

## Post-emergence weed control in *cool-season* turfgrasses

### Site preparation is an important prologue to effective pre-emergence and post-emergence weed control.

by John McNamara, Ph.D.  
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■ Weeds are plants...they just grow where they're not wanted.

A white clover plant may be considered an integral part of turf by some, but others view it as an undesirable weed.

Weeds are a major problem in turfgrass, and are usually the most visible pests. Weeds destroy aesthetic and functional aspects of turf and perhaps more importantly, compete with turfgrass for water, nutrients, light, carbon dioxide and space. Correct identification, knowledge of plant characteristics and lifecycle play an important role in preventing and controlling common weeds.

Proper management fosters a denser, more vigorous turf which is pleasing to the eye and also discouraging to invading weeds. The presence of weeds is often a sign of turf which has been neglected or improperly managed.

When weeds invade our turf, we often seek a quick solution by using a wide array of available herbicides. Many of these applications, although effective, cannot provide long-term control of many weeds which may be present.

Continued herbicide use, without correcting conditions leading to weed encroachment,



Yarrow

can lead to weed problems that are even more persistent and difficult to control. A well balanced approach, including proper identification of weeds as well as cultural, mechanical and chemical control, will minimize weed competition.

**Cultural practices**—One of the most common cultural mistakes that is made in poor turf and weedy turfgrass is selecting non-competitive turf cultivars. Adapted turfgrass cultivars are more tolerant of environmental stress and are less likely to be damaged by pests than non-adapted grasses.

Turfgrass selection should be based on species and cultivar evaluation conducted over a number of years and under varying conditions. University recommendations are mainly based on such regional trials. Use mixtures (two or more species) and blends (two or more cultivars rather than a single cultivar). This spreads adaptability as it will ensure a broad genetic base and adaptation to a wide range of growing conditions. Mixtures and blends will maintain better stand density and compete more readily against weed invasion than unadapted grasses.

Using adapted cultivars, proper mowing height and frequency, fertilization, irrigation, and proper drainage are all cultural practices which will promote a competitive turf.

**Mechanical control**—Tilling prior to turfgrass establishment can be considered one example of mechanical control. The seed bed should be prepared a few weeks before seeding. A final shallow till just prior to seeding should be done to destroy any weed seedlings that have germinated since the last tillage operation.

**Soil coring or aeration** can alleviate soil



Plantain

compaction, enhance rooting, increase water penetration, enhance nutrient uptake and minimize thatch build-up. Certain weeds, such as prostrate knotweed, are more competitive when soils are compacted. Soil aeration, when turf is actively growing improves turfgrass growth.

**Mowing**, another example of mechanical control, is basic to turfgrass culture. Unfortunately, most weeds which infest turfgrass areas can tolerate close mowing heights. The idea is to select a mowing height and frequency based on growth rate and environmental conditions. As a general rule, remove no more than one-third of the leaf area with any mowing. Keep mowing equipment sharp and in good operating condition. Continuous mowing with a dull mower blade weakens turf, making it prone to stress injury and weed invasion. Proper mowing practices help develop and maintain a dense, vigorous turf less subject to weed competition.

Although more commonly used for disease control, **sanitation** practices can help control weeds. Sanitation refers to the physical removal or avoidance of placing undesirable plants where they are not wanted. Violets, often planted in flower beds, can become established in turfgrass where they are a troublesome pest. Avoid planting species such as violets close to the edge of flower beds where they can readily invade the turf.

Mowing and edging equipment should be kept clean. A mower may pick up a sprig of zoysiagrass from an adjacent turf and move it



Curly dock

to a section of bluegrass turf. If conditions are favorable, the zoysiagrass can become established in the bluegrass.

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When establishing a turf stand, make sure to use nothing but the highest quality seed available. Low quality seed often contains weed seed. One way to ensure the seed you buy is high quality is to only buy certified seed, which indicates what percentage, if any, weed seed is present and guarantees the genetic purity of the seed bag.

**Chemical control**—Herbicides are an integral part of any weed control strategy. Herbicides provide an effective, convenient method of controlling weeds in turf, but should be considered as a supplement to proper cultural and mechanical control methods. For the most part, herbicides are specific as to which weeds they will control, and herbicide selection depends on which weeds are present.

