

● MANAGING WEEDS AT HOME
AND IN OUR COMMUNITIES

BAND-AIDS ARE NOT ENOUGH

Herbicides kill weeds, but they don't solve weed problems. In order to solve a weed problem, it's necessary to change the conditions that are allowing weeds to thrive. Making these changes prevents weed problems, and provides a long-term solution.

This approach can be used wherever weed management is needed. In lawns, careful mowing, aeration, overseeding, fertilization, and irrigation will keep weeds at bay. Shrub beds can be designed to minimize weed encroachment and mulches can be used to prevent germination of weed seeds. Biological control, introducing weeds' natural enemies to reduce their abundance, offers ecologically sound and cost-effective weed management on a larger scale.

A preventive approach to weed management should be the strategy of choice in our lawns and back yards, in parks, on school grounds, and in other public areas. Spreading the word about successful preventive techniques will reduce our dependence on chemical herbicides.

BY CAROLINE COX

Herbicides are intensively marketed as simple, relatively inexpensive, and quick solutions to weed problems wherever they might occur. However, this simplistic approach needs a complete overhaul. Quite apart from whatever health and environmental problems an herbicide might cause, using an herbicide to solve a weed problem poses a basic contradiction. Herbicides almost never change the underlying conditions that promote the growth of a weed. Therefore, they can't solve any weed problems; they can only temporarily remove the evidence of the problem by killing the weeds that are present. They are "band-aids" and not solutions. Using herbicides commits us to a treadmill in which we will have to use them over and over and over again in order to keep weeds at bay.

Nonchemical approaches to weed management, on the other hand, start from a different premise. Weeds grow because we have created an environment favorable to the weed. In order to truly solve a weed problem we need to change the weed's environment so that the weed does not continue to prosper. We have a wide variety of choices when we make changes in a weed's environment: every-

thing from promoting the vigorous and healthy growth of desirable plants to encouraging natural enemies of the weed to reduce its abundance. In short, as a famous plant population biologist has written, "weeds are created by the gulf between the habitats man creates and the plants he chooses to grow in them."¹ Solving weed problems involves lessening that gulf.

This article describes how weed managers, working on scales that vary from small backyards to hundreds of acres, have found efficient successful ways of discouraging weeds without using chemical herbicides. They have changed the weeds' environment so that it no longer favors the weed, and thus have solved their

problems for the long term.

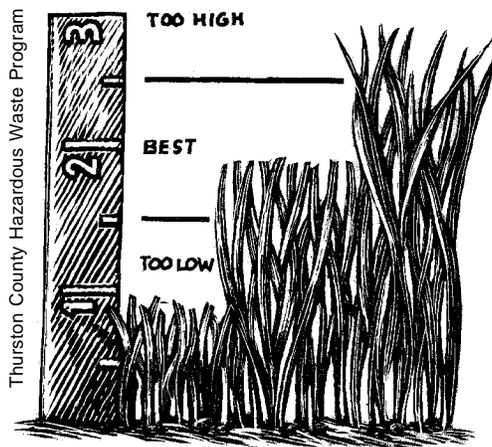
Keeping Weeds Out of Lawns

Maintaining relatively weed-free lawns or turf without using chemical herbicides is straightforward. Cultural practices that promote the growth of desirable grass will almost always reduce weed populations to a level where they are no longer a problem. Even a reference book, like the British Crop Protection Council's *Weed Control Handbook*, that is heavily oriented towards recommendations for chemical herbicides, writes that "excessive weediness can be caused by poor drainage, acidity or nutrient deficiencies in the soil or by faulty management. . . . It may be more economic to control weeds by altering these factors than by a direct attack."²

The concept is simple. Lawn and turf managers need to design a management system that favors the vigorous healthy growth of grass. This will keep most weed problems at low levels. "The best defense against weeds is a healthy lawn," wrote Warren Schultz of Rodale Press (Organic Gardening). "If the lawn is thick and vigorous, there won't be room for weeds to elbow their way in."³ The idea is to prevent problems from occurring, so you don't have to treat them. The concept applies whether you are in charge of your own front lawn or acres of park turf.

