Weed Control Suggestions for Christmas Trees, Woody Ornamentals, and Flowers

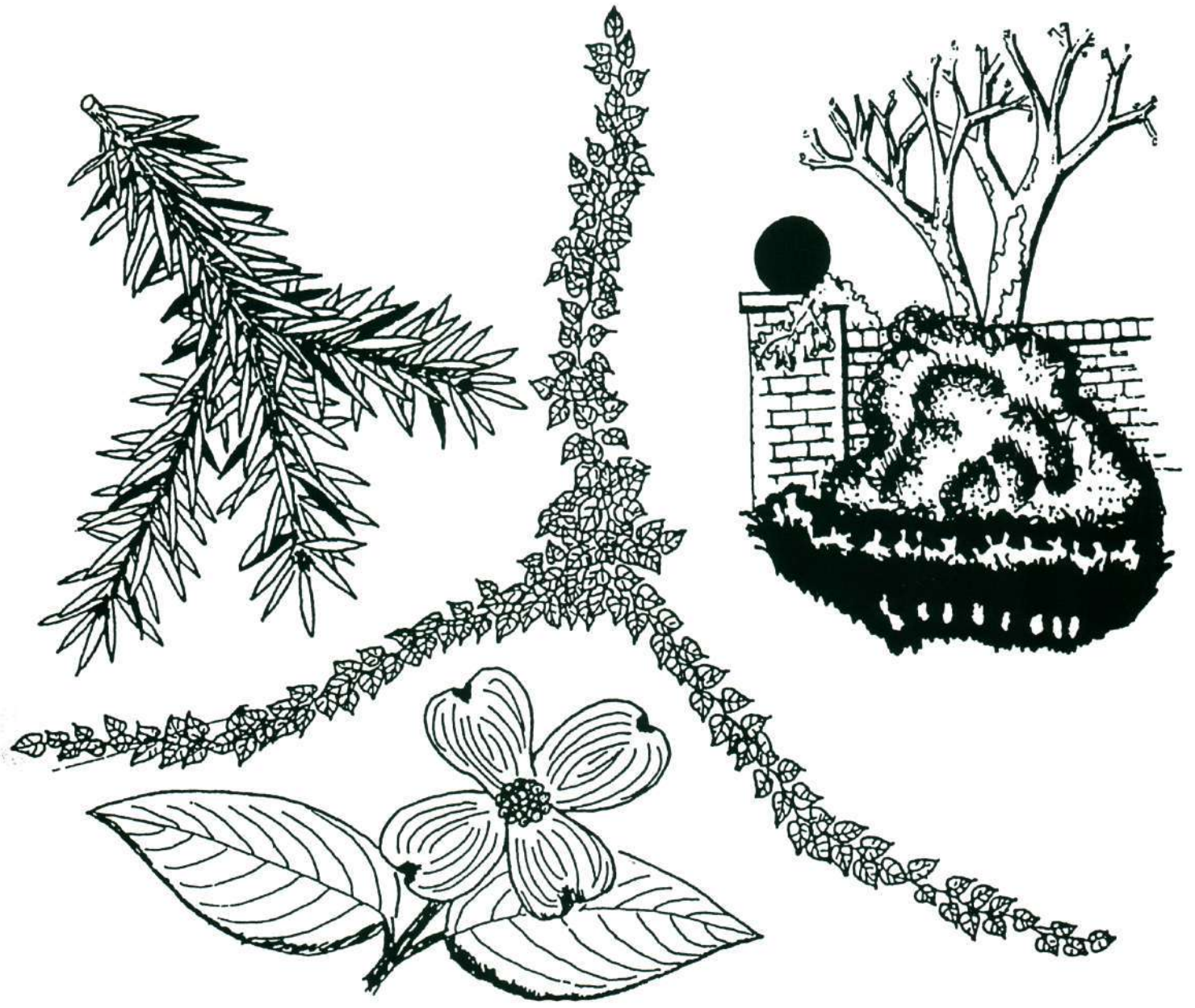
Michigan State University Extension Service

Walter Skroch, North Carolina Extension; Joseph C. Neal, Cornell University; Jeffrey F. Derr, Virginia Polytechnic Institute and State University; Andrew Senesac, Long Island Horticultural Research Station, Cornell.

Issued May 1995
106 pages

Weed Control Suggestions for Christmas Trees, Woody Ornamentals, and Flowers

Extension Bulletin E-2490, May 1995
Reprinted for Michigan use courtesy of
North Carolina Cooperative Extension Service
North Carolina State University



Recommendations for the use of agricultural chemicals are included in this publication as a convenience to the reader. The use of brand names and any mention or listing of commercial products or services in this publication does not imply endorsement by the North Carolina Cooperative Extension Service nor discrimination against similar products or services not mentioned. Individuals who use agricultural chemicals are responsible for ensuring that the intended use complies with current regulations and conforms to the product label. Be sure to obtain current information about usage regulations and examine a current product label before applying any chemical. For assistance, contact your county Cooperative Extension Service agent.

Prepared by

Walter A. Skroch
Extension Horticulture Specialist (Weed Control),

with technical review and editing by
Joseph C. Neal, Associate Professor of Weed Science
Department of Floriculture and Ornamental Horticulture
20 Plant Science, Cornell University, Ithaca, NY 14853
and
Jeffrey F. Derr, Extension Weed Specialist
Virginia Polytechnic Institute and State University
Hampton Roads Agricultural Experiment Station
1444 Diamond Springs Rd., Virginia Beach, VA 23455
and
Andrew Senesac, Extension Weed Scientist
Cornell Cooperative Extension
Long Island Horticultural Research Laboratory
39 Sound Avenue, Riverhead, NY 11901

Acknowledgment

Assistance in editing, proofing, typing and checking labels
by Chris Catanzaro and Gail Mahnken, research assistants in horticulture was appreciated.
Sincere thanks to Tom Knecht in Agricultural Communications for editing.

BULLETIN CERTIFICATION
MICHIGAN STATE UNIVERSITY

Weed Control Suggestions for Christmas Trees, Woody Ornamentals, and Flowers

Walter A. Skroch
Extension Horticulture Specialist (Weed Control)
North Carolina State University
Raleigh, North Carolina

Dr. Curtis N. Peterson, Associate Professor, Department of Horticulture, Michigan State University, has reviewed the 1994 revised edition of North Carolina State University publication titled, "Weed Control Suggestions for Christmas Trees, Woody Ornamentals, and Flowers" and found it contents to be applicable to the control of weeds for Christmas trees, woody ornamentals and flowers in Michigan. MSU has assigned **E-2490** to this bulletin.

Recommendations in the above mentioned publication can be adopted by Michigan growers. Any modifications within the publication will be published during the current growing season in the Michigan State University Landscape CAT Alert newsletter available for a subscription fee from CAT Editor, Room 11, Agricultural Hall, Michigan State University, East Lansing, MI 48824-1039.

Any immediate questions regarding herbicide use on plant genus and/or species can be directed to Dr. Curtis Peterson by calling (517) 353-9226 or by FAX at (517) 353-0890. Listed below are a number of MSU Extension agents located throughout Michigan who have knowledge of herbicides used on Christmas trees, woody ornamentals and flowers and are able to make recommendations.

Mary A.Wilson
MSU Extension - Genesee County
(810) 732-1407

Gary L Heilig
MSU Extension - Ingham County
(517) 676-7207

Ralph W. Heiden
MSU Extension - Jackson County
(517) 788-4292

Gerald E. Draheim
MSU Extension - Kalamazoo County
(616) 383-8830

Rebecca E. Finneran
MSU Extension - Kent County
(616) 336-3265

Gregory M. Patchan
MSU Extension - Oakland County
(313) 858-0887

Thomas A. Dudek
MSU Extension - Ottawa County
(616) 846-8250

James E. Thews
MSU Extension - Saginaw County
(517) 799-2233

Roberta L. Lawrence
MSU Extension - Washtenaw County
(313) 971-0079

Robert J. Bricault
MSU Extension - Wayne County
(313) 494-3005

Dr. Dean M. Krauskopf
MSU Extension - Wayne County
(313) 494-3005

Jill L. O'Donnell
MSU Extension - Wexford County
(616) 779-9480

CONTENTS

INTRODUCTION

This manual has been written to assist professional nursery operators and landscapers develop effective weed control strategies for a given situation. The first five sections present general information on weed biology, discuss fumigation and sterilization as a weed control method, describe the types of herbicide formulations and application equipment available, explain how to calculate herbicide application rates and to calibrate application equipment, list some important cautions, and define some terms commonly used in weed control. Those sections are followed by a chart that cross-references the common and trade names of herbicides and by listings of the label information for 38 common herbicides. The final sections of this publication present charts that indicate (1) weed susceptibilities to the various herbicides and (2) the ornamental plant groups for which the herbicides are registered and con therefore legally be used.

To get the most out of this resource, we suggest that you first read the general section on weed biology and herbicide application. Next, conduct a site evaluation to determine the weeds present or expected from prior-season weeds that were in or near the planting area. One key is to look for perennial weeds that may not be easily controlled once the crop is in the ground. When the problem weeds have been identified, refer to the last two sections of this manual. The weed susceptibility charts list the weeds controlled by a herbicide. The herbicide registration charts identify the herbicide and the ornamental crops for which it is labeled. Cross-reference between these two charts to find the herbicides that you need to control the weeds and that will be safe on your ornamental plantings.

Next, plan the crop planting scheme with weed control procedures in mind to make weed management easier in the future. For example, there is no herbicide available to control nutsedge safely in certain herbaceous ornamentals. Therefore, these herbaceous species should not be planted in an area where nutsedge is a problem. Also, do not mix plant species that differ in herbicide safety. For example, many herbicides labeled for *Euonymus* are not labeled for firs and spruce. When these species are planted together, weed control will be very expensive and may not be possible using herbicides.

The next step is to look up each herbicide to be used in the label information section. These short descriptions of each herbicide describe the good points, bad points and special instructions. As the last step before a final decision is reached, **read the herbicide label carefully** to be sure there are no additional restrictions that are not included in this manual. Remember that labels change frequently, so it is very important to read the most recent version prior to making a final decision. Following all the steps in this procedure should help you make informed decisions in planning an effective weed management program for your operation.

WEED BIOLOGY

Weeds (any plants growing in an undesirable location) can alter the profitability of a nursery operation. They compete with marketable nursery crops for water, nutrients, light, and space. Weeds can also inhibit crop growth through the production and release of allelopathic chemicals. In addition, they detract from the appearance of a landscape and harbor insects, mites, rodents, nematodes, and plant diseases. Weeds grow under nearly all conditions, including those under which desirable plants are grown, in seedbeds, transplant beds, containers, fields, and landscapes. Even escaped ornamentals such as Japanese knotweed, English ivy, and *Miscanthus* have become weedy species.

To control weeds successfully, it is necessary to understand the characteristics and life cycles of weed species. It is equally important to see how these habits influence weed management strategies.

Weed Growth Stage

Knowing the stages of weed growth can help in developing a control strategy. The stage of growth greatly influences the weed's susceptibility to or tolerance of herbicides. The four stages of growth and development that constitute the life cycle are:

- Germination — period when the plant emerges from the seed coat.
- Seedling — period when the plant is small and vulnerable.
- Vegetative — period of rapid growth and production of roots and foliage. Uptake of water and nutrients is rapid and they move throughout the plant.
- Flowering and seed production — period when uptake of water and nutrients is slow and is directed mainly to the flower and seed structures. After seeds mature, there is little or no energy production or movement of water and nutrients.

Preemergence herbicides act primarily on weeds as they germinate and generally have little effect on emerged weeds. Contact postemergence herbicides are generally most effective from the seedling to early vegetative stages. Certain systemic herbicides, such as glyphosate, are most effective at the flowering stage.

Weed Life Cycle

Weeds that infest ornamental plantings have one of four life cycles: summer annual, winter annual, biennial, or perennial.

A summer annual weed emerges in the spring, flowers, and sets seed before the first frost in fall. Examples are common ragweed, large crabgrass, and prostrate spurge. A winter annual such as henbit, annual bluegrass, chickweed, and Virginia pepperweed germinates in late summer or early fall and overwinters as a small, dormant seedling.

A biennial weed reproduces from seed and completes its life cycle in two growing seasons. During the first season it grows and develops, and in the second season it produces seeds. Common examples include wild carrot, old field toadflax, and Carolina false dandelion. Biennials are similar to winter annuals but germinate earlier in the summer. As days lengthen and temperatures rise in the spring, both winter annuals and biennials are stimulated to flower, set seed, and die before the end of the summer.

A perennial weed lives two or more years. It may produce seed in the first or second year, depending on the species. Most reproduce from seed as well as one or more vegetative systems such as bulbs, tubers, corms, or lateral roots. Bindweed, johnsongrass, bermudagrass, dandelion, nutsedge, and the docks are common perennial weeds.

Weed Classification

Weeds are also classified by their physical appearance as broadleaf weeds, grasses, or grass-like weeds. These groups may contain species with annual, biennial, and perennial life cycles.

As **broadleaf seedlings** emerge, they have two cotyledons (seed leaves). Their leaves are generally broad with netted veins. Broadleaves usually have a taproot and a relatively coarse root system. All actively growing broadleaf plants have exposed

growing points at the end of each stem and in each leaf axil. Perennial broadleaf plants may also have growing points on roots and stems below the soil surface. Examples of such perennials include mullein, dandelion, plantain, sumac, and poison ivy.

As they emerge from the seed, **grass seedlings** have only one cotyledon (seed leaf). Their leaves generally are narrow and upright with parallel veins. The growing point of seedling grasses is sheathed and initially is located at or below the soil surface. Examples of grass weed species are foxtail, bluegrass, dallisgrass, and johnsongrass.

The diverse group of **grasslike weeds** contains the sedges, rushes, *Allium*, and others. Sedges are similar to grasses, having long, narrow leaves with parallel veins. The stems of sedges are triangular, however, and the leaves emerge in patterns of three, whereas grasses have flat or round stems with alternate or opposite leaves. Rushes have erect, round stems, but unlike grasses, the stems have no nodes. The *Alliums* (wild onion and garlic) have round leaves that enlarge at the base to form an underground bulb. Several other grasslike plants such as blue-eyed grass and horsetail also fit into this group.

Weed Identification

In many cases, identifying weeds early in their life cycle is critical to the control strategy. Often a weed can be easily controlled during the seedling stage but may be difficult to control after it becomes established. Almost all herbicides are selective; that is, they control some weeds and not others. Likewise, they can damage some desirable plants and not others. Weed species are diverse, and it is necessary to understand how they are categorized for control purposes. As with any pest problem, the weed must be identified before developing a control strategy. Weed identification manuals can help diagnose weed problems. Check **Suggested Readings** 1, 3, 6, 8, 9 and 11 at the end of this publication.

Scouting a growing area will allow you to determine which weeds are present and where the weeds are located in the area. The actual scouting process can be accomplished in a fairly simple manner. The first and most important aspect is to map the areas, noting the species and locations of weeds as well as the species of ornamentals present. Many nurseries already have planting maps developed that may be adapted to this purpose. Using this map, conduct a weed inventory of each growing area or block. Walking fields in a wide zigzag pattern is an efficient way to do this. Note the general weed population and record relative densities. Take particular note of heavy infestations of a single species, perennial weeds, species you do not know (could it become a serious weed in the future?), and weeds that may be new to the area. Also notice which species are not controlled by your current management program, for these species may become more numerous unless you alter your management program.

FUMIGATION AND STEAM STERILIZATION

Preplant soil fumigation may be the best control method in cases where difficult-to-control weeds occur or when the cropping situation prevents the use of effective postplant control measures. Fumigants will kill most weeds, including most dormant weed seeds. Preemergence herbicides affect only germinating weeds and have no effect on dormant weed seed. Seeds of certain weeds can remain dormant but viable for many years in the soil. Fumigants are thus more effective than herbicides for eradication. Resistant weeds are difficult to control by fumigation and often require additional treatment. Generally, hard-seeded weeds such as morningglory, Carolina geranium, white clover, red stem filaree, prickly sida, and sedges from seed are not controlled by fumigation.

Soil fumigation or steam sterilization is only a temporary weed control measure. Most weed seeds present can be killed using these methods, and marketable crops can often become better established in the absence of weed competition. However, as new weed seeds are introduced into the planting area, they will germinate and grow as in any other situation since fumigation and sterilization have no residual activity. Temporary soil fumigants used for weed control are methyl bromide, metham (Vapam, Sectagon, and Busan), dazomet (Basamid Granular), and steam.

Regardless of the method chosen, good soil

preparation is the key to successful sterilization. Remove or turn under crop or other organic debris before treatment, and cultivate the soil to a depth of 6 to 8 inches. At the time of treatment, the soil should be free of clods and fresh organic debris, be moist enough for seed germination, and be at a temperature appropriate for the product being used.

Methyl bromide is a colorless, odorless gas and is highly toxic to humans, pets, and wildlife. **Use this product with caution.** Chloropicrin (tear gas) is added as a warning to the applicator and to enhance the fumigant's activity. Methyl bromide is a liquid when under pressure, but it becomes a gas when released. Since it is highly volatile, cover the area with a polyethylene tarp before treatment, sealing all edges with soil. Puncture the cans of methyl bromide under the plastic tarp with a recommended device. See the product label for details. Licensed applicators are available to treat large areas on a contract basis.

Whether treating small or large areas, the tarp should cover the area for a minimum of 24 hours and then be removed for aeration. Do not plant for 7 to 10 days after the tarp has been removed. Longer aeration times are required when formulations with more than 20 percent chloropicrin are used. (Consult the label for details.) Since polyethylene is permeable to methyl bromide, the tarp may be left on as a plastic mulch. This is often done by growers who fumigate in the fall before spring planting. When the plastic is used as mulch, longer aeration times are necessary to allow all methyl bromide residues. In warm weather, two weeks is generally sufficient, but if there is any question, a soil bioassay should be conducted.

Metham is a water-soluble liquid that can be applied by spray, injection, or irrigation. Metham is less volatile and less toxic to mammals than methyl bromide; thus, it is generally less hazardous to use. Metham is less active than methyl bromide, especially on weed seeds, and requires a 14- to 21- day waiting period before planting. Covering for 48 hours with a tarp aids activity but is not required. If the soil is not covered, it is important to irrigate immediately after application to seal the soil surface. Do not apply metham when the air temperature exceeds 90°F. This product is toxic to fish and wildlife. **Use it with caution.**

Dazomet is a granular product that can be applied with a spreader, making it easy to apply because specialized equipment is not required. After application, dazomet must be tilled into the soil and sealed either by compacting the soil surface with a roller, by watering to seal surface cracks or by covering the soil surface with plastic. Dazomet requires soil moisture for activation, and the recommended soil temperature at application is 54° to 64°F. The time dazomet remains active in the soil can be prolonged by cooler soil temperatures and can range from 10 to 30 or more days. To ensure that the soil is safe for planting, a bioassay should be conducted beginning 7 to 14 days after treatment.

Steam sterilization is used primarily by greenhouse operators. Where applicable, it is a safe and effective alternative to chemical soil fumigation. The soil should be maintained at 180°F for a minimum of 30 minutes. This treatment is sufficient to kill most pathogenic organisms; however, many weed seeds will escape injury.

Soil bioassays are conducted to determine if the soil is free of fumigation chemicals that will damage the crop. The following materials are needed to conduct the assay:

- garden trowel
- clear glass jars with resealable lids, 1 to 2 cup capacity
- 100 percent pure cotton balls
- leaf lettuce seeds
- rubber gloves

Follow this step-by-step procedure:

1. Using a garden trowel, half-fill individual jars with soil samples taken at various points in the treated area. One sample jar using untreated soil should also be collected for comparison to the treated soil. Take samples from a depth of 3 to 4 inches or to the depth of the final planting. **Replace jar lids immediately after placing soil in the jar to prevent any chemical loss from volatilization.**
2. Saturate cotton balls with water.
3. Dip the moistened balls in the lettuce seeds

and place one ball, seed side up, in each jar with the soil sample. **Quickly replace the resealable jar lid to minimize the escape of fumes from the jar.**

4. Place the jars in a warm, sunny location, such as a greenhouse or a window, until germination occurs. Lettuce seeds usually germinate in 2 to 3 days under these conditions.

5. Compare the germination of seeds on the treated and untreated soils. Reduced or delayed germination of the seed on treated soil indicates that chemical residues are still in the soil and it is unsafe for planting.

6. Continue taking samples using these procedures at approximately one-week intervals until the lettuce seeds in both the treated and untreated soil samples germinate at the same rate and time. At this time, the treated area will be safe for planting.

7. **CAUTION:** Cool temperatures and rainfall can slow the movement of soil fumigants out of the soil. Rain can also leach residues deeper into the soil than the original level of application. When taking soil samples, these factors should be considered on an individual basis for the planting site.

Fumigation and sterilization provide only temporary solutions to problems. In addition to destroying pest organisms, they destroy beneficial organisms that convert ammonia to nitrates for plant uptake. Therefore, to avoid ammonium toxicity, nitrate-nitrogen fertilizers should be used in newly sterilized soils. To reduce the chance of reinfestation, avoid recontaminating the treated areas.

HERBICIDE APPLICATION

To achieve maximum benefit from any herbicide program, you must select appropriate chemicals and follow proper application procedures. This section provides information on herbicides and methods of application. The way an herbicide can be used and applied depends on the characteristics of the active ingredient (ai), the chemical that does the work: whether it is absorbed by foliage or by the root system, whether it works on contact or is translocated, whether it is selective or nonselective and whether it is persistent or nonpersistent. The application timing and techniques employed will greatly affect the results. Timing depends on the stage of weed growth, weed pressure, weed and crop species, environmental conditions, soil type, and chemical characteristics of the herbicide. Choose the application technique based on the chemical activity (such as preemergence versus postemergence), treatment area, proximity of nontolerant crops, chemical formulation, and available resources.

Herbicide Formulations

The active ingredient in an herbicide is the chemical that does the work. Active ingredients can rarely be used in their pure form. They are usually changed or mixed with inert ingredients to make them convenient to handle and safe, easy, and accurate to apply. This mixture of active and inert ingredients is a formulation. An herbicide formulation contains the active ingredient along with a liquid or dry carrier and may also contain surfactants, emulsifiers, or other adjuvants to improve the safety or performance of the active ingredient or both.

Some formulations are ready for use. Others must be diluted with water or some other liquid carrier specified on the label. The label directions explain how to use a formulation. The most common liquid and dry formulations are discussed here.

Liquid Formulations

Flowables (F or L). Some active ingredients can be produced only as a solid or, at best, a semisolid. These solids are finely ground and suspended in a minimal amount of liquid carrier (water) for a flowable formulation. The fine particles in flowable (or flowable solid) formulations seldom clog spray nozzles, need only moderate agitation, and mix readily with water. Most can be handled as easily as emulsifiable concentrate formulations.

Emulsifiable Concentrates (EC or E). An emulsifiable concentrate is a liquid formulation

that can mix with water to form an emulsion. Each gallon of an EC usually contains 1 to 8 pounds of active ingredient. Diluted ECs usually need little agitation in the spray tank. The carrier is generally an organic solvent. An emulsifier is added to permit mixing of the organic solvent with water. The emulsifying agents and solvents in EC formulations can damage some crops. These crops may require a different formulation of the active ingredient, such as a wettable powder or granule.

Solutions (S). True solutions contain a mixture of two or more substances, the solute (active ingredient) and a solvent (usually water). Those true solutions that are soluble in water require no agitation in the spray tank. Highly concentrated solutions are possible as special formulations.

Liquified Gases. Some fumigants are gases that become liquid when under pressure. For this reason, such formulations are stored under pressure, which may be either high or low, depending on the product. These formulations are applied by:

1. injecting them directly under tarps,
2. releasing them under tarps,
3. releasing them into structures such as pot and equipment storage areas.

Other active ingredients remain liquid in an ordinary container but turn into a gas or vapor when or after they are applied. These formulations do not require storage under pressure. Consequently, they must be put into the soil or confined in a space before they change to a gas; otherwise, they could be lost to the air.

Dry Formulations

Wettable Powders (WP or W). These are dry, finely ground herbicide formulations. They look like dusts, but unlike dusts they are designed to mix readily with water and most are more concentrated. They contain 15 to 98 percent active ingredient, usually in amounts of 50 percent or more. Wettable powders form a suspension rather than a true solution when added to water. To maintain this suspension, good agitation is needed in the spray tank. Compared to ECs, good wettable powders are safer to use on plants. Water dispersible granules (WDG or DG) and dry flowables (DF) are improved versions of wettable powders. The WDG and DG formulations readily pour from containers with little or no dust. Dust is a problem when mixing wettable powder formulations.

Soluble Powders (SP). Soluble powders are also dry formulations. When they are added to water, they completely dissolve to form true solutions. The mixture in the spray tank may need to be agitated for these solutions to dissolve. Once they have dissolved, no more agitation is usually needed. The amount of active ingredient in a soluble powder is usually no more than 50 percent.

Granules (G). Granular formulations are small, individual particles that are applied dry. Most are made by applying a liquid formulation of an active ingredient to inert coarse particles (granules) of some porous carrier material. Carrier materials often used are sand, clay, ground corn cobs, or pulverized walnut shells. The pesticide is either absorbed into the granule, coats the outside, or both. The amount of active ingredient ranges from 1 to 10 percent. Granular formulations are easier to handle and safer to apply than ECs or dusts. They are used most often as soil treatments and are applied either directly to the soil or over plants. Granular formulations should always be applied dry. Never mix them with water. However, granules require rainfall or irrigation to activate the herbicide and to remove excess chemicals from the foliage. Certain preemergence herbicides such as oxyfluorfen and oxadiazon can injure plant foliage, especially if the foliage is wet. Formulating these compounds as granules reduces the potential for foliar uptake and crop injury.

Application Equipment for Liquid Formulations

Conventional sprayers, regardless of size, have certain common components. Each has a tank, pressure source, pressure regulator and gauge, shutoff valve, and nozzles. See **Suggested Reading** 2 for details on application methods and equipment for large acreages.

Backpack or **hand-held sprayers** are preferred when treating small areas. All the functional parts of a large sprayer can be found in these smaller sprayers, but there are some differences and limitations:

1. The tank is smaller and lacks an agitator. Spray mixtures that contain wettable powder formulations require frequent shaking of the tank for agitation.
2. The power-driven pump is replaced by continual positive displacement pumping, compressed air, or carbon dioxide (CO_2).
3. Often there is no pressure regulator other than the discretion and reliability of the operator. Applying herbicides accurately requires some level of pressure regulation, whether it is done by monitoring pressure gauges or adding a pressure regulator to the system.
4. The boom is smaller yet similar in design and function. With minor modifications most **continuous-pump, compressed-air,** or **carbon-dioxide sprayers** are satisfactory for applying herbicides to small areas (up to several acres).

For directed spraying beneath the foliage of sensitive crops, **flooding nozzles** can be used to direct a low-pressure spray to the lower few inches of the crop stem. On uneven terrain, these nozzles should be mounted on floating skids. **Spray shields** are often used in combination with directed sprays to further minimize injury from spray drift.

Banded applications are common in Christmas trees and field-grown nursery stock. Herbicides are applied in a narrow band to control weeds within the plant row. Areas between the plants are managed with cultivation, mowing, or chemical plant suppressants. The width of the band under the plant should extend at least to the dripline of the trees or shrubs. Cover crops such as tall fescue or orchardgrass can retard crop growth if allowed to grow near desired plants. In shrubs, uniform application is difficult because the foliage may intercept over-the-top sprays. In these situations, flooding or wide-angle nozzles may be arranged on either side of the plant row for a directed application under the foliage with excellent spray distribution.

Rope-wick applicators were developed to apply herbicides to weeds that grow taller than the crop. Rope-wick applicators consist of a loop of rope saturated with a concentrated herbicide solution by a *wicking* action. The saturated rope is wiped across the tall weeds without touching the crop plant, thus preventing injury. Applying herbicides to nursery stock often precludes the use of conventional application techniques. Adaptations such as the rope-wick have been developed for these and other unique weed control situations.

Controlled droplet application (CDA) technology provides another option for herbicide application. This system is based on releasing the spray liquid onto a spinning disk or cylinder where it is spun to the outer edge and broken into droplets. The delivery to the outer edge of the capillary tubes, disc notches, or cylinder perforations produces droplets of more uniform size than those produced by conventional spray systems. The CDA system operates with little power and little or no pressure. It has been claimed that growers using a CDA system can reduce the amount of pesticide needed because the droplets are in the best size range for peak activity. However, additional data are needed to verify this claim.

CDA systems have a few disadvantages. Foliar penetration can be limited, especially in the gravitational types. They are unsuited to windy conditions. They make it difficult for the operator to see and direct the spray pattern.

One CDA system produces electrically charged spray droplets that are electrostatically attracted to plant or soil surfaces. This system may reduce spray drift and provide better foliar penetration. The applied material may also be distributed more uniformly than with other systems that rely solely upon gravity to carry the spray to the target site. However, special formulations, of which there are few, are required for this type of sprayer.

Application Equipment for Granular Formulations

Granular formulations of preemergence herbicides are popular for weed control in container-grown nursery crops. Unlike liquid formulations that may adhere to foliage and prevent soil contact, granules can sift through dense foliage onto the soil surface. Placement on the soil surface enables the herbicide to work properly and may enhance its selectivity in marginally sensitive crops. However, there are several difficulties associated with the use of granules.

- Runoff water from excess rain or irrigation may remove the granules.
- Granules may collect in the crowns of rosette-form plants or leaf bases, causing injury.
- Compared to other formulations, granules cost more per unit of active ingredient.
- The application rate is more difficult to control.
- Uniform herbicide distribution is more difficult to achieve than for sprayed formulations.

As with sprayer application, accurately metering and distributing granular formulations is essential to achieving good weed control and minimizing crop injury. Granular spreaders distribute the herbicides in one of three ways: by gravitational drop, mechanically fed drop, and centrifugal force. All three types are available as tractor-mounted models or as smaller hand-operated spreaders.

Gravitational drop spreaders allow the granules to drop through an adjustable orifice. The application rate is adjusted by changing the orifice size, the travel speed, or both. Differences in size and density of the granules affect the rate of flow at any given orifice size. For example, smaller, heavier particles flow more easily than larger or lighter particles. A beater bar must be present within the chemical bin to prevent clogging and to ensure uniform distribution to the orifice.

Mechanically fed drop spreaders have an orifice that can be replaced with a slotted roller or similar device that measures the volume of granules to be dropped. This method is more accurate but more expensive. The application rate can be adjusted by gearing the roller to the ground speed or by replacing the slotted roller with a roller of a different calibration.

Centrifugal spreaders drop the herbicide onto a revolving plate or oscillating arm from which it is expelled by centrifugal force. The application pattern is nonuniform; therefore, two fully overlapping passes in opposite directions are recommended. Hand-operated centrifugal spreaders should be geared so that the spinning plate revolves faster than the hand crank, reducing both operator fatigue and irregularities in swath width. Because these spreaders are versatile and highly maneuverable, they are the types most often used.

Soil Incorporation Equipment and Techniques

The use of equipment to incorporate herbicides into the soil is limited in nurseries. One incorporation technique frequently used is irrigation. Water removes excess chemical from plant foliage and moves the herbicide into the soil, where it comes into contact with germinating weed seeds. When preparing new sites, incorporation may be desirable, depending on the weed species present and the necessary cleanup procedures. See **Suggested Reading** 10 for details on herbicide incorporation tools and techniques.

Cleaning and Care of Equipment

When spraying has been completed, excess spray solution must be disposed of properly according to the manufacturer's and governmental guidelines. **Rinse** the tank and nozzles thoroughly with water or a cleaning solution appropriate for the chemical used. **Partially fill** the tank and run clean water through the system for several minutes. Many companies suggest **lubricating** the moving parts periodically. Consult the owner's manual for specifics. If no spraying is scheduled for some time, **remove** both the pump and nozzles. **Clean and dry them. Store** them in a lightweight oil.

NOTE: NEVER clean nozzles with wire, knives, or other hard-surfaced objects. They can damage the nozzle, which may change the spray pattern and delivery rate. Soft wood (toothpicks), toothbrushes, or liquid solvents are recommended.

Calculating Herbicide Rates

Herbicide recommendations are made in one of two ways:

1. Amount of active chemical per unit area, such as 2 pounds of active ingredient (ai) per acre.
2. Amount of product per unit area, such as 3 quarts per acre.

The examples that follow illustrate how to calculate the amount of herbicide required to meet the recommended rate for a given area.

Example 1: The herbicide label shows that the product contains 4 pounds of active ingredient per gallon. The recommended application rate is 6 pounds of active ingredient per treated acre. How many gallons of product do you need to treat 1 acre?

Complete the following steps to convert from pounds of product to pounds active ingredient (ai) or vice versa. Substitute the values from the label into the following formula:

$$\frac{\text{amount of ai}}{\text{amount of formulated product}} = \frac{\text{desired ai/acre}}{\text{amount of product needed/acre}}$$

After setting up the formula, cross multiply and then divide both sides of the equation by 4 lb ai:

Step 1:

$$\frac{\text{4 lb ai}}{\text{1 gal product}} = \frac{\text{6 lb ai/acre}}{\text{? gal of product/acre}}$$

Step 2:

$$\text{4 lb ai} \times \text{? gal of product/acre} = \text{6 lb ai/acre} \times \text{1 gal of product}$$

Step 3:

$$\text{? gal of product/acre} = \frac{\text{6 lb ai/acre} \times \text{1 gal of product}}{\text{4 lb ai}}$$

$$= \text{1.5 gal of product/acre}$$

Therefore, 1.5 gallons of product contains 6 pounds of active ingredient. This amount must be accurately distributed over 1 acre.

When some fraction of an acre is to be treated, as in banded applications, the amount of product required should be decreased by the proportion of an acre that is to be untreated.

Example 2: You want to treat 1 acre of field-grown ornamentals with a 30-inch spray band and 60-inch row spacing. Using the rate of 1.5 gal of product/acre from the previous example, how many gallons of product will you need?

The following formula works for both liquid and granular products. Be sure you use the same measure —that is, inches or feet— for both band and row width. Substitute the values for your situation into the following formula:

$$\text{rate per acre} \times \frac{\text{band width}}{\text{row width}} = \text{amount needed/acre}$$

$$\text{1.5 gal/acre} \times \frac{\text{30 inch band}}{\text{60 inch row}} = \text{1.5} \times (1/2)$$

$$= \text{0.75 gal/acre}$$

For this 30-inch banded application, you would use 0.75 gallon of product per acre. The application rate remains 1.5 gallons of product per acre. You simply have reduced the amount of product to match the amount of land to be treated.

Often the active ingredient in a formulation is expressed as a percentage of the formulated weight. The following problem shows how to convert percentage (%) of active ingredient to a weight measure.

Example 3: Suppose that you want to apply 4 pounds active ingredient of a 90 percent wettable powder (90 WP) formulation per acre. How much of the product would be required per acre?

Use the following formula to solve the problem:

$$\frac{\text{ai/acre}}{\text{\% of ai in product}} = \text{product needed/acre}$$

$$\frac{\text{4 lb ai/acre}}{\text{0.90 (or 90\%)}} = \text{4.4 lb of product per acre}$$

Thus applying 4.4 pounds of a 90 percent wettable powder formulation per acre will produce the desired rate.

Equipment Calibration

Once you have determined the desired application rate and treatment area, you must calibrate the sprayer or granular spreader to apply precisely that amount. The following information will help you with equipment calibration.