Herbicide selection also depends on which turfgrass species are present. Always read and follow herbicide label directions. Double coverage at half rate in two directions assures a more even distribution than full rate applied in one direction. Do not apply granular formulations to wet turf.

The purpose of **pre-emergence** herbicides is to form a chemical barrier at the soil surface to control weeds during germination, before they emerge. **Post-emergence** herbicides are applied to target weeds that have already emerged from the soil. Post-emergence herbicides may be **selective** or **non-selective** and act as systemic or non-systemic (contact) types.

**Systemic** herbicides are absorbed and moved within the plant system. They are commonly used to control perennial weeds, since they are translocated to underground plant parts and eliminate regrowth from these structures. **Contact** herbicides kill only those plant parts which are sprayed and are not translocated within the plant. They are most effective on annual weeds. Uniform coverage is essential for effective weed control using a contact herbicide.

**Pre-emergence application tips**—Pre-emergence herbicides are used primarily to control annual grasses, but may control annual broadleaf weeds as well. For these products to be effective, they should be applied a few weeks prior to the germination of the weeds controlled. A second application is sometimes needed to provide season-long control.

• **Prepare the site.** Pre-emergence herbicides must reach the soil where weed seeds germinate. To maximize the amount of product which reaches the site, the turfgrass must be prepared properly. Rake and remove trash, thatch, leaves and excess dead grass from the turfgrass. This allows the soil surface to warm

quickly in the spring and enhance turf growth.

• **Mow the grass.** It is helpful to mow the turfgrass prior to herbicide application to reduce herbicide interception. Research conducted at the University of Nebraska has shown that up to 95 percent of applied pre-emergence herbicide can be retained on the turfgrass leaves and never reach the soil. By mowing prior to the treatment, less material is intercepted by the turf and more gets to the soil surface.

• **Irrigate.** It is critical to water pre-emergence herbicides into the turfgrass as soon as possible. Usually, between one-half to one inch of water is sufficient for many of the pre-emergence herbicides to be moved into the soil and activated. Without irrigation or rainfall soon after application, the product stays on the turf and can be degraded by sunlight, which greatly reduces efficacy.

**Post-emergence application tips**—Regardless of the type of weed, there are several factors that influence the effectiveness of postemergence applications.

• **Apply when weeds are small.** For annual weeds, or the seedlings of perennials, control is easiest to achieve when the weeds are small. As the weeds age, changes in leaf surface characteristics, such as growth habit and physiological function occur. These changes result in reduced herbicide uptake and translocation. The larger the weed, the more difficult it is to control. Larger weeds may require higher rates or repeat applications, which can increase injury to existing turf.

• **Apply to healthy weeds.** Weeds are more susceptible to herbicides if they are actively growing at the time of the application. Any stress that reduces the vigor of the weed often results in less herbicide uptake and translocation, the end result being erratic control. Good soil moisture and moderate air temperatures should be present when making applications. If soil moisture is lacking, water the turfgrass a few days prior to the intended spray date. Applications made early in the morning or late in the afternoon are also helpful. At these times, air temperature is low and water stress is at a minimum.

• **Avoid irrigation and rainfall.** Post-emergence herbicides must be retained on the leaf surface of the weed so the material can be absorbed and translocated within the weed. Although these herbicides have some soil activity, most of the weed control benefits are from foliar activity. If irrigation or rainfall occurs shortly after herbicide application, significant amounts of the herbicide can be washed off the weed, resulting in reduced control. Generally, there needs to be an eight-hour, rain-free period after an applica-

tion has been made.

• **Do not pre-mow.** The target weeds must have enough leaf area to intercept a lethal dose of the herbicide. To ensure adequate leaf surface, don't mow the area prior to spraying for weeds.

Ideally, the area should not be mowed for two to three days before treatment. After treatment, allow another three to four days to pass before mowing the area. This allows enough time for the herbicide to be thoroughly translocated within the weed.

For more specific information, consult your local or state turfgrass specialist or other experts.

—Dr. McNamara is an extension weed scientist at the University of Nebraska.

## Identify the problem

■ From a control standpoint, determining the lifecycle of the weeds—whether they are annuals, biennials or perennials—is essential for management purposes.

