

WEED MANAGEMENT IN LANDSCAPES

*Integrated Pest Management for Landscape Professionals
and Home Gardeners*



Weed management in landscape plantings is often made difficult by the complexity of many plantings: usually more than one species is planted in the landscaped area and there is a mix of annual and perennial ornamentals. The great variety of ornamental species, soil types, slopes, and mulches creates the need for a variety of weed management options. There are also considerations regarding public concern about the use of chemicals to control weeds. The choice of a specific weed management program depends on the weeds present and the types of turf or ornamentals planted in the area. Because of the many variables, weeds in landscape plantings are controlled by a combination of nonchemical and chemical methods.

Most landscape plantings include turfgrass, bedding plants, herbaceous perennials, shrubs, and trees. Information on integrated pest management for turfgrass can be found in *UC IPM Pest Management Guidelines: Turfgrass* (see "References"). Use this publication as a practical review and guide to weed management options suited to general types of landscape plantings.

WEED MANAGEMENT BEFORE PLANTING

An integrated approach, utilizing several options, is the most economical and effective means of controlling weeds. Begin your weed management plan for landscapes before planting by following these five basic steps:

1. *Site assessment.* Before soil preparation and when the weeds are visible, evaluate the soil, mulch, and slope of

the site. Identify the weed species in the area, with particular emphasis on perennial weeds. The best time to look for winter annual weeds is mid- to late winter; perennials and summer annuals are easiest to identify in mid- to late summer.

2. *Site preparation.* The most often overlooked aspect of a landscape maintenance program is site preparation. Control existing weeds, especially perennials, before any grading and development are started. Glyphosate (Roundup, etc.) can be used to kill existing annual and perennial weeds. Preplant treatment with fumigants (available to licensed pesticide applicators only) or soil solarization can be used if time allows; however, 6 weeks are required for solarization to work and it is most effective when done during the time of highest sun radiation—from June to August in California.

3. *Define the type of planting.* There are more weed control options if the planting consists entirely of woody plants as opposed to herbaceous annuals or perennial plants, or a mixture of all three.

4. *Don't introduce weeds.* Weeds are sometimes introduced in the soil brought to the landscape site either when amending the soil or in the potting mix of transplants.

5. *Encourage rapid establishment of desired plants.* Use the best management practices to get the plants established as quickly as possible so that they become competitive with

weeds and more tolerant of herbicides applied to the site. Hand-weeding and keeping weeds from producing seeds in the landscape will greatly reduce overall weed populations.

WEED MANAGEMENT AFTER PLANTING

When developing a weed management plan for an existing planting or after an installation is in place, consider the types of plants present and the weeds present and their life cycles (annual, biennial, perennial) (Table 1).

TABLE 1. Common Weeds in Landscape Plantings.

Annuals

annual bluegrass
clover (black medic and burclover)
common groundsel +
crabgrass (large and smooth) +
little mallow (cheeseweed)
pigweed (redroot and prostrate)
prickly lettuce
purslane
sowthistle
spurge (prostrate and creeping) +
wild barley
wild oat

Biennials

bristly oxxtongue +

Perennials

bermudagrass +
creeping woodsorrel +
dandelion
field bindweed +
kikuyugrass
nutsedge (yellow and purple) +
oxalis (creeping woodsorrel and
Bermuda buttercup)

+ especially troublesome

Weed control options in the landscape include hand-weeding and cultivation, mowing, mulching, hot water treatments, and chemical control. All of these methods are used at one time or another in landscape maintenance operations (Table 2). After elimination by hand-pulling, cultivation, or a post-emergent herbicide application, the subsequent growth of annual weeds can be discouraged with mulches and/or preemergent herbicides.

Cultivation and Hand-weeding

Cultivation (hoeing) and hand-weeding selectively remove weeds from ornamental plantings. These methods are time-consuming, expensive, and must be repeated frequently until the plantings become established. Cultivation can damage ornamentals with shallow roots, bring weed seeds to the soil surface, and propagate perennial weeds. When cultivating, avoid deep tilling, as this brings buried weed

seeds to the soil surface where they are more likely to germinate. Perennial weeds are often spread by cultivation and should be controlled or removed by other methods.

Frequent hand-removal of weeds when they are small and have not yet set seed will rapidly reduce the number of annual weeds. If weeds are scattered at a site, hand-weeding may be the preferred management method. Hand-

TABLE 2. How to Manage Weeds in Five Types of Landscape Plantings.

Type of planting and comments	Recommendations
<p>Woody Trees and Shrub Beds. Densely shaded plantings reduce weeds. Preplant weed control is not as critical as in other types of plantings. It is often necessary to combine treatments for complete weed control.</p>	<p>Control perennial weeds before planting (although control may be possible after planting); use geotextile fabrics with a shallow layer of mulch or use a thick layer of mulch without a geotextile base; use a preemergent herbicide, if needed, and supplement with spot applications of postemergent herbicides and/or hand-weeding. Perennial weeds may be controlled by manual removal, spot applications of glyphosate or glufosinate, or, in some instances, dormant-season applications of preemergent herbicides. Escaped weeds may be controlled manually or with spot applications of postemergent herbicides.</p>
<p>Woody Ground Cover Beds. Woody ground covers should exclude most weeds; however, weed encroachment during establishment is likely.</p>	<p>Control perennial weeds before planting, although perennial grasses may be selectively controlled after planting with fluazifop (Fusilade, Ornamec), clethodim (Envoy), or other selective grass herbicides. Annual weeds may be controlled with mulch plus a preemergent herbicide, supplemented with some hand-weeding. Use geotextiles where possible but do not use them where ground covers are expected to root and spread. After planting, it is difficult to make spot applications of nonselective herbicides without injuring desirable plants. Postemergent control of most annual and perennial grasses is possible.</p>
<p>Annual Flower Beds. A closed canopy will help shade out many weeds. Periodic cultivations (at 3- to 4-week intervals and between display rotations) will suppress many weeds.</p>	<p>Control perennial weeds before planting and carefully select flower species for weed management compatibility. Annual weeds may be controlled with mulches, preemergent herbicides, frequent cultivation, and/or hand-weeding. Perennial grasses can be selectively controlled with clethodim or fluazifop, or other grass-selective herbicides, but other perennial weeds cannot be selectively controlled after planting. Geotextiles generally are not useful because of the short-term nature of the planting. Avoid nonselective herbicides after planting.</p>
<p>Herbaceous Perennial Beds. Weed management options in herbaceous perennial beds are similar to those for annual flowers, except (1) it is more important to eradicate perennial weeds as there will be no opportunity to cultivate or renovate the bed for several years; and (2) fewer species are included on herbicide labels.</p>	<p>Control perennial weeds before planting; use geotextiles where possible; use mulches with a preemergent herbicide; and supplement with hand-weeding.</p>
<p>Mixed Plantings of Woody and Herbaceous Plants. Weed management is complex because of the diversity of species. Different areas of the bed could receive different treatments. Site preparation is critical because postplant herbicide choices are few.</p>	<p>Plant the woody species first; control perennial weeds in the first two growing seasons, then introduce the herbaceous species. Plant close together to shade the entire area. Another option may be to define use-areas within the bed that will receive similar weed management programs.</p>

weeding can be time consuming and costly but should be included in all weed management programs to keep weeds from seeding.

Young weeds in open areas also can be controlled with small flaming units. Propane burners are available to rapidly pass over young weeds to kill them. A quick pass over the plant is all that is necessary; do not burn the weed to the ground. Flaming is more effective on broadleaf weeds than grasses. Be careful not to flame over dry vegetation and dry wood chips or near buildings and other flammable materials, and don't get the flame near desired plants.

The top growth of older weeds can be controlled by using a string trimmer. Annual broadleaf weeds are more effectively controlled than annual grasses because the growing points of grasses are usually below ground. Perennial weeds regrow rapidly after using a string trimmer. Be careful not to girdle and kill desirable shrubs and trees with repeated use of a string trimmer.

Mowing

Mowing can be used to prevent the formation and spread of weed seeds from many broadleaf weeds into cultivated areas by cutting off flower heads. However, weeds that flower lower than the mowing blade are not controlled. Repeated mowing tends to favor the establishment of grasses and low-growing perennial weeds. Mowing of some ground covers can rejuvenate them and make them more competitive against weeds.

Mulches

A mulch is any material placed on the soil to cover and protect it. Mulches suppress annual weeds by limiting light required for weed establishment. Many types of landscape mulches are available. The most common are bark and other wood products and black plastic or cloth materials. Other products that are used include paper, yard compost, hulls from nuts (pecans) or

cereals (rice), municipal composts, and stones.

Organic mulches include wood chips, sawdust, yard waste (leaves, clippings, and wood products), and hardwood or softwood bark chips or nuggets. Bark chips are moderate-sized particles ($\frac{1}{8}$ to $\frac{1}{2}$ inch) and have moderate to good stability, while bark nuggets are larger in size ($\frac{1}{2}$ to $2\frac{1}{2}$ inches) and have excellent stability over time. These materials can be used in landscape beds containing herbaceous or woody ornamentals.

The thickness or depth of a mulch necessary to adequately suppress weed growth depends on the mulch type and the weed pressure. The larger the particle size of the mulch, the greater the depth required to exclude all light from the soil surface. Coarse-textured mulches can be applied up to 4 inches deep and provide long-term weed control. Fine-textured mulches pack more tightly and should only be applied to a depth of about 2 inches. If the mulch is too decomposed, it may serve better as a weed propagation medium rather than a means of prevention. Plan to periodically replenish landscape mulches, regardless of particle size, because of decomposition, movement, or settling. If seedlings germinate in mulches, a light raking, hoeing, or hand-weeding will remove the young weeds.

Inorganic mulches, which include both natural and synthetic products, are generally more expensive and less widely used in the landscape. Natural inorganic mulches are stable over time and include materials such as sand, gravel, or pebbles. Most of these products are used in public and commercial plantings. If using a rock mulch, consider placing a landscape fabric underneath it. The fabric creates a layer between the mulch and soil, preventing rock pieces from sinking into the soil. The fabric prevents soil from moving above the rock layer, which would bring weed seed to the surface.

Black plastic (solid polyethylene) can be used underneath mulches to improve weed control. It provides excellent control of annual weeds and suppresses perennial weeds, but lacks porosity and restricts air and water movement. For this reason, black plastic may not be the preferred long-term weed control method in landscape beds.

Synthetic mulches, which are manufactured materials that are called geotextile or landscape fabrics, have been developed to replace black plastic in the landscape. Geotextiles are porous and allow water and air to pass through them, overcoming the major disadvantage of black plastic. Although these materials are relatively expensive and time-consuming to install, they become cost-effective if the planting is to remain in place for 4 or more years. Geotextiles are used mainly for long-term weed control in woody ornamental trees and shrubs. Geotextiles should not be used where the area is to be replanted periodically, such as in annual flower beds or in areas where the fabric would inhibit the rooting and spread of ground covers. Tree and shrub roots can penetrate the materials and if the material is removed, damage can occur to the plant's root system. This might be a concern if a fabric has been in place longer than 5 years. At least one geotextile fabric (BioBarrier) has an herbicide encapsulated in nodules on the fabric that reduces root penetration problems.

Placing a landscape fabric under mulch results in greater weed control than mulch used alone. There are differences in the weed-controlling ability among the geotextiles: fabrics that are thin, lightweight, or have an open mesh allow for greater weed penetration than more closely woven or non-woven fabrics.

To install a landscape fabric, you can plant first and then install the fabric afterwards using U-shaped nails to peg it down. After laying the cloth close to

the ground, cut an "X" over the plant and pull it through the cloth. If laying down a fabric before planting, cut an "X" through the fabric and dig a planting hole. Avoid leaving soil from the planting hole on top of the fabric because this could put weed seeds above the material. Fold the "X" back down to keep the geotextile sheet as continuous as possible. Weeds will grow through any gap in the landscape fabric, so it is important to overlap pieces of fabric and tack them down tightly. Apply a shallow mulch layer (about 1 inch deep) to thoroughly cover the fabric and prevent photodegradation. If weeds grow into or through the geotextile, remove them when they are small to prevent them from creating holes in the fabric. Maintain a weed-free mulch layer on top of the fabric by hand-weeding or by applying herbicides. Use of a rock mulch above a landscape fabric can have greater weed control than fabric plus organic mulch combinations.

Yellow nutsedge grows through all geotextiles but some fabrics are better at suppressing yellow nutsedge than others (for more information, see *Pest Notes: Nutsedge*, listed in "References").

Problems with Organic and Natural Inorganic Mulches. There are several problems associated with the use of organic and inorganic mulches. Perennial weeds such as field bindweed and nutsedges often have sufficient root reserves to enable them to penetrate even thick layers of mulches. Some annual weeds will grow through mulches, while others may germinate on top of them as they decompose. Weeds that are a particular problem are those that have windborne seeds such as common groundsel, prickly lettuce, and common sowthistle. Applying mulches at depths of greater than 4 inches may injure plants by keeping the soil too wet and limiting oxygen to the plant's roots. Disease incidence, such as root or stem rot, may increase when deep mulches are maintained.

When mulches are too fine, applied too thickly, or begin to decompose, they stay wet between rains and allow weeds to germinate and grow directly in the mulch. For best weed control, use a coarse-textured mulch with a low water-holding capacity. When used alone, mulches rarely provide 100% weed control. To improve the level of weed control, apply preemergent herbicides at the same time as the mulch (see Table 3). Supplemental hand-weeding or spot spraying may also be needed.

