# COOL-SEASON WEED CONTROL GUIDE

Good turf management is still the best way to control weeds. But if cool-season weeds appear in your turf, here's how to handle them.

*by Thomas L. Watschke, Ph.D., Penn State University*

Any successful weed control program begins with cultural practices that favor the competitive nature of the desired turfgrass species over all others. The existence of weeds most often indicates that one or more management practices are not as they should be.

Improper mowing height and/or frequency, improper irrigation (too much or too little), improper rate and timing of fertilizer applications, compaction, pH problems, thatch and chemical injury are a few of the management factors that influence weed invasion.

Therefore, when a weed problem is identified, the proper course of action is to determine why a void existed in the turf allowing the unwanted plant to encroach in the first place. Once the reason for encroachment has been found, appropriate changes in cultural practices must be taken before and/or in combination with the proper selection and use of a herbicide.

Most weeds cannot be completely controlled with cultural practices, but herbicide activity can be greatly enhanced when the turf is managed to be as competitive as possible.

Too often, when a weed problem is identified, the first course of action is to find out what chemical is recommended for control. As a result, the reason for the void in the turf is not considered as part of the overall weed control strategy. Generally, such a weed control program utilizes more herbicides than necessary and is not as successful as it should be.

From a chemical standpoint, pre-emergence herbicides work best on annual grassy weeds and some annual broadleaf species. Currently, benefin, benefin + trifluralin, bensulide, Dacthal, pendimethalin, oxadiazon and siduron are the primary pre-emergence herbicides labelled for use on cool-season turf.

**Crabgrass, a bunch type grassy weed, can be controlled with a properly timed application of pre-emergent herbicide.**

As these products are absorbed from the chemical barrier that is formed as they are dissolved in water, they suppress the emergence of germinating plants. Therefore, it is imperative that pre-emergence herbicides be applied seven to 10 days prior to expected emergence. If rainfall does not occur within two to three days, irrigation should be applied. Your local extension recommendations will take into account the germination time for your area.

## Post-emergence weed control

For several years, the organic arsenicals (MSMA, DSMA, CMA and MAMA) were the primary herbicides used for the post-emergence control of summer annual grassy weeds. These materials continue to be used successfully, particularly when applied sequentially (two to three applications).

Control is rarely equivalent to that attained using pre-emergence herbicides. And, in some cases, desired

species can be injured during hot weather. Always be sure to be completely familiar with the label of any pesticide before you use it.

Recently, a new post-emergence material has been labelled for use and has provided excellent annual grassy weed control in many instances. With proper timing, one application can provide control equivalent to the best pre-emergence material. This product (Acclaim) has less potential for injury than the arsonates, but has been found to injure some varities of Kentucky bluegrass when applications are made prior to mid-June. Turf treated with Acclaim should not be mowed for a day or two and should never be treated if under moisture stress.

### Broadleaf weed control

The vast majority of broadleaf weeds, regardless of life cycle, are controlled by 2,4-D, MCPP, dicamba or tri-

*The best control of new broadleaf seedlings can be attained with bromoxynil.*

chlopyr and combinations thereof. Most of the time, amine formulations are used and provide safe and excellent control. On occasion, ester formulations are used for more difficult-to-control species like oxalis, wild garlic and others.

Although excellent results can be attained using ester forms, care should be taken that they not be used during hot weather. When temperatures are predicted to be in the 80s, do not use esters as they can damage non-target species due to volatility.

On new seedings, the best control of broadleaf seedlings can be attained with bromoxynil, while risk to the seedling grass is minimal.

Before using other broadleaf herbicides, be sure that the turf has been mowed a minimum of three times. For best control, broadleaf weeds should be actively growing and not under moisture stress. Too often, broadleaf weeds are sprayed during hot and dry conditions and the resulting control is less than it should be.

The risk of injuring the desired turfgrass is also greater during hot and dry conditions. Broadleaf weeds vary greatly in their susceptibility to herbicidal action. For some species, ex-

