How to Maximize Preemergence Herbicide Performance for Summer Annual Weeds

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Preemergence herbicides form the base of a chemical weed control program for summer annual weeds in turfgrasses and are used primarily to control annual grasses and certain annual broadleaf weeds. They persist in the soil and control susceptible weeds for two to six months. The length of control depends on the specific chemical being used, soil, physical and chemical properties, soil moisture levels, and soil temperatures. The soil persistence of these herbicides is advantageous in terms of length of weed control; however, it may be a disadvantage if seeding, sprigging or sodding operations are planned for a treated site. Newly-seeded and sprigged turfgrasses have a low tolerance to most preemergence herbicides (siduron and oxadiazon are noted exceptions). Appropriate waiting periods after herbicide application are required before reestablishing the site with turf. The herbicide label should be consulted to determine the length of time required before establishment operations can be conducted safely.

Each year there are instances where for some reason preemergence herbicides fail to control weeds or injury occurs to turfgrasses. Why? Well let's examine the factors that will maximize the effectiveness of a preemergence herbicide.

I. Preemergence herbicides must be applied prior to weed seed germination. The mode of action for most preemergence herbicides (e.g., bensulide, benefin, dithiopyr, oryzalin, pendimethalin, prodiamine) is the inhibition of certain phases of cell division during the seed germination process. As the weed seed germinates, the herbicide is absorbed by the root or shoot, cell division is blocked, growth is inhibited and eventually the immature seedling dies. Emerged weeds visible at the time of application are not controlled by preemergence herbicides. Although the majority of herbicides may be classified as preemergence or postemergence chemicals, atrazine, simazine, dithiopyr, ethofumesate, and pronamide are exceptions. Dithiopyr will control seedling crabgrass (prior to tiller development), but will not control seedling goosegrass.

II. Application Timing. The various species of crabgrass and goosegrass are among the most troublesome annual grass weeds in turf. Crabgrass initiates spring germination when soil temperatures at a 4-inch depth reach 53 to 58°F . This can occur from mid-February to late April in most areas of the southeastern United States. Goosegrass germinates at soil temperatures of 60 to 65°F. Because of higher temperature requirements for germination, goosegrass normally germinates two-to-eight weeks later in spring than crabgrass. The old rule of thumb is to apply the preemergence herbicide two weeks before crabgrass seed germination. However, recent research has shown that most preemergence herbicides can be applied in December and January and still provide high levels of crabgrass control the following summer months. Preemergence herbicides begin to degrade when exposed to the environment primarily by microbial decomposition. Degradation is higher under warm, moist soil

conditions and lower under cool, dry soil conditions. The low activity of soil microorganisms involved in herbicide decomposition during the cold, winter months is probably the reason preemergence herbicides can be applied in December and January several weeks in advance of crabgrass and goosegrass seed germination and still provide high levels of control the following summer. Early is always better than late with respect to preemergence application for summer annual grass weeds!

III. Application Frequency. In Georgia and most other southern states, repeat applications have ben shown to increase control of crabgrass and goosegrass, particularly if soil seed populations of these species is high. While research has shown that December and January applications can provide effective control of crabgrass in the following summer months, research has also shown that applying ½ the recommended rate at the normal application time and again 6 to 8 weeks later will improve crabgrass and goosegrass control for most products. Some research has also shown that after the use of normal herbicide application rates for one or two years, subsequent yearly rates may be reduced. B. J. Johnson showed that in properly maintained bermudagrass, herbicide rates required to control crabgrass or goosegrass could be halved or eliminated in subsequent years when an normal rate was applied the first year.

IV. Turfgrass tolerance. When considering any herbicide, the first consideration is the tolerance of the desirable turfgrass species to the chemical in question. As a general rule, preemergence herbicides are not as phytotoxic to established turfgrass species as postemergence herbicides. Notable exceptions are atrazine, simazine and pronamide on cool-season grasses. Additionally, the tolerance of fall-seeded tall fescue to several preemergence herbicides is low. Research has shown that tall fescue seeded from mid-September through mid-October was tolerant to most preemergence herbicides applied the following early March. However, if tall fescue was seeded in mid-November, most preemergence herbicides applied in early March caused moderate to severe injury expressed as stand reduction. Reference to the herbicide label will show recommended turfgrass species and time intervals that are required to prevent injury from time of seeding and herbicide application date.

V. Weed Species. In general, crabgrass is easier to control with preemergence herbicides than goosegrass. Herbicides that have consistently controlled crabgrass in most university tests include members of the dinitroaniline herbicide family (benefin, oryzalin, benefin + oryzalin, benefin + trifluralin, prodiamine, pendimethalin), dithiopyr, bensulide and oxadiazon. High levels (>80%) of goosegrass control have consistently occurred with oxadiazon, prodiamine, dithiopyr, pendimethalin, oryzalin and benefin + oryzalin. Atrazine and simazine rarely provide acceptable levels of either crabgrass or goosegrass control.

VI. Aerification. Core aeration generally has not been recommended or practiced following a preemergence herbicide application. Core aeration was believed to disrupt the herbicide barrier in the soil and stimulate weed emergence. B. J. Johnson reported in 1987 that core aeration immediately prior to or one, two, three, or four months after applications of benefin, bensulide, DCPA, and bensulide + oxadiazon to common bermudagrass did not stimulate large crabgrass emergence.