**Annuals** require one year or less to complete their lifecycle. They germinate from seed, mature and produce seed for the next generation in less than 12 months. Winter annuals such as sheperdspurse and henbit are most visible in the spring after bolting (stalk elongation). After bolting has occurred, the chances of achieving satisfactory control by any form decreases. Summer annuals such as crabgrass and prostrate knotweed are most easily controlled in the early spring before they germinate, or when small and actively growing.

**Biennials** complete their lifecycle in two years. They form a rosette during the first year, maintain the rosette during the dormancy of the winter, then continue vegetative growth with flowering and seed development the following year. They are most easily controlled in the fall or early spring when the plants are still in the rosette stage. Members of the thistle family, such as musk and plumeless, are classic examples in turf.

**Perennials** are plants that live for more than two years, and may live indefinitely. Many perennials grow from seed, but may arise from reproductive structures such as tubers, roots, stolons and rhizomes. Dandelions, white clover, quackgrass and ground ivy are examples of perennial weeds. Best control is achieved by fall application of an appropriate herbicide.

—Dr. McNamara

# Post-emergence weed control in warm-season turfgrasses

by Tim R. Murphy, Ph.D.

■ Pre-emergence herbicides are invaluable for providing effective control of common annual weeds such as crabgrass and goosegrass. However, most turfgrass sites are infested with weeds that are not controlled by pre-emergence herbicides.

Fortunately, warm-season turfgrass managers have a wide array of post-emergence herbicides which can be used to control these problem weeds. A complete chemical weed control program can usually be based on post-emergence herbicides. However, multiple applications are commonly needed and most post-emergence herbicides usually cause temporary injury to turfgrasses. Therefore, the primary use of post-emergence herbicides is to supplement the level of weed control obtained with the use of a pre-emergence herbicide.

A successful post-emergence weed control program depends on well-maintained turf. Use of recommended fertility programs, water requirements, mowing heights and schedules, and disease and insect control will greatly increase turf competition against weeds. It will also improve the tolerance of warm-season turfgrass to post-emergence herbicides and increase the effectiveness of the post-emergence weed control program.

Numerous herbicides are available to control emerged weeds in warm-season turfgrasses (Table 1). However, several factors must be considered in selecting the appropriate herbicide.

**Turfgrass tolerance**—The single most important factor in selecting a post-emergence herbicide is the tolerance of the turfgrass to the herbicide.

Warm-season turfgrass species differ in their tolerance to post-emergence herbicides. For example, bermudagrass has good tolerance to MSMA and DSMA. However, carpetgrass, centipedegrass and St. Augustinegrass are severely injured by these herbicides. Additionally, cultivars within a species may respond differently to the same herbicide. Meyer zoysiagrass has better tolerance to MSMA than Emerald or Matrella. Refer to the product label to determine if the herbicide may be used on a particular turfgrass species.

Correct weed identification is a prerequisite for selecting an appropriate herbicide. After the weed has been identified, review the label to determine if the herbicide will control the problem weed. Reference to land grant university weed control guides may show the effectiveness of herbicides in controlling weed species that are not listed on the herbicide label.

**Application frequency**—For some herbicides, a repeat application is necessary to effectively control the weed. For example, two applications of MSMA, at a

seven- to 10-day interval, are necessary to control crabgrass in bermudagrass. In contrast, one application of Vantage will usually control crabgrass in centipedegrass.

Other than athletic fields and sod farms, turfgrasses are rarely grown as the sole plant in the landscape. Ornamentals may be injured by herbicide spray and vapor drift or by root absorption of some herbicides. Ester formulations of the phenoxy herbicides (2,4-D, dichlorprop) easily volatilize during warm temperatures and can injure sensitive ornamentals by vapor drift.

Their use should be avoided during the warm months of the year on or near sites that contain ornamentals.

Spray drift damage can be prevented by spraying when the wind velocity is less than 5 mph, and by selecting a nozzle tip and spray pressure that produces large spray droplets.

Atrazine (Aatrex), dicamba (Banvel) and dicamba-containing herbicides can injure broadleaf ornamentals via root uptake, particularly on sandy soils if rainfall occurs immediately after application. Avoid the use of these herbicides over the root zone of shrubs and small trees.

—Dr. Murphy is an extension agronomist in weed scientist at the University of Georgia.



