Chapter 10

Weed Control in Nursery and Landscape Plantings

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Learning Objectives:

From reading and studying this chapter you should be able to:
• Know what a weed is
• Differentiate between annual, biennial and perennial weeds
• Understand how weed types influence management approaches
• Know the steps in a weed management plan for nurseries and landscapes
• Understand weed management including non-chemical and chemical approaches
• Understand herbicide types, and be able to differentiate between preemergence and postemergence herbicides and know when to use each type
• Distinguish between selective and non-selective herbicides
• Distinguish between translocated and non-translocated herbicides
• Identify factors that affect herbicide performance or non-performance

Introductory Comments:

Weeds in ornamental nurseries and the landscape present serious problems for nursery operators and lawn care professionals. An increasing emphasis in the U.S. is being placed on providing quality ornamentals for planting into well-designed and maintained landscapes for improved aesthetics and enjoyment of the public. This requires effective weed management. A balanced weed management program includes an integrated approach of prevention, sanitation, hand weeding, mulches, mowing, cultivation, and herbicides. Selecting the most suitable methods of controlling weeds in ornamental nurseries is a difficult task, although herbicides do play a major role. In home landscapes that utilize a balanced approach to weed management, herbicides do not have to play the major role. The objective of this chapter is to provide information concerning weeds, the methods used to control them and the approaches to use when designing a weed control program for ornamental nurseries and the landscape.

Weed Principles

What particular plants are considered to be weeds and why do we concern ourselves with weeds? There are many definitions of weeds. In this chapter a weed is considered to be a plant growing where it is not desired, or a plant out of place that is undesirable in the nursery or landscape setting. Typically, weed refers to naturally
occurring aggressive plants that are injurious to people or to agriculture. Weeds can compete with desirable plants for essential growth factors including light, moisture, nutrients and space resulting in poor growth of ornamental plants. Weeds present in containers or in root balls of ornamentals for sale detract from their appearance and can result in future problems when the plant is placed in the landscape. Weeds can harbor other pests such as insects, diseases, nematodes and mammals (such as rodents) that reduce ornamental plant growth. In addition, in the landscape, weeds can be unsightly and detract from aesthetic appeal. For these main reasons, weeds must be controlled. Unlike other pests, weeds can always be counted on to be present and they must be dealt with. However, there are many methods of control available.

In order to best control weeds it is important to know what type of weed is causing a problem. Weed identification is critical to choosing the most appropriate method for management. There are many good websites available to assist in weed identification (see Websites of Interest). However, before attempting to identify a weed it is important to understand some basic biology related to weed types.

**Growth Form.** Plants can be divided into gymnosperms, monocots and dicots. Gymnosperms include pines, firs, spruces, cedar, redwoods and hemlock and are generally not considered to be weeds. Monocots tend to have narrow leaves with parallel veins and include lilies, iris, grasses, sedges, palms, orchids and bananas. Grasses and sedges are the most common monocot weeds. Dicots have broadleaves and include most of the common non-grassy weeds we encounter. Some examples include redroot pigweed, dandelion, common lambsquarters, purslane, carpetweed, nightshades, mustards, Canada thistle and field bindweed.

**Lifecycle.** Weeds can be separated into 3 groups based on lifecycle or the time during which the plant lives within a given season.

- **Annuals** are the most common weeds. They complete their lifecycle from seed to seed in one growing season. Annual weeds come in many different forms including summer and winter annuals. *Summer annual* weeds germinate in the spring, grow and flower over summer, produce seed and die in fall when temperatures decrease. *Winter annuals* emerge in late summer and most over winter as a rosette and after receiving a cold treatment, send up a flower stalk (bolt), flower, and produce seeds early in the following summer. Exceptions to this pattern are henbit and chickweed which do not form rosettes, but over winter as immature and mature plants.

- **Biennials** are a second group of plants (such as wild carrot) that live for two years and are similar in many ways to winter annuals except they flower and produce seed only in the second year.

- **Perennials** are a third group of plants which can grow for a number of years, sometimes indefinitely and can be herbaceous (soft stemmed) or woody and reproduce by seed or vegetative (asexual)
reproduction. *Herbaceous perennials* include field bindweed, yellow nutsedge, and quackgrass; *woody perennials* include trees, woody shrubs and vines. Since perennials can have extensive above (stolons) and below ground (rhizomes, roots and tubers) vegetative parts, they are much more difficult to control with all removal techniques available once they become established.

Within these groups of weeds, annuals are most easily controlled, followed by biennials then perennials. Examples of weeds commonly encountered in Indiana can be seen at: [http://www.ppws.vt.edu/weedindex.htm](http://www.ppws.vt.edu/weedindex.htm) or at the other web sites listed at the end of this chapter.

**Weed Control Methods.**

All successful weed management programs, whether in the nursery or the landscape, involve an integrated approach that utilizes a combination of methods. Methods can include non-chemical approaches alone or can include chemicals (herbicides). Regardless of the approach, no one method will solve all weed problems, thus a need exists for the use of many weed control tools. The key to success in weed management is to have a plan for how weeds will be managed and a good knowledge of the variety and effectiveness of available tools.

Before any weed management practice is used, the successful manager will assess each site and determine what weed pressure must be dealt with. Without a thorough assessment of each site, the general approach is to use herbicides, because weed problems are anticipated, therefore, a preventative approach is the easiest. In all cases, weeds must be minimized to achieve the most appealing nursery plants for sale or to maintain the aesthetics of the landscape.

**Nursery weed management.** Nursery weed management is short term since most of the nursery plants at any one site will be present for 3 years or less, and then a new variety of plants are introduced to the site. In nurseries several steps are important in reducing weed problems initially and throughout the life of the nursery.

1. **Site assessment.** The site chosen for the nursery should be conducive to growing the desired ornamental plants and should be free of problem weeds, especially perennials. Choose sites where soil has been well managed and weed problems are minor. Obtain the past history of the site if possible.

2. **Site preparation.** Eliminate perennial and other problem weeds by use of fumigation (if allowed), use of systemic herbicides such as glyphosate or 2,4-D, or use some type of agronomic or cover crop where broad spectrum herbicides can be used.

3. **Weed management plan.** Base the nursery weed management plan on weeds present at the site and types of management tools available. It is important to integrate the use of non-chemical and chemical tools.
and to not use the same herbicides repeatedly. Use of one herbicide repeatedly is a poor practice and can result in herbicide resistant weeds or loss of effective control as weed spectrums shift to weeds not easily controlled by that particular herbicide. The types of crops grown in the nursery will dictate the types of weed management tools available and the specific types of herbicides that can be used. Information on weed management is available from local extension offices, university specialists or from information available on the internet (see Additional Readings and Websites of Interest).

4. **Weed management practices assessment.** Each year the weed management program for each nursery site should be assessed to determine the effectiveness of the practices used.

An effective nursery weed control plan involves an intensive approach to initially remove the most problematic weeds from the site and then a program that keeps weed pressure minimized. Some difference in weed management approaches is necessary in liners versus container production relating to herbicide use and other cultural practices as outlined below.

**Landscape site weed management.** In the landscape, a longer-term approach is necessary as the site must be maintained for multiple years. A good plan for each landscape site will result in a more aesthetically pleasing area and will cost less to maintain. If weed management is not well thought out, supplemental hand weeding will be necessary. This is expensive and will account for the majority of landscape bed maintenance costs. When used exclusively, hand weeding can cost 10 to 100 times as much as an effective herbicide or mulching program. However, many of the costly and unsightly weed problems can be avoided or at least minimized with a little planning. Developing a landscape weed management plan involves five basic steps.

1. **Site assessment.** Survey the site for cultural aspects as well as weed species.

2. **Define the type of planting.** The type of planting, woody shrubs vs. bedding plants etc., will define the post-plant weed management options available.

3. **Selection of ornamentals species and compatible weed management options.** Based upon design, cultural, and weed management criteria.

4. **Site preparation.** Control weeds which cannot be controlled after planting.

5. **Installation and implementation;** of the plants and the weed management plan.

Site assessment involves determining what plants will grow best in the area and what steps must be taken to adequately eliminate existing weeds to allow the successful performance of the subsequently planted ornamentals. Site preparation involves removal of undesirable weedy vegetation prior to planting of the landscape plants.
Perennial weed elimination is critical in site preparation. When perennials are a major problem, the best method of elimination is the use of a non-selective systemic postemergent herbicide (applied to foliage of emerged weeds) such as glyphosate. If no perennials exist at the site, the best approach is to properly prepare the soil for planting by addition of soil amendments that allow good tilth and fertility. Healthy, vigorously growing plants are better able to compete with weed invasions. Weed management options in ornamentals, whether the plantings are trees or shrubs, woody groundcovers, annual flowers, herbaceous perennials or mixed plantings of woody and herbaceous plants, include prevention and sanitation, mulches, geotextiles, handweeding, and in some cases, herbicides.

Weeds are most problematic in the initial years of any ornamental planting, when plants are small. In established groundcover beds or dense planting of herbaceous perennials, weed problems decrease as the plants grow and cover the soil surface. In hedges or mixed plantings, weeds can be a persistent problem in the areas not occupied by intended plantings.

**Non-Chemical Weed Management Tools**

**Prevention and sanitation.** As with all crops it is important to eliminate problem weeds from a site prior to planting. This is true in nurseries and in the landscape. In nurseries this may include cropping the site with agronomic crops and maintaining a high level of weed control, fallowing the site and using non-selective herbicides to eliminate problem weeds, cover cropping with cereal grains or legumes (green manures), or use of chemical fumigation prior to planting. Establishing plants in a weed free site is critical to long-term success. A second form of prevention is to exclude weed introduction into the nursery. Weed seed and other propagules can be introduced into the nursery as wind-blown seed, can be washed in by runoff, deposited by animals, or be introduced in contaminated potting soil, and in root balls of purchased plants. In both nurseries and home or public landscapes, never purchase trees, liners or container plants that contain weeds. Many weeds, especially perennials, are introduced into nurseries and home landscapes from contaminated stock plants and once introduced can cause a continuing weed management problem. Other types of prevention include not allowing weeds to produce seeds, scouting to identify infestations of new weeds that can be targeted for control, removal of containers with perennial weeds and disposal of the biomass of weeds pulled from containers especially if they have seedheads or can reproduce vegetatively.

**Cultivation** involves removing weeds by manual or mechanical methods. Manual hand removal is tedious and expensive but is occasionally necessary in nurseries, especially in containers. Mechanical techniques in liner beds and other in-ground plantings in nurseries can include rototilling, diskng, plowing and hoeing, but care must be employed to avoid physical damage to valuable plants during weed removal. Cultivation is most effective against annual weeds and can actually promote a worse problem when used in perennial weed infestations since vegetative propagules can be
spread. Repeated cultivations are necessary in perennial weed control and this is not always possible in nurseries. Cultivation on wet soils should be avoided as this results in damage to soil structure and leads to compaction.

**Cover Crops** are used in nurseries to improve weed management. Common cover crops include seeded grain crops (rye, oats, wheat) or legumes that can be mowed and maintained as a living mulch, or killed by a herbicide and used as a dried surface mulch. Some difficulties with establishment and stand vigor have limited these techniques in northern latitudes.

**Mowing** is a form of weed control used in nurseries and home landscapes to reduce the reproductive potential of weeds. Mowing needs to be timed prior to seed production and must be repeated when used against perennial weeds in order to weaken the underground rhizomes and roots. Mowing is not effective against low growing weeds or weeds that flower below the mowing blade height.

**Mulching** is a very effective method of weed control for home and public landscape beds and in certain nursery beds and container production. Mulching the soil surface reduces light and oxygen exchange necessary for the germination of many weed seeds and also presents a physical barrier to emergence. Other beneficial properties include moisture retention, soil stabilization and aesthetics, and a reduction in the need for herbicides.

Mulches include natural organic, natural inorganic and synthetic materials. Natural organic mulches can be composted yard wastes or animal wastes, various grain straws (weed free), peat moss, and pine straw, but the most common types are wood chips, hardwood bark or softwood bark. Organic mulches are placed on the soil at 2-3 inch or greater depths and provide good weed control and have good stability over 1 to 2 years. Bark mulches are extremely popular in landscaping situations.

Inorganic mulches are not commonly used in commercial nurseries but are fairly common in home and public landscapes. Inorganic mulches can include sand, pebbles, stones, shale and other rock types and often are available in a variety of colors. Inorganics are stable over a long time but require either plastic sheeting or geotextile fabric being placed on the soil surface under them or the repeated use of a herbicide since weeds do germinate and emerge through them.

Synthetic mulches are manufactured and are generally some type of polyethylene or woven synthetic fabric. These mulches are available as solid sheets, mats, or webbed material and come in a variety of colors, thickness and service lives. Solid sheets are impermeable to water, but mats or webbed materials are permeable. The main purpose of synthetic materials is to prevent weeds from germinating and becoming a problem. These mulches are commonly used in landscapes especially under inorganic mulches and are commonly used as soil covers in nurseries under containers to reduce weed problems between pots.
Geotextiles are synthetic fabrics that cover the soil surface but allow movement of water and air while reducing the light reaching the soil surface which reduces weed germination and growth. These materials are becoming more popular in landscape weed control but also may have some use in liner nurseries. Although, these materials are expensive and require installation, they become more cost effective over time since they last 4 years or longer. They are as effective as a preemergent herbicide (a herbicide applied to the soil prior to weed seed germination and plant emergence) which requires reapplication each year. Geotextiles are used on perennial plantings that do not require yearly replanting but are unsuitable for spreading groundcover beds since the fabric inhibits plant rooting. Geotextiles often are covered by a mulch to reduce photodegradation and improve the appearance of the beds. Any weeds growing through the textiles should be quickly removed to prevent holes in the fabric barrier.

**Chemical Weed Management Tools**

_Herbicides_ are still the most widely used technique for weed control in nurseries and are safely used in a variety of other landscape situations. Weed control is essential in nurseries in order to provide healthy weed free plants for the consumer. The key component in nursery and landscape weed management is to start weed free and maintain the site as weed free as possible. Once weeds become widespread in the nursery or landscape, it is very difficult to ever remove all the weeds. Use an integrated weed management approach for best results and when using herbicides, obtain help in selecting proper herbicides for weed control from local county extension educators or other public agencies. There are many excellent weed management guides available from the university extension service in most states (see literature cited).

Prior to choosing and using a herbicide an applicator should know what weeds need to be controlled and then always read the herbicide manufacturer's literature and labels. The label provides information related to proper use and performance of the herbicide in order to obtain the most effective weed control with no injury to valued ornamentals. Basic label information includes: herbicide name, active and inert ingredients, precautionary statements and directions for use. The precautionary statement includes information about hazards related to product use, clothing that must be worn by applicator, user safety and environmental hazards. Directions for use include how to safely apply the herbicide, proper storage and disposal of the product, weeds controlled, crops where the herbicide can be used, rates of herbicide to use, timing of herbicide application, application equipment, acceptable tank mixtures, acceptable spray additives, crop rotation restrictions and restrictions and limitations on herbicide use.

The types of herbicides used in nurseries and landscapes include both preemergence and postemergence compounds (see below). There is a wide variety of herbicide choices available; however, there is also a wide variety of landscape ornamental plants with significant differences in tolerance to herbicides. The manager should plan
ahead by preparing the site properly and planting species having similar herbicide tolerances together in order to simplify herbicide applications and improve the effectiveness of the weed control program. The wide variety of plants in most landscapes results in many limitations relating to a simple herbicide only approach to weed control; therefore, many landscape managers and homeowners choose to use mulches, hand removal and spot sprays with broadspectrum herbicides. Nonselective sprays such as glyphosate, glufosinate, and pelargonic acid are especially effective for killing vegetation in brick walks, along landscape bed borders or under woody ornamentals. Best results are obtained when weeds are 1 to 2 inches tall and actively growing and care must be used to keep the spray off of valued ornamentals.

**Preemergence herbicides** are those applied prior to weeds emerging from the soil. Emerged weeds are not controlled in most cases, so timing of application is critical for success with preemergence herbicides. Preemergence herbicide use requires choosing the appropriate chemical for weeds at the site (based on scouting and previous experience), and application at the proper rate prior to any weed emergence. Selectivity of herbicides for ornamentals is often achieved by formulation. Many preemergence herbicides in woody ornamentals are formulated as granules and application should be made when foliage is dry and the granules will tend to bounce off the leaves. Most preemergence herbicides work best when uniform distribution is followed by immediate irrigation to wash the herbicide off the plant foliage. The irrigation moves the herbicide into the growth medium or soil where it can inhibit weed seed germination.

Many preemergence herbicides for nurseries provide acceptable weed control for most of the season in field production and for 8 to 12 weeks in containers. For containers, hand weeding is generally practiced prior to reapplication of preemergence herbicides to eliminate emerged weeds. Preemergence herbicides can be used under containers for weed control and are commonly used in landscape beds if the herbicide has limited potential for causing damage to the ornamentals planted at the site.

**Postemergence herbicides** are herbicides that are applied to emerged weeds. Some types provide contact kill of the shoot only (example paraquat) while others are absorbed by the foliage and can be translocated throughout the shoot and root system (example glyphosate; 2,4-D) resulting in total weed death. Postemergence herbicides are often applied with a spray adjuvant (a surfactant, or spreader-sticker) that is added to the spray solution to improve herbicide activity. There are many postemergence herbicides available for use in nursery liner production and in the landscape. In field nurseries directed spray applications or spot treatments of nonselective herbicides such as glyphosate, glufosinate, paraquat or pelargonic acid are commonly used to control emerged annual and perennial weeds. Selectivity is obtained by carefully directing or shielding the application to the base of woody ornamentals. There are only a limited number of postemergence grass specific herbicides available for use in container production and no herbicides specifically...
Herbicides can be classified as selective or nonselective. These categories apply to both preemergence herbicides and postemergence herbicides. Nonselective herbicides kill everything they come in contact with. Generally postemergence herbicides such as glyphosate would fall in this category. Nonselective herbicides must be applied carefully to avoid contact with desirable plants. Techniques such as directed or spot sprays or use of shields avoids damage to valuable plants. Selective herbicides control a specific type of weed and can have activity on both broadleaf and grass weeds or can selectively kill only grass or broadleaf weeds (monocots or dicots). With use of selective herbicides it is important to know what weeds are present and what crops do or do not have tolerance to the herbicide.

Factors that affect herbicide performance

Several factors can affect the performance of herbicides. Always read the herbicide label and make sure that the herbicide chosen is labeled for use in the crop and for the weeds you are trying to control. The herbicide label is the best source of information regarding crop tolerance and weed susceptibility, rates to use, spray volumes to use for application, and appropriate timing of application. Do not expect a preemergence herbicide to control perennial weeds or weeds for which it is not labeled. Also do no expect most postemergence herbicides to have any soil residual activity.

Considerations for preemergence herbicides.

1. These herbicides must be applied to weed free soil or soil that has been tilled to remove existing weeds. They work best if applied to soil where plant residue is minimal. Small emerged weeds generally will not be controlled by most preemergence herbicides and will continue to grow.

2. Soil moisture is important for the maximum effectiveness of preemergence herbicides. Most herbicides require rainfall or irrigation shortly after application to be most effective. The moisture moves the herbicide into the top ½” to 1” of soil where weed seed germination occurs so uptake by the emerging shoot and/or roots can be maximized. Application to moist soil is preferable to application to dry soils.

3. Soil type and the amount of organic matter can also affect herbicide performance. Rates often need to be adjusted for soil type and organic matter content. Finer textured soils or those with high organic matter content may require the application of a higher rate of herbicide. Refer to the herbicide label for rate adjustments based on soil factors.

Considerations for postemergence herbicides.

1. These herbicides must be applied to emerged plants. Refer to the product label for timing of
application and the types of weeds controlled. Generally speaking, the best results from postemergence herbicides are realized when they are applied to actively growing weeds.

2. These herbicides must be applied so good coverage of the foliage occurs. Complete coverage is important for contact herbicides such as paraquat, Scythe and Finale. Although complete foliar coverage is less important for herbicides that translocate after foliar absorption (glyphosate, 2,4-D, grass specific herