

Weed Control in Home Lawns

Weed control in lawns begins with a healthy, vigorous, dense stand of turf. Healthy turf aids weed control by growing to fill bare areas, shading the soil surface, and shading newly emerged weeds. Without sunlight, many new weeds cannot survive. A healthy, lush, green stand of turf, free from weeds, is pleasing to look at and can bring a sense of satisfaction and accomplishment to the homeowner.

Most recommended turf production practices, although not solely intended as weed control methods, do aid in weed control. Any production practice that promotes healthy turf also helps reduce weed establishment. Here are some examples:

- Use soil tests to keep the pH in the proper range.
- Add fertilizer at rates recommended on the soil test report to encourage rapid turf growth. Too much fertilizer, however, particularly nitrogen, is detrimental to the turf stand.
- Irrigate during periods of limited rainfall to relieve stress and encourage growth. To encourage deep rooting, apply large volumes of water periodically rather than watering briefly and frequently.
- Excessive water can stress turf and increase weed growth. Virginia buttonweed, for example, thrives in wet areas and is particularly difficult to control with herbicides. Use preventive measures to reduce the potential for invasion of this weed in

turf. Build up low areas to avoid "ponding" or standing water.

- Insects and diseases can stress and kill turf. Control these pests to avoid potential damage to the turf.
- Mowing can stress turf if too much vegetation is removed by the clipping process. Set your mower to remove less than one-third of the vegetation to avoid "scalping."
- Bare soil is a prime area for weed invasion. Bare areas can be reseeded, plugged, or left for adjacent grass to grow into. Cover reseeded areas with mulch, such as grain straw, until the area is filled with turf.

Use these agronomic production practices to help control weeds. Regardless of how well you follow good production practices, though, weed seeds will germinate and seedlings will emerge. When this occurs, you must rely upon chemical control methods. Herbicides help homeowners maintain lawns that are free of unsightly weeds.

Weed Classification

Weed identification is the first step toward chemical control. The pest must be correctly identified before a herbicide to control it can be selected or recommended. County agents can assist you with weed identification. Identification guides with color pictures are available at many bookstores. These books can be quite helpful for the do-it-yourself homeowner.



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Weeds can be classed into three broad categories based on life cycle: annuals, biennials, and perennials.

Annuals

Weeds that produce seeds within 1 year after emergence are classified as annuals. Those that emerge in the spring, grow through the summer, and produce seeds in the fall are called summer annuals. Examples of summer annuals are crabgrass, goosegrass, spurge, knotweed, and lespedeza. Weeds that emerge in the fall, grow during the winter, and produce seeds in the late spring are called winter annuals. Examples of winter annual weeds are henbit, chickweed, and annual bluegrass.

Biennials

Biennial weeds require 2 years to produce seeds. These weeds emerge and grow the first year, overwinter as a dormant rosette of leaves, resume growth, and produce seeds the second year. Wild carrot and common mullein are examples of biennial weeds.

Perennials

The third category of weed growth is perennial weeds. These plants emerge, grow, and produce some structure that enables the plant to overwinter and resume growth the next year. They typically reproduce by vegetative mechanisms as well as seeds. Common examples are bermudagrass, bahiagrass, dallisgrass, Florida betony, Virginia buttonweed, wild garlic, and nutsedge.

Perennial weeds reproduce in several ways. Bermuda-grass produces rhizomes, or underground stems, capable of rooting and producing new plants at each node. Bermuda-grass also produces stolons that are similar to rhizomes but are above the soil surface rather than below. Yellow and purple nutsedges produce tubers, which are underground storage organs capable of producing new plants. A potato is another example of a tuber. Wild onion and garlic produce bulbs or underground vertical stems encased in fleshy leaves. The other mechanism of vegetative reproduction is creeping roots or roots modified for food storage and reproduction. This reproductive mechanism is used by Virginia buttonweed.

Weed Control

Many weeds can be removed by hand. Scattered individual plants can be removed manually. However, hand removal is tedious and time consuming. Herbicides that reduce the time required to control weeds are available to homeowners. Herbicides can be broadly classified by their methods of application.

Preemergence Herbicides. Preemergence herbicides are those herbicides applied to the soil surface or turf canopy before weed emergence. These herbicides kill weeds before, or soon after, seedlings emerge. Postemergence herbicides, by contrast, are applied to the weed vegetation after emergence from the soil. Some weeds are more easily controlled with preemergence herbicides than postemergence herbicides. For this reason, a combination of preemergence and postemergence herbicides is recommended for weed control in most lawns.

Postemergence Herbicides. Apply postemergence herbicides soon after weed emergence to ensure optimum activity. As a general rule, small weeds are more easily controlled than are larger weeds. However, weed seeds do not all germinate and emerge simultaneously. Apply postemergence herbicides after emergence of many annual weeds.

Formulations

Sprayable Herbicides. Sprayable herbicides are available in several formulations: emulsifiable concentrate (EC or E), water dispersible (WDG, D, DF), flowable (F, AS, or LF), soluble concentrate (S), soluble powder (SP), or microencapsulated (M or ME). These formulations are mixed with water and sprayed onto the turf canopy or weeds. All formulations contain inert ingredients in addition to the active herbicide ingredient (hereafter referred to as active ingredient or ai).

Most formulations contain emulsifiers, surfactants, wetting agents, antifoaming agents, etc., to help keep the active ingredient suspended in water and enhance plant uptake. All herbicide labels state the amount of active ingredient and amount of inert ingredients in the container. Knowledge of this information can help the do-it-yourself homeowner make economical herbicide purchases.

Granular Formulations. Other herbicides are available as granular formulations (G). The granules are applied directly to the turf or soil surface. Granular materials may be less difficult to apply, but these materials are usually more expensive per unit of active ingredient than the sprayable formulations. Many herbicides are available in either sprayable or granular form.

Active Ingredient. The concentration of the active ingredient varies among formulations. Before purchasing a herbicide, compare costs based on the amount of active ingredient in that formulation. Read the label under the list of ingredients. The label will state the amount of active ingredient in that container. Liquid formulations usually state the amount as pounds of active ingredient per gallon or volume of the container. Granular and dry formulations may state the amount of active ingredient per 100 pounds or may simply list the percentage by weight of active ingredient in that formulation. The percentage of active ingredient by weight multiplied by the weight of material in the container is the amount of active ingredient in that container. Use a calculator to price herbicides based on the amount of active ingredient before deciding which formulation to purchase. Remember to purchase the maximum amount of active ingredient for your money.

Adjuvants. The activity of most postemergence herbicides is enhanced with the addition of an adjuvant. A herbicide must be absorbed by the plant and translocated to its site of action to kill the weed. Adjuvants facilitate herbicide movement into the leaf. Several types of adjuvants are available, but all do not enhance herbicide absorption.

Spray Additions

Surfactants and crop oil concentrates are the most widely recommended adjuvants. At low concentrations, surfactants reduce the surface tension of the spray droplet, causing the drop to spread out on the leaf surface. At high concentrations, the surfactant partially dissolves the waxy layer on the leaf surface, thereby enhancing herbicide movement into the leaf. Crop oil concentrates aid in cuticle penetration and reduce surface tension of the spray droplet. They generally are not recommended for use with turf herbicides. Many postemergence herbicide labels require addition of a surfactant.

The rate of surfactant to add to the tank is indicated on the herbicide label. Most, however, recommend 0.25 percent based on the volume of the spray tank (indicated v/v). If, for example, the volume of a spray tank is 1 gallon (or 128 ounces), and the label recommends the addition of 0.25 percent (v/v) surfactant, 0.3 of an ounce of surfactant should be added to the spray tank.

Some individuals suggest substituting household detergents for surfactants because they cause the same effect. Household detergents do not contain as much surface active ingredient per unit volume as do agricultural surfactants, and the amount of surface active ingredient per unit volume varies among brands of detergents; therefore, their use is more costly than use of agricultural surfactants. Detergents foam excessively, can form scums that affect sprayer performance, and can interfere with herbicide activity. If the label recommends a surfactant, purchase a good agricultural surfactant to save money.

Application Equipment

Application equipment for either dry or liquid herbicides is available at most garden centers, cooperatives, and hardware stores. The purpose of the applicator is to distribute a small amount of herbicide uniformly over a large area. Granular applicators simply sling herbicide-coated particles or granules over the ground. Liquid herbicide formulations are mixed with a carrier, usually water, and the solution is sprayed to the target.

Several types of dry and liquid applicators are available. Granular applicators may be plastic or metal with a rotating disk to distribute the granules. Some applicators are carried manually and hand operated. Others are pushed by the user and are ground driven. Hopper capacity varies, but it is usually larger on the ground-driven devices. Granular applicators are useful for the homeowner to have for distribution of fertilizer and seeds, in addition to herbicides and other granular pesticides.

Liquid applicators vary from containers that fit on the end of a garden hose, to backpack pump-up sprayers, to motorized sprayers (Figures 3 and 4 on the following page). All are suitable for application of spray solution to turf. Generally, the hose-end applicators produce large droplets that do not drift. Pump-up sprayers offer

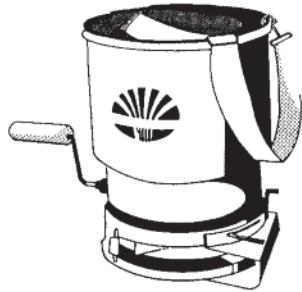


Figure 1:
Manual granular spreader

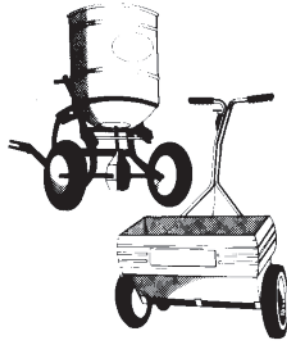


Figure 2:
Ground-driven granular spreaders



Figure 3:
Garden hose sprayer

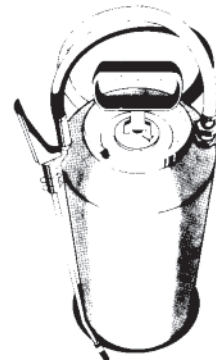


Figure 4:
Air-pressurized sprayer

the flexibility of altered size and pattern of spray droplets. Some pump-up sprayers are equipped with a boom to spray a wide (2 to 6 feet) area. Others are equipped with only a single nozzle. Those with a single nozzle generally apply a uniform amount of spray solution over the entire width of distribution. Width of distribution for all liquid applicators fluctuates with changed boom height.

Constant, uniform boom height during herbicide application is critical. Streaks of uncontrolled weeds occur if the boom is held too low. Turf can be injured by this type of misapplication. If the boom is held too high, the herbicide application rate will be less than adequate, and poor weed control will result. Generally, booms equipped with multiple flat fan or whirl chamber nozzles should be held 16 to 20 inches above the target. For preemergence herbicide application, the soil is the target. For postemergence herbicide application, the weeds are the target.