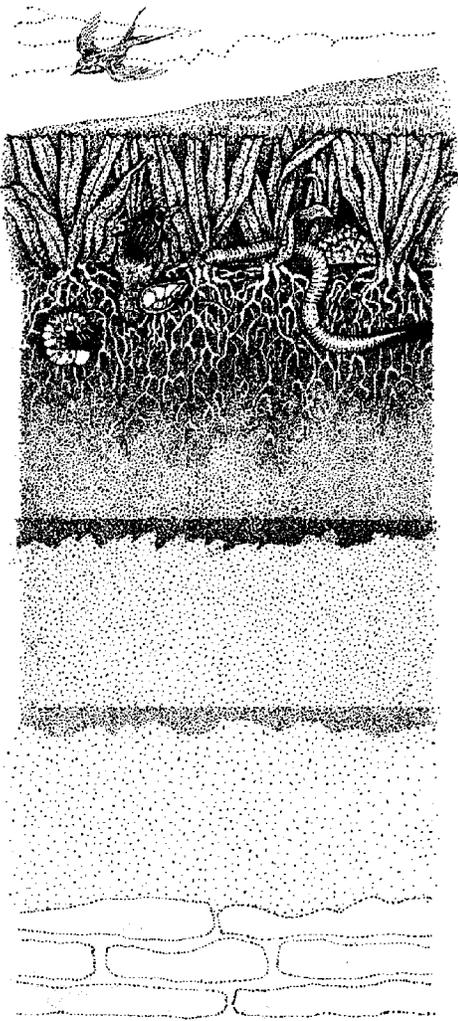
The important lawn or turf management practices include the following:

- Choose a variety of grass that thrives in



Mowing at the correct height helps keep weeds out of lawns.

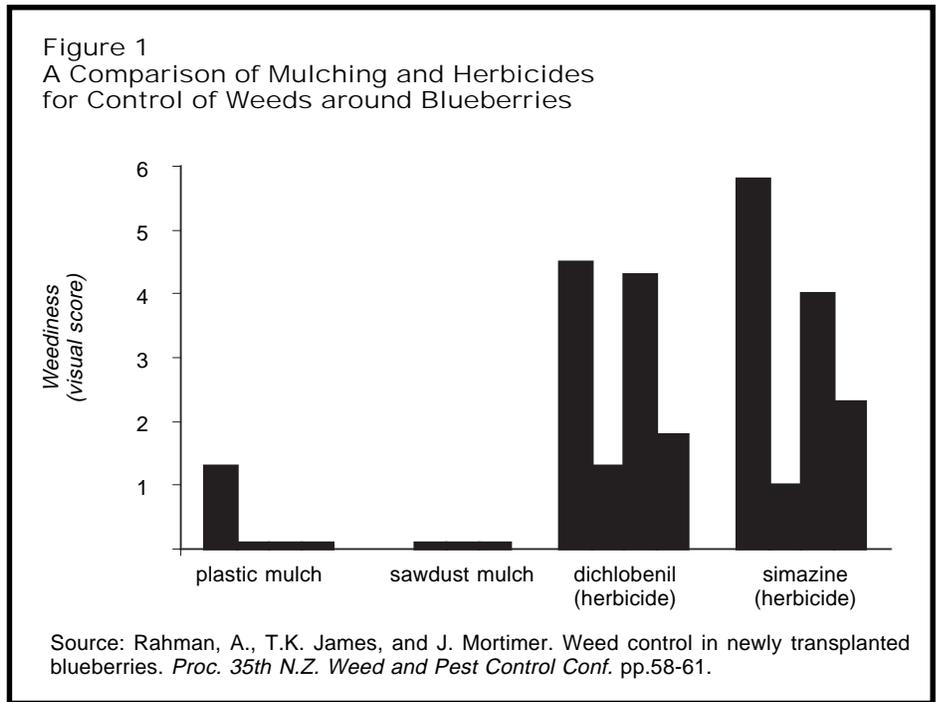
Caroline Cox is JPR's editor.



