



Weed Control Options in Landscape Beds and Groundcovers

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Weed management in landscape plantings can be complex. Challenges arise from differences in the combinations of ornamental plants grown, the type of weeds that occur, and the use of mulches. Herbicide options are often limited by mixtures of woody and herbaceous ornamentals in the landscape, as well as health and environmental concerns. Usually, various control strategies must be combined to keep weeds from detracting from the beauty and quality of a landscape.

Weeds can be grouped in three general categories: broadleaf, grasses, and sedges. Each type presents its own special problems and often requires different control measures. With Hawaii's year-round growing season, all of these weed types can constantly become established in a landscape, and a continuing year-round program is necessary to keep weeds under control.

Many of the common broadleaf weeds that infest Hawaii's landscape are annuals; that is, they grow from a seed, flower and produce seeds, and die within one growing season—a period of weeks or months. Annual weeds are most likely to enter the cultivated landscape area through seed dispersal by wind, birds, or soil erosion. In Hawaii, many annuals do not appear seasonally but rather occur throughout the year, with no winter dormancy period. They therefore have a continuous life cycle and present a constant problem.

Both annual and perennial grassy weeds occur in Hawaii's landscapes. Perennial grasses live for many years. They can spread by seed dispersal as do annuals, but creeping perennials also spread by extending "run-

ner" stems either underground (rhizomes) or over the surface of the soil (stolons), or by both methods. These grasses are especially hard to control because of the difficulty in completely killing all of the rhizomes and stolons. Popular turfgrasses like bermudagrass, centipedegrass, and zoysiagrass are warm-season perennials that often invade neighboring landscaped garden areas by extending runners. These grasses are most likely to be a continual problem during the warm summer months when they are actively growing. Repeated herbicide treatments may be necessary to maintain a killed strip between landscape beds and the turf.

Annual grasses are easier to control than perennials. They are classified as "summer" or "winter" types based on their emergence pattern, although both types tend to persist throughout the year in Hawaii. Summer annuals germinate more prolifically in the spring, grow during the summer months, and flower in late summer or early fall, after which they gradually begin to die. Common summer annuals include large crabgrass in landscape beds and smooth crabgrass, goosegrass, and smutgrass in turf areas. Winter annuals tend to emerge more in the fall in Hawaii, persist through the winter into spring, and die in the hot, dry summer months.

Certain sedges can be troublesome weeds. They persist in the soil by producing underground tubers as propagules, in addition to spreading by seed and rhizomes. Sedges are often mistakenly identified as grasses, but herbicides that control grassy or broadleaf weeds are usually ineffective on them. Among the most com-

Caution: Pesticide registrations frequently change. Mention of a pesticide in this publication is not a guarantee that the product will be registered for the same use in the future. Read the pesticide label to be sure that the intended use is included on it, and follow all label directions. Consult an agrichemical sales representative, the Hawaii Department of Agriculture, or the University of Hawaii Cooperative Extension Service for up-to-date information on available pesticide formulations.

mon weedy sedges in Hawaii are purple and yellow nut-sedge (nutgrass), green and white kyllinga, and McCoy grass. (See also CTAHR publication L-9, *Nutgrass control in the lawn, landscape, and garden.*)

Design and prepare the ornamental planting bed with weed control in mind

Grouping similar plant types together allows for more weed control options in landscape beds. Herbaceous plants, especially annual flowers, are more sensitive to herbicides than ornamental shrubs or trees. In such flower beds, the preferred weed control options are use of preemergence herbicides, mulching, and hand pulling. More herbicides are registered for use around woody ornamentals, which also help shade out weeds that might otherwise germinate.

A rich variety of plant types and colors is desirable and attractive in a landscape, but designers should carefully consider the requirements for maintaining the landscape over time. Before establishing a planting, evaluate the site's soil type and slope and identify existing weeds so suitable plants, mulches, and herbicide options can be selected. Before the beds are planted, control existing weeds with a nonselective herbicide such as RoundUp® or Finale™.

Avoid introducing weeds or their propagules (seeds, rhizomes, stolons) into the landscape with soil or planting materials, or on equipment. Eliminate emerging weeds before they begin to form seed. Soil of container-grown stock and root balls of field-grown nursery stock may contain weed seeds, tubers, or fragments of rhizomes, which are also transplanted into the landscape.