Calibration of Large Ground Sprayers

Large ground sprayers are calibrated as follows:

1. **Measure the output of all spray nozzles** and replace any whose output varies more than 10 percent from the average output.
2. **Fill the spray tank with clean water** to a marked level.
3. **Select throttle and gear settings** for the desired speed of travel and operating pressure. Spray the water over a premeasured distance — for example, 500 feet.
4. **Measure the amount of water required** to fill the tank to the original mark. This is the amount that was delivered over the spray area.

The volume (number of gallons) applied per acre for broadcast spray applications may be calculated as shown in the following example.

You want to treat 1 acre using a spray boom with six nozzles spaced 20 inches apart. When calibrated, the spray rig took 105 seconds to travel 500 feet. It sprayed a total of 365 ounces of water in this time. How many gallons, at this calibration, will it take to cover one acre?

Step 1:
Convert the number of ounces delivered to gallons using this formula:

$$\frac{\text{365 oz}}{\text{128 oz/gal}} = \text{2.85 gal}$$

Step 2:
Calculate the number of square feet treated during the calibration using the following formulas:

spray swath width x distance = sq ft treated
swath width = 6 nozzles x 20 inch spacing
= 120 inches = 10 feet
10 ft x 500 ft = 5,000 sq ft treated

Step 3:
The application rate is 2.85 gallons per 5,000 square feet. To convert this value to gallons per acre, use the following formula:

$$\frac{\text{rate delivered}}{\text{area covered}} \times \text{square feet/acre} = \text{gallons per acre}$$

$$\frac{\text{2.85 gal}}{\text{5,000 sq ft}} \times \text{43,560 sq ft/acre} = \text{25 gal/acre}$$

If the amount applied is different from the desired rate, correct it by changing the speed or nozzle size. A change in the operating pressure has less effect on the rate of application (increasing pressure four-fold will double output) yet significantly affects spray drift. Higher pressure makes the droplet size smaller, so drift is increased and more herbicide may be sprayed offtarget. Once you know the volume applied in gallons per acre, you must calculate the amount of herbicide needed to achieve the desired application rate. The following example shows how to calculate the correct rate:

Example 4. You want to treat 4 acres using the calibration in the previous example that delivers 25 gallons per acre. You need to apply 1 quart of herbicide per acre. How much herbicide and how much water must be mixed together to treat the 4 acres?

Use the following steps to calculate the herbicide and water volume needed to spray the 4 acres.

Herbicide:
1 qt/acre x 4 acres = 4 quarts of herbicide (1 gallon)

Spray volume and water:
25 gal/acre x 4 acres = 100 gallons of spray

100 gal spray − 1 gal herbicide = 99 gal water

The above method applies to broadcast spray applications. For banded applications, decrease the total spray volume (in gallons) and the amount of herbicide used by the fraction of an acre to be left untreated, as explainedpreviously, in the rate calculation section. Collect the output from all nozzles directed into the banded treatment area for rate calculations. Other methods can be used to calibrate large sprayers. For more information and examples, refer to **Suggested Reading** 2.

Calibration of Hand-Held and Backpack Sprayers

To calibrate a small sprayer, it is recommended that you use 650 feet as the calibration spray area with an 80-inch boom (four nozzles set 20 inches apart). This area is 1/10 of an acre and will simplify calculations.

To calibrate the sprayer, follow these steps:

1. **Fill the spray tank** to a known level with water, leaving at least one-fourth of the tank empty for air compression.
2. While **maintaining a steady pressure** (within 5 psi), spray 650 feet (measured beforehand).
3. **Refill the tank** to the original level, accurately measuring the amount of water required. The number of gallons used times 10 equals the number of gallons per acre the sprayer applies at your speed of travel.

Correct application depends on the applicator walking at the same speed during calibration as during field application.

Maintaining a constant speed of travel while spraying is important. A normal military cadence with 30-inch steps equals 3 miles per hour. Some find it helpful to hum a march tune to maintain this cadence. To practice, measure 100 feet and walk this distance carrying the sprayer. At a speed of 3 miles per hour walking this distance should take approximately 23 seconds.

To adjust the application rate, alter the concentration of herbicide in the tank or change nozzles. Once you have established a constant cadence, **do not attempt to change the rate by adjusting ground speed.** Doing so will produce an uneven application. As with larger sprayers, periodically check the nozzle outputs, and replace any that vary more than 10 percent from the average.

Calibration of Granular Applicators

The procedures for calibrating a granular applicator are similar to those used to calibrate spray rigs.

1. **Collect the output over a known distance and swath width.** Many spreaders are equipped with catch pans for this purpose. For others, collect the granules in a plastic bag covering the spreader orifice.
2. **Adjust the spreader orifice or ground speed** until the desired application rate is achieved. Maintain a constant ground speed when using hand-held equipment.
3. **Since the delivery rate varies** for each formulation, the calibration procedure must be performed with each chemical, preferably by the person who will make the field application.

CAUTIONS AND PRECAUTIONS

There are many cautions and precautions found on individual herbicide labels. **Every label should be read carefully, and the directions must be followed.** Many general cautions and precautions apply, some of which are discussed in this section.

Product Labeling and Restrictions

Each herbicide varies in the hazard or danger that it presents to the user. Labels are required to contain a signal word to inform the user of the products potential danger. Knowing the meaning of these signal words will help you determine precautions you may wish to take in addition to those on the label. The signal words are as follows:

- **DANGER** — The herbicide is highly toxic. A teaspoonful taken by mouth could kill an average-sized adult. Any product that is highly toxic orally, dermally, or through inhalation OR causes severe eye and skin burning will be labeled DANGER. If the product is highly toxic orally, dermally, or through inhalation, it will also be labeled **POISON**.

- **WARNING** — The herbicide is moderately toxic. A teaspoonful to tablespoonful taken by mouth could kill an average-sized adult.

- **CAUTION** — The herbicide is slightly toxic. An ounce to a pint taken by mouth could kill an average-sized adult.

Every label contains precautionary statements regarding hazards to humans, domestic animals, and the environment as well as physical or chemical hazards. These statements should be read before using the product to prevent accidents and misuse.

Handling

Herbicide labels vary in the type of protective clothing and equipment safety statements they contain. The signal words will alert you to look for these precautions. Herbicides can enter the body in three principal ways — through the mouth (orally), through the skin and eyes (dermally), and through the lungs by inhalation. To prevent herbicides from entering the body, applicators mau need to use protective clothing and equipment. As a user, your common sense and knowledge of the product should help you assess potential hazards and select the kind of protection you need. See **Suggested Readings** 2 and 7 for additional details on herbicide safety.

General Application Considerations

Each herbicide label contains general cautions and precautions about the application of the product. Not all of these statements have been included in the label section of this manual. The following precautionary statements are often found and should be followed unless the label specifically states otherwise.

1. Do not apply herbicides through irrigation equipment.
2. Avoid spray drift onto off-target species and out of the treatment area.
3. Avoid runoff to adjacent water or wetland areas.
4. Do not apply more than the recommended rates and treatments over a given period of time.

DEFINITIONS

Active ingredient: the actual herbicide or chemical in a formulation that is responsible for the herbicidal effect. The term **active ingredient per acre** (ai/A) refers to the amount of active ingredient to apply to each acre.

Banded treatment: distributed in a strip, effectively treating some fraction of the total crop acreage. Frequently, the treated strip extends several inches on either side of the crop row. The space between the rows is cultivated or mowed.

Broadcast treatment: one that is distributed uniformly over an entire area.

Contact herbicide: one that is toxic to plant tissue upon contact and usually not translocated.

Nonselective herbicide: one that is generally toxic to plants without regard to species.

Selective herbicide: one that is more toxic to some plant species than to others.

Postemergence (Post): a treatment that is applied after the weed seedlings emerge. This term may have two meanings: after emergence of the weed or after emergence of the crop. In this publication, postemergence application refers to the weed status unless otherwise noted.

Postemergence directed: applied to existing weeds with little or none of the spray contacting the crop.

Postemergence over-the-top (POT): the chemical is applied over the crop and can contact crop foliage with little or no damage.

Preemergence (Pre): a treatment applied before weed seedlings emerge. This term usually refers to treatments made before weeds emerge, regardless of crop status. However, this term may also relate to the crop status.

Preemergence directed: applied to weed-free soil with little or no contact with the already developing crop.

Preplant incorporated (PPI): applied and tilled into the soil before seeding or transplanting.

Preplant treatment: application of an herbicide to the soil before the crop is planted. Preplant herbicides are generally incorporated into the soil.

Soil incorporation: application of an herbicide to the soil, followed immediately by mechanical mixing of the herbicide with the soil.

Soil residual: a chemical that remains active in the soil for an extended period of time.

Translocated herbicide: one that moves within the plant (systemic).

Cross-Reference to Common and Trade Names of Herbicides

Label Information by Herbicide

Trade Name: Acclaim **Common Name:** fenoxaprop **Formulation:** 1 EC

Uses: Postemergence control of annual grassy weeds in established cool-season turfgrass, nursery crops, and many landscape ornamentals including trees, shrubs, herbaceous perennials, and annuals.

	Amount of Active Ingredient	**Amount by Formulation** 1 EC
Per Acre	0.1 to 0.3 lb	15 to 45 oz
Per 1,000 sq ft		0.34 to 1 oz
Spot Treatment (per gallon)		0.34 to 0.53 oz

Recommended rates for annual grass control:

Growth Stage	**lb ai/A**	**oz/A**	**oz/1000 sq ft**
seedling (no tillers)	0.12	15	0.34
1-2 tillers	0.14	23	0.53
3-4 tillers	0.25	32	0.73
4-5 tillers	0.35	45	1

Major Weeds Controlled: Annual grasses such as crabgrass, goosegrass, barnyardgrass, foxtails, and panicums.

Major Weeds Not Controlled: Annual bluegrass, broadleaf weeds, and sedges. Most perennial grasses are tolerant.

For Best Results: Apply to young (seedling to three tiller), actively growing grasses. May be tank mixed following label directions with other preemergence and postemergence herbicides. Thorough spray coverage is essential for optimum results. Flat fan nozzles are recommended. Addition of a surfactant is generally *not recommended*.

Cautions and Precautions: Do not use on Bar Harbor juniper, *Salvia*, *Pittosporum*, or *Podocarpus*. Check label for other species restrictions. Weed and crop tolerance may vary according to environmental conditions, and tolerance should be determined prior to extensive use. Temporary stunting or chlorosis may occur on succulent, rapidly growing ornamentals. Do not apply more than 138 oz per acre per growing season.

Residual activity: Up to two weeks of residual control has been reported.

Volatility and Leaching Potential: Loss from volatility is minimal. Leaching is negligible.

Symptoms and Mode of Action: Growth inhibition occurs within 48 hours. Meristems turn black shortly thereafter. Yellow to red foliage develops in about 7 to 10 days; plants die in about 14 days. Mechanism of action involves inhibition of lipid synthesis at the root and shoot meristems.

Manufacturer: Hoechst-Roussel Agri-Vet Company **EPA Reg #:** 8340-18-54382

Trade Name: Barricade **Common Name:** prodiamine **Formulation:** 65 WG

Uses: Selective preemergence residual control of many annual grasses and broadleaf weeds in turf and landscapes.

	Amount of Active Ingredient	**Amount by Formulation** 65 WG
Per Acre	0.65 to 0.75 lb	1.0 to 1.15 lb
Per 1,000 sq ft	0.24 to 0.27 oz	0.37 to 0.42 oz

Major Weeds Controlled: Annual grasses such as crabgrass, goosegrass, foxtails, barnyardgrass, and broadleaf signalgrass. Some annual broadleaf weeds such as carpetweed, chickweed, knotweed, oxalis, shepherdspurse, prostrate spurge, lambsquarters, and pigweed.

Major Weeds Not Controlled: Established weeds, perennial grasses, and large-seeded broadleaf weeds.

For Best Results: Barricade must be incorporated with 1/2 inch of rainfall or irrigation or with shallow cultivation as soon as possible after application. Incorporation should not be delayed more than 14 days after application.

Cautions and Precautions: On landscape ornamentals, no more than 1.15 lb/A of Barricade may be applied in any 60-day period, and no more than 2.3 lb/A may be applied in a calendar year. On turf, no more than 1.15 lb/A or the maximum yearly application rate, whichever is less, may be applied in any 60-day period. Maximum yearly application rates range from 1.0 to 2.3 lb/A, depending upon turf species.

Residual Activity: Season-long annual grass control is provided in many situations.

Volatility and Leaching Potential: Photodecomposition and volatilization occur when the product remains on the surface for prolonged periods without incorporation. Strongly adsorbed by soil; not readily leached.

Symptoms and Mode of Action: Absorbed through roots and inhibits root and shoot growth, perhaps through interference with cell division.

Manufacturer: Sandoz Agro Inc. **EPA Reg.** 55947-43

Trade Name: Basagran T/O **Common Name:** bentazon **Formulation:** 4 L

Uses: Postemergence control of seedling broadleaf weeds, yellow nutsedge and annual sedges in warm- and cool-season turf, nonbearing fruit or nut trees, and selected field-grown ornamental trees, shrubs, and groundcovers.

	Amount of Active Ingredient	**Amount by Formulation** 4 L
Per Acre	0.75 to 1 lb	1.5 to 2 pt
Per 1,000 sq ft		0.5 to 0.75 fl oz

Major Weeds Controlled: Mallow, purslane, smartweed, velvetleaf, wild buckwheat, wild mustard, yellow nutsedge, and Canada thistle. Control of spring-germinating horseweed has also been observed (fall-germinating horseweed was not controlled).

Major Weeds Not Controlled: Grasses, perennial broadleaves, and mature weeds are not controlled. Purple nutsedge, dandelion, spurge, and woodsorrel are not controlled.

For Best Results: Apply as a directed spray to small, actively growing weeds when soil moisture is good. For yellow nutsedge control, two applications are recommended; the first when sedge is 6 to 8 inches tall and the second 7 to 10 days later. For Canada thistle control, apply bentazon when the weed is between 8 inches tall and the bud stage; make a second application 7 to 10 days later. The addition of 1 qt/A of crop oil concentrate is recommended when treating yellow nutsedge, Canada thistle, and several other species (see label for details). Do not cultivate five days before or after application. Allow 8 hours of drying time.

Cautions and Precautions: Addition of crop oil concentrates will increase activity; however, crop foliage may be burned when humidity and temperature are high. Do not use on nonbearing food crops within one year of harvest.

Residual Activity: No soil residual activity should be expected.

Volatility and Leaching Potential: No loss occurs from volatility or photodegradation. Bentazon is rapidly incorporated into soil organic matter and rapidly broken down by microbes; therefore, leaching potential is low. Do not apply to crops under environmental stress.

Symptoms and Mode of Action: Contact burning action. Translocation is minimal. Mechanism involves inhibition of photosynthesis; therefore, symptoms may take up to several days to develop. Higher temperatures and addition of crop oil may accelerate and increase the incidence and severity of burn.

Manufacturer: BASF Corporation; **EPA Reg. #** 7969-45

Trade Name: Basamid Granular **Common Name:** dazomet **Formulation:** 99 G

Use: Soil fumigant for preplant control of most weeds, nematodes, and soil fungi in seedling and propagation beds for ornamentals, wildflowers, nonbearing crops, and nonbearing fruit and forest trees.

	Amount of Active Ingredient	**Amount by Formulation** 99 G
Per Acre	347 lb	350 lb
Per 1,000 sq ft		8 lb

Major Weeds Controlled: Small-seeded grasses and broadleaves.

Major Weeds Not Controlled: Legumes, sedges from seed, and morninglories.

For Best Results: Soil temperature must be above 43°F and should be from 54°F to 64°F. Area should be in seedbed condition with sufficient moisture for good plant growth for 5 to 14 days before treatment. Seal the soil as soon as possible after incorporation by compacting the surface, by moistening, or by covering with plastic.

Cautions and Precautions: Do not apply to growing crops. Conduct a germination test of treated soil before planting crop. Vapors from treated soils may injure growing plants in enclosed structures. Do not apply within 4 feet of growing plants or closer than the dripline of trees and large shrubs.

Residual Activity: All gaseous residues must be removed before planting. Soil moisture and temperature and soil structure influence time required for removal.

Volatilization and Leaching Potential: Dazomet is easily lost through volatilization.

Symptoms and Mode of Action: Dazomet degrades to methylisothiocyanate in the presence of moisture and disrupts biological functions of absorbing organisms.

Manufacturer: BASF Corporation **EPA Reg. #** 7969-99

Trade Name: Betasan, Bensumec, Pre-San, others **Common Name:** bensulide

Formulations: 4 E*, 7 G, 12.5 G, others

Uses: Preemergence control of annual grasses and several annual broadleaf weeds in established turf (including bentgrass greens) and selected woody and herbaceous ornamentals.

	Amount of Active Ingredient	**Amount by Formulation**		
		4 E	7 G	12.5 G
Per Acre	7.5 to 12.5 lb	15 to 25 pt	107 to 180 lb	80 to 100 lb
Per 1,000 sq ft		5.6 to 7.3 oz	2.4 to 4.1 lb	1.8 to 2.4 lb

Major Weeds Controlled: Crabgrass, annual bluegrass, goosegrass, barnyardgrass, and henbit.

Major Weeds Not Controlled: Woodsorrel, most large-seeded annual broadleaves, and perennials.

For Best Results: Apply before emergence of weeds. Irrigate the area for 10 to 15 minutes after application to move the product into the weed seed germination zone. Do not apply peat moss prior to application. Remove dead grass, leaves, and other debris before application.

Cautions and Precautions: Do not allow children or pets on treated area until the product has been watered in and the grass is completely dry. Do not apply more than 50 pints per acre per year. Inactivated in soils high in organic matter. Odor can be objectionable. Some fertilizer products contain bensulide. Check these labels carefully as some species labeled for bensulide alone are not labeled for the fertilizer products.

Residual activity: Three to four months.

Volatility and Leaching Potential: Volatility is low but irrigation is necessary for activation. Low leaching potential.

Symptoms and Mode of Action: Bensulide inhibits root growth. Susceptible weeds do not emerge. Crop injury associated with root growth inhibition often expresses itself as wilting during drought and an overall reduction in growth and vigor.

Manufacturer: Zeneca **EPA Reg. #:** 10182-163 (and others)

---

*Caution: When the product is available in more than one formulation, the formulation designated with the asterisk (*) was used as the primary source of information for this publication. Additional cautions may be included on the labels of other formulations. Users are responsible for checking labels for other uses and restrictions.

Trade Name: Brom-O-Gas 2% **Common Name:** methyl bromide, chloropicrin

Formulation: 98%

Use: Soil fumigant for preplant control of most weeds, fungi, nematodes, insects, and mites in seedbeds and transplant beds for ornamentals, flowers, and Christmas trees.

	Amount of Active Ingredient	**Amount by Formulation** 98%
Per Acre	240 to 450 lb	240 to 450 lb
Per 1,000 sq ft		10 to 15 lb

Major Weeds Controlled: Most small-seeded broadleaves and grasses.

Major Weeds Not Controlled: Legumes, Carolina geranium, red stem filaree, morninglories, dichondra, bindweed, prickly sida, and sedges.

For Best Results: Soil preparation is extremely critical for obtaining good results. Soil should be in seedbed condition, free of clods and undecomposed organic matter, and with moisture content from 25 to 75 percent of field capacity. Soil temperature should be between 50° and 80°F at the injection depth (6 to 8 inches). Do not fumigate when soils are too wet or too cold.

Cautions and Precautions: Liquid is under pressure and extremely hazardous. Chloropicrin is added as a warning agent and may cause irritation to the eyes and upper respiratory tract. All residues must be removed from the soil before planting. Aerate the soil for at least two weeks before setting transplants. Under some conditions, the levels of ammonia nitrogen in the soil may be increased. Use nitrate sources of nitrogen fertilizer until plants are well established and soil is above 65°F to avoid ammonia injury and nitrate starvation.

Residual Activity: All residues must be removed before planting. Soil temperature and moisture and soil structure influence the time required for removal of residues.

Symptoms and Mode of Action: Highly reactive fumes inhibit respiration resulting in disruption of biochemical processes.

Manufacturers: Great Lakes Chemical Corporation and Ethyl Corporation **EPA Reg. #** 88-55-2

Trade Names: Casoron, Dyclomec, Norosac, others **Common Name:** dichlobenil
Formulations: 4 G*, 50 W

Uses: Winter-applied preemergence control of annual and perennial broadleaf and grassy weeds in established field-grown woody ornamentals, nut and fruit trees, and noncropland areas. Provides some postemergence control on selected perennials.

	Amount of Active Ingredient	Amount by Formulation	
		4 G	50 W
Per Acre	4 to 6 lb	100 to 150 lb	8 to 12 lb
Per 1,000 sq ft		2.3 to 3.4 lb	2.9 to 4.4 oz

Major Weeds Controlled: Preemergence control of most spring-germinating annuals. Postemergence control of many winter annual weeds. Control of several perennial weeds including dandelion, field horsetail (*Equisetum*), red sorrel, fescue, orchardgrass, and wild carrot. The higher rate will suppress other perennials including yellow nutsedge, mugwort, quackgrass, and bindweed.

Major Weeds Not Controlled: Hemp dogbane and vetch are not controlled. Weeds germinating in mid- to late summer will not be controlled, in particular, late-germinating annual grasses.

For Best Results: Apply in fall before soil freezes. Irrigation or precipitation is necessary after treatment. Soil temperatures must be 55°F or less or rapid decomposition and volatilization losses will occur. The granular formulations have provided more consistent weed control.

Cautions and Precautions: Do not use on sandy soils. For perennial weed control, do not make surface application to areas cultivated during the fall or summer before application. Do not use for six months after planting rooted cuttings. Do not use in seedbeds, transplant or cutting beds, or greenhouses. Do not allow granules to lodge in foliage (especially conifer species) or to accumulate and contact trunk at or below the soil line. The following species restrictions apply: Azalea: Use only on kurume, mollis, hardy hybrid types, and hardy native species. Holly: Do not use on *Ilex crenata, I. rotunda,* or *I. vomitoria*. Pines: Species are sensitive to injury if applied within two years after transplanting. *Do not use on firs, hemlocks, and spruce.* In research, potentilla, viburnum, and lilac were injured when dichlobenil was applied before one full season of growth. Do not apply to stone fruits within one month of harvest. See label for additional precautions.

Residual Activity: At the rates labeled for use in nursery stock, residual control will last into early summer. Mulch atop the herbicide will extend the length of residual control. Cultivation in late spring will reduce the residual control. Higher rates will provide longer residuals, but crops will generally be injured.

Volatility and Leaching Potential: Highly volatile. Product use in enclosed structures could cause crop injury. In fine-textured soils, the leaching potential is low. In coarse-textured soils, leaching potential is moderate. Dichlobenil can move down a slope. Whether this occurs by mass action movement of granules or leaching of the active ingredient is unclear.

Symptoms and Mode of Action: Acts primarily on growing points and root tips. Upward translocation is rapid. Inhibits growth of meristems (growing points). Crop injury symptoms include delayed bud break, general reduction in vigor, and marginal chlorosis and "scorching" of the leaves.

Manufacturers: Uniroyal Chemical Company, Inc. and PBI/Gordon Corporation
EPA Reg. #: 2217-675

---

*Caution: When the product is available in more than one formulation, the formulation designated with the asterisk (*) was used as the primary source of information for this publication. Additional cautions may be included on the label for other formulations. Users are responsible for checking labels for other uses and restrictions.

Trade Name: Dacthal **Common Name:** DCPA

Formulations: 75 WP, 6 FL*, 5 G, others

Uses: Preemergence control of annual grasses and certain broadleaf weeds in newly planted or established woody and herbaceous ornamentals as well as established turf. Postemergence control of creeping speedwell.

	Amount of Active Ingredient	**Amount by Formulation**		
		75 WP	6 FL	5 G
Per Acre	6 to 15 lb	8 to 20 lb	4 to 10 qts	120 to 300 lb
Per 1,000 sq ft		3 to 7 oz	3 to 7 oz	2.7 to 6.9 lb

Major Weeds Controlled: Crabgrass and some other annual grasses, chickweed, carpetweed, and others. Creeping speedwell is controlled after emergence by the 75 WP or 6 FL formulations.

Major Weeds Not Controlled: Velvetleaf, common ragweed, mustards, jimsonweed, galinsoga, smartweed and nutsedge. Generally not effective on perennial weeds.

For Best Results: To avoid clogged spray nozzles, thoroughly mix with water before adding to the spray tank. Apply sprays in a minimum of 20 gallons per acre (GPA) (40 to 60 GPA is preferred). Use on mineral soils. A minimum of 1/4 inch of water must be applied within 3 to 5 days of application to activate. Water immediately if surface is dry and subsoil is moist enough to germinate weeds. Apply to creeping speedwell at full bloom.

Cautions and Precautions: Do not use on bugleweed (*Ajuga*), button pink, carnation, geum, pansy, phlox, sweet William, ornamental speedwells (*Veronica* spp.), or telanthera. *Do not use in Suffolk County (Long Island) New York.* Avoid use on well drained soils with water tables close to the surface.

Residual Activity: Four to eight weeks, depending upon the rate. Longer annual grass control can be expected in good turf. Do not reseed turf for 60 days following treatment.

Volatility and Leaching Potential: Nonvolatile. Low leaching potential; however, a mobile breakdown product has been found in ground water in Suffolk County, NewYork.

Symptoms and Mode of Action: Kills germinating seeds; the exact mechanism is not yet known. Symptoms of injury on susceptible ornamentals include a general loss of vigor, then chlorosis (which may take up to four weeks to develop), followed by a gradual decline.

Manufacturer: ISK Biotech Corporation **EPA Reg. #:** 50534-10 (and others)

---

*Caution: When the product is available in more than one formulation, the formulation designated with the asterisk (*) was used as the primary source of information for this publication. Additional cautions may be included on the labels of other formulations. Users are responsible for checking labels for other uses and restrictions.

Trade Name: DeMoss **Common Name:** Potassium salts of fatty acids

Formulation: 40%

Use: Postemergence control of mosses, algae, lichens, and liverworts inside greenhouses, on growing containers, benches, trees, lawns, and turf.

	Amount of Active Ingredient	**Amount by Formulation** 40%
Spot Treatment	1.6 to 2.4 oz	4 to 6 oz/gal

Major Weeds Controlled: Mosses, algae, lichens, and liverworts.

Major Weeds Not Controlled: Not used for general weed control.

For Best Results: Use soft water and mix fresh spray. Moisten moss and surrounding grass before treatment or treat soon after rain. Moisten structures with fresh water before treating. Avoid spraying when precipitation is expected.

Cautions and Precautions: Prevent spray or runoff from contacting plant foliage. Treated surfaces may be temporarily slippery. Do not apply to moss or algae in lawns or turf when air temperature exceeds 85°F. Do not use on fruit trees.

Residual Activity: None

Volatility and Leaching Potential: Active ingredient is rapidly degraded by microorganisms; little potential for leaching exists.

Symptoms and Mode of Action: Penetrates cuticle and results in plant desiccation.

Manufacturer: Mycogen Corporation **EPA Reg. #** 53219-4

Trade Name: Derby **Common Name:** simazine + metolachlor **Formulation:** 5 G (1 + 4)

Uses: Preemergence control of annual grasses and broadleaf weeds in established woody nursery crops, landscape plantings, and Christmas tree plantations. May be used in container-, field-, or liner-grown ornamentals.

	Amount of Active Ingredient	**Amount by Formulation** 5 G
Per Acre	3 to 5 lb (0.6 to 1.0 lb simazine + 2.4 to 4.0 lb metolachlor)	60 to 100 lb
Per 1,000 sq ft		1.4 to 2.3 lb

Major Weeds Controlled: Annual grasses including crabgrass, foxtail, barnyardgrass, and panicum; annual broadleaf weeds such as chickweed, galinsoga, black nightshade, pigweed, ragweed, evening primrose; and suppression of yellow nutsedge.

Major Weeds Not Controlled: Velvetleaf, triazine-resistant groundsel, and ragweed. Generally not effective on yellow woodsorrel (*Oxalis*) or horseweed. Partial control of hairy nightshade. Perennial weeds are not controlled. Do not expect broadleaf weed control comparable to a full rate of Princep.

For Best Results: Apply before weeds germinate, and irrigate for activation. Irrigate with sufficient water to wash granules off the foliage of ornamentals to reduce the chance of injury. A second application will be needed for full-season weed control and nutsedge suppression.

Cautions and Precautions: Do not use in areas where the water table is close to the surface and where soils are very permeable. Do not apply to seedbeds, cutting beds, or unrooted cuttings before transplanting. Do not apply to plants until the soil has firmly settled around roots. Wash granules from foliage to reduce the chance of injury. Do not make more than two applications per year. Do not apply more than 160 lb/A per year.

Residual Activity: Three to four months.

Volatility and Leaching Potential: Volatility is negligible. Leaching potential depends upon soil type. Leaching potential is moderately high on sands and loamy sands, moderate on sandy loams, and low on finer textured soils.

Symptoms and Mode of Action: Kills germinating weed seedlings. As this product is a combination of two herbicides with very different modes of action, the symptoms can mimic either simazine or metolachlor, depending on the species. See Princep and Pennant descriptions.

Manufacturer: Ciba Plant Protection **EPA Reg. #:** 100-715

Trade Name: Devrinol **Common Name:** napropamide **Formulations:** 50 WP

Uses: Preemergence control of many annual grasses and some broadleaf weeds in container- and field-grown ornamentals, groundcovers, and flowers. May be used in liner beds, newly transplanted or established nursery crops, and Christmas trees.

	Amount of Active Ingredient	**Amount by Formulation** 50 WP
Per Acre	4 to 6 lb	8 to 12 lb
Per 1,000 sq ft		3 to 4.4 oz

Major Weeds Controlled: Annual grasses and some annual broadleaves including chickweed, groundsel, knotweed, pineappleweed, knawel, and filaree. Cutleaf evening primrose can be controlled if the herbicide is applied before the seeds germinate.

Major Weeds Not Controlled: The following are generally not controlled from seed: bindweed, morningglory, mustard, nightshade, horsenettle, jimsonweed, yellow woodsorrel, horseweed, spurge, and fleabane daisy. Large-seeded broadleaf weeds, perennials, and established weeds are not controlled.

For Best Results: Apply to freshly weeded (or cultivated) soil before weeds germinate. Dormant season treatments, that is from November through March, have been successful. Incorporate immediately by tillage, irrigation, or rainfall. Control may decrease if water is not provided within two to three days of application. See label for use on potting mixes.

Cautions and Precautions: Apply to newly planted container stock after soil has settled from first watering. The 50 WP formulation can burn young, tender foliage on some plants. It is best applied before bud break or after the new growth has matured. Devrinol is registered for use in warm-season turf but will injure cool-season species.

Residual Activity: Full-season grass control can be expected from a single spring application. At the higher rates, carryover can affect the establishment of grass cover crops seeded in late summer or early fall.

Volatility and Leaching Potential: Moderately volatile. Photolabile. Incorporation via irrigation or cultivation will reduce losses due to volatility and photodegradation. Leaching is negligible.

Symptoms and Mode of Action: Inhibits root growth. Susceptible weeds do not emerge. Root growth of crops may be inhibited resulting in wilting during periods of stress. Young, tender crop foliage may exhibit contact-burn-type injury. In rare cases, plant height and vigor of herbaceous ornamentals is reduced.

Manufacturer: Zeneca and others **EPA Reg. #:** 10182-231 and others

Trade Name: Eptam **Common Name:** EPTC **Formulations:** 2.3 G*, 5 G

Uses: Selective preemergence control of annual grass weeds and many broadleaf weeds plus a few perennial weeds in field-grown woody ornamentals, groundcovers, and some flowers.

	Amount of Active Ingredient	**Amount by Formulation**	
		2.3 G	5 G
Per Acre	5 to 6 lb	220 to 260 lb	100 to 120 lb
Per 1,000 sq ft		5 to 6 lb	2.3 to 2.75 lb

Major Weeds Controlled: Most annual grasses, some annual broadleaves including black and hairy nightshade, chickweed, purslane, pigweed, and lambsquarters. Suppresses some perennial weeds such as quackgrass and yellow nutsedge.

Major Weeds Not Controlled: Emerged annuals and most perennials are not controlled. Due to the short residual effect, late-germinating weeds are not controlled.

For Best Results: Prior to application, soil must be loose and free of clods. Physically incorporate into the soil immediately after application to a depth of 2 to 3 inches. Thorough incorporation is necessary for good weed control. Apply when conditions are favorable for weed germination and growth.

Cautions and Precautions: Use only on mineral soils. Do not store near seeds or fertilizers. Do not use on flowering bulbs, salvia, phlox, snapdragon, and ornamental peppers as injury may occur.

Residual Activity: Short-term, residual weed control lasts four to six weeks. Rapidly decomposed by soil microorganisms.

Volatility and Leaching Potential: Highly volatile when applied to moist soils. Incorporate physically or with irrigation immediately after treatment. Leaching may occur in coarse-textured soils with excessive rainfall or irrigation.

Symptoms and Mode of Action: Inhibits underground shoot growth of emerging weeds. Exact mechanism has not been confirmed. Injury symptoms include reduced vigor and crinkled foliage.

Manufacturer: Zeneca **EPA Reg. #** 10182-160

---

*Caution: When the product is available in more than one formulation, the formulation designated with the asterisk (*) was used as the primary source of information for this publication. Additional cautions may be included on the labels of other formulations. Users are responsible for checking labels for other uses and restrictions.

Trade Name: Finale **Common Name:** glufosinate **Formulation:** 1 L

Uses: Nonselective control of a broad spectrum of emerged annual and perennial grasses and broadleaf weeds. Finale may be used for trimming and edging in landscape areas and for weed control in recreational and public areas such as airports and parks. Also used for weed control in field- and container-grown nursery stock when applied as a directed spray and for weed control in farmstead noncrop areas.

	Amount of Active Ingredient	**Amount by Formulation**
		1 L
Per Acre	0.75 to 1.5 lb	3 to 6 qt
Per 1,000 sq ft		2.2 to 4.4 fl oz
Spot Treatment		1.5 to 4 fl oz/gal

Major Weeds Controlled: Many emerged annual and perennial grasses and broadleaves.

Major Weeds Not Controlled: Weeds that emerge after application.

For Best Results: Apply to actively growing weeds. Application rates vary with weed species and weed growth stage.

Cautions and Precautions: Unsatisfactory control may result if weeds are stressed by drought or cool temperatures or if the weed population is dense. When applied near desirable vegetation, the herbicide must be applied as a directed spray because it is nonselective. A shielded sprayer may be necessary in some situations.

Residual Activity: No residual activity.

Volatility and Leaching Potential: Adsorbed to soil colloids. Rapidly broken down by microorganisms.

Symptoms and Mode of Action: Visual effects may be seen within two to four days. The compound inhibits glutamine synthetase. This allows ammonium ions to build up within the plant, causing tissue destruction and limiting photosynthesis.

Manufacturer: Hoechst-Roussel Agri-Vet Company **EPA Reg.** 8340-42-54382

Trade Names: Fusilade, Ornamec, others **Common Name:** fluazifop-P-butyl

Formulation: 0.5 EC, 1 EC*, others

Use: Selective postemergence control of annual and perennial grasses. May be applied over the top of many ornamentals including many woody and herbaceous ornamentals in container and field nurseries and landscapes.