Liquid and granular applicators have advantages and disadvantages. The granular herbicides are quick and easy to use because there is no mixing with water. Herbicide drift is minimal with granule application. However, particle size varies among different fertilizers and herbicides so the applicator should be calibrated for each herbicide and fertilizer formulation. Although most granular herbicide labels list a setting for certain types of granular applicators, the setting must be fine-tuned.

Calibration

Calibration each time a new formulation or herbicide is used can be cumbersome and slow, but it reduces the potential for misapplication.

Therefore, you should calibrate granular applicators before each use of a new herbicide formulation.

Once you select and purchase an applicator, calibrate the unit to determine the application rate for that piece of equipment. The herbicide rate, either per acre or per 1,000 square feet, is constant for a particular herbicide application. However, the amount of herbicide to put in either type of applicator depends upon the amount of granules or spray solution applied per unit of land. This will vary from applicator to applicator. All calibration methods are similar. The first step is to measure some unit of land. Determine the area covered with each pass of the applicator.

Liquid Applicators. For liquid applicators, fill the tank to some level with clean water. Mark the level of water in the tank. Walk and spray the water for a predetermined distance. Remember to hold the nozzle or boom at the intended application height. Determine the width of the spray distribution to the target at that height. One method to determine the width of a spray application is to fill the device with water and spray across a dry, paved surface. You can easily see and measure the width application. Measure the volume of water required to refill the tank to the original level. The width of the spray distribution times the length walked is the area covered. That volume per unit area sprayed is the sprayer output. Convert to quarts or gallons per 1,000 square feet.

Granular Applicators. Calibrate granular applicators by trial and error. Fill the hopper with a known (preweighed) amount of granular material. Set the gate opening according to the label suggestions. Arrange pie plates in a straight line and walk perpendicular toward them, operating

the spreader. Measure spreader width from the line walked to the last pie pan that contains granules. Weigh the material remaining in the hopper. Subtract the weight of the remaining herbicide from the initial herbicide weight. The difference is the amount applied to the calibration area. Determine the area covered in the calibration procedure. This is the width of granule distribution multiplied by distance walked. Calculate the herbicide application rate (herbicide weight per unit area).

Before application of the herbicide, you must determine the size of the area to be sprayed. Most homeowners know the dimensions of their property. Determine the area of the lot by multiplying the length and the width. If the lot is not an equal distance on all sides, determine the average length of the sides. Use this average number to determine the area. From the area of the lot, subtract all "nonturf" areas (for example, the house, flower gardens, flower borders around the house, vegetable gardens, other buildings, driveway, etc.). After the "nonturf" areas are subtracted from the total area of the lot, the remainder should be all the area that contains turf. Multiply the sprayer output (quarts or gallons/1,000 square feet) by the area of turf (square feet) to determine the total volume that will be required to spray that area. Divide this total volume needed by the capacity of the sprayer to determine the number of tanks needed to cover.

Herbicide Selection

Chemical weed control begins with a preemergence herbicide application. If a preemergence herbicide is not used, weed control becomes a defensive tactic. Many preemergence herbicides are labeled for use in Mississippi lawns. Because some are more expensive than others, determine which herbicides can be used on your turf and will control the weed spectrum present in your lawn before you purchase them.

Turfs vary in their sensitivity to several herbicides. Table 1 in this publication contains a listing of turfgrass tolerance to preemergence and postemergence herbicides. Remember to consult this table before making the final herbicide selection. Table 1 also shows weed response to several herbicides. This table is useful in determining which herbicide(s) will best control the weeds present. Often, a combination of herbicides must be used to provide year-round weed control.

Before turf establishment, some homeowners may wish to contract with a private company to fumigate the turf seedbed. Chemicals are available that kill live organisms, including disease pathogens, insects, nematodes, weed seeds, and reproductive structures. These materials are not readily available to the homeowner since they are extremely toxic to humans. Individuals who are licensed by the Mississippi Department of Agriculture can purchase and apply these materials.

After fumigation, the soil should not be worked at a depth greater than the fumigation depth. Doing so will bring organisms not killed by the fumigant into the sterile soil.

Preemergence Herbicides

Apply preemergence herbicides from early to mid-March for the control of summer annual weeds. For winter annual weeds, apply after mid-August and before September 1. If you live in the southern portion of the state, apply preemergence herbicides at the beginning of this period (close to mid-August). If you live in the northern part of the state, apply at the end of this period.

All preemergence herbicides must move into the upper portion of the soil to control weeds. Herbicides not washed into the soil are decomposed by ultraviolet sunlight or lost as gases. Some herbicides are more susceptible to decomposition than others. Therefore, the length of time a herbicide can stay on the soil surface before moving into the soil and still provide acceptable weed control varies among herbicides. However, the sooner the herbicide is washed into the soil, the better the weed control activity will be. Rainfall will move these materials into the soil. If rainfall is not forecast within 1 or 2 days after preemergence herbicide application, apply 0.5 of an inch of irrigation to move the herbicide into the soil.

Herbicides can be classified according to the chemical structure of the active ingredient molecule. Some of the classes of herbicide chemistry commonly used on turf include dinitroaniline, phenoxy, organic arsenical, triazine, nitrile, and benzoic. Several herbicides used on turf do not fit into any of these classes and are categorized as miscellaneous herbicides. Herbicides within a particular class usually are applied similarly, behave in plants and soil similarly, and often control similar weed spectrums.

For example, the dinitroanilines are applied to the soil surface. Rainfall is needed soon after application to wash (or leach) these herbicides into the top 1 inch of the soil surface. These herbicides do not have postemergence activity. The way they control weeds is through inhibiting cell division. These herbicides are not translocated within the plant; therefore, root cells are the primary site of activity. They will inhibit root cell division in turf as well; therefore, do not apply until turf is well established.

The following recommendations are very general. Follow the restrictions and precautions for each product. Restrictions may vary from one brand to another of the same active ingredient. For example, atrazine is available in four formulations:

- Aatrex®
- Bonus S®
- Purge II®
- WynStar®

Aatrex® can be applied to bermudagrass, centipedegrass, St. Augustinegrass, and zoysiagrass before April 15 and after October 1.

Purge II® can be applied to centipedegrass and St. Augustinegrass at any time of the year but only to dormant bermudagrass. Purge II® is not labeled for application to zoysiagrass.

Bonus S® is labeled for application to centipedegrass, St. Augustinegrass, and zoysiagrass during late winter, spring, or fall.

WynStar® can be applied to bermudagrass, centipedegrass, St. Augustinegrass, and zoysiagrass between October 1 and December 15 after a killing frost, unless previous applications to green grass have been proven acceptable.

The label is the final authority that must be followed during application of that product.

Dinitroaniline Herbicides

Benefin. Benefin (Balan®) is formulated as a 2.5 percent granular. The suggested use rate of benefin is 1.8 to 2.7 pounds of 2.5G/1,000 square feet or 0.05 to 0.07 of a pound ai (active ingredient)/1,000 square feet.

Benefin controls several annual grasses such as crabgrass, annual bluegrass, and green and yellow foxtail. Do not use benefin on newly sprigged or seeded turf. Benefin can be used on established bahiagrass, bermudagrass, hybrid bermudagrass, zoysiagrass, centipedegrass, St. Augustinegrass, and fescue. Do not apply where fall overseeding with a cool-season turf species is

planned. Benefin and oryzalin are formulated as a 2 percent granular premix sold under the trade-name XL®.

XL®. XL® spectrum of weed control is similar to that of benefin. The suggested use rate is 2.5 to 3.5 pounds of the 2 percent granules or 0.05 to 0.07 of a pound ai/1,000 square feet. XL® can be used on southern turfs of bahiagrass, bermudagrass, zoysiagrass, centipedegrass, St. Augustinegrass, and tall fescue. Do not apply where fall overseeding with a cool-season species is planned. XL® is safer to use on warm-season turfs than is Team®.

Team®. Team® is a 2 percent granular premix of benefin and trifluralin. Weeds controlled are similar to those controlled with benefin or XL®. Suggested use rate is 2.3 to 3.4 pounds 2 percent granular or 0.05 to 0.07 of a pound ai/1,000 square feet. Team can be used on bahiagrass, bermudagrass, zoysiagrass, centipedegrass, St. Augustinegrass, and fescue lawns. Do not apply where fall overseeding with a cool-season species is planned.

Oryzalin. Oryzalin (Surflan®) can be used on bahiagrass, bermudagrass, hybrid bermudagrass, zoysiagrass, centipedegrass, St. Augustinegrass, and tall fescue. Oryzalin controls many annual grasses and broadleaf weeds such as goosegrass, crabgrass, annual bluegrass, carpetweed, prostrate knotweed, chickweed, and henbit. The use rate of oryzalin is 1.5 to 2.2 ounces of Surflan AS® formulation or 0.05 to 0.07 of a pound ai/1,000 square feet. Do not apply oryzalin to newly sprigged bermudagrass, zoysiagrass, centipedegrass, or St. Augustinegrass until these grasses are established. Oryzalin applied in the spring to fall-overseeded, cool-season turf species can cause injury.

Pendimethalin. Pendimethalin can be used on all warm-season turfgrasses. The use rate of pendimethalin is 2.0 pounds of Halts Crabgrass Preventer® or 0.03 of a pound of ai/1,000 square feet. Pendimethalin controls annual grasses and broad-leaf weeds. The spectrum of weeds controlled is similar to that of benefin, oryzalin, Team® (trifluralin and benefin), and XL® (oryzalin and benefin). Pendimethalin is available in several formulations and brand names. Fertilizer impregnated with pendimethalin is also available. Pendimethalin can be applied to bermudagrass, hybrid

bermudagrass, zoysiagrass, centipedegrass, St. Augustinegrass, and fescue.

Prodiamine. Barricade® can be purchased in a sprayable formulation, granular, or impregnated on fertilizer. This herbicide controls many annual grasses and small-seeded broadleaf weeds. The use rate of the 65WG formulation is 0.83 ounce/1,000 ft² on tall fescue and all warm-season turfgrasses except St. Augustinegrass. This rate is equal to 0.75 lb ai/1,000 ft². A second application of the same rate can be made 60 days after the first on all warm-season turfs, except St. Augustinegrass. Do not apply more than twice a year. Do not apply Barricade® to recently sodded turf until the next year.

Triazine Herbicides

Atrazine. Atrazine, when applied pre-emergence, controls many summer and winter annual broadleaf weeds such as chickweed, henbit, sorrel, clovers, Florida betony, spurge, and knotweed. Atrazine will provide some pre-emergence control of annual grasses, especially annual bluegrass, in the winter. Atrazine plus surfactant also has good postemergence weed control activity on some small, actively growing weeds. The use rate of atrazine is 0.75 to 1.5 ounces of a 4L formulation or 0.02 to 0.05 of a pound ai/1,000 square feet.

