

WEEDS

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WEEDS

Learning Objectives

- Learn the basics of weed biology and classification
- Learn how to identify weeds by different plant parts
- Learn the basic weed-control methods
- Learn about the different types of herbicide application equipment
- Learn how to calibrate a sprayer
- Learn how to remove a tree stump
- Learn about noxious weeds and why they are classified that way

Introduction

“A weed is a plant that interferes with the management objectives for a given area of land at a given point in time.” -J. M. Torell

A weed is any plant that is growing where it is not wanted and is more competitive than the surrounding desirable plants. Time, energy, and money for weed control can be kept to a minimum by planning carefully and choosing wisely in practices and materials. Effective weed management involves learning about the weed, understanding the particular site and situation, and employing a diversity of practices to provide desirable results.

Weeds are not only unsightly but also compete with desirable plants for nutrients, water, sunlight, and space. In addition to competing with landscape and vegetable plants, some weeds secrete toxins into the soil which, much like herbicides, damage or inhibit the growth of desirable plants. Weeds can ruin lawns, gardens, and flower beds. In some situations, weeds can be such a problem that the only practical weed control is to destroy the entire planting.

Weeds can also provide a “bridge” for insects and diseases from one growing season to another. When weeds are present, additional applications of insecticides and fungicides may be required.

Weeds have contributed to several other problems in the home landscape environment. Field bindweed, for example, can grow through asphalt, causing the premature failure of driveways and streets. Weeds contribute to health problems such as hay fever, respiratory problems, and skin irritations. Some weeds puncture bike tires and injure bare feet. Pets also are affected by weeds. Weed seeds may enter their nostrils and ears, causing irritation and infections; weed seeds may become enmeshed in their fur, causing discomfort. Often times a veterinarian is needed to remove the seed.

Most homeowners are concerned with weeds that exist near their homes because weeds are a general nuisance, mar the natural beauty of a home site, and decrease the value or marketability of residential properties. Weeds contribute to fire and safety hazards and reduce property values.

Landscapes and yards overgrown with weeds serve as a reservoir of weed seed that can spread to neighboring yards. As a result, some municipalities have ordinances requiring owners to cut down overgrown, weedy lots. A few imported weeds are so invasive and expensive to control that they have been declared noxious and therefore illegal to grow or go to seed.

Although seeds are generally thought of as uninvited guests, weeds do have some limited beneficial characteristics. Weeds can be a source of feed for domestic animals and wildlife, can help prevent erosion, and can add organic matter to the soil.

Weed Biology and Classification

The classification of weeds is achieved by grouping together those weeds whose similarities are greater

than their differences. For preciseness, weeds are grouped botanically by family, genus, species, and variety. For convenience, weeds are commonly classified in categories such as terrestrial and aquatic or woody and herbaceous.

Weeds also are classified as trees, shrubs, grasses, sedges, and ferns. They are also commonly grouped according to similar life cycles, that is the cycle of life from viable seed to mature plant and the cycle of viable seed formation to plant death. On this basis, weeds are grouped as annuals, biennials, and perennials.

ANNUAL WEEDS

These complete a life cycle in one year. Annuals germinate from seed and emerge, grow, flower, set seed, mature, and die in one growing season. Annual weeds depend upon the production of large numbers of viable seeds for long-term survival. Many successful weed species produce thousands of seeds per plant (Table 1). In addition, weed seed has varying levels of dormancy that contribute to its persistence (Table 2). This characteristic gives weeds the ability to germinate over a period of many years.

Annuals that complete a life cycle during the period from spring to fall are referred to as summer annuals. The majority of weeds that are found in the garden or in new lawns and landscapes are summer annuals. Examples commonly found in yards include different pigweeds, common lambsquarters, hairy nightshade, common purslane, prostrate spurge, prostrate knotweed, green and yellow foxtail, barnyard grass, and crabgrass.

Table 2. Germination percentages per year of weed seeds buried 8 inches deep.

Common name	Life cycle	1	2	3	4	16	21
	Percentage of germination after (years)						
Canada thistle	perennial	21	35	15	6	3	1
Green foxtail	annual	1	3	6	4	0	0
Quack grass	perennial	21	0	0	0	0	0
Redroot pigweed	annual	9	0	1	11	0	0
Velvetleaf	annual	0	0	45	70	75	57

Gross, W. L., “Viability of Buried Weed Seeds,” *Journal of Agricultural Research* 29(7): 346–62.

Table 1. Seed production for common weeds.

Common name	Number of seeds produced per plant
Barnyard grass	7,000
Green foxtail	34,000
Redroot pigweed	117,000

Annuals that germinate and emerge in the fall, lie dormant during the winter, resume growing in the spring until maturity, and die in the late spring or early summer are referred to as winter annuals. Some of the most troublesome winter annual weeds are annual bluegrass and downy brome and a number of mustards, such as shepherd's purse and flixweed.

