



The dandelion is a winter broadleaf weed which can be treated with 2,4-D.

## AFTER THE FACT

If your pre-emergence weed control didn't work, here's a guide to the post-emergence choices.

### WARM-SEASON

by Euel Coats,  
Mississippi State University

**P**ost-emergence herbicides are applied after weeds have emerged. Post-emergence herbicides act either by contact or after absorption and translocation (systemic).

Contact herbicides act rapidly, while translocated herbicides usually require several days for their phytotoxic action to be observed. Translocated types usually kill the entire plant, whereas contact herbicides kill only the contacted part of the foliage.

Best results will usually be obtained with post-emergence herbicides if plants are young and actively growing, and the air temperature is above 70 degrees Fahrenheit. Foliar applied herbicides are less effective if the soil is dry.

Consult the herbicide label for the optimum growth stage and environmental conditions needed to obtain the best results with a given herbicide. Surfactants are frequently rec-

ommended for use with post-emergence herbicides. For consistent results, use non-ionic agricultural surfactants sold specifically for use with herbicides.

Warm-season turfgrasses vary in their susceptibility to post-emergence herbicides. However, it is possible in most cases to discuss bermudagrasses and zoysiagrasses as a group and centipedegrass and St. Augustinegrass as a second group similarly in herbicide tolerance.

Many herbicides that can be used on bermudagrasses and zoysiagrasses cannot be used on either centipedegrass or St. Augustinegrass. Weed problems in warm season turfgrasses occur both in the growing and dormant seasons.

#### Winter grass weeds

Annual bluegrass is by far the most severe grassy weed infesting southern turf areas during the late warm growing season, through the dormant period, and into the early part of the next growing season. This weed occurs in all turf environments, especially in moist soils. Aside from decreasing the aesthetic value of turf, the primary objection of annual bluegrass in southern turf is the onset of other

weed problems associated with the rapid die-back of annual bluegrass in late spring.

Bermudagrass coverage of bare spots is usually slow following fade-out of annual bluegrass, leaving sections of the soil surface exposed. Weeds tend to germinate in bare areas.

A particular problem is goosegrass, which is usually difficult and expensive to control.

Pronamide application made as early as November or as late as April will give annual bluegrass control in dormant turfs. Ideally, treatment should be made prior to seed production to reduce next year's seed source. Application prior to seed production is also early enough for effective annual bluegrass control while not interfering with the transition of bermudagrass. The earlier a dense bermudagrass canopy develops, the more competitive the turf will be with summer weeds.

Another approach employed on many golf courses is to use a post-emergence application of a non-selective herbicide such as paraquat or cacodylic acid prior to the breaking of bermudagrass dormancy. This usually does an excellent job on annual

bluegrass, as well as any annual broadleaf weeds present.

However, injury is often encountered if application is delayed until the bermudagrass begins breaking dormancy. The degree of injury is dependent on the amount of green foliage present at the time of application.

### Winter broadleaf weeds

Important broadleaf weed species include: common chickweed, henbit, clovers, mouseear chickweed, lawn burweed (spurweed), dandelion, wild onion, wild garlic, plantains, speedwells and others.

Henbit, chickweed and clovers dictate that something other than 2,4-D be used for post-emergence broadleaf weed control.

In dormant bermudagrass and zoysiagrass, Banvel or a two- or three-way herbicide combination containing Banvel are usually used.

The phenoxy herbicides are safe on completely dormant turfs. Actively growing turfs vary considerably in their tolerance to phenoxy-type materials.

St. Augustinegrass will usually tolerate 0.5 lb/A of 2,4-D with only minimal injury if the air temperature is below 80 degrees Fahrenheit. This may not seem important when using phenoxy on dormant warm-season turfs, but invariably application is made at various stages during spring transition.

Turfgrasses are more susceptible to phenoxy injury during this transition period.

The combination of mecoprop plus chlorflurenol is often used by homeowners, especially in St. Augustinegrass lawns. Wild garlic is a major perennial weed problem in many warm season turfs during the cool growing season.

A fall application followed by a spring application of 2,4-D for three or more years has been used for wild garlic control with varying degrees of success. Image, a new herbicide recently labeled (1987) for use in turf has shown potential for more effective control of wild garlic than 2,4-D, and should contribute significantly to more effective management of wild garlic.