Aeration at one or two months after application increased large crabgrass cover 5% for oxadiazon at 2.0 lbs. ai/acre, but not at 4.0 lbs. ai/acre. In a related Georgia study, it was shown that core aeration at one, two, or three months after an application of oxadiazon did not decrease goosegrass control on a 'Tifgreen' bermudagrass putting green. In Michigan, core aeration, or vertical mowing, immediately or one month after an application of benefin, bensulide, or DCPA did not affect large crabgrass control in annual bluegrass. A study conducted in North carolina showed that aeration did not affect the activity of several preemergence herbicides in controlling crabgrass species in either 'Tifgreen' or common bermudagrass. However, in creeping bentgrass, significantly greater amounts of crabgrass occurred in aerified plots with the cores returned than in plots not aerified, or aerified plots with the cores removed. While most herbicide labels do not recommend aeration after preemergence herbicide application, university-conducted research has not shown an adverse effect on crabgrass control. Results can vary between research plots and commercial turfgrass sites and there may be situations where core aeration after preemergence herbicide application could stimulate crabgrass and goosegrass emergence. But, if the site requires aeration to encourage turfgrass growth and development, then it should be done. If crabgrass or goosegrass emerges, there are excellent postemergence herbicides that can be used.

VII. Herbicide Formulation Type. Preemergence herbicides are available as a sprayable or dry formulation. Dry formulations consist of the herbicide impregnated on an inert carrier such as clay or various analyses of fertilizer. Herbicide/fertilizer carrier products have become extremely popular in the turfgrass industry. Applying a herbicide/fertilizer product is convenient and enables two operations to be conducted at the same time. In general, sprayable and granular formulations of preemergence herbicides are equally effective in control susceptible weeds. But keep in mind that regardless of the formulation, herbicides must be uniformly applied to the site for acceptable control. Uniform coverage is usually easier to achieve with a spray than with a granular application. Several factors impact the results obtained with a herbicide formulated on a fertilizer carrier. Of these, application uniformity and percent load of the herbicide are the most critical. Application uniformity is determined by particle size, uniformity of particle size, and application equipment. Particle size and uniformity of particle size is determined by the manufacturer or formulator. As particle size decreases, the density of particles per unit area increases. Uniform particle sizes are equally important to prevent ballistic segregation. Research conducted in Mississippi showed that southern crabgrass control increased to a point then leveled off as particle size of a dry fertilizer/herbicide product decreased. In other words extremely small particle sizes were not necessary to achieve high levels of control. This research concluded that with dithiopyr and oryzalin a particle size 465 particles per gram or greater was necessary to achieve high levels of control. For prodiamine, a particle size of 165 particles per gram or more was sufficient. For oxadiazon, a size fraction of either 58 or 165 particles per gram or greater were equivalent in activity on southern crabgrass.

Another key factor to effective performance of the fertilizer/herbicide product is the percent load of the herbicide. High load products usually are applied at a lower amount of total material per acre than a low load product. Research conducted in North Carolina showed that

prodiamine formulated on a 0.29G product controlled smooth crabgrass better than when formulated as 0.5G product. The increase in smooth crabgrass control was attributable to the better coverage with 0.29G product.

Maximum control of summer annual weeds with preemergence herbicides can be achieved by following these basic guidelines:

1. Apply the product at the recommended time and rate. Weather varies from year to year and it may be necessary to apply earlier than normal. Reference to 30 day weather forecasts can help with this decision.

2. Apply the product before rain is expected or water it in with ½ inch of irrigation water. Numerous instances of poor weed control occur each year because of the lack of rain or an irrigation event within 7 days of preemergence application. Additionally, irrigating-in the herbicide is an excellent method to prevent losses due to volatility and lateral herbicide leaching. Turfgrass preemergence herbicides essentially do not leach in downward direction beyond a depth of 2 to 3 inches due to binding to soil colloids and organic matter. But they can move laterally, particularly if heavy rainfall occurs shortly after application. Thus, irrigation will usually improve weed control and will help to prevent lateral movement.

3. Calibrate all application equipment. Uniform application is critical to achieving good weed control.

4. If fertilizer/herbicide formulations are to be used, select a product that has uniform particle size and a sufficient number of particles that will ensure even, uniform application. Also, be sure that the herbicide load is sufficient to apply the recommended rate of the product. There is good data that indicates that dithiopyr rates can be reduced if applied on a dry granular carrier. However, with most other preemergence herbicides the amount of active ingredient applied per acre should be the same either for sprayable or dry formulations.

5. Delay mowing until after a rainfall or irrigation event. Studies have shown that mowing and bagging operations can remove significant quantities of a preemergence herbicide if conducted before the herbicide is moved into the soil by rain or irrigation water.

6. Properly maintain the turfgrass. Following recommended cultural practices that promote normal turfgrass growth and development will enable the turfgrass to compete with weeds. The first line of defense against weed infestations has been, and probably always will be, a thick, healthy, properly maintained turfgrass. Adherence to recommended soil fertility and pH levels, proper irrigation, controlling other pests, and mowing at the correct height and frequency will improve the effectiveness of most chemical weed control programs. The use of herbicides in the absence of proper turfgrass maintenance practices may provide weed control but the eventual goal of a high quality, aesthetically-

appealing turfgrass will not be achieved.

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