	Amount of Active Ingredient	Amount by Formulation	
		0.5 EC	1 EC
Per Acre	0.25 to 0.4 lb	4 to 6 pt	2 to 3 pt
Per 1,000 sq ft		1.5 to 2.2 fl oz	0.8 to 1.1 fl oz
Spot Treatment (amount per gallon)		2.5 fl oz	1.5 fl oz

Major Weeds Controlled: Annual and most perennial grasses.

Major Weeds Not Controlled: All broadleaf weeds, sedges, rushes, lilies, and other nongrasses. Bluegrass, red fescue, and sweet vernal grass have shown considerable tolerance.

For Best Results: Mix with nonionic surfactant. Some ready-to-use formulations are available; do not add additional surfactant to such formulations. Spray annual grasses at 2 to 8 inches tall before tillering. For perennial grass, spray during the spring growth flush but before heading. Cultivation two to three weeks after treatment may assist weed control. Thorough coverage is essential for optimum results; spray to cover but not to runoff. Optimum control is attained when weeds are not stressed.

Cautions and Precautions: Use only nonionic surfactants. Do not apply if rain is expected within 1 hour. Do not tank mix with other pesticides or fertilizers except as instructed on the label. Check the label restrictions on bluegreen junipers, azalea cultivars, and other cultivar restrictions that may not be listed in the tables of this publication. Directed sprays are required to prevent unacceptable injury on some species. Do not apply to plants that may be harvested for food within one year.

Residual Activity: Up to two weeks of soil residual activity has been reported.

Volatility and Leaching Potential: Low volatility and negligible leaching occur when used as directed.

Symptoms and Mode of Action: Growth inhibition occurs within 48 hours. Meristems turn black shortly thereafter. Yellow to red foliage develops in about 7 to 10 days, and plants die within 14 days. Inhibits cell division by blocking acetyl Co A carboxylase, a lipid biosynthesis enzyme.

Manufacturer: Zeneca, PBI/Gordon Corp., others **EPA Reg. #:** 10182-104, others

---

*Caution: When the product is available in more than one formulation, the formulation designated with the asterisk (*) was used as the primary source of information for this publication. Additional cautions may be included on the labels of other formulations. Users are responsible for checking labels for other uses and restrictions.

Trade Name: Gallery **Common Name:** isoxaben **Formulation:** 75 DF

Use: Preemergence broadleaf weed control in established turf, field- and container-grown ornamentals, groundcovers, nursery stock, ornamental bulbs, Christmas tree plantations, and non-bearing fruit trees.

	Amount of Active Ingredient	**Amount by Formulation** 75 DF
Per Acre	0.5 to 1.0 lb	0.66 to 1.33 lb
Per 1,000 sq ft		0.25 to 0.5 oz

Major Weeds Controlled: Many broadleaf weeds including chickweed, oxalis, horseweed, dogfennel, and prostrate spurge.

Major Weeds Not Controlled: Velvetleaf, mallow, morningglory, cutleaf evening primrose, annual grasses, most perennials, and established weeds.

For Best Results: Apply to weed-free soil. Needs 1/2 inch of water within 21 days to activate. Generally mixed with a preemergence grass herbicide. See label for additional information.

Cautions and Precautions: Do not apply to newly transplanted plants until the media or soil has settled and no cracks are present. Do not apply to bedding plants or areas where bedding plants will be planted within the next year. Do not apply to groundcovers until they are well rooted. Do not apply more than 4 pounds of Gallery in 12 months, and repeat applications of 1 pound per acre should not be applied less than 60 days after the previous application. Use of Gallery is prohibited on several species. See label for details.

Residual Activity: When applied in the fall, control of spring-germinating weeds can be expected.

Volatility and Leaching Potential: No significant photodecomposition or volatilization occurs with field use. Slightly susceptible to leaching.

Symptoms and Mode of Action: Has not been documented. Appears to disrupt root and hypocotyl development by inhibiting cell wall synthesis.

Manufacturer: DowElanco **EPA Reg. #** 62719-145

Trade Name: Goal **Common Name:** oxyfluorfen **Formulation:** 1.6 E

Uses: Preemergence and postemergence control of certain annual grasses and broadleaf weeds in conifer seedbeds, transplants, and field- and container-grown nursery stock. A component of Rout and Ornamental Herbicide 2, granular products used preemergence in container- or field-grown nursery stock. Frequently tank mixed with sethoxydim (Vantage) for tall fescue sod suppression in orchards, Christmas tree plantations, and nurseries.

	Amount of Active Ingredient	Amount by Formulation 1.6 E
Per Acre	0.25 to 0.5 lb	1.25 to 2.5 pt (pre or post application to seedbeds)
	1.0 to 2.0 lb	5 to 10 pt (pre or post applications to transplants or containers)
Per 1,000 sq ft		0.5 to 0.9 fl oz (seedbeds)
		1.8 to 3.7 fl oz (transplants or containers)

Major Weeds Controlled Preemergence: Annual grasses such as crabgrass, barnyardgrass, and annual bluegrass plus many broadleaves from seed including clover, groundsel, woodsorrel, bittercress, galinsoga, spurge, mallow, smartweed, and others.

Major Weeds Controlled Postemergence: Young seedling annual grasses and seedling broadleaves including groundsel, pigweed, smartweed, wild mustard, lambsquarters, and others. Temporary suppression of several perennial dicots has been reported.

Major Weeds Not Controlled: Established grasses, goldenrod, horseweed, dogfennel, oxeye daisy, Indian hemp, red sorrel, and other perennials. Large dicot weeds will be burned but not controlled.

For Best Results: For preemergence control, apply to a clean, weed-free, smoothly tilled soil surface. Do not disturb the soil after application. For postemergence control, add 0.25% nonionic surfactant and apply to seedling weeds less than 4 inches tall. May be tank mixed with other herbicides according to label directions to improve grass control. Useful in conifers and conifer seedbeds. See label for additional information on timing and application methods. At least 1/4 inch of rainfall should occur with three to four weeks after application.

Cautions and Precautions: Burns most broadleaf plants. Postemergence applications to conifer seedbeds should not be made until a minimum of five weeks after emergence of the conifer seedlings to allow the seedlings to harden off. Postemergence applications to container-grown conifers and conifer transplants should be made before bud break or after the foliage has hardened off. Do not apply in enclosed greenhouse structures as injury to foliage may result. Do not store or transplant treated container stock in an enclosed structure until completion of four irrigations (a minimum of 21 days) as injury to nonlabeled plants may occur. Some varieties or cultivars of labelled species may be injured by Goal; make sure that a particular variety is tolerant before conducting wide-scale spraying. Fruit or nut trees and vines should be dormant at the time of application.

Residual Activity: Up to eight weeks of weed control, depending on the application rate.

Volatility and Leaching Potential: A relatively low water solubility results in negligible leaching potential in most circumstances. Leaching might occur with frequent irrigation over sandy soils; under those conditions, a postemergence application at lower rates would be preferred.

Symptoms and Mode of Action: In preemergence applications, seedlings rarely emerge from the soil. After seedling emergence, it acts as a contact herbicide for which light is required. Foliar applications result in rapid (within days) necrosis of tissues contacted by the spray. Green, tender stems may be similarly burned. No direct effects on roots should occur.

Manufacturer: Rohm and Haas Company **EPA Reg. #:** 707-174.

Trade Name: Gramoxone Extra **Common Name:** paraquat **Formulation:** 2.5 L

Use: A nonselective postemergence contact herbicide used as a preplant cleanup or postplant directed spray to control most small annual broadleaf and grassy weeds and to suppress perennial weeds. For use ONLY IN PRODUCTION NURSERIES.

	Amount of Active Ingredient	**Amount By Formulation** 2.5 L
Per Acre	0.6 to 0.9 lb	2 to 3 pt
Per 1,000 sq ft		0.7 to 1.1 fl oz
Spot Treatment		1 fl oz + 0.25 fl oz nonionic surfactant/gal

Major Weeds Controlled: Nonselective control of seedling annual weeds.

Major Weeds Not Controlled: Perennials that will resprout. The following annuals are considered difficult to kill when they are beyond the seedling stage: Virginia pepperweed, lambsquarters, dayflower, filaree, horseweed, knotweed, *Malva*, Pennsylvania smartweed, velvetleaf, fall panicum, kochia, tansy mustard, prickly lettuce, morningglory, cheatgrass, and volunteer wheat.

For Best Results: Apply to small, actively growing weeds until complete coverage is obtained. Apply before plants are mowed. Use a nonionic surfactant. May be tank mixed with other herbicides following label directions.

Cautions and Precautions: THIS IS A HIGHLY TOXIC, RESTRICTED USE HERBICIDE. DO NOT USE AROUND HOME GARDENS, SCHOOLS, RECREATIONAL PARKS, OR PLAYGROUNDS. Do not allow the spray to contact bark less than one year old, green stems, fruit, or foliage as injury may result. See label for additional precautions.

Residual Activity: No residual activity in mineral soils.

Volatility and Leaching Potential: Essentially no volatility. Does not leach in mineral soils because the compound is rapidly and irreversibly bound by soil clay particles.

Symptoms and Mode of Action: Rapidly absorbed. Interacts with light to produce superoxides that destroy plant cells. On a sunny day, treated tissues will appear water-soaked within hours. Necrosis follows within one or two days. Dead tissues usually turn black.

Manufacturer: Zeneca **EPA Reg. #:** 10182-280

Trade Name: Image **Common Name:** imazaquin **Formulation:** 1.5 LC

Use: Preemergence and postemergence control of broadleaf weeds, sedges, and some grasses in field-grown ornamentals and warm-season turfgrass.

	Amount of Active Ingredient	**Amount by Formulation** 1.5 LC
Per Acre	0.4 to 0.5 lb	1 to 1.3 qts
Per 1,000 sq ft		0.75 to 1 fl oz

Major Weeds Controlled: Some broadleaves and sedges such as hairy bittercress, chickweed, Carolina geranium, yellow nutsedge, and purple nutsedge. Wild garlic and wild onion are also controlled.

Major Weeds Not Controlled: Most annual and perennial grasses and broadleaves such as cocklebur, pigweed, mustards, ragweed, lambsquarters, and others. Some annual grasses are partially controlled.

For Best Results: Follow recommended timing on the label for use in turfgrass. May be tank mixed with other herbicides following label directions. Use with a nonionic surfactant. Do not apply when wind velocity exceeds 10 miles per hour. Postemergence control may require several weeks. Postemergence application is required for control of wild garlic and wild onion.

Cautions and Precautions: Do not apply to unlabeled ornamentals, cool-season turf, or annual bedding plants. Do not use on container-grown ornamentals. Do not apply around the following species: azalea, viburnum, pieris, abelia, and ligustrum. Use only on well-established, nonstressed ornamentals or injury may result. Temporary growth suppression may be observed on some treated plants. Do not apply to areas where bedding plants may be planted the following year.

Residual Activity: At recommended rates, season-long weed control can be expected.

Volatility and Leaching Potential: Nonvolatile. Imazaquin is highly mobile, and the amount of leaching is influenced by soil pH and organic matter with less leaching occurring in soils with greater organic matter content.

Symptoms and Mode of Action: Inhibits the enzyme acetolactate synthase, responsible for the production of certain amino acids.

Manufacturer: American Cyanamid Company **EPA Reg. #** 241-303

Trade Name: Kerb **Common Name:** pronamide **Formulation:** 50 W

Uses: Dormant-season applications in field-grown woody ornamentals and Christmas trees for preemergence and early postemergence control of winter annual and perennial cool-season grasses and chickweed. Preemergence control of certain other broadleaf weeds and grasses.

	Amount of Active Ingredient	**Amount by Formulation** 50 W
Per Acre	1 to 2 lb	2 to 4 lb
Per 1,000 sq ft		0.7 to 1.5 oz

Major Weeds Controlled: *Postemergence*: ryegrass, barley, bluegrass, fescues, rye, wheat, chickweed, and suppression of quackgrass. *Preemergence:* all of the above species plus wild mustard, London rocket, shepherdspurse, and red sorrel (from seed).

Major Weeds Not Controlled: Summer annual broadleaf weeds, late-germinating grasses, and most perennial broadleaf weeds.

For Best Results: Apply in the fall before soil freezes. Moisture from rain, irrigation, or melting snow is necessary after treatment. Soil temperatures must be 55°F or lower or rapid decomposition and volatilization loss will occur.

Cautions and Precautions: Do not incorporate. Should not be applied to seedlings or to transplants less than one year old. Kerb is inactive in high organic matter soils. Because Kerb has produced tumors in laboratory animals, this product is a RESTRICTED USE PESTICIDE.

Residual Activity: Residual activity is dependent upon soil temperature and application rate. At these recommended rates, preemergence control from a late fall or winter application will last into late spring or early summer.

Volatility and Leaching Potential: When used according to label directions (that is, when temperatures are below 55°F), volatility is low; however, volatility increases as temperature increases. Significant lateral surface movement can occur, particularly when applied on slopes. Consequently, it is reasonable to assume that on coarse textured soils leaching potential would be moderate to high. On fine textured soils or soils high in organic matter, leaching potential would be low.

Symptoms and Mode of Action: Absorbed through the roots, translocated upward. Inhibits mitosis (cell division in meristem tissue) and may have additional effects. The progress of herbicide action is slow and no characteristic symptoms are usually apparent other than growth inhibition and senescence.

Manufacturer: Rohm and Haas Company **EPA Reg. #:** 707-159

Trade Name: Lasso, Lasso Micro-tech, Lasso II **Common Name:** alachlor

Formulations: 4 E*, 15 G

Use: Preemergence control of yellow nutsedge, annual grasses and certain broadleaf weeds in *Juniperus* and *Taxus* spp. The granular formulation is labelled for several other species as well.

	Amount of Active Ingredient	Amount by Formulation	
		4 E	15 G
Per Acre	4 lb	4 qt	27 lb
Per 1,000 sq ft		2.9 fl oz	9.8 oz

Major Weeds Controlled: Several annual broadleaves and grasses including galinsoga, pigweed, purslane, crabgrass, foxtail, broadleaf signalgrass, and barnyardgrass.

Major Weeds Not Controlled: Large-seeded annual broadleaves, most perennials, and established weeds. The following are generally not controlled from seed: bermudagrass, bullnettle, Canada thistle, bindweed, quackgrass and lambsquarters.

For Best Results: Apply as a directed spray after transplanting or to established plantings before weed emergence. Either incorporate physically in upper 1 to 2 inches of soil or water within 10 days of application. Check label for rates on specific soil textures and for additional information on application timing and methods.

Cautions and Precautions: Do not exceed three applications per year or retreat within 21 days. Contact with green foliage may cause injury. Do not apply granules to wet foliage as granules may stick and cause plant injury. If granules do stick to foliage, irrigate within 1 hour to remove the granules. Do not use on seedbeds, unrooted cuttings, or before transplanting. Applications when the temperature exceeds 90°F may injure ornamentals. Store above 32°F to keep product in solution. Because Lasso has produced tumors in laboratory animals, this product is a RESTRICTED USE PESTICIDE.

Residual Activity: Control may last from 6 to 10 weeks depending upon soil type and weather conditions.

Volatility and Leaching Potential: Little loss occurs through volatilization. Alachlor is adsorbed to clay minerals and organic matter so leaching should not be great unless soils are sandy and low in organic matter.

Symptoms and Mode of Action: Absorbed mainly by germinating plant shoots, secondarily by roots. Appears to inhibit protein synthesis.

Manufacturer: Monsanto Company **EPA Reg. #** 524-314 (Lasso) 524-344 (Lasso II)

---

*Caution: When the product is available in more than one formulation, the formulation designated with the asterisk (*) was used as the primary source of information for this publication. Additional cautions may be included on the labels of other formulations. Users are responsible for checking labels for other uses and restrictions.

Trade Name: Ornamental Herbicide II (OH2)
Common Name: oxyfluorfen + pendimethalin **Formulation:** 3 G (2+1)

Use: Preemergence control of grasses and broadleaf weeds in container- and field- grown woody ornamentals.

	Amount of Active Ingredient	**Amount by Formulation** 3 G
Per Acre	2 + 1 lb (oxyfluorfen + pendimethalin)	100 lb
Per 1,000 sq ft		2.3 lb

Major Weeds Controlled: Several annual grasses and broadleaf weeds including large crabgrass, foxtails, annual ryegrass, hairy bittercress, cudweed, and prickly lettuce.

Major Weeds Not Controlled: Perennial weeds and emerged weeds.

For Best Results: Do not incorporate physically. Water to activate immediately after application. Repeat application at three month intervals. Remove existing weeds before application.

Cautions and Precautions: Apply to dry foliage only. Water in immediately to wash the particles off the plant foliage and to activate the herbicide. Do not apply while plants are producing a new flush of spring growth. Do not apply to plants such as yucca or *Hosta* with leaves that channel granules to the leaf base. Do not use in greenhouses. Not recommended for bedding plants, liner production beds, groundcovers, flowers, turf or plants bearing edible fruit. Do not apply when extremely cold temperatures (35°F or lower) are expected. Do not use on *Erica mediterranea* (Mediterranean heather), *Rhododendron* spp. ('Hinocrimson' and 'Snow' azalea), *Sarcococca hookeriana* var. *humilis*, *Euonymus alata* 'Compacta', or *Potentilla fruticosa* 'Goldfinger'.

Residual Activity: Eight to twelve weeks of weed control can be expected, depending on the growing medium and irrigation practices.

Volatility and Leaching Potential: Low volatility and low leaching potential. However, do not apply in enclosed structures as volatilization is possible. In container nurseries, surface runoff may result when broadcast applications are employed since many granules fall between pots. Otherwise, the potential for leaching and surface runoff is very low.

Symptoms and Mode of Action: Oxyfluorfen acts as a contact herbicide, disrupting cell membranes via a mechanism that requires light for activation. Pendimethalin inhibits root development by affecting cell division. See the descriptions for Goal and Pendulum for more details. Injury symptoms on ornamentals include contact-type burn where granules are trapped on the foliage and girdling at the soil line on some azalea cultivars.

Manufacturer: O. M. Scott & Sons Company **EPA Reg. #:** 538-172

Trade Names: Pendulum, Southern Weedgrass Control, Weedgrass Control 60 WP, others

Common Name: pendimethalin

Formulations: 60 DG*, 60 WP, 2.68 G (60 DG is available in soluble bags)

Uses: Preemergence control of grasses and certain broadleaf weeds in field and container grown ornamentals, established Christmas trees, turf, and noncropland areas.

	Amount of Active Ingredient	**Amount by Formulation**		
	2.68 G	2.68 G	60 DG (bags)	
Per Acre	2 to 3 lb	76 to 113 lb	3.3 to 6.6 lb	43 to 87 bags
Per 1,000 sq ft		1.7 to 2.5 lb	1.2 to 2.4 oz	1 to 2 bags

Major Weeds Controlled: Annual grasses including crabgrass, barnyardgrass, foxtails, and panicums, and some annual broadleaves including prostrate spurge, bittercress, yellow woodsorrel, chickweed, pearlwort, pigweeds, lambsquarters, and velvetleaf.

Major Weeds Not Controlled: Common groundsel is not controlled. Poor or marginal control of galinsoga, nightshades, and ragweed is to be expected. Mature, established weeds and grasses are not controlled.

For Best Results: Apply to weed free soil. Irrigate to activate and remove granules from foliage. Apply before budbreak as growth inhibition can occur when the 60 DG formulation is applied after budbreak. Apply only to established plantings.

Cautions and Precautions: Do not apply to wet foliage. Do not incorporate or apply directly to bare roots of woody ornamentals. Overapplication in cool, wet soils can increase injury. Delay first application to ornamental bare-root liners for two to four weeks. Stressed plants are more susceptible to injury. Persistent yellow color can stain equipment and landscape areas. See label for additional information.

Residual Activity: Three to five months of grass control can be expected at normal use rates.

Volatility and Leaching Potential: Slight loss from the soil surface can result from photodegradation and volatility. Irrigation soon after application will limit these losses. Strongly adsorbed to soil organic matter and clay and, therefore, not leached.

Symptoms and Mode of Action: Inhibits root development by affecting cell division. Typical injury symptoms include swollen, stubby roots. These symptoms are most commonly seen on affected grasses.

Manufacturer: American Cyanamid Co. and O. M. Scott and Sons, Inc. **EPA Reg. #:** 241-340

---

*Caution: When the product is available in more than one formulation, the formulation designated with the asterisk (*) was used as the primary source of information for this publication. Additional cautions may be included on the labels of other formulations. Users are responsible for checking labels for other uses and restrictions.

Trade Name: Pennant **Common Name:** metolachlor **Formulations:** 7.8*, EC, 5 G

Uses: Preemergence control of annual grasses, certain broadleaf weeds, and yellow nutsedge in nursery (field and container) and landscape plantings of many woody and some herbaceous ornamentals. Also used in Christmas tree transplant beds and field plantings.

	Amount of Active Ingredient	Amount by Formulation	
		7.8 EC	5 G
Per Acre	2 to 4 lb	2 to 4 pt	40 to 80 lb
Per 1,000 sq ft		0.75 to 1.5 fl oz	1 to 2 lb

Major Weeds Controlled: Most annual grasses, yellow nutsedge, galinsoga, and black nightshade.

Major Weeds Not Controlled: The following are generally not controlled from seed: dandelion, lambsquarters, bittercress, yellow woodsorrel, wild mustard, bullnettle, Canada thistle, bindweed, bermudagrass, and quackgrass.

For Best Results: Apply before weeds emerge or after existing weeds have been removed. Use higher rates on organic soils or where nutsedge or a heavy weed infestation is expected. Commonly tank mixed with other herbicides to expand the spectrum of weeds controlled; follow label directions. Tank mixes with some herbicide formulations have been incompatible. This incompatibility was minimized by increasing spray volume to 80 gallons per acre or more and using a commercial mix aid product.

Cautions and Precautions: Do not apply more than twice a year. Do not use in greenhouses or other enclosed structures. Do not apply to seedbeds, cutting beds, or unrooted cuttings before transplanting or to plants until the soil has firmly settled around roots. The EC formulation can cause temporary foliar burn on some species. Wash from foliage to reduce the chance of injury when applied over the top. Injury to ornamental grasses has been reported. Avoid using the granules on plants having leaf shapes and growth habits that may trap granules or concentrate them at the growing points.

Residual Activity: Three to four months of grass control can be expected, depending upon the rate, rainfall, and soil type.

Volatility and Leaching Potential: Relatively nonvolatile. Moderately water soluble but readily adsorbed by soil organic matter. Where soil organic matter approaches 2 percent, leaching is not expected to be significant.

Symptoms and Mode of Action: Germinating grasses absorb metolachlor through the shoots just above the seed, whereas dicots absorb it through both shoots and roots. The most common injury symptom is crinkled leaves, in grasses accompanied by unfurled leaves. These symptoms take two to three weeks to develop. Metolachlor inhibits both cell division and enlargement; however, the exact mechanism of action is unknown.

Manufacturer: Ciba Plant Protection **EPA Reg. #:** 100-691

---

*Caution: When the product is available in more than one formulation, the formulation designated with the asterisk (*) was used as the primary source of information for this publication. Additional cautions may be included on the labels of other formulations. Users are responsible for checking labels for other uses and restrictions.

Trade Name: Predict **Common Name:** norflurazon **Formulation:** 80 DF

Uses: Preemergence control of grasses and broadleaf weeds in field-grown deciduous trees.

	Amount of Active Ingredient	Amount by Formulation 80 DF
Per Acre	2.4 lb	3 lb
Per 1,000 sq ft		1.1 oz

Major Weeds Controlled: Broadleaves such as carpetweed, fiddleneck, and prickly sida. Annual grasses such as barnyardgrass, crabgrass, goosegrass, foxtails, and others.

Major Weeds Not Controlled: Emerged weeds.

For Best Results: Soil should be settled and firm before application. Norflurazon must be moved into weed seed germination zone. If no rain occurs within four weeks of application, activate herbicide by flood or sprinkle irrigation.

Cautions and Precautions: Not compatible with all dinitroanilines in tank mixes. Use directed spray and avoid foliage contact. Do not apply until fall following first full season of growth after transplanting. Do not use on coarse textured soils. Apply only once each year.

Residual Activity: Norflurazon has a soil half-life of 45 to 180 days. Some plants are very sensitive to norflurazon. Does not leach greatly in soils. Norflurazon is adsorbed by clay and organic matter in soils; amount of leaching is dependent upon organic matter and clay contents.

Volatility and Leaching Potential: Exposure on the soil surface can lead to losses through volatilization and photodegradation.

Symptoms and Mode of Action: Inhibits carotenoid biosynthesis through inhibition of phytoene desaturase. Results in chlorophyll degradation. Injury symptoms often first appear as veinal chlorosis and progress to bleached, white foliage.

Manufacturer: Sandoz Agro Inc. **EPA Reg.** 55947-78

Trade Names: Princep, Simazine, Princep Caliber 90, others **Common Name:** simazine

Formulations: 4 L*, 90 DF

Uses: Preemergence control of many annual broadleaf and grass weeds in field-grown woody nursery stock, shelterbelts, and Christmas trees.

	Amount of Active Ingredient	Amount by Formulation	
		4 L	90 DF
Per Acre	2 to 3 lb	2 to 3 qt	2.2 to 3.4 lb
Per 1,000 sq ft		1.5 to 2.2 oz	0.8 to 1.25 oz

Note: The granular (4 G) formulation is no longer registered.

Major Weeds Controlled: Many annual broadleaf weeds including common chickweed, horseweed, wild mustards, pigweed, lambsquarters, galinsoga, groundsel, ragweed, and others. Annual grasses such as crabgrass, panicum, and foxtail are somewhat tolerant but can be controlled at the higher rates.

Major Weeds Not Controlled: Late-germinating summer annual grasses are often not controlled. Annual bluegrass is labeled but control is variable. Velvetleaf and established perennials are also tolerant. Many species have developed resistance to simazine (a triazine herbicide), including groundsel, lambsquarters, ragweed, and pigweed.

For Best Results: Apply prior to weed germination. Needs 1 to 2 inches of water for optimum activity. May be tank mixed following label directions.

Cautions and Precautions: Use lower rates on coarse-textured soils and soils low in organic matter. In nurseries, do not apply for at least one year after transplanting. To avoid Christmas tree injury, do not use on seedbeds or cutting beds. Do not apply to Christmas trees less than two years of age. Do not use until soil is firmly settled around roots. Do not apply more than once a year except as directed for quackgrass control.

Residual Activity: Three to six months of broadleaf weed control can be expected, depending upon rate, soil type and environmental conditions.

Volatility and Leaching Potential: Essentially nonvolatile; thus moderate leaching potential. Leaching can occur on coarse-textured soils. Movement in surface runoff may also occur when heavy rains follow application.

Symptoms and Mode of Action: Absorbed mostly through the roots. Translocated upward to mature leaves and growing points. Inhibits photosynthesis. Weed seedlings may emerge from the soil, then turn yellow and die. Symptoms of injury on nursery stock include interveinal chlorosis resembling iron chlorosis, marginal chlorosis and necrosis, reduced vigor, and general chlorosis of the new growth.

Manufacturer: Ciba Plant Protection **EPA Reg. #:** 100-603

---

*Caution: When the product is available in more than one formulation, the formulation designated with the asterisk (*) was used as the primary source of information for this publication. Additional cautions may be included on the labels of other formulations. Users are responsible for checking labels for other uses and restrictions.

Trade Name: Prism **Common Name:** clethodim **Formulation:** 0.94 L

Uses: Postemergence control of labeled grass weeds in greenhouses, lathhouses, shadehouses, and around outdoor ornamentals, including nurseries, parks, Christmas or other tree farms, roadside plantings, and landscaped areas around buildings.

	Amount of Active Ingredient	**Amount by Formulation** 0.94 L
Per Acre	0.06 to 0.25 lb	8 to 34 fl oz
Per 1,000 sq ft		0.18 to 0.78 fl oz

Major Weeds Controlled: Many annual and some perennial grasses such as barnyardgrass, crabgrass, crowfoot grass, foxtails, field sandbur, bermudagrass, johnsongrass, and quackgrass.

Major Weeds Not Controlled: Sedges and broadleaf weeds.

For Best Results: Apply to actively growing grasses that are not under environmental stress. Add a nonionic surfactant (containing at least 80 percent active ingredient) at a rate of 1 pint per 50 gallons of spray solution. Consult label for appropriate application timing for perennial grass control.

Cautions and Precautions: Unsatisfactory control may result if grasses are stressed by drought, temperature extremes, excessive water, or low humidity, or if grasses are not at the correct growth stage at the time of application. Do not cultivate treated grasses seven days before or seven days after application or control may be reduced. Do not apply a broadleaf herbicide within one day following Prism application. Do not apply Prism if rainfall is expected within 1 hour of application. Sugar maples cannot be tapped for syrup within one year of application. Do not apply more than 68 fluid ounces (0.5 pound active ingredient) per acre per season.

Residual Activity: No residual activity.

Volatility and Leaching Potential: Little volatility. Clethodim is rapidly degraded through activity of microbes and exposure to sunlight. The chemical is only slightly adsorbed and has the potential to leach, but degradation is very rapid so the actual amount of leaching is probably slight.

Symptoms and Mode of Action: Slow acting herbicide; requires 7 to 14 days for control. Inhibits acetyl coenzyme A carboxylase, an important enzyme for many biosynthetic pathways.

Manufacturer: Valent U.S.A. Corporation **EPA Reg. #** 59639-78

Trade Name: Redeem **Common Name:** triclopyr **Formulation:** 3 L

Uses: Postemergence directed spray for control of herbaceous annual and perennial broadleaf weeds and suppression of woody species in Christmas tree plantations.

	Amount of Active Ingredient	Amount by Formulation 3 L
Per Acre	0.5 to 1.0	21 to 43 fl oz
Per 1,000 sq ft		0.5 to 1 oz

Major Weeds Controlled: Most herbaceous broadleaf weeds plus poison ivy, brambles, and hardwood saplings.

Major Weeds Not Controlled: Grasses and sedges. Will only suppress well established woody plants more than two or three years old.

For Best Results: Apply as a directed spray in late summer or early fall after Christmas trees harden off and before target weeds drop their leaves. Addition of a nonionic surfactant to the spray solution is recommended.

Cautions and Precautions: Apply only in well established plantations that were planted at least one full year prior to application. Contact with actively growing Christmas trees can cause needle and limb injury. Injury is greatest on white pine and Douglas fir, and these trees must be planted three full years before application. Do not apply where runoff may reach irrigation water or agricultural land. Apply only when there is little or no hazard of spray drift. Do not apply with 2,4-D.

Residual Activity: A postemergence, nonresidual herbicide; although two to three weeks of soil residual activity may occur.

Volatility and Leaching Potential: The amine formulation has low volatility. An ester formulation used in non-crop areas has a higher potential for volatility and vapor drift. Because of the short soil life, leaching is unlikely; however, at two to four times the recommended rate, injury to woody trees and shrubs from root uptake has been observed.

Symptoms and Mode of Action: An auxin-type herbicide believed similar to 2,4-D. Susceptible weeds will exhibit typical auxin-type injury symptoms, epinasty and twisted growth leading to necrosis. Injury symptoms on conifers include twisted and chlorotic new growth that later becomes necrotic. Symptoms of injury may reappear in spring growth the year after application.

Manufacturer: DowElanco **EPA Reg #:** 62719-37

Trade Name: Reward **Common Name:** diquat dibromide **Formulation:** 2 L

Uses: Nonselective postemergence weed control for rights-of-way, around ornamental gardens, walkways, patios, beneath greenhouse benches, and along driveways.

	Amount of Active Ingredient	Amount by Formulation 2 L
Per 100 gal	0.5 to 1.0 lb	1 to 2 qt
Per 1 gal	0.166 oz	4 teaspoons

Major Weeds Controlled: Nonselective postemergence control of broadleaves and grasses.

Major Weeds Not Controlled: Weeds that emerge after application.

For Best Results: A 75 percent nonionic surfactant should be added to the spray solution. Apply for full coverage and thorough weed contact. Best control occurs if weeds are young when treated. Retreatment may be necessary for grasses and established weeds.

Cautions and Precautions: Avoid spray contact with desirable vegetation.

Residual Activity: None

Volatility and Leaching Potential: Nonvolatile. Strongly adsorbed by soil; little leaching expected.

Symptoms and Mode of Action: Interacts with light to produce superoxides that destroy plant cells. On a sunny day, treated tissues will appear water-soaked within hours. Necrosis follows within one or two days. Dead tissue usually turns black.

Manufacturer: Zeneca **EPA Reg. #** 10182-353

Trade Name: Ronstar **Common Name:** oxadiazon **Formulations:** 2 G*, 50 WP

Uses: Preemergence control of annual grasses and broadleaf weeds in field and container-grown woody ornamentals, landscapes, and turf. Also used in some loblolly, slash and white pine seedbeds (applied after emergence of the crop).

	Amount of Active Ingredient	**Amount by Formulation**	
		2 G	50 WP
Per Acre	2 to 4 lb	100 to 200 lb	4 to 8 lb
Per 1,000 sq ft		2.25 to 4.5 lb	1.5 to 3.0 oz

Major Weeds Controlled: Goosegrass, crabgrass, other annual grasses, woodsorrel, bittercress, velvetleaf, and many other annual broadleaves.

Major Weeds Not Controlled: Chickweed and pearlwort. Only partial control of galinsoga and spurge should be expected. Emerged weeds are not controlled (although the 50 WP formulation has some postemergence activity).

For Best Results: Apply before rainfall or irrigate for improved control. Do not disturb the soil surface by cultivation after treatment. May be applied to newly transplanted and established ornamentals.

Cautions and Precautions: Do not incorporate. Do not apply to wet foliage or under conditions in which granules will collect on leaves. Do not use on plants that will bear edible fruit within one year. The following plants have been found to be sensitive under some growing conditions: andromeda, azalea, cotoneaster, spring heath, Canadian hemlock, hibiscus, rhododendron, Norway and white spruce, and viburnum. Do not use the 50 WP formulation on cool-season turf; directed applications to nursery stock are suggested to avoid injury. Do not apply in greenhouses.

Residual activity: Effectiveness may be expected to last three to four months; however, residual effects on grass cover crops have been observed five months after treatment.

Volatility and Leaching Potential: Volatility is low to moderate. Very low water solubility and adsorption to organic matter prevent leaching.

Symptoms and Mode of Action: Contact action by affecting the young shoot as it grows through the treated zone. Symptoms of injury generally consist of areas of necrotic tissues where the granules have adhered to the foliage.

Manufacturer: Rhone-Poulenc Ag Company **EPA Reg. #:** 264-445 (2 G) **#:** 264-472 (50 WP)

---

*Caution: When the product is available in more than one formulation, the formulation designated with the asterisk (*) was used as the primary source of information for this publication. Additional cautions may be included on the labels of other formulation. Users are responsible for checking labels for other uses and restrictions.

Trade Name: Roundup, Kleenup, others **Common Name:** glyphosate

Formulations: 4 L*, 94 WSD, others

Use: Nonselective postemergence control of most herbaceous and many woody plants. Used for cleanup before all types of planting and as a postemergence directed or spot spray for general weed control in established woody crops including Christmas trees. Also labeled for weed control under benches and in walkways of greenhouses when no plants are in the house. Do not spray the growing media.

	Amount of Active Ingredient	Amount by Formulation	
		4 L	94 WSD
Per Acre	1 to 5 lb	1 to 5 qt	0.9 to 4.4 lb
Per 1,000 sq ft		1.5 to 3.7 tbsp	0.3 to 1.6 oz
Spot Treatment		0.67 to 2.67 oz/gal spray	

Major Weeds Controlled: Nonselective herbicide. Nearly all plants are controlled or severely injured. Some perennial weeds are controlled at only certain times of year. See page 48 for specific recommendations for perennial weeds.

