

Terms to Know

Acclimate - To adapt to a new chemical, physical, or biological environment.

Adsorption - The retention of solids, liquids, or gasses at an interface.

Bulk density - The weight of soil per unit volume.

Cation exchange capacity (CEC) - The sum total of all exchangeable positively charged ions, such as sodium, magnesium and potassium, that a soil can adsorb. Expressed as milliequivalents per gram of soil.

Half-life - The time required for half of the original amount of applied fungicide to disappear.

Immobilization - The reduction in movement of fungicides.

Leaching - The removal of fungicides dissolved in water from upper soil layers to the ground water.

Metabolites - Products of microbial metabolism.

Microbial community - Interacting populations of microorganisms.

Non-polar molecules - Molecules with no electrical charge.

Polar molecules - Molecules possessing two equal and opposite electrical charges.

Vapor pressure - The pressure exerted by a fungicide in its gaseous state in equilibrium with that in the liquid state. A measure of the potential of a fungicide to convert to a gas.

Volatilization - The conversion of a fungicide from a liquid to a gaseous state and its subsequent escape from the soil.

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Poa annua Management

by Bridget Ruemmele
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Poa annua, or annual bluegrass, is regarded as either a help, a hindrance, or purely a frustration,

depending on your particular situation. This grass is often described as a light green to yellow green annual plant with boat-shaped leaf tips. It usually germinates in the fall and flowers profusely, even at mowing heights as low as those found on golf greens. Unlike Kentucky bluegrass, annual bluegrass tolerates shade; however, survival can be poor during hot, dry summers, such as those some of us experienced in 1993 and 1995.

Growth characteristics

The most common identifying characteristics associated with annual bluegrass are its light green color, annual growth habit, and profuse flowering. In cool humid areas of the country, like New England, annual bluegrass may be found in various forms, ranging from that described above to dark green perennial types that seldom flower. A number of people have detailed annual bluegrass variability (Adams and Bryan, 1977; Gibeault, 1971; Law *et al.*, 1977; Warwick and Briggs, 1978a; Warwick and Briggs, 1978b; and Youngner, 1959). This variability is what may induce frustration in managing your site to remove annual bluegrass; what works at someone else's site may not be successful at yours.

Annual bluegrass is a colonizer, which means it readily establishes on new sites. It is extremely adaptable to harsh environments as well as to the desirable conditions in which most turfgrasses thrive. Since annual bluegrass can survive on shallow rooting, it can even tolerate compacted soil such as is found in high traffic areas.

Annual bluegrass is pervasive throughout much of the world and can be found in just about any site; often establishing bare areas where other grasses will not grow. It is not usually found in wooded areas; however, since its seed is so readily spread, it does not take long for it to be introduced into any cleared area.

Poa annua seed can survive several years in soil before germinating, which compounds the frustration in controlling this plant. A single plant can be a prolific seed producer. While working with numerous types of annual/perennial bluegrass at the University of Minnesota, I found that a single seedhead could contain 200 or more seeds, most of which were viable. Coupled with this high seed count, a single plant may produce many flower heads; it is, therefore, easy to see why a population can become so extensive.

Controlling *Poa annua*

Controlling *Poa annua* may include both pre- and post-emergent procedures. Both cultural and chemical methods will be described.

As turf managers know, the first line of defense in any weed control is a dense, healthy turf. Since many weedy plants, such as annual bluegrass, germinate most readily when exposed to light, heavily shaded ground can reduce germination significantly. Whenever an established turfgrass area thins out or becomes bare, it is important to find and correct whatever condition led to the grass' demise; it is also important to replace the turf with seed or sod as soon as possible in order to reduce weed, especially annual bluegrass, encroachment.

Cultural methods

There are several cultural practices that may discourage *Poa annua* invasion. Unfortunately, while a single plant or two can be pulled or dug out, by the time the problem is recognized, the site may contain too many plants to eradicate by hand. Compacted soils, inadequate drainage, excessive close mowing, high nitrogen, adequate water through natural rainfall or supplemental irrigation, and mild summers all favor annual bluegrass growth. While the weather is beyond anyone's control, you can aerify to decrease soil compaction, if that is a problem. Correcting any drainage problems and raising the mower height above one inch, if possible, will further discourage *Poa annua* encroachment. Reducing nitrogen and irrigation frequency, to favor more desirable turfgrasses over *Poa annua*, as well as limiting phosphorus applications will also decrease annual bluegrass populations.

Reducing pH, as well as occasionally withholding water, can also encourage preferred turfgrass growth. This control, however, may not be practical on intensely utilized sites, since desired grasses may be too severely stressed by these actions.

Annual bluegrass is highly susceptible to a number of diseases, including anthracnose, dollar spot, brown patch, pythium, and snow mold. It is possible to let disease decimate the population, but you should then be prepared to replant the area to prevent the re-establishment of annual bluegrass from seed. This process would be undesirable if preferred grasses, which also may be susceptible to these diseases, are present.

Extensive ice cover can be detrimental to *Poa annua* survival. Repeated thawing and freezing may also

Table 1. *Poa annua* control strategies.