Mulches are an effective tool

Mulches are commonly used in landscape beds to improve appearance, conserve moisture, and control weeds. Mulches work well in suppressing annual weeds but generally will not suppress perennials as effectively. Mulches can be classified as organic (bark, wood chips, compost, leaves), inorganic (crushed rock, crushed coral, gravel), and synthetic (black plastic, landscape fabric). Mulches limit light and physically block seedling growth.

As organic mulches break down into finer particles, the mulch layer becomes a good growing medium for weeds. Inorganic and synthetic mulches therefore usually provide better weed control than organic mulches. Although natural inorganic mulches such as gravel or

stone are generally more expensive than organic mulches, they are stable over time, allow good water drainage and air flow, and can make a very attractive addition to the landscape.

Coarse-textured organic mulches such as wood chips can be applied up to 4 inches deep and provide long-term weed control. Fine-textured mulches pack more tightly and should be limited to a depth of 2 inches. They degrade more quickly and consequently provide weed suppression for a shorter period of time. The optimum mulch is relatively coarse-textured with a low water-holding capacity.

Perennial weeds such as bindweed, oxalis, and plantain often have sufficient root reserves to penetrate even thick mulch layers. Some annual weeds can grow through mulches or germinate on top of a mulch as it decomposes. Weeds with wind-borne seeds, such as horseweed, fireweed, and dandelion, are most likely to become established in a mulch.

Weed barriers can improve the weed control obtained with mulches

Solid black plastic film under a mulch dramatically improves weed control compared to mulch alone. Black plastic has been used for years and provides excellent control of annual weeds and suppression of perennials. However, nonporous black plastic restricts water penetration and air exchange; thus, it is not recommended for long-term use in landscape plantings.

Porous, black landscape fabrics (geotextiles) have been developed to replace black plastic film in landscapes. Landscape fabrics form a barrier and block sunlight from reaching weed seeds but allow the water and gas exchange necessary for plant health. However, weed shoots can penetrate up through any openings in the fabric, and grass roots can penetrate down through openings in the fabric if they are allowed to germinate on the surface of the mulch. Therefore, the fabric should be free of rips and other openings for maximum weed control. A key to the successful use of fabrics is maintaining the mulch layer free of weeds, either by hand-weeding or the use of herbicides. Some brands of fabric, such as Biobarrier II®, contain a preemergence herbicide. Although relatively expensive and labor intensive to install, landscape fabrics are cost effective if the planting is to remain in place for several years.

Landscape fabrics are most useful for long-term

weed control around trees, shrubs, and woody ornamental plantings. They are less suitable for annual flower beds that are replanted periodically, or in plantings where a fabric could inhibit rooting and spread of groundcover plants. Landscape fabrics can eventually be damaged by tree and shrub roots, and pulling up a fabric may be difficult due to root growth within the material.

When installing a fabric, first remove existing weeds and stones. Cut the fabric to fit loosely around tree trunks and shrubs, leaving enough room for future growth and also to inspect the root crown for injury. For unplanted beds, cut an “H” in the fabric for each planting hole. Avoid leaving soil from the planting hole on top of the fabric, because this will serve as a source of weed seeds.

After planting, fold the fabric back down to keep the sheet as continuous as possible, and secure it with U-shaped pegs. Apply a thin layer of organic or rock mulch on top of the fabric to prevent its deterioration from exposure to UV light (photo-degradation). If weeds grow into or through the fabric, remove them when they are small to prevent holes from forming in the fabric.

Mulches in combination with herbicides improves weed control

Because mulches rarely provide complete weed control, preemergence and postemergence herbicides can be applied to improve the level of control. Some factors to consider before selecting an herbicide are

- Which weeds are present and which weeds are expected to emerge? Are the grassy weeds annual or perennial? Choose an herbicide or combination of herbicides that will be effective on these weeds.
- Which ornamental species are present in the planting? Is it safe to over-spray a grass herbicide? Be sure the herbicide is registered for use on these species.
- How close are susceptible ornamentals and turf, and what is the risk that they will be injured by the herbicide?
- What is the potential for residual effects of the herbicide on subsequent plantings, especially those containing annual flowers?
- What precautions need to be taken to protect the applicator and property owners?
- What method will be used to apply the herbicide (granular or spray formulation)?
- How much will the treatment cost?
- How long will it take for the treatment to be effective, and how long will it last?