Avoid mulches with a pH less than 4 or that have an "off odor" such as ammonia, vinegar, or rotten egg smell. These mulches were stored incorrectly and contain chemical compounds that may injure plants, especially herbaceous plants.

If using a composted mulch, temperatures achieved during the composting process should have killed most weed seeds. However, if the compost was stored uncovered in the open, weed seeds may have been blown onto the mulch. Be sure the mulch is not contaminated with weed seeds or other propagules such as nutsedge tubers.

Hot Water or Steam Treatments

There are several machines currently available that use hot water or steam to kill weeds. These machines are most effective on very young annual weeds or perennials that have recently emerged from seeds. The effect is similar to that of a nonselective, post-emergent herbicide. Hot water and steam are not very effective on perennial weeds with established storage organs, such as rhizomes and bulbs, nor do they control woody plants. In general, broadleaf weeds are more easily controlled by this method than grasses. The equipment is expensive to purchase and maintain, so these machines are not appropriate for home use. However, commercial landscapers may find them useful in certain situations where the use of herbicides

is not desired such as when line-marking playing fields, in playgrounds, around woody plants, for edging, and for weeds growing along fence lines. Some brands of equipment travel slowly (about 2 mile/hour) and are probably not cost-effective for weed control along roadsides. Because these methods employ boiling water or steam, workers must be adequately trained in the use of the machines to prevent severe burns.

Herbicides for Landscape Plantings

Herbicides have been effectively used in many types of landscape plantings and are most often integrated with the cultural practices discussed above. Generally, home gardeners should not need to apply herbicides to existing landscape plantings. Hand-weeding and mulching should provide sufficient control and avoid hazards to desirable plants associated with herbicide use. Many herbicides listed here are for use by professional landscape pest managers and are not available to home gardeners. To determine which herbicide(s) are in a product, look at the active ingredients on the label.

Preemergent Herbicides. When weeds have been removed from an area, preemergent herbicides can then be applied to prevent the germination or survival of weed seedlings. Preemergent herbicides must be applied before the weed seedlings emerge. Examples of preemergent herbicides include: DCPA (Dacthal), dithiopyr (Dimension), isoxaben (Gallery), metolachlor (Pennant), napropamide (Devrinol), oryzalin (Surflan, Weed Stopper), oxadiazon (Ronstar), oxyfluorfen (Goal), pendimethalin (Pendulum, Pre-M), and prodiamine (Barricade). DCPA, dithiopyr, oryzalin, napropamide, pendimethalin, and prodiamine control annual grasses and many broadleaf weeds and can be used safely around many woody and herbaceous ornamentals. Metolachlor has become popular because it controls yellow nutsedge as well as most an-

nual grasses. Isoxaben is used for control of broadleaf weeds.

Timing of a preemergent herbicide application is determined by when the target weed germinates, or by when the weed is in the stage that is most sensitive to the herbicide. In general, late summer/early fall applications of preemergent herbicides are used to control winter annuals, while late winter/early spring applications are used to control summer annuals and seedlings of perennial weeds. If heavy rainfall occurs after preemergent herbicide application or if a short residual product was applied, a second preemergent herbicide application may be needed. Generally, herbicides degrade faster under wet, warm conditions than under dry, cool conditions.

No cultivation should occur after an application of oxyfluorfen; however, shallow cultivation (1 to 2 inches) will not harm napropamide, pendimethalin, or oryzalin. Also, soil type and pH can affect the activity of some herbicides. Use the information contained in herbicide labels and from your local county Cooperative Extension office to determine the tolerance of an ornamental plant species to a given herbicide.

Match herbicides with weeds present, and consider using herbicide combinations. Combinations of herbicides increase the spectrum of weeds controlled and provide effective control of grasses and many broadleaf weeds. Commonly used combinations include tank mixes of the materials listed above or isoxaben/trifluralin (Snap-shot), oryzalin/benefin (XL), oxyfluorfen/oryzalin (Rout), and oxyfluorfen/pendimethalin (Ornamental Herbicide II). Check the label to determine which ornamental species the material can safely be used around and which species of weeds are controlled.

Postemergent Herbicides. When weeds escape preemergent herbicides or geotextile fabrics, postemergent herbicides can be used to control established weeds. Postemergent herbicides

control existing plants only and do not give residual weed control. Their primary function is to control young annual species, but they are also used to control perennial species. Clethodim and fluazifop selectively control most annual and perennial grasses. Glufosinate (Finale), diquat (Reward), and pelargonic acid (Scythe) are nonselective, contact herbicides that kill or injure any vegetation they contact. They kill annual weeds, but only “burn off” the tops of perennial weeds. Glyphosate (Roundup Pro and others) is a systemic herbicide. It is translocated to the roots and growing points of mature, rapidly growing plants and kills the entire plant. It is effective on most annual and perennial weeds.

