

## Potential Problems with Continuous Use of the Same Herbicide

*Fred Yelverton*

Are there problems with using the same turfgrass herbicide year after year? The answer is a very emphatic "yes." Continuous use of the same herbicide, or herbicides with the same mode of action, can cause either of two major problems. It can cause the development of herbicide resistance, and/or weed population shifts and the development of new weed problems. The following is a discussion of herbicide resistance. A discussion of weed population shifts will be included in a later issue.

Weed populations that are resistant to herbicides are becoming more common in turfgrass management and agricultural production. Insect resistance to insecticides and pathogen resistance to fungicides were documented long before herbicide resistance in weeds. Before any documented cases of herbicide resistance, it was generally believed that herbicide resistance would not occur in weed populations. The reasoning was that weeds, unlike insects and plant pathogens, are not mobile; where a weed germinates is where it completes its life cycle. Of course, hindsight is always more accurate than foresight and weed scientists were definitely wrong on this prediction.

What is herbicide resistance and how does it occur? **A weed is herbicide resistant when it can survive an herbicide dose several times greater than normally necessary for control. It is important to point out that herbicides do not cause any genetic alteration in plants. Herbicide resistance is nothing more than selection pressure for a resistant biotype of the weed that already exists in a weed population.** For instance, suppose on a golf course there are one million annual bluegrass (*Poa annua*) plants and in this population there is one plant that has the genetic makeup to survive an herbicide that normally kills annual bluegrass. You continue to use this same herbicide each year and control the susceptible annual bluegrass plants, but this one resistant plant continues to pollinate, produce seed and increase in numbers. For a few years, you may not notice there is a problem because you are getting acceptable control. But, control continues to get worse as you continue to control the susceptible plants, while the resistant weeds increase in numbers. After a while, the annual bluegrass population is made up of mostly resis-

tant biotypes that this particular herbicide will not control. How long does it take? Generally, **herbicide resistance can occur in 7 to 10 years of continuous annual use of the same herbicide or herbicide family.** There are documented cases of annual bluegrass resistance to the triazines in North Carolina, Mississippi, and California, just to name a few. There are also documented cases of goosegrass (*Eleusine indica*) resistance to dinitroaniline herbicides in several states. Other cases of herbicide resistance are suspected with various herbicides and weeds.

It is important to note that herbicide resistance will not always appear. In fact, with some herbicides there have never been documented cases of herbicide resistance. For resistance to occur, the resistant biotypes must be in the weed population. If they are not present, then resistance will not develop. How can you prevent herbicide resistance? **Rotating among herbicides with different modes of action can be very effective in preventing the development of herbicide resistance. This means rotating herbicides in different herbicide families that have a different mode of action.** For instance, in the case of triazine-resistant annual bluegrass, most of the documented cases have been with continuous use of simazine. Rotating with another triazine, such as atrazine, will not break the resistance cycle because these two herbicides have the same mode of action. However, rotating with pronamide (Kerb®) or a dinitroaniline (pendimethalin, prodiamine, oryzalin, etc.) will delay the development of herbicide resistance. Weed control modeling research has predicted that using a triazine 2 years in a row and another herbicide with a different mode of action in the third year (and continuing this cycle) can delay the onset of resistance for 45 years. Alternating a triazine one year and another herbicide family the next year continuously can delay resistance for 60 years. Of course, these are computer models, but they are probably fairly accurate.

Understanding herbicide resistance and the practices that can prevent the development of resistance are important for turfgrass managers. Remember that herbicide use in turfgrass management has not been in practice very long from a historical perspective. The incidences of herbicide resistance will increase in the future unless management practices are put in place to prevent its occurrence. 