Herbicides are classified according to their mode of action and the kinds of weeds they control. Some classes of herbicides are effective either on grasses or broadleaf weeds but not both. Many herbicides that are effective on grasses or broadleaves are not at all effective on sedges. Therefore, management strategies can be very different, depending on the weeds present and their location within the landscape bed.

Preemergence herbicides

Preemergence herbicides affect germinating seeds and are generally used to control annual grasses and broadleaf weeds that spread primarily by seed dispersal. To be effective, this type of herbicide should be applied to the soil several weeks before weed seeds would normally germinate. In Hawaii, seeds are continually being disbursed and germinating, which necessitates periodic applications of preemergence herbicide throughout the year.

Granular preemergence herbicide formulations may be applied with a fertilizer spreader. The spreader must be calibrated to apply the rates specified on the product label. Liquid formulations can be applied with compressed-air or hose-end sprayers. Both granular and liquid preemergence herbicide formulations can be applied over the top of existing ornamentals and groundcovers, if the label allows. Preemergence herbicides must cover the area uniformly and come in contact with the soil, and most of them need to be activated by irrigation or rainfall within 1–2 weeks of application. Best results are obtained when at least ½ inch of water is applied to the area immediately after applying the herbicide. This also helps to wash the herbicide off the foliage of any existing plants and onto the soil surface.

Preemergence herbicides differ in the length of their residual effect and should be reapplied accordingly. Some preemergence formulations are volatile and must be cultivated into the soil for maximum effectiveness; others form a thin film over the surface of the soil and are ineffective if the soil surface is disturbed after application. Generally, herbicides degrade faster under wet, warm conditions than under dry, cool conditions.

Dinitroanilines are a group of preemergence herbicides that are most effectively used on groundcovers or plantings that contain only herbaceous plants. This group includes Treflan® (trifluralin), Surflan® (oryzalin), Pendulum™ and PreM™ (pendimethalin), Barricade™

(prodiamine), and TeamPro® (trifluralin + benefin). They inhibit root development in germinating seedlings and are most active on annual grasses but also prevent the emergence of some broadleaf weeds. Other preemergence herbicides for landscapes are Devrinol® (napropamide), Pennant™ (metolachlor), and Dacthal® (DCPA), all of which prevent the emergence of annual grasses and some broadleaf weeds. Pennant, in addition, has preemergence activity on yellow nutsedge. Gallery® (isoxaben) controls a wide spectrum of broadleaf weeds, and Goal® (oxyfluorfen) has greater preemergence activity on broadleaf weeds than grasses.

Additional choices are available for annual grass and broadleaf control in woody ornamental plantings. In addition to the other preemergence formulations, control of annual grasses and some broadleaf weeds is also obtained with Casoron™ (dichlobenil), Ronstar™ (oxadiazon), and the combination products Regal O-O® (oxyfluorfen + oxadiazon), Rout® (oxyfluorfen + oryzalin), Ornamental Herbicide2® (oxyfluorfen + pendimethalin), Snapshot TG® (isoxaben + trifluralin), and XL™ (oryzalin + benefin). These products are best for woody ornamental plantings because of their potential for injuring herbaceous plants. Ronstar has greater preemergence activity on broadleaf weeds than grasses. Casoron controls annual weeds and also certain perennial grasses and tough-to-control weeds like thistle, horsetail, oxalis, wood sorrel, and plantain. It can be used around established woody ornamentals such as yews, arborvitae, and juniper, but not around firs, spruces, or hemlocks. Casoron should be applied during cooler weather and covered with mulch or watered in soon after application. Of the herbicides registered for landscapes, Casoron is one of the best for preemergence control of biennial and perennial weeds. Because Casoron affects some turf-grasses, care must be taken to prevent the granules from reaching turf areas when applying it to ornamental beds. Also, Casoron and Ronstar should not be used in herbaceous ornamental beds.

Use the information contained in herbicide labels to determine tolerance of ornamental plants to a given herbicide. Match herbicides with weeds present and consider using herbicide combinations. Combinations of herbicides increase the number of species of weeds controlled and provide effective control of grasses and many broadleaf weeds.