Time	Control Measure
New planting	soil sterilants
Pre-emergence	benefin (Balan [®]) bensulide (Betasan [®]) oxadiazon (Ronstar [®]) prodiamine (Barricade [®]) ethofumesate (Prograss [®]) pendimethalin (Pre-M [®]) ¹ DCPA (Dacthal [®]) ¹ isoxaben (Gallery [®]) ²
Post-emergence	ethofumesate (Prograss [®])
Seedhead suppression ³	Maleic hydrazide chlorfluorenil mefluidide (Embark [®]) Paclobutrazol (Scott's TGR [®])
¹ May require a second application or higher rates for control. ² May only provide suppression or partial control. ³ Variability within <i>Poa annua</i> causes varied and unpredictable responses to growth regulators.	

hydrate and kill plant crowns. Unfortunately, favored grasses may also succumb to this problem.

Chemical methods

Before using any chemical control, make sure your state allows its use on *Poa annua*. Find out whether its use is restricted (requiring a pesticide applicator license), and familiarize yourself with the safe, proper application procedures and timing.

New sites may be treated with soil sterilants to stop annual bluegrass seed germination; however, this only provides short-term control and, due to their being taken off the market, soil fumigant options are decreasing.

Pre-emergent grass control chemicals are useful in preventing, or at least greatly reducing, annual bluegrass germination. Post-emergent products, on the other hand, are somewhat successful in controlling established populations. A word of caution—some of the products listed in Table 1 may also harm desirable turfgrasses. Be sure to check the herbicide label for turfgrasses which could be affected adversely.

Timing is most critical with pre-emergent weed control. Make sure you follow label instructions to ensure the product is applied at the correct time (just before germination) and in the prescribed manner to activate the chemical. Pre-emergent herbicides often block germination by forming a chemical barricade in the soil. Although the greatest annual bluegrass germination typically occurs in fall, seed may germinate at any time conditions are suitable; as a result, repeat pre-emergent herbicide applications during the same growing season may be needed to control *Poa annua*.

Several pre-emergent herbicides that are effective on weedy grasses will control annual bluegrass. An extensive list of chemicals and their product names is available in the January 1995 issue of *Grounds Maintenance* magazine. Examples include benefin (Balan[®]), bensulide (Betasan[®]), oxadiazon (Ronstar[®]), and prodiamine (Barricade[®]). Some products, like pendimethalin (Pre-M[®]) or DCPA (Dacthal[®]), may require either higher rates or a second application for control. Other chemicals, such as isoxaben (Gallery[®]), may only provide suppression or partial control.

Fewer post-emergent herbicidal controls are effective for annual bluegrass. Most products listed in the 1995 *Grounds Maintenance* article do not indicate cool-season turfgrass tolerance to the herbicides. Kentucky bluegrass, perennial ryegrass, fine fescues, and bentgrass fit this classification.

Post-emergent annual bluegrass management includes using growth regulators, to suppress flowering and the resulting seed production, as well as herbicides, to kill the plants, hopefully before they flower. Since pollination and fertilization leading to seed development may occur even as the flowers emerge from the plants, timing is critical in controlling *Poa annua*.

Several growth regulators have been tested for suppression of annual bluegrass flowering with varying degrees of success (Cooper *et al.*, 1987 and Danneberger *et al.*, 1987). Unfortunately, the variability within this weed species causes varied and unpredictable responses to growth regulators.

Maleic hydrazide, chlorfluorenil, and mefluidide (Embark[®]) all successfully inhibit flowering by *Poa annua*. Paclobutrazol (Scott's TGR[®]), which stunts seedheads, has been used to convert *Poa annua* sites to desirable turfgrasses. I found a range of seedhead control with mefluidide in tests conducted at the University of Minnesota. Some *Poa annua* selections had excellent seedhead suppression, while others showed little effect. The length of suppression also varied depending on the plant selections. Thus, what works for one person may not be as successful for someone with different strains of annual bluegrass. This is not to discourage you from trying growth regulators—just be aware that the product may or may not perform well in your situation.

A relatively new product, ethofumesate (Prograss[®]), provides both pre- and post-emergent control. Effective control has been demonstrated in many situations on several strains of annual bluegrass, although I do know some sod growers in New England who have been frustrated in their attempts to use this product. Lack of control could be due to improper timing of applications or resistant genotypes of *Poa annua*, rather than the product itself. Some states have not registered this product or have placed restrictions on its use. Check the label before using it.

You may find one or more of these cultural and

chemical controls useful in managing annual bluegrass. Do not be surprised if it takes a combination of methods. The battle will likely be long-term and result in reduced populations rather than total elimination.

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Conditions Favoring *Poa annua* Invasion

- * Compacted soils
- * Inadequate drainage
- * Excessive close mowing
- * High nitrogen
- * Adequate water
(natural rainfall or supplemental irrigation)
- * Mild summers

Cultural Controls for *Poa annua*

- * Aerify to decrease soil compaction.
- * Correct drainage problems.
- * Raise mower height above one inch, if possible.
- * Reduce nitrogen frequency.
- * Reduce irrigation frequency.
- * Limit phosphorus applications.
- * Reduce pH, and occasionally withhold water.
(Note: This control may not be practical on intensely utilized sites, since desired grasses may be too severely stressed by these actions.)

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