BIENNIAL WEEDS

Biennials require two growing seasons to complete their life cycle. Biennials germinate, emerge, and usually form a rosette (radial cluster of leaves lying close to the ground) the first year. During the second year, the plant bolts (produces a flower stalk), flowers, sets seed, matures, and dies. Biennial weeds are not as prevalent as annual weeds in gardens; but they may appear along property borders, in ground covers, and within perennial planting. Biennials that are commonly found in a home garden-landscape site include: sweet clover, common burdock, common mullein, bull thistle, and Queen Anne's lace.

PERENNIAL WEEDS

These live three years or more and reproduce sexually (from seed) and asexually (from vegetative growth). They may or may not flower the first year. Perennials that reproduce from seed are identical to annuals and biennials in the seedling stage and thus are most susceptible to control when they are young. Within a few weeks or months, however, perennials develop vegetative reproductive organs, giving them the ability to propagate and spread asexually. It is this characteristic that makes perennials so difficult to control. Perennials are classified into three different categories based upon how they reproduce.

Simple perennials have either a large taproot such as a dandelion or a fibrous root system such as bunchgrass. Simple perennials propagate mostly by seed, but if the roots are broken into pieces, each piece is capable of reproducing new plants.

Creeping perennials reproduce by rhizomes (stems) or creeping roots as well as by seed. Quack grass and field bindweed are good examples.

Bulbous perennials reproduce by bulb or nutlike structures and by seeds as well. Purple nutsedge and bulbous bluegrass are examples of bulbous perennials.

Identification

Identification of a weed should be the first step taken in a successful control program. Successful identification of weed species requires that a sample, with as much of the plant as possible, be intact. This includes flowers, stems, leaves, and roots. Careful examination of various plant structures should be used in the identification process to distinguish between "look-a-likes." A knowledge of where and how the weed was growing also will help in identifying which control measures can be used.

FLOWER

This is the structure most commonly used in classifying and identifying plants. However, weed-control measures often must be implemented before flowering. When flowers are present, note the arrangement on the stem, their size, shape, color, the presence or absence of various flower parts, and number of petals. These are all important factors in determining the particular family in which a plant is classified. If the plant has set seed, note characteristics such as size, shape, type of fruit, capsules, pods, burs, hardness, and structure.

LEAVES AND STEM

Weeds also can be identified through careful examination of leaves and stem. Stem woodiness, cross section, and the presence or absence of leaves on the stem should be observed. Stem woodiness is classified as herbaceous (a stem that is not woody), semi-woody, and woody (a perennial stem that is entirely woody such as found in a tree). Cross section of the stem refers to the shape of the stem and is often closely tied to leaf arrangement and leaf shape. Stems may be oval, round, triangular, ridged, square, winged, or grooved. Flowering stem leaves may be absent (dandelion) to uniformly leafy.

WEED STRUCTURE

Leaf arrangement, type, presence or absence of stipules, petioles, and tendrils, venation, length, shape, surface, and succulence are all important clues for identifying weeds.

ROOTS

All the belowground plant parts can also provide information on the plant. Pull or dig up some of the

root system and belowground plant parts. Determine whether it has a fibrous or taproot system and look for bulbs, corms, tubers, or rhizomes.

Identification of the weed before implementing control practices is important but requires more extensive knowledge than what has been covered in this section.

Weeds of the West, Weeds of Nebraska and the Great Plains, and Weeds 2.0 for Identification of Weeds of the Western United States are several excellent identification references available to help identify weeds. County Extension educators and the University of Idaho departments of Plant Sciences; Soil and Water Systems; and Entomology, Plant Pathology, and Nematology also are available to assist in identifying problem weeds and to provide suggestions for their control.

Weed-Control Methods

Once the weed is identified and biology of the plant is understood, control measures can be considered. “Silver bullets” and “one-shot control programs” that will control weeds without harming nontarget plants are very rare or nonexistent. An integrated approach to weed control is the most efficient and environmentally safe approach. An integrated approach also uses a combination of cultural, mechanical, physical, and chemical techniques to bring weed populations to an acceptable level. Six methods available to the homeowner include prevention, biological control, cultural control, mulches, mechanical control, and chemical control.

PREVENTION

The most effective, least costly weed-control strategy. Avoid the introduction of weed problems through careful examination of materials that will be used in developing the home landscape or garden.

Carefully examine the label on packaged seed and bulk seed. Avoid buying seed containing weed seed. If noxious weed seed is present, return the seed to the supplier and ask for your money back. It is against the law to sell and propagate noxious weeds. Some seed catalog companies sell “wildflower” mixes that may contain noxious weed seed. The scientific names found in the catalog description and on the seed packet should be compared to the list of noxious weeds listed at the end of this chapter. Report the problem to your county weed supervisor who will

contact the Idaho State Department of Agriculture to lodge a complaint against the company.

