BY DAVID M. KOPEC, PH.D.

Poa annua in review

The first in a two-part series looking at annual bluegrass. This month: its origins, ability to self pollinate and behavior as a perennial.

Next month:
CONTROL METHODS

Poa annua, or annual bluegrass, is the most prevalent winter/spring grassy weed in golf course and sports turf management. It's been around for a long time. If you wrote down every research project title that was ever conducted in turfgrass science and management in the last 100 years, *Poa annua* would most likely win the contest as the most "research prone" topic to date. There are a couple of reasons for this.

On an evolutionary scale, *Poa* is a unique plant genus, with grass plants growing in all kinds of environments from alpine climates to deserts. Some *Poas* are perennials, while others are annuals. *Poa* "chromosomes" often reside in related complexes, that is, they often share certain chromosomes. Therefore, chance groupings of chromosomes may either come together (converge), or split away from each other (diverge), allowing for bridging (chromosome swapping or passing), and or new species of *Poa* to form. *Poa annua* most likely came from a chance cross of *Poa infirma* with *Poa supina*, producing a 14 chromosome mule that could not reproduce by seed. This mule no doubt went through a spontaneous doubling of its chromosomes, to produce our modern day 28 chromosome *Poa annua*. These plants can be true annuals, perennials or something in between.

SO WHY IS IT PESKY?

Poa annua is a problem because it's found almost anywhere there is moisture in some part of a "cool season" climate. Thus, it's essentially everywhere, listed by the USDA in all 50 states, including Hawaii, where it's found at higher elevations. There's even *Poa annua* in Death Valley, Calif. Areas that receive 20 to 40 inches of rain (or more) a year and have a real fall, winter and spring often have *Poa annua* germination flashes that occur in late summer/early fall and then again in lesser amounts in the late winter/early spring. In arid areas that have a brief rainy season in the fall, annual bluegrass has the largest germination period in the fall.

In any case, *Poa annua* seedlings emerge and have tremendous seedling vigor. After germination and establishment, they build up food reserves, they flower (often) profusely, and then die, leaving an ample amount of seed to survive under harsh soil temperatures until just the right time next year when the next generation germinates. This is the case of the annual type or *Poa annua*, as it's referred to.

To make things worse (better for

Poa annua, pictured here in test plots, is listed by the USDA in all 50 states, including Hawaii, where it's found at higher elevations. Areas that receive 20 to 40 inches or more of rain per year and have a real fall, winter and spring often have *Poa* germination flashes that occur in late summer/early fall, and then again in lesser amounts in the late winter/early spring. Arid areas with a brief rainy season in the fall see their largest *Poa* germinations in the fall.

DAVID M. KOPEC

Poa), *Poa annua* seed heads can adapt to mowing heights readily. Flowering plants often flare-out and send their flower stalks out in a circle pattern, hugging the ground just lower than the mowing height. *Poa annua* will flower at ⅛-inch mowing height on greens, and it will flower profusely at heights of ⅜ inch to 1.5 inches. At taller heights, it flowers somewhat less when it has competition from other turfgrasses in maintained turf.

WAIT, THERE'S MORE

Poa annua plants can exhibit a unique habit of having some of the individual flowers shed pollen before the seed head even opens up. Thus, the seed stalk can have viable seeds produced in heads that have been mowed down before the seed head ever opens up.

There's more to the story. *Poa annua* is self pollinating. It doesn't need another plant to get different pollen to make seed. So, theoretically, you can get one seed from one plant on your course, and it produces dozens, hundreds and thousands of plants in just three years. In year four, hundreds of thousands, and in year five, millions.

The process of self pollination has some real-life genetic consequences, which also make *Poa annua* the problem that it is. When a plant pollinates itself, it locks in gene sequences in a state that promotes genetic uniformity by 50 percent each time it self pollinates for the next generation. Thus, self pollination quickly sets in generational plants that have a relatively urgent selection pressure for survival in any given environment. The results are near immediate. A significant group of plants can be poorly adapted and die out. At the same time, a small group of plants can have the right combination of genetic traits that give it a strong local adaptation (called fitness). These plants quickly dominate the weaker ones and then pre-dominate the population of plants after that.

In each subsequent flowering generation, the desirable genes become "highly fixed," in combinations that are in a quick-acting state in response to the type of environment it has become adapted to. The result is lots of plants in a relatively short period of time that can reproduce and make more like plants from seed and thrive in that environment, year after year. The downside is that on a long-term evolutionary scale, if a major change in environment occurs, the selection pressure is quick to get rid of the now existing population of fixed plants.