Atrazine is available in several flowable formulations, granular form, and premixed with fertilizer. Several brand names of atrazine are available. Atrazine can be used on bermudagrass, centipedegrass, St. Augustinegrass, and zoysiagrass. Atrazine may injure newly sprigged hybrid bermudagrass.

Do not exceed 0.75 of an ounce of a 4L formulation/1,000 square feet on newly sprigged turfgrass or on hybrid bermudagrass. Do not apply to newly seeded bermudagrass until the rhizomes are well established. Do not exceed two applications per year on any turf. Do not use atrazine on alkaline soils. Do not apply atrazine near rooting zone of flowers, trees, or shrubs.

Simazine. Weed control with simazine is similar to that with atrazine. Several brand names and formulations of simazine are available. The suggested use rate is 0.75 to 1.50 ounces 4L formulation or 0.02 to 0.05 of a pound/1,000 square feet. Newly sprigged turfgrass and hybrid bermudagrass are sensitive to simazine. Follow same uses and precautions as stated for atrazine.

Acid Amide Herbicides

Metolachlor. Pennant® herbicide is labeled for use on warm-season turfgrasses such as bahiagrass, bermudagrass, centipedegrass, and St. Augustinegrass. Pennant® controls many annual grasses and broadleaf weeds, including yellow nutsedge. The suggested use rate is 0.75 to 1.5 ounces of the 7.8E formulation or 0.9 to 1.9 pounds ai/1,000 square feet.

Do not apply Pennant® to turf under stress. Do not apply until turf has overwintered and has a developed rhizome system. Do not apply more than 2.9 ounces of Pennant® 7.8E/1,000 square feet per season.

Miscellaneous Herbicides

DCPA. DCPA can be applied for control of most annual grasses and some broadleaf weeds. DCPA provides some control of spurge. Spurge is a common problem in Mississippi lawns. DCPA controls crabgrass and annual bluegrass pre-emergence. Postemergence application will control creeping speedwell. DCPA can be used on newly seeded turf after plants have reached 1 to 2 inches in height. The residual activity of DCPA is short, however. Several applications may be necessary for control during the entire season. For summer-long control of crabgrass, a second application of one-half the suggested use rate will be required. The use rate of DCPA is 4.6 to 5.6 pounds of 5 percent granular/1,000 square feet or 0.23 to 0.28 of a pound ai/1,000 square feet. DCPA is available in liquid and granular formulations. Bermudagrass, hybrid bermudagrass, zoysiagrass, centipedegrass, St. Augustinegrass, and fescue are tolerant to DCPA.

Isoxaben. Isoxaben (Gallery®) is labeled for use on bahiagrass, bermudagrass, zoysiagrass, centipedegrass, and St. Augustinegrass. Isoxaben controls several winter and summer annual broadleaf and grass weeds. The suggested use rate of isoxaben is 0.25 to 0.5 of an ounce of 75 DF or 0.01 to 0.02 of a pound ai/1,000 square feet.

Postemergence Herbicides

Phenoxy Herbicides

2,4-D. 2,4-D can be used for control of many summer and winter annual and perennial broadleaf weeds in turf. Weeds controlled are ground ivy, lawn burweed, dandelion, plantain, and many other broadleaf weeds. Apply 0.75 of

an ounce of 4 pounds ai/gallon formulation or 0.02 of a pound ai/1,000 square feet on bermudagrass, hybrid bermudagrass, zoysiagrass, or fescue. The use rate for St. Augustinegrass, Tifgreen, or Tifdwarf bermudagrass is 0.38 of an ounce of a 4-pound ai/gallon formulation or 0.01 of a pound ai/1,000 square feet. Acceptable weed control with rates recommended for use on St. Augustinegrass, Tifgreen, or Tifdwarf bermudagrass may require a second application 10 to 14 days after the first.

Control of weeds such as dandelion and plantain is better with 2,4-D than with dicamba. Several companies sell 2,4-D or mixtures that contain 2,4-D. Fertilizer impregnated with 2,4-D is also available. Use low spray pressure, less than 25 psi, and do not apply on windy days to reduce drift potential to susceptible plants. Use caution to prevent spray solution contact with desirable broadleaf plants (flowers, vegetables, ornamentals, and shrubs).

The active ingredient of 2,4-D can transform from a liquid to a gas phase. This chemical change is called volatilization. Once in the vapor form, this herbicide can move in air currents to off-target areas. This type of herbicide movement is different from spray drift movement in which fine spray droplets are moved by air currents to off-target sites. The amine formulations of 2,4-D are less volatile than the low-volatile or ester formulations. Be sure to purchase an amine formulation of 2,4-D rather than a low-volatile or other ester formulation if this herbicide is to be applied near broadleaf plants. Remember to use caution when applying 2,4-D near broadleaf ornamentals and shrubs to avoid spray drift movement onto desirable plants.

MCPP. MCPP (mecoprop) weed control spectrum is similar to 2,4-D, but its activity is slower. MCPP does, however, control some weeds, such as clover, better than 2,4-D. The suggested use rate of MCPP is 1.5 to 2.5 ounces of a 2-pound ai/gallon formulation or 0.02 to 0.04 of a pound ai/1,000 square feet. MCPP can be used on centipedegrass, St. Augustinegrass, and other turfgrasses. Use caution when applying MCPP near desirable broadleaf plants.

Benzoic Acid Herbicide

Dicamba. Dicamba is an effective herbicide for control of broadleaf weeds. Apply this herbicide at 0.38 of an ounce of a 4-pound ai/gallon formu-

lation or 0.01 of a pound ai/1000 square feet. Dicamba controls Florida betony, chickweed, buttercup, henbit, clovers, lespedeza, pennywort, knotweed, and wild onion. Dicamba provides better control of these weeds than does 2,4-D. Several formulations of dicamba are available. Dicamba can be used on bermudagrass, hybrid bermudagrass, zoysiagrass, centipedegrass, St. Augustinegrass, and fescue. Do not apply dicamba close to flowers, shrubs, or trees. Many broadleaf plants can absorb dicamba from the soil and translocate the material to the growing points. Distorted or malformed leaves will be produced if this occurs. Use caution during application of this material near broadleaf plants.

Premixes

Many prepackaged mixtures (premixes) of 2,4-D, 2,4-DP, MCP, and dicamba are available. Premixes contain various rates of two or more of these herbicides. Premixes are formulated to capitalize on the strengths of each herbicide and to facilitate homeowner use. Control of a broader spectrum of weeds is possible with mixtures than with either of these products used singly. Prices of these materials may exceed that of the individual products on a dollar/pound ai basis, so compare prices before purchasing. Remember, you can mix these herbicides at the rates you prefer in the spray tank. Likewise, you can increase the rate by adding another herbicide in the spray tank. Do not exceed the suggested 2,4-D rate on St. Augustinegrass when using a premix.

Organic Arsenicals

CMA. CMA weed control spectrum is similar to that of DSMA and MSMA (see following entries). The use rate is 7.4 ounces of a 1-pound ai/gallon formulation or 0.06 of a pound ai/1,000 square feet. CMA can be used on bermudagrass, hybrid bermudagrass, and zoysiagrass. Do not use on centipedegrass or St. Augustinegrass. This herbicide causes less turf discoloration than does DSMA or MSMA.

DSMA. DSMA can be used to control escaped annual grasses, bahiagrass, dallisgrass, and for nutsedge suppression. Control of goosegrass will not be as good as that of other annual grasses. Multiple applications at 7- to 10-day intervals will be necessary for control of perennials, grasses, and nutsedges. Nutsedge control requires applications at 30-day intervals during

the growing season for 2 or more years. The suggested use rate of DSMA is 2.5 to 4.0 ounces of a 3.6-pound ai/gallon formulation or 0.07 to 0.11 of a pound ai/1,000 square feet. Add nonionic surfactant at a rate of 0.25 percent (v/v) if the formulation does not contain surfactant. Many formulations of DSMA are available. DSMA can be used on bermudagrass, hybrid bermudagrass, and zoysiagrass. Do not use this herbicide on centipedegrass or St. Augustinegrass.

MSMA. MSMA activity is very similar to that of DSMA. Weed control may be better than that with DSMA. The use rate of MSMA is 1.5 to 3.3 ounces of 4 pounds ai/gallon formulation or 0.05 to 0.10 of a pound ai/1,000 square feet. MSMA can be used on bermudagrass, hybrid bermudagrass, and zoysiagrass. Do not use MSMA on centipedegrass or St. Augustinegrass.

Imadazalinone Herbicide

Imazaquin. Image® is an effective herbicide for control of purple and yellow nutsedges, other sedges, wild onion, garlic, parsley-piert, chickweed, and henbit. The use rate is 0.5 to 1.0 ounce or 0.008 to 0.02 of a pound ai/1,000 square feet plus 0.25 percent (v/v) of a nonionic surfactant. Imazaquin can be used on established bermudagrass, zoysiagrass, centipedegrass, and St. Augustinegrass. Do not mow St. Augustinegrass less than 48 hours after application. Do not overseed or sprig less than 1 1/2 months after application. Drift onto ornamentals will cause injury. Use caution around ornamentals when applying this herbicide to turf.

Sulfonyleurea Herbicide

Halosulfuron-methyl. Halosulfuron-methyl (Manage® 75 WDG) is recommended to control yellow and purple nutsedges and to suppress green kyllinga in bahiagrass, bermudagrass, centipedegrass, St. Augustinegrass, and zoysiagrass. The use rate of Manage® is 0.015 to 0.031 ounces/1000 ft² (= 0.43 to 0.87 grams) or 0.01 to 0.02 ounces ai/1,000 ft². Apply after nutsedge has 3 to 8 leaves. Use lower rates for light infestations and the higher rate for heavy infestations. A second application may be needed 6 to 10 weeks after the initial treatment for complete control. Add nonionic surfactant at 0.5 percent with Manage® applications. Grasses should be well established at the time of application. Do not

mow turf 2 days before or less than 2 days after Manage® applications. Do not apply directly over the top of flowers, ornamentals, shrubs, or other desirable plants. Do not use clippings from treated areas to mulch around vegetables or ornamentals.

Triazine Herbicide

Atrazine. Atrazine has postemergence activity on many weed species. Addition of surfactant (0.25 percent v/v) will enhance the activity of this application. See the atrazine section under preemergence herbicides for rates, tolerant turfs, time of application, etc.

Miscellaneous Herbicides

Bentazon. Basagran® controls yellow nutsedge in bermudagrass, hybrid bermudagrass, zoysiagrass, centipedegrass, St. Augustinegrass, bahiagrass, and fescue. Apply 0.75 to 1.5 ounces of 4 pounds ai/gallon formulation or 0.02 to 0.04 of a pound ai/1,000 square feet at 10- to 14-day intervals, but do not make more than three applications per season. Do not mow less than 5 days after application.

Fenoxaprop-ethyl. Fenoxaprop-ethyl is sold under the tradename Acclaim 1EC®. The use rate of Acclaim® is 0.23 to 1.02 ounces or 0.0018 to 0.008 pound ai/1,000 square feet. Acclaim® controls annual grasses in zoysiagrass, fescue, and perennial ryegrass. Common bermudagrass suppression can be obtained with repeated applications. Repeat applications at 28- to 35-day intervals. However, use no more than three applications (3.16 ounces/1,000 square feet) per season. Addition of 0.25 percent nonionic surfactant is recommended.

Glufosinate. Finale® is a relatively new herbicide. Like glyphosate, it is nonselective and is postemergence. It also controls a broad spectrum of grass and broadleaf weeds. The rate of application for spot treatment depends upon weed species and size and ranges from 2 to 3 ounces per gallon of water for highly susceptible weeds. For more difficult to control annuals and perennials, the rate of application ranges from 3 to 4 ounces per gallon of water.

Finale® is suited for chemically trimming sidewalks, driveways, patios, flower beds, and natural areas because the herbicide does not move within the plant. This characteristic also

makes Finale® a better choice than glyphosate for application to dormant turf, but Finale® should only be applied to turf that is completely dormant with no signs of visible green stems, stolons, or foliage. Applications at 2.2 to 4.4 ounces per 1,000 square feet to dormant turf will control a wide variety of annual and perennial grasses and broadleaf weeds.

Glyphosate. There are several formulations and tradenames available. Glyphosate is a nonselective, postemergence herbicide that controls numerous annual and perennial grasses and broadleaf weeds. Ready-to-use formulations are available and are quite effective. However, they may not be economical if you consider the volume of water in the container.

Glyphosate products can be used for spot treatments in and around flower beds, but since the herbicide moves within the plant following absorption, you should use caution to avoid contacting the foliage with the spray.

Glyphosate has also been used to control emerged weeds in dormant warm-season turfs. This treatment can be tricky and is highly dependent on temperatures prior to the application. Turf grasses must be completely dormant with no green foliage, stems, or stolons to avoid injury to turf. Glyphosate is also quite useful as a product to edge walkways, patios, and driveways. However, since it does move within the plant, injury may extend several inches away from the point of application, thus creating a

ragged appearance.

For general weed control, a 1 percent solution (1.3 ounces per gallon of water) is adequate to control most annual weeds, and a 2 percent solution (2.6 ounces per gallon of water) works well on most perennial weeds. These solutions should be made from a 41 percent active ingredient concentrate base formulation. For optimum control of perennial weeds, make applications at the time of flowering, or at least 3 weeks before a killing frost.

Sethoxydim. Sethoxydim (Vantage® 1EC) controls crabgrass, goosegrass, and bahiagrass in centipedegrass and fine fescue lawns. Application rate of Vantage® is 0.5 to 0.75 ounce or 0.004 to 0.006 pound ai/1,000 square feet. Do not apply less than 3 weeks after spring greenup of centipedegrass. Do not apply before newly planted centipedegrass has 3 inches of new stolon growth. Do not apply to stressed centipedegrass. Do not mow area targeted for treatment within 7 days before or after Vantage® application.

For best bahiagrass control, do not mow within 7 days after application. Do not exceed 0.5 ounce/1,000 square feet per application to seedling centipedegrass or a total of 1.0 ounce/1,000 square feet per season. Do not exceed 0.75 ounce/1,000 square feet per season to established centipedegrass or 1.5 ounces/1,000 square feet per season. Do not apply to tall fescue turf.

Table 1. Turfgrass tolerance to herbicides.¹

Herbicide	Common bermuda	Hybrid bermuda	Centipede	Zoysia	St. Augustine	Tall fescue
Preemergence						
Atrazine	T	I	T	T	T	S
Benefin	T	T	T	T	T	T
Benefin + oryzalin	T	T	T	T	T	T
DCPA	T	T	T	T	T	T
Isoxaben ²	T	T	T	T	T	T
Metolachlor	T	T	T	NR	T	NR
Oryzalin	T	T	T	T	T	T
Pendimethalin	T	T	T	T	T	T
Prodiamine	T	T	T	T	T	T
Simazine	T	T ²	T	T	T	NR
Postemergence						
Bentazon	T	T	T	T	T	T
CMA	T	T	S	T	T	I
2,4-D	T	T ²	T ²	T	S	T
2,4-D + dicamba	T	T	T	T	S	T
2,4-D + MCPP ³	T	T	T	T	S	T
2,4-D + MCPP + dicamba	T	T	T	T	S	T
2,4-D + 2,4-DP ⁴	T ²	T ²	T ²	T ²	T ²	T
Dicamba	T	T	T	T	T	T
Fenoxaprop-ethyl	S	S	S	T	S	T
Halosulfuron-methyl	T	T	T	T	T	T
Imazaquin	T	T	T	T	T	S
MCPP	T	T	T	T	T	T
MCPP + chlorflurenol	T	T	T	T	T	S
MSMA/DSMA	T	T	S	T	S	I
Sethoxydim	S	S	T	S	S	S

1 T indicates tolerant when applied according to label directions; S indicates sensitive, do not use; I indicates intermediate, use with caution, or at reduced rates; NR indicates not registered for this turf. Consult product label before use.

2 Consult label for product use instructions and restrictions.

3 MCPP is an abbreviation for mecoprop.

4 2,4-DP is an abbreviation for dichlorprop.

