Weed control in cool season turfgrass

by S. Wayne Bingham
Virginia Tech

■ Turfgrass management programs vary widely and depend, to a large extent, on the area or its use (see chart below). Weed management strategies begin with developing a total management program.

High quality turfgrass needs a greater maintenance intensity to provide a dense cover. In an established cool-season turfgrass, several agronomic practices are very important in the strategies against weeds:

- mowing height for Kentucky bluegrass may be 2½ inches to obtain the best defense against weed encroachment;
- mowing frequency is based on growth rate and is often enough so that only one-third of the turfgrass foliage is removed each time;
- irrigation to supplement natural rainfall when turfgrass begins to show signs of silt is particularly important, and may require an average of two to five times during the summer; and
- proper timing of fertilizer practices are programmed to encourage root development and foliar density. Even then, herbicides are an important part in weed management strategies.

Pre-emergence herbicides—These herbicides are used extensively for crabgrass control; are applied prior to weed seed germination; are relatively insoluble in water; require some irrigation or rain to be most efficacious; are adsorbed to organic matter and clay in the soil surface; and prevent establishment of annual grasses by inhibiting the root growing out of the seed.

The commonly used pre-emergence herbicides in cool-season turfgrasses are listed in Table 1 and rated for effectiveness in crabgrass and goosegrass control as well as tolerances of bluegrass, tall fescue and perennial ryegrass.

For pre-emergence herbicides, it is important to identify the annual grassy weed growing in prior years. Check the label or tables for herbicide effectiveness and turfgrass tolerance before applications are made at least two weeks prior to expected germination.

Crabgrass germination occurs first, then goosegrass three or more weeks later. Crabgrass and goosegrass germinate in open, thin stands of turgrass and emergence is delayed and restricted in dense stands. Some herbicides provide less residual time than others and may require sequential applications. In cases of both crabgrass and goosegrass problems, split applications should be made to have enough herbicide present at the peak germination period of each grassy weed.

Post-emergence herbicides—In many cases, several different broadleaf weeds grow together and often require a combination of two or three herbicides. Commonly used formulations containing one active ingredient include 2,4-D, mecoprop, dicamba and triclopyr. (See Table 2.)

Approximately 120 weeds are important to turfgrass management programs. Each herbicide's active ingredient provides control of a portion of these weeds. For example:

2,4-D + dicamba control about 90 percent of weed species;

2,4-D + diclorprop + dicamba = 85 percent;

dicamba alone = 75 percent;

2,4-D + diclorprop = 70 percent;

2,4-D + mecoprop + dicamba = 70 percent;

2,4-D + dichlorprop + mecoprop = 70 percent;

2,4-D + mecoprop = 65 percent;

2,4-D alone = 50 percent;

triclopyr alone = 40 percent; and

mecoprop alone = 25 percent.

Each label will indicate the most commonly controlled list of weed species

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COOL-SEASON WEED CONTROL STRATEGIES

- ❖ Follow good management practices to grow quality turfgrass.
- ❖ Prevent turfgrass from becoming thin or containing voids for weed encroachment.
- ❖ Select herbicides for turfgrass tolerance for weeds involved.
- ❖ Apply uniformly with calibrated applicator using label directions and precautions.
- ❖ Select the best time for each application.
- ❖ Employ a reliable applicator who will follow instructions and wear protective clothing.

—*S.W.B.*

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and the turfgrasses that are tolerant for effective use. Therefore, it is imperative to identify the problem weeds and select a formulation appropriate for selective control.

The newest—Isoxaben (Gallery) is an exceptional broadleaf herbicide which gives pre-emergence control. It appears quite effective for summer annual weeds such as knotweed, spotted spurge, yellow woodsorrel and purslane. With post-emergence herbicides for control of emergend weeds, isoxaben provides some control of perennial weeds such as white clover, dandelion and plantain. It is for pre-emergence and has little post-emergence activity on weeds.

–Dr. S. Wayne Bingham is professor of weed science at Virginia Polytechnic Institute and State University in Blacksburg, Virginia.

