killed before reestablishment.

Scientists have discovered that a gene exists that allows some plants to tolerate the effects of this herbicide. Recent advancements have made it possible for scientists to isolate this gene from an agrobacterium and place it in plants that normally would be susceptible to Roundup. This has been a very successful technology in crops like soybeans and has revolutionised weed control in many agricultural areas in the US.

Scientists at the O.M. Scotts Co. of Marysville, Ohio, in conjunction with scientists from the Monsanto Co. of St. Louis, Missouri have successfully inserted this gene into creeping bentgrass. This Roundup ready bentgrass is still experimental and has not been approved for sale as of spring 2003. When this technology does reach the market, it will provide one of the first truly effective means of removing Poa annua, which is susceptible to Roundup, from creeping bentgrass turf. In addition to Poa annua, the Roundup should also control most other weeds that compete with bentgrass on the golf course.

Preparation of the area to be converted to Roundup ready creeping bentgrass

Perennial ryegrass fairways area being seeded with Roundup ready bentgrasses

The technology is not fool proof. It is possible that resistance may develop in weeds over a period of time as Roundup is applied and Roundup ready Poa annua could be eventually develop. However, this would take time and if Roundup ready bentgrasses are released for sale, they provide the promise of many years of Poa annua-free greens, tees and fairways.

At Iowa State University, work is presently underway to determine the best procedure for converting existing turf to Roundup ready bentgrasses. The research is designed to study the effects of Roundup timing before and after seeding. The objective is to convert to Roundup ready bentgrasses while taking the renovated area out of play for the shortest possible time. The work began in the autumn of 2002 and involves the conversion of existing creeping bentgrass greens and fairways, as well as the conversion of fairways presently consisting of Poa pratensis and Lolium perenne.

Initial results indicate that conversion to Roundup ready bentgrass can be easily performed by seeding directly into existing turf, combined with Roundup applications to kill the existing turf. This project will continue for at least one more season and will include further work on the management of the areas once they have been converted to Roundup ready bentgrasses.

Footnote:

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