Major Weeds Not Controlled: Weeds under poor growing conditions such as water stress or disease and insect damage may show erratic or reduced control. Many perennial weeds, particularly woody species, are not well controlled when treated at nonoptimal times. Field horsetail (*Equisetum arvensis*) and legumes are not well controlled.

For Best Results: Apply to actively growing plants. Do not apply if rainfall or overhead irrigation will occur within 6 hours. Treat before mowing or after regrowth to specified size as described on the label. Coverage should be uniform and complete, but do not apply to the point of runoff. Season of application is very important for controlling many species. The addition of a surfactant may be necessary for some formulations or for better control of certain weeds; consult label for details.

Cautions and Precautions: Avoid contact with foliage, green stems, or fruit of desirable plants since severe injury or death may result. Injury to plants receiving small amounts of drift may be expressed one to two years after the occurrence. Do not use more than 25 gallons of spray solution per acre. Keep people and pets off treated areas until dry to prevent transfer to desirable foliage. Limited amounts of drift to leaves will damage many plants.

Residual Activity: Glyphosate is rapidly bound by clay particles resulting in no soil residual activity; however, in soilless media or pure sands, crop injury from root uptake has been observed.

Volatility and Leaching Potential: Nonvolatile. Although glyphosate is very water soluble, it binds rapidly and tightly to soil colloids so that leaching does not occur.

Symptoms and Mode of Action: Absorbed through foliage and green stems and translocated throughout the plant. Growth inhibition occurs within days, but symptoms may take 7 to 10 days to develop. Symptoms include general chlorosis followed by senescence. Woody plants that are not killed may show injury symptoms on the new growth for two or more years. The symptoms may include chlorotic, strap-shaped leaves, shortened internodes, and witches-brooming. Mechanism of action involves inhibition of aromatic amino acid synthesis (a process unique to the plant kingdom).

Manufacturer: Monsanto Company **EPA Reg. #:** 524-445

---

*Caution: When the product is available in more than one formulation, the formulation designated with the asterisk (*) was used as the primary source of information for this publication. Additional cautions may be included on the labels of other formulation. Users are responsible for checking labels for other uses and restrictions.

Control of Herbaceous Perennials, Woody Vines, and Shrubs with Glyphosate (Roundup)

Glyphosate is the most versatile chemical for controlling perennial weeds in ornamentals and Christmas trees. For optimum control, use no more than 25 gallons of final spray solution per acre, apply only to dry plants, and allow at least 6 hours without rain or irrigation after application. A 1 percent solution (1.25 ounces of Roundup 4 L per gallon of water) will give excellent control of the target plant at the least cost. For some species, increasing the percentage to 1.5 or 2.0 percent is advisable. One part glyphosate and two parts water (33 percent) can be used for wick applications. Glyphosate is currently available in many products. The liquid products range from a 0.5 percent ready-to-use formulation to concentrates of up to 53.8 percent active glyphosate. There is also a new dry flowable formulation that contains 94 percent active ingredient. Some of these products need a surfactant, some are ready to use. **Check each label for specific instructions.** A partial list of the products includes Avail, Blot-Out, Blot-Out 2, Kleenup Grass and Weed Killer (RTU), Kleenup Spot Weed and Grass Killer, Systemic Weed and Grass Killer, Rodeo, Accord, Mirage, Rattler, Ranger, Honcho, and Deploy Dry.

By taking advantage of periods of high and low susceptibility of ornamental plants and problem weeds, you can manage many difficult problems with this chemical. In general, conifers and broadleaf evergreen shrubbery are most tolerant to glyphosate in late fall and early winter, whereas small quantities will cause severe damage in the spring. In contrast, deciduous plants are much more tolerant in winter, spring, and early summer. They can easily be damaged by glyphosate contact in the late summer and early fall. As little as a half dozen leaves on a 2-inch branch sprayed with a 1 percent solution can cause death for the entire branch. The chart below has been developed using this information.

Optimum Application Rates and Timing of Glyphosate

Weedy Species	Amount of Roundup 4L to Obtain 90% or Better Control One Season Later	Application Timing for Best Control
Perennial grasses (quackgrass, johnsongrass, fescue, etc.)	1%	At time of first flowering
Bermudagrass	2%	At time of first flowering
Composites (asters, goldenrod, dogfennel, horseweed, etc.)	1%	At time of first flowering
Poison ivy	2%	Two weeks on either side of full bloom (early summer)
Honeysuckle	1 to 1.5%	Full bloom and up to a month after (early summer)
Kudzu	1.5 to 2%	Full bloom and up to a month after (early summer)
Blackberry	1 to 1.5%	Fall and early winter
Trumpetcreeper (cow-itch vine)	1.5%	Late summer to mid-fall before frost
Our data suggest that the following plants can be controlled with Roundup, although the manufacturer does not claim effectiveness on the product label.		
Passion flower (maypop)	1%	Early bloom to first fruit
Virginia creeper	1%	Late summer or first sign of fall color
Clematis vine	1%	After bloom until frost
Sericea lespedeza	1%	Full bloom (midsummer)
Mugwort	1.5 to 2%	Full flower (late summer to early fall)
Wisteria	1.5 to 2% (not on label)	Six to eight weeks after bloom (mid- to late summer)
Greenbrier	3% (not on label)	Five fully expanded leaves (early spring)
English ivy	2 or 3% (not on label)	Three to five fully expanded new leaves (early spring)
Japanese knotweed	2% (not on label)	Late summer to early fall but before frost

In general, the application times given above have been most efficacious. Following these suggestions should give better control of the target species and reduce the total amount of chemical used.

Trade Name: Rout **Common Name:** oxyfluorfen + oryzalin **Formulation:** 3 G (2+1)

Uses: Preemergence control of grass and broadleaf weeds in container- and field-grown woody and a few herbaceous ornamentals.

	Amount of Active Ingredient	**Amount by Formulation**
		3 G
Per Acre	2 + 1 lb	100 lb
Per 1,000 sq ft		2.3 lb

Major Weeds Controlled: Many annual grasses and broadleaf weeds.

Major Weeds Not Controlled: Established annual and perennial weeds.

For Best Results: Do not incorporate physically or disturb soil after application. Approximately 1/2 inch of water applied immediately after application is necessary for activation and to wash particles off the foliage.

Cautions and Precautions: Do not apply to bare roots of ornamentals. Do not apply to wet foliage. Do not apply to plants, such as yucca or *Hosta,* with leaves that channel granules to the leaf base. Do not use in enclosed structures or greenhouses, and do not apply within two weeks of placing plants in enclosed structures. Do not apply two weeks before or after leaf bud break. Do not apply within two months of use of other herbicides. Do not apply more than twice a season. No more than 100 pounds per acre per year should be applied to field-grown ornamentals and Christmas trees. Do not use on the following species: *Euonymus japonica* 'Silver King', *Euryops pectinatus, Ficus pumila, Ilex crenata* 'Helleri', *Trachelospermum asiaticum* 'Oblanceolatum'.

Residual Activity: Eight to twelve weeks of weed control can be expected depending upon the growing medium and irrigation practices.

Volatility and Leaching Potential: Low volatility and low leaching potential. However, do not apply in enclosed structures as volatilization is possible. In container nurseries, surface runoff may result when broadcast applications are employed since many granules fall between pots. Otherwise, the potential for leaching and surface runoff is very low.

Symptoms and Mode of Action: Oxyfluorfen acts as a contact herbicide disrupting cell membranes via a mechanism that requires light for activation. Oryzalin inhibits root development by affecting cell division. See the descriptions for Goal and Surflan for more details. Injury symptoms on ornamentals include contact-type burn where granules are trapped on the foliage and girdling at the soil line on some azalea cultivars.

Manufacturer: Grace-Sierra Company **EPA Reg. #:** 58185-27

Trade Name: SharpShooter **Common Name:** Potassium salts of fatty acids

Formulation: 18%

Use: Nonselective postemergence contact herbicide for control of most young, succulent, actively growing weeds. May be used in and around walks, driveways, flower beds, trees, and shrubs. Also labeled for use in greenhouses.

Amount of Active Ingredient	Amount by Formulation 18%
Spot Treatment	5.5 to 11 oz/qt of water

Major Weeds Controlled: Small seedling weeds.

Major Weeds Not Controlled: Older annual and perennial weeds will only be suppressed with top kill.

For Best Results: Ensure thorough wetting and complete coverage of all unwanted vegetation but avoid runoff. Apply in warm, dry weather for most rapid results.

Cautions and Precautions: Avoid contact with desirable vegetation. Do not apply using hose-end sprayers. Keep people and pets off treated areas until dry. The odor can be offensive. Avoid skin and eye contact as irritation is likely.

Residual Activity: No soil residual activity has been reported.

Volatility and Leaching Potential: Volatility and leaching are negligible.

Symptoms and Mode of Action: Disrupts cell membranes causing rapid cell desiccation. On a sunny, warm day initial symptoms of water-soaked foliage may be observed within minutes.

Manufacturer: Mycogen Corporation **EPA Reg. #:** 42697-35

Trade Name: Snapshot DF **Common Name:** isoxaben + oryzalin

Formulation: 80 DF (20% + 60%)

Use: Preemergence control of most annual broadleaf weeds and annual grasses in container-, landscape- and field-grown ornamentals, nursery stock, Christmas tree plantations, nonbearing fruit trees, and groundcovers.

	Amount of Active Ingredient	**Amount by Formulation** 80 DF
Per Acre	2 to 4 lb 0.5 to 1 lb isoxaben + 1.5 to 3 lb oryzalin	2.5 to 5 lb
Per 1,000 sq ft		0.92 to 1.84 oz

Major Weeds Controlled: Many annual broadleaf and grass weeds.

Major Weeds Not Controlled: Perennials and established weeds.

For Best Results: Apply before emergence of target weeds or immediately after cultivation. One-half inch or more of water is required for activation within 21 days. May be activated by incorporation in top 1 to 2 inches of soil.

Cautions and Precautions: Do not apply to new transplants until soil has settled and there are no cracks. Do not apply to nursery seedbeds or transplant beds or to unrooted liners or cuttings. Do not apply to bedding plants or to areas where bedding plants will be planted within one year. Do not apply to pots less than 4 inches wide. Repeat applications should not be made less than 90 days after previous application. Apply no more than 15 pounds per acre in a 12 month period. Use is prohibited on several species; check label for details.

Residual Activity: Duration of weed control varies with application rate and management practices.

Volatilization and Leaching Potential: Volatilization losses are small. Isoxaben leaches very little; oryzalin can leach to a limited extent.

Symptoms and Mode of Action: Isoxaben appears to disrupt root and hypocotyl development, but this effect has not been documented. Oryzalin affects root growth by inhibiting cell division.

Manufacturer: DowElanco **EPA Reg. #** 62719-174

Trade Name: Snapshot TG **Common Name:** isoxaben + trifluralin

Formulation: 2.5 TG (0.5 + 2.0%)

Use: Preemergence control of most annual broadleaf weeds and annual grasses in container-, landscape- and field-grown ornamentals, nursery stock, Christmas tree plantations, nonbearing fruit trees, and groundcovers.

	Amount of Active Ingredient	**Amount by Formulation** 2.5 TG
Per Acre	2.5 to 5 lb 0.5 to 1 lb isoxaben + 2 to 4 lb trifluralin	100 to 200 lb
Per 1,000 sq ft		2.3 to 4.6 lb

Major Weeds Controlled: Many annual broadleaf and grass weeds.

Major Weeds Not Controlled: Perennials and established weeds.

For Best Results: Apply in late summer to early fall or in early spring before the emergence of target weeds or immediately after cultivation. One-half inch or more of water is required within three days for activation. If irrigation is not possible, the herbicide may be activated by incorporation in top 1 to 2 inches of soil.

Cautions and Precautions: Do not apply to new transplants until soil has settled and there are no cracks. Do not apply to nursery seedbeds or transplant beds or to unrooted liners or cuttings. Do not apply to bedding plants or to areas where bedding plants will be planted within one year. Do not apply to pots less than 4 inches wide. Repeat applications of 150 pounds per acre or more should not be made less than 60 days after previous application. Apply no more than 600 pounds per acre in a 12 month period. Use is prohibited on several species, check label for details.

Residual Activity: Duration of weed control varies with application rate and management practices.

Volatility and Leaching Potential: Isoxaben is nonvolatile. Trifluralin is somewhat volatile; therefore, the herbicide should be incorporated soon after application. Isoxaben leaches very little, and trifluralin is strongly adsorbed to soil so that little leaching occurs.

Symptoms and Mode of Action: Isoxaben appears to disrupt root and hypocotyl development, but this effect has not been documented. Trifluralin affects root growth by inhibiting cell division.

Manufacturer: DowElanco **EPA Reg. #** 62719-175

Trade Name: Stinger **Common Name:** clopyralid **Formulation:** 3 L

Uses: Postemergence control of legumes, composites, and other broadleaf weeds in conifers.

	Amount of Active Ingredient	Amount by Formulation 3 L
Per Acre	0.09 to 0.25 lb	4 to 11 oz
Per 1,000 sq ft		0.09 to 0.25 oz

Major Weeds Controlled: Many broadleaves especially composites, polygonums, and legumes. Also controls Canadian thistle, Russian thistle, smartweed, cocklebur, and sow thistle.

Major Weeds Not Controlled: Emerged weeds and lambsquarters, pigweeds, grasses, and sedges.

For Best Results: Apply to actively growing weeds prior to flower stalk development. Annuals should be less than 4 inches high and perennials should be in the rosette stage. Best application time is mid- to late spring. Application to wet foliage may decrease control. Allow 6 to 8 hours drying time after application.

Cautions and Precautions: Do not contaminate irrigation water or water used for domestic purposes. Tree injury may occur with the addition of a surfactant or crop oil. Do not exceed 1/2 pint per acre on blue spruce and do not exceed 2/3 pint per acre on other species. Avoid drift. Do not make aerial applications.

Residual Activity: Clopyralid has a half-life of a few weeks to a few months across a range of soil types. Significant residues are not expected after one year, but some plants are very sensitive to the herbicide.

Volatility and Leaching Potential: Not strongly adsorbed to soil so it has a high leaching potential, but field studies indicate that leaching is probably minimal. Label recommends that this product not be used on very permeable soils (such as sands and loamy sands) with shallow water tables or in areas with sinkholes over limestone bedrock or in areas with severely fractured surfaces.

Symptoms and Mode of Action: Symptoms are similar to those resulting from phenoxy herbicides. Mode of action has not been determined.

Manufacturer: DowElanco **EPA Reg.** 62719-73

Trade Name: Surflan **Common Name:** oryzalin **Formulation:** 4 AS

Uses: Preemergence, surface-applied herbicide for control of annual grasses and many broadleaf weeds in established and newly planted field-grown ornamentals, groundcovers, bulbs, and some flowers as well as some container-grown ornamentals.

	Amount of Active Ingredient	**Amount by Formulation** 4 AS
Per Acre	2 to 4 lb	2 to 4 qt
Per 1,000 sq ft		1.5 to 3 oz

Major Weeds Controlled: Annual grasses such as crabgrass, barnyardgrass, ryegrass, and johnsongrass (from seed). Broadleaf weeds controlled include pigweed, bittercress, common chickweed, spurge, and yellow woodsorrel. At the higher rate partial control of velvetleaf, groundsel, and smartweed is obtained.

Major Weeds Not Controlled: Poor or erratic control of ragweed, asters, groundsel, jimsonweed, galinsoga, nightshade, morningglory, prickly sida, velvetleaf, mouseear chickweed, dodder, and Venice mallow have been reported.

For Best Results: Apply 1/2 inch of water to activate. May be shallowly cultivated (1 to 2 inches). May be tank mixed with other herbicides for improved broadleaf control following label directions.

Cautions and Precautions: Do not use in conifer seedbeds or transplant beds. Rooted cuttings should be established two weeks or more before application. Do not apply to groundcovers until they are well rooted. Overapplication may result in crop injury. Residues from spring applications may inhibit the establishment and growth of fall-seeded grasses (such as oats or rye) used as a winter cover crop. Do not repeat applications for at least 90 days. Use on several species is prohibited; see label for details.

Residual Activity: Four to six months of weed control depending on rate, irrigation practices, weed spectrum, and soil type.

Volatility and Leaching Potential: Little volatility or photodegradation. Stable on the soil surface for several weeks without incorporation. On coarse soils low in organic matter a limited amount of leaching can occur.

Symptoms and Mode of Action: Inhibits root development by affecting cell division. Typical injury symptoms include swollen, stubby roots. These symptoms are most commonly seen on grasses. No significant absorption or translocation occurs. May cause girdling and stem swelling when used on young fir or spruce seedlings.

Manufacturer: DowElanco **EPA Reg. #:** 62719-113

Trade Name: Trifluralin, Treflan, Preen **Common Name:** trifluralin

Formulations: 5 G, 4 EC*, 1.47 G

Use: Preemergence control of annual grasses and broadleaf weeds in field- or container-grown nursery stock, landscape ornamentals, groundcovers, roses, and many annual and perennial flowers.

	Amount of Active Ingredient	Amount by Formulation		
		1.47 G	5 G	4 EC
Per Acre	0.5 to 1 lb (soil incorporation only)	34 to 68 lb	10 to 20 lb	1 to 2 pt
Per 1,000 sq ft		0.8 to 1.6 lb	3.7 to 7.3 oz	0.36 to 0.73 fl oz
Per Acre	4 lb (ornamental groundcovers)		80 lb	1 gal
Per 1,000 sq ft			1.8 lb	2.9 fl oz

Major Weeds Controlled: Annual grasses such as crabgrass, barnyardgrass, downy brome, foxtail, and johnsongrass (from seed). Annual broadleaves controlled include pigweed, lambsquarters, and common chickweed.

Major Weeds Not Controlled: The following are generally not controlled: cocklebur, velvetleaf, jimsonweed, ragweed, groundsel, Venice mallow, and nutsedge. Erratic or partial control of purslane and galinsoga has been observed.

For Best Results: Apply prior to germination of weed seeds or to clean, cultivated, weed-free areas. Must be incorporated within a few hours after application. Use lower rates if physically incorporated and higher rates if applied to the surface and watered in. May be combined with other herbicides for an expanded spectrum of weed control.

Cautions and Precautions: Do not apply granules to wet foliage. Not recommended for muck soils.

Residual Activity: Two to three months of residual control can be expected.

Volatility and Leaching Potential: Moderately volatile and subject to photodegradation. Insoluble; leaching is negligible.

Symptoms and Mode of Action: Inhibits root development by affecting cell division. Typical injury symptoms include swollen, stubby roots. These symptoms are most commonly seen on grasses. No significant absorption or translocation occurs.

Manufacturers: DowElanco **Formulators:** Gowan Co., Lebanon Chemical Corp., many others

EPA Reg. #: 10163-181

---

*Caution: When the product is available in more than one formulation, the formulation designated with the asterisk (*) was used as the primary source of information for this publication. Additional cautions may be included on the labels of other formulation. Users are responsible for checking labels for other uses and restrictions.

Trade Name: Vantage **Common Name:** sethoxydim **Formulation:** 1EC

Uses: Postemergence over-the-top or directed herbicide for the control of grasses in nonbearing food crops, trees, ornamentals, groundcovers, bedding plants, and Christmas trees, including seed and transplant beds.

	Amount of Active Ingredient	**Amount by Formulation** 1 EC
Per Acre	0.3 to 0.5 lb	36 to 60 fl oz
Per 1,000 sq ft		0.8 to 1.4 fl oz
Spot Treatment		2 to 3 oz/gal

Major Weeds Controlled: Emerged annual and perennial grasses.

Major Weeds Not Controlled: Annual or perennial sedges, annual bluegrass, and broadleaf weeds. The following species are also tolerant: red, chewings, and hard fescues; sweet vernal grass; and dicondra turfs.

For Best Results: Apply to small, actively growing grasses that have not been mowed. May be tank mixed following label directions. Thorough coverage is essential. For optimum control of perennial grasses, apply in the spring when grasses are 4 to 8 inches tall.

Cautions and Precautions: Do not cultivate between 5 days before and 7 days after application. Do not mow between 20 days before and 7 days after treatment. Do not apply when rain or irrigation will occur within 1 hour. Injury has been reported on some ornamentals including 'Snow' azalea, potentilla varieties 'Jackmanni' and 'K. Vandyke', privet, and oak. These instances have usually been associated with higher than labeled rates applied to young tissue.

Residual Activity: Primarily a foliar-applied, postemergence herbicide. No soil residual activity should be expected. However, do not seed grass crops for two weeks after application.

Volatility and Leaching Potential: Loss from volatility is minimal. Sethoxydim has little potential for leaching as sethoxydim is rapidly decomposed in soil.

Symptoms and Mode of Action: Growth inhibition occurs within 48 hours. Meristems turn black shortly thereafter. Yellow to red foliage develops in about 7 to 10 days, and plants die within about 14 days. Inhibits cell division by blocking acetyl Co A carboxylase, an enzyme involved in lipid biosynthesis.

Manufacturer: BASF Corporation **EPA Reg. #:** 7969-88

Trade Name: Vapam, Sectagon, Busan **Common Name:** metham

Formulation: 3.18 L*, 3.4 L, or 4.2 L

Use: Soil fumigant or potting media fumigant for preplant control of weeds and germinating weed seeds, nematodes, symphylids and soil borne diseases in most planting areas, especially seed and transplant beds before establishment.

	Amount of Active Ingredient	Amount by Formulation
		3.18 L
Per Acre	239 to 318 lb	75 to 100 gal
Per 1,000 sq ft		1.7 to 2.3 gal

Major Weeds Controlled: Many annual and perennial broadleaf and grass weeds.

Major Weeds Not Controlled: Clovers, morninglories, and sedges from seed.

For Best Results: Cultivate soil thoroughly to loosen and break up clods. Irrigate one week before application. Soil temperature must be between 40° and 90°F at the 3-inch depth. Use solution promptly after mixing; do not allow it to stand. Activity is increased by the use of a tarp. Cultivate 2 inches deep seven days after treatment to aerate the soil. See label for treatment of potting media.

Cautions and Precautions: Do not apply within 3 feet of the dripline of desirable plants. Keep children and pets out of treated area until dry. RESTRICTED USE PESTICIDE.

Residual Activity: Metham has no residual activity once all residues are removed from soil. Do not seed earlier than 21 days after application if tarp is used. Plant into soil 14 to 20 days after treatment or longer if soil is cold and wet. For applications greater than 100 gallons per acre, wait 60 days before planting.

Volatilization and Leaching Potential: Metham is not volatile, but the main breakdown product is rapidly lost through volatilization. Metham is water soluble and can be leached, however, its rapid conversion to breakdown products that generally disappear completely in two to four weeks probably decreases the amount of leaching that actually occurs.

Symptoms and Mode of Action: Absorbed by roots and below-ground growth. Decomposes in the soil to produce methylisothiocyanate, which moves as a vapor and disrupts biological functions of absorbing organisms.

Manufacturer: Zeneca **EPA Reg. #** 10182-150

---

*Caution: When the product is available in more than one formulation, the formulation designated with the asterisk (*) was used as the primary source of information for this publication. Additional cautions may be included on the labels of other formulation. Users are responsible for checking labels for other uses and restrictions.

Trade Name: XL **Common Name:** benefin + oryzalin **Formulation:** 2 G (1 + 1)

Uses: Preemergence control of many annual grasses and some broadleaf weeds in newly planted or established container or field nursery stock and landscape plantings, including some flower bulbs and groundcovers. Product used in warm-season turf. Product will injure cool-season turf.

	Amount of Active Ingredient	**Amount by Formulation** 2 G
Per Acre	4 to 6 lb 2 to 3 lb of benefin + 2 to 3 lb of oryzalin	200 to 300 lb
Per 1,000 sq ft		4.5 to 7 lb

Major Weeds Controlled: Annual grasses such as crabgrass, foxtail, and barnyardgrass and a few broadleaf weeds such as common chickweed and carpetweed.

Major Weeds Not Controlled: Established weeds. Provides partial control of wild carrot, fleabane, common groundsel, yellow woodsorrel, Indian mustard, ragweed, nightshade, and galinsoga. Do not expect the same level or longevity of weed control as from the labeled rate of Surflan.

For Best Results: Apply prior to weed germination. Irrigation, rain, or shallow cultivation (1 to 2 inches) is needed for activation. Cultivation or otherwise disturbing the soil surface after the initial incorporation may reduce control.

Cautions and Precautions: Do not use in seedbeds or transplant beds. Do not apply to emerged tulips in the spring. Do not use on cool-season turfgrasses. May thin some established warm-season grasses at higher rates. Do not apply to turfgrass planted the previous fall.

Residual Activity: About six to eight weeks of residual grass control may be expected. Residual control of broadleaves may be shorter.

Volatility and Leaching Potential: Some volatility and photodecomposition may occur. Irrigation immediately after application will minimize these effects. A limited amount of leaching can occur on coarse soils with low organic matter content.

Symptoms and Mode of Action: Both benefin and oryzalin (Surflan) inhibit cell division by disrupting tubulin formation. Classic symptoms of injury in grasses are stubby (short, thickened) roots. Diverse symptoms occur in susceptible dicots, from puckered and mottled foliage in herbaceous species to stem girdling and swelling at the ground line in fir and spruce seedlings.

Manufacturer: DowElanco **EPA Reg. #:** 62719-136

Weed Susceptibility Charts

Weed and crop tolerance change with the time, rate, and method of application. This section provides information concerning the response of weeds to herbicides labeled for ornamental uses. Weed control ratings are based on good conditions for herbicide activity. See the label information in this publication and the herbicide label for conditions of optimum activity. The following table lists common and scientific names of the weeds included in the weed susceptibility charts found on the next few pages. If you need assistance with weed identification, see **Suggested Readings** 1, 5, and 7 at the end of this manual.

Common and Scientific Weed Names

ANNUALS — GRASSLIKE

Barnyardgrass	*Echinochloa crusgalli*
Bluegrass, annual	*Poa annua*
Brome, downy	*Bromus tectorum*
Crabgrass, large	*Digitaria sanguinalis*
Crabgrass, smooth	*Digitaria ischaemum*
Fescue, tall (seedling)	*Festuca arundinacea*
Foxtail	*Setaria spp.*
Goosegrass	*Eleusine indica*
Horsetail	*Equisetum spp.*
Johnsongrass (seedling)	*Sorghum halepense*
Panicum, fall	*Panicum dichotomiflorum*
Ryegrass, annual	*Lolium multiflorum*
Sandbur	*Cenchrus longispinus*
Signalgrass, broadleaf	*Brachiaria platyphylla*

ANNUALS — BROADLEAF

Bittercress, hairy	*Cardamine hirsuta*
Carpetweed	*Mollugo verticillata*
Chickweed, common	*Stellaria media*
Cocklebur, common	*Xanthium strumarium*
Dayflower	*Commelina spp.*
Dogfennel	*Eupatorium capillifolium*
Dodder	*Cuscuta spp.*
Eclipta	*Eclipta prostrata*
Filaree, redstem	*Erodium cicutarium*
Fleabane	*Erigeron spp.*
Galinsoga, hairy	*Galinsoga ciliata*
Geranium, Carolina	*Geranium carolinianum*
Groundsel, common	*Senecio vulgaris*
Henbit	*Lamium amplexicaule*

ANNUALS — BROADLEAF, CONT'D

Horseweed	*Conyza canadensis*
Jimsonweed	*Datura stramonium*
Joepyeweed	*Eupatorium maculatum*
Knotweed, prostrate	*Polygonum aviculare*
Lambsquarters, common	*Chenopodium album*
Lespedeza, annual	*Lespedeza striata*
Lettuce, prickly	*Lactuca serriola*
Mallow	*Malva spp.*
Morningglory, tall	*Ipomea purpurea*
Mustard, wild	*Brassica kaber*
Nightshade, black	*Solanum nigrum*
Pearlwort	*Sagina spp.*
Pepperweed, Virginia	*Lepidium virginicum*
Pigweed	*Amaranthus spp.*
Pineappleweed	*Matricaria matricarioides*
Poorjoe	*Diodia teres*
Purslane, common	*Portulaca oleracea*
Pusley, Florida	*Richardia scabra*
Ragweed, common	*Ambrosia artemisiifolia*
Shepherdspurse	*Capsella bursa-pastoris*
Sida, prickly	*Sida spinosa*
Smartweed, Pennsylvania	*Polygonum pensylvanicum*
Sowthistle, annual	*Sonchus oleraceus*
Speedwell	*Veronica spp.*
Spurge, prostrate	*Euphorbia supina*
Spurge, spotted	*Euphorbia maculata*
Spurry, corn	*Spergula arvensis*
Velvetleaf	*Abutilon theophrasti*
Vetch	*Vicia spp.*
Woodsorrel, yellow	*Oxalis stricta*

PERENNIALS — GRASSLIKE

Bermudagrass	*Cynodon dactylon*
Fescue, tall	*Festuca arundinacea*
Johnsongrass	*Sorghum halepnese*
Nutsedge, purple	*Cyperus rotundus*
Nutsedge, yellow	*Cyperus esculentus*
Orchardgrass	*Dactylis glomerata*
Quackgrass	*Elytrigia repens*

PERENNIALS — BROADLEAF

Aster, white heath	*Aster pilosus*
Carrot, wild	*Daucus carota*
Chickweed, mouseear	*Cerastium vulgatum*
Clover, white	*Trifolium repens*
Cudweed	*Gnaphalium obtusifolium*
Daisy, oxeye	*Chrysanthemum leucanthemum*
Dandelion, common	*Taraxacum officinale*
Dichondra	*Dichondra repens*
Dock, broadleaf	*Rumex obtusifolia*
Dock, curly	*Rumex crispus*
Evening primrose, common	*Oenothera biennis*
Geranium, Carolina	*Geranium carolinianum*
Ground ivy	*Glecoma hederacea*
Horsenettle	*Solanum carolinense*
Mock strawberry	*Duchesnea indica*
Mugwort	*Artemisia vulgaris*
Plantain	*Plantago spp.*
Pokeweed, common	*Phytolacca americana*
Sorrel, red	*Rumex acetosella*
Thistle, Canada	*Cirsium arvense*
Woodsorrell, creeping	*Oxalis corniculata*
Woodsorrell, yellow (mature)	*Oxalis stricta*

PERENNIALS — WOODY

Blackberry	*Rubus spp.*
Greenbrier or catbrier	*Smilax spp.*
Honeysuckle, Japanese	*Lonicera japonica*
Locust	*Robinia spp.*
Multiflora rose	*Rosa multiflora*
Poison ivy	*Rhus radicans*
Poison oak	*Rhus toxicodendron*
Trumpetcreeper	*Campsis radicans*
Virginia creeper	*Parthenocissus quinquefolia*
Virgin's bower or clematis	*Clematis virginiana*

OTHER

Liverwort	Hepatacyte class
Moss	Musci class

Table 1. Weed Susceptibilities to Preemergence Herbicides

Based on label:
G = good control (80-100%)
F = fair control (50-80%)
P = poor control (0-50%)
Based on other research:
g = good control (80-100%)
f = fair control (50-80%)
p = poor control (0-50%)

Broadleaves	Barricade	Betasan*	Casoron*	Dacthal*	Derby	Devrinol	Eptam	Gallery	Goal	Image	Kerb	Lasso	OH2	Pendulum*	Pennant	Predict	Princep*	Ronstar G	Rout	Snapshot DF	Snapshot TG	Surflan	Trifluralin*	XL
Bittercress, hairy			g	p	f	g		G	g	G			G	g	P		f	G	g	G	G	g	p	
Carpetweed	G	p	G	G	G	G		F	G			G	g	G	G	G	G	G	g	G	F	G	G	G
Carrot, wild			G			P		G									P			G	G	P		
Chickweed, common	G		G	G	G	G	G	G	f	G	G		G	G	f	G	G	P	G	G	G	G	G	G
Chickweed, mouseear			G		G	P		G		G	G			G			P			G	G	P		
Clover, white			g			P		G	G	G				p			f		G	G	G	P		
Cocklebur, common		p	P	P		P			G		P	P		P	P	F	f						P	
Cudweed			G					G		F			G	G		G	g			G	G	P		
Dandelion (seedling)			G	f	f	P		G		F			G	p	P		f		G	G	G	g		f
Dodder				F		P														p	q	P		
Dogfennel	p		G					G					g	p		G	g	f	g	G	G	P		
Evening primrose	p		G		G	g		f	g	G			g	f	f	f	g	G	G	G	G	g		
Eclipta	p				g			g						p		g		p	g	g	g	G		
Filaree, redstem			g			G		G	G					G		G	G		g	G	G	g		G
Fleabane			g					G					G			F	g			G	G	g		
Galinsoga, hairy		p	P	P	G	g	P	G	g		f	G		P	G	f	g	G		G	G	f	P	
Geranium, Carolina			g			g		G		G						G	f			G	G	g		
Groundsel, common	f		G		F	G		G	G	g			G	P	F	F	G	G	G	G	G	f	f	G
Henbit	G	G	G		G	g	G	G	G	G				G		F	G			G	G	G		G
Horseweed (marestail)			G		f	f		G	f				G	p	f	F	g	f	G	G	G	q		F
Jimsonweed		p	P	P		P		G	G		P	P	P	P	P	f	g		P	G	G	P	P	
Knotweed, prostrate	G		G	f	g	G		G	G	f				G	g		f	g	g	G	G	G	G	G
Lambsquarters	G	F	G	G		G	G	G	G			F		G	f	F	G	G	G	G	G	G	G	G
Lettuce, prickly			g		G	G		G	G				g				p			G	G	F		F
Liverwort			P			P											P	G						

* See text for other trade names of these herbicides.

Table 1. Weed Susceptibilities to Preemergence Herbicides, continued

Based on label:
G = good control (80-100%)
F = fair control (50-80%)
P = poor control (0-50%)
Based on other research:
g = good control (80-100%)
f = fair control (50-80%)
p = poor control (0-50%)

Broadleaves	Barricade	Betasan*	Casoron*	Dacthal*	Derby	Devrinol	Eptam	Gallery	Goal	Image	Kerb	Lasso	OH2	Pendulum*	Pennant	Predict	Princep*	Ronstar G	Rout	Snapshot DF	Snapshot TG	Surflan	Trifluralin*	XL
Mallow			P			F		F	G								P			F	F	F	P	F
Morningglory, annual		P	g	P	f	P		f	G			F		f	f	F	G	f		G	F	F	f	F
Moss						P								p	f		P	g	G			p		
Mugwort	p					P	G										p					p		
Mustard, wild			G	p		f		G	G		G	P			p		G	g	g	G	G	F		F
Nightshade, black		P	g	P	G	P	G	G	G			G		p	G		G			G	G	F	f	F
Pearlwort			P			P							G	g	g		P		G					
Pepperweed			g		g	g		G	G		g		G	g			G	f		G	G	g		g
Pigweed spp.	G	G	G	F	G	G	G	G	G			G	G	G	G	G	G	G	G	G	G	G	G	G
Pineappleweed			G			G		G						p	f	G	G	g		G	G	g		
Plantain			G			P		G							g	F	P			G	G	g		
Pokeweed, common	g				f			p	g					g	p	f	f	p	g			g		
Purslane, common	G	f	G	G	F	G	G	G	G			G	g	G	F	G	G	G	G	G	G	G	G	G
Pusley, Florida			G	G	G	P	G	F				G		G	G	F	G			F	F	G		G
Ragweed, common	f	P	G	p	G	F		G	f		g	F		p	f	F	G	g		G	G	F	P	F
Shepherdspurse	G	G	G	f	G	g		G	G		G		G	G		G	G	G	G	G	G	G		G
Sida, prickly	p				g	P		G	G			F		g	P	G	g	g		G	G	F		F
Smartweed		P	G	P		g		G	G			F		G	f	F	G	G		G	G	F	f	F
Sorrel, red						P		G	f	G	G						P			G	G			
Sowthistle, annual	p		g	f	f	G		G	G				G	g		F	f	G	G	G	G	F		F
Speedwell spp.			g	G		P		G	G					g			G	G		G	G			
Spurge, prostrate	G		G	F	f	P		G	G				G	G	f	G	f	F	G	G	G	G		G
Spurge, spotted			G	F	G	P		G	G				G	G		F	f		G	G	G	F		F
Spurry, corn			P			P	G		G								P							
Thistle, Canada			G			P											P							

* See text for other trade names of these herbicides.