### Summer grass and sedge weeds

Crabgrass and dallisgrass invade more turf acreage in the southern United States than any other grass. Post-emergence control of these two weeds, especially crabgrass, can be accomplished in centipedegrass with Poast.

In St. Augustinegrass, an applica-



Henbit, chickweed and clover (pictured here) dictate that something other than 2,4-D be used for post-emergence broadleaf weed control.

tion of Asulox will give reasonably good control of crabgrass and certain other annual grassy weeds. In bermudagrass and zoysiagrass, control can be achieved with MSMA, DSMA or CMA. In fact, dallisgrass control in bermudagrass and zoysiagrass relies heavily on these herbicides.

MSMA plus metribuzin plus surfactant gives good post-emergence control of goosegrass. Two applications of MSMA (2 lbs/A) plus metribuzin ( $\frac{1}{16}$  lb/A) plus 1 quart of non-ionic surfactant per 100 gallon tank mix applied seven days apart will generally give excellent control of even mature goosegrass.

Remember, the methane arsonates can be used only on bermudagrass and zoysiagrass. Other grass weed problems in southern turfs include sandbur, bahiagrass, crowfootgrass and torpedograss.

Sandbur and bahiagrass can be controlled with methane arsonates, although several applications may be required.

No means of selective control of torpedograss in any southern turf species has been developed.

Both annual and perennial sedges are problems in the southern United States. Purple nutsedge and, to a lesser extent, yellow nutsedge, are the most severe problems. Yellow nutsedge can be controlled with Basagran. Roundup will control nutsedge when used as a site preparation aid.

Image, in addition to controlling wild garlic, will also control purple and yellow nutsedge, as well as many annual sedges.

Although broadleaf weeds are a problem throughout the southern

United States in turf, no species appears to reach the level of infestation equivalent to that of the summer grasses.

Among the more important summer broadleaf weeds are prostrate spurge, prostrate knotweed, yellow woodsorrel, Virginia buttonweed and Florida betony.

### Summer broadleaf weeds

As a group, they are rather difficult to control. Multiple applications of a two- or three-way hormone mixture are necessary for effective control and repeat treatments are often needed.

From our limited experience with some members of the group, we generally observe that the use of a good agricultural grade surfactant is warranted when applying a hormone herbicide.

A mixture of 2,4-D plus dichlorprop has given equal or better post-emergence control of Virginia buttonweed than other hormone herbicide mixtures in our research trials in 1984, 1985 and 1986.

We have observed that the level of Virginia buttonweed control can be increased an additional 15 to 20 percent if a pre-emergence herbicide, such as oxadiazon or Princep, is applied at the same time a post-emergence application is made. The increase attributable to the pre-emergence herbicide appears to be due to reduced regrowth or reinfestation of Virginia buttonweed from seed.

### Cool season turfgrass weeds

Weed control technology for cool season turfgrasses overseeded into warm season turfs (bermudagrass) is somewhat limited. The small acreage has not justified the expenditure of re-

sources by university researchers. Also, chemical companies have been reluctant to label their herbicides for this use due primarily to the limited acreages and high financial risk involved.

Nevertheless, fair to good control of weeds in this turf situation can usually be achieved.

Annual bluegrass control in overseeded golf greens may be accomplished with Prograss. Prograss will control annual bluegrass when applied either pre-emergence or post-emergence. However, Prograss is recommended only for post-emergence control in overseeded golf greens, and further only to greens overseeded to a monostand of ryegrass or blend of ryegrass. Prograss may also be used to control annual bluegrass in overseeded turfs.

Safety to perennial ryegrass dictates that it be used as a post-emergent. One or two applications are needed, and the first application should be made 30 days after overseeding (bermudagrass dormant). The follow-up application should not be made after the date specified on the label. It appears that the safe use of Prograss is limited to the northern part of the bermudagrass belt.

Unless the bermudagrass is completely dormant at application, significant delays in growth from dormancy to actively growing bermudagrass can occur.

Disadvantages of Prograss may involve both the bermudagrass and the ryegrass. If bermudagrass is not dormant when the initial application is made, delays in transition are sometimes observed the following spring.