## HERBICIDE Guide DIRECTORY

### COOL-SEASON HERBICIDES

| Herbicide | Brand Name(s) | Company | Uses |
|---|---|---|---|
| **ammonium sulphanate** | Ammate | DuPont | Non-selective rights of way herbicide |
| **asulam** | Asulox | Rhone Poulenc | Postemergence grassy weed control for turf and ornamentals |
| **atrazine** | Aatrex | Ciba Geigy | Non-selective control in non-crop areas. |
| **benefin** | Balan | Elanco | Preemergence control of annual grasses and broadleaf weeds in established turf. |
| **bensulide** | Betasan<br>Pre-San<br>Lescosan<br>Betamec-4 | ICI<br>Sierra<br>Lesco<br>PBI Gordon | Preemergence control of annual grasses and broadleaf weeds in established turf and established flower gardens. Safe near tulip and daffodil bulbs. |
| **bentazon** | Basagran | BASF | Selective postemergence control of nutsedge in warm-season turf. |
| **bromacil** | Hyvar | DuPont | Nonselective control of weeds and grasses in non-crop areas. Usually mixed with diuron for roadsides and rights-of-way. |
| **bromoxynil** | Buctril | Rhone Poulenc | Postemergence control of broadleaf weeds in seedling turf, established turf and non-crop areas. |
| **cacodylic acid** | Phytar<br>Rad-E-Cate | Vertac<br>Vineland | Nonselective control for turf renovation, edging and in plant beds. |
| **chloramben** | Amiben | Rhone Poulenc | Preemergence control in ornamentals. |
| **chlorflurenol** | Maintain | Uniroyal | Growth regulator. Also controls broadleaf weeds and vines. |
| **copper** | Cutrine-Plus | Applied Biochemists | Control algae, chara and hydrilla in potable water. |
| **dalapon** | Dalapon 85<br>Dowpon M | Fermenta<br>Dow | Selective control of perennial and annual grasses in non-crop areas and ditchbanks. |
| **dazomet** | Mylone | Hopkins Ag. | Preplant sterilant for turf and ornamental beds. |
| **DCPA** | Dacthal | Fermenta | Preemergence control of annual grasses and broadleaf weeds in turf and ornamental beds. |

# HERBICIDE DIRECTORY

## COOL-SEASON HERBICIDES

| Herbicide | Brand Name(s) | Company | Uses |
|---|---|---|---|
| **dicamba** | Banvel | Sandoz | Selective postemergence control of broadleaf weeds in turf and for noncrop control of brush. |
| **dichlobenil** | Dyclomec | PBI Gordon | Selective weed control in ornamental beds and for total weed control on roadsides, fencerows, etc. |
| **dichlorprop** | 2,4-DP | Rhone Poulenc | Brush control and aquatic weed control. |
| **diphenamid** | Enide | Nor-Am, Upjohn | Selective control of annual grasses and broadleaf weeds in bermudagrass, dichondra and around ornamenta.s |
| **DSMA** | Methar 30<br>DSMA Liquid<br>DSMA 81%<br>Weed-E-Rad | W.A. Cleary<br>Drexel<br>Vertac<br>Vineland | Selective postemergence control of sedges and grasses in turf and ditchbanks and storage yard. |
| **diquat** | Diquat | Valent | Aquatic weed control. |
| **diuron** | Karmex<br>Dynex<br>Diuron 80WP<br>Urox | DuPont<br>Vertac<br>Drexel<br>Hopkins | Generally used at high rates for nonselective total weed control in industrial sites. |
| **endothall** | Aquathol K<br>Endothall | Pennwalt<br>Pennwalt | Aquatic weed control and turf herbicide and dessicant. |
| **EPTC** | Eptam | ICI | Selective control of annual grassy weeds, nutgrass, and perennial weeds. |
| **ethofumesate** | Prograss | Nor-Am | For control of Poa annua and white clover in fairways. |
| **fosamine** | Kernite | DuPont | Brush control. |
| **flurprimidol** | Cutless | Elanco | Growth regulator that suppresses annual bluegrass. |
| **fluazifop-butyl** | Fusilade | ICI Americas | Selective postemergence control of grassy weeds in ornamentals. |
| **fluridone** | Sonar | Elanco | Broad spectrum herbicide for submersed and emersed aquatic weeds. |

**BROADLEAF WEEDS POST-EMERGENCE HERBICIDE COMBINATIONS**

- ☐ TRIMEC
- ☐ TREXSAN
- ☐ SUPER TRIMEC
- ☐ TURFLON
- ☐ WEEDONE DPC

cellent control can result from a single application. However, it is more common that most broadleaf weeds require two applications spaced a few weeks apart. The more difficult-to-control species are rarely ever completely controlled, but the level of infestation can be greatly reduced.

### Total control

The severe weather in much of the country during the summer of 1988 caused substantial turf loss in some locations. Consequently, more renovation activity existed than in most years.

Glyphosate (Roundup) is the most commonly-used total vegetation control product on the market. It provides excellent control of most unwanted

**PRE-EMERGENCE HERBICIDES WITH SOIL LONGEVITY:**

- ☐ BENEFIN
- ☐ DCPA
- ☐ OXADIAZON
- ☐ PENDIMETHALIN
- ☐ BENSULIDE

**Nimblewill is characterized by clumps of dark blue-green leaves during the summer. Regrowth starts at the nodes of the stems in spring.**

vegetation, is deactivated by the soil within a few days, and is translocated within treated plants, allowing for the control of more stubborn perennial grasses.

Overseeding can be accomplished within a matter of days after Roundup treatment. In many instances, the treated site is verticut in several directions (perhaps in conjunction with aerification) and overseeded in a broadcast manner. If vegetatively-spreading perennial grasses (creeping bentgrass, quackgrass and nimblewill) are present in the stand to be

## HERBICIDE DIRECTORY

### COOL-SEASON HERBICIDES

| Herbicide | Brand Name(s) | Company | Uses |
|---|---|---|---|
| **glyphosate** | Rodeo | Monsanto | For control of emerged aquatic weeds and broad leaf weeds in or near aquatic sites, such as ditchbanks. |
| **glyphosate** | Roundup | Monsanto | Nonselective, short-term herbicide for turf renovation and total weed control along fences and plant beds. |
| **imazaquin** | Image | American Cyanamid | Experimental herbicide for turf |
| **imazapyr** | Arsenal | American Cyanamid | Broad spectrum systemic industrial herbicide |
| **linuron** | Lorox | DuPont | Short-term control of annual weeds in roadsides and fence rows. |
| **mefluidide** | Embark | PBI Gordon | Growth regulator that suppresses Poa annua. |
| **metham** | Vapam | ICI | Preplant soil fumigant killing weeds, weed seed, insects and fungi. |
| **methyl bromide** | Dowfume | Dow | Fumigant for pre-plant control. Also kills weed seed. |
| **metribuzin** | Sencor | Mobay | Postemergence control of goosegrass in warm-season turf. |
| **MCPP** | MCPP<br>Mecomec MCPP<br>Chipco Turf Herbicide | Fermenta<br>PBI Gordon<br>WA Cleary<br>Rhone Poulenc | Selective broadleaf weed control in turf. Often combined with other herbicides. |
| **MSMA** | Daconatel<br>Broadside<br>Ansar<br>Weed-Hoe | Fermenta<br>Vertac<br>Drexel<br>Vineland | Postemergence selective control of crabgrass and broadleaf weeds in turf. Also, grassy weed control in ditchbanks, roadsides, industrial areas. |
| **napropamide** | Devrinol | ICI | Selective control of weeds in ornamental beds and containers. Experimental combination with Betasan for season-long crabgrass control in turf. |
| **oryzalin** | Surflan | Elanco | Preemergence control of weeds in established ornamentals and warm-season turf. |
| **oxadiazon** | Ronstar | Rhone Poulenc | Preemergence control of weeds in ornamentals and turf. |

## HERBICIDE DIRECTORY

### HERBICIDES OF COOL-SEASON GRASSES

| | | | |
|---|---|---|---|
| **oxyfluorfen** | Goal | Rohm & Haas | Selective control of weeds in ornamentals. |
| **paraquat** | Paraquat | Valent | Nonselective control of weeds in rights-of-way, industrial areas and fencerows. |
| **pendimethalin** | Proturf Weedgrass Control Pre-M | Lesco | Preemergence turf herbicide for control of grassy and broadleaf weeds. |
| **picloram** | Tordon | Dow | Systemic, long-term killer of woody plants and broadleaf weeds. |
| **prometon** | Pramitol | Ciba Geigy | Nonselective herbicide with long residual for industrial weed control. |
| **pronamide** | Kerb | Rohm & Haas | Poa annua control in warm season grasses. Also weed and grass control around woody ornamentals and Christmas trees. |
| **sethoxydim** | Poast | BASF | Postemergence control of grassy weeds around broadleaf ornamentals. |
| **siduron** | Tupersan | DuPont | Preemergence control of annual grasses in newly seeded turf areas. |
| **simizine** | Princep | Ciba Geigy | Selective control of annual grasses and broadleaf weeds in established bermudagrass. Also, used in industrial and aquatic weed control. |
| **sulfometuron-methyl** | Oust | DuPont | Non-selective industrial and selective in bermudagrass. |
| **tebuthiuron** | Spike | Elanco | Brush control and total vegetation control in non-crop areas. |
| **trifluralin** | Treflan | Elanco | Selective preemergence weed control in established ornamentals and under asphalt. |
| **triclopyr** | Garlon | Dow | Systemic control of woody plants in rights-of-way and industrial sites. |
| **2,4-D** | 2,4-D | Dow<br>Fermenta<br>Rhone Poulenc<br>Vertac | Selective control of weeds in turf and numerous other areas. Usually mixed with other herbicides. |
| **Vorlex** | Vorlex | Nor-Am | Preplant fumigant. Broadleaf weed control in established turf. |

SOURCE: Dr. Tom Watschke

renovated, do not verticut for at least 10 days after treatment to allow for a more complete translocation of the Roundup into the vegetative organelles.

In some circumstances, a turf manager may have the need to fumigate a seedbed prior to planting. Seed of certain unwanted species may be known to exist in the site or insect and/or disease problems may require fumigation for control. Most commonly, methyl bromide is used for fumigation. It is extremely toxic and would require application by a licensed applicator.

*For best control, broadleaf weeds should be actively growing and not under moisture stress. Too often, broadleaf weeds are sprayed during hot and dry conditions and the resulting control is less than it should be.*

For large areas, fumigation is best accomplished by commercial applicators who have the right equipment and can perform the task efficiently and safely.

### Poa annua control

Most turf managers desiring to control *Poa annua* use one of two methods. If the desired species is perennial ryegrass, then the best course of action is to use ethofumesate (Prograss). This product has provided spectacular control in mixed *Poa annua*/turf-type perennial ryegrass stands.

When *Poa annua* is unwanted in combination with creeping bentgrass, the most successful course of action has been to use paclobutrazol (Scott's TGR). Spring and fall applications of this product have resulted in dramatic increases in creeping bentgrass populations over as little as a two-year period.

*Poa annua* is discolored by such treatment, but the discoloration is not long lasting, and as the amount of creeping bentgrass increases, the amount of discoloration on site decreases. **LM**

# HERBICIDE COMBINATIONS

| Herbicide | Brand Name(s) | Company | Uses |
|---|---|---|---|
| 2, 4-D plus MCPP | Chipco Turf Kleen<br>Cleary<br>Scotts II<br>SDS<br>Tee Time<br>Lescopar | Rhone Poulenc<br>WA Cleary<br>OM Scott<br>Fermenta<br>Andersons<br>Lesco | Broadleaf weed control in established turf. |
| 2, 4-D plus dicamba | Scotts I<br>Banvel Plus<br>Lesco<br>Selective<br>Herbicide | OM Scott<br>Sandoz<br>Lesco | Selective postemergence control of weeds in turf. |
| 2, 4-D plus MCPP plus dicamba | Three-way<br>Trimec<br>Trexan | Lesco<br>PBI Gordon<br>Sierra | Selective, broad spectrum control of weeds in turf. |
| 2, 4-D plus MCPP plus dicamba plus MSMA | Trimec plus | PBI Gordon | Broad spectrum postemergence control of broadleaf weeds and annual grasses. |
| 2, 4-D plus dichlorprop | Weedone DPC | Rhone Poulenc | Selective postemergence control of weeds in turf. |
| 2, 4-D plus dichlorprop | Weedone DPC Amine | Rhone Poulenc | Broad-spectrum, selective, postemergence control of weeds in turf. |
| 2, 4-D plus dicamba plus dalapon | Banvel Plus | Sandoz | Broad spectrum, post-emergence turf weed control. |
| 2, 4-D plus prometon | Vegemec | PBI Gordon | Selective postemergence control of weeds in turf. |
| 2, 4-D plus triclopyr | Turflon-D | Dow Chemical | Selective postemergence turf herbicide for broadleaf weeds. |
| Balan plus Ronstar | Regalstar | Regal Chem. | Broad spectrum pre-emergence control of weeds in turf. |
| amitrol plus simazine | Amizine | Rhone Poulenc | Season-long control of weeds and grasses. |
| MSMA plus cacodylic acid | Broadside | Crystal | Nonselective, broad spectrum weed control. |
| diuron plus sodium chlorate plus sodium metaborate | Chlorea | Rhone Poulenc | Nonselective weed and grass killer. |
| benefin plus oryzalin<br>benefin plus trifluralin | XL<br>Team | Elanco | Preemergence control of annual grasses and broadleaf weeds in established turf. |
| bensulide plus oxadiazon | ProTurf Goosegrass/ Crabgrass Control | OM Scott | Broad-spectrum pre-emergence control of annual grasses. |
| bromacil plus diuron | Rout<br>Krovar | Hopkins<br>DuPont | Wide range control of weeds in industrial sites and rights-of way. |
| MSMA plus dicamba | Mondak | Sandoz | Noncropland general weed control. |
| prometon, simazine anc chlorate | Pramitol | Ciba Geigy | Full-season weed control in industrial sites. |
| tebuthiuron plus trifluralin | Spike<br>Treflan | Elanco | Non-selective, season-long, preemergence and postemergence control of weeds industrial and non-cropland areas. |

SOURCE: Dr. Watschke

Note: These tables represent a partial list of available herbicides

# WARM-SEASON WEED CONTROL GUIDE

Controlling warm season weeds requires a one-two punch: vigorous turf and proper herbicide use.

*by Tim R. Murphy, Extension Agronomist, University of Georgia*

They don't fly or lay eggs, but weeds are probably considered by most landscape managers the major pest in warm-season turfgrasses.

For a vigorous, high quality weed-free turfgrass, you need a two-phase weed management strategy.

The first phase involves the use of cultural practices and insect and disease control programs that promote a dense, vigorous turf cover.

Weeds are opportunistic and easily infest bare or thin turfgrass areas. Keeping to approved cultural practices for fertility, watering, cultivation and mowing will promote vigorous turfgrass growth. It will also help prevent weed infestations. Insect and disease control programs should be continually monitored throughout the year.

**TABLE 1**

**WARM-SEASON TURFGRASS TOLERANCE TO PRE-EMERGENCE HERBICIDES.**

| | TURFGRASSES | | | | |
|---|---|---|---|---|---|
| **Herbicide** | **Bahia-grass** | **Bermuda-grass** | **Centipede-grass** | **St. Augustine-grass** | **Zoysia grass** |
| *(PRE-EMERGENCE)* | | | | | |
| atrazine[1] | NR | T(D) | T | T | I |
| benefin | T | T | T | T | T |
| benefin + oryzalin | T | T | T | T | T |
| benefin + trifluralin | T | T | T | T | T |
| bensulide | T | T | T | T | T |
| bensulide + oxadiazon | NR | T | NR | NR | T |
| DCPA | T | T | T | T | T |
| ethofumesate[2] | NR | T(D) | NR | NR | NR |
| fenarimol | — | T | — | — | — |
| napropamide | T | T | T | T | NR |
| oryzalin | T | T | T | T | T |
| oxadiazon | NR | T | NR | T | T |
| pendimethalin | T | T | T | T | T |
| pronamide | NR | T | NR | NR | NR |
| simazine | NR | T | T | T | T |

[1]When dormant, bermudagrass and zoysiagrass have good tolerance to atrazine.
[2]Ethofumesate is labeled for use on dormant bermudagrass that is overseeded with perennial ryegrass.
T = Tolerant at labeled rates; I = Intermediate tolerance, NR = Not registered for use on this turfgrass.

*SOURCE: DR. MURPHY*

## Using herbicides

The second phase of the weed management strategy involves using herbicides.

When used in combination with approved cultural practices and insect and disease control programs, herbicides can help prevent weeds. However, strict reliance on herbicides without regard for other management practices will not result in a high quality, aesthetically appealing turfgrass.

The herbicides used in warm-season turfgrasses are classified as either pre-emergence or post-emergence chemicals. Pre-emergence herbicides form the foundation of the chemical weed control program. They are primarily used for the control of annual grasses such as crabgrass, goosegrass and annual bluegrass. Post-emergence herbicides are generally used to control problem weeds, such as nutsedge, dallisgrass and wild garlic onions, that are not controlled by pre-emergence herbicides.

When pre-emergence weed control fails, post-emergence herbicides provide a valuable option for controlling emerged weeds. A complete chemical weed control program can be accomplished in most warm-season turfgrasses with post-emergence herbicides if multiple applications are used. But because repeat applications can cause temporary turfgrass injury, most landscape managers prefer to use post-emergence herbicides in conjunction with a pre-emergence weed control program.

Pre-emergence herbicides are applied to the turfgrass site prior to weed seed germination. This group of herbicides controls weeds during the weed seed germination process. Pre-emergence herbicides do not affect the viability of dormant weed seeds. Weeds that have emerged at the time of application will not be controlled by most pre-emergence herbicides.

### Going both ways

Although most herbicides may be classified as pre-emergence or post-emergence, atrazine (Aatrex, Purge), simazine (Princep) and pronamide (Kerb) are exceptions. These herbicides have pre-emergence and post-emergence activity on a wide variety of winter annual weeds.

Pre-emergence herbicides are applied in the spring for crabgrass and goosegrass control and in the fall months primarily for annual bluegrass control. They must be applied before weed seed germination.

Late February to early March applications generally provide better crabgrass control than later applications. However, in the cooler, mountainous regions of the South, the spring application may be delayed until late March or early April. For annual bluegrass, late August to early October applications are used, depending on geographical location.

Pre-emergence herbicides need rainfall or irrigation water to move them into the zone of maximum weed seed germination. Recommendations vary slightly among different pre-emergence herbicides, but unless one-fourth to one-half inch of rainfall occurs within seven days, the herbicide should be irrigated into the top two inches of the soil profile.

A thick thatch layer decreases the persistence of pre-emergence herbicides. Elimination of heavy thatch by cultivation (aerification, verticutting, topdressing) increases herbicide contact with the soil and helps prevent accelerated breakdown of the herbicide in the thatch layer.

Cultivation has not been generally recommended or performed *after* a pre-emergence herbicide application. Cultivation was believed to disrupt the herbicide barrier in the soil and stimulate weed emergence.

A recent study conducted in Georgia investigated the effect of core aeration prior to and after pre-emergence herbicides had been applied to common Bermudagrass. Coring at the time of application or up to four months after pre-emergence herbicide application did not decrease large crabgrass control for five pre-emergence herbicides that were evaluated.

In a related study, coring up to three months following an application of oxadiazon (Ronstar) to a Bermudagrass putting green did not affect goosegrass control. Data are not available for other weed species; however, it appears that core aeration does not influence the normal level of weed control of pre-emergence herbicides.

### Vertical mowing

A study conducted in Michigan on annual bluegrass showed that a light vertical mowing did not decrease large crabgrass control for three different pre-emergence herbicides. The effects of vertical mowing on the efficacy of pre-emergence herbicides has not been investigated on Southern turfgrasses. Using vertical mowing to remove thatch may possibly affect the effectiveness of pre-emergence herbicides under Southern environmental conditions.

Established warm-season turfgrasses have excellent tolerance to labeled pre-emergence herbicides (see table 1). Newly-seeded and sprigged turfgrasses have a low level of tolerance and can be severely injured by most pre-emergence herbicides.

On immature turfgrasses, pre-

## HERBICIDE DIRECTORY

### COMMON AND TRADE NAMES OF WARM-SEASON TURFGRASS HERBICIDES.

| Common Name | Company | Trade Name and Formulation[1] |
|---|---|---|
| DCPA | Fermenta | Dacthal 75W |
| dicamba | Sandoz<br>PBI/Gordon | Banvel 4 lbs./gal.<br>Dicamba 4, 4 lbs./gal. |
| DSMA | Interag, Vineland, Others | Numerous trade names and formulations are available. |
| ethofumesate | Nor-Am | Prograss 1.5EC |
| fenarimol | Elanco | Rubigan 50W, 1AS |
| glyphosate | Monsanto | Roundup 4 lbs./gal. |
| imazaquin | Lesco | Image 1.5 lbs./gal. |
| MCPA | PBI/Gordon | MCPA 4 lbs./gal. |
| MCPA + MCPP | Riverdale | Weedestroy Triamine II |
| + dichlorprop MCPP | Royalgard<br>Rhone-Poulenc<br>PBI/Gordon<br>Lesco | Sabre<br>Turf Herbicide MCPP 2 lbs./gal.<br>Mecomec 4 4 lbs./gal.<br>Lescopex 2.5 lbs./gal. |
| MCPP + 2,4-D + dicamba | PBI/Gordon | Trimec Southern |
| metribuzin<br>MSMA | Mobay<br>Fermenta, Platte, Others | Sencor Turf 75W<br>Numerous trade names and formulations are available. |
| napropamide | Lesco<br>ICI | Devrinol 5-G Ornamental<br>Devrinol 50WP, 5G |
| oryzalin | Elanco | Surflan 4AS |
| oxadiazon | Rhone-Poulenc | Ronstar 2G |
| pendimethalin | Lesco<br>Scotts | PRE-M 60DG<br>Southern Weedgrass Control 2.45G, Turf Weedgrass Control 1.71G, Weedgrass Control 60DG |
| pronamide | Rohm-Haas | Kerb 50W |
| sethoxydim | BASF | Poast 1.5 lbs./gal. |
| simazine | Ciba-Geigy | Princep 80W, 4L, 90DG, 4G |

emergence herbicide applications should be delayed until the soil is completely covered.

Pre-emergence herbicides persist in the soil for two to four months, advantageous in terms of length of weed control. However, these herbicides may cause establishment problems if seeding, sprigging, or sodding is planned for a particular site.

The herbicide label should be consulted to determine the length of time needed before renovation operations can be safely conducted.

### New pre-emergents

Three pre-emergence herbicides are in the final stages of development and evaluation by chemical companies and universities:

- Monsanto Company is investigating MON 15100 (Dimension) for annual grass and broadleaf weed control in both cool- and warm-season turfgrasses.
- Isoxaben (Gallery) is being evaluated by the Elanco Products Co. for wide spectrum broadleaf weed control and is expected to be on the market in 1989.
- Prodiamine (Sentinel) is a dinitroaniline herbicide being evaluated by the Sandoz Crop Protection Corp. for annual grass and broadleaf weed control in all major turfgrasses.

### Post-emergents

Post-emergence herbicides are applied directly to the foliage of emerged weeds. In contrast to pre-emergence herbicides, this group of

*See Guide on page 58*

**TABLE 2**

**WARM-SEASON TURFGRASS TOLERANCE TO POST-EMERGENCE HERBICIDES.**

| | TURFGRASSES | | | | |
|---|---|---|---|---|---|
| **Herbicides** | **Bahia-grass** | **Bermuda-grass** | **Centipede-grass** | **St. Augustine-grass** | **Zoysia-grass** |
| *(POSTEMERGENCE)* | | | | | |
| asulam | NR-S | T[1] | NR-S | T | NR-I |
| atrazine | NR-I | T(D) | T(D) | T | I |
| bentazon | T | T | T | T | T |
| bromoxynil | T | T | T | T | T |
| 2,4-D | T | T | S-I | S-I | T |
| 2,4-D + dicamba | T | T | S-I | S-I | T |
| 2,4-D + dichlorprop | T | T | S-I | S-I | T |
| 2,4-D + mecoprop | T | T | S-I | S-I | T |
| 2,4-D + mecoprop + dicamba | T | T | S-I | S-I | T |
| 2,4-D + mecoprop + dichlorprop | T | T | I | I | T |
| dicamba | T | T | I-T | S-I | T |
| DSMA, MSMA | S | T | S | S | I |
| glyphosate[2] | NR-S | T(D) | NR-S | NR-S | NR-S |
| imazaquin | — | T | T | T | T |
| MCPA + MCPP + dichlorprop | T | T | I | I | T |
| MCPP + 2,4-D + dicamba | T | T | I | I | T |
| MCPP | T | T | S-I | S-I | T |
| metribuzin | NR-S | T | NR-S | NR-S | NR-S |
| pronamide | NR | T | NR | NR | NR |
| sethoxydim | NR-S | NR-S | T | NR-S | NR-I |

[1] Asulam is labeled for use only on 'Tifway' (419) bermudagrass.
[2] Bermudagrass is tolerant to glyphosate when completely dormant.
T = Tolerant at labeled rates; I = Intermediate tolerance, use at reduced rates; S = Sensitive, do not use this herbicide; NR = Not registered for use on this turfgrass.

## Control of annual grass

Crabgrass (large, smooth, Southern) and goosegrass are common summer annual weeds in warm-season turfgrasses. With the exception of atrazine, simazine and pronamide, spring applications of pre-emergence herbicides will provide good to excellent control of crabgrass (see table 3). Goosegrass tends to germinate later in the spring than crabgrass and is more difficult to control. Single applications of oxadiazon and bensulide + oxadiazon (goosegrass/crabgrass control) have provided high levels of goose-

*See Grass on page 58*

**TABLE 3**

**ANNUAL GRASS CONTROL RATINGS FOR PRE-EMERGENCE HERBICIDES.**

| Herbicide | Crabgrass spp. | Goosegrass | Annual bluegrass |
|---|---|---|---|
| atrazine | P | P | E |
| benefin | E | F | E |
| benefin + oryzalin | E | F-G | E |
| benefin + trifluralin | E | F | E |
| bensulide | E | P | P |
| bensulide + oxadiazon | E | G | — |
| DCPA | E | F | G |
| napropamide | E | G | G |
| oryzalin | E | F-G | E |
| oxadiazon | G | E | G |
| pendimethalin | E | F-G | E |
| pronamide | F | P | E |
| simazine | F | P | E |

E = Excellent, ≥ 90% control.
G = Good, 80 to 89% control.
F = Fair, 70 to 79% control.
P = Poor, < 70% control.

*SOURCE: DR. MURPHY*

## Control of problem weeds with post-emergents

Many problem weeds can be controlled with selected post-emergence herbicides. Bentazon (Basagran) will control **yellow nutsedge**, but won't kill **purple nutsedge**. Monthly applications of MSMA or DSMA in tolerant turfgrasses will suppress the growth of both nutsedge species. Imazaquin (Image) has provided good control of purple nutsedge in tests conducted in Mississippi and Georgia. In tolerant turfgrasses (Meyer zoysiagrass, Bermudagrass), the addition of MSMA to imazaquin increases purple nutsedge control.

**Wild garlic** can be controlled with winter applications of 2,4-D or two-way and three-way herbicide mixtures that contain 2,4-D or dicamba. Late fall applications of imazaquin may also be used.

**Virginia buttonweed** is an extremely difficult weed to control in warm-season turfgrasses. Research conducted in Mississippi showed that 2,4-D + dichlorprop (Weedone DPC) is more effective for Virginia buttonweed control than other two-way and three-way broadleaf herbicide mixtures.

**Dallisgrass** and **bahiagrass** can be controlled in tolerant turfgrasses with MSMA and DSMA. Usually two to three applications, each at an interval of 5 to 10 days, is needed to control these weeds. In centipedegrass, two applications of sethoxydim at an interval of 10 to 14 days suppresses bahiagrass but not dallisgrass growth. Asulam (Asulox) will provide fair control of bahiagrass in St. Augustinegrass.

*—Tim Murphy* □

herbicides has no or only minimal soil residual activity. Certain post-emergence herbicides may be used at low rates on newly-established warm-season turfgrasses.

A general rule is to delay the application until sprigs have rooted and are actively growing, or until the turfgrass has been mowed three to four times. Delaying the application allows time for the sprigs or seedlings to become established. It also improves their tolerance to post-emergence herbicides.

Post-emergence herbicides may be used at various times during the year. Applications to weeds that are actively growing and not under drought and/or temperature stress will result in better control. Target the application to coincide with air temperatures

**Guide** *from page 56*

grass control in experiments conducted in Georgia.

Split applications, each at an interval of 8 to 10 weeks, of benefin + oryzlin (XL), benefin + trifluralin (Team), oryzalin (Surflan), pendimethalin (various trade names) and napropamide (Devrinol) will also provide acceptable (>80%) control of goosegrass. With the exception of bensulide, the pre-emergence herbicides used in warm-season turfgrasses will control annual bluegrass.

*—Tim Murphy* □

## HERBICIDE DIRECTORY

### COMMON AND TRADE NAMES OF WARM-SEASON TURFGRASS HERBICIDES.

| Common Name | Company | Trade Name and Formulation[1] |
|---|---|---|
| asulam | Rhone-Poulenc | Asulox 3.34 lbs./gal. |
| atrazine | Royalgard<br>Ciba-Geigy | Purge 4 lbs./gal.<br>Aatrex 4L, 90DG, 80W |
| benefin | Elanco<br>Lesco | Balan 2.5G, 85DG<br>2.5 Benefin Granular (2.5G) |
| benefin + oryzalin | Elanco | XL 2G |
| benefin + trifluralin | Elanco | Team 2G |
| bensulide | ICI<br>Royalgard<br>PBI/Gordon<br>Lesco | Betasan 2.9E, 4E, 3.6G, 7G, 12.5G<br>Roysan 4E, 12.5G<br>Betamec 4LF<br>Lescosan 4E, 7G |
| bensulide + oxadiazon | Scotts | Goosegrass/Crabgrass Control 6.5G |
| bentazon | BASF | Basagran - 4lbs./gal. |
| bromoxynil | Rhone-Poulenc<br><br>Lesco | Buctril 2 lbs./gal., Buctril 4EC, Brominal 2 lbs./gal., ME4 Brominal<br>Brominal 2 lbs./gal. |
| 2,4-D | Interag, Lesco, Fermenta Others | Numerous trade names and formulations are available |
| 2,4-D + dicamba | Rhone-Poulenc<br>Lesco<br>PBI/Gordon | Weedone Super D Pro Amine<br>Eight-One Selective Herbicide<br>Phenaban 801 |
| 2,4-D + dichlorprop | Rhone-Poulenc | Weedone DPC Amine, Weedone DPC |
| 2,4-D + mecoprop | Lesco<br>Rhone Poulenc<br>PBI/Gordon | Lescopar<br>Turf Kleen<br>Phenomec 2+1 |
| 2,4-D + mecoprop + dicamba | Lesco | Three-way |
| 2,4-D + mecoprop + dichlorprop | Riverdale | Weedestroy Triamine |

[1]Numeral refers to percent or pounds of active ingredient.

*SOURCE: DR. MURPHY*

*Since most pre-emergence herbicides are not effective against emerged weeds, applications must be made before weed seed germination.*

of 60 to 90°F. Applications made below 60°F can result in poor herbicide activity. Temperatures greater than 90°F increase the chance of injury to the turfgrass.

In contrast to pre-emergence herbicides, warm-season turfgrasses differ markedly in their tolerance to post-emergence herbicides. For example, centipedegrass has excellent tolerance to sethoxydim (Poast); however, other warm-season turfgrasses can be severely injured by this herbicide. Also, cultivars within a turfgrass species may respond differently to the same herbicide.

### More injury risk

Research conducted in Georgia showed that Meyer zoysiagrass had better tolerance to MSMA than Emerald and Matrella. The risk of injury from post-emergence herbicides is greater during the spring green-up process (transition from winter dormancy to active growth) than when the turfgrass is fully dormant or actively-growing (completely green).

Post-emergence herbicides need a 6- to 24-hour rain-free period after application for maximum absorption. Irrigation schedules should be coordinated with post-emergence herbicide applications to prevent inadvertent wash-off from treated weeds.

Mowing schedules also need to be coordinated with post-emergence herbicide applications. A general rule is to delay mowing three to four days before and after application. The delay prior to treatment increases the leaf surface area of the weed and improves spray coverage and leaf retention. The delay after treatment is needed to allow time for herbicide absorption and translocation processes to occur.

The majority of pre-emergence herbicides used in warm-season turfgrasses are extremely safe to apply near ornamentals. In fact, many pre-emergence herbicides such as oryzalin, benefin + oryzalin, DCPA (Dacthal), oxadiazon and others are labeled for use in landscape ornamentals. Refer to the label to determine if there are any precautions on the use of a herbicide near landscape ornamentals.

Post-emergence herbicides however, can readily injure ornamentals, either by foliage contact or by root absorption. Spray drift injury can be prevented by spraying on calm days at wind speeds less than 5 mph and by using a nozzle tip and spray pressure that produces large droplets.

Ester formulations of 2,4-D and other phenoxy herbicides can injure ornamentals by vapor drift. (Vapor drift is the gaseous movement of herbicide vapors from the site of application.)

Ester formulations usually provide slightly better weed control than amine formulations. However, due to the potential for vapor drift, ester formulations should not be used during the warm months when conditions are favorable for volatilization.

Avoid applying atrazine or herbicides that contain dicamba over the root zone of desirable ornamentals. Ornamentals can be injured by root uptake of these herbicides. Ornamental injury due to root uptake is most likely to occur on sandy soils when a heavy rainfall immediately follows a dicamba or atrazine application.

### Proper storage important

Herbicides should be stored in their original containers with intact labels and in areas separate from insecticides and fungicides. Numerous incidents of turfgrass injury occur each year due to a non-labeled herbicide being mistakenly applied as an insecticide or fungicide.

Always keep records of all herbicide and other pesticide applications. The documents can be a valuable resource in the event complaints arise concerning the management practices used on a particular site.

Professional landscape managers probably have more herbicides labeled for use in turfgrasses than any other agricultural commodity. Cultural practices that promote vigorous turfgrass growth, and the timely use of pre-emergence and post-emergence herbicides should enable the landscape manager to grow a high quality, aesthetically appealing, weed-free turfgrass. **LM**