Table 1. **TURFGRASS TOLERANCE AND WEED CONTROL RATINGS TO PRE-EMERGENCE HERBICIDES**

Herbicide	Ky. bluegrass[1]	Tall fescue	Perennial ryegrass	Large crabgrass[2]	Goosegrass
Benefin	T	T	T	S	I
Bensulide	T	T	T	S	R
DCPA	T	T	T	S	I
Dithiopyr	T	T	T	S	I
Oxadiazon	T	T	T	S	S
Pendimethalin	T	T	I	S	I
Prodiamine	T	T	I-T	S	I
Siduron	T	T	I	S	R
Benefin + trifluralin	T	T	I-T	S	I
Bensulide + oxadiazon	T	T	T	S	S

[1]Relative tolerance of turfgrass species: T=tolerant; I= intermediate, use with caution at low rates, may cause temporary injury and thinning; S= turfgrass is not sufficiently tolerant or not registered for use.
[2] S= weed is susceptible; I= intermediate control, good control at times with high rates, may require more than one treatment annually; R= resistant, less than 70 percent control.

Source: Dr. Bingham

Table 2. **EFFECTIVENESS OF BROADLEAF HERBICIDES; RESPONSE TO HERBICIDES AND MIXTURES**

Control product ➧ / Broadleaf ➧	2,4-D	dicamba	2,4-D + mecoprop	2,4-D + mecoprop+ dicamba	2,4-D+ dicamba	2,4-D+ diclorprop	2,4-D + triclopyr	triclopyr+ clopyralid
Black medic	R	S	I	S	S	S	S	S
Va. buttonweed	R	R	R	I-R	I	I	I	I
C. chickweed	R	S	S	S	S	S	S	S
M. chickweed	R	S	S-I	S	S	S	S	S-I
W. clover	I	S	S	S	S	S	S	S
C. dandelion	S	S	S	S	S	S	S	S
Dock	I	S	I	I	S	I	I	S-I
Wild garlic	I	I	I	I	S-I	I		
Ground ivy	I-R	S-I	I	I	S-I	I	S	S-I
Henbit	I	S	I	S-I	S	S	S	S
Knotweed	R	S	I	I	S	I		
B. plantain	S	I-R	S	S	S	S	S	S
S. spurge	I-R	S-I	S-I	S-I	S-I	S-I	S-I	S-I
Corn speedwell	R	R	R	R	R	I	I	I
Red sorrel	R	S	I	I	S	I	S-I	S-I
Violets	I-R	I	I-R	I-R	I	I	I	I
Wild carrot	S	S	S	S	S	S	S	
Yarrow	I	S	I	I	S	I	I	
Yellow wood-sorrel	I	R	I-R	I	I	S	I	I

R = Resistant weed, usually less than 70 percent control; I = intermediate level of control, with high ratio or repeat applications; S = susceptible weed, usually controlled at recommended rates.

Source: Dr. Bingham

Post-emergence weed control in warm-season turfgrasses

by Tim R. Murphy, Ph.D.
University of Georgia

■ Unlike pre-emergence herbicides which must be applied at certain times of the year, pos—emergence herbicides provide the turfgrass manager with viable options to control weeds over the entire year. A complete chemical weed control program can be based on post-emergence herbicides; however, most post—emergence herbicides usually cause temporary injury to turfgrasses. Therefore, the primary use of postemergence herbicides is to supplement the level of weed control obtained with the use of pre-emergence herbicides.

Proper turfgrass maintenance is the first step in the development of a successful post-emergence weed control program. Adherence to recommended fertility programs, water requirements, mowing heights and schedules, and controlling diseases and insects will significantly increase turfgrass competition with weeds. It will also improve the effectiveness of the post-emergence weed control program.