Inspect nursery plants and transplants before purchase to avoid introducing roots, rhizomes, or stolons of perennial weeds. Buy your plants from a reliable nursery that sells only weed-free plants.

Avoid introducing weed seeds, roots, rhizomes, stolons, and bulbs into the garden and flower beds by using weed-free straw, manure, mulch, compost, and soil. Unless these amendments have been sterilized, they probably contain weed seed. Know the source of these amendments before transporting them to your yard. Selecting sources with relatively low weed populations and avoiding sources with undesirable weed species will pay off in the long run.

Tillage equipment can easily spread unwanted weeds to relatively weed-free areas. Clean garden tractors, tillers, hand tools, and other equipment to remove soil, weed seeds, and plant parts.

Irrigation water that flows through canals and streams can transport weed seed to your yard. Screen irrigation water from surface sources.

“One year’s seed, seven years of weeds.” Control vegetative and seed sources around the yard and garden. Destroy weeds before they become established, set seed, and let them mature.

BIOLOGICAL CONTROL

This type of control uses other organisms to control weeds. It is not a very practical solution to many weed problems found in urban home horticultural settings, but it may be useful on small acreages. Geese can be used to remove actively growing weeds in dormant strawberries, asparagus, peppermint, cane berries, and trees. Hogs will seek out fleshy-rooted weeds in fallow. Sheep and goats can control many weed and brush species in pastures. Insects and diseases also can be used to suppress or kill specific weeds; however, this type of control generally lags behind weed populations. Many gardening enthusiasts have been disappointed in the use of insects and diseases to control weeds.

CULTURAL CONTROL

These practices have been found to be effective and cost-efficient in a home horticultural setting. Integrating cultural control components with other control measures minimizes the impact of weeds on desirable plants, yet provides acceptable control.

Select competitive plants. Use plant competition to minimize weed establishment, growth, and reproduction. A vigorously growing ground cover that is more competitive than the weeds will lessen the weed problem. Generally, weeds are more competitive than the garden crop species during early development. Weed competition during the first 3–4 weeks after the garden emerges will have the greatest effect on the garden yield. Vigorously grown garden crops develop canopies that shade weeds, suppress weed germination, and hinder growth. Garden crops that are slow growing and less competitive should be transplanted. Table 3 shows when selected garden crops are most sensitive to weed competition.

Anything that would encourage vigorous growth of desirable garden plants to compete with weeds should be implemented. Provide moisture to desirable plant roots, using a method that will reduce or eliminate the moisture to weeds. Rotate crops to break the natural cycle of weeds, insects, and disease. A rotation may include fallowing or omitting crop production for one or more years. Growing different types of plants in the area each year may also be effective. Plant winter cover or competitive plants rather than leaving the soil bare.

Alter planting dates. Delay planting until after the first flush of weeds has emerged, then use cultivation techniques to remove small weeds. Plant for optimum growth of desired plants while avoiding growing conditions conducive to weed germination and growth. Seeding lawns in late summer and early fall is a good example of this method.

Place and time fertilizer applications to maximize plant growth by banding fertilizer applications. Band or side-dress fertilizers near desirable plants (while placing nutrients in a less-available position to weeds growing between the rows) to promote optimum crop growth.

MULCHES

These are an extremely effective weed-control tool in the garden and around the home landscape. Mulches are soil coverings such as plastic or straw that prevent sunlight from reaching the soil. A mulch conserves moisture and modifies the microclimate and soil temperature around the plant. They are categorized as natural or artificial: natural mulches

Table 3. Weed-competition period for garden crops.

Crop	Critical period for weed competition (number of weeks after emergence or transplanting)
Beets	2–4
Cabbage	3–4
Carrots	4½
Corn	3
Cucurbit family (melons)	5
Onions	12
Peas	3–4
Potatoes	3–4
Row crops not covered	4
Snap beans	4
Spinach and lettuce	3–4
Tomatoes	5

Source: Nelson, J. E., G. McKinney, and J. F. Connor. 1989. *Home Garden Weed Management*. Montana State University (Bozeman), EB 58.

are effective in eliminating annual weeds and reducing the competitiveness of perennial weeds; artificial mulches are effective in controlling both annual and perennial weeds.

Natural mulches are applied 2–4 inches deep after weeds are removed through cultivation or with a herbicide. They are composed of materials such as bark, grass clippings, leaves, compost, manure, sawdust, wood chips, straw, hay, crushed corncob, and pine needles. Most natural mulches are considered waste products and are often disposed of in landfills. Many of these mulching materials are free of charge. A visit to your local tree-care expert or gardening store may provide specific suppliers' names.

As with other materials used in the home landscape, the homeowner should examine and avoid mulch material with weed seeds and live vegetative plant parts capable of establishing new weed infestations. The life expectancy of natural mulch will vary from 1–3 years depending on the material used, depth of material, and management associated with the landscape or garden.

