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emergence herbicides is directly through the leaf surface. Therefore, it is important to have good coverage of the weeds, regardless of their growth stage.

Timing of application: If the application is not timed to coincide with the growth stage which is most susceptible to herbicide treatment, control results may be erratic or poor. In general, spring application of a product containing two or three herbicides is a standard treatment for broadleaf weed control. However, post-emergence herbicides can also be applied in the fall for certain weed species, such as ground ivy, hawkweed, plantain, wild strawberry and thistles. The fall treatment also controls many seedlings of winter annuals, germinating in late August or early September.

Common chickweed, corn speedwell and henbit are among many winter annuals.



Wild violets are difficult to control. A follow-up application is usually required one to four weeks after the first application.

Formulations: Choose a product formulation best suited to your needs. Ester and amine formulations have different activity. Amines are soluble in water, while esters are oil soluble. Esters are generally better weed control products than are corresponding amine products. Esters tend to penetrate into the leaf better than amines. However, esters are slightly volatile. This volatility loss can result in injury to non-target susceptible plants.

For post-emergence broadleaf weed control, mixtures of two to three herbicides are commonly used because the combinations are more effective than any single herbicide in controlling hard-to-control weeds.

Table 3 lists several products for hard-to-control weeds.

—The author is an associate professor of weed science at the University of Massachusetts.

Table 2

COMMONLY USED BROADLEAF HERBICIDE MIXTURES FOR POST-EMERGENCE WEED CONTROL

Herbicide	Trade name	Ratio	Manufacturer
2,4-D + MCPP	2 plus 2	1:1	Fermenta
	Lescopar	1:2	Lesco
	2,4-D-MCPP	2:1	Cleary's
2,4-D + 2,4-DP	Chipco Weedone DPC Ester	1:1	Rhone-Poulenc
	Chipco Weedone DPC Amine	1:1	Rhone-Poulenc
	Turf D + DP Ester	1:1	Riverdale
2,4-D + dicamba	Eight-one selective herbicide	8:1	Lesco
	Riverdale 81 selective weed killer	8:1	Riverdale
	Riverdale 101 weed killer	10:1	Riverdale
2,4-D + 2,4-DP + MCPP	Weedestroy Triamine	1:1:1	Riverdale
	Weedestroy Triester	1:1:2	Riverdale
MCPA + MCPP+2,4-DP	Weedestroy Triamine II	1:1:1	Riverdale
2,4-D+MCPP+ dicamba	Three-way selective herbicide	1:0.5:0.009	Lesco
	Trimec classic	1:0.5:0.1	Gordons
	Bentgrass selective	0.5:1.5:0.2	Lesco
	Triplet	2.44:1.3:0.22	Riverdale
2,4-D + triclopyr	Turflon D Ester	2:1	Dow
	Turflon II Amine	2.6:1	Dow
Triclopyr + clopyralid	Confront Amine	3:1	Dow

Source: Dr. Bhowmik

Table 3

SUGGESTED TREATMENTS FOR HARD-TO-CONTROL BROADLEAF WEEDS

Weed	Control product trade name	Comments
Ground ivy (<i>Glachoma hederacea</i>)	Turflon D Super Trimec Weedone DPC	Very difficult to control in summer. Fall application is desirable.
Prostate knotweed (<i>Polygonum aviculare</i>)	Same as ground ivy	Summer control difficult
Creeping speedwell (<i>Veronica filliformis</i>)	Turflon D Weedone DPC Trimec	Difficult to control. Several other speedwell species are also difficult to control.
	Dacthal 6F	Can be controlled with pre-emergence application.
Spurge (<i>Euphorbia supina</i>)	Turflon D Trimec Weedone DPC	Spring/summer application desirable.
	Dacthal PreM, Team, Dimension	Can be controlled with spring application of pre-emergence herbicides.
Wild violets (<i>Viola spp.</i>)	Turflon	Difficult to control; usually requires follow-up app. in 1-4 weeks.
Yellow woodsorrel (<i>Oxalis stricta</i>)	Turflon D Super Trimec Weedone DPC Pre-M, Team, Dimension	Spring applications of pre-emergence herbicides will control oxalis.

Source: Dr. Bhowmik

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Post-emergence weed control in warm-season grasses

Post-emergence herbicides control many problem annual and perennial weeds not controlled by the pre-emergents.

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

■ Proper turfgrass maintenance is the first step in developing a successful weed control program. Adhering to recommended fertility programs, water requirements, mowing heights and schedules, and disease and insect control will greatly

increase turfgrass competition with weeds. It will also improve the effectiveness of the chemical weed control program.

Post-emergence herbicides can be applied on a "spot treatment" or "as needed" basis directly to a weed infestation. Spot treatments of post-emergents are less expensive than broadcast applications of pre-emergents. Low rates of most post-emergents may be used on newly sprigged or sodded warm-season turfgrasses. In areas that are scheduled to be overseeded or renovated, the majority of post-emergents can be used up to one month before renovation.

The time interval from application to seeding, sprigging or sodding operations for pre-emergence herbicides varies from six weeks to four months.

Several factors must be considered in selecting the proper control product.

Turfgrass tolerance: Warm-season turfgrasses differ in their tolerance to post-emergence herbicides (Table 1). Consult the product label to determine if the herbicide may be used on a particular turfgrass species.

Weed species: 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.

Application frequency: For some weed species and herbicides, a repeat application



Dr. Murphy

Table 1

TURFGRASS TOLERANCE TO POST-EMERGENCE HERBICIDES

Herbicide	Turf Variety					
	Bahia	Bermuda	Centipede	Carpet	St. Augustine	Zoysia
asulam	NR-S	T*	NR-S	NR-S	T	NR
atrasine	NR-I	S(D)	T	NR-I	T	I
bentazon	T	T	T	NR-I	T	T
bromoxynil	T	T	I	NR-I	T	T
2,4-D	T	T	I	I	S-I	T
2,4-D + dicamba	T	T	S-I	S-I	S-I	I
2,4-D + dichlorprop	T	T	I	I	I	T
2,4-D + mecoprop	T	T	S-I	I	S-I	T
2,4-D + mecoprop + dicamba	I-T	I-T	S-I	S-I	S-I	T
2,4-D + mecoprop + dichlorprop	T	T	I	I	I	T
dicamba	T	T	I-T	I	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)	S(D)	S	S	S	S*
imazaquin	NR-S	T	T	NR-I	T	T
MCPA + mecoprop + dichlorprop	T	T	I	I	I	T
mecoprop	T	T	S-I	I	S-I	T
metribuzin	NR-I	T	NR-S	NR-S	NR-S	NR-S
metsulfuron	NR-S	T	NR-T	NR	T	NR-T
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 NR= Not registered for use on this turfgrass.

* Labeled only on Tifway (419) bermudagrass and St. Augustinegrass.

** Bahiagrass and bermudagrass are tolerant to glyphosate when completely dormant.

Source: Dr. Murphy

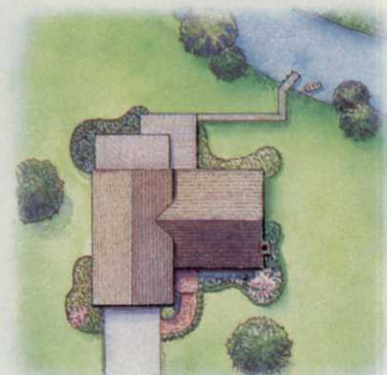
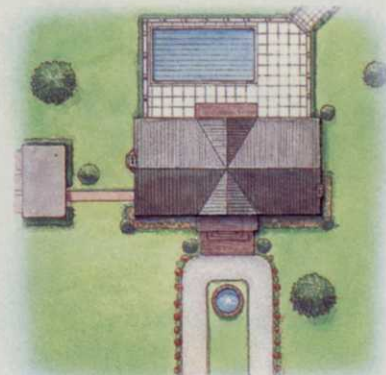
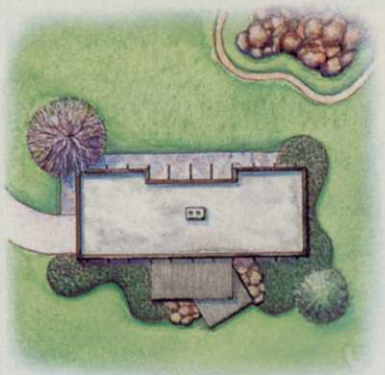
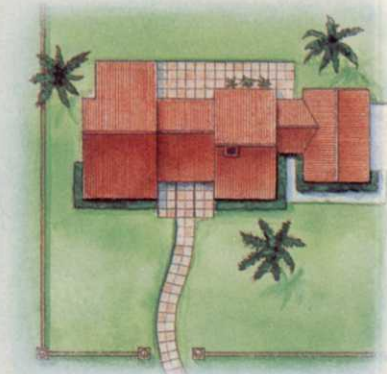
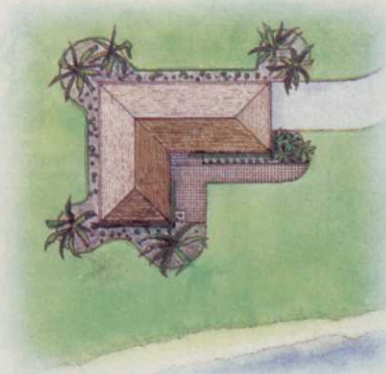
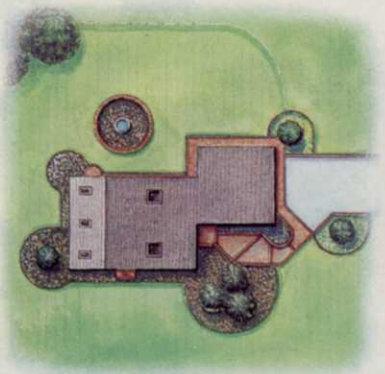
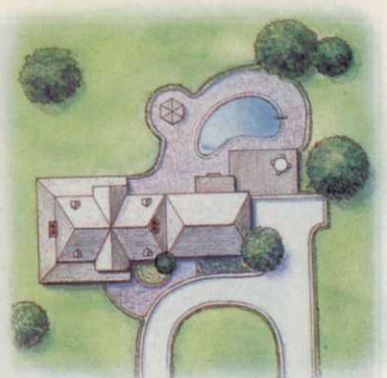
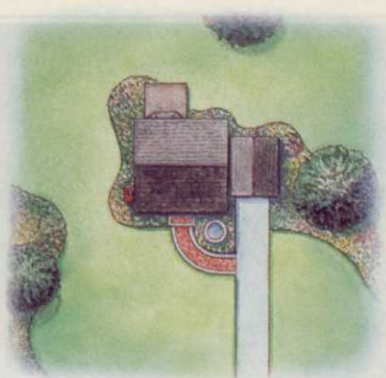
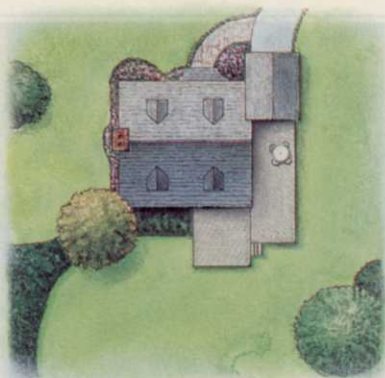
Post-emergence suggestions

• Apply post-emergents 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-emergents than weeds that are environmentally stressed. Target the application to coincide with good soil moisture conditions and air temperatures of 60° to 90° F.

• Do not apply to heat-stressed or drought-stressed turf or weeds. The tolerance of warm season turf to post-emergents decreases at air temperatures greater than 90° F, when turfgrasses are drought-stressed or growing under high soil moisture and high relative humidity conditions.

Herbicides with 2,4-D, dicamba, mecoprop, dichlorprop, imazaquin, MSMA and DSMA should not be applied at high air temperatures since there is a high risk of increased turfgrass injury. Always follow the most restrictive warning shown on the label.

The tolerance of warm-season turf to herbicides is generally lower during



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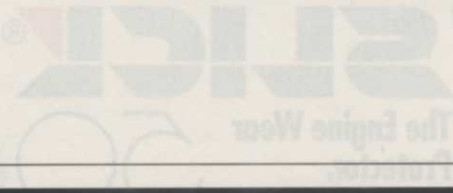
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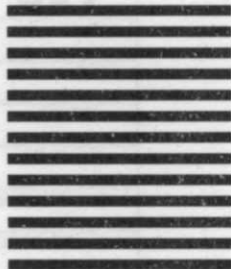
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is necessary. For example, two applications of MSMA + Sencor, at a 7- to 10-minute interval, are needed to control goosegrass. In contrast, one application of Illoxan will usually control goosegrass.

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, on or near sites that contain ornamentals. Spray drift damage can be prevented by spraying when the wind velocity is less than five mph, and by selecting a nozzle tip and spray pressure that produce large spray droplets.

Because of their soil residual characteristics, Aatrex and dicamba (Banvel, Dicamba 4) can injure broadleaf ornamentals via root uptake, particularly on sandy soils if rainfall occurs immediately after application. Avoid using these herbicides

spring green-up than when the turfgrass is dormant or after full green-up. Research has shown that the decrease in turf quality which may result from using post-emergents during green-up is temporary and persists for two to six weeks after application. If dense weed populations necessitate using a post-emergent during green-up, use the lowest recommended rate or one-half the recommended rate to minimize herbicide injury to the turf.

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

- Plan mowing schedules accordingly. Mowing should be delayed three to four days before or after a post-emergence herbicide application.

- Do not apply immediately before rainfall or irrigation.

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

- Calibrate all spray equipment and train the operator.

over the rootzone of shrubs and small trees.

If possible, post-emergence herbicides use should be avoided during spring green-up or during extremely hot weather.

The need to use post-emergence herbicides during these times can be avoided by scouting for weeds during winter, late spring and early summer. Most turfgrass

post-emergence herbicides are more effective when applied to smaller weeds. Scouting will enable timely and effective applications of post-emergence herbicides.

—The author is an extension agronomist specializing in weed science, University of Georgia.

Table 2

POST-EMERGENCE HERBICIDES, WARM-SEASON TURFGRASS

Common name	Trade name	Uses
asulam	Asulox	Grass weed control in St. Augustinegrass
atrazine	Aatrex, others	Pre- and post-broadleaf and grass weed control
bentazon	Basagran T/O	Primarily used for yellow nutsedge control
bromoxynil	Buctril	Broadleaf weed control on seed or sod farms
2, 4-D	numerous formulations	Broadleaf weed control
2,4-D + dicamba	Eight-One, Phenaban 801	
2,4-D + dichlorprop	Weedone DPC Amine,	Broadleaf weed control
	Weedone DPC Ester	
2,4-D mecoprop	Lescopar, Phenomec 2+ 1, 2 Plus 2	Broadleaf weed control
2,4-D + mecoprop + dicamba	Trimec Classic, Tex-san, Three-Way	Broadleaf weed control
2,4-D + mecoprop + dichlorprop	Weedestroy Triamine, Weedestroy Tri-Ester	Broadleaf weed control
dicamba	Banvel, Dicamba 4	Broadleaf weed control
diclofop-methyl*	Iloxan	Goosegrass control in bermudagrass
diquat**	Diquat	Winter annual weed control in dormant bermudagrass
DSMA	numerous formulations	Grass weed control in bermudagrass and zoysiagrass
ethofumesate	Prograss	Pre-/early post-annual bluegrass control, overseeded bermuda
fenoxaprop	Acclaim	Annual grass control and suppression of bermudagrass in zoysia
glyphosate	Roundup	Winter annual weed control in bermudagrass
imazaquin	Image	Purple nutsedge and wild garlic control in warm season turfgrass (except bahiagrass). Also controls certain annual broadleaf weeds.
meoprop	Mecomec, Lescopex	Broadleaf weed control
meoprop + 2,4-D + dicamba	Southern Trimec	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 bahiagrass, wild garlic prostrate spurge and numerous broadleaf weeds in bermudagrass and St. Augustinegrass
MSMA	Numerous formulations	Grass weed control in bermudagrass and zoysiagrass
MSMA + 2,4-D +	Trimec Plus	Grass and broadleaf weed control, bermudagrass/ zoysiagrass
meoprop + dicamba		
pronamide	Kerb	Annual bluegrass control in bermudagrass
sethoxydim	Vantage	Annual grass control in bermudagrass
sethoxydim	Vantage	Annual grass control and bahiagrass suppression in centipedegrass

* Diclofop-methyl has a state label for use in Alabama, Georgia, Florida, North and South Carolina.

** Diquat has a state label in Arkansas, Louisiana, Mississippi, Oklahoma, Tennessee and Texas for winter annual weed control in dormant bermudagrass.

Source: Dr. Murphy