Table 1. Weed Susceptibilities to Preemergence Herbicides, continued

Based on label:
G = good control (80-100%)
F = fair control (50-80%)
P = poor control (0-50%)
Based on other research:
g = good control (80-100%)
f = fair control (50-80%)
p = poor control (0-50%)

Broadleaves	Barricade	Betasan*	Casoron*	Dacthal*	Derby	Devrinol	Eptam	Gallery	Goal	Image	Kerb	Lasso	OH2	Pendulum*	Pennant	Predict	Princep*	Ronstar G	Rout	Snapshot DF	Snapshot TG	Surflan	Trifluralin*	XL
Velvetleaf		P	P	P		P		G	G		f	P		G	g	G	f	g		G	G	F	P	p
Yellow Woodsorrel (Oxalis)	G		G		f	P		G	G	g			G	G	p	p	P	G	G	G	G	G		f
Grasses (or grasslike)																								
Barnyardgrass	G	G		w	G	G	G	p	G			G	G	G	G	G	G	G	G	G	G	G	G	G
Bermudagrass	p	P		P	P	P	G	p	P		p	P	P	P	p	F	P	P	P	p	q	P	P	
Bluegrass, annual	G	G	G	F	G	G	G	p	G	F	G		G	G	G	G	G	G	G	G	G	G	G	G
Brome, downy						G		p			G					G	G				G	g	G	
Crabgrass, large	G	G	G	G	G	G	G	p	G			G	G	G	G	G	G	G	G	G	G	G	G	G
Crabgrass, smooth	G	G	G	G	G	G	G	p	f			G		G	G	G	G	G		G	G	G	G	G
Fescue, tall	p	P	G	P	p	P		p		F	g			P		G	F	P		p	p	P	P	
Foxtail (yellow, green)	G		G	G	G	G	G	p				G	g	G	G	G	G	G	G	G	F	G	G	G
Foxtail, giant	G		G		G	G	G	p	G			G	g	G	G	G	G		g	G	G	G	G	G
Goosegrass	G	G		F	G	G	G	p	G			G	g	G	G	G	G	G	G	G	G	G	G	G
Horsetail (Equisetum)		P	G	P	P			p	f					P	P		P	P				P	P	
Johnsongrass (rhizome)				P				p			p					F	P					p		
Johnsongrass (seedling)	G			F	F	F	F	p	f			F	g	G	F	G	P	f	g	F	F	G	G	G
Nutsedge, yellow	p	p	G	P	G	f	G	p	P	f	p	G	P	P	G	F	P	P	P	p		P	P	
Orchardgrass			G					p			G				p	F	F					g		
Panicum, fall				f	G	G	g	p				G		G	G	G	G	G	G	G	G	G		G
Quackgrass		P	G	P			G	p			f			P		F		P				P		
Ryegrass, annual			G		g	g		p	g		g		g		g	G	F	g	g	G	G	g		
Sandbur				F	F	G	G	p				F			F	G	P		g	G	G	G	G	G
Signalgrass, broadleaf	G				G			p				f		G	G	G	G			G		G	G	G

* See text for other trade names of these herbicides.

Table 2. Weed Susceptibilities to Postemergence Herbicides

Based on the label:	Based on other research:
G = Good control (80-100%)	g = good control (80-100%)
F = Fair control (50-80%)	f = fair control (50-80%)
P = Poor control (0-50%)	p = poor control (0-50%)

Broadleaves	Acclaim	Basagran	Casoron*	Demoss	Finale	Fusilade*	Goal	Gramoxone	Kerb	Image	Prism	Redeem*	Reward	Roundup*	Sharpshooter	Stinger	Ornamec*	Vantage
Bittercress, hairy	P					P		g		G	P		g		G		P	P
Blackberry	P					P		f			P	G	f	G	F		P	P
Carpetweed	P					P	G	g			P		g		G		P	P
Carrot, Wild	P		G			P		g			P		g		G		P	P
Chickweed, common	P	f			G	P	f	g	G	G	P		g	G	G		P	P
Chickweed, mousear	P				G	P		g	G	G	P		g	G	G		P	P
Clematis	P					P		f			P		f		F		P	P
Clover, white	P				G	P	G	f		G	P	G	f	G	F		P	P
Cocklebur, common	P	G			G	P	G	g			P		g	G	G	G	P	P
Cudweed	P		G			P		g		F	P		g		G		P	P
Dandelion (seedling)	P				G	P	f	g		F	P	G	g		F	G	P	P
Dayflower	P	G			f	P					P			f	f		P	P
Dodder	P					P		g			P		g		G		P	P
Dogfennel	P					P		f			P		f	G	F	G	P	P
Eclipta		f				P					P				F		P	P
Evening primrose	P	p			g	P	f	g		G	P		g	G	G		P	P
Filaree, redstem	P				G	P	G	g			P		g	G	G		P	P
Fleabane	P				G	P		g			P		g	G	G		P	P
Galinsoga, hairy	P	G				P	f	g			P		g	g	G		P	P
Geranium, Carolina	P					P		g		G	P		g	G	G		P	P
Groundsel, common	P					P	G	g			P		g	G	G	G	P	P
Henbit	P	p			g	P	G	g		G	P		g	g	G		P	P
Honeysuckle	P					P		f			P		f	G	F		P	P
Horseweed (marestail)	P				G	P		f			P		f	G	F	G	P	P
Jimsonweed	P	G			G	P	G	g			P		g		G	G	P	P
Knotweed, prostrate	P					P	G	g			P		g		G		P	P
Lambsquarters	P	F			G	P	G	f			P	G	f	G	P		P	P
Lespedeza	P					P		f			P	G	f	f	F		P	P
Lettuce, prickly	P				G	P	G	g			P	G	g	G	G	G	P	P
Liverwort	P			G		P	P	g			P		g		G		P	P
Locust	P					P		f			P	G	f	G	F		P	P
Mallow	P	G			G	P	G	g			P		g	G	G		P	P
Morningglory, annual	P	F				P	G	g			P		g	G	G		P	P
Moss	P			G		P		f			P		f		F		P	P
Mugwort	P		G			P		f			P	f	g	f	G	f	P	P
Mustard, wild	P	G			G	P	G	g			P		g	G	G		P	P
Nightshade, black	P	f			G	P	G	g			P		g		G	G	P	P
Pearlwort	P					P		g			P		g		G		P	P
Pepperweed	P					P	G	g			P		g		G		P	P
Pigweed spp.	P	P			G	P	G	g			P		g	G	G		P	P
Pineappleweed	P					P		f			P		f		F	G	P	P

* See text for other trade names of these herbicides.

Table 2. Weed Susceptibilities to Postemergence Herbicides, continued

Based on the label:	Based on other research:
G = Good control (80-100%)	g = good control (80-100%)
F = Fair control (50-80%)	f = fair control (50-80%)
P = Poor control (0-50%)	p = poor control (0-50%)

Broadleaves	Acclaim	Basagran	Casoron*	Demoss	Finale	Fusilade*	Goal	Gramoxone	Kerb	Image	Prism	Redeem*	Reward	Roundup*	Sharpshooter	Stinger	Ornamec*	Vantage
Plantain	P	P	g		G	P		g			P	f	g		G	p	P	P
Poison ivy (oak)	P					P		f			P	G	f	G	F		P	P
Pokeweed, common	p					P					P				F		P	P
Purslane, common	P	G			G	P	G	g			P	G	g		G		P	P
Pusley, Florida	P					P		g			P		g	G	G		P	P
Ragweed, common	P	F			G	P	f	g			P		g	G	G	G	P	P
Shepherdspurse	P	G			G	P	G	g			P		g	G	G		P	P
Sida, prickly	P	G				P	G	f			P		f	G	F		P	P
Smartweed	P	G			G	P	G	f			P	G	f	G	F		P	P
Sorrel, red	P		G			P	G	f		G	P		f		F	G	P	P
Speedwell spp.	P	P				P	G	g			P	f	g		G	p	P	P
Spurge, prostrate	P	P				P		g		p	P		g	G	G		P	P
Spurge, spotted	P					P		g			P		g	G	G		P	P
Spurry, corn	P					P	G	g			P		g		G		P	P
Thistle, Canada	P	G	G		G	P		f			P		f	G	F	G	P	P
Trumpetcreeper	P					P		f			P		f	F	F		P	P
Velvetleaf	P	G			G	P	G	g			P		g	G	G	G	P	P
Vetch	P					P		f			P	G	f	p	F		P	P
Virginia creeper	P					P		f			P	g	f	g	F		P	P
Yellow Woodsorrel (Oxalis	P	P	g		G	P		g			P	G	g	g	G	p	P	P
Grasses (or grasslike)																		
Barnyardgrass	G	P			G	G	G	g			G	P	g	G	P	p	G	G
Bermudagrass		P			G	G		f			G	P	f	G	f	p	G	G
Bluegrass, annual	P	P			G		G	g	G	F	G	P	g	G		p		
Brome, downy					G							P		G		p		
Crabgrass, large	G	P			G	G	G	g			G	P	g	G		p	G	G
Crabgrass, smooth	G	P			G	G		g			G	P	g	G		p	G	G
Fescue, tall	p	P	G		G	f		g	G	F		P	f	G		p	f	F
Foxtail (yellow, green)	G	P			G	G		g			G	P	g	G		p	G	G
Foxtail, giant	G	P			G	G	G	g			G	P	g	G		p	G	G
Goosegrass	G				G	G	G	g			G	P	g	G		p	G	G
Horsetail (Equisetum)	P		G		G						P					p	P	P
Johnsongrass (mature)		P			G	G		f				P	f	G		p	G	G
Johnsongrass (seedling)	G	P			G	G		g			G	P	g	G		p	G	G
Nutsedge, yellow	P	G	G		G	p		f			P		f	F	f	p	P	P
Orchardgrass	P		G			f		g	G			P	f	G		p	f	F
Panicum, fall	G	P			G	G	f	g			G	P	g	G		p	G	G
Quackgrass	P	P	G		G	G		f	G		G	P	f	G		p	G	G
Ryegrass, annual		P			G			g	G			P	g	G		p	g	g
Sandbur					G	G		f			G	P	f	G		p	G	G
Signalgrass, broadleaf					G	G		g			G	P	g	G		p	G	G

* See text for other trade names of these herbicides.

Herbicide Registration Charts

This section is designed to help you plan your herbicide program. Each herbicide is cross referenced to many species of ornamentals and use sites. All listings are based on product labels available in January, 1994. After referring to these tables, **check the product label for information concerning rate, timing, or cultivar limitations before using the herbicide.**

The tables in this section are separated into preemergence and postemergence herbicides. In addition, the tables are separated into woody and herbaceous plants for convenience.

Woody plants can be divided into several large groups: conifers, broadleaf evergreens, and deciduous trees and shrubs. In general, age of bark, age of tree, shape of tree, and plant growth periods often are similar for each group. These characteristics often dictate herbicide use and application methods.

Conifers include all cypress, junipers, pines, spruce, hemlocks, yews, and others. These plants generally have a winter dormancy period in which their herbicide tolerance is high. Conversely, they are often very susceptible to damage early in the annual bud break cycle.

Broadleaf evergreens include shrubs and trees such as abelia, azalea, camelia, rhododendron, mountain laurel, leucothoe, pieris, ligustrum, hollies, and others. They tend to be very subject to damage from herbicides applied at bud break or early in their spring growth flush.

Deciduous woody plants have a wide range of tolerance to many postemergence herbicides based on the growth cycle. Buds can be easily damaged as they begin growth with some herbicides, whereas most deciduous plants become very susceptible to damage late in the growing season. This is especially true for glyphosate and sulfosate, which are readily translocated when they are sprayed on foliage in late summer or fall.

Note: In the cross reference list of ornamental and scientific names, the genera *Ajuga*, *Chrysanthemum*, *Dianthus*, *Impatiens*, *Matricaria*, *Narcissus*, *Oenothera*, *Salvia*, *Tilia*, and *Thymus* are represented by more than one common name. The common name jasmine represents more than one scientific name.

Cross-Reference List of Ornamental Common and Scientific Names of Ornamental Plants

Abelia grandiflora	abelia, glossy
Abies balsamea	fir, balsam
Abies concolor	fir, white (concolor)
Abies fraseri	fir, fraser
Abies spp.	fir species
Acer ginnala	maple, amur
Acer negundo	boxelder
Acer palmatum	maple, Japanese
Acer platanoides	maple, Norway
Acer rubrum	maple, red
Acer saccharinum	maple, silver
Acer saccharum	maple, sugar
Acer spp.	maple species
Achillea	yarrow species
Acorus	sweet flag
Aesculus spp.	buckeye species
Agapanthus	African lily
Ageratum	ageratum
Ajuga	bugleweed
Ajuga	ajuga
Alcea	hollyhock
Allium	chives, ornamental
Allium	allium
Alternanthera	Joseph's coat
Lobularia	sweet alyssum
Amaranthus	amaranthus
Anagallis	pimpernel
Anthemis	marguerite, golden
Antirrinum	snapdragon
Aquilegia	columbine
Arctostaphylos uva-ursi	bearberry (kinnikinick)
Arctotis	African daisy
Armerenaria	sea pink
Arenaria	sandwort
Arinaema	Jack-in-the-pulpit
Artemisia	wormwood
Asclepias	butterflyweed (milkweed)
Asparagus	asparagus fern
Astilbe	astilbe
Aucuba spp.	golddust plant
Aurinia	alyssum or golddust
Begonia	begonia, fibrous
Berberis julianae	barberry, wintergreen
Berberis spp.	barberry species
Betula nigra	birch, river
Betula papyrifera	birch, paper
Betula pendula	birch, European white
Bougainvillea spp.	bougainvillea species
Buxus harlandii	boxwood, harland
Buxus microphylla	boxwood, littleleaf
Buxus sempervirens	boxwood, common
Buxus spp.	boxwood species
Cactus	cactus
Calendula	calendula
Callistemon spp.	bottlebrush
Callistephus	aster
Calluna spp.	heather species
Camellia japonica	camellia, Japanese
Camellia sasanqua	camellia, Sasanqua
Camellia spp.	camellia species
Campanula	bellflower
Canna	canna
Capsicum	pepper, ornamental
Caragana arborescens	pea-shrub, Siberian
Carex	carex
Carissa grandiflora	plum, Natal
Carya illinoiensis	pecan
Cassia spp.	senna
Castanea mollissima	chestnut, Chinese
Catharanthus	periwinkle (bedding plant)
Ceanothus americanus	redroot
Cedrus deodora	cedar, deodar
Cedrus spp.	cedar species
Celosia	cockscomb
Celtis occidentalis	hackberry
Centaurea	bachelor's button
Cerastium	snow-in-summer
Cercis canadensis	redbud, eastern
Chaenomeles speciosa	quince, flowering
Chamaecyparis obtusa	cypress, Hinoki
Chamaecyparis pisifera	cypress, Japanese false
Chamaecyparis spp.	cypress, false
Cheiranthus	wallflower
Chrysanthemum	shasta daisy
Chrysanthemum	chrysanthemum
Chrysanthemum	daisy
Cistus spp.	rockrose
Citrus spp.	citrus, ornamental
Clarkia	godetia
Coleus	coleus
Convallaria	lily-of-the-valley
Convolvulus	morning glory
Coreopsis	calliopsis (coreopsis)
Cornus florida	dogwood, flowering
Cornus kousa	dogwood, Korean

Cornus sericea (stolonifera)	dogwood, redosier
Cornus spp.	dogwood species
Coronilla	crown vetch
Cortaderia	pampas grass
Corylus spp.	filbert (hazelnut)
Cosmos	cosmos
Cotinus coggygria	smokebush
Cotoneaster apiculatus	cotoneaster, cranberry
Cotoneaster dammeri	cotoneaster, bearberry
Cotoneaster horizontalis	cotoneaster, rockspray
Cotoneaster microphyllus	cotoneaster, small leaved
Cotoneaster salicifolius	cotoneaster, willowleaf
Cotoneaster spp.	cotoneaster species
Crataegus spp.	hawthorn species
Crocus	crocus
Cryptomeria japonica	cryptomeria cedar, Japanese
Cuphea spp.	heather, false
Cupressocyparis leylandii	cypress, Leyland
Cupressus sempervirens	cypress, Italian
Cupressus spp.	cypress species
Cytisus spp.	broom species
Dahlia	dahlia
Daucus	Queen Anne's lace
Delphinium	larkspur
Deutzia spp.	deutzia species
Dianthus	carnation
Dianthus	sweet William
Dianthus	pink
Dicentra	bleeding heart
Digitalis	foxglove
Dimorphotheca	cape marigold
Doronicum	leopards-bane
Echinacea	coneflower, purple
Elaeagnus angustifolia	olive, Russian
Elaeagnus pungens	eleagnus, thorny
Eleagnus spp.	eleagnus species
Endymion spp.	hyacinth, wood
Erica spp.	heath species
Eschscholzia	poppy, California
Eucalyptus spp.	eucalyptus species
Euonymus alata	euonymus, winged
Euonymus fortunei	euonymus, wintergreen
Euonymus japonica	euonymus, Japanese
Euonymus kiautschovica	euonymus, spreading
Euonymus spp.	euonymus species
Euphorbia	snow-on-mountain
Fagus spp.	beech species
Fatshedera lizei	tree-ivy
Festuca	fescue, blue
Ficus spp.	fig species
Forsythia intermedia	forsythia, border
Forsythia spp.	forsythia species
Fragaria	strawberry, ornamental
Fraxinus americana	ash, white
Fraxinus pensylvanica	ash, green
Fraxinus spp.	ash species
Freesia	freesia
Gaillardia	gaillardia
Gardenia	jasmine species
Gardenia jasminoides	jasmine, cape
Gazania	gazania
Gelsemium sempervirens	jessamine, Carolina
Geranium	cranesbill
Gerbera	gerbera daisy
Geum	geum (Avens)
Gilia	gilia
Ginkgo biloba	ginkgo
Gladiolus	gladiolia
Gleditsia triacanthos	honeylocust, thornless
Gypsophila	baby's breath
Hamamelis virginiana	witchhazel
Hedera	ivy
Helianthus	sunflower
Helichrysum	strawflower
Hemerocallis	daylily
Hemigraphis alternata	red-ivy
Herniaria	rupturewort
Hesperis	dames rocket
Heuchera	coral bell
Hibiscus syriacus	rose-of-sharon (althea)
Hosta	hosta
Hosta	lily, plaintain
Hyacinthus	hyacinth
Hydrangea spp.	hydrangea
Hypericum spp.	St. John'swort
Iberis	candytuft
Ilex aquifolium x cornuta	holly, English x Chinese
Ilex aquifolium	holly, English
Ilex cassine	holly, dahoon
Ilex cornuta	holly, Chinese
Ilex crenata	holly, Japanese
Ilex glabra	inkberry
Ilex latifolia	holly, luster-leaf
Ilex meserveae	holly, blue boy/girl
Ilex opaca	holly, American
Ilex spp.	holly species
Ilex vomitoria	holly, yaupon

Ilex x attenuata	holly, Foster
Illicium spp.	anise
Impatiens	impatiens
Impatiens	balsam
Iris	iris, rhizomatous
Iris	iris, bulbous
Jasminum spp.	jasmine species
Juglans nigra	walnut, black
Juglans spp.	walnut species
Juniperus chinensis	juniper, Chinese
Juniperus conferta	juniper, shore
Juniperus excelsa	juniper, spiney Greek
Juniperus horizontalis	juniper, creeping
Juniperus procumbens	juniper, Japanese garden
Juniperus sabina	juniper, Savin
Juniperus spp.	juniper species
Juniperus squamata	juniper, singleseed
Juniperus virginiana	cedar, eastern red
Justicia brandegeana	shrimp plant
Kalmia latifolia	laurel, mountain
Kniphofia	poker plant
Koelreuteria paniculata	golden raintree
Kolkwitzia amabilis	beautybush
Laburnum anagyroides	laburnum (golden-chain tree)
Lagerstroemia indica	myrtle, common crape
Lantana	lantana
Larix spp.	larch species
Lathyrus	sweet pea
Lavendula	lavender
Layia	tidy tips
Leucothoe axillaris	leucothoe, coast
Leucothoe spp.	leucothoe species
Liatris	gayfeather (liatris)
Ligustrum japonicum	privet, Japanese
Ligustrum lucidum	privet, waxleaf
Ligustrum ovalifolium	privet, California
Ligustrum sinense	privet, Chinese
Ligustrum spp.	privet species
Lilium	lily
Limonium	statice
Linum	scarlet flax
Liquidambar styraciflua	sweetgum, American
Liriodendron tulipifera	poplar, tulip
Liriope	liriope
Lobelia	lobelia
Lonicera spp.	honeysuckle species
Lupinus	lupine
Lysimachia	moneywort
Maclura pomifera	osage orange
Magnolia grandiflora	magnolia, southern
Magnolia spp.	magnolia species
Mahonia aquifolium	grape-holly, Oregon
Mahonia spp.	mahonia species
Malus floribunda	crabapple, flowering
Malus spp.	crabapple species
Malus x domestica	apple
Matricaria	chamomile
Matricaria	feverfew
Matthiola	stock
Mertensia	bluebells
Mesembryanthemum and other genera	iceplant
Mirabilis	four o'clock
Miscanthus	miscanthus
Morea	fortnight lily
Morus alba	mulberry, white
Muscari	hyacinth, grape
Myoporum spp.	myoporum species
Myosotis	forget-me-not
Myrica cerifera	myrtle, wax
Nandina domestica	nandina (heavenly bamboo)
Narcissus	narcissus
Narcissus	daffodil
Nasturtium	nasturtium
Nemophila	baby-blue-eyes
Nephrolepsis	sword fern
Nerium oleander	oleander
Nicotiana	nicotiana
Nyssa sylvatica	tupelo, black
Ochna serrulata	bird's-eye bush
Oenothera	sundrops
Oenothera	evening primrose
Olea spp.	olive species
Ophiopogon	mondo grass
Opuntia	prickly pear
Ornithogalum	star-of-Bethlehem
Osmanthus heterophyllus	osmanthus (false-holly)
Osmanthus spp.	osmanthus species
Oxydendrum arboreum	sourwood
Pachysandra	pachysandra
Paeonia	peony
Papaver	poppy
Paxistima canbyi	paxistima (pachistima)
Pelargonium	geranium
Pennisetum	fountain grass (red or green)
Penstemon	beardtongue
Petunia	petunia

Philadelphus spp.	mockorange
Phlox	phlox
Photinia fraseri	photinia, fraser (red tip)
Photinia glabra	photinia, smooth
Physocarpus opulifolius	ninebark
Physostegia	false dragonhead
Picea abies	spruce, Norway
Picea glauca	spruce, white
Picea pungens	spruce, Colorado blue
Picea rubens	spruce, red
Picea spp.	spruce species
Pieris japonica	andromeda, Japanese
Pieris spp.	andromeda species
Pinus elliottii	pine, slash
Pinus mugo	pine, mugo
Pinus nigra	pine, Austrian
Pinus palustris	pine, longleaf
Pinus radiata	pine, Monterey
Pinus resinosa	pine, red (Norway)
Pinus spp.	pine species
Pinus strobus	pine, white
Pinus sylvestris	pine, Scotch
Pinus taeda	pine, loblolly
Pinus thunbergii	pine, Japanese black
Pinus virginiana	pine, scrub (Virginia)
Pistacia	pistachio
Pittosporum tobira	pittosporum, Tobira
Platanus x acerifolia	planetree, London
Platanus occidentalis	sycamore
Platycladus orientalis	arborvitae, Oriental
Podocarpus spp.	podocarpus species
Polygonum	pink clover
Populus deltoides	cottonwood, eastern
Populus spp.	poplar species
Portulaca	moss-rose
Potentilla fruticosa	potentilla, bush
Potentilla spp.	potentilla (cinquefoil)
Primula	primrose
Prunus caroliniana	cherry laurel, Carolina
Prunus cerasifera	plum, cherry
Prunus glandulosa	almond, flowering
Prunus laurocerasus	cherry laurel, common
Prunus persica	peach, common
Prunus sargentii	cherry, sargent
Prunus serotina	cherry, black
Prunus serrulata	cherry, Japanese
Prunus spp.	cherry species
Prunus subhirtella pendulata	cherry, Higan
Prunus x cistena	cherry, purpleleaf sand
Prunus yedoensis	cherry, Yoshino
Pseudotsuga menziesii	fir, Douglas
Pyracantha coccinea	pyracantha, scarlet
Pyracantha spp.	pyracantha species
Pyrus calleryana 'Bradford'	pear, Bradford
Pyrus spp.	pear species
Quercus alba	oak, white
Quercus coccinea	oak, scarlet
Quercus nigra	oak, water
Quercus palustris	oak, pin
Quercus phellos	oak, willow
Quercus rubra	oak, red
Quercus spp.	oak species
Quercus virginiana	oak, live
Ranunculus	ranunculus
Raphiolepis indica	hawthorn, Indian
Rhododendron carolinanum	rhododendron, Carolina
Rhododendron catawbiense	rhododendron, Catawba
Rhododendron indicum	azalea, Indian
Rhododendron maximum	rhododendron, rosebay
Rhododendron molle	azalea, mollis
Rhododendron obtusum	azalea, kurume
Rhododendron spp.	rhododendron species
Rhododendron spp.	azalea species
Ribes alpinum	currant, alpine
Robinia spp.	locust species
Rosa spp.	rose species
Rosmarinus	rosemary
Rudbeckia	black-eyed Susan
Rumohra	leatherleaf fern
Saintpaulia	African violet
Salix spp.	willow species
Salvia	sage, sweet or Texas
Salvia	scarlet sage
Salvia	salvia
Samanea saman	rain-tree (ohai)
Sanguisorba	burnet
Santolina	lavendercotton
Sanvitalia	zinnia, creeping
Saponaria	soapwort
Scabiosa	mourning-bride
Scilla	squill
Sedum	sedum (stonecrop)
Sempervivum	hens and chickens
Senecio	dusty miller
Silene	catchfly

Solanum	nightshade
Sorbus spp.	mountain-ash species
Spiraea spp.	spiraea species
Spiraea vanhouttei	spiraea, Vanhoutte
Stachys	lamb's ear
Stokesia	Stoke's aster
Strelitzia	bird of paradise
Symphoricarpos albus	snowberry
Syringa persica	lilac, Persian
Syringa vulgaris	lilac, common
Tagetes	marigold
Taxodium distichum	cypress, bald
Taxus canadensis	yew, American
Taxus cuspidata	yew, Japanese
Taxus media	yew, Anglojap
Taxus spp.	yew species
Ternstroemia gymnanthera	cleyera, Japanese
Teucrium	germander
Thuja occidentalis	arborvitae, American
Thuja spp.	arborvitae species
Thymus	mother of thyme
Thymus	wild thyme
Tilia spp.	linden
Tilia spp.	basswood
Trachelospermum jasminoides	jasmine, star
Tradescantia	spiderwort
Trientalis	starflower
Tsuga canadensis	hemlock, Canadian
Tsuga carolinia	hemlock, Carolina
Tsuga spp.	hemlock species
Tulipa	tulip
Ulmus americana	elm, American
Ulmus pumila	elm, Siberian
Ulmus spp.	elm species
Verbena	verbena
Veronica	speedwell (Veronica)
Viburnum spp.	viburnum species
Viburnum suspensum	viburnum, sandankwa
Viburnum tinus	laurustinus
Viburnum wrightii	viburnum, Wright
Vinca major	vinca (groundcover)
Vinca minor	periwinkle (groundcover)
Viola	pansy
Weigela spp.	weigela species
Yucca	yucca
Zinnia	zinnia

Table 3. Preemergence Herbicides Registered for Use on Woody Ornamentals

F = registered for use in the field (or landscape)
C = registered for use in containers
f/c = registered for both field and container use
Ø = label prohibits use on this species
F*, C*, or f/c* = registered for some species or cultivars; consult label for details.
Ø* = prohibited for some cultivars within a species; consult label for details.

s = southern or western species
n = northern--zone 6 or lower (Arnold Zone)

Common Name	Genus and species		Barricade	Betasan#	Dyclomec#	Dacthal#	Derby	Devrinol	Eptam	Gallery	Goal	Image	Kerb	Lasso	Lasso II	OH2	Pendulum#	Pennant	Predict	Princep#	Ronstar G	Rout	Snapshot DF	Snapshot TG	Surflan	Trifluralin#	XL
abelia, glossy	*Abelia x grandiflora*	n		F		F	f/c	f/c		f/c		Ø				f/c	f/c	f/c				f/c	F	f/c	F		F
almond, flowering	*Prunus glandulosa*	n	F*		F			F		f/c															f/c		
andromeda species	*Pieris spp.*	n	F*			F*			F	f/c*		Ø				f/c				F	f/c	f/c*	F*	f/c*	f/c*	F*	f/c*
andromeda, Japanese	*Pieris japonica*	n	F			F	F		F	f/c		Ø				f/c	f/c	F		F	f/c*	f/c*	F	f/c	f/c	F	f/c
anise tree (spice bush)	*Illicium spp.*	s					f/c*			f/c*							f/c*	F						f/c*			
apple, common	*Malus x domestica*	n			F*			F		F	F*		F					F	F*					F	F	F	F
arborvitae species	*Thuja spp.*	n	F*		F	F	f/c*	c		F*	f/c*		F			f/c		f/c*		F	f/c	f/c*	F*	f/c*	f/c*	F*	f/c*
arborvitae, American	*Thuja occidentalis*	n	F		F	F	f/c	c		F	f/c		F			f/c	f/c	f/c		F	f/c	f/c*	Ø*	f/c*	Ø*	F	
arborvitae, Oriental	*Platycladus orientalis*	n			F	F		c		F	f/c		F					F		F		f/c*	F	F	f/c		f/c
ash species	*Fraxinus spp.*	n			F	F	F*	F		f/c*			F					F					f/c*		F	F*	
ash, green	*Fraxinus pennsylvanica*	n			F	F	F	F					F				f/c	F			f/c				F		
ash, white	*Fraxinus americana*	n			F	F	F	F					F					F							F	F	
azalea species	*Rhododendron spp. (azalea)*	n	F*	F	F*	F	f/c*	f/c	F	f/c*		Ø	F			f/c*	f/c	F			f/c*	f/c*	f/c*	f/c*	F	F	F
azalea, Chinese	*Rhododendron molle*	n		F	F	F		f/c	F			Ø	F			f/c	f/c	F			f/c				F	F	F
azalea, Hiryu	*Rhododendron obtusum*	n	F*	F	F	F	f/c	f/c	F	f/c		Ø	F			Ø*	f/c	f/c			f/c	f/c*		f/c*	F	F	F
azalea, Macranthum	*Rhododendron indicum*	n		F		F	f/c	f/c	F	f/c		Ø	F			f/c	f/c	f/c			f/c		f/c	f/c	F	F	F
barberry species	*Berberis spp.*	n	F*		F	F	f/c*		F	f/c*			F			f/c	f/c*	F		F	f/c	f/c*	F*	f/c*	f/c*	F	f/c*
barberry, wintergreen	*Berberis julianae*	n	F		F	F			F				F			f/c		F		F	f/c						
basswood (linden)	*Tilia spp.*	n			F				F				F				f/c								f/c*		
bearberry (kinnikinick)	*Arctostaphylos uva-ursi*	n			F																f/c	f/c					
beautybush	*Kolkwitzia amabilis*	s			F																						
beech species	*Fagus spp.*	n											F														
beech, European	*Fagus sylvatica*	n											F								f/c						
birch, European white	*Betula pendula*	n			F	F		F					F			f/c	f/c	F							F	F	

See text for other trade names of these herbicides.

Table 3. Preemergence Herbicides Registered for Use on Woody Ornamentals, continued

F = registered for use in the field (or landscape)
C = registered for use in containers
f/c= registered for both field and container use
Ø = label prohibits use on this species
F*, C*, or f/c* = registered for some species or cultivars; consult label for details.
Ø* = prohibited for some cultivars within a species; consult label for details.

s = southern or western species
n = northern--zone 6 or lower (Arnold Zone)

Common Name	Genus and species		Barricade	Betasan#	Dyclomec#	Dacthal#	Derby	Devrinol	Eptam	Gallery	Goal	Image	Kerb	Lasso	Lasso II	OH2	Pendulum#	Pennant	Predict	Princep#	Ronstar G	Rout	Snapshot DF	Snapshot TG	Surflan	Trifluralin#	XL
birch, paper	*Betula papyrifera*	n			F	F		F		F			F			f/c		F			f/c		F	F			
birch, river	*Betula nigra*	n			F	F	f/c	F		f/c			F			f/c	f/c	f/c					F	f/c	F		
bird's-eye bush	*Ochna serrulata*	s																				f/c						
bottlebrush	*Callistemon spp.*	s	F*					f/c		f/c*						f/c	f/c*				f/c*			F*	f/c*	f/c*		f/c*
bougainvillea	*Bougainvillea spp.*	s						f/c		f/c*								F			f/c*	f/c	F	f/c*				
boxelder	*Acer negundo*	n			F															F								
boxwood species	*Buxus spp.*	n	F*	F	F	F	f/c*	f/c	F	f/c*			F			f/c		f/c	F*		f/c*	f/c*	f/c*	f/c*	f/c*	F*	f/c*
boxwood, common	*Buxus sempervirens*	n		F	F	F	f/c	f/c	F				F			f/c	f/c	f/c			f/c	f/c*	f/c		f/c	F	f/c
boxwood, harland	*Buxus harlandii*	n		F	F	F		f/c	F				F			f/c		f/c	F							F	
boxwood, littleleaf	*Buxus microphylla*	n	F	F	F	F	f/c	f/c	F	f/c			F			f/c		f/c			f/c	f/c	f/c	f/c	F	F	F
broom species	*Cytisus spp.*	n								F*						f/c		F			f/c*		F*	F*			
buckeye species	*Aesculus spp.*	n											F				f/c*										
camellia species	*Camellia spp.*	s			F	F		f/c	F	f/c						f/c		F			f/c*			f/c*		F*	
camellia, Japanese	*Camellia japonica*	s			F	F		f/c	F							f/c	f/c	F			f/c			f/c		F	
camellia, Sasanqua	*Camellia sasanqua*	s			F	F		f/c	F							f/c		F			f/c					F	
cedar species	*Cedrus spp.*	n						f/c					F								f/c*						
cedar, eastern red	*Juniperus virginiana*	n		F	F*	F	f/c	f/c	F	f/c	f/c		F	F	f/c	f/c	f/c	f/c	F*	F	f/c		F	f/c	F	F	F
cedar, Atlas	*Cedrus atlantica*	n						f/c					F								f/c						
cedar, deodar	*Cedrus deodara*	n						f/c					F														
cherry species	*Prunus spp.*	n			F*			F		F*	F*		F			f/c		F					F*	F*	F*	F	F*
cherry, Higan	*Prunus subhirtella pendulata*	n						F					F			f/c		F								F	
cherry, Japanese flowering	*Prunus serrulata*	n						F								f/c		F								F	
cherry, purpleleaf sand	*Prunus x cistena*	n						F								f/c	f/c	F				f/c				F	
cherry, sargeant	*Prunus sargentii*	n						F								f/c		F								F	

See text for other trade names of these herbicides.