If the second application is made too late, significant delays in spring transition are also observed. Additionally, Prograss can be used only on ryegrass.

Consequently, overseeding mixtures containing creeping bentgrass, red fescue or rough bluegrass cannot be planted when Prograss is used for



Common chickweed tolerant to 2,4-D, necessitates the use of other materials.

annual bluegrass control.

Broadleaf weed problems in overseeded turf are quite variable. A number of the common winter annual broadleaf weeds found throughout the southern United States during the dormant season may or may not be a problem in overseeded turf.

Henbit, common chickweed, clovers, spurweed and mustards are among the more important of this group. Competition from the overseeded turf would seem to hold infestations down significantly. When a herbicide is needed, henbit, common chickweed and (or) clovers usually dictate the herbicide(s) that will be used.

These weeds are fairly tolerant to 2,4-D, necessitating the use of other

“phenoxy type” materials. In general, Banvel or a phenoxy-Banvel mixture are recommended for broadleaf control where these weeds are present.

Banvel or Banvel mixtures appear to be the most widely used for control of these weeds. Numerous two-way mixtures of Banvel and 2,4-D formulations exist on the market. These and the three-way mixtures Trex-San or Trimec are probably used more than Banvel alone. Weed-B-Gon for Southern Grasses, which is a mixture of mecoprop and chlorflurenol, is also used to some extent by homeowners. In overseeded greens where lawn burweed (spurweed) is the problem, Buctril or Brominal is a very effective and safe herbicide to use. **LM**

## COOL-SEASON

by John R. Hall III, Virginia Polytechnic University

**P**ost-emergence herbicides most commonly include materials utilized to selectively control broadleaf weeds, annual grassy weeds and sedge-type plants after they have germinated or emerged. However, this category can also include non-selective materials that are used in renovation for total plant kill prior to seeding.

The most commonly utilized cool-season turfgrass broadleaf herbicides include materials such as 2,4-D, 2,4-DP (dichloroprop), mecoprop (MCP), dicamba and bromoxynil. Annual grassy post-emergence weed control in cool-season turfgrass is achieved with materials such as DSMA (disodium methane arsonate), MSMA (monosodium methane arsonate),

MAMA (monoammonium methane arsonate), CMA (calcium methane arsonate) and fenoxaprop-ethyl.

The arsonates have also been shown to be moderately effective for control of yellow nutsedge in cool-season turfgrasses. However, bentazon has provided more effective long term control with less injury to the desirable cool-season turfgrass.

Glyphosate has proven to be the most effective renovation herbicide where total kill of the existing stand of grasses and weeds is desirable. Soil

sterilants are certainly considered post-emergence herbicides. However, safety concerns associated with their use in the homeowner environment have reduced their popularity.

Many factors affect herbicide efficacy. Some of the more important factors that should be given consideration prior to use include the following:

**1. Identification of the weed and desirable turfgrass.** Positive identification of the weed to be controlled is essential to prescribing the most effective herbicide.

In addition, it is important to know which turfgrass the weed is in since different turfgrasses have varying susceptibility to applied herbicides.

**2. Growth stage of the weed.** Most effective post-emergence weed control is achieved on young, actively growing weeds. If weeds are nearing the end of their life cycle and not actively growing, they will not be effectively controlled.

Examples of improper timing would include attempts to control winter annuals such as common chickweed, henbit, German moss (Knawel) and sowthistle in June when they have already produced seed for the upcoming fall germination and are near the end of their

annual life cycle.

**3. Growth rate of the weed.** The more metabolically active a weed is, the more effectively it will be controlled by herbicides. Therefore, any factor such as sunlight, moisture or good nutrition that speeds up growth rate will generally increase herbicide efficacy.

If weeds to be controlled are under heat or drought stress they will not be metabolically active and will be less affected by applied herbicides.

On the other hand, if the desirable cool-season turfgrass is somewhat sensitive to the herbicide being applied and is under drought or heat stress, it is likely it will suffer greater damage from the application.

**3. Morphology of the weed.** If the weed to be controlled has a thick, waxy cuticle or a leaf shape which is not conducive to good herbicide spray contact, decisions about which formulation of the herbicide to utilize can be critical. Weeds like wild onion and wild garlic are better controlled with liquid sprays than granular sprays.