Live mulches such as grasses and legumes sometimes are used between perennial plant rows. These live mulches are grown to a predetermined stage, killed, and allowed to remain in place to decompose over time. In the garden, natural mulches such as straw can be used in the planting of asparagus, cabbage, carrots, cauliflower, lettuce, peas, potatoes, turnips, and other cool-season crops to reduce weed competition while maintaining cool soil temperatures.

Artificial mulches include plastic, polyester landscape cloth, and sometimes newspaper and tar paper. When artificial mulches are used in a landscape application, natural mulches are applied 1 inch deep on top. The natural mulch hides the artificial mulch and protects it from solar degradation. Polyester landscape cloth should be used in landscape applications rather than plastic or tar paper. Polyester landscape cloth allows air exchange and moisture percolation through the mulch to the root zone. Natural mulches stay put on polyester landscape cloth but tend to slide off plastic.

In vegetable garden applications, black plastic is the preferred artificial mulch. It increases the rate at which soils warm during the growing season and it modifies the microclimate for improved growth rates of warm-season vegetables such as tomato, muskmelon, watermelon, cucumber, and squash. It is relatively inexpensive and easy to handle. When black plastic is used, irrigation applications need to be modified from surface or sprinkler systems to drip applications that function below the plastic. Other colored plastics may enter the commercial market place in the future. Colored plastic mulches, like those that come in red, have increased tomato yields by 10%–15% over black plastic mulch.

Newsprint also can be used in the garden and can be very effective in reducing weed problems. Newspapers can be turned into the soil at the end of the season, unlike black plastic, which must be taken up before cultivation. Tar paper can be used to mulch around trees and shrubs, but it is more difficult to apply and is rarely used.

A process that has become more popular in recent years is solarization. Solarization uses the sun's energy to raise soil temperatures high enough to kill weeds, including seeds, roots, and rhizomes as

well as many other soil organisms. Solarization is accomplished by laying and anchoring the edges of a sheet of clear plastic over the entire fallowed area to be treated. The soil should be moist to conduct and hold heat, to stimulate weed seed germination, and to prevent dormancy of belowground vegetative plant parts. To conduct heat as deeply as possible, the soil should be firm.

Maximum weed kill depends upon the amount of bright, sunny weather and weed species. The longest day of the year and when most direct solar radiation occurs is on June 21, the vernal equinox. Position the plastic by June 1 and leave it in place for about two months. If precipitation is more than 20 inches per year, solarization may need to be extended into mid-summer and may be less satisfactory in such areas.

Late winter and early spring solarization may reduce weed populations before planting, but it is not as effective as late spring and summer solarization. However, the entire growing season is not lost when using this type of solarization. The process for accomplishing this type of solarization is as follows:

1. Till the garden soil and prepare the seedbed in autumn.
2. Place clear plastic over the garden in midwinter or soon after snowmelt. Solar heat warms the soil under the plastic on warm, sunny days, causing seeds to germinate. Sprouted weeds, however, die as daytime temperatures rise to temperatures of 100°F–130°F under the plastic, which should be high enough to kill most species. Weeds may also die from freezing.
3. Leave the plastic in place and continue solarization until planting time. Because tilling the soil after removing the plastic brings more weed seeds near the soil surface, plant without further tillage.

MECHANICAL CONTROL

Includes hoeing, pulling, rototilling, mowing, cultivating, and burning. Mechanical methods are best adapted to eliminating annual weeds depending on the species, the particular location, and the type of implement used. Seedling biennial and perennial weeds also can be controlled mechanically. Once the perennial weed is able to vegetatively reproduce, mechanical control is not very effective. Mechanical methods such as hoeing, mowing, and cultivating

cut the plant off at or just below the surface leaving the root or rhizome behind to send up new growth. Deeper tillage such as rototilling or deep plowing may bring some of the roots or rhizomes to the surface, but even if a small root segment or rhizome remains in moist soil, the weed can reestablish itself.

In some instances mechanical control can spread weeds to infest new areas. Effective mechanical control of perennial weeds will require cultivation every 14–21 days. This repeated cultivation over 2–3 years stimulates root development while depleting stored food (carbohydrates) and eventually the plant dies.

Hoeing cuts the plant at or just below the soil surface. Hoes should be kept sharp to reduce the effort of controlling weeds. Often times gardeners will use the hoe to dig or aerate the soil. This is an improper use of this tool. Use a shovel or rototiller to aerate soil. Deep cultivation has a tendency to bring weed seed to the soil's surface providing an excellent environment for weed seed germination. Deep hoeing or tillage in the garden also can damage desirable plants. A proper hoeing technique disturbs the soil very little while removing the weed. Many different hoe styles are available.

- A **hand cultivator** or **tractor-mounted cultivator** generally consists of V-shaped teeth, which till the soil 1–2 inches deep. The action of this tool is similar to the hoe, in that it cuts the weed off at or just below the soil surface and drags the small weed root to the soil surface to dry. Other implements such as disk harrows, sweeps, rolling cultivators, and finger weeders are in this same category.
- **Mowing** is an effective way of reducing the amount of seed that weeds will produce and eliminating annuals. The practice must be timed to remove the top before seed is produced. Mowing after viable seed has set can be a good way of spreading weeds to new areas. The vigor and stand density of established perennial weeds can be reduced through repeated mowing, although it requires a long period of time.
- **Hand weeding** is effective, but it is a labor-intensive method of removing weeds growing close to desirable plants. Care must be taken that the weed pulling does not damage the roots of desirable plants.

- **Burning or flaming** weeds is generally done with a propane torch. Timing of the operation must be such that control is performed before viable seed set. The most effective control of annual weeds is when they are small (about 3–5 inches tall). The effect of burning perennial weeds is similar to that of mowing. Consider carefully where and when this method is used, since it is more difficult to control in tall dry weeds than previous methods outlined. There have been cases in which out-of-control burning operations have burned a straw pile, barn, or home. Check with local ordinances and regulations before burning perennial weeds.

CHEMICAL CONTROL

This method can save labor while providing acceptable control. When used correctly, chemical control can be an inexpensive weed-control tool. However, it does have some drawbacks. Herbicides can injure or kill desirable plants and are expensive if used improperly.

Extension educators are often asked to investigate injured or dying trees, shrubs, and other desirable landscape or garden plants that “the neighbor sprayed” only to find out that the gardener used herbicide inconsistent with the label's instructions.

Thoroughly read the label of any herbicide. Be sure the beneficial plant to be protected is listed on the label. Timing of the herbicide applications must follow the label instructions. Even an application of 2,4-D for control of weeds in lawns can injure grass if applied during the heat of the summer. **Always read and follow label directions!**

Herbicides usually are not used in vegetable gardens for several reasons:

- No single herbicide can be used safely on all vegetables grown in a garden
- Some herbicides can persist in the soil and injure sensitive vegetable crops the following year
- Spray drift can injure sensitive plants growing in the garden

Herbicides are grouped into families based on chemical properties and how the chemical works to kill the plant. Herbicides also are grouped by when they are applied to control weeds.

Preemergence herbicides are applied before the emergence of the weed or crop. Herbicides in this group kill weeds as they germinate. These herbicides are further classified as preplant and postplant preemergence herbicides. Preplant herbicides are applied to the soil before planting the desired crop and before the weeds germinate. Postplant herbicides are applied after the desired crop has been planted but before the weeds or crop have germinated.

Generally, preemergence herbicides are applied to the surface of the soil and either watered in (precipitation or irrigation) or mechanically incorporated into the soil. Failure of these herbicides to work may be the result of poor incorporation because the weeds have already germinated.

Postemergence herbicides are designed to kill emerged weeds. These herbicides may be translocated (e.g., 2,4-D) or contact herbicides (e.g., paraquat). Translocated herbicides are applied to foliage or soil. Plants absorb the herbicide through leaves, stems, or roots and move it through the plant to the site of herbicidal action (where the herbicide works). Translocated herbicides work well on perennial plants because the herbicide is moved to roots and other belowground vegetative reproductive parts. Contact herbicides are applied to the foliage of the plant. These herbicides kill only where they directly contact the plant and do not move within the plant. Contact herbicides are a poor choice for the control of perennial weeds.

Herbicides are further classified as selective and nonselective. If the herbicide kills the weed but does not injure the beneficial plant, then the herbicide is termed selective. If the herbicide injures or kills the weed and beneficial plant, then the herbicide is known as nonselective.

Herbicides should only be used according to label directions. Registered uses and rates of application are listed on the product label. Improper use or application rate can cause injury or death to nontarget plants even though the product is selective. Selectivity of a herbicide may depend on any one or a combination of the following factors:

1. Some plants may be able to detoxify the herbicide by metabolizing it into a harmless substance while other plants are killed.

2. Foliar-applied herbicides may not be absorbed by leaves or stems because various structures (such as pubescents and thick waxy cuticles) block the absorption of the herbicide.
3. Selectivity of a herbicide may also be due to its placement in the soil. Herbicides such as Casoron, when applied correctly by shallow incorporation, will kill germinating weeds and shallow-rooted weeds. Deep-rooted desirable perennial plants will not absorb the herbicide because the herbicide is placed above the root zone.

Soil sterilants are applied to the soil to prevent the growth of weeds and other plants. Some sterilants may be applied to foliage with desired results, but they will leave a long-lasting residue in the soil. The length of time that a sterilant will be effective depends on the rate applied and the persistence of the herbicide.

Extreme care should be taken when using soil sterilants. Some of these products have a tendency to move with water and can easily be leached from the point of application to root zones of beneficial plants (trees, shrubs, and grass) thus injuring nontarget plants. Soil sterilants are not suggested for use in the yard or garden because they are long lasting and difficult to remove if the homeowner decides to change the use of the treated area.

Fumigants are nonselective and can kill seed and plant parts below the soil surface. Fumigants are not readily available and are only used in greenhouse or commercial operations.

Before product labeling, herbicides undergo a series of tests before they are approved for use by a gardener. These tests evaluate the fate of the herbicide in the environment and potential hazards to the user and non-target organisms. Determining the fate of the herbicides in the environment include how they degrade, how herbicides move with water (leach), how they bind with soil, how quickly they volatilize and drift, and how toxic they are to fish or other nontarget organisms. The label contains most of this information as well as directions for use. Impact to the environment can be minimized by following **all** of the label instructions and environmental warning statements.

Additional information specific to the behavior of herbicides in plants and soils, use precautions, toxicological properties, and herbicidal use can be obtained from your Extension educator.

Herbicide-Application Equipment

Several types of application equipment are suitable for weed control. Application equipment ranges in price from inexpensive canister plastic sprayers to elaborate and expensive power sprayers pulled by garden tractors. The most important consideration is to find suitable equipment for the particular job or situation. Choose dependable equipment that will have a long service life and will do the type of job you need. Types of application equipment include the following:

HAND-SPRAY BOTTLES

Several home and garden herbicides are now packaged in a ready-to-use, disposable applicator spray bottles, much like common glass and window cleaners. They are meant to be used for spot treating small areas or individual weeds.

HOSE-END SPRAYERS

These sprayers attach to the end of a garden hose and may be acceptable for soil drenches and preemergence herbicides with a wide margin of safety. Because they are difficult to calibrate and too variable for proper application, hose-end sprayers are not recommended for most herbicides where precision of application is desired.

COMPRESSED AIR CANISTER SPRAYERS

The most common sprayers used by homeowners are 1- to 3-gallon compressed air sprayers. There are metal and plastic models. Both are equally effective, but the plastic model is less expensive. A compressed air sprayer is ideal for spot spraying postemergence herbicides and will provide a reasonably precise application of preemergence herbicides. Problems encountered through the use of this sprayer include nozzle plugging and spray tank corrosion (this is not a problem with plastic or stainless steel sprayers).

Compressed air sprayers do present a safety problem if the pressure in the tank is not equalized

with the outside pressure before opening the tank to refill or clean it. However, some manufacturers now include a pressure relief valve that eliminates this hazard.

BACKPACK SPRAYERS

Several models of backpack sprayers are available. These are usually more expensive; but they are versatile, have up to a 5 gallon capacity, and can be maintained at more uniform pressure than canister sprayers. These sprayers are constructed of plastic or stainless steel, but the inexpensive plastic models are preferred. One of the few disadvantages associated with a backpack sprayer is the tendency for the applicator to leak and then soak the wearer's back with herbicide.

POWER SPRAYERS

These sprayers are a good investment and ideal for large areas. They have a pump and regulator to provide constant pressure and a more uniform spray delivery. The spray tank may consist of plastic, fiberglass, stainless steel, galvanized steel, or epoxy-lined steel. These systems usually have a gun-type nozzle for spot treatments and sometimes a boom for broadcast applications. The disadvantages of power sprayers are similar to those of the backpack sprayers and pressurized canister sprayers.

WICK WIPERS

Various makes and models of "wiper" applicators are available, primarily for use in applying a 33% solution of glyphosate. Wick wipers allow accurate placement of herbicide on unwanted plants, which helps to deter spray drift.

GRANULAR APPLICATORS

These applicators spread granular herbicide formulations of fertilizers. Two general types of granular applicators are available to homeowners:

1. The **gravity** or **drop-type** applicator is best used on level turf areas or on level areas where the soil has been firmed. Use of this type of applicator on a steep hill or loose soil conditions will result in nonuniform applications.
2. The **cyclone** or **whirlybird** will operate under almost any type of condition but is affected by wind and tall vegetation.

Sprayer Calibration

Many people do not calibrate their application equipment and then wonder why their weed-control efforts fail. Calibration for a herbicide treatment differs from an insecticide or fungicide treatment. Insecticides and fungicides are applied at a specific concentration while herbicides are applied at a specific rate of product per unit area (e.g., ounces per 1,000 sq ft).

NOTE

It is best not to use the same sprayer for both insect and weed control. Some herbicides, such as 2,4-D, are difficult to completely remove from sprayers. If you do decide to use the same sprayer, be sure to wash it with detergent after herbicide use. Then, fill the tank and prime the system with an ammonia solution (1 quart of household ammonia in 10 quarts of water) and let stand. After 12–24 hours, rinse and purge the sprayer with clean water until the ammonia solution is totally removed.

Therefore, the amount of water used is not as important as the amount of herbicide used per unit area as long as adequate coverage is obtained with the water used.

Factors affecting the calibration of a sprayer include pressure, nozzle size, condition, number, the viscosity of the spray, and the speed at which the area is covered. Variable pressure will cause variable spraying.

Therefore, maintaining constant pressure or using a pressure regulator will facilitate a consistent application. The rate of speed that an area is covered should be held as constant as possible to improve the accuracy of the application. Gardeners using handheld or hand-operated sprayers will operate their sprayers at different pressures and cover areas at different speeds. Therefore, calibration should be done by the individual who will be making the application.

CALCULATING YOUR SPRAYER

Any kind of sprayer can be calibrated by using the following steps:

1. Check the operation of the sprayer. Check for a clogged nozzle and hose, rust in the tank, and

leaks. Thoroughly clean and repair the sprayer before calibrating the sprayer.

2. Mark off 100 square feet. (You may want to use 1,000 square feet for a more accurate calibration.) Use a string or garden hose to mark off the area.
3. Add a known quantity of water to the sprayer that is sufficient to cover the marked-off calibration area.
4. Spray the calibration area exactly as you would spray herbicide. Be sure to walk the same speed and use the same pressure as you would when spraying the herbicide. Remember, you only need to lightly wet the plants. Don't spray until the water drips off.
5. Measure the remaining water in the tank. The difference between what you originally added to the tank and what remains is the amount of water required to cover 100 square feet (or 1,000 square feet).

NOTE

Many recommendations are given per 1,000 square feet. If 100 square feet is used for calibration, multiply the difference remaining in the tank by 10 to calculate the amount of water that would be required to cover 1,000 square feet.

- If you applied 18 fluid ounces to a 100-square-foot area, apply 180 fluid ounces or 1.4 gallons of water to cover a 1,000 square foot area.
- Add the recommended rate of the chemical to the amount of water needed to spray 1,000 square feet.
- Apply the herbicide by walking the same speed and using the same pressure as when you calibrated.

GRANULAR APPLICATORS

These can be calibrated in a similar way as sprayers, but the applicator must use the herbicide granular material in the calibration process. A cement or asphalt driveway or a large plastic canvas sheet can be used to catch the herbicide as it is distributed by the spreader. The surface area of the drive or canvas sheet is measured. Then the applicator is in the same

Table 4. Designation of Idaho noxious weeds.

Black henbane (<i>Hyoscyamus niger</i> L.)
Buffalo bur (<i>Solanum rostratum</i> Dun.)
Canada thistle [<i>Cirsium arvense</i> (L.) Scop.]
Dalmatian toadflax [<i>Linaria dalmatica</i> (L.) Mill.]
Diffuse knapweed (<i>Centaurea diffusa</i> Lam.)
Dyer's woad (<i>Isatis tinctoria</i> L.)
Eurasian watermilfoil (<i>Myriophyllum spicatum</i>)
Field bindweed (<i>Convolvulus arvensis</i> L.)
Hoary cress [<i>Cardaria draba</i> (L.) Desv.]
Johnsongrass [<i>Sorghum halepense</i> (L.) Pers.]
Jointed goatgrass (<i>Aegilops cylindrica</i> Host)
Leafy spurge (<i>Euphorbia esula</i> L.)
Matgrass (<i>Nardus stricta</i> L.)
Meadow knapweed (<i>Centaurea pratensis</i> Thuill.)
Milium (<i>Milium vernale</i> Bieb.)
Orange hawkweed (<i>Hieracium aurantiacum</i> L.)
Musk thistle (<i>Carduus nutans</i> L.)
Perennial pepperweed (<i>Lepidium latifolium</i> L.)
Perennial sow thistle (<i>Sonchus arvensis</i> L.)
Poison hemlock (<i>Conium maculatum</i> L.)
Puncture vine (<i>Tribulus terrestris</i> L.)
Purple loosestrife (<i>Lythrum salicaria</i> L.)
Rush skeletonweed (<i>Chondrilla juncea</i> L.)
Russian knapweed [<i>Acroptilon repens</i> (L.) DC.]
Scotch broom [<i>Cytisus scoparius</i> (L.) Link]
Scotch thistle (<i>Onopordum acanthium</i> L.)
Silverleaf nightshade (<i>Solanum elaeagnifolium</i> Cav.)
Skeletonleaf bursage (<i>Ambrosia tomentosa</i> Nutt.)
Spotted knapweed (<i>Centaurea stoebe</i> L.)
Syrian bean-caper (<i>Zygophyllum fabago</i> L.)
Tansy ragwort (<i>Senecio jacobaea</i> L.)
Toothed spurge (<i>Euphorbia dentata</i> Michx.)
Whitetop (<i>Lepidium draba</i>)
Yellow hawkweed (<i>Hieracium pratense</i> Tausch)
Yellow star thistle (<i>Centaurea solstitialis</i> L.)
Yellow toadflax (<i>Linaria vulgaris</i> Mill.)

manner that it would be operated for the actual application. After completing this calibration application, the granules are swept up and weighed.

EXAMPLE

You have sprayed 13 ounces on the 100 square feet.

$$13 \text{ oz} \times 10 = 130 \text{ oz (about 1 gallon) per 1,000 square feet}$$

Add the recommended amount of herbicide to 1 gallon of water to spray the 1,000 sq ft area.

Adjustments are made to the applicator until the desired amount has been applied in a consistent manner. The operator should note the setting on the applicator so that calibration is not required before each time an application is made. However, calibration should be done whenever the source of the material changes or at the beginning of the season each year.

Tree Stump Removal

When trees are hewn from a landscape, removal of the remaining stumps often becomes a difficult problem.

MECHANICAL REMOVAL

Using heavy equipment, such as a backhoe, to remove a tree stump can be expensive. It also might result in unacceptable damage to turf, ornamentals, or other adjacent vegetation. Failure to remove the complete stump and roots will often result in a proliferation of new shoots.

Some homeowners use an axe or chain saw to cut away stumps. This generally requires a lot of time and energy but can be successful if the trunk is not too large and if the roots can be removed.

CHEMICAL TREATMENTS

Treating tree trunks with an appropriate herbicide concentrate before cutting (or treatment of live stumps after cutting) will kill stumps and roots and stop sprouts from developing. Use caution when treating trunks or stumps with herbicides. Some herbicides may leach into the root zone of nearby plants. Application of herbicide is usually best accomplished with a paintbrush rather than a sprayer. A dead stump will normally decompose in 1 or 2 years. Then, the rotted wood can easily be removed by hand.

Noxious Weeds

“Noxious weed” means kind of species of any plant having the potential to cause injury to public health, crops, livestock, land or other property, and which is designated as noxious by the director.

Chapter 24, Title 22, Idaho Code, Noxious Weeds

Noxious weeds are weeds that have been declared by law to be noxious. Property owners must not allow noxious weeds to go to seed or propagate on their land. Idaho, through the State Department of Agriculture, determines weeds to be listed as noxious and provides counties the power to administer the law.

Procedures have been set by law and rules promulgated by the State Department of Agriculture which form noxious weed districts. These districts direct noxious weed-control efforts within in their jurisdiction. These efforts may include handling complaints, entering property through an established procedure to control noxious weeds, attaching claims against property to cover control costs, and cooperating with other agencies and organizations in controlling noxious weeds. The weeds listed in Table 4 are officially designated and published as noxious.

It shall be the duty and responsibility of all persons and nonfederal agencies to control noxious weeds on land and property that they own, in accordance with this chapter and with rules and regulations promulgated by the director of the Department of Agriculture.

Chapter 24, Title 22, Idaho Code, Noxious Weeds

Further Reading

BOOKS

- Ahrens, W. H., and M. T. Edwards. 1994. *Herbicide Handbook*. 7th ed. Champaign, IL: Weed Science Society of America.
- Buchholtz, K. P. et al. 1976. *Weeds of the North Central States*. North Central Regional Publication No. 36, University of Illinois, Agricultural Experiment Station, Circular 718.
- Callihan, R. H., R. T. Dobbins, and S. L. Carson. 1993. *Weeds 2.0 for Identification of Weeds of the Western United States*. University of Idaho, Cooperative Extension System, Weed Diagnostics Laboratory.
- Pacific Northwest Pest Management Handbooks. n.d. *Weed Management Handbook*. Corvallis: Oregon State University. <https://pnwhandbooks.org/weed>.
- Stubbendieck, J., G. Y. Friisoe, and M. R. Bolick. 1994. *Weeds of Nebraska and the Great Plains*. Nebraska Department of Agriculture, Bureau of Plant Industry.
- Whitson, T. D. et al. 1991. *Weeds of the West*. The Western Society of Weed Science in cooperation with the Western United States Land Grant Universities, Cooperative Extension Services.

BOOKLETS AND PAMPHLETS

University of Idaho Extension

- BUL 775 *Planning an Idaho Vegetable Garden*
- CIS 1041 *Conduct Your Own Garden Research*

ALWAYS read and follow the instructions printed on the pesticide label. The pesticide recommendations in this UI publication do not substitute for instructions on the label. Pesticide laws and labels change frequently and may have changed since this publication was written. Some pesticides may have been withdrawn or had certain uses prohibited. Use pesticides with care. Do not use a pesticide unless the specific plant, animal, or other application site is specifically listed on the label. Store pesticides in their original containers and keep them out of the reach of children, pets, and livestock.

Trade Names— To simplify information, trade names have been used. No endorsement of named products is intended nor is criticism implied of similar products not mentioned.

Groundwater— To protect groundwater, when there is a choice of pesticides, the applicator should use the product least likely to leach.

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