Table 3. Preemergence Herbicides Registered for Use on Woody Ornamentals, continued

F = registered for use in the field (or landscape)
C = registered for use in containers
f/c= registered for both field and container use
Ø = label prohibits use on this species
F*, C*, or f/c* = registered for some species or cultivars; consult label for details.
Ø* = prohibited for some cultivars within a species; consult label for details.

s = southern or western species
n = northern--zone 6 or lower (Arnold Zone)

Common Name	Genus and species		Barricade	Betasan#	Dyclomec#	Dacthal#	Derby	Devrinol	Eptam	Gallery	Goal	Image	Kerb	Lasso	Lasso II	OH2	Pendulum#	Pennant	Predict	Princep#	Ronstar G	Rout	Snapshot DF	Snapshot TG	Surflan	Trifluralin#	XL
cherry, Yoshino	*Prunus yedoensis*	n						F		F			F			f/c		F					F			F	
cherry-laurel, Carolina	*Prunus caroliniana*	s						F								f/c		F							F	F	F
cherry-laurel, common	*Prunus laurocerasus*	n	F					F								f/c	f/c	F			f/c				F		F
chestnut, Chinese	*Castanea mollissima*	n				F					F*															F	
citrus, ornamental	*Citrus spp.*	s						f/c	F	F*								F	F*		f/c*		F*	F*	f/c		
cleyera, Japanese	*Ternstroemia gymnanthera*	s			F		f/c			f/c								F				f/c	f/c	f/c	f/c		F
cotoneaster species	*Cotoneaster spp.*	n	F*		F	F	f/c*	f/c		f/c*			F		F	f/c	f/c*	f/c		F	f/c*	f/c*	f/c*	f/c*	f/c*	F*	f/c*
cotoneaster, bearberry	*Cotoneaster dammeri*	n	F		F	F		f/c		f/c			F		F	f/c		f/c		F	f/c	f/c*	f/c	f/c	f/c	F	f/c
cotoneaster, cranberry	*Cotoneaster apiculatus*	n	F		F	F		f/c		f/c			F		F	f/c	f/c	f/c		F	f/c		f/c	f/c	f/c	F	f/c
cotoneaster, rock	*Cotoneaster horizontalis*	n			F	F	f/c	f/c		f/c			F		F	f/c	f/c	f/c		F	f/c		f/c	f/c	f/c	F	f/c
cotoneaster, rockspray	*Cotoneaster microphyllus*	n	F		F	F		f/c					F		F	f/c		f/c		F	f/c				F	F	F
cotoneaster, willowleaf	*Cotoneaster salicifolius*	n			F	F		f/c					F		F	f/c		f/c		F	f/c	f/c*				F	
cottonwood, eastern	*Populus deltoides*	n			F	F	F	F		F								F			f/c		F		F	F	
crabapple species	*Malus spp.*	n	F*		F	F		F			F*		F		F		f/c	F	F*		f/c					F	F
crabapple, Japanese	*Malus floribunda*	n	F		F	F	F	F					F		F		f/c	F			f/c					F	F
cryptomeria (cedar, Japanese)	*Cryptomeria japonica*	n															f/c								f/c		f/c
cypress species	*Cupressus spp.*	n		F*		F		f/c		F*						f/c					f/c		F*	F*	f/c*		f/c*
cypress, bald	*Taxodium distichum*	n						f/c										F	F						f/c*	F	
cypress, false	*Chamaecyparis spp.*	n	F*					f/c	F	F*						f/c					f/c*		F*	F*	F*		F*
cypress, Hinoki	*Chamaecyparis obtusa*	n						f/c	F	F						f/c					f/c	f/c*	F	F			
cypress, Italian	*Cupressus sempervirens*	n	F					f/c								f/c					f/c	f/c*			f/c		f/c
cypress, Japanese false	*Chamaecyparis pisifera*	n	F					f/c	F	F						f/c	f/c				f/c	f/c*	F	F			
cypress, Leyland	*Cupressocyparis leylandii*	n						f/c									f/c				f/c						
deutzia species	*Deutzia spp.*	n			F	F				F*							f/c*				f/c*		Ø*	F*	Ø*	F	

See text for other trade names of these herbicides.

Table 3. Preemergence Herbicides Registered for Use on Woody Ornamentals, continued

F = registered for use in the field (or landscape)
C = registered for use in containers
f/c= registered for both field and container use
Ø = label prohibits use on this species
F*, C*, or f/c* = registered for some species or cultivars; consult label for details.
Ø* = prohibited for some cultivars within a species; consult label for details.

s = southern or western species
n = northern--zone 6 or lower (Arnold Zone)

Common Name	Genus and species		Barricade	Betasan#	Dyclomec#	Dacthal#	Derby	Devrinol	Eptam	Gallery	Goal	Image	Kerb	Lasso	Lasso II	OH2	Pendulum#	Pennant	Predict	Princep#	Ronstar G	Rout	Snapshot DF	Snapshot TG	Surflan	Trifluralin#	XL
dogwood species	*Cornus spp.*	n	F*		F	F	f/c*	f/c	F	f/c*			F		F	f/c	f/c*	f/c	F	F	f/c*	f/c*	F*	f/c*	f/c*	F*	
dogwood, flowering	*Cornus florida*	n	F		F	F	f/c	f/c	F	f/c			F		F	f/c	f/c	f/c	F	F	f/c	f/c	F	f/c	F	F	
dogwood, Korean	*Cornus kousa*	n			F	F		f/c	F				F		F	f/c	f/c	f/c	F	F	f/c				f/c	F	
dogwood, redosier	*Cornus sericea (stolonifera)*	n	F		F	F	f/c	f/c	F				F		F	f/c		f/c	F	F	f/c		F	F			
elaeagnus species	*Elaeagnus spp.*	n	F*		F*	F	F*			f/c*								F		F*		f/c*		f/c*		F*	
elaeagnus, thorny	*Elaeagnus pungens*	n	F			F	F			f/c								F				f/c*		f/c		F	
elm species	*Ulmus spp.*	n			F	F				F*			F				f/c*			F*	f/c		F*	F*			
elm, American	*Ulmus americana*	n			F	F							F							F	f/c						
elm, Siberian	*Ulmus pumila*	n			F	F							F							F	f/c						
eucalyptus species	*Eucalyptus spp.*	n						f/c		F*										F	f/c		F*	f/c*	F*		F*
euonymus species	*Euonymus spp.*	n	F*		F	F	f/c*	f/c	F				F		F	f/c	f/c*	f/c*			f/c*	f/c*	F*	f/c*	f/c*	F*	f/c*
euonymus, Japanese	*Euonymus japonica*	n	F		F	F	F	f/c	F	f/c*			F		F	f/c	f/c	F				Ø*	F	f/c*	f/c		f/c
euonymus, spreading	*Euonymus kiautschovica*	n	F		F	F		f/c	F	F			F		F	f/c		f/c			f/c		F	F*		F	
euonymous, winged	*Euonymus alata*	n			F	F	f/c	f/c	F	Ø*			F		F	Ø*	f/c	f/c				f/c*	Ø*	Ø*	F	F	F
euonymus, wintercreeper	*Euonymus fortunei*	n	F		F	F	F	f/c	F	f/c*			F		F	f/c	f/c	f/c			f/c	f/c*	F	f/c*	f/c	F	f/c
fig species	*Ficus spp.*	s						f/c		f/c*	F*							F			f/c*	Ø*	F*	f/c*			
filbert (hazelnut)	*Corylus spp.*	n			F			F		F	F*								F*								
fir species	*Abies spp.*	n				F	F*	f/c	F	F*	F*		F				f/c*	F		F			F*	F*	F*	F*	F*
fir, balsam	*Abies balsamea*	n				F	F	f/c	F				F				f/c	F		F					F	F	F
fir, Douglas	*Pseudotsuga menziesii*	n						f/c			F		F				f/c	F		F	f/c		Ø		Ø	F	F
fir, fraser	*Abies fraseri*	n				F	F	f/c	F		F		F				f/c	F		F					F		F
fir, white (concolor)	*Abies concolor*	n				F	F	f/c	F	F			F				f/c	F		F			F	F	F		F
forsythia species	*Forsythia spp.*	n	F*		F	F	f/c*	f/c		f/c*			F			f/c	f/c*	f/c			f/c*	f/c*	F*	f/c*	F*	F	F*
forsythia, border	*Forsythia x intermedia*	n	F		F	F	f/c	f/c		f/c			F			f/c	f/c	f/c			f/c	f/c*	F	f/c	F	F	F

See text for other trade names of these herbicides.

Table 3. Preemergence Herbicides Registered for Use on Woody Ornamentals, continued

F = registered for use in the field (or landscape)
C = registered for use in containers
f/c= registered for both field and container use
Ø = label prohibits use on this species
F*, C*, or f/c* = registered for some species or cultivars; consult label for details.
Ø* = prohibited for some cultivars within a species; consult label for details.

s = southern or western species
n = northern--zone 6 or lower (Arnold Zone)

Common Name	Genus and species		Barricade	Betasan#	Dyclomec#	Dacthal#	Derby	Devrinol	Eptam	Gallery	Goal	Image	Kerb	Lasso	Lasso II	OH2	Pendulum#	Pennant	Predict	Princep#	Ronstar G	Rout	Snapshot DF	Snapshot TG	Surflan	Trifluralin#	XL
ginkgo	*Ginko biloba*	n								F			F				f/c	f/cF			f/c		F	F	f/c		f/c
golddust plant	*Aucuba spp.*	s	F*			F	f/c*	F									f/c*	f/c*									
golden raintree	*Koelreuteria paniculata*	n			F																				F		F
grape-holly, Oregon	*Mahonia aquifolium*	s														f/c				F	f/c	f/c			F		F
hackberry	*Celtis occidentalis*	n			F																						
hawthorn species	*Crataegus spp.*	n				F		F		F*			F											F*			
hawthorn, Indian	*Raphiolepis indica*	s	F				F	f/c		f/c		F				f/c	f/c	F				f/c*	F	f/c	f/c	F	F
heath species	*Erica spp.*	n				F				f/c*						Ø					f/c*			f/c*			
heather species	*Calluna spp.*	n	F*		F			f/c		f/c*											f/c*			f/c*			
hemlock species	*Tsuga spp.*	n					f/c*	F	F	f/c*	F*		F				f/c*	f/c*		F	f/c*			f/c*		F*	
hemlock, Canada	*Tsuga canadensis*	n	F				f/c	F	F	f/c	F		F				f/c	f/c		F	f/c*		Ø	f/c	Ø	F	
hemlock, Carolina	*Tsuga caroliniana*	n						F	F				F					F		F							
holly species	*Ilex spp.*	n	F*		F*	F	f/c*	f/c	F*	f/c*		F*	F		f/c	f/c	f/c*	f/c*	F*	F	f/c	f/c*	f/c*	f/c*	f/c*	F	f/c*
holly, American	*Ilex opaca*	n	F		F	F		f/c	F				F		f/c	f/c	f/c	F	F*	F	f/c					F	
holly, blue boy/girl	*Ilex meserveae*	n			F	F		f/c		F			F		f/c	f/c		F		F	f/c		F	F		F	
holly, Chinese	*Ilex cornuta*	n	F		F	F	f/c	f/c		f/c*		F*	F		f/c	f/c	f/c	f/c		F	f/c	f/c*	f/c	f/c*	f/c	F	f/c
holly, dahoon	*Ilex cassine*	s			F	F		f/c					F		f/c	f/c		F		F	f/c					F	
holly, English	*Ilex aquifolium*	n			F	F		f/c		F			F		f/c	f/c		F		F	f/c		F	F	F	F	F
holly, English x Chinese	*Ilex aquifolium x cornuta*	n			F	F		f/c					F		f/c	f/c		F	F*	F	f/c					F	
holly, Foster's hybrid	*Ilex x attenuata*	s			F	F	f/c	f/c		f/c			F		f/c	f/c	f/c	f/c	F*	F	f/c			f/c		F	
holly, Japanese	*Ilex crenata*	n	F			F	f/c	f/c	F	f/c		F*	F		f/c	f/c	f/c	f/c	F*	F	f/c	Ø*	f/c	f/c	f/c	F	F
holly, lusterleaf	*Ilex latifolia*	n			F	F		f/c					F		f/c	f/c		F		F	f/c					F	
holly, yaupon	*Ilex vomitoria*	n				F	f/c	f/c		f/c		F*	F		f/c	f/c	f/c	F		F	f/c	f/c*	f/c	f/c	f/c	F	f/c
honeylocust, thornless	*Gleditsia triacanthos*	n						F		F			F				f/c	F		F			F	F		F	

See text for other trade names of these herbicides.

Table 3. Preemergence Herbicides Registered for Use on Woody Ornamentals, continued

F = registered for use in the field (or landscape)
C = registered for use in containers
f/c = registered for both field and container use
Ø = label prohibits use on this species
F*, C*, or f/c* = registered for some species or cultivars; consult label for details.
Ø* = prohibited for some cultivars within a species; consult label for details.

s = southern or western species
n = northern--zone 6 or lower (Arnold Zone)

Common Name	Genus and species		Barricade	Betasan#	Dyclomec#	Dacthal#	Derby	Devrinol	Eptam	Gallery	Goal	Image	Kerb	Lasso	Lasso II	OH2	Pendulum#	Pennant	Predict	Princep#	Ronstar G	Rout	Snapshot DF	Snapshot TG	Surflan	Trifluralin#	XL
honeysuckle species	*Lonicera spp.*	n	F*		F	F		F		F*						f/c		F		F*	f/c	f/c*	F*	F*	F*	F	F*
hydrangea	*Hydrangea spp.*	n				F	F*			Ø						f/c		F				Ø*	Ø	Ø			
inkberry	*Ilex glabra*	n			F	F		f/c		f/c			F		f/c	f/c		F		F	f/c		F	f/c		F	
jasmine species	*Jasminum spp.*	s	F*													f/c		F			f/c*	f/c					
jasmine species	*Gardenia spp.*	s	F*		F		f/c*	f/c		f/c*						f/c		f/c*			f/c*		f/c*	f/c*	f/c*		F*
jasmine, cape (gardenia)	*Gardenia jasminoides*	s	F		F		f/c	f/c		f/c		F*				f/c	f/c	f/c			f/c	f/c*	f/c	f/c	f/c		F
jessamine, Carolina	*Gelsemium sempervirens*	s								f/c								F				f/c		f/c			
juniper species	*Juniperus spp.*	n	F*	F	F	F	f/c*	f/c	F	f/c*	f/c*	F*	F	F	f/c	f/c	f/c	f/c*	F*	F	f/c	f/c*	f/c*	f/c*	f/c*	f/c	F	f/c
juniper, Chinese	*Juniperus chinensis*	n	F	F	F	F	f/c	f/c	F	f/c*	f/c	F*	F	F	f/c	f/c	f/c	f/c		F	f/c	f/c*	f/c	f/c*	f/c	F	f/c
juniper, creeping	*Juniperus horizontalis*	n	F	F	F	F	f/c	f/c	F	Ø*	f/c	F*	F	F	f/c	f/c	f/c	f/c	F*	F	f/c	f/c*	Ø*	Ø*	f/c	F	f/c
juniper, Greek	*Juniperus excelsa*	n		F	F	F		f/c	F				F	F	f/c	f/c	f/c	F		F	f/c				f/c	F	f/c
juniper, Japanese garden	*Juniperus procumbens*	n		F	F	F		f/c	F	f/c	f/c		F	F	f/c	f/c	f/c	F		F	f/c		f/c	f/c	f/c	F	f/c
juniper, Savin	*Juniperus sabina*	n		F	F	F	f/c	f/c	F	f/c*	f/c		F	F	f/c	f/c	f/c	f/c		F	f/c	f/c*	F	f/c*	f/c	F	f/c
juniper, shore	*Juniperus conferta*	n	F	F	F	F	F	f/c	F	f/c		F*	F	F	f/c	f/c	f/c	F		F	f/c	f/c*	F	f/c	f/c	F	f/c
juniper, singleseed	*Juniperus squamata*	n		F	F	F		f/c	F	f/c*		F*	F	F	f/c	f/c	f/c	F		F	f/c	f/c*	F	f/c*	f/c	F	f/c
laburnum (golden-chain tree)	*Laburnum anagyroides*	n						F																			
larch species	*Larix spp.*	n						F													f/c*					F*	
laurel, mountain	*Kalmia latifolia*	n				F				f/c			F				f/c	f/c						f/c	F	F	F
laurustinus	*Viburnum tinus*	s	F			F	f/c	F	F	F*		Ø	F			f/c		f/c			f/c		F*	F*	f/c	F	f/c
leucothoe species	*Leucothoe spp.*	n			F		f/c*	f/c	F	f/c*							f/c*	f/c*			f/c*		F*	f/c*	F*		F*
leucothoe, coast	*Leucothoe axillaris*	n			F		F	f/c	F	f/c							f/c	F			f/c		F	f/c	F		F
lilac, common	*Syringa vulgaris*	n			F	F	F		F	F			F			f/c	f/c	F			f/c		F	F	f/c	F	f/c
lilac, Persian	*Syringa x persica*	n			F	F			F				F			f/c		F			f/c						
linden (basswood)	*Tilia spp.*	n			F		F*		F				F				f/c								f/c*		

See text for other trade names of these herbicides.

Table 3. Preemergence Herbicides Registered for Use on Woody Ornamentals, continued

F = registered for use in the field (or landscape)
C = registered for use in containers
f/c= registered for both field and container use
Ø = label prohibits use on this species
F*, C*, or f/c* = registered for some species or cultivars; consult label for details.
Ø* = prohibited for some cultivars within a species; consult label for details.

s = southern or western species
n = northern--zone 6 or lower (Arnold Zone)

Common Name	Genus and species		Barricade	Betasan#	Dyclomec#	Dacthal#	Derby	Devrinol	Eptam	Gallery	Goal	Image	Kerb	Lasso	Lasso II	OH2	Pendulum#	Pennant	Predict	Princep#	Ronstar G	Rout	Snapshot DF	Snapshot TG	Surflan	Trifluralin#	XL
locust species	*Robinia spp.*	n			F	F												F								F*	
magnolia species	*Magnolia spp.*	n			F	F			F	f/c*			F			f/c	f/c*	F	F*		f/c		F*	f/c*	F*		F*
magnolia, southern	*Magnolia grandiflora*	n			F	F			F	f/c			F			f/c	f/c	F	F		f/c		F	f/c	F		F
mahonia species	*Mahonia spp.*	s								f/c*						f/c*				F	f/c*	f/c*		f/c*	F*		F*
maple species	*Acer spp.*	n	F*		F	F	F*	F	F	f/c*			F			f/c	f/c*	F	F*		f/c		F*	f/c*	F	F*	F
maple, amur	*Acer ginnala*	n			F	F		F	F	F			F			f/c		F			f/c		F	f/c	F		F
maple, Japanese	*Acer palmatum*	n	F		F	F	F	F	F	f/c			F			f/c	f/c	F			f/c			f/c	F		F
maple, Norway	*Acer platanoides*	n	F		F	F	F	F	F				F			f/c	f/c	F			f/c				F	F	F
maple, red	*Acer rubrum*	n			F	F	f/c	F	F	F			F			f/c	f/c	f/c	F		f/c		F	F	F	F	F
maple, silver	*Acer saccharinum*	n			F	F	F	F	F	f/c			F			f/c		F			f/c		F	f/c	F	F	F
maple, sugar	*Acer saccharum*	n			F	F	F	F	F				F			f/c	f/c	F			f/c				F	F	F
mockorange	*Philadelphus spp.*	n			F	F							F												f/c	F	f/c
mountain-ash species	*Sorbus spp.*	n			F		F*						F														
mulberry, white	*Morus alba*	n								F													F	F			
myoporum species	*Myoporum spp.*	s																			f/c*				F*	F	F*
myrtle, common crape	*Lagerstroemia indica*	s	F				F	f/c		f/c		F*					f/c	F	F		f/c		f/c	f/c	f/c		
myrtle, wax	*Myrica cerifera*	n					f/c			f/c		F					f/c	f/c						f/c			
nandina (heavenly bamboo)	*Nandina domestica*	n	F		F		f/c	f/c		f/c							f/c	F			f/c	f/c*	f/c	f/c	F		F
ninebark	*Physocarpus opulifolius*	n																F									
oak species	*Quercus spp.*	n	F*		F	F	f/c*	F*	F	f/c*			F			f/c	f/c*	F	F*	F*	f/c		f/c*	f/c*	f/c	F*	F
oak, live	*Quercus virginiana*	s			F	F			F	f/c			F			f/c	f/c	F			f/c			f/c	f/c		F
oak, pin	*Quercus palustris*	n			F	F		F	F	F			F			f/c	f/c	F	F		f/c		F	F	f/c	F	F
oak, red	*Quercus rubra*	n	F		F	F	F		F	f/c			F			f/c		F		F	f/c		f/c	F	f/c	F	F
oak, scarlet	*Quercus coccinea*	n			F	F	F		F				F			f/c		F			f/c				f/c	F	F

See text for other trade names of these herbicides.

Table 3. Preemergence Herbicides Registered for Use on Woody Ornamentals, continued

F = registered for use in the field (or landscape)
C = registered for use in containers
f/c= registered for both field and container use
Ø = label prohibits use on this species
F*, C*, or f/c* = registered for some species or cultivars; consult label for details.
Ø* = prohibited for some cultivars within a species; consult label for details.

s = southern or western species
n = northern--zone 6 or lower (Arnold Zone)

Common Name	Genus and species		Barricade	Betasan#	Dyclomec#	Dacthal#	Derby	Devrinol	Eptam	Gallery	Goal	Image	Kerb	Lasso	Lasso II	OH2	Pendulum#	Pennant	Predict	Princep#	Ronstar G	Rout	Snapshot DF	Snapshot TG	Surflan	Trifluralin#	XL
oak, water	*Quercus nigra*	n			F	F			F				F			f/c	f/c	F			f/c				f/c		F
oak, white	*Quercus alba*	n			F	F			F				F			f/c		F			f/c				f/c		F
oak, willow	*Quercus phellos*	n			F	F	f/c		F	f/c			F			f/c	f/c	f/c	F		f/c		F	f/c	f/c		F
oleander	*Nerium oleander*	s						F		f/c*						f/c	f/c	F			f/c	f/c	f/c	f/c*	f/c		f/c
olive	*Olea spp.*	s	F*					F		F*	F*													F			F*
osmanthus species	*Osmanthus spp.*	n			F			F		f/c*							f/c*	F			f/c*	f/c*		f/c*			F*
osmanthus (false-holly)	*Osmanthus heterophyllus*	n			F			F										F			f/c	f/c*			F		F
paxistima (pachistima)	*Paxistima canbyi*	n			F	F																					
pea-shrub, Siberian	*Caragana arborescens*	n			F															F							
peach, common	*Prunus persica*	n	F*		F*			F		F	F*		F			f/c	f/c	F						F		F	
pear species	*Pyrus spp.*	n			F*		F*	F		F	F*		F					F	F*				F	F	F*		F*
pear, Bradford	*Pyrus calleryana 'Bradford'*	n	F				F	F					F					F									
pecan	*Carya illinoinensis*	n			F			F		F	F*								F*				F	F	f/c		
photinia, fraser (red-tip)	*Photinia x fraseri*	s	F		F			f/c		f/c		F				f/c	f/c	F			f/c	f/c	f/c	f/c	f/c		f/c
photinia, smooth	*Photinia glabra*	s			F		f/c	f/c								f/c		F									
pine species	*Pinus spp.*	n	F*			F	f/c*	f/c	F	f/c*	F*		F			f/c	f/c*	f/c*		F*	f/c	f/c*	F*	f/c*	f/c	F*	F
pine, Austrian	*Pinus nigra*	n	F			F		f/c	F	f/c	F		F			f/c	f/c	F		F	f/c			f/c	f/c	F	F
pine, Japanese black	*Pinus thunbergiana*	n	F			F	f/c	f/c	F	F			F			f/c		f/c			f/c	f/c	F	F	f/c	F	F
pine, loblolly	*Pinus taeda*	n				F		f/c	F		F		F			f/c	f/c	F			f/c				f/c	F	F
pine, longleaf	*Pinus palustris*	n				F		f/c	F		F		F			f/c		F			f/c				f/c		F
pine, Monterey	*Pinus radiata*	n	F	F		F		f/c	F	F	F		F			f/c		F			f/c	f/c	F	F	f/c		
pine, mugo	*Pinus mugo*	n				F	F	f/c	F	f/c	F		F			f/c	f/c	F		F	f/c	f/c*		f/c*	f/c		F
pine, red (Norway)	*Pinus resinosa*	n				F		f/c	F				F			f/c		F		F	f/c				f/c	F	F
pine, Scotch	*Pinus sylvestris*	n	F			F	F	f/c	F	f/c	F		F			f/c	f/c	F		F	f/c	f/c	F	f/c	f/c	F	F

See text for other trade names of these herbicides.

Table 3. Preemergence Herbicides Registered for Use on Woody Ornamentals, continued

F = registered for use in the field (or landscape)
C = registered for use in containers
f/c= registered for both field and container use
Ø = label prohibits use on this species
F*, C*, or f/c* = registered for some species or cultivars; consult label for details.
Ø* = prohibited for some cultivars within a species; consult label for details.

s = southern or western species
n = northern--zone 6 or lower (Arnold Zone)

Common Name	Genus and species		Barricade	Betasan#	Dyclomec#	Dacthal#	Derby	Devrinol	Eptam	Gallery	Goal	Image	Kerb	Lasso	Lasso II	OH2	Pendulum#	Pennant	Predict	Princep#	Ronstar G	Rout	Snapshot DF	Snapshot TG	Surflan	Trifluralin#	XL
pine, scrub (Virginia)	*Pinus virginiana*	n				F	f/c	f/c	F		F		F			f/c	f/c	F			f/c				f/c		F
pine, slash	*Pinus elliottii*	s				F		f/c	F		F		F			f/c		F			f/c	f/c			f/c		F
pine, white	*Pinus strobus*	n	F			F	f/c	f/c	F	f/c	F		F			f/c	f/c	f/c		F	f/c	f/c	F	f/c	f/c	F	F
pistachio	*Pistacia spp.*	s	F*					F		F	F*																
pittosporum, Tobira	*Pittosporum tobira*	s	F		F	F	f/c	f/c		f/c						f/c	f/c	f/c			f/c	f/c*	F	f/c	F		
planetree, London	*Platanus x acerifolia*	n				F							F													F	
plum, cherry	*Prunus cerasifera*	n						F								f/c	f/c	F									
plum, Natal	*Carissa grandiflora*	s						F									f/c				f/c						
podocarpus species	*Podocarpus spp.*	n	F*			F	f/c*	f/c	F	F							f/c*	F			f/c*	f/c*	F	f/c*	F*		f/c*
poplar species	*Populus spp.*	n			F	F	F	F					F					F			f/c					F*	
poplar, tulip	*Liriodendron tulipifera*	n				F	F						F					F	F							F	
potentilla (cinquefoil)	*Potentilla spp.*	n				F	f/c			f/c*						f/c*	f/c*	F			f/c*	f/c*	f/c*	f/c*		F	
potentilla, bush	*Potentilla fruticosa*	n				F	f/c			f/c*						Ø*		F			f/c	f/c	f/c	f/c*		F	
privet species	*Ligustrum spp.*	n	F*	F	F	F	F*	f/c		f/c*		Ø	F			f/c	f/c*	f/c*			f/c	f/c*	f/c*	f/c*	f/c*	F	f/c*
privet, California	*Ligustrum ovalifolium*	n		F	F	F	F	f/c		F		Ø	F			f/c	f/c	F			f/c		F	F		F	
privet, Chinese	*Ligustrum sinense*	n		F	F	F		f/c				Ø	F			f/c	f/c	F			f/c	f/c*	f/c*			F	
privet, Japanese	*Ligustrum japonicum*	n	F	F	F	F	f/c	f/c		f/c		Ø	F			f/c	f/c	f/c			f/c	f/c*	f/c	f/c	f/c	F	f/c
privet, waxleaf	*Ligustrum lucidum*	n	F	F	F	F		f/c		f/c		Ø	F			f/c	f/c	F			f/c	f/c	f/c	f/c	f/c	F	f/c
pyracantha species	*Pyracantha spp.*	n	F*	F	F		F*	f/c		f/c*			F			f/c	f/c*	F			f/c*	f/c*	F*	f/c*	f/c*	F	f/c*
pyracantha, scarlet	*Pyracantha coccinea*	n	F		F		F	f/c					F			f/c	f/c	F			f/c				f/c	F	f/c
quince, flowering	*Chaenomeles speciosa*	n			F								F				f/c				f/c						
rain-tree (ohai)	*Samanea saman*	s																			f/c						
red-ivy	*Hemigraphis alternata*	s																									
redbud, eastern	*Cercis canadensis*	n				F				f/c			F			f/c						f/c	f/c	f/c	f/c	F	

See text for other trade names of these herbicides.

Table 3. Preemergence Herbicides Registered for Use on Woody Ornamentals, continued

F = registered for use in the field (or landscape)
C = registered for use in containers
f/c= registered for both field and container use
Ø = label prohibits use on this species
F*, C*, or f/c* = registered for some species or cultivars; consult label for details.
Ø* = prohibited for some cultivars within a species; consult label for details.

s = southern or western species
n = northern--zone 6 or lower (Arnold Zone)

Common Name	Genus and species		Barricade	Betasan#	Dyclomec#	Dacthal#	Derby	Devrinol	Eptam	Gallery	Goal	Image	Kerb	Lasso	Lasso II	OH2	Pendulum#	Pennant	Predict	Princep#	Ronstar G	Rout	Snapshot DF	Snapshot TG	Surflan	Trifluralin#	XL
redroot	*Ceanothus americanus*	n								F							f/c				f/c		F	F	f/c	F	f/c
rhododendron species	*Rhododendron spp.*	n	F*		F	F	f/c*	f/c	F	f/c*			F			f/c	f/c	f/c*			f/c*	f/c*	f/c*	f/c*	f/c	F	f/c
rhododendron, Carolina	*Rhododendron carolinianum*	n				F		f/c	F	Ø			F			f/c	f/c	F			f/c		Ø	Ø	f/c	F	f/c
rhododendron, Catawba	*Rhododendron catawbiense*	n				F	f/c	f/c	F	Ø*			F			f/c	f/c	f/c			f/c		Ø*	Ø*	f/c	F	f/c
rhododendron, rosebay	*Rhododendron maximum*	n				F	f/c	f/c	F	F			F			f/c	f/c	F			f/c		f/c	F	f/c	F	f/c
rockrose	*Cistus spp.*	s			F																f/c*					F	
rose species	*Rosa spp.*	n	F*		F	F	F	f/c	F	F*								F			f/c		F*	F*	F	F	F
rose-of-sharon (althea)	*Hibiscus syriacus*	n						f/c		F							f/c	F			f/c*		F	F	F		F
russian-olive	*Elaeagnus angustifolia*	n			F	F	F			f/c								F		F	f/c		f/c	f/c	f/c		
senna	*Cassia spp.*	s	F*							f/c*														f/c*			
shrimp plant	*Justicia brandegeana*	s	F																		f/c				f/c		f/c
smokebush	*Cotinus coggygria*	n								f/c														f/c			
snowberry	*Symphoricarpos albus*	n					F											F									
sourwood	*Oxydendrum arboreum*	n	F				f/c			f/c							f/c							f/c			
spirea species	*Spiraea spp.*	n			F	F	F			f/c*			F			f/c	f/c*	F				f/c*	F*	f/c*		F*	
spirea, Vanhoutte	*Spiraea vanhouttei*	n			F	F	F			f/c			F			f/c	f/c	F					F	f/c		F	
spruce species	*Picea spp.*	n	F*			F	F*	F	F	f/c*	F*		F			f/c	f/c*	F			f/c	f/c*	F*		F*	F*	f/c*
spruce, Colorado blue	*Picea pungens*	n				F	F	F	F	f/c*	F		F			f/c	f/c	F		F	f/c	f/c*	F	f/c*	f/c	F	f/c
spruce, Norway	*Picea abies*	n	F			F	F	F	F	F	F		F			f/c	f/c	F		F	f/c*	f/c*	F	F	F	F	F
spruce, red	*Picea rubens*	n				F		F	F				F			f/c		F		F	f/c						
spruce, white	*Picea glauca*	n				F	F	F	F	F*	F*		F			f/c	f/c	F		F	f/c*	f/c*	F*	F*	F	F	F
St. Johnswort	*Hypericum spp.*	n		F				F								f/c	f/c*	F			f/c	f/c	F	F		F	F
star-jasmine	*Trachelospermum jasminoides*	s		F				f/c				F									f/c	f/c			F		F
sweetgum, American	*Liquidambar styraciflua*	n				F				F			F				f/c	F					F	F	f/c	F	f/c

See text for other trade names of these herbicides.

Table 3. Preemergence Herbicides Registered for Use on Woody Ornamentals, continued

F = registered for use in the field (or landscape)
C = registered for use in containers
f/c= registered for both field and container use
Ø = label prohibits use on this species
F*, C*, or f/c* = registered for some species or cultivars; consult label for details.
Ø* = prohibited for some cultivars within a species; consult label for details.

s = southern or western species
n = northern--zone 6 or lower (Arnold Zone)

Common Name	Genus and species		Barricade	Betasan#	Dyclomec#	Dacthal#	Derby	Devrinol	Eptam	Gallery	Goal	Image	Kerb	Lasso	Lasso II	OH2	Pendulum#	Pennant	Predict	Princep#	Ronstar G	Rout	Snapshot DF	Snapshot TG	Surflan	Trifluralin#	XL
sycamore	*Platanus occidentalis*	n				F				F			F				f/c		F				F			F	
tree-ivy	*Fatshedera lizei*	s																							f/c		f/c
tupelo, black	*Nyssa sylvatica*	n																								F	
viburnum species	*Viburnum spp.*	n	F*			F	f/c	F	F	f/c*		Ø	F			f/c		f/c			f/c*	f/c*	F*	f/c*	f/c*	F	F*
viburnum, Sandankwa	*Viburnum suspensum*	n				F	f/c	F	F			Ø	F			f/c		f/c			f/c				F	F	F
viburnum, Wright	*Viburnum wrightii*	n	F			F	f/c	F	F			Ø	F			f/c		f/c			f/c					F	
walnut species	*Juglans spp.*	n	F*		F*	F		F*		F*	F*		F				f/c*		F						F*	F*	
walnut, black	*Juglans nigra*	n	F			F		F		F	F*		F				f/c		F							F	
weigela species	*Weigela spp.*	n	F*		F	F				F*						f/c		F				f/c*	F*	F*	F*	F	F*
willow species	*Salix spp.*	n			F	F	F			F*			F				f/c*	F					F*	F*		F	
witchazel	*Hamamelis virginiana*	n																			f/c						
yew species	*Taxus spp.*	n			F	F	f/c*	F	F	F*	f/c		F	F	F	f/c	f/c*	f/c*		F	f/c	f/c*	F*	F*	F*	F*	F*
yew, American	*Taxus canadensis*	n			F	F		F	F		f/c		F	F	F	f/c		F		F	f/c						
yew, Anglojap	*Taxus x media*	n	F		F	F		F	F		f/c		F	F	F	f/c	f/c	F		F	f/c	f/c*			F	F	
yew, Japanese	*Taxus cuspidata*	n	F		F	F	f/c	F	F	F	f/c		F	F	F	f/c	f/c	f/c		F	f/c		F	F	F	F	F

See text for other trade names of these herbicides.

Table 4. Postemergence Herbicides Registered for Use on Woody Ornamentals

OT = registered for over-the-top use.
D = registered for directed applications to the base of the plant.
O* = registered for over-the-top use on certain species within the genus; consult label for more detailed information.
D* = registered for directed applications on certain species within the genus; consult label for more detailed information.

s = southern or western species
n = northern--zone 6 or lower (Arnold Zone)

Common Name	Genus species		Acclaim	Basagran	Casoron*	DeMoss	Finale	Fusilade*	Goal	Gramoxone	Kerb*	Prism	Redeem*	Reward	Roundup*	Sharpshooter	Stinger	Ornamec*	Vantage
abelia, glossy	*Abelia x grandiflora*	n				D	D	OT		D		OT		D	D	D		OT	OT
almond, flowering	*Prunus glandulosa*	n				D	D			D				D	D	D			
andromeda species	*Pieris spp.*	n				D	D	O*		D				D	D	D		O*	
andromeda, Japanese	*Pieris japonica*	n				D	D	OT		D				D	D	D		OT	
anise tree	*Illicium spp.*	s				D	D			D				D	D	D			
apple, common	*Malus x domestica*	n				D	D		D*	D		O*		D	D	D			
arborvitae species	*Thuja spp.*	n		D*	OT	D	D	O*	O*	D	OT			D	D	D		O*	O*
arborvitae, American	*Thuja occidentalis*	n		D	OT	D	D	OT	OT	D	OT			D	D	D		OT	O*
arborvitae, Oriental	*Playtcladus orientalis*	n			OT	D	D	OT	OT	D	OT			D	D	D		OT	OT
ash species	*Fraxinus spp.*	n		D*	OT	D	D	O*		D	OT			D	D	D		O*	O*
ash, green	*Fraxinus pennsylvanica*	n		D	OT	D	D	OT		D	OT			D	D	D			OT
ash, white	*Fraxinus americana*	n			OT	D	D	OT		D	OT			D	D	D			OT
azalea spp.	*Rhododendron spp. (azalea)*	n	OT	D	O*	D	D	D*		D	OT	OT		D	D	D		D*	O*
azalea, Chinese	*Rhododendron molle*	n	OT	D	O*	D	D			D	OT	OT		D	D	D			O*
azalea, Hiryu	*Rhododendron obtusum*	n	OT	D	O*	D	D	D*		D	OT	OT		D	D	D		D	O*
azalea, Macranthum	*Rhododendron indicum*	n	OT	D	O*	D	D	D*		D	OT	OT		D	D	D		D	O*
barberry species	*Berberis spp.*	n	OT		OT	D	D	O*		D	OT	O*		D	D	D		O*	O*
barberry, wintergreen	*Berberis julianae*	n	OT		OT	D	D			D	OT			D	D	D			
basswood (linden)	*Tilia spp.*	n				D	D	OT		D	OT			D	D	D			O*
bearberry (kinnikinick)	*Arctostaphylos uva-ursi*	n				D	D	OT		D				D	D	D		OT	
beautybush	*Kolkwitzia amabilis*	s			OT	D	D			D				D	D	D			
beech species	*Fagus spp.*	n				D	D			D	OT			D	D	D			
birch, European white	*Betula pendula*	n			OT	D	D	OT		D	OT			D	D	D			OT
birch, paper	*Betula papyrifera*	n		D	OT	D	D			D	OT	OT		D	D	D			OT
birch, river	*Betula nigra*	n			OT	D	D	D		D	OT			D	D	D		D	OT
bird's-eye bush	*Ochna serrulata*	n				D	D			D				D	D	D			OT
bottlebrush	*Callistemon spp.*	s				D	D	O*		D				D	D	D		D*	O*
bougainvillea	*Bougainvillea spp.*	s				D	D	OT		D				D	D	D		OT	OT
boxelder	*Acer negundo*	s			OT	D	D			D				D	D	D			

* See text for other trade names of these herbicides.

Table 4. Postemergence Herbicides Registered for Use on Woody Ornamentals, continued

OT = registered for over-the-top use.
D = registered for directed applications to the base of the plant.
O* = registered for over-the-top use on certain species within the genus; consult label for more detailed information.
D* = registered for directed applications on certain species within the genus; consult label for more detailed information.

s = southern or western species
n = northern--zone 6 or lower (Arnold Zone)

Common Name	Genus species		Acclaim	Basagran	Casoron*	DeMoss	Finale	Fusilade*	Goal	Gramoxone	Kerb*	Prism	Redeem*	Reward	Roundup*	Sharpshooter	Stinger	Ornamec*	Vantage
boxwood species	*Buxus spp.*	n	O*	D*	OT	D	D	O*		D	OT	O*		D	D	D		O*	O*
boxwood, common	*Buxus sempervirens*	n		D	OT	D	D	OT		D	OT	OT		D	D	D		OT	OT
boxwood, harland	*Buxus harlandii*	n			OT	D	D			D	OT			D	D	D			
boxwood, littleleaf	*Buxus microphylla*	n			OT	D	D	OT		D	OT			D	D	D		OT	OT
broom species	*Cytisus spp.*	n				D	D			D				D	D	D			
buckeye species	*Aesculus spp.*	n				D	D			D	OT			D	D	D			
camellia species	*Camellia spp.*	n		D*	OT	D	D	O*		D		O*		D	D	D		O*	O*
camellia, Japanese	*Camellia japonica*	s		D	OT	D	D	OT		D		OT		D	D	D		OT	OT
camellia, Sasanqua	*Camellia sasanqua*	s			OT	D	D	OT		D				D	D	D		OT	OT
cedar species	*Cedrus spp.*	s				D	D			D	OT			D	D	D			
cedar, Atlas	*Cedrus atlantica*	n				D	D			D	OT			D	D	D			
cedar, deodar	*Cedrus deodara*	n				D	D			D	OT			D	D	D			
cedar, Japanese	*Cryptomeria japonica*	n				D	D			D	OT			D	D	D			
cedar, eastern red	*Juniperus virginiana*	n			OT	D	D	D*	OT	D	OT		D	D	D	D		D*	O*
cherry species	*Prunus spp.*	n		D*		D	D	D*	D*	D	O*	O*		D	D	D		O*	O*
cherry, black	*Prunus serotina*	n				D	D			D	OT			D	D	D			OT
cherry, Higan	*Prunus subhirtella pendulata*	n				D	D			D	OT			D	D	D			
cherry, Japanese flowering	*Prunus serrulata*	n				D	D			D	OT			D	D	D			
cherry, purpleleaf sand	*Prunus x cistena*	n				D	D			D	OT			D	D	D			OT
cherry, sargent	*Prunus sargentii*	n				D	D			D	OT			D	D	D			
cherry, Yoshino	*Prunus yedoensis*	s				D	D			D	OT			D	D	D			
cherry-laurel, Carolina	*Prunus caroliniana*	n				D	D	O*		D				D	D	D		O*	O*
cherry-laurel, common	*Prunus laurocerasus*	n				D	D			D				D	D	D			
chestnut, Chinese	*Castanea mollissima*	s				D	D		D*	D				D	D	D			
citrus, ornamental	*Citrus spp.*	s				D	D	O*		D		O*		D	D	D		O*	
cleyera, Japanese	*Ternstroemia gymnanthera*	n			OT	D	D	OT		D				D	D	D		OT	OT
cotoneaster species	*Cotoneaster spp.*	n	OT	D*	OT	D	D	O*		D	OT			D	D	D		O*	O*
cotoneaster, bearberry	*Cotoneaster dammeri*	n	OT	D	OT	D	D	OT		D	OT			D	D	D		OT	OT
cotoneaster, cranberry	*Cotoneaster apiculatus*	n	OT	D	OT	D	D	OT		D	OT			D	D	D		OT	OT

* See text for other trade names of these herbicides.

Table 4. Postemergence Herbicides Registered for Use on Woody Ornamentals, continued

OT = registered for over-the-top use.
D = registered for directed applications to the base of the plant.
O* = registered for over-the-top use on certain species within the genus; consult label for more detailed information.
D* = registered for directed applications on certain species within the genus; consult label for more detailed information.

s = southern or western species
n = northern--zone 6 or lower (Arnold Zone)

Common Name	Genus species		Acclaim	Basagran	Casoron*	DeMoss	Finale	Fusilade*	Goal	Gramoxone	Kerb*	Prism	Redeem*	Reward	Roundup*	Sharpshooter	Stinger	Ornamec*	Vantage
cotoneaster, littleleaf	*Cotoneaster microphyllus*	n	OT		OT	D	D	OT		D	OT			D	D	D		OT	
cotoneaster, rockspray	*Cotoneaster horizontalis*	n	OT		OT	D	D			D	OT			D	D	D			
cotoneaster, willowleaf	*Cotoneaster salicifolius*	n	OT		OT	D	D	OT		D	OT			D	D	D		OT	
cottonwood, eastern	*Populus deltoides*	n			OT	D	D			D				D	D	D			
crabapple species	*Malus spp.*	n			OT	D	D	O*	D*	D	OT			D	D	D		O*	O*
crabapple, Japanese	*Malus floribunda*	n			OT	D	D	OT		D	OT			D	D	D		OT	
currant, alpine	*Ribes, alpinum*	n				D	D			D				D	D	D			
cypress species	*Cupressus spp.*	n				D	D			D				D	D	D			
cypress, bald	*Taxodium distichum*	n				D	D			D				D	D	D			
cypress, false	*Chamaecyparis spp.*	n	O*			D	D	O*		D				D	D	D		O*	
cypress, Hinoki	*Chamaecyparis obtusa*	n				D	D	OT		D				D	D	D		OT	
cypress, Italian	*Cupressus sempervirens*	n				D	D	OT		D				D	D	D		OT	OT
cypress, Japanese false	*Chamaecyparis pisifera*	n				D	D	D*		D				D	D	D		D*	
cypress, Leyland	*Cupressocyparis leylandii*	n				D	D	D		D				D	D	D		D	OT
deutzia species	*Deutzia spp.*	n			OT	D	D	O*		D				D	D	D		O*	
dogwood species	*Cornus spp.*	n	O*	D*	OT	D	D	O*		D	OT	O*		D	D	D		O*	O*
dogwood, flowering	*Cornus florida*	n	OT	D	OT	D	D	OT		D	OT	OT		D	D	D		OT	OT
dogwood, Korean	*Cornus kousa*	n			OT	D	D			D	OT			D	D	D			
dogwood, redosier	*Cornus sericea (stolonifera)*	n		D		D	D	OT		D	OT			D	D	D		OT	OT
elaeagnus species	*Elaeagnus spp.*	n		D*		D	D	O*		D				D	D	D		O*	O*
elaeagnus, thorny	*Elaeagnus pungens*	n				D	D			D				D	D	D			OT
elm species	*Ulmus spp.*	n			OT	D	D			D	OT			D	D	D			O*
elm, American	*Ulmus americana*	n			OT	D	D			D	OT			D	D	D			
elm, Siberian	*Ulmus pumila*	n			OT	D	D			D	OT			D	D	D			
eucalyptus species	*Eucalyptus spp.*	n				D	D	D*		D				D	D	D		D*	O*
euonymus species	*Euonymus spp.*	n	OT	D*	OT	D	D	D*		D	OT	OT		D	D	D			
euonymus, Japanese	*Euonymus japonica*	n	OT		OT	D	D	OT		D	OT	OT		D	D	D		OT	OT
euonymus, spreading	*Euonymus kiautschovica*	n	OT	D	OT	D	D	OT		D	OT	OT		D	D	D		OT	OT
euonymus, winged	*Euonymus alata*	n	OT		OT	D	D	D*		D	OT	OT		D	D	D		D*	OT

* See text for other trade names of these herbicides.

Table 4. Postemergence Herbicides Registered for Use on Woody Ornamentals, continued

OT = registered for over-the-top use.
D = registered for directed applications to the base of the plant.
O* = registered for over-the-top use on certain species within the genus; consult label for more detailed information.
D* = registered for directed applications on certain species within the genus; consult label for more detailed information.

s = southern or western species
n = northern--zone 6 or lower (Arnold Zone)

Common Name	Genus species		Acclaim	Basagran	Casoron*	DeMoss	Finale	Fusilade*	Goal	Gramoxone	Kerb*	Prism	Redeem*	Reward	Roundup*	Sharpshooter	Stinger	Ornamec*	Vantage
euonymus, wintercreeper	*Euonymus fortunei*	s	OT		OT	D	D	OT		D	OT	OT		D	D	D		OT	
fig species	*Ficus spp.*	n				D	D	O*	D*	D		O*		D	D	D		O*	O*
filbert (hazelnut)	*Corylus spp.*	n			OT	D	D		D*	D				D	D	D			
fir species	*Abies spp.*	n		D*		D	D	D*	O*	D	OT	O*	D*	D	D	D	O*	D*	O*
fir, balsam	*Abies balsamea*	n				D	D	OT		D	OT		D	D	D	D	OT		
fir, Douglas	*Pseudosuga menziesii*	n		D		D	D	OT	OT	D	OT	OT	D	D	D	D	OT	OT	OT
fir, fraser	*Abies fraseri*	n		D		D	D	D	OT	D	OT		D	D	D	D	OT	D	OT
fir, white (concolor)	*Abies concolor*	n				D	D	OT		D	OT			D	D	D		OT	OT
forsythia species	*Forsythia spp.*	n	OT	D*	OT	D	D	O*		D	OT			D	D	D		O*	O*
forsythia, border	*Forsythia intermedia*	n	OT		OT	D	D	OT		D	OT			D	D	D		OT	
ginkgo	*Ginko biloba*	s				D	D			D	OT			D	D	D			
golddust plant	*Aucuba spp.*	n				D	D	O*		D		OT		D	D	D		O*	
golden raintree	*Koelreuteria paniculata*	s			OT	D	D	OT		D				D	D	D			OT
grape-holly, Oregon	*Mahonia aquifolium*	n				D	D			D				D	D	D			
hackberry	*Celtis occidentalis*	n			OT	D	D	OT		D				D	D	D			OT
hawthorn species	*Crataegus spp.*	s	OT			D	D			D	OT			D	D	D			
hawthorn, Indian	*Raphiolepis indica*	n				D	D	OT		D	OT	OT		D	D	D		OT	OT
heath species	*Erica spp.*	n				D	D			D				D	D	D			
heather species	*Calluna spp.*	n			OT	D	D	O*		D				D	D	D		O*	
hemlock species	*Tsuga spp.*	n		D*		D	D	O*	O*	D	OT			D	D	D		O*	O*
hemlock, Canada	*Tsuga canadensis*	n		D		D	D	OT	OT	D	OT		D	D	D	D		OT	OT
hemlock, Carolina	*Tsuga caroliniana*	n				D	D			D	OT			D	D	D			
holly species	*Ilex spp.*	n	O*	D*	O*	D	D	O*		D	OT	OT		D	D	D		O*	O*
holly, American	*Ilex opaca*	n	OT		OT	D	D	OT		D	OT	OT		D	D	D		OT	
holly, blue boy/girl	*Ilex meserveae*	n	OT		OT	D	D	OT		D	OT	OT		D	D	D		OT	
holly, Chinese	*Ilex cornuta*	s		D	OT	D	D	OT		D	OT	OT		D	D	D		OT	O*
holly, dahoon	*Ilex cassine*	n			OT	D	D			D	OT	OT		D	D	D			
holly, English	*Ilex aquifolium*	n			OT	D	D			D	OT	OT		D	D	D			
holly, English x Chinese	*Ilex aquifolium x cornuta*	s			OT	D	D			D	OT	OT		D	D	D			

* See text for other trade names of these herbicides.

Table 4. Postemergence Herbicides Registered for Use on Woody Ornamentals, continued

OT = registered for over-the-top use.
D = registered for directed applications to the base of the plant.
O* = registered for over-the-top use on certain species within the genus; consult label for more detailed information.
D* = registered for directed applications on certain species within the genus; consult label for more detailed information.

s = southern or western species
n = northern--zone 6 or lower (Arnold Zone)

Common Name	Genus species		Acclaim	Basagran	Casoron*	DeMoss	Finale	Fusilade*	Goal	Gramoxone	Kerb*	Prism	Redeem*	Reward	Roundup*	Sharpshooter	Stinger	Ornamec*	Vantage
holly, Foster's hybrid	*Ilex x attenuata*	n			OT	D	D	OT		D	OT	OT		D	D	D		OT	
holly, Japanese	*Ilex crenata*	n	OT	D		D	D	OT		D	OT	OT		D	D	D		OT	O*
holly, lusterleaf	*Ilex latifolia*	n			OT	D	D			D	OT	OT		D	D	D			
holly, yaupon	*Ilex vomitoria*	n				D	D	OT		D	OT	OT		D	D	D		OT	OT
honeylocust, thornless	*Gleditsia triacanthos*	n		D		D	D	O*		D	OT			D	D	D		O*	O*
honeysuckle species	*Lonicera spp.*	n		D*	OT	D	D	D*		D		OT		D	D	D		D*	O*
hydrangea	*Hydrangea spp.*	n	OT			D	D	O*		D				D	D	D		O*	OT
inkberry	*Ilex glabra*	s				D	D	OT		D		OT		D	D	D		OT	
jasmine species	*Gardenia spp.*	s			OT	D	D	O*		D		OT		D	D	D		O*	O*
jasmine species	*Jasminum spp.*	s				D	D			D		OT		D	D	D			O*
jasmine, cape	*Gardenia jasminoides*	s				D	D	OT		D		OT		D	D	D		OT	OT
jasmine, star	*Trachelospermum jasminoides*	n				D	D	OT		D				D	D	D		OT	OT
jessamine, Carolina	*Gelsemium sempervirens*	n				D	D	OT		D				D	D	D		OT	OT
juniper species	*Juniperus spp.*	n	O*	D*	OT	D	D	D*	O*	D	OT	O*		D	D	D		D*	O*
juniper, Chinese	*Juniperus chinensis*	n		D	OT	D	D	D*	OT	D	OT	OT		D	D	D		D*	O*
juniper, creeping	*Juniperus horizontalis*	n		D	OT	D	D	D*	OT	D	OT	OT		D	D	D		D*	O*
juniper, Greek	*Juniperus excelsa*	n			OT	D	D			D	OT			D	D	D			
juniper, Japanese garden	*Juniperus procumbens*	n			OT	D	D		OT	D	OT			D	D	D		OT	
juniper, Savin	*Juniperus sabina*	n			OT	D	D	D*	OT	D	OT			D	D	D		D*	O*
juniper, shore	*Juniperus conferta*	n		D	OT	D	D	D*		D	OT	OT		D	D	D		D*	O*
juniper, singleseed	*Juniperus squamata*	n			OT	D	D			D	OT			D	D	D			
laburnum (golden-chaintree)	*Laburnum anagyroides*	n				D	D			D				D	D	D			
larch species	*Larix spp.*	s				D	D			D				D	D	D			O*
laurel, mountain	*Kalmia latifolia*	n			OT	D	D			D	OT			D	D	D			
laurustinus	*Viburnum tinus*	n	OT			D	D			D	OT			D	D	D			OT
leucothoe species	*Leucothoe spp.*	n			OT	D	D	D*		D				D	D	D			
leucothoe, coast	*Leucothoe axillaris*	n			OT	D	D			D				D	D	D		D	
lilac, common	*Syringa vulgaris*	n		D	OT	D	D			D	OT			D	D	D			OT
lilac, Persian	*Syringa x persica*	n			OT	D	D			D	OT			D	D	D			

* See text for other trade names of these herbicides.

Table 4. Postemergence Herbicides Registered for Use on Woody Ornamentals, continued

OT = registered for over-the-top use.
D = registered for directed applications to the base of the plant.
O* = registered for over-the-top use on certain species within the genus; consult label for more detailed information.
D* = registered for directed applications on certain species within the genus; consult label for more detailed information.

s = southern or western species
n = northern--zone 6 or lower (Arnold Zone)

Common Name	Genus species		Acclaim	Basagran	Casoron*	DeMoss	Finale	Fusilade*	Goal	Gramoxone	Kerb*	Prism	Redeem*	Reward	Roundup*	Sharpshooter	Stinger	Ornamec*	Vantage
linden (basswood)	*Tilia spp.*	n			OT	D	D	OT		D	OT			D	D	D			O*
locust species	*Robinia spp.*	n			OT	D	D			D				D	D	D			
magnolia species	*Magnolia spp.*	s	OT	D*	OT	D	D	D*		D	OT			D	D	D		D*	O*
magnolia, southern	*Magnolia grandiflora*	n	OT	D	OT	D	D	D		D	OT			D	D	D		D	OT
mahonia species	*Mahonia spp.*	n			OT	D	D	D*		D				D	D	D		O*	
maple species	*Acer spp.*	n	O*	D*	O*	D	D	D*		D	OT	OT		D	D	D		D*	O*
maple, Amur	*Acer ginnala*	n			OT	D	D	OT		D	OT	OT		D	D	D			
maple, Japanase	*Acer palmatum*	n	OT		OT	D	D	OT		D	OT	OT		D	D	D		OT	OT
maple, Norway	*Acer platanoides*	n			OT	D	D	OT		D	OT	OT		D	D	D		OT	
maple, red	*Acer rubrum*	n	OT	D	OT	D	D	D		D	OT	OT		D	D	D		D	OT
maple, silver	*Acer saccharinum*	n		D	OT	D	D	OT		D	OT	OT		D	D	D		OT	OT
maple, sugar	*Acer saccharum*	n			OT	D	D	OT		D	OT	OT		D	D	D			
mockorange	*Philadelphus spp.*	n			OT	D	D	O*		D	OT			D	D	D		O*	
mountain-ash species	*Sorbus spp.*	s			OT	D	D	O*		D	OT			D	D	D			O*
mulberry, white	*Morus alba*	s				D	D			D				D	D	D			
myoporum species	*Myoporum spp.*	n				D	D	O*		D				D	D	D		O*	O*
myrtle, common crape	*Lagerstroemia indica*	n				D	D	OT		D		OT		D	D	D		OT	OT
myrtle, wax	*Myrica cerifera*	s				D	D	OT		D				D	D	D		OT	
nandina (heavenly bamboo)	*Nandina domestica*	n	OT	D	OT	D	D	D		D		OT		D	D	D		D	OT
ninebark	*Physocarpus opulifolius*	n		D		D	D	OT		D				D	D	D		OT	OT
oak species	*Quercus spp.*	s		D*	OT	D	D	O*		D	OT	OT		D	D	D		O*	O*
oak, live	*Quercus virginiana*	n			OT	D	D	OT		D	OT	OT		D	D	D		OT	
oak, pin	*Quercus palustris*	n			OT	D	D	OT		D	OT	OT		D	D	D			
oak, red	*Quercus rubra*	n			OT	D	D			D	OT	OT		D	D	D			
oak, scarlet	*Quercus coccinea*	n			OT	D	D			D	OT	OT		D	D	D			
oak, water	*Quercus nigra*	n		D	OT	D	D			D	OT	OT		D	D	D			OT
oak, white	*Quercus alba*	n			OT	D	D			D	OT	OT		D	D	D			OT
oak, willow	*Quercus phellos*	s		D	OT	D	D			D	OT	OT		D	D	D			
oleander	*Nerium oleander*	s	OT			D	D	D*		D				D	D	D		D	OT

* See text for other trade names of these herbicides.

Table 4. Postemergence Herbicides Registered for Use on Woody Ornamentals, continued

OT = registered for over-the-top use.
D = registered for directed applications to the base of the plant.
O* = registered for over-the-top use on certain species within the genus; consult label for more detailed information.
D* = registered for directed applications on certain species within the genus; consult label for more detailed information.

s = southern or western species
n = northern--zone 6 or lower (Arnold Zone)

Common Name	Genus species		Acclaim	Basagran	Casoron*	DeMoss	Finale	Fusilade*	Goal	Gramoxone	Kerb*	Prism	Redeem*	Reward	Roundup*	Sharpshooter	Stinger	Ornamec*	Vantage
olive	*Olea spp.*	n				D	D	O*	D*	D		O*		D	D	D		O*	O*
olive, Russian	*Elaeagnus angustifolia*	n		D		D	D	OT		D		OT		D	D	D		OT	OT
osage orange	*Maclura pomifera*	n				D	D			D				D	D	D			OT
osmanthus (false-holly)	*Osmanthus heterophyllus*	n			OT	D	D			D				D	D	D			OT
osmanthus species	*Osmanthus spp.*	n			OT	D	D	O*		D				D	D	D		O*	O*
paxistima (pachistima)	*Paxistima canbyi*	n			OT	D	D			D				D	D	D			
pea-shrub, Siberian	*Caragana arborescens*	n				D	D			D				D	D	D			
peach, common	*Prunus persica*	n				D	D		D*	D		O*		D	D	D			
pear species	*Pyrus spp.*	s				D	D		D*	D	OT	O*		D	D	D		O*	O*
pear, Bradford	*Pyrus calleryana 'Bradford'*	s				D	D	OT		D	OT			D	D	D		OT	
pecan	*Carya illinoinensis*	n				D	D		D*	D		O*		D	D	D			
photinia, fraser (red-tip)	*Photinia fraseri*	n	OT		OT	D	D	OT		D		OT		D	D	D		OT	OT
photinia, smooth	*Photinia glabra*	n	OT		OT	D	D			D		OT		D	D	D			OT
pine species	*Pinus spp.*	n		D*		D	D	O*	O*	D	OT	OT		D	D	D	O*	O*	O*
pine, Austrian	*Pinus nigra*	n		D		D	D	OT	OT	D	OT	OT		D	D	D		OT	OT
pine, Japanese black	*Pinus thunbergii*	n		D		D	D			D	OT	OT		D	D	D			OT
pine, loblolly	*Pinus taeda*	n		D		D	D	OT	OT	D	OT	OT		D	D	D			OT
pine, longleaf	*Pinus palustris*	n		D		D	D	OT	OT	D	OT	OT		D	D	D			OT
pine, Monterey	*Pinus radiata*	n				D	D		OT	D	OT	OT		D	D	D			
pine, mugo	*Pinus mugo*	n		D		D	D	OT	OT	D	OT	OT		D	D	D		OT	OT
pine, red (Norway)	*Pinus resinosa*	s		D		D	D	OT		D	OT	OT		D	D	D		OT	OT
pine, Scotch	*Pinus sylvestris*	n		D		D	D	OT	OT	D	OT	OT	D	D	D	D		OT	OT
pine, scrub (Virginia)	*Pinus virginiana*	s		D		D	D	OT	OT	D	OT	OT		D	D	D			OT
pine, slash	*Pinus elliottii*	s		D		D	D	OT	OT	D	OT	OT		D	D	D			OT
pine, white	*Pinus strobus*	n	OT	D		D	D	OT	OT	D	OT	OT	D	D	D	D	OT	OT	OT
pistachio	*Pistacia spp.*	n				D	D		D*	D		O*		D	D	D			
pittosporum, Tobira	*Pittosporum tobira*	n				D	D	OT		D		OT		D	D	D		OT	OT
planetree, London	*Platanus x acerifolia*	n				D	D	OT		D				D	D	D			
plum, cherry	*Prunus cerasifera*	n				D	D			D				D	D	D			

* See text for other trade names of these herbicides.

Table 4. Postemergence Herbicides Registered for Use on Woody Ornamentals, continued

OT = registered for over-the-top use.
D = registered for directed applications to the base of the plant.
O* = registered for over-the-top use on certain species within the genus; consult label for more detailed information.
D* = registered for directed applications on certain species within the genus; consult label for more detailed information.

s = southern or western species
n = northern--zone 6 or lower (Arnold Zone)

Common Name	Genus species		Acclaim	Basagran	Casoron*	DeMoss	Finale	Fusilade*	Goal	Gramoxone	Kerb*	Prism	Redeem*	Reward	Roundup*	Sharpshooter	Stinger	Ornamec*	Vantage
plum, Natal	*Carissa grandiflora*	n				D	D	OT		D				D	D	D		OT	OT
podocarpus species	*Podocarpus spp.*	n				D	D	D*		D		OT		D	D	D		D*	O*
poplar species	*Populus spp.*	n		D*	OT	D	D			D	OT			D	D	D			O*
poplar, tulip	*Liriodendron tulipifera*	n				D	D			D	OT			D	D	D			OT
potentilla (cinquefoil)	*Potentilla spp.*	n				D	D	D*		D		OT		D	D	D		D*	O*
potentilla, bush	*Potentilla fruticosa*	n				D	D	O*		D		OT		D	D	D		OT	
privet species	*Ligustrum spp.*	n	OT		OT	D	D	D*		D	OT	OT		D	D	D		O*	O*
privet, California	*Ligustrum ovalifolium*	n	OT		OT	D	D	OT		D	OT	OT		D	D	D		OT	
privet, Chinese	*Ligustrum sinense*	n	OT		OT	D	D			D	OT	OT		D	D	D			
privet, Japanese	*Ligustrum japonicum*	n	OT		OT	D	D	D*		D	OT	OT		D	D	D		D	OT
privet, waxleaf	*Ligustrum lucidum*	s	OT		OT	D	D	OT		D	OT	OT		D	D	D			OT
pyracantha species	*Pyracantha spp.*	s	O*		OT	D	D	O*		D		OT		D	D	D		O*	O*
pyracantha, scarlet	*Pyracantha coccinea*	n			OT	D	D	OT		D		OT		D	D	D		OT	
quince, flowering	*Chaenomeles speciosa*	n			OT	D	D	OT		D	OT			D	D	D			
rain-tree (ohai)	*Samanea saman*	n				D	D			D				D	D	D			
red-ivy	*Hemigraphis alternata*	n				D	D	OT		D				D	D	D		OT	
redbud, eastern	*Cercis canadensis*	n				D	D	OT		D	OT			D	D	D		OT	
redroot	*Ceanothus americanus*	n				D	D			D				D	D	D			
rhododendron species	*Rhododendron spp.*	s	OT	D	O*	D	D	D*		D	OT	OT		D	D	D		D*	O*
rhododendron, Carolina	*Rhododendron carolinianum*	n	OT	D	OT	D	D			D	OT	OT		D	D	D			O*
rhododendron, Catawba	*Rhododendron catawbiense*	n	OT	D	OT	D	D	O*		D	OT	OT		D	D	D		OT	O*
rhododendron, rosebay	*Rhododendron maximum*	n	OT	D	OT	D	D			D	OT	OT		D	D	D			O*
rockrose	*Cistus spp.*	s			OT	D	D	O*		D				D	D	D		O*	
rose species	*Rosa spp.*	s	OT		OT	D	D	OT		D		OT		D	D	D		O*	
rose-of-sharon (althea)	*Hibiscus syriacus*	n				D	D	OT		D				D	D	D		OT	
senna	*Cassia spp.*	n				D	D	D*		D				D	D	D		D*	O*
shrimp plant	*Justicia brandegeana*	n				D	D	D		D				D	D	D		D	OT
smokebush	*Cotinus coggygria*	n				D	D			D				D	D	D			
snowberry	*Symphoricarpos albus*	n				D	D			D				D	D	D			

* See text for other trade names of these herbicides.

Table 4. Postemergence Herbicides Registered for Use on Woody Ornamentals, continued

OT = registered for over-the-top use.
D = registered for directed applications to the base of the plant.
O* = registered for over-the-top use on certain species within the genus; consult label for more detailed information.
D* = registered for directed applications on certain species within the genus; consult label for more detailed information.

s = southern or western species
n = northern--zone 6 or lower (Arnold Zone)

Common Name	Genus species		Acclaim	Basagran	Casoron*	DeMoss	Finale	Fusilade*	Goal	Gramoxone	Kerb*	Prism	Redeem*	Reward	Roundup*	Sharpshooter	Stinger	Ornamec*	Vantage
sourwood	*Oxydendrum arboreum*	n				D	D			D				D	D	D			
spirea species	*Spiraea spp.*	n		D*	OT	D	D	D*		D	OT	O*		D	D	D		D*	O*
spirea, Vanhoutte	*Spiraea vanhouttei*	n			OT	D	D	D*		D	OT			D	D	D		D	OT
spruce species	*Picea spp.*	n		D*		D	D	O*	O*	D	OT		D*	D	D	D	O*	O*	O*
spruce, Colorado blue	*Picea pungens*	n		D		D	D	OT	OT	D	OT		D	D	D	D		OT	OT
spruce, Norway	*Picea abies*	n		D		D	D	OT	OT	D	OT			D	D	D		OT	OT
spruce, red	*Picea rubens*	s				D	D			D	OT			D	D	D			
spruce, white	*Picea glauca*	n		D		D	D	OT	O*	D	OT		D	D	D	D		OT	OT
St. Johnswort	*Hypericum spp.*	n				D	D			D				D	D	D			O*
sweetgum, American	*Liquidambar styraciflua*	s		D		D	D	OT		D	OT	OT		D	D	D		OT	OT
sycamore	*Platanus occidentalis*	n		D		D	D	OT		D	OT			D	D	D			OT
tree-ivy	*Fatshedera lizei*	n				D	D	OT		D				D	D	D		OT	
tupelo, black	*Nyssa sylvatica*	n				D	D			D				D	D	D			
viburnum species	*Viburnum spp.*	n	OT	D*		D	D	D*		D	OT			D	D	D		O*	O*
viburnum, Sandankwa	*Viburnum suspensum*	n	OT			D	D	OT		D	OT			D	D	D		OT	OT
viburnum, Wright	*Viburnum wrightii*	n	OT			D	D			D	OT			D	D	D			
walnut species	*Juglans spp.*	n				D	D		D*	D	OT			D	D	D			O*
walnut, black	*Juglans nigra*	n				D	D		D*	D	OT			D	D	D			OT
weigela species	*Weigela spp.*	n	OT		OT	D	D	O*		D	OT			D	D	D		O*	OT
willow species	*Salix spp.*	n	OT		O*	D	D	D*		D				D	D	D		D*	O*
witchhazel	*Hamamelis virginiana*	n				D	D			D				D	D	D			
yew species	*Taxus spp.*	n	OT	D*	OT	D	D	O*	OT	D	OT			D	D	D		O*	O*
yew, American	*Taxus canadensis*	n	OT		OT	D	D		OT	D	OT			D	D	D			
yew, Anglojap	*Taxus x media*		OT		OT	D	D	OT	OT	D	OT			D	D	D		OT	
yew, Japanese	*Taxus cuspidata*		OT	D	OT	D	D	OT	OT	D	OT			D	D	D		OT	O*

* See text for other trade names of these herbicides.