So, if you're counting on global warming to get rid of your *Poa annua*, don't count on it. Why? Because *Poa annua* keeps its options open by occasionally cross pollinating with a neighboring plant. The result of this out-crossing or cross pollination event results in immediate genetic diversity. Different combinations of gene arrangements arise from cross pollinating, and these forms are more environmentally flexible. They can adapt to changes in the environment rather quickly, since these plants have more subtle but important options in their physiological pathways to respond to new and different environments. There are many new gene combinations for this to occur on, so, the long-term survival of the species is maintained, simply by out-crossing.

After these new diverse plants arise after the first cross pollination, these plants can divert back to self pollination, which causes rapid selection pressure for highly adapted plants that are the predominate in each subsequent generation.

POA AS A PERENNIAL

The *Poa annua* we've described is more or less the annual type of annual bluegrass, which comes year after year from seed, and often it seeds, it flowers and dies.

As smart as these plants are from the genetic adaptation strategies we talked about, do you think there's another survival mechanism?

The answer is yes. In the right environment, *Poa annua* can maintain itself as a year-round perennial. This occurs in areas that have seven to 10 months of cool, moist conditions or other continental and/or maritime climates that have adequate rainfall and a short period of stress (hot and/or humid period) for three to four months at most.

In this general case, *Poa annua* can live in a somewhat less stressful environment and switch its thinking from seed production to vegetative persistence for survival. Thus, perennial *Poa annua* diverts most of its food reserves into vegetative growth (more

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leaves and shoots), rather than a terminal devotion to heavy flowering. Therefore, perennial *Poa annua* plants form and persist in environments where it can compete with other grasses that usually undergo the same stresses as its neighboring plants, surviving the plant community's trials and tribulations just like the next guy, year after year.

Since most perennial *Poa annua* types are believed to originate as beneficial plants from cross pollinations, you often see many diverse-looking plants of perennial type in a given area (even on a single golf course green). These plants are mutts that have flexible survival skills, and look as different as you do from your brothers and sisters. Mutts make the toughest dogs, don't they? Their innate diversity keeps them flexible to handle life's challenges. If they need to ramp up the genetic amplification, there's always self pollination, even in "perennial" *Poa annua* plants. Perennials develop on greens and fairways within five years of a new turf establishment.

As you can see, *Poa annua* is an incredible plant. It has a diverse portfolio of survival schemes and genetic adaptation mechanisms, either creating its own diversity, or becoming many types of pure breeds on its own. It makes its own stocks, bonds and treasury bills and never needs a bail-out. **GCI**

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IMPACT ON THE BUSINESS

Making it work

AT POLE CREEK GOLF CLUB IT MAKES SENSE TO MANAGE POA RATHER THAN GET RID OF IT.

BY MARISA PALMIERI

Most golf course superintendents are tasked with eradicating *Poa annua*.

But that's not always economically feasible, and it's not always necessary, either, says golf course superintendent Craig Cahalane at Pole Creek Golf Club in Tabernash, Colo.

The municipal course's greens, once all-bentgrass, are now 90 percent *Poa*. That may seem like a nightmare to some, but, Cahalane says that in the three years he's been at Pole Creek, he's only had several complaints from golfers.

"No one complains as long as you manage it well," he says. "With the Proxy/Primo program we use, we control the seedheads well, so the golfers don't mind."

While the ideal situation would be to shrink or completely eliminate the *Poa* population, it's just too costly for Pole Creek, which is a 27-hole municipal course owned by the Frazier Valley Metropolitan Recreation District.

"At this point, it would probably have to come out of a capital budget, and we're spending capital on equipment, we just built some restrooms and we just redid our irrigation system for $1.7 million."

In short, the golfers don't mind, so it's not a priority.

As far as getting rid of *Poa* goes, "We aren't going to go there right now," Cahalane says.

He estimates it would cost hundreds of thousands of dollars to eradicate *Poa* from the facility's 27 greens (plus two putting and chipping holes). The last cost estimate Cahalane received was between $10,000 to $15,000 per green.

So instead, Cahalane manages the *Poa* with plant growth regulators – five to six applications of Primo at the beginning of the summer (about two or three per month) and three Proxy applications (one per month).

Cahalane spends about $1,600 on PGRs for the whole year. His maintenance budget is about $720,000, which Cahalane considers to be low- to mid-range.

In addition to the dollars it would take to eradicate Poa, such an undertaking would cause lost revenue for Pole Creek, because the facility would have to close 9 holes at a time.

"We're only open for five months a year, so we'd be losing too much revenue by doing that," Cahalane says. GCI