Purple nutsedge



Wild garlic



Virginia buttonweed

**Table 1. Names of warm-season turfgrass post-emergence herbicides<sup>1</sup>**

Common name	Trade name(s)	Uses
asulam	Aulox	grass weed control in St. Augustinegrass
atrazube	Aatrex, others	pre- and post-broadleaf and grass weed control
bentazon	Basagran T/O	primarily used for yellow nutsedge control
bentazon + atrazine	Prompt	yellow nutsedge and broadleaf weed control incentipede grass, St. Augustine grass and zoysiagrass
bromoxynil	Buctril	broadleaf weed control
2,4-D	numerous formulations	broadleaf weed control
2,4-D + dicamba	Eight-One	broadleaf weed control
2,4-D + dichlorprop	Weedone DPC Amine Weedone DPC Ester	broadleaf weed control
2,4-D + mecoprop	Lescopar; 2 Plus 2	broadleaf weed control
2,4-D + mecoprop + dicamba	Trimec Classic; Trimec 992; Three-Way	broadleaf weed control
2,4-D + mecoprop + dichlorprop	Weedestroy Triamine; Weedestroy Tri-Ester	broadleaf weed control
dicamba	Banvel	broadleaf weed control
diclofop-methyl <sup>2</sup>	Iloxan	goosegrass control in golf course bermudagrass
diquat	Reward	winter annual weed control in dormant bermuda grass
DSMA	numerous formulations	grass weed control in bermudagrass and zoysiagrass
ehofumesate	Prograss	pre- and early post- <i>poa annua</i> (annual bluegrass) control in overseeded bermudagrass. Common bermuda grass suppression in St. Augustine grass
fenoxaprop	Acclaim	annual grass weed control and suppression of bermudagrass in zoysiagrass
glyphosate	Roundup	winter annual weed control in dormant bermudagrass and bahiagrass
haalosulfuron	Manage	controls yellow and purple nutsedge
imazaquin	Image	nutsedge and wild garlic control in warm-season turfgrasses (except bahia grass). Also controls certain annual broadleaf weeds.
mecoprop	Mecomex; Lescopex	broadleaf weed control
mecoprop + 2,4-D + dicamba	Southern Trimec Trimec Bent	broadleaf weed control
MCPA + mecoprop + dicamba	Trimec Encore, Encore DSC	broadleaf weed control
MCPA + mecoprop + dichlorprop	Weedestroy Triamine II, Weedestroy Tri-Ester II	broadleaf weed control
metribuzin	Sencor Turf	goosegrass control in bermudagrass. Also controls prostrate spurge, winter annual broadleaf weeds.
MSMA	numerous formulations	grass weed control in bermudagrass and zoysiagrass
MSMA + 2,4-D + mecoprop + dicamba	Trimec Plus	grass and broadleaf weed control in bermudagrass and zoysiagrass
pronamide	Kerb T/O	annual bluegrass control in bermuda grass
sethoxydim	Vantage	annual grass control and suppression of bahiagrass in centipede grass
triclopyr + clopyralid	Confront	broadleaf weed control in bermudagrass, centipede grass & zoysiagrass

<sup>1</sup> Refer to the herbicide label for a complete listing of tolerant turfgrasses and labeled application sites.

<sup>2</sup> Diclofop-methyl has a state label for use in Alabama, Florida, Georgia, Mississippi, North Carolina, South Carolina and Texas.

## Post-emergence use suggestions

- Apply post-emergence herbicides to small, actively-growing weeds. Perennial and annual weeds that are growing under good soil moisture conditions at moderate air temperatures are easier to control than weeds that are stressed due to adverse environmental conditions.

- Target the application to coincide with good soil moisture conditions at air temperatures of 60-90° F. Applications on cold, wintery days, or to drought-stressed weeds will result in poor weed control.

- Post-emergence herbicide use should be avoided when turfgrasses and weeds are stressed due to high air temperatures or drought.

The tolerance of warm-season turfgrasses to post-emergence herbicides decreases at air temperatures greater than 90° F when turfgrasses are drought-stressed or when they are growing under high soil moisture and high relative humidity conditions.