Table 2. Weed and turf response to turf herbicides.¹

	Proflaminate	Atrazine	Benfen	Benfen + Oryzalin	DCPA	Isoxaben	Metolachlor	Oryzalin	Pendimethalin	Simazine	Atrazine	Bentazon	CMA/DSMA/MSMA	2,4-D	2,4-D + Dicamba	2,4-D + MCPP	2,4-D + MCPP + Dicamba	2,4-D + 2,4-DP	Dicamba	Fenoxaprop-ethyl	Halosulfuron-methyl	Imazaquin	MCPP	MCPP + Chlorfurenol	Sethoxydim	
	Preemergence										Postemergence															
Grass																										
Bahiagrass	N	-	G	G	G	-	N	G	G	-	-	N	F	N	N	N	N	N	N	N	-	-	N	N	N	S
Bluegrass, annual	E	G	G	G	G	S	L	E	E	E	G	N	N	N	N	N	N	N	N	N	-	-	L	N	N	F
Crabgrass	G	F	G	E	G	S	L	E	E	F	-	N	E	N	N	N	N	N	N	N	L	-	-	N	N	G
Dallisgrass	N	-	G	G	G	-	-	G	G	-	-	N	E	N	N	N	N	N	N	N	-	-	N	N	N	F
Goosegrass	G	F	F	F	G	S	L	G	G	N	F	N	F	N	N	N	N	N	N	N	L	-	-	N	N	F
Sandbur	-	F	G	G	G	-	-	G	G	-	F	N	G	N	N	N	N	N	N	N	-	-	L	N	N	F
Broadleaf																										
Betony, Florida	-	E	N	N	N	-	-	N	N	-	F	-	N	N	G	-	G	G	G	N	-	-	-	-	-	N
Buttercup	-	N	N	N	N	-	-	N	N	N	F	-	N	F	G	G	E	G	E	N	-	-	F	-	-	N
Buttonweed, Virginia	N	-	N	N	N	-	-	N	N	G	-	-	N	N	G	F	G	G	F	N	-	-	N	G	N	N
Carpetweed	-	-	G	G	G	L	L	G	N	E	G	-	N	G	G	G	G	G	G	N	-	-	F	N	N	N
Clover	-	G	N	N	N	-	-	N	N	F	G	-	N	N	E	G	E	E	E	N	-	-	E	F	N	N
Chickweed	F	E	N	F	G	L	-	G	G	E	E	-	N	F	G	G	E	G	E	N	-	G	G	E	N	N
Dandelion	N	-	N	N	N	-	-	N	N	F	N	-	N	E	E	E	E	E	G	N	-	-	F	G	N	N
Dichondra	N	E	N	N	N	N	-	N	N	N	F	-	N	F	G	G	G	G	G	N	-	-	-	F	N	N
Garlic, wild	N	-	N	N	N	-	-	N	N	N	N	-	N	F	F	F	F	F	F	N	-	E	N	-	-	N
Henbit	-	E	N	N	N	L	-	G	G	E	E	-	N	F	G	G	E	G	E	N	-	F	F	N	N	N
Ivy, ground	N	-	N	N	N	-	-	N	N	N	F	-	N	G	G	N	G	G	G	N	-	-	-	G	N	N
Knotweed	-	G	N	F	N	L	-	F	N	G	-	-	N	F	G	G	G	G	E	N	-	-	G	-	-	N
Lespedeza	-	G	N	N	N	-	-	N	N	F	G	-	N	F	G	G	G	G	E	N	-	-	G	G	N	N
Pennywort	N	G	N	N	N	L	-	N	N	-	-	-	N	F	-	-	-	-	E	N	-	L	-	G	N	N
Pepperweed, Virginia	-	-	N	N	N	-	-	N	N	E	-	-	N	G	G	G	G	G	G	N	-	-	F	-	-	N
Plantain	-	-	N	N	N	L	-	N	N	F	-	-	N	E	G	G	G	G	F	N	-	-	F	F	N	N
Pusley, Florida	-	E	N	F	N	-	L	N	N	G	-	-	N	N	-	N	-	-	-	N	-	-	N	F	N	N
Shepherdspurse	-	-	N	N	N	L	-	N	N	E	-	-	N	G	G	G	G	G	G	N	-	-	F	-	-	N
Speedwell	-	E	N	N	N	L	-	N	N	F	G	-	N	N	F	F	F	F	N	N	-	-	N	F	N	N
Spurge, prostrate	-	G	N	N	F	L	-	F	F	G	F	-	N	N	G	G	G	G	G	N	-	-	-	N	N	N
Spurweed	-	G	N	N	N	-	-	N	N	E	G	-	N	F	G	F	G	G	G	N	-	L	-	-	-	N
Woodsorrel	-	G	N	N	N	L	-	F	F	G	-	-	N	N	F	N	F	F	G	N	-	F	F	F	N	N
Sedge																										
Nutsedge, purple	N	N	N	N	N	N	N	N	N	N	N	N	F	N	N	N	N	N	N	N	E	G	N	N	N	N
Nutsedge, yellow	N	N	N	N	N	N	L	N	N	N	N	G	F	N	N	N	N	N	N	N	E	G	N	N	N	N

¹ E = excellent, G = good, F = fair, N = no activity, L = control indicated on label, S = suppression indicated on label, - = no data.



By Dr. John Byrd, Jr., Extension and Research Professor, Plant and Soil Sciences.

Remember, before using any pesticide, read and follow directions stated on the label. The information given here is for educational purposes only. References to commercial products or trade names are made with the understanding that no discrimination is intended against other products that may also be suitable.

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