Post-emergence herbicides offer several advantages relative to the use of pre-emergence herbicides:

- Can be applied as less expensive "spot treatments" or "as needed" directly to a weed infestation.
- Postemergence herbicides control many problem annual and perennial weeds that are not controlled by pre-emergence herbicides.
- Low rates of most post-emergence herbicides may be used on newly sprigged or sodded warm-season turfgrasses. (most pre-emergence herbicides are recommended only for established turfgrasses.
- In areas that are scheduled to be overseeded or renovated, the majority of postemergence herbicides can be used prior to renovation. The time interval from application to seeding, sprigging or sodding operations for most pre-emergence herbicides varies from six weeks to 4 months.

Think first!

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.

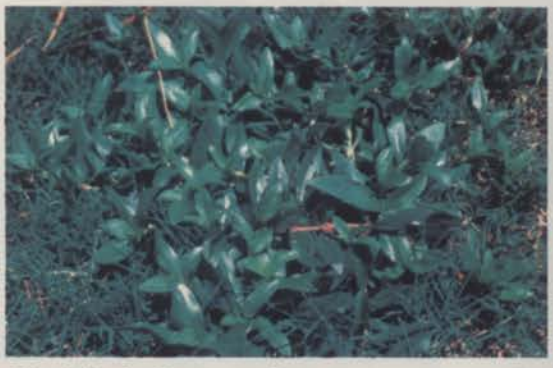
Turfgrass Tolerance: The single most important factor in selecting a post-emergence herbicide is the tolerance of the turfgrass to the herbicide. Warm-season turfgrasses differ in their tolerance to post-emergence herbicides (Table 2). For example, bermudagrass has good tolerance to MSMA and DSMA; however, 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'. The product label should always be consulted to determine if the herbicide may be used on a particular turfgrass species.

Weed Species: Correct weed identification is a prerequisite for the selection of an appropriate herbicide. Weed identification assistance is available at county Extension Service offices and through chemical company representatives. After the weed has been identified, the herbicide label should be reviewed to determine if the herbicide will control the problem weed. Also, 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 weed species and herbicides, a repeat application is necessary to effectively control the weed. For example, two applications of MSMA + Sencor, at a 7 to 10 interval, are necessary to control goosegrass. In contrast, one application of Illoxan will usually control goosegrass.

Ornamental Tolerance: Ornamentals may be injured by spray or vapor drift or by root absorption of the herbicide. Ester formulations of the phenoxy herbicides (2,4-D, dichlorprop) easily volatilize during warm temperatures and can injure sensitive ornamentals by vapor drift. Therefore, they should not be used 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 miles per hour, and selecting a nozzle tip and spray pressure that produces large spray droplets.

Due to their soil residual characteristics, atrazine (Aatrex) and 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.



Virginia buttonweed

Suggestions for use

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 with post-emergence herbicides 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 to 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 since there is an increased risk of unacceptable turfgrass injury. Always follow the most restrictive warning that is shown on the label. As previously mentioned, weed control is also poorer when herbicides are applied to environmentally stressed weeds than when applied to actively-growing weeds. 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 necessitates the use of a post-emer-

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Table 1.

POST-EMERGENCE HERBICIDES FOR WARM-SEASON TURFGRASS[1]

Common Name	Trade Name(s)	Uses
asulam	Asulox	Grass weed control in St. Augustinegrass
atrazine	Aatrex, others	Pre- and post-emergence broadleaf and grass weed control
bentazon	Basagran T/O	Primarily used for yellow nutsedge control
bentazon + atrazine	Prompt	Yellow nutsedge/broadleaf weed control in centipedegrass, St. Augustinegrass, zoysiagrass
bromoxynil	Buctril	Broadleaf weed control on non-residential turf
2,4-D	numerous	
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[2]	Illoxan	Goosegrass control in bermudagrass
diquat[3]	Diquat	Winter annual weed control in dormant bermudagrass
DSMA	numerous	Grass weed control in bermudagrass and zoysiagrass
ethofumesate	Prograss	Pre- and early post-emergence annual bluegrass control in over- seeded bermudagrass, and common bermudagrass suppression in St. Augustinegrass
fenoxaprop	Acclaim	Annual grass control and suppression of bermudagrass in zoysiagrass
glyphosate	Roundup	Winter annual weed control in dormant bermudagrass and bahiagrass
imazaquin	Image	Purple nutsedge and wild garlic control in warm-season turfgrasses (except bahiagrass); also controls certain broadleaf weeds
mecoprop	Mecomec, 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 and numerous winter annual broadleaf weeds
metsulfuron	DMC	Controls 'Pensacola' bahiagrass, wild garlic, prostrate spurge, many broadleaves
MSMA	numerous	Grass weed control in bermudagrass and zoysiagrass
MSMA + 2,4-D + mecoprop + dicamba	Trimec Plus	Grass and broadleaf weed control in bermudagrass, zoysiagrass
pronamide	Kerb	Annual bluegrass control in bermudagrass
sethoxydim	Vantage	Annual grass control and suppression of bahiagrass in centipedegrass

