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Weed Management

Kentucky Master Gardener Manual Chapter 20

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Every garden has weeds, and every gardener wonders what to do about them. Gardening involves lots of small decisions that can have a cumulative effect on those weed problems. This chapter will explore the origin of weeds, their adaptation and impact, and the techniques you can use to manage weeds in your landscape.

Understanding Weeds

To control weeds, you first need to understand them and be able to identify them.

Why Are Weeds a Problem?

The plants we call weeds are often aggressive, persistent plants—they are not shrinking violets. Weeds do have some redeeming qualities, but these qualities are often overwhelmed by the plants' "weedy" attributes.

The most useful definition of a weed is that it is a plant that is a hazard, nuisance, or causes injury to people, animals, or a desirable crop. A plant may be defined as a weed in some cases but not in others. For example, clover can be a valuable addition to a pasture and is tolerated in many lawns. But if you are a park manager faced with reducing liability due to bee stings, you may feel compelled to remove clover in some parts of the park. Another example is maple seeds. When they sprout in an herbaceous perennial flower bed they are weeds, but they may well have come from trees that are part of the planted landscape.

Weeds can cause a range of problems in your garden or community, including the following:

- Competing with desirable crops
- Reducing the aesthetic qualities of a landscape
- Obstructing sight lines on roadways
- Interfering with water drainage from roads and low-lying communities
- Creating a fire hazard along railways and next to power substations
- Presenting allergy or poison hazards for humans or animals (through skin contact, ingestion, or inhalation)
- Harboring diseases, rodents, and insect pests
- Imparting off-flavors to water

Why Do We Have Weeds?

People have been cultivating plants for almost 10,000 years. When the first agriculturists tilled ground, planted seeds, and irrigated, they created an artificial environment that favored crops. They also selected and bred certain plants to improve the plants' food, fiber, or medicinal characteristics. The very practices that favored growth of these earliest crops inadvertently encouraged other plants that also liked plowed soil. Many of these plants became very aggressive competitors on farms and in gardens.

As agricultural practices and products spread, plants we now call weeds extended their range. Native plants that liked tilled ground joined the weed inventory and moved well beyond their original habitat. It is amazing how many of "our" weeds are equally well known in Asia, Europe, Africa, and South America. Table 1 shows the original home of some common weeds.

Many weeds traveled the world in feed and seed, on equipment, in ships' ballast, or in the bellies of domesticated animals. In addition, many plants that once had value as food, fiber, medicine, or ornamentals remained to become a nuisance long after their usefulness had diminished. Once weeds get a foothold in a new area, they spread by wind, water, animals, in trade goods, and in equipment.

Plants that might be tame in their native landscape can become nasty when moved to new locations. The new environment might suit them better, or they might have left their natural enemies behind. Kudzu was originally introduced to help stabilize steep slopes and prevent erosion. It now grows uncontrolled in much of the southern United States and has become established in several Kentucky counties where it is unsightly and chokes out native vegetation. Purple loosestrife was originally planted as a pond ornamental, but now it aggressively competes with native vegetation in wetland areas.

Table 1. Origin of several common weeds.

Weed species	Origin
Canada thistle	Eurasia
Pigweed	Tropical Americas
Field bindweed	Europe
Common purslane	Western Asia
Common chickweed	Europe
Dandelion	Europe
Quackgrass	Mediterranean
Barnyardgrass	Eurasia
Crabgrass	Europe
Poison ivy	Native
Johnsongrass	Mediterranean
Common lambsquarters	Eurasia
Musk thistle	Eurasia
Yellow foxtail	Europe
Trumpet creeper	Native
Morningglory	Tropical Americas

Nations establish quarantines to exclude new weed species. State departments of agriculture designate some weeds as noxious and implement programs to restrict their spread. There may be specific requirements for control of certain noxious weeds in some locations.

Once weedy species are established in a region, it is virtually impossible to eradicate or remove them completely. Instead, gardeners must live with them and work to lessen their negative impact. Various techniques offer a range of options to achieve that goal.

Weed Identification

If you can accurately identify a plant that is causing problems in your landscape, you have taken the first step toward good management. Fortunately, most problems are caused by a surprisingly short list of weeds. Often, a little time spent with a good reference (see "For More Information" at the end of this chapter) will help you put a name to some of the challenging plants you encounter. You may find it helpful to give some of your worst weeds specific nonsense names until you get a more accurate identification. Then, it will be easy to mesh your new knowledge with your old identification.

Weed books usually first classify plants into two groups and a miscellaneous category:

- *Monocots* (Figure 1) include grasses, lilies, and the like.
- *Dicots* (Figure 2) are broadleaf species.
- "Other" weeds include mosses, horsetails, and ferns.

Plants are further subdivided within each major category by *family*—for example, the buckwheat, rose, and borage families. Within these family groupings are the *genera*, and within the genera, *species*.

Scientific (botanical) names are in Latin and include the genus name followed by the species name. For example, common dandelion is known as *Taraxacum officinale*. The scientific name is used worldwide and eliminates the confusion caused when the same common name refers to several plants.

You don't have to be a botanical expert to work through a weed identification book, although it does help to learn some of the key characteristics of the major families.

Once you know a plant, you can gather important details about its life cycle and how it spreads within the landscape or garden. With practice, you can learn to distinguish weed seedlings from your planted vegetables and flowers.

Weed Life Cycles

Most gardens have a mix of annual and perennial weeds plus a few biennials. When you understand the life cycle of troublesome weeds, you can begin to make intelligent decisions about control strategies. Later sections of this chapter examine some of those strategies. Table 2 lists some of our worst weeds by common and botanical names and their life cycles.

Figure 1. Examples of monocots: bermudagrass *(Cynodon dactylon),* crabgrass *(Digitaria* spp.*)*, and nimblewill *(Muhlenbergia schreberi* J.F. Gmel.*)*.

Table 2. Weeds classified by life cycle.

Annuals	**Common name**	**Botanical name**
Grass weeds	Annual bluegrass	*Poa annua*
	Barnyardgrass	*Echinochloa crus-galli*
	Crabgrass	*Digitaria sanguinalis*
	Yellow foxtail	*Steria glauca*
Broadleaf weeds	Annual sowthistle	*Sonchus oleraceus*
	Birdsrape mustard	*Brassica rapa*
	Carolina Geranium	*Geranium carolinianum*
	Catchweed bedstraw	*Galium aparine*
	Common chickweed	*Stellaria media*
	Common lambsquarters	*Chenopodium album*
	Common mallow	*Malva neglecta*
	Common purslane	*Portulaca oleracea*
	Common ragweed	*Ambrosia artemisiifolia*
	Cressleaf groundsel	*Senecio glabellus*
	Hairy bittercress	*Cardamine hirsuta*
	Ladysthumb	*Polygonum persicaria*
	Mayweed chamomile	*Anthemis cotula*
	Nodding spurge	*Euphorbia nutans*
	Pineapple weed	*Matricaria matricarioides*
	Prostrate knotweed	*Polygonum aviculare*
	Shepherdspurse	*Capsella bursa-pastoris*
	Smooth pigweed	*Amaranthus hybridus*
Biennials	**Common name**	**Botanical name**
Broadleaf weeds	Bull thistle	*Cirsium vulgare*
	Common mullein	*Verbascum thapsus*
	Musk thistle	*Carduus nutans*
	Prickly Lettuce	*Lactuca serrioia*
	Teasel	*Dipsacus sylvestris*
	Wild carrot (Queen Anne's lace)	*Daucus carota*
Perennials	**Common name**	**Botanical name**
Grass weeds	Bermudagrass	*Cynodon dactylon*
	Johnsongrass	*Sorghum halepense*
	Quackgrass	*Elytrigia repens*
	Velvetgrass	*Holcus lanatus*
Broadleaf weeds	Blackberry	*Rubus spp.*
	Buckhorn plantain	*Plantago lanceolata*
	Canada thistle	*Cirsium arvense*
	Creeping buttercup	*Ranunculus repens*
	Curly dock	*Rumex crispus*
	Dandelion	*Taraxacum officinale*
	Field bindweed	*Convolvulus arvensis*
	Hedge bindweed	*Calystegia sepium*
	Oxalis (woodsorrel)	*Oxalis corniculatus*
	Poison ivy	*Toxicodendron radicans*
	Red sorrel	*Rumex acetosella*
Others	**Common name**	**Botanical name**
	Horsetail	*Equisetum arvense*
	Star-of-Bethlehem	*Ornithogalum umbellatum*
	Wild garlic	*Allium vineale*
	Yellow nutsedge	*Cyperus esculentus*

Note: This list is not exhaustive, but it does include many of the most common weeds that gardeners should recognize.

Figure 2. Wild violet *(Viola* sp.*),* an example of a dicot.

Types of Weeds

Weeds include annuals, biennials, and perennials.

Annuals

Annuals go from seed to seed in less than a year, often in periods as short as 45 days. Once they have thrown off their usually vast quantities of seed, the plants die. As you might suspect, annual weeds are numerous because their growth habit parallels our agricultural cropping pattern.

Annual weeds can be found in both winter and summer.

Winter annuals germinate in late fall through early spring and go to seed in spring/early summer. Some common examples include hairy bittercress, henbit, several mustards, annual bluegrass, and common chickweed (Figure 3). Clearly, the cooler temperatures and lower light intensity of winter are not an obstacle to these

Figure 3. Common chickweed, an example of an annual weed.

Figure 4. Musk thistle, an example of a biennial weed.

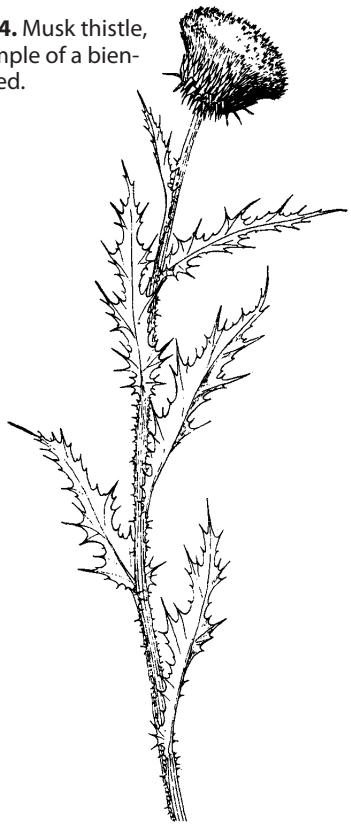
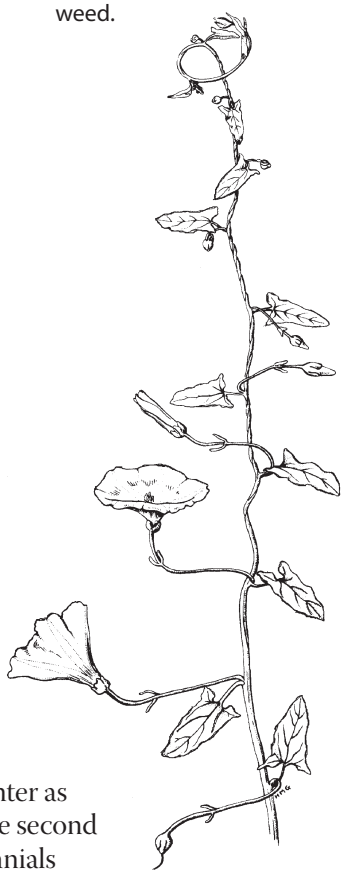


Figure 5. Field bindweed *(Convolvulus arvensis),* an example of a perennial weed.



weeds. They prosper when other competitive weeds and plants are absent. A few winter annuals, especially common groundsel, seem to germinate in flushes throughout the year.

Summer annuals get started in the spring and summer and go to seed in the summer and fall. Many of our most annoying weeds are in this group, including crabgrass, pigweed, purslane, and lambsquarter. Most summer annuals germinate quickly, ahead of many flower and vegetable seeds. Others do not germinate until May or June and then grow aggressively and complete their life cycle without delay.

As discussed below, annuals have sophisticated mechanisms to ensure good year-to-year seed survival.

Biennials

Biennial species are less common. They take more than one year but less than two to complete their life cycle. Most start from seed in the fall or spring and grow through the summer, fall, winter, and next spring. They overwinter as *rosettes*. In the second summer, biennials flower and die. Examples include wild carrot (Queen Anne's lace), bull thistle, and musk thistle (Figure 4).

Perennials

These weeds often are the most difficult to manage. *Woody* species generally go dormant in the winter and begin growth in spring from aboveground stems. Aboveground parts of *herbaceous* perennials may die back, but their underground storage organs survive the winter. Many are deep rooted and continue to grow during summer droughts. The life span of perennials varies. They spread from seed and often from roots, tubers, bulbs, and rhizomes. Tilling of perennial weeds often spreads them, and mulches may have little impact. Weeds in this group include quackgrass, poison ivy, Canada thistle, horsetail, and field bindweed (Figure 5).

Weeds and Your Landscape

Weeds can disturb the appearance of a landscape. Most garden soils contain a lot more weed seeds than the vegetable or flower seeds you plant. Studies on commercial vegetable farms show that viable weed seed populations in the top 6 inches of soil average 900 per square foot, with some fields having more than 7,000 viable seeds per square foot!

What is worse, weed seeds germinate very quickly when the ground is tilled. Two weeks after planting, it may be very difficult to find your flowers and vegetables amid all the weeds. Some poorly tended gardens may end up with 10 to 20 times more weight in weeds than in desired plants.

Weed Competition

Weeds compete directly with garden plants for light, nutrients, and water. A successful weed grows aggressively to capture whatever resource is in shortest supply. Crop plants may end up stunted and unable to produce a normal product. Paired test plots of vegetables that were either weeded or left untouched provide some eye-opening results (Table 3).

Research in England showed that a delay in weeding could reduce final yield by 3 percent per day, depending on the crop, weed species, and weed density. Some plants (onions, for example) need a certain leaf area to produce a marketable crop, while others (e.g., potatoes and artichokes) can send up new leaves and recover to produce a near-normal yield if weeds are removed early enough.

Some characteristics that help weeds compete include the following:

- Aggressive vegetative growth from seeds
- Abundant and rapid reproduction
- Good means of dispersing seeds
- Long-lived seeds and other plant parts
- Wide adaptability to soil types and climates
- Ability to time germination to coincide with favorable conditions
- Ability to thrive in disturbed or bare soil

Table 3. Vegetable yields in weeded and unweeded plots.[1]

	Yield (lb)	
Crop	**Weedy**	**Nonweedy**
Carrots	27.9	503.3
Beets	45.9	240.3
Cabbage	129.1	233.6
Onions	3.6	67.7
Tomatoes	23.2	164.2
Potatoes	52.7	148.3

[1] Plot sizes not specified, but weedy and nonweedy plots were equal in size. With the exception of weed management, both plots were treated the same.

Rapid Root and Top Growth

Weeds grow quickly to capture sunlight, water, space, and nutrients. They often can alter their branching pattern, leaf size, and leaf orientation to win the battle for light. In soil short of moisture, weeds' root growth can stunt crop roots.

Sophisticated Reproductive Strategies

Not only do weeds produce tremendous numbers of seeds, they also have ways to prevent all of their seeds from germinating during years with less favorable weather. Seeds can be buried in undisturbed soil for an amazing length of time and still germinate. Lotus seed in Manchurian lakebeds has germinated 1,000 years after the seed was produced. Common lambsquarter seed from Egyptian tombs also has been viable after many years. Table 4 shows weed seed production and survival rates. These survival rates are under optimal conditions, and most weed seeds are nowhere near these rates. Nevertheless, as the saying goes, one year of weeds leads to seven years of hoeing.

Table 4. Weed seed production and seed survival in soil.

Weed species	Seeds per plant	Seed survival (yrs)
Spotted knapweed	1,100	7–10
Lambsquarters	72,450	40
Purslane	52,300	40
Dandelion	15,000	6
Pennsylvania smartweed	19,300	30
Canada thistle (per stem)	680	21
Pigweed	117,400	10
Barnyardgrass	7,160	3
Crabgrass	25,000	3

Note: Seed survival means that some viable seed remains. Generally, however, most seeds germinate or lose viability within three to 10 years or less, depending on soil conditions. A few, however, will hang on to aggravate future gardeners.

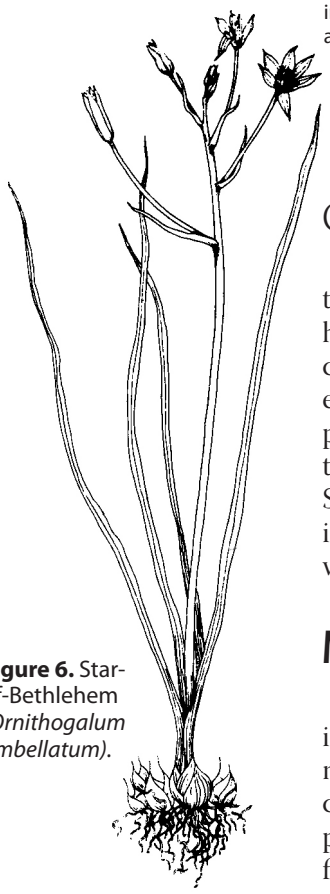


Figure 6. Star-of-Bethlehem *(Ornithogalum umbellatum)*.

Chemical Warfare between Plants

Some weeds produce compounds in their leaves and/or roots that can kill or harm other plants. This phenomenon is called *allelopathy*. The compounds aren't effective on all the species with which a particular weed might be competing, but they at least can improve the weed's odds. Some weeds that have allelopathic qualities include quackgrass, Canada thistle, pigweed, kochia, purslane, and smartweed.

Managing Weeds

Weeds are part of the dynamic and shifting garden landscape. As discussed earlier, many weeds are especially adapted to a cultivated environment. A gardener should plan for weeds. It is possible to develop a fairly comprehensive weed management strategy that takes into account landscape objectives, weeds already present, available tools, and personal gardening philosophy.

In the broadest sense, weed management has the following three objectives:

- Preventing introduction of new weeds
- Discouraging weeds so they can't compete with desired plants
- Preventing weeds from going to seed, thus reducing over time the weed seed burden in the soil

Prevention

Most garden soils already have many weeds and other weed seeds can be blown in, but the alert gardener can take some steps to prevent introduction of new weeds. Examine any soil you plan to bring to your lot. Pay particular attention to the presence of Johnsongrass, Canada thistle, and Star-of-Bethlehem, which will cause years of agony if found in your landscape (Figure 6).

Watch container plants from nurseries, garden exchanges, and plant sales. They can be a source of several tough plants, particularly *Oxalis*, buttercups and the weedy veronicas. Remove any sign of these plants before placing new trees, shrubs, or flowers in your landscape.

Finally, cultivate a relationship with your neighbors that allows for a coordinated approach to creeping perennial weeds such as field bindweed, English ivy, blackberries, and Japanese knotweed.

Cultural and Mechanical Control

You can manipulate the landscape in ways that reduce weed success if you work from the premise that weeds thrive in disturbed ground. Cultural and mechanical control methods can help you reduce the impact and spread of weeds without herbicides.

Several are discussed below.

Rotation

Rotating vegetable crops can reduce weed infestations. Noncompetitive crops such as carrots and onions should follow more aggressive vegetables such as winter squash or corn. *Fallowing* (keeping part of the garden clean-tilled or in a summer cover crop) can help reduce weed problems for the next season.

Solarization is a way to reduce weed- and disease-infested garden areas. In July, thoroughly till and moisten the soil. Stretch clear plastic over the soil as tightly as possible. The heat captured under the plastic steams the soil, killing many weed roots and seeds. Leave the plastic on through August. The area can be planted in the fall or the following spring.

Weeding

Cultivating soil to control weeds has been practiced for thousands of years. Agricultural yields improved tremendously when cultivating equipment became widely available. Tilling and hand pulling normally are gardeners' first weapons in the weed wars.

Advantages—A germinating weed is very vulnerable to root disturbance from hoeing, hand pulling, or rototilling, It also helps break up soil crusts that may limit vegetable or flower seedling growth.

Disadvantages—Mechanical weed removal must be done early and often to be effective—cultivating perennial weeds can spread reproductive underground portions of the plants, causing more weeds to grow; tilling brings new weed seeds to the surface; excessive cultivation destroys soil tilth and causes compaction.

When tilling, take care not to damage your plants' roots. For example, it generally is unwise to hoe close to shallow-rooted rhododendrons and blueberries.

Remember that some plant compounds are toxic to the skin. You should wear gloves when hand weeding. Also, a sharpened hoe makes for more effective weeding.

Bed planting

Planted beds are areas designed with untilled areas between them. Soil working is reduced, and mulches are used extensively. Flower or vegetable crops often are planted close together to compete against weeds. Shading is effective in preventing some weed species from germinating. Transplants are used extensively.

Advantages—Less weed seeds are brought to the surface; leaving untilled areas (either in sod or heavily mulched) reduces the area that needs to be managed for weeds.

Disadvantages—Most of the tilling and weeding must be done by hand; some gardeners plant too closely and crops are stunted, much as with weed competition.

Using transplants

Transplants can be one of the best weed management strategies. Vegetables or flowers can be started in a cold frame or greenhouse and set out into the freshly worked garden.

Advantages—The transplant has a head start against germinating weed seeds and, if it is managed well in the transplanting process, it should effectively compete against many weeds.

Disadvantages—It takes time to produce transplants or money to buy them; not all plants transplant well.

Mulches

Mulching should be part of any landscape planting because of the weed suppression it provides. When bare soil is covered, many weed seeds either won't germinate or can't grow through mulch.

Mulch materials may be organic (such as shredded bark or leaves, pine needles, compost, or newspapers) or synthetic (such as plastic or landscape fabrics). They can be applied in both winter and summer for year-round weed control. Mulch materials may be home generated or purchased, but purchased materials can be somewhat expensive.

Advantages—If used effectively, mulches significantly reduce time spent pulling weeds; fewer weed seeds are brought to the surface than with hoeing or rototilling; mulching correctly can cool the soil and help manage soil moisture; plastic mulches can work well on well-drained and aerated soils and around some deep-rooted trees and shrubs.

Disadvantages—If organic mulches are applied in a layer of 6 or more inches, they may produce acids that can hurt plants; plastic mulches can create a zone of lifeless soil that often leads to root disease due to their inability to "breathe" around shallow-rooted species such as rhododendrons; weed seeds can blow in and germinate in the organic mulch covering generally used

over synthetic mulches to improve their appearance, thus reducing weed control; plastic and landscape fabrics can give shelter to mice (voles) or rats.

Choosing the right mulch

Which mulch will work best depends on your landscape.

Woody landscapes—Twice-yearly applications of organic mulches such as bark go a long way toward reducing weed problems. As the material decays, it improves soil tilth and aeration around landscape plants. Fall applications of mulch can reduce winter and spring weed problems.

In general, plastic mulch is not the best choice for woody landscape beds.

Landscape fabrics are better than plastic mulches in a woody landscape bed, since water and air can pass through them. Laminated fabrics are more expensive, but they are porous, wick water through the fiber, and prevent roots from penetrating. When choosing a fabric, make sure it cannot be broken or stretched with your finger. Easily perforated fabrics are not effective.

Annual gardens—Plastic mulch does have a place in annual vegetable and flower gardens. It usually is used along with drip irrigation and bed planting. Make slits in the plastic, then place transplants in the slits next to the water source. Add fertilizer to the soil before transplanting or later through the irrigation system. Dispose of the plastic after the growing season.

Black plastic is preferred for weed control because it reduces light to the soil, thus preventing weed growth. Clear plastic sometimes is used where weeds are few, since it warms the soil faster than black plastic but does not control weeds. Be sure to stretch the plastic tightly over the soil surface to get the benefits of soil warming as well as weed control.

Landscape fabrics can be used in the same way as plastic. Since they allow moisture to pass through, they don't require a drip system. However, they are thicker than plastic and tend to cool the soil instead of warming it. This cooling can be a problem for crops such as tomatoes, peppers, and melons, which require very warm soil.

For most vegetable and flower gardens, organic mulches are the best choice, because they tend to improve the soil as they break down. In the summer, many gardeners use organic mulches to conserve moisture and control weeds. It is best to apply these mulches around heat-loving plants such as peppers after the soil is warm.

Winter organic mulches can be pulled back or tilled in before planting in the spring.

Organic mulches can cause nitrogen deficiency as they decompose, and leaves from a few trees can inhibit growth of some plants and seeds if they are part of organic mulches. Walnut trees are one example.

Effect of water management

Weeds need water to germinate and grow. When a garden is irrigated with sprinklers, the entire area is usually watered and must be weeded. When water is directed only to desired plants, such as with drip irrigation, much of the garden stays dry, so that in those drier areas, weed problems are much reduced. Drip systems are excellent tools for reducing weed growth. They are often combined with bed planting and/or plastic mulches in vegetable and annual flower plots to control weed growth.

Advantages—They are fairly easy to set up; they have come down in cost.

Disadvantages—Despite improvements and reduced cost, drip systems still can be costly to install and complicated to maintain; in some cases, they might not provide an adequate moisture zone for desirable plants.

Competitive plantings of groundcovers, herbaceous perennials

In permanent landscapes, it often is best to eliminate bare areas under trees and shrubs by planting them with groundcovers or herbaceous perennials. Many species do well as understory plants and can provide both foliage and flowers (e.g., hostas, ferns, and daylilies).

For lawns, more tolerant gardeners now can choose mixes that include certain broadleaves (e.g., yarrow) with good lawn

character. These mixes tend to repel some of the weedier broadleaf species.

Use caution when selecting groundcovers for these areas. Some plants such as creeping euonymus (winter creeper), English ivy, and periwinkle (vinca minor) can become weedy escapees.

Advantages—The landscape can be more visually interesting; over time the need for weeding is reduced.

Disadvantages—The cost of establishing plants; herbaceous perennial weeds such as Canada thistle, bindweed, and quackgrass can cause problems; some shallow-rooted plants, such as rhododendrons, don't like aggressive understory plantings; lawns planted in both grass and broadleaf species do not look exactly like traditional lawns. Also, they cannot tolerate the herbicides usually recommended to get rid of undesirable plants.

Cover crops

Cover crops are generally grown in winter on annual vegetable and flower beds. Fast-growing crops such as winter grains are the most competitive with weeds. The cover crop may be a winter-hardy grain, a legume, or a combination of both. Cover crops are by no means 100 percent successful in weed suppression, so there may be some weeds to contend with.

Advantages—Cover crops smother winter weed growth; they capture excess fertilizer, improve soil tilth, and when turned under, increase organic matter; they are generally inexpensive; in warm areas, some cover crops can be cut and left on the surface as a weed-suppressing mulch during the growing season, and some crops, such as tomatoes, can be transplanted through the residue. The residue enhances the environment for beneficial soil insects.

Disadvantages—Gardeners in most areas have to till in the cover crop before they can plant a spring/summer garden, which can delay planting in a wet spring; rye grain used as a cover crop might reduce germination of some small-seeded vegetables such as lettuce; slugs and other insects may prosper if the residue isn't turned under.

Chemical Control

Herbicides are another tool for managing weeds. The extent to which you choose to use them depends on your personal philosophy, garden objectives, and particular weed problems. Herbicides may have a place in your garden, but you should always know what the alternatives are and what makes the most sense given your situation.

All herbicides have detailed label instructions on mixing, application timing, weeds controlled, plants around which they can be used, and other significant issues concerning their safe and effective use. The label is the legal document administered by the EPA that defines the use of a product and your responsibilities as a consumer. It is crucial that you read the instructions on the label before you purchase a product and follow them as you mix and apply it.

Herbicides control weeds by interfering with critical plant functions, thus resulting in the death of plants. Not all herbicides act in the same manner.

You need to understand some important terms and concepts before purchasing and applying herbicides.

Selective and nonselective

A *selective* herbicide controls certain plants and not others. For example, many lawn herbicides control broadleaf plants, such as dandelions, without damaging grasses. A few products control some (though not all) weedy grasses without harming turf. Other selective herbicides affect germinating seeds and sprouting herbaceous plants but not established woody trees and shrubs. A handful of products control grasses without damaging broadleaf species.

If an herbicide is selective, the label will provide extensive information about plants around which it can safely be used and weeds and plants it is likely to affect. In addition, there will be instructions on when to use the herbicide to obtain desired results and avoid problems.

Nonselective herbicides can potentially damage any type of plant. Some last a long time, having a residual effect; others do not. The label details how the herbicide acts.

It is important to remember that some products may be selective at certain rates but lose that selectivity as the amount of herbicide applied increases.

Systemic and nonsystemic

Most herbicides are *systemic*, which means they circulate from the point of initial absorption to other parts of the plant to have their effect. They may be sprayed on the leaves and move to the roots or vice versa.

Nonsystemic or *contact* herbicides affect only the part of the plant they touch. When a contact product is sprayed on leaves, it generally kills those leaves but does not travel to the root system. They may control young annual or biennial weeds, but while they may cause established perennial weeds to lose leaves, the weeds will resprout. Very few contact products are available to home gardeners.

Foliar-active and soil-active

Herbicides also are classified by the way they move into plants. Many common products are *foliar-active*, meaning they enter through leaves. For example, glyphosate (e.g., Roundup) must enter through green tissue. If this product is applied to bare soil, it has no effect on germinating seeds. Also, glyphosate cannot be picked up by roots in most soils.

Soil-active products are absorbed through roots or through the growing tips of germinating seeds.

A number of products are both soil-active and foliar-active, although one absorption route is usually more important. Again, the label will describe how to apply the herbicide.

Preemergent and postemergent

Finally, it is important to know when to use an herbicide relative to the growth of the weeds and the crop. A *preemergent* herbicide is put on before weeds sprout. The desirable plants (landscape trees and shrubs, vegetables, flowers, bulbs, etc.) may or may not be present. Careful label reading is important!

A *postemergent* product is used after weeds are up. Selectivity of postemergent herbicides may depend on crop age, application rate, or other factors. It's important to understand application timing as it relates to both weed and crop growth. Again, read and follow the label.

Herbicide interactions

Herbicide results are influenced by a number of factors. A plant with a waxy leaf (such as poison ivy) or a hairy leaf (such as stinging nettle) may not absorb an herbicide as well as a plant with a smooth leaf. Likewise, a plant with narrow, upright leaves may be hard to cover adequately with spray mixture. Or, a weed's growing point may be protected under the soil surface.

Environmental conditions can affect an herbicide, rendering it useless against the target plant or causing unintended damage to nontarget plants. In general, as temperature increases, herbicides work faster. However, some herbicides can become volatile (gaseous) at certain temperatures.

Some formulations of 2,4-D and some of its related chemistries can volatize off leaves shortly after application if temperatures climb into the mid-80s. Since small amounts of this herbicide can visibly distort sensitive plants, high temperatures and high humidity combined with a little wind can cause serious problems in your own and surrounding gardens.

Wind drift by itself can be a problem when using any herbicide. As you pump a sprayer, the pressure increases, which in turn creates a smaller spray droplet. The smaller the droplet, the more likely it is to become airborne and move away from where you want it to land. Again, this drift can cause unintended consequences and problems for neighborhood landscapes.

Moisture in modest quantities is needed to move soil-applied herbicides such as trifluralin into the soil. However, if a downpour occurs shortly after a soil-applied herbicide is applied, the chemical may wash downslope instead of entering the soil. This runoff can damage lawns or other plants in its path. When you use foliar chemicals, there must be enough time between application and rain to

allow the plant to absorb the herbicide. Eight hours of dry weather is normally enough. While eight hours is ideal, significant plant damage can occur in considerably less time. There are many stories of gardeners misapplying herbicides and then trying to wash them off, only to find that the plant was already damaged.

Sometimes, herbicides work poorly in dry weather. Drought-stressed plants conserve water by reducing transpiration through leaves. In this condition, they are less able to absorb herbicides. Several systemic products have specific statements on the label about their reduced effectiveness when plants are drought stressed.

Specific herbicides

Many of the herbicides listed below are not labeled for use in vegetable gardens. Always read the label to determine whether or not the application site is appropriate for the product considered for use.

Note—All herbicides listed may not be available in your area or suitable for your situation. Consult with your local extension agent for current herbicides recommended for use in Kentucky.

2,4-D—This systemic, foliar, postemergent herbicide affects broadleaves, especially herbaceous annuals, biennials, and perennials. It is a common component in lawn products, since it doesn't damage established grass. It is sold under numerous trade names and is often combined with other closely related chemicals—mecoprop (MCPP) and dichlorprop (2,4-DP)—to broaden the spectrum of weed control.

Dicamba—Dicamba has the same effect on plants as 2,4-D. It also is systemic, postemergent, and foliage applied. Dicamba is very active against broadleaves, especially some of the harder-to-control lawn weeds. It is used in some lawn herbicide mixtures. It is more dangerous to woody plants than 2,4-D and can be absorbed through roots. It is not uncommon to see landscape tree and shrub injury when dicamba is used extensively on lawns surrounded by woody plants. Dicamba also is sold under many trade names. Normally, it is mixed with other herbicides at very low rates.

Glyphosate—Glyphosate is a systemic, nonselective, foliage-applied herbicide. It potentially affects any plant with which it comes in contact. Glyphosate is absorbed through leaves, green bark (usually a very young tree or shrub), or freshly cut stems. The chemistry of glyphosate is such that it becomes tied up on soil particles. Little chance exists that glyphosate can be picked up by roots unless they are somehow exposed to it.

Glyphosate tends to follow the flow of sugars in plants. If it is applied to an actively growing woody plant, the chemical tends to move to the new leaves (where the sugars are headed) and stunt the terminal growth. In that circumstance, it may not move to the root system in sufficient quantities, and the plant survives. Thus, it is best used on perennial plants as they begin flowering or in the fall as they start storing sugars for winter.

Glyphosate can be used on some grasses almost any time they are green and on annuals when they are actively growing. It works faster (in seven to 10 days) in warm weather. It also can be effective in colder weather, but results might not be evident for a month or more. It is sold as Roundup and several other brand names.

Triclopyr—This product is systemic and predominantly foliage absorbed. In some cases, it can be absorbed through bark. Triclopyr is active against broadleaf plants, especially woody species. It has no effect on established grass. It often is used on blackberries, and poison ivy. It is sold alone or sometimes mixed with 2,4-D for control of brush and other harder to control broadleaf weeds. Read the label carefully to see whether the formulation is an ester or an amine. Avoid applying ester formulations in hot weather to reduce potential volatility and drift.

Oryzalin and trifluralin—These preemergent herbicides act on germinating seeds. They are most effective on annuals.

It is very important to read the labels for oryzalin and trifluralin carefully. These products differ in their need for mixing into the soil, the weeds they control (some, but not all, grasses and broadleaves), and the plants around which they can be used.

Trifluralin is sold as Preen, Treflan, and several other names. Oryzalin is marketed as Surflan, and Weed Preventer. Plants sensitive to these herbicides cannot be planted for several months after use.

Fluazifop—Fluazifop controls many grass species but does not harm most broadleaf plants. It is applied after grasses emerge and are rapidly growing. It takes seven to 14 days or more to see results. It is sold as Grass-B-Gon and other brand names.

Sethoxydim—Sethoxydim controls grasses and does not harm most broadleaf plants. It is applied after grass has emerged and is growing rapidly. The most common trade name is Poast.

Weed Management for Specific Situations

Your particular landscape or situation determines how you manage weeds.

Lawns

Choose grass species suited for your area. A vigorous lawn reduces weed invasion. Good fertility, watering, and mowing will keep your turf in top condition. Plan an annual program of overseeding weak areas, especially shade areas. Work to reduce insect damage to your lawn; weakened areas offer little competition to encroaching weeds.

Lawn blends that contain grass-cover combinations may provide a stable plant community that resists invasion by more weedy species. These combination lawns do not have the feel of pure grass, however, and some people find them unacceptable. Other homeowners swear by them.

If the grass you plant can tolerate a mowing height of 1¾ inches or more, the shade cast by the grass will inhibit many broadleaf weeds. Use a fertilizer low in phosphorus to avoid stimulating clover (assuming you don't want clover in your lawn). Some broadleaf weeds can be managed by hand pulling, but smaller species may be hard to control this way.

Weedy perennial grasses such as quackgrass, Bermudagrass, and nimblewill can be very invasive. Once these plants establish, you have few options short of complete renovation. Some gardeners spot-spray the patches with glyphosate and then overseed them.

Summer annual grasses such as crabgrass are generally part of most well maintained lawns.

Usually, lawns are weakest in shady areas and where drainage is a problem. Annually overseed lawns in those areas to maintain a viable turf. Moss often grows where grass is weak.

Many homeowners use broadleaf herbicides, either alone or in combination with fertilizer ("weed and feed"). To reduce the amount of herbicide used, it generally is much better to spot-spray weedy areas rather than apply herbicides over the entire lawn each time you fertilize.

Herbicide-treated lawn clippings should be used cautiously as mulch or in compost. Unintended damage to nontarget plants can occur. For example, clopyralid-containing products can persist for more than a year.

If young children or pets use the lawn, be cautious with herbicides!

Renovation

Lawn renovation often is done to reestablish turfgrasses where weedy grass species have taken over. The weedy species must be killed (especially perennials) before a new lawn is planted.

A single rototilling generally spreads rather than controls problem grasses, but repeated tillage over three to four weeks can give acceptable control in dry weather.

Some homeowners use glyphosate to kill an existing weedy lawn then dethatch and overseed. Repeat applications of glyphosate are sometimes necessary before seeding. They don't use rototilling unless the lawn needs to be reshaped. With good temperatures and water, a new lawn can be up and growing in three to four weeks.

Woody Landscape Areas

Weeds in landscape beds can be managed with a mix of techniques that include mulching, water placement, competitive planting, hand pulling, and herbicides applied as both spot and broadcast treatments.

Mulches should be your first line of defense against weeds. They reduce the germination of weed seeds and protect the soil. Organic mulches such as bark probably are the most effective and cause the least problems. Hoeing in mulch is easy and disrupts most annual weeds. Landscape fabrics may be used around annual and perennial flowers but should not be used around woody plants, where they often encourage surface root growth. Perennial weeds generally are not deterred by organic mulches and may defeat landscape fabrics as well.

Drip irrigation puts water around desirable plants but doesn't water everything, and the dry areas will have much less potential for weed growth.

When bare areas are planted with robust plants, weeds struggle to compete.

Complex landscapes that cover most of the ground generally have fewer weed problems as the plants become established—which can be a great reason to buy more plants! It does help to have a plan and know which species will work best. In some cases, competitive plantings may limit your herbicide choices.

The herbicides most commonly used in woody landscapes are isoxaben, pendimethalin, oryzalin, trifluralin, and spot application of glyphosate. Be sure you understand how these products work to avoid damaging desirable plants.

Mention or display of a trademark, proprietary product, or firm in text or figures does not constitute an endorsement and does not imply approval to the exclusion of other suitable products or firms.

Annual Flower and Vegetable Gardens

Annual vegetable and flower gardens can be weed nightmares. Working the garden in the spring offers an opening for weed seeds. Their aggressive growth can quickly dominate a garden.

Weeds are best managed in flower and vegetable gardens by a combination of hoeing, hand pulling, use of vigorous plants that shade the ground as they mature (including extensive use of transplants), drip irrigation, mulches, and relentless attention that keeps weeds from going to seed. Winter weeds can be managed by mulches or cover crops.

In general, herbicides are not a good option for home vegetable gardening due to the complex of different plants that are grown.

Some gardeners use glyphosate before the first spring cultivation to control persistent perennial weeds, especially quackgrass. Trifluralin (Preen or Treflan) is labeled for use around some (but not all!) flowers and vegetables. Oryzalin has some home-garden labels for flowers. Read the labels carefully and follow instructions if you use herbicide products.

For More Information

University of Kentucky Cooperative Extension Service publications:

Weeds of Kentucky Turf (AGR-12) http://www.ca.uky.edu/agc/pubs/agr/agr12/agr12.pdf

Weed Control for Kentucky Home Lawns (AGR-208) http://www2.ca.uky.edu/agcomm/pubs/AGR/AGR208/AGR208.pdf

Other resources:

McCarty.LB, et.al. Color Atlas of Turfgrass Weeds. Ann Arbor Press. 1991.

Haragan, Patricia Dalton. Weeds of Kentucky and Adjacent States: A Field Guide. University Press of Kentucky, 1991.

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