Additionally, waxy cuticles are better penetrated by low-volatile esters than amine formulations. Concern about the increased probability of ester volatilization in the landscape has however reduced ester popularity.

**4. Air and soil temperature.** Maximum metabolic activity in most weeds occurs between 55 and 80 degrees Fahrenheit and therefore herbicide spraying should be planned for times of the year when temperatures are in this range. Temperatures outside this range will reduce metabolic activity and therefore herbicide effectiveness.

**5. Rainfall probability and foliage wetness.** Liquid herbicides are most effectively absorbed when applied to dry leaf surfaces. Water dilution rates for herbicides have been recommended assuming the foliage is dry at the time of application.

Wet foliage will reduce liquid herbicide effectiveness at normal water spray rates. Granular herbicides are generally more effectively absorbed when applied to wet foliage.

Most foliar absorbed post-emergence herbicides require four to six hours of foliar absorption to be effective. Rainfall prior to this time will significantly reduce herbicide effectiveness.

Anything that reduces metabolic activity of the weed during the foliar absorption period will increase the time required to achieve adequate herbicide absorption. Other factors such as physiological detoxification of applied herbicides, organic matter binding, soil binding, leaching,

## Herbicide Manufacturers

### American Cyanamid

1 Cyanamid Plaza  
Wayne, NJ 07470  
(201) 831-2000

### The Andersons

P.O. Box 119  
Maumee, OH 43537  
(419) 893-5050

### Applied Biochemists

5300 West County Line Rd.  
Mequon, WI 53092  
(414) 242-5870

### BASF Wyandotte

100 Cherry Hill Rd.  
Parisippany, NJ 07054  
(201) 263-3400

### Ciba Geigy Corp.

P.O. Box 18300  
Greensboro, NC 27419  
(919) 292-7100

### W.A. Cleary Chemical Corp.

1049 Somerset St.  
Somerset, NJ 08873  
(201) 247-8000

### PBI/Gordon Corp.

1217 West 12th St.  
Kansas City, MO 64101  
(816) 421-4070

### Hoechst-Roussel

Route 202-206 North  
Somerville, NJ 08876  
(201) 231-2000

### Hopkins Agric. Chem. Co.

P.O. Box 7190  
Madison, WI 53707  
(608) 221-6200

### ICI Americas

P.O. Box 751  
Wilmington, DE 19899  
(302) 575-3000

### Lebanon Chemical Corp.

P.O. Box 180  
Lebanon, PA 17042  
(717) 273-1685

### Crystal Chemical InterAmerica Co.

1523 North Post Oak Rd.  
Houston, TX 77055  
(713) 682-1221

### Dow Chemical USA

P.O. Box 1706  
Midland, MI 48640  
(517) 636-1105

### Drexel Chemical Co.

2487 Pennsylvania St.  
Memphis, TN 38109  
(901) 774-4370

### E.I. Du Pont de Nemours

1007 Market St.  
Wilmington, DE 19898  
(302) 774-1000

### Elanco Products Co.

Lilly Corporate Center  
Indianapolis, IN 46285  
(317) 276-3759

### Fermenta Plant Protection

P.O. Box 348  
Painesville, OH 44077  
(216) 357-3000

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photo decomposition, water pH, mixture incompatibility and rate of the herbicide applied can all have an effect upon the efficacy of the applied herbicide.

Combinations of commonly used broadleaf post-emergence herbicides are generally more effective in providing broad spectrum weed control than single herbicide mixtures.

Repeat applications of some herbicides will be necessary for 100 percent control. Use of post-emergence arsenicals for annual grass control actually necessitates re-application two

or three times at 10- to 14-day intervals.

Repeat applications of the broadleaf herbicides should be spaced at least 30 to 45 days apart to minimize injury to the turfgrass.

In all spraying situations, spot spraying minimizes cost, environmental exposure and general stress on the desirable species while maximizing herbicide efficiency. In all instances, it is of paramount importance that label recommendations be closely followed.

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**FARM & GOLF COURSE SUPPLY CO., INC.**  
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**FISHER & SON COMPANY, INC.**  
Malvern, PA • (215) 644-3300

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**J. AND L. ADIKES, INC.**  
Jamaica, NY • (718) 739-4400

**NORTHAMPTON COUNTY SEED CO.**  
Bath, PA • (215) 837-6311

**ROCKLAND CHEMICAL CO., INC.**  
W. Caldwell, NJ • (201) 575-1322

**SEACOAST LABORATORIES**  
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**WILSON FEED AND SEED**  
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#### MID-WEST

**BUNTON SEED COMPANY**  
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**C.O. LOWE SALES**  
Columbus, OH • (614) 771-0486

**LEATHERMANS, INC.**  
Canton, OH • (216) 452-8866  
1-800-362-0487 (OH only)  
1-800-542-7333 (outside Ohio)\*

**PROFESSIONAL TURF SPECIALTIES**  
Champaign, IL • (217) 352-0591

**TENNESSEE OUTDOOR POWER**  
LaVergne, TN • (615) 793-6052  
1-800-854-4851 (TN only)

**THORNTON-WILSON, INC.**  
Maineville, OH • (513) 683-2141

**TOLEDO TURF EQUIPMENT**  
Toledo, OH • (419) 473-2503

**TURF AND TREE SUPPLIES**  
Rockton, IL • (815) 624-7578

**TURF PRODUCTS LTD.**  
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**TURF SPECIALTIES, INC.**  
Fort Wayne, IN • (219) 484-6338  
1-800-552-1989 (IN only)

**TURF SPECIALTIES, INC.**  
Zionsville, IN • (317) 875-7955  
1-800-552-1989 (IN only)

**TURFGRASS, INC.**  
South Lyon, MI • (313) 437-1427  
1-800-521-8873 (MI only)

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**ROBISON'S LAWN AND GOLF, INC.**  
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**ROBISON'S LAWN AND GOLF, INC.**  
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**TURF MANAGEMENT SUPPLY**  
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**WISCONSIN TURF EQUIPMENT CORP.**  
Janesville, WI • (608) 752-8766

**WISCONSIN TURF EQUIPMENT CORP.**  
New Berlin, WI • (414) 544-6421

\* Outside Ohio only applies to these states: Pennsylvania, New York, West Virginia, Kentucky, Indiana, Michigan.

## Herbicide Manufacturers

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### Lesco Products

20005 Lake Rd.  
Rocky River, OH 44116  
(216) 333-9250

### Mallinckrodt Inc.

P.O. Box 5439  
St. Louis, MO 63147  
(314) 895-2000

### Mobay Chemical Group

P.O. Box 4913  
Kansas City, MO 64120  
(816) 242-2000

### Monsanto Co.

800 North Lindbergh Blvd.  
St. Louis, MO 63167  
(314) 694-1000

### Nor-Am Chemical Co.

3509 Silverside Rd.  
PO Box 7495  
Wilmington, DE 19803  
(302) 575-2000

### Ortho Div. Chevron

575 Market St.  
San Francisco, CA 94105  
(415) 894-7700

### Pennwalt Corp.

Three Pkwy.  
Philadelphia, PA 19102  
(215) 587-7000

### Regal Chemical Co.

P.O. Box 900  
Alpharetta, GA 30201  
(404) 475-4837

### Rhone-Poulenc Inc.

Agrichemical Div.  
P.O. Box 125  
Black Horse Lane  
Monmouth Junction, NJ 08852  
(201) 297-0100

### Rohm & Haas Co.

Independence Mall West  
Philadelphia, PA 19105  
(215) 592-3000

### Sandoz Crop Protection

341 E. Ohio  
Chicago, IL 60611  
(312) 670-4665

### OM Scott & Sons

Proturf Div.  
Marysville, OH 43041  
(513) 644-0011

### Stauffer Chemical Co.

Agricultural Chem. Div.  
Westport, CT 06881  
(203) 222-3294

### Union Carbide

Agricultural Products  
T.W. Alexander Dr.  
Research Triangle Park, NC 27709  
(919) 549-2000

### Uniroyal Chemical

Elm Street  
Naugatuck, CT 06770  
(203) 723-3000

### Vertac Chemical Co., Inc.

5100 Poplar Ave.  
Suite 3122  
Memphis, TN 38137  
(901) 767-6851

### Vineland Chemical Co., Inc.

1611 W. Wheat Rd.  
P.O. Box 745  
Vineland, NJ 08360  
(609) 691-3535