Mulches can interact with herbicides

The placement of an herbicide in relation to an organic mulch can affect the herbicide's performance, especially the preemergence formulations. In addition, specific characteristics of organic mulches can affect how herbicides work. A mulch that is primarily fine particles can reduce the availability of some herbicides. The finer the organic material (peat moss or manure, compared to bark), the greater the binding of the herbicide. Most herbicides are tightly bound by soil organic matter, less with mulches, and although the binding may minimize leaching, it can also minimize the activity of the herbicide. Mulch that is made up of larger, coarse particles will have little effect on reducing herbicide activity.

A more important factor is the depth of the mulch. A preemergence herbicide applied on top of a thin mulch may be able to leach through to where the weed seeds are germinating, but when applied to the top of a thick layer of mulch it may not get down to the zone where the seeds are germinating. Products like Ronstar and Goal that require a continuous surface layer must be placed on the soil surface under the mulch. Most preemergence herbicides work best when applied underneath the mulch layer. Such placement is possible only if the herbicide is applied before the mulch is deposited or if additional mulch is spread after herbicide application. Another reason to apply herbicides under mulch is to reduce volatilization losses.

In general, the preemergence herbicides listed above, with the exception of Casoron, do not control established perennial grasses. Preemergence herbicides for crabgrass do control perennial grasses germinating from seed, and some inhibit pegging down of creeping perennials. However, to effectively control perennial grasses in groundcovers and ornamental landscape beds, postemergence herbicides should be used.

Postemergence herbicides

Postemergence herbicides are used to kill weeds after they have germinated and are growing. To be effective, most postemergence herbicides must be absorbed through the leaves; therefore, liquid sprays generally work better than dry, granular materials. Postemergence herbicides are effective against grasses, sedges, and broadleaf weeds. They are most effective when applied to young, vigorously growing weeds. Postemergence herbicides generally provide little residual weed control.

They are either inactivated by binding to soil particles or rapidly degraded by soil microorganism. The postemergence products that are available for control of perennial grasses and broadleaf weeds include both selective and nonselective materials. Nonselective herbicides kill all plants, including desirable ornamentals and turfgrasses, so extreme care should be used when applying them. Selective postemergence products carry less risk of injury to desirable plants, and many can be applied directly over the top of ornamentals and turf.

Selective postemergence herbicides

The selective herbicides for grass control, generally referred to as postemergence grass herbicides, are the compounds of choice in broadleaf groundcovers and ornamental beds due to their high degree of safety to desirable plants. This group of selective herbicides includes Poast™ and Vantage™ (sethoxydim), Fusilade™ and Ornamec™ (fluazifop), Acclaim™ (fenoxaprop), and Envoy™ (clethodim). These products are systemic, meaning that they are taken up into the plant's system and affect the roots as well as rhizomes and stolons of perennial grasses. Repeat treatments are usually necessary for long-term control of established grasses. Members of this class of herbicide only control grasses and have practically no effect on most broadleaf weeds, sedges such as nutgrass and kyllinga, and other nongrass monocots such as wild onion and wild garlic. These herbicides must not be applied over the top of ornamental grass or to many of the turfgrasses, and care should be taken to prevent drift into areas planted with these when applying the products to ornamental beds.

Sethoxydim (Poast, Vantage) and fluazifop (Fusilade, Ornamec) have been used extensively for annual and perennial grass control in a wide range of herbaceous and woody broadleaf ornamentals. These two types of herbicides are commonly used to control established Johnsongrass, bermudagrass, and quackgrass, tenacious weeds with few control options when growing among ornamentals. Sethoxydim does not affect centipedegrass if used at recommended rates, and is therefore very effective in controlling most grassy weeds in centipedegrass turf. Fluazifop is effective on all annual and perennial grasses including all warm-season turfgrasses used in Hawaii. Acclaim effectively controls annual grasses, with suppression of certain perennial grasses including bermudagrass. Envoy is the newest

compound in this group; it controls both annual and perennial grasses, including bermudagrass, in a wide range of ornamentals.

Sedges such as nutgrass (purple and yellow nutsedge), green and white kyllinga, and McCoy grass are perennials that present their own special problems. They are not affected by most of the grass or broadleaf herbicides, although the preemergence herbicide Pennant™ will control yellow nutsedge. The most effective control for most sedges is with the postemergence products Image (imazaquin) and Manage™ (halosulfuron). Both can be applied over many broadleaf ornamentals and turfgrasses. Always read the label to be sure it is safe to over-spray the existing plants.