[1] Refer to the herbicide label for a complete listing of tolerant turfgrasses and labeled application sites.
[2] Diclofop-methyl has a state label for use in Alabama, Florida, Georgia, Mississippi, North Carolina, South Carolina and Texas.
[3] Diquat has a state label in Arkansas, Louisiana, Mississippi, Oklahoma, Tennessee and Texas for winter annual weed control in dor- mant bermudagrass.

Source: Dr. Murphy

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Table 2. WARM-SEASON TURFGRASS TOLERANCE TO POST-EMERGENCE HERBICIDES

HERBICIDE	Bahiagrass	Bermudagrass	Centipedegras	Carpetgrass	St. Augustinegrass	Zoysiagrass
asulam	NR-S	T[1]	NR-S	NR-S	I-T	NR
atrazine	NR-I	S(D)	T	NR-T	T	I
bentazon	T	T	T	NR-T	T	T
bentazon + atrazine	NR-I	NR-I	NR-T	NR-I	NR-T	NR-T
bromoxynil	T	T	T	NR-I	T	T
2,4-D	T	T	I	I-T	S-I	T
2,4-D + dicamba	T	T	S-I	I-T	S-I	T
2,4-D + diclorprop	T	T	I	I-T	S-I	T
2,4-D + mecoprop	T	T	S-I	I-T	S-I	T
2,4-D + MCPP + dicamba	I-T	I-T	S-I	I-T	S-I	T
2,4-D + MCPP + diclorprop	T	T	I	I	I	T
dicamba	T	T	I-T	T	S-I	T
diclofop-methyl	NR	T	NR	NR	NR	NR
DSMA, MSMA	NR-S	T	NR-S	NR-S	NR-S	I
fenoxaprop	NR-S	NR-S	NR-S	NR	NR-S	T
glyphosate	S(D)[2]	S(D)[2]	S	S	S	S
imazaquin	NR-S	T	T	NR-I	T	T
MCPA + MCPP + dichlorprop	T	T	I	I	I	T
mecoprop (MCPP)	T	T	S-I	I-T	S-I	T
metribuzin	NR-I	T	NR-S	NR-S	NR-S	NR-S
metsulfuron	NR-S	T	I-T	NR-I	I-T	NR-S
pronamide	NR	T	NR	NR	NR	NR
sethoxydim	NR-S	NR-S	T	NR-I	NR-S	NR-I

T = Tolerant at labeled rates
I = Intermediate tolerance, use at reduced label rates
S = Sensitive, do not use this herbicide
D = Dormant applications are recommended

Source: Dr. Murphy

gence herbicide during green-up, use only the lowest recommended or one-half the recommended rate to minimize herbicide injury to the turfgrass.

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 interval of 7 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 3 to 4 days before or after a post-emergence herbicide application. The delay prior to application will 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.

The effectiveness of many post-emergence herbicides is enhanced by the addition of a crop oil concentrate or surfactant to the spray mixture, particularly under less than ideal spray conditions. However, indiscriminate use of surfactants or crop oil concentrates can increase the risk of turfgrass injury. The herbicide label should be reviewed to determine if the use of a surfactant or crop oil concentrate is recommended.

Calibrate all spray equipment and train the operator.

--The author is extension agronomist in weed science at the University of Georgia's Cooperative Extension Service.

The majestic maple: mid-America's choice

Because of its traits, silver maple is one of the poorest choices for a street tree. Excessive pruning–to avoid power lines–causes heart rot.

Silver maples can grow to heights of 80 feet or more.

by Kenneth J. Schoon, Ph.D.
Indiana University Northwest

■ The dependable maple tree has become the most popular tree in the midwestern portion of the U.S., according to statistics from the Midwest Urban Tree Index.

Maples have a number of characteristics which contribute to their popularity: attractive shape, dense shade, fall color and (especially in the case of the silver maple) rapid growth.

The Index classified communities into three categories: urban centers with populations greater than 150,000; suburban communities adjacent to urban centers; and small cities of fewer than 65,000 persons.

The silver maple is not only the most popular shade tree in urban mid-America, it is nearly three times as common as the second-

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If planted at a spacing of 30 feet, the maple will run out of elbow room long before it reaches its potential spread.

The maple comprises more than 40 percent of all trees on urban public lands in the Midwest.

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place sugar maple. In 20 of 27 communities surveyed in the Index, the silver maple was the most common tree, and in five more communities it ranked second. In 25 of the communities, at least one species of tree comprises more than 15 percent of total trees. In 20 of the communities, it is the silver maple.

Other trees that exceed 15 percent in individual communities are: sugar maple, American elm, green ash, Norway maple, Siberian elm and callery pear.

As late as 1965, Donald Wyman (in "Trees for American Gardens") described the American elm as the most popular shade tree in North America. But as Dutch elm disease ravaged parts of the country, elms have largely been replaced by maples and ash trees. The American elm's abundance in a few midwestern communities today, such as Oak Park and Evanston (Ill.) is largely the result of aggressive maintenance programs.

Each urban center in the Index lists silver maple as its most common. Urban centers, though, contain many trees seldom planted today: Siberian elm, sycamore, mulberry, cottonwood, catalpa, boxelder and ailanthus.

Ornamental trees have become very popular in the suburbs. While crab apple trees are now found throughout all midwestern regions, suburban communities have the largest concentraton of other small ornamental fruit trees like the fruitless callery pear. In Munster, Ind., for example, 78 new "Bradford" callery pears were planted in 1991.

LaPorte, Ind., known as the "Maple City," uses a figure of a maple tree in its city seal. Seventy-eight percent of the city's street trees are maples, most of them sugar maples.

Northern or southern, newer or older communities, urban, suburban or small city, it is the maple that comprises more than 40 percent of all trees on urban public lands in the Midwest.

--Photographs courtesy of Holden Arboretum, Mentor, Ohio.

MOST COMMON URBAN TREES

	Urban centers	Suburban communities	Small cities
1.	Silver maple	Silver maple	Silver maple
2.	Norway maple	Norway maple	Sugar maple
3.	Green ash	Green ash	Red maple
4.	American elm	Honeylocust	Norway maple
5.	Sugar mpale	Sugar maple	Green ash
6.	White ash	American elm	White ash
7.	Hackberry	White oak	American sycamore
8.	Siberian elm	Siberian elm	Siberian elm
9.	Honeylocust	Red maple	Honeylocust
10.	Red maple	Pear	Pin oak
11.	Crabapple	Crabapple	Little-leaf linden
12.	Pin oak	Northern red oak	Tulip tree
13.	Little-leaf linden	Boxelder	Sweetgum
14.	American sycamore	Eastern cottonwood	Northern red oak
15.	Mulberry	White ash	Crabapple
16.	Eastern cottonwood	Pin oak	Hackberry
17.	Eastern white pine	American basswood	Redbud
18.	American basswood	American sycamore	American elm
19.	Northern catalpa	Little-leaf linden	Northern catalpa
20.	Colorado blue spruce	Black locust	Pear

Source: Midwest Urban Tree Index