Table 5. Preemergence Herbicides Registered for Use on Herbaceous Ornamentals

(Bedding Plants, Bulbs, Cutflowers, Perennials, and Groundcovers)

R = Registered for this species. Can be applied over the top.
D = Registered for this species. Directed application only.
I = Registered, but research indicates that injury can occur.
P = Label PROHIBITS use on this species.
R*, D* = Registered for some species; check label for details.

Common Name	Genus		Barricade	Betasan*	Dacthal*	Derby	Devrinol	Eptam	Gallery	Image	OH II	Pendulum*	Pennant	Ronstar G	Rout	Snapshot DF	Snapshot TG	Surflan	Trifluralin*	XL
African daisy	*Arctotis*	ann					R												R	
African lily	*Agapanthus*	ann	R				R						R	R*				R*		R*
African violet	*Saintpaulia*	ann			R															
Ageratum	*Ageratum*	ann			R		R	R				R*	R						R	
Allium	*Allium*	per						P					R							
Ajuga	*Ajuga*	per		R	P		R	R	P			R*	R	R*		P	P	R		
Alyssum (Golddust)	*Aurinia*	per		R	R								R							
Amaranthus	*Amaranthus*	ann						R												
Asparagus fern	*Asparagus*	ann					R					R							R	
Aster	*Callistephus*	ann		R	R		R	R				R							R	
Astilbe	*Astilbe*	per											-					R		
Baby-blue-eyes	*Nemophila*																			
Baby's breath	*Gypsophila*	per			R							R			R			R*		
Bachelor's button	*Centaurea*	ann		R															R	
Balsam	*Impatiens*	ann						R											R	
Beardtongue	*Penstemon*	per										R								
Begonia, fibrous	*Begonia*	ann						R												
Bellflower	*Campanula*	per		R	R								R*					R	R	
Bird of paradise	*Strelitzia*	ann					R											R*		R*
Black-eyed susan	*Rudbeckia*	per										R						R	R	
Bleeding heart	*Dicentra*	per			R													R		
Bluebells	*Mertensia*																			
Bugleweed (Ajuga)	*Ajuga*	per		R	P		R	R	P			R*	R	R*		P	P	R		
Burnet	*Sanguisorba*	per																		
Butterflyweed	*Asclepias*	per										R*	R							
Cactus	*Cactus*	per																		
Calendula	*Calendula*	ann		R															R	
Calliopsis	*Coreopsis*	per										R*	R						R	
Candytuft	*Iberis*	per		R	R				P					R*	R*	P	P			
Canna	*Canna*	ann										R*	R*							
Cape marigold	*Dimorphotheca*	ann	R											R				R	R	R
Carex	*Carex*	per				R			R			R	R				R			
Carnation	*Dianthus*	per			P			R						R					R	
Catchfly	*Silene*	ann																		
Chamomile	*Matricaria*	ann																		
Chives, ornamental	*Allium*	per											R							
Chrysanthemum	*Chrysanthemum*	ann			R		R	R					R	R				R	R	R*
Cockscomb	*Celosia*	ann										R*								
Coleus	*Coleus*	ann			R															
Columbine	*Aquilegia*	per			R								R							
Coneflower	*Echinacea*	per			R													R*		
Coral bell	*Heuchera*	per		R	R															
Cosmos	*Cosmos*	ann			R														R	
Cranesbill	*Geranium*	ann					R													
Crocus	*Crocus*	per						P					R							

* See text for other trade names of these herbicides.

Table 5. Preemergence Herbicides Registered for Use on Herbaceous Ornamentals, continued

(Bedding Plants, Bulbs, Cutflowers, Perennials, and Groundcovers)

R = Registered for this species. Can be applied over the top.
D = Registered for this species. Directed application only.
I = Registered, but research indicates that injury can occur.
P = Label PROHIBITS use on this species.
R*, D* = Registered for some species; check label for details.

Common Name	Genus		Barricade	Betasan*	Dacthal*	Derby	Devrinol	Eptam	Gallery	Image	OH II	Pendulum*	Pennant	Ronstar G	Rout	Snapshot DF	Snapshot TG	Surflan	Trifluralin*	XL
Crown vetch	*Coronilla*	ann																	R	
Daffodil	*Narcissus*	per		R			R	P	R				R			R		R		R
Dahlia	*Dahlia*	ann		R	R		R	R											R	
Daisy	*Chrysanthemum*	per		R			R	R				R*	R						R	
Dames rocket	*Hesperis*	per																		
Daylily	*Hemerocallis*	per						R	R			R	R			R	R	R		
Dusty miller	*Senecio*	ann										R*	R							
Evening primrose	*Oenothera*	per											R							
False dragonhead	*Physostegia*	per											R							
Fescue, blue	*Festuca*	per							R			R					R			R
Feverfew	*Matricaria*	ann			R															
Forget-me-not	*Myosotis*	per			R														R	
Fortnight lily	*Morea*	ann										R	R							
Fountain grass, green	*Pennisetum*	per							R			R					R*			
Fountain grass, red	*Pennisetum*	per																		
Four o'clock	*Mirabilis*	ann			R														R	
Foxglove	*Digitalis*	per			R															
Freesia	*Freesia*	per		R																
Gaillardia	*Gaillardia*	per			R								R						R	
Gayfeather (liatris)	*Liatris*	per																R*		
Gazania	*Gazania*	ann		R			R	R	R			R*	R	R*		R	R	R*	R	R*
Geranium	*Pelargonium*	ann			R		R					R*	R					R*		R*
Gerbera daisy	*Gerbera*	ann																		
Germander	*Teucrium*	per			P														R	
Geum (avens)	*Geum*	per			P							R	R					R*		
Gilia	*Gilia*																			
Gladiolus	*Gladiolus*	ann		R	R		R						I			R		R	R	R
Godetia	*Clarkia*	ann																		
Heath	*Erica*	per			R				R*		P			I			R*			
Heather	*Calluna*	per	R*				R		R*					R*			R*			
Heather, false	*Cuphea*	ann																		
Hens and chickens	*Sempervivum*	per																		
Hollyhock	*Alcea*	ann																	R	
Hosta (plantain-lily)	*Hosta*	per				R*	R		R*	R*		R	R*			R*	R*	R		
Hyacinth	*Hyacinthus*	ann						P	R				R			R		R		
Hyacinth, grape	*Muscari*	per						P					R							
Hyacinth, wood	*Endymion*	per						P					R							
Iceplant	*(several genera)*	per	R	R	P		R	R	R			R	R	R		R	R	R	R	R
Impatiens	*Impatiens*	ann											I					R*		R*
Iris, bulbous	*Iris*	per			R			P	R				R			R		R		R
Iris, rhizomatous	*Iris*	per			R								R					R		
Ivy	*Hedera spp*	per	R*	R	R	R*	R	R	R*				R	R*		R*	R*	R*	R	R*
Jack-in-the-pulpit	*Arisaema*	per																		
Joseph's coat	*Alternanthera*	ann			P															
Lamb's ear (stachys)	*Stachys*	per											R							

* See text for other trade names of these herbicides.

Table 5. Preemergence Herbicides Registered for Use on Herbaceous Ornamentals, continued

(Bedding Plants, Bulbs, Cutflowers, Perennials, and Groundcovers)

R = Registered for this species. Can be applied over the top.
D = Registered for this species. Directed application only.
I = Registered, but research indicates that injury can occur.
P = Label PROHIBITS use on this species.
R*, D* = Registered for some species; check label for details.

Common Name	Genus		Barricade	Betasan*	Dacthal*	Derby	Devrinol	Eptam	Gallery	Image	OH II	Pendulum*	Pennant	Ronstar G	Rout	Snapshot DF	Snapshot TG	Surflan	Trifluralin*	XL
Lantana	*Lantana*	per			R		R		R					R*	R*					
Larkspur	*Delphinium*	per			R								R							
Lavender	*Lavendula*	per																		
Lavendercotton	*Santolina*	per			R						R									
Leatherleaf fern	*Rumohra*	ann	R										R							
Leopards-bane	*Doronicum*	per											R							
Lily	*Lilium*	per			R			P					R							
Lily-of-the-valley	*Convallaria*	per																		
Liriope	*Liriope*	per	R*			R*	R		R*	R*		R*	R			R*	R*	R*	R	R*
Lobelia	*Lobelia*	per																	R	
Lupine	*Lupinus*	per			R								R						R	
Marguerite, golden	*Anthemis*	per			R															
Marigold	*Tagetes*	ann		R	R			R				R*	I					R	R	R
Miscanthus	*Miscanthus*	per							R*			R					R*			
Mondo grass	*Ophiopogon*	per	R*			R*			R*	R*		R*	R*			R*	R*			
Moneywort	*Lysimachia*	ann																		
Morningglory	*Convolvulus*	ann			R							R							R	
Moss-rose	*Portulaca*	ann			R													R*	R	
Mother of thyme	*Thymus*	per			R															
Mourning-bride	*Scabiosa*	ann			R														R	
Narcissus	*Narcissus*	ann		R			R	P	R				R			R		R		R
Nasturtium	*Nasturtium*	ann			R			R											R	
Nicotiana	*Nicotiana*	ann																	R	
Nightshade	*Solanum*	ann										R								
Pachysandra	*Pachysandra*	per		R	R	R*	R	R	R*	R*	R*	R	R	R*		R*	R*			
Pampas grass	*Cortaderia*	per	R						R		R	R*	I			R	R			
Pansy	*Viola*	ann		R	P			R					R					R*		R*
Peony	*Paeonia*	per			R															
Pepper, ornamental	*Capsicum*	ann						P												
Periwinkle	*Catharanthus*	ann		R								R*							R	
Periwinkle	*Vinca minor*	per	R	R			R	R	R		R	R	R	R		R	R	R	R	R
Petunia	*Petunia*	ann			R		R	R					R					R	R	R
Phlox	*Phlox*	per			P			P					R						R	
Pimpernel	*Anagallis*	ann																		
Pink	*Dianthus*	per			P			R											R	
Pink clover	*Polygonum*	per																		
Poker-plant	*Kniphofia*	per			R															
Poppy	*Papaver*	per																		
Poppy, California	*Eschscholzia*	ann										R							R	
Prickly pear	*Opun tia*	per																		
Primrose	*Primula*	per		R																
Queen Anne's lace	*Daucus*	ann											R							
Ranunculus	*Ranunculus*	per		R														R*		
Rose	*Rosa*	per	R*		R	R	R	R	R*				R	R		R*	R*	R	R	R
Rosemary	*Rosmarinus*	per	R						R			R				R	R		R	

* See text for other trade names of these herbicides.

Table 5. Preemergence Herbicides Registered for Use on Herbaceous Ornamentals, continued

(Bedding Plants, Bulbs, Cutflowers, Perennials, and Groundcovers)

R = Registered for this species. Can be applied over the top.
D = Registered for this species. Directed application only.
I = Registered, but research indicates that injury can occur.
P = Label PROHIBITS use on this species.
R*, D* = Registered for some species; check label for details.

Common Name	Genus		Barricade	Betasan*	Dacthal*	Derby	Devrinol	Eptam	Gallery	Image	OH II	Pendulum*	Pennant	Ronstar G	Rout	Snapshot DF	Snapshot TG	Surflan	Trifluralin*	XL
Rupturewort	*Herniaria*																			
Sage, sweet or Texas	*Salvia*	ann						P										R		
Salvia	*Salvia*	ann						P							R*				R	
Sandwort	*Arenaria*																			
Scarlet flax	*Linum*	ann																		
Sea pink	*Armeria*	per																		
Sedum (stonecrop)	*Sedum*	per	R*	R	R		R	R	P				R	R*		P	P	R*	R	R*
Shasta daisy	*Chrysanthemum*	per					R						R					R	R	
Snapdragon	*Antirrhinum*	ann			R			P					R					R	R	
Snow-in-summer	*Cerastium*	per																	R	
Snow-on-mountain	*Euphorbia*	ann							P							P	P		R	
Soapwort	*Saponaria*	per																		
Speedwell(veronica)	*Veronica*	per											R						R	
Spiderwort	*Tradescantia*	per			R															
Squill (scilla)	*Scilla*	per						P					R							
St.-John's-wort	*Hypericum*	per		R			R	R	R		R	R*	R	R*	R	R	R		R	R
Star-of-Bethlehem	*Ornithogalum*	per											R							
Starflower	*Trientalis*	per																		
Statice	*Limonium*	ann											I							
Stock	*Matthiola*	ann		R															R	
Stoke's aster	*Stokesia*	per										R						R		
Strawberry, ornamental	*Fragaria*	per		R				R				R*							R	
Strawflower	*Helichrysum*	ann			R															
Sundrops	*Oenothera*	per			R								R							
Sunflower	*Helianthus*	ann			R														R	
Sweet alyssum	*Lobularia*	ann		R	R														R	
Sweet flag	*Acorus*	per										R								
Sweet pea	*Lathyrus*	ann		R	R														R	
Sweet William	*Dianthus*	per			P			R					R					R	R	
Sword fern	*Nephrolepsis*	per																		
Tidy tips	*Layia*	ann																		
Tulip	*Tulipa*	ann		R				P	R				R			R		R		R
Verbena	*Verbena*	per										R*			R*				R	
Vinca (ground cover)	*Vinca major*	per					R				R		R	R				R	R	R
Wallflower	*Cheiranthus*	per		R																
Wild thyme	*Thymus*	per																		
Wormwood	*Artemisia*	per			R								R*							
Yarrow	*Achillea*	per			R							R*	R					R	R	
Yucca	*Yucca*	per	R*			R*			P, R	R*	P	R*	R			P	P, R	R*		R*
Zinnia	*Zinnia*	ann		R	R		R	R					I					R	R	R
Zinnia, creeping	*Sanvitalia*																			

* See text for other trade names of these herbicides.

Table 6. Postemergence Herbicides Registered for Use on Herbaceous Ornamentals

(Bedding Plants, Bulbs, Cutflowers, Perennials, and Groundcovers.)

OT = Registered for over the top application.
D = Registered for directed application only.
I = Registered, but research indicates that injury may occur.
P = Label PROHIBITS use on this species.
O*, D* = Registered for some species. Check label for details.

Common Name	Genus		Acclaim	Basagran	Demoss	Finale	Fusilade*	Gramoxone	Image	Ornamec*	Prism	Reward	Roundup*	Sharpshooter	Vantage
African daisy	*Arctotis*	ann			D	D		D				D	D	D	
African lily	*Agapanthus*	ann			D	D	O*	D		O*		D	D	D	O*
African violet	*Saintpaulia*	ann			D	D		D				D	D	D	
Ageratum	*Ageratum*	ann			D	D	OT	D		OT	OT	D	D	D	
Allium	*Allium*	per			D	D		D				D	D	D	
Alyssum (Golddust)	*Aurinia*	per			D	D		D				D	D	D	
Amaranthus	*Amaranthus*	ann			D	D		D				D	D	D	
Asparagus fern	*Asparagus*	ann			D	D	O*	D		O*	O*	D	D	D	O*
Aster	*Callistephus*	ann			D	D		D				D	D	D	
Astilbe	*Astilbe*	per	OT		D	D	O*	D		O*		D	D	D	
Baby's breath	*Gypsophila*	per	OT		D	D		D				D	D	D	
Baby-blue-eyes	*Nemophila*	ann	OT		D	D		D				D	D	D	
Bachelor's button	*Centaurea*	ann			D	D		D				D	D	D	
Balsam	*Impatiens*	ann			D	D		D				D	D	D	OT
Beardtongue	*Penstemon*	per	OT		D	D		D				D	D	D	
Begonia, fibrous	*Begonia*	ann	OT		D	D	O*,D*	D				D	D	D	O*
Bellflower	*Campanula*	per	OT		D	D	O*	D		O*		D	D	D	O*
Bird of paradise	*Strelitzia*	ann			D	D	O*	D		OT		D	D	D	
Black-eyed susan	*Rudbeckia*	per	OT		D	D		D				D	D	D	
Bleeding heart	*Dicentra*	per	OT		D	D	D	D		D*		D	D	D	O*
Bluebells	*Mertensia*	per	OT		D	D		D				D	D	D	
Bugleweed (Ajuga)	*Ajuga*	per	OT		D	D	D*	D		D*	O*	D	D	D	O*
Burnet	*Sanguisorba*	per	OT		D	D		D				D	D	D	
Butterflyweed	*Asclepias*	per			D	D		D				D	D	D	O*
Cactus	*Cactus*				D	D		D				D	D	D	
Calendula	*Calendula*	ann			D	D	OT	D		OT		D	D	D	
Calliopsis	*Coreopsis*	per	OT		D	D	O*	D		O*		D	D	D	
Candytuft	*Iberis*	per	OT		D	D	O*	D		O*		D	D	D	O*
Canna	*Canna*	ann			D	D		D				D	D	D	OT
Cape marigold	*Dimorphotheca*	ann	OT		D	D	O*	D				D	D	D	
Carex	*Carex*	per			D	D		D				D	D	D	
Carnation	*Dianthus*				D	D		D				D	D	D	
Catchfly	*Silene*	ann	OT		D	D		D				D	D	D	
Chamomile	*Matricaria*	ann	OT		D	D		D				D	D	D	
Chives, ornnamental	*Allium*	per			D	D	OT	D		O*		D	D	D	
Chrysanthemum	*Chrysanthemum*	ann	OT		D	D	OT	D		OT	OT	D	D	D	OT
Cockscomb	*Celosia*	ann			D	D		D				D	D	D	O*
Coleus	*Coleus*	ann	OT		D	D	O*	D		O*	OT	D	D	D	O*
Columbine	*Aquilegia*	per	OT		D	D	D*	D		D*		D	D	D	
Coneflower	*Echinacea*	per	OT		D	D		D				D	D	D	
Coral bell	*Heuchera*	per			D	D		D				D	D	D	O*
Cosmos	*Cosmos*	ann	OT		D	D		D				D	D	D	
Cranesbill	*Geranium*				D	D	O*	D		O*	OT	D	D	D	OT
Crocus	*Crocus*	per			D	D		D				D	D	D	

* See text for other trade names of these herbicides.

Table 6. Postemergence Herbicides Registered for Use on Herbaceous Ornamentals, continued

(Bedding Plants, Bulbs, Cutflowers, Perennials, and Groundcovers.)

OT = Registered for over the top application.
D = Registered for directed application only.
I = Registered, but research indicates that injury may occur.
P = Label PROHIBITS use on this species.
O*, D* = Registered for some species. Check label for details.

Common Name	Genus		Acclaim	Basagran	Demoss	Finale	Fusilade*	Gramoxone	Image	Ornamec*	Prism	Reward	Roundup*	Sharpshooter	Vantage
Crown vetch	*Coronilla*				D	D	OT	D		OT		D	D	D	
Daffodil	*Narcissus*	per			D	D		D				D	D	D	
Dahlia	*Dahlia*	ann			D	D		D			OT	D	D	D	O*
Daisy	*Chrysanthemum*	per	OT		D	D	OT	D		OT		D	D	D	
Dames rocket	*Hesperis*		OT		D	D		D				D	D	D	
Daylily	*Hemerocallis*	per	OT		D	D	OT	D		OT	OT	D	D	D	OT
Dusty miller	*Senecio*	ann			D	D	O*	D		OT		D	D	D	O*
Evening primrose	*Oenothera*	per	OT		D	D		D				D	D	D	
False dragonhead	*Physostegia*	per			D	D		D				D	D	D	
Fescue, blue	*Festuca*	per			D	D		D				D	D	D	OT
Feverfew	*Matricaria*	ann			D	D		D				D	D	D	
Forget-me-not	*Myosotis*	per	OT		D	D		D				D	D	D	
Fortnight lily	*Morea*	ann			D	D		D				D	D	D	
Fountain grass, green	*Pennisetum*	per			D	D	D	D		D		D	D	D	
Fountain grass, red	*Pennisetum*	per			D	D	O*	D		OT		D	D	D	OT
Four o'clock	*Mirabilis*	ann			D	D		D				D	D	D	
Foxglove	*Digitalis*	per			D	D		D				D	D	D	
Freesia	*Freesia*				D	D		D				D	D	D	
Gaillardia	*Gaillardia*	per	OT		D	D		D				D	D	D	
Gayfeather (liatris)	*Liatris*	per	OT		D	D	O*	D		O*		D	D	D	
Gazania	*Gazania*	ann	OT		D	D	O*,D*	D		O*,D*	OT	D	D	D	OT
Geranium	*Pelargonium*	ann	OT		D	D	O*	D		O*	O*	D	D	D	O*
Gerbera daisy	*Gerbera*	ann			D	D		D				D	D	D	O*
Germander	*Teucrium*	per			D	D		D				D	D	D	
Geum (avens)	*Geum*	per			D	D		D				D	D	D	
Gilia	*Gilia*		OT		D	D		D				D	D	D	
Gladiolus	*Gladiolus*	ann			D	D	O*,D*	D		O*,D*		D	D	D	OT
Godetia	*Clarkia*	ann			D	D		D				D	D	D	
Heath	*Erica*	per			D	D		D				D	D	D	
Heather	*Calluna*	per			D	D	O*	D		O*		D	D	D	
Heather, false	*Cuphea*				D	D		D				D	D	D	O*
Hens and chickens	*Sempervivum*	per			D	D	O*	D		OT		D	D	D	
Hollyhock	*Alcea*	ann			D	D	O*	D		O*		D	D	D	
Hosta (plantain-lily)	*Hosta*	per	OT		D	D	O*	D	O*	O*		D	D	D	OT
Hyacinth	*Hyacinthus*	ann			D	D		D				D	D	D	
Hyacinth, grape	*Muscari*	per			D	D		D				D	D	D	
Hyacinth, wood	*Endymion*	per			D	D		D				D	D	D	
Iceplant	*(several genera)*	per			D	D	O*,D*	D		O*,D*		D	D	D	
Impatiens	*Impatiens*	ann			D	D		D				D	D	D	OT
Iris, bulbous	*Iris*	per	OT		D	D	OT	D		OT	OT	D	D	D	OT
Iris, rhizomatous	*Iris*	per	OT		D	D	OT	D		OT	OT	D	D	D	OT
Ivy	*Hedera spp*	per		O*	D	D	O*	D		O*	O*	D	D	D	O*
Jack-in-the-pulpit	*Arisaema*	per			D	D		D				D	D	D	O*
Joseph's coat	*Alternanthera*	ann			D	D		D				D	D	D	

* See text for other trade names of these herbicides.

Table 6. Postemergence Herbicides Registered for Use on Herbaceous Ornamentals, continued

(Bedding Plants, Bulbs, Cutflowers, Perennials, and Groundcovers.)

OT = Registered for over the top application.
D = Registered for directed application only.
I = Registered, but research indicates that injury may occur.
P = Label PROHIBITS use on this species.
O*, D* = Registered for some species. Check label for details.

Common Name	Genus		Acclaim	Basagran	Demoss	Finale	Fusilade*	Gramoxone	Image	Ornamec*	Prism	Reward	Roundup*	Sharpshooter	Vantage
Lamb's ear (stachys)	*Stachys*	per			D	D		D				D	D	D	
Lantana	*Lantana*	per			D	D	O*,D*	D		O*,D*	OT	D	D	D	O*
Larkspur	*Delphinium*	per	OT		D	D		D				D	D	D	
Lavender	*Lavendula*	per			D	D		D				D	D	D	O*
Lavendercotton	*Santolina*	per			D	D	O*	D		O*		D	D	D	O*
Leatherleaf fern	*Rumohra*	ann			D	D	O*	D				D	D	D	
Leopards-bane	*Doronicum*	per	OT		D	D		D				D	D	D	
Lily	*Lilium*	per			D	D		D				D	D	D	
Lily-of-the-valley	*Convallaria*	per			D	D		D				D	D	D	O*
Liriope	*Liriope*	per	O*	O*	D	D	O*	D	O*	O*	O*	D	D	D	O*
Lobelia	*Lobelia*	per	OT		D	D		D				D	D	D	O*
Lupine	*Lupinus*	per			D	D		D				D	D	D	
Marguerite, golden	*Anthemis*	per			D	D		D				D	D	D	
Marigold	*Tagetes*	ann			D	D	OT	D		OT	OT	D	D	D	OT
Miscanthus	*Miscanthus*	per			D	D		D				D	D	D	
Mondo grass	*Ophiopogon*	per			D	D	D	D	OT	D	OT	D	D	D	OT
Moneywort	*Lysimachia*	ann			D	D	O*	D			O*	D	D	D	O*
Morningglory	*Convolvulus*	ann			D	D	O*	D		R		D	D	D	
Moss-rose	*Portulaca*	ann			D	D	O*	D				D	D	D	O*
Mother of thyme	*Thymus*	per			D	D		D				D	D	D	
Mourning-bride	*Scabiosa*	ann			D	D		D				D	D	D	
Narcissus	*Narcissus*	ann			D	D		D				D	D	D	
Nasturtium	*Nasturtium*	ann			D	D		D				D	D	D	
Nicotiana	*Nicotiana*	ann			D	D		D			O*	D	D	D	OT
Nightshade	*Solanum*	ann			D	D		D				D	D	D	
Pachysandra	*Pachysandra*	per		O*	D	D	OT	D	O*	OT		D	D	D	O*
Pampas grass	*Cortaderia*	per			D	D	D	D		D		D	D	D	
Pansy	*Viola*	ann			D	D		D			OT	D	D	D	O*
Peony	*Paeonia*	per	OT		D	D		D				D	D	D	
Pepper, ornamental	*Capsicum*	ann			D	D		D				D	D	D	OT
Periwinkle	*Catharanthus*	ann			D	D		D				D	D	D	O*
Periwinkle	*Vinca minor*	per	OT		D	D	OT	D		OT		D	D	D	OT
Petunia	*Petunia*	ann	OT		D	D	OT	D		OT	OT	D	D	D	OT
Phlox	*Phlox*	per			D	D		D			OT	D	D	D	O*
Pimpernel	*Anagallis*	ann	OT		D	D		D				D	D	D	
Pink	*Dianthus*	per	OT		D	D		D			OT	D	D	D	O*
Pink clover	*Polygonum*				D	D	OT	D		O*		D	D	D	
Poker-plant	*Kniphofia*	per			D	D		D				D	D	D	
Poppy	*Papaver*	per	OT		D	D		D				D	D	D	
Poppy, California	*Eschscholzia*		OT		D	D		D				D	D	D	
Prickly pear	*Opun tia*				D	D	D	D		D		D	D	D	
Primrose	*Primula*	per			D	D		D				D	D	D	
Queen Anne's lace	*Daucus*	ann			D	D		D				D	D	D	
Ranunculus	*Ranunculus*	per			D	D		D				D	D	D	

* See text for other trade names of these herbicides.

Table 6. Postemergence Herbicides Registered for Use on Herbaceous Ornamentals, continued
(Bedding Plants, Bulbs, Cutflowers, Perennials, and Groundcovers.)

OT = Registered for over the top application. D = Registered for directed application only.
I = Registered, but research indicates that injury may occur. P = Label PROHIBITS use on this species.
O*, D* = Registered for some species. Check label for details.

Common Name	Genus		Acclaim	Basagran	Demoss	Finale	Fusilade*	Gramoxone	Image	Ornamec*	Prism	Reward	Roundup*	Sharpshooter	Vantage
Rose	*Rosa*	per	OT		D	D	OT	D		OT	OT	D	D	D	
Rosemary	*Rosmarinus*				D	D	O*	D		O*		D	D	D	OT
Rupturewort	*Herniaria*				D	D	D*	D		D*		D	D	D	O*
Sage, sweet or Texas	*Salvia*	ann			D	D	O*	D		OT	OT	D	D	D	O*
Salvia	*Salvia*	ann	P		D	D	O*	D		OT	OT	D	D	D	
Sandwort	*Arenaria*				D	D	O*	D		O*		D	D	D	O*
Scarlet flax	*Linum*	ann	OT		D	D		D				D	D	D	
Sea pink	*Armeria*	per			D	D		D				D	D	D	O*
Sedum (stonecrop)	*Sedum*	per			D	D	O*	D		O*	OT	D	D	D	O*
Shasta daisy	*Chrysanthemum*	per	OT		D	D	OT	D		OT		D	D	D	OT
Snapdragon	*Antirrhinum*	ann	OT		D	D	OT	D			OT	D	D	D	OT
Snow-in-summer	*Cerastium*	per	OT		D	D	O*	D		O*		D	D	D	P
Snow-on-mountain	*Euphorbia*	ann			D	D		D				D	D	D	
Soapwort	*Saponaria*	per	OT		D	D		D				D	D	D	
Speedwell (veronica)	*Veronica*	per			D	D		D				D	D	D	O*
Spiderwort	*Tradescantia*	per			D	D		D				D	D	D	
Squill (scilla)	*Scilla*	per			D	D		D				D	D	D	
St.-John's-wort	*Hypericum*	per			D	D		D				D	D	D	O*
Star-of-Bethlehem	*Ornithogalum*	per			D	D		D				D	D	D	
Starflower	*Trientalis*		OT		D	D		D				D	D	D	
Statice	*Limonium*	ann	OT		D	D		D				D	D	D	O*
Stock	*Matthiola*	ann			D	D		D				D	D	D	O*
Stoke's aster	*Stokesia*	per			D	D		D				D	D	D	
Strawberry, ornamental	*Fragaria*	per			D	D	O*	D		O*		D	D	D	
Strawflower	*Helichrysum*	ann			D	D		D				D	D	D	
Sundrops	*Oenothera*	per			D	D		D				D	D	D	
Sunflower	*Helianthus*	ann			D	D		D				D	D	D	
Sweet alyssum	*Lobularia*	ann	OT		D	D		D			O*	D	D	D	
Sweet flag	*Acorus*	per			D	D		D				D	D	D	O*
Sweet pea	*Lathyrus*	ann			D	D		D				D	D	D	
Sweet William	*Dianthus*	per	OT		D	D	OT	D		OT	OT	D	D	D	OT
Sword fern	*Nephrolepsis*				D	D	OT	D		O*		D	D	D	
Tidy tips	*Layia*		OT		D	D		D				D	D	D	
Tulip	*Tulipa*	ann			D	D		D				D	D	D	
Verbena	*Verbena*	per			D	D		D			O*	D	D	D	OT
Vinca (ground cover)	*Vinca major*	ann	OT		D	D	OT	D		OT		D	D	D	OT
Wallflower	*Cheiranthus*	per			D	D		D				D	D	D	
Wild thyme	*Thymus*	per	OT		D	D		D				D	D	D	
Wormwood	*Artemisia*	per			D	D		D				D	D	D	
Yarrow	*Achillea*	per	OT		D	D	O*	D		O*		D	D	D	
Yucca	*Yucca*	per			D	D	O*	D		O*		D	D	D	
Zinnia	*Zinnia*	ann	OT		D	D	OT	D	O*		O*	D	D	D	O*
Zinnia, creeping	*Sanvitalia*		OT		D	D		D				D	D	D	

* See text for other trade names of these herbicides.

Suggested Readings

1. Baldwin, F. L., and E. B. Smith. 1983. *Weeds of Arkansas: Lawns, Turf, Road-sides, Recreation Areas. A Guide to Identification.* Little Rock: Arkansas Cooperative Extension Service.

2. Beasley, E. O., and W. A. Skroch. 1984. *Pesticide Application: Equipment and Methods for Trees, Shrubs, and Trellised Vines.* AG-310. Raleigh: North Carolina State University, North Carolina Cooperative Extension Service. $1.50.

3. Murphy, T. R., D. L. Colvin, R. Dickens, J. W. Everest, D. Hall, and L. B. McCarty. 1993. *Weeds of Southern Turfgrasses: Golf Courses, Lawns, Roadsides, Recreational Areas, Commercial Sod.* C. M. Hinton, Publications Distribution Center, IFAS Building 664, Univ. of Florida, Gainesville, FL 32611. Also available from University of Georgia Cooperative Extension Service and the Alabama Cooperative Extension Service at Auburn University.

4. Murphy, T. R., and G. R. Wade. *Weed Control in Landscape Plantings.* Bull. 842. 24 p. Cooperative Extension Service, University of Georgia, Athens, GA. $0.25.

5. *North Carolina Agricultural Chemicals Manual.* Raleigh: North Carolina State University, College of Agricultural and Life Sciences. Revised yearly. $12.00.

6. Radford, A. E., H. E. Ahles, and C. R. Bell. 1968. *Manual of the Vascular Flora of the Carolinas.* Chapel Hill: University of North Carolina Press.

7. Robertson, R. L., J. R. Baker, R. K. Jones, W. M. Lewis, L. T. Lucas, W. A. Skroch, and J. H. Wilson. *Pesticide Training Manual — Ornamentals and Turfgrass Pest Control.* North Carolina Cooperative Extension Service. North Carolina State University.

8 Southern Weed Science Society. *Weed Identification Guide.* Southern Weed Science Society, 309 West Clark St., Champaign, IL 61820. $97.00. (Includes over 300 colored photos of weeds.)

9. Stucky, J. M., T. J. Monaco, and A. D. Worsham. 1980. *Identifying Seedlings and Mature Weeds Common in the Southeastern United States.* AG-208, Bull. 461. Raleigh: North Carolina State University, North Carolina Cooperative Extension Service. $7.00.

10. Thompson, L., Jr., W. A. Skroch, and E. O. Beasley. 1981. *Pesticide Incorporation.* AG-250. Raleigh: North Carolina State University, North Carolina Cooperative Extension Service.

11. Wax, L. M., et al. 1981. *Weeds of the North Central States.* North Central Regional Research Publication No. 281. University of Illinois, Urbana, IL.

PESTICIDE EMERGENCY INFORMATION

For any type of an emergency involving a pesticide, immediately contact the following emergency information centers for assistance.

Current as of May 1, 1995

Human Pesticide Poisoning

MICHIGAN POISON CONTROL SYSTEM

From anywhere in Michigan, call

1-800-POISON 1

1-800-764-7661

Special Pesticide Emergencies

Animal Poisoning

Your veterinarian:

Phone No.

or

Animal Health Diagnostic Laboratory (Toxicology) Michigan State University:

(517) 355-0281

Pesticide Fire

Local fire department:

Phone No.

and

Fire Marshal Division, Michigan State Police:
M–F: 8–12, 1–5

(517) 322-5847

Traffic Accident

Local police department or sheriff's department:

Phone No.

and

Operations Division, Michigan State Police:

****(517) 336-6605***

Environmental Pollution

Pollution Emergency Alerting System (PEAS), Michigan Department of Natural Resources:

Phone No.

and

For environmental emergencies:

****1-800-292-4706***

Pesticide disposal information

Michigan Department of Natural Resources. Waste Management Division.
Monday– Friday: 8 a.m.–5 p.m.

(517) 373-2730

**** Telephone Number Operated 24 Hours***

National Pesticide Telecommunications Network

Provides advice on recognizing and managing pesticide poisoning, toxicology, general pesticide information and emergency response assistance. Funded by EPA, based at Texas Tech University Health Services Center.
Monday – Friday:
8:00 a.m. – 6:00 p.m. Central Time Zone

1-800-858-7378

Revised by Larry G. Olsen, *Pesticide Education Coordinator, Michigan State University*

North Carolina
Cooperative Extension Service

NORTH CAROLINA STATE UNIVERSITY
COLLEGE OF AGRICULTURE & LIFE SCIENCES

This publication contains pesticide recommendations based on research and pesticide regulations. However, changes in pesticide regulations occur constantly. Some pesticides mentioned may no longer be available, and some uses may no longer be legal. If you have questions about the legality and/or registration status for using pesticides, contact your county MSU Extension office.

To protect yourself and others and the environment, always read the label before applying any pesticide.

Reprinted (200) 5:95-KMF-UP, $10, for sale only