- Herbicides that contain 2,4-D, dicamba, mecoprop, dichlorprop, imazaquin, MSMA and DSMA should not be applied at high air temperatures (greater than 90° F), since there is an increased risk of unacceptable turfgrass injury. Always follow the most restrictive warning on the label. Additionally, the tolerance of warm-season turfgrasses to herbicides is generally lower during spring green-up than when the turfgrass is dormant or after full green-up. Fortunately, research has shown that the decrease in turfgrass quality that may result from the use of post-emergence herbicides during green-up is temporary and persists for 2 to 6 weeks after application. If a dense weed population requires a post-emergence herbi-

cide during green-up, use only the lowest recommended or one-half the recommended rate to minimize herbicide injury to the turfgrass. If needed, the application can be repeated after full green-up.

- Single applications at high rates generally cause more turfgrass injury than repeat applications at low rates.

Additionally, single, high rate applications often do not control perennial weeds. The repeat application is usually made at intervals of seven to 14 days after the first application, or when regrowth of the weed is noted.

- Mowing schedules must be coordinated with post-emergence herbicide applications. Generally, mowing should be delayed three to four days before or after a post-emergence herbicide application to increase the leaf surface area of the weed and spray deposition. The delay after application is necessary to allow adequate time for herbicide absorption and translocation in the target weed species.

- Do not apply post-emergence herbicides immediately before rainfall or irrigation. Rainfall or irrigation immediately after application can wash the herbicide from the treated weed foliage and decrease control. On irrigated sites, watering drought-stressed weeds one to two days before a post-emergence herbicide application will usually improve control of the problem weeds species.

- Use surfactants and crop oil concentrates according to label directions.

- Calibrate all spray equipment and train the operator.

—Dr. Murphy

**Common bermudagrass.** Unless desired, common bermudagrass is an aggressive, competitive weed. Multiple applications of Vantage can suppress bermudagrass in centipedegrass. In zoysiagrass, repeat applications of Acclaim at three-week intervals during the summer months will suppress it.. Prograss can be used to suppress actively-growing common bermudagrass in St. Augustinegrass.

**Bahiagrass.** Repeat applications of MSMA or DSMA at seven- to 10-day intervals will control bahiagrass in MSMA/DSMA-tolerant turfgrasses. In centipedegrass, repeat applications of Vantage at 10-1

**Dallisgrass.** A perennial, dallisgrass is hard to control. In bermudagrass or zoysiagrass, 2-4 repeat applications of MSMA or DSMA will be necessary. Also a non-ionic surfactant should be used with MSMA or DSMA to control dallisgrass. Applications should be made when dallisgrass is growing under good soil moisture conditions. Staying on the application schedule (2-4 applications, each at a 5- to 10-day interval) will be required to control dallisgrass.

## Problem weeds

**Nutsedge(s).** Basagran T/O will provide good control of yellow nutsedge, but not of purple nutsedge. Monthly applications of MSMA or DSMA in tolerant turfgrasses in the late spring and summer months can suppress the growth of both species. With the exception of bahiagrass and carpetgrass, Image can be used in warm-season turfgrasses for yellow and purple nutsedge control. MSMA to Image generally improves nutsedge control in MSMA-tolerant turfgrasses.

A repeat application, 6- to 8-weeks after the first, of Image or Image+MSMA is required to control nutsedge during the summer months. Manage (halosulfuron) is now registered for nutsedge control in warm-season turfgrasses. Manage provides good to excellent control of purple and yellow nutsedge. A repeat application 6- to 10-weeks after the first application may be needed for season-long control. Warm-season turfgrasses have excellent tolerance to Manage.

**Virginia Button weed.** The most difficult to control broadleaf weed in southern turfgrasses. This warm-season perennial reproduces by seed, cut plant pieces, and fleshy roots. Research shows that repeat applications, at intervals of three to six weeks, of a two-way or three-way herbicide is needed in the summer to suppress Virginia buttonweed.

Research in Mississippi shows that 2,4-D undergoes more translocation to the roots of Virginia buttonweed than other broadleaf herbicides. Therefore, two-way or three-way herbicides with a high concentration of 2,4-D may provide better Virginia buttonweed control than products low in 2,4-D or products that do not contain 2,4-D.

**Wild garlic.** Fall (November) plus a winter (January-February) application of 2,4-D or two-way or three-way products that contain a phenoxy herbicide or dicamba over a two to three year period will control wild garlic. Early- to mid-winter applications of Image have also provided good to excellent control of emerged wild garlic.

—Dr. Murphy