Very few if any postemergence herbicides can safely be over-sprayed against broadleaf weeds in groundcovers or ornamental beds. This is because most plants used for groundcover or ornamentals are also broadleaf plants that will be affected by the herbicide. In these cases, selective and nonselective post-emergence herbicides may be used as a spot spray on existing broadleaf weeds if they are located away from the desirable plants, such as on top of mulch, and there is little danger of over-spray. Because most broadleaf weeds in Hawaii are annuals, the best control is obtained with one of the preemergence products mentioned above.

Herbicide combinations increase the weed control spectrum. When allowed by the labels, some of the grass and broadleaf herbicides discussed previously may be mixed. Product labels must be checked carefully for lists of ornamental species that the product has been registered for use in.

Nonselective postemergence herbicides

In some situations it is desirable to eliminate all vegetation for renovations, vegetation management, or simple spot spraying. Herbicides used for this purpose fall into the general category of nonselective postemergence products. These herbicides can further be separated into several different types based on their mode of action.

Some are soil-applied and enter plants through root uptake, providing immediate as well as residual control. Examples of this type are Pramitol® (prometon) and Spike® (tebuthiuron). Others are applied to the foliage and primarily used to eliminate existing vegetation. RoundUp Pro™ (glyphosate) and Finale™ (glufosinate-ammonium) both use this mode of uptake. Some herbi-

cides have both types of activity; examples are Hyvar[®] (bromacil), Krovar[®] (bromacil + diuron), Arsenal[®] (imazapyr), and Sahara[®] (imazapyr + diuron).

Some of these herbicides are systemic and are more effective in killing woody and perennial plants. Systemics tend to be slow acting but result in total kill of the entire plant. Others are contact herbicides and tend to work very quickly, earning them the nickname of “burndown” herbicides. These rapidly “top-kill” all vegetation contacted by their spray, but perennial weeds can regrow. Common contact herbicides include Reward[™] and Aquatrim II (diquat), Scythe[®] and Quick[®] (pelargonic acid), and Montar[®] and Weed Ender[®] (cacodylic acid). Finale also produces a rapid burndown.

Fumigants are a valuable type of nonselective herbicide used for treating soil prior to planting. They may control nematodes, insects, and plant diseases in addition to weeds. Methyl bromide has been the mainstay soil fumigant for many years. However, its use has become restricted in recent years and will be completely banned by the year 2005. Two newer preplant fumigants are metham sodium, sold under the brand names Metham CLR[®], Vapam HL[®], Soil Prep[®], and Sectasory[®], and dazomet, sold under the brand name Basamid[™] Granular.

It is important to understand that all nonselective herbicides kill any plant they contact and can cause unwanted injury to desirable plants upon contact with green stems, roots, or foliage. All must be applied only as directed or used as spot treatments in which ornamentals and turf are not contacted. Due to the potential for in-

jury to nontarget plants with any of these products, and especially those that translocate, extreme care must be taken when applying them around desired plants. Shielding nontarget plants to prevent spray contact can minimize the potential for systemic injury.

It is important to identify by name the grassy and broadleaf weeds and sedges that infest the landscape beds and groundcovers you maintain. Determine if they are annual or perennial, and then develop a control strategy that accommodates the ornamentals being maintained and the weeds that need to be controlled. Depending on the situation, you may need methods that are cultural, chemical, or a combination of these to control weed problems.

Herbicide injury to nontarget plants

Soil-applied herbicide damage to established ornamental plants is often temporary, but serious growth inhibition can occur with newly planted plants. Preemergence herbicides that contain oryzalin or isoxaben may be more likely to cause injury to nontarget plants. Some methods are available to remove unwanted herbicide toxicity from the soil, but usually it just takes time for the herbicide to completely degrade. To speed degradation, supplement soil organic matter by incorporating compost, and keep the soil moist but not wet during periods of hot weather. Herbicide injury symptoms vary with the plant species and the herbicide and can include yellowing (chlorosis), bleaching, root stunting, distorted growth, and death of leaves or the entire plant.

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