Mulch and Herbicide Placement. The placement of an herbicide in relation to an organic mulch can affect the herbicide’s performance. Additionally, the characteristics of organic mulches can affect how herbicides work. A mulch that primarily consists of fine particles can reduce the availability of some herbicides. The finer the organic material (compost or manure, compared to bark), the greater the binding of the herbicide. Most herbicides are tightly bound by organic matter, and while the binding minimizes leaching, it can also minimize an herbicide’s activity. Mulch that is made up of coarse par-

ticles will have little effect on herbicide activity.

Another important factor is the depth of the mulch. An 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 of weed seed germination. Products like oxadiazon (Ronstar) and oxyfluorfen (Goal) that require a continuous surface layer must be placed on the soil surface under the mulch. Suggestions for use of mulch with herbicides are given in Table 3.

Avoiding Herbicide Injury. Because of the close proximity of many different species of plants in the landscape, herbicide injury may occur, resulting in visual plant damage. Herbicide injury symptoms vary according to plant species and the herbicide and can include yellowing (chlorosis), bleaching, root stunting, distorted growth, and the death of leaves. Granular formulations of preemergent herbicides are less likely to cause injury than sprayable formulations. Using a granular formulation reduces the potential for foliar uptake, but granules of oxadiazon (Ronstar) or oxyfluorfen (Goal) mixtures will injure plants if they collect in the base of leaves or adhere to

TABLE 3. Suggestions for Placement of Herbicide with an Organic Mulch.

Herbicide	Application
Devrinol (napropamide)	under the mulch
Gallery (isoxaben)	best under the mulch, moderate control when applied on top of mulch
OHII (pendimethalin plus oxyfluorfen)	works well both under or over mulch
Pennant (metolachlor)	under the mulch
Ronstar (oxadiazon)	over the mulch
Rout (oryzalin plus oxyfluorfen)	works well both under or over mulch
Surflan (oryzalin)	best under the mulch but provides some control when applied on top of mulch
Surflan plus Gallery	under the mulch but will give a fair amount of control even when applied on top of mulch
Treflan (trifluralin)	under the mulch
XL (oryzalin/benefin)	under the mulch

wet leaves. Apply nonselective herbicides such as diquat, pelargonic acid, or glyphosate with low pressure and large droplets on a calm day. Use shielded sprayers when making applications around ornamentals to avoid contact with nontarget plants.

Herbicide injury to established plants from soil-applied chemicals is often temporary but can cause serious growth inhibition to newly planted ornamentals. Herbicides that contain oryzalin or isoxaben are more likely to cause this injury. Injury may result when persistent herbicides are applied to surrounding areas for weed control in turf, agronomic crops, or complete vegetative control under pavement. Activated charcoal incorporated into the soil may adsorb the herbicide and minimize injury. Usually it just takes time for herbicide residues to com-

pletely degrade. To speed degradation, supplement the organic content of the soil and keep it moist but not wet during periods of warm weather.

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UC Statewide IPM Project. *UC IPM Pest Management Guidelines: Turfgrass*. Oakland: Univ. Calif. Agric Nat. Res. Publ. 3365-T. Also available online at <http://www.ipm.ucdavis.edu/PMG/selectnewpest.turfgrass.html>

For more information contact the University of California Cooperative Extension or agricultural commissioner's office in your county. See your phone book for addresses and phone numbers.

AUTHOR: C. A. Wilen and C. L. Elmore
EDITOR: B. Ohlendorf
TECHNICAL EDITOR: M. L. Flint
DESIGN AND PRODUCTION: M. Brush

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Pesticides are poisonous. Always read and carefully follow all precautions and safety recommendations given on the container label. Store all chemicals in the original labeled containers in a locked cabinet or shed, away from food or feeds, and out of the reach of children, unauthorized persons, pets, and livestock.

Confine chemicals to the property being treated. Avoid drift onto neighboring properties, especially gardens containing fruits or vegetables ready to be picked.

Do not place containers containing pesticide in the trash nor pour pesticides down sink or toilet. Either use the pesticide according to the label or take unwanted pesticides to a Household Hazardous Waste Collection site. Contact your county agricultural commissioner for additional information on safe container disposal and for the location of the Household Hazardous Waste Collection site nearest you. Dispose of empty containers by following label directions. Never reuse or burn the containers or dispose of them in such a manner that they may contaminate water supplies or natural waterways.

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