Earthworms aerate the soil and allow grass to flourish.

your climate.⁴ County extension agents are a good source of this information.

• **Mow high, often, and with sharp blades.**⁴ Tall grass is thicker, and blocks sunlight from the soil surface, preventing the germination of weed seeds that might be present.³ Tall grass also has a deeper root system, making the turf more competitive with deep-rooted weeds.⁴ Appropriate mowing schedules can minimize problems from some very difficult weeds. For a good example, consider bermudagrass, which has been called "the most common grass in the world and among the most serious of weeds." Oklahoma horticulture specialist A.D. Brede found that bermudagrass occupied up to 40 percent of turf area when tall fescue turf was mowed closely for a two year period. When a higher mowing height was used (2 1/4 inches) bermudagrass



Both a synthetic and an organic mulch were more effective than herbicides when used for weed control around blueberry plants.

decreased by almost 90 percent.⁵ A research team at the University of Maryland found that high mowing (3.5 inches) completely eliminated crabgrass encroachment in tall fescue.⁶ In Florida, turf plots mowed high (and fertilized) changed over a two-year period from 85 percent weeds to 1 percent weeds.⁷ High mowing gives an appearance of lush, abundant growth that can be very aesthetically pleasing.⁸

• **Irrigate carefully.** Watering during dry periods is essential for maintaining a weed-free turf. Many weeds have deeper roots than typical turf, and will survive drought better than the turf.^{3,4} In Eugene, where summers are typically dry, Tim Rhay, in charge of city park maintenance, has found that optimal irrigation schedules are crucial to maintaining athletic-quality turf without broadcast applications of herbicides.⁹ If a higher weed population is acceptable, irrigation may not be essential. Watering deeply, through the entire root zone, encourages the grass to develop a deep root system, and also allows less frequent irrigation than if watering is shallow. The rule of thumb is that a lawn needs 1 1/2 to 2 inches of water per week and irrigation is needed for any of that amount that is not supplied by rainfall.³

• **Aeration helps keep turf healthy.** Aeration physically improves soil that has been compacted, and allows grass and turf to flourish.³ There are a variety of machines that can accomplish this task and they are suitable for various scales, from manual cultivators or pitchforks for small back yards to mechanized equipment suitable for large acreages.^{3,9} If your home lawn has a good earthworm population, your soil will be less prone to compaction.³

• **Overseeding keeps weeds from getting a foothold.** Lawn and turf is often disturbed, as anyone who has looked at a soccer field at the end of a rainy game is sure to notice. If damaged areas are left bare, the most likely result is that weeds will colonize the bare areas. Eugene's Tim Rhay found that overseeding is key to maintaining athletic turf. The fields he manages are overseeded on an annual basis after the end of the sports season with specialized equipment that cuts a groove in the soil and then drops grass seed in the grooves.⁹

Overseeding can also be used to manage extremely high quality turf. For example, the practice fields used by the National Football League's Seattle Seahawks are maintained without herbicides. A sand and seed mixture is used to overseed

any disturbed areas on a daily basis.⁹

• **Judicious fertilization is important.** Moderate amounts of fertilizer can encourage vigorous growth of lawn and turf and thus discourage weeds.⁴ It is important not to overfertilize, especially with nitrogen. For example, high fertilization rates encouraged bermudagrass invasion of experimental plots of tall fescue.⁵ County extension agents can give advice about amounts and timing of fertilizer applications.

Keeping Weeds Out of Shrub and Flower Beds

Shrub and flower beds are an important part of many yards, parks, and the landscapes around buildings. Promoting the growth of these ornamental plants, and discouraging the growth of unwanted plants is important to both home gardeners and landscape managers. How can this be accomplished without the use of herbicides? Again, the most important steps to take are those that *prevent* weed problems from occurring.

The University of California's integrated pest management project offers a detailed description of the most effective steps towards a weed-free landscape.¹⁰ These steps begin with landscape design and end with landscape care techniques and include the following:

• **Whenever there is the opportunity to design a landscape that minimizes weed problems, that opportunity should not be missed.** The University of California suggests the following steps: select species that are well adapted to local soils, moisture, temperature, and light; avoid planting species with incompatible characteristics close together; separate shrub areas from turf with sidewalks, driveways, or landscape barriers; and design any irrigation systems to provide water to the desirable plants and not to potential weeds.¹⁰

• **Prepare planting sites carefully.** Cultivation is a time-honored method for reducing the population of weeds, particularly annual weeds. Cultivation will also reduce the population of weed seeds if it is followed by irrigation and a second cultivation. The seeds germinate following the irrigation, then the young seedlings are killed by the second cultivation. These steps can be repeated as necessary. Some stubborn perennial weeds can be killed by repeated cultivation, especially if plant and root remnants dry out between cultivations.¹⁰

Another site preparation technique for controlling annual and some perennial weeds is solarization. This technique uses heat to kill weeds and weed seeds. Existing vegetation is scraped off the area to be solarized or mowed closely. The area is then covered with clear plastic for 4 - 6 weeks during hot sunny weather.¹⁰ In regions where summer weather is often cloudy, longer times will be needed, but solarization can still be effective. For example, a study at Tuskegee University in Alabama found that Alabama's extensive summer cloud cover and rainfall meant that almost 100 days was required for successful solarization. However, solarization was as effective as the herbicide dacthal is reducing populations of four problem weeds: nutsedge, crabgrass, barnyardgrass, and pigweed.¹¹

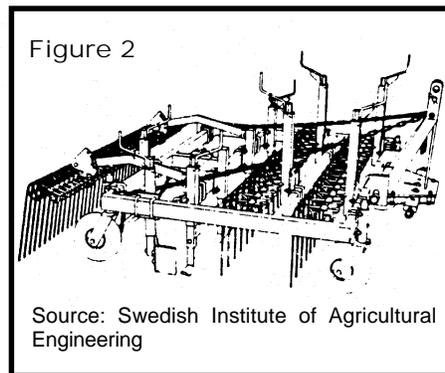


Figure 2
Harrows provide effective weed control on gravel surfaces.

• **Use mulches to reduce weeds in established plantings.** The University of California describes mulching as 'one of the most effective and desirable methods of preventing germination and growth of annual weeds.'¹⁰ Mulches exclude sunlight, thus depriving weeds of the light necessary to their growth,¹⁰ conserve moisture, reduce compaction, and reduce erosion.¹² Many different materials can be used as mulches including bark and wood chips, hay and straw, paper, compost, as well as some specially designed landscape fabrics.¹² The organic mulches often add to the appearance of a shrub or flower bed, providing an attractive contrast to the color of leaves and flowers.¹² Compost is particularly good at providing soil conditioning and allowing water penetration.¹⁰

Organic mulches need to be spread thickly, at least 3 to 4 inches thick to be effective, and will need periodic replenishment as they break

down.¹⁰ Organic mulches also need to be kept away from the trunks of shrubs where they can promote disease, and can harbor slugs, snails, and rodents.¹²

On-farm experiments in Virginia have shown that a mulch combination, paper with straw on top, is particularly effective at preventing weeds. Using solarization first, then applying the combination mulch, was able to successfully inhibit a severe bermudagrass infestation.¹³

Experiments that compare the efficacy of mulching with that of standard herbicide treatments often find mulches to be as efficient as herbicides in preventing weed growth.¹⁴⁻¹⁶ (See Figure 1.)

The few weeds that survive in a shrub bed that has been designed to minimize weed problems can be removed with simple nonchemical techniques. These include the following:

• **Handweeding is "the oldest form of weed control and is still of great value in landscapes."**¹⁰ It is most effective and easiest when plants are small.¹⁰

• **Hoing can also effectively remove weeds.** Hoing should be shallow, so that the root systems of desirable plants are not disturbed and weed seeds from deep in the soil are not brought to the surface.¹⁰ Sharp tools are essential. Specialized hoes that make this job more efficient are available. One that is recommended by a Eugene landscape consultant is the weed wing.¹⁷ On an institutional scale, hoing is attractive if labor costs are not high; schools have successfully used student labor for this purpose.⁸

• **Flaming is a useful nonchemical technique.** In this technique, propane or kerosene is the fuel source for a flame. The operator uses the flame to briefly heat the basal stem area of weeds. Cells rupture from the heat, and the stem dies, followed by the other above ground parts of the plant. Flaming can be used to kill weeds that have grown through mulch if care is taken not to burn or melt the mulch.¹⁰

Specialized Weed Problems

Keeping special-use areas free of vegetation can be difficult for weed managers who wish to use alternatives to pesticides. However, even in areas that have traditionally been difficult, innovative weed managers have found simple, cost-effective solutions. For example, incorporation of generous amounts of sawdust together with frequent shallow cultivation of baseball in-

fields with a rotating harrow successfully keeps these areas weed-free. (See Figure 2.) Putting a trailing roller behind the harrow and using some tilt-down brush attachments allows the efficient preparation of a finished surface.¹⁸

On gravel surfaces, Swedish agricultural engineers have found that weed harrows give effective weed control at a cost that is comparable to using herbicides. The same engineers found that a tractor mounted rotating stiff wire brush provides effective and reasonably priced weed control on paved surfaces.¹⁹

In areas where germination of weed seeds is a problem, applications of corn gluten meal (available via mail order from Gardens Alive) can be useful. While not impacting established plants, germination of pigweed, purslane, lamb's-quarter, crabgrass, and foxtail was reduced up to 90 percent.²⁰

Managing Weeds on a Larger Scale

When a particular weed has spread over many acres, many of the techniques that work well for yards, parks, or institutional landscapes seem less feasible. In these situations, one of the most promising weed management techniques, and one of the few that is truly reasonable, is biological control, "the suppression of pest organisms by their natural enemies."²¹ In practice this means using a host-specific plant-eating insect or a plant disease to reduce the population of a target weed. Biological control offers many advantages; when it works well it is "environmentally safe, energy self-sufficient, cost-effective, and often self-sustaining."²¹

Many of the plant species that are our most difficult weed problems have come to the United States from other parts of the world. Brought here by accident or by design, they often arrive without the natural enemies that keep their populations in check in their native areas.²² These species are excellent candidates for biological control. By introducing their natural enemies, we change the environment so it does not encourage the targeted weed.

Successful biological weed control in the U.S. began in the mid-1940s when four insects were introduced to reduce the population of St. Johnswort, also known as Klamath weed. Klamath weed is native to Europe, Asia, and north Africa and was first introduced to the U.S. in the 1800s. It contains a pigment, hypericin, that

is toxic to livestock. About 2 million acres of western North America are thought to have been infested with Klamath weed in the 1940s; about half of this acreage was in California. The results of the introductions were called "spectacular."²³ In California, populations of Klamath weed were reduced by 99 percent. In Idaho, populations were reduced about 97 percent. In

Hawaii following introduction of two weevils.²⁷

Some newer biological weed control programs have also shown promise. In British Columbia, Canada, introduction of two seed-head flies and a root beetle reduced diffuse knapweed abundance in a grazed pasture over 70 percent.²⁸ Leafy spurge has been reduced to less than 5 percent of the total vegetation at sites in the southern Canadian prairies where a root-feeding beetle was introduced.²⁸ In Oregon, an introduced leaf beetle has shown promise in controlling the aquatic weed purple loosestrife.²⁹

A second biological weed control technique involves the use of plant diseases specific to a particular weed. In some cases the disease-causing organisms can be applied to the target weed in much the way that herbicides are applied, so they are often called mycoherbicides. Rusts have been used in the control of diffuse knapweed and skeleton weed,³⁰ and several species of fungi are lethal to spotted knapweed.³¹ Three plant diseases are or will shortly be commercially available (to control strangler vine in citrus orchards, northern joint vetch in rice and soybeans, and round leaf mallow). Disease-causing bacteria appear to be a promising control of the weedy grass downy brome (cheatgrass) and bacteria inhibiting other weed species have been identified.³⁰ With more research and development, these products could offer a useful alternative to chemical herbicides.

Biological control is certainly not a silver bullet. In most cases up to ten years are required after introduction for insect natural enemies to become established and reach high population densities. Also, many biological control researchers caution that its success will be limited in areas where a vigorous alternative plant community is not present due to disturbances like grazing.²⁹ Biological weed control does offer the opportunity to permanently reduce the population of a weed; in most cases both weed and natural enemy will continue to survive in small populations following introduction of the natural enemy and decline of the weed population.

Starting a biological control program from scratch is a large project, and not one that can be done by an individual or a community. Biological weed control protocols require that candidates for introduction be carefully screened for any possible effects on crops and other desirable species. This screening is carried out almost exclusively by the federal government.³¹

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Leafy spurge.

California, Klamath weed was replaced in rangeland primarily by a native perennial bunchgrass.²³

Other examples of successful biological weed control projects in the U.S. include management of alligator weed in the Southern U.S. by a flea beetle;²⁴ control of musk thistle in Virginia and Montana by a weevil;²⁵ 93 percent suppression of tansy ragwort by a flea beetle and a moth in Oregon;²⁶ and a strong decline in populations of puncturevine in California and

However, once the original introductions have been made, individuals and local communities can play an important role in the biological weed control process. A good example can be found in Arcadia, Nebraska, where rancher Jim Holmes started a small business selling the weevils that are natural enemies of the musk thistle. Government scientists released the weevils at a few sites in Nebraska in the 1970s but dropped the project because the weevils did not appear to be establishing well. Holmes found a few weevil-infested thistleheads at one of the release sites and took them to his ranch. Over the next eight years the weevil population expanded, the insects took care of his thistle problem, and he went into the business of selling them.³²

Similar projects could be undertaken by any individual or community that has a problem with a weed that is the subject of an ongoing biological control program. Natural enemies are also available for purchase from several private companies in the U.S.

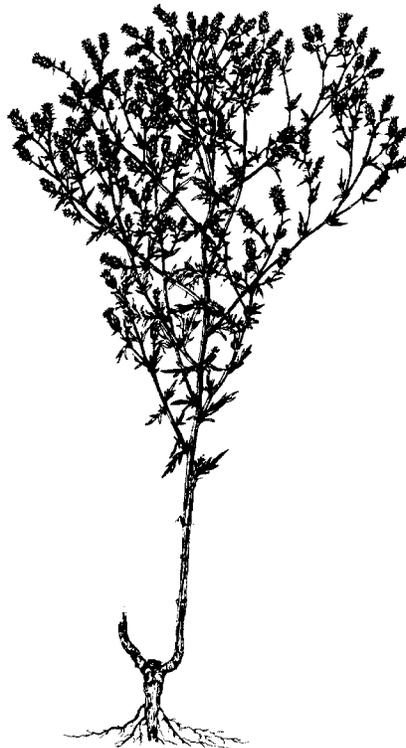
Stepping Back

Whether you are taking care of your own back yard, maintaining a city park, or a dealing with a different kind of weed problem, your goal is fundamentally the same. You need cost-effective techniques to modify the particular environment with which you are working so that it no longer encourages or allows the growth of weeds. These techniques will allow you to prevent many of your weed problems and manage the others for the long term. Weed managers everywhere are finding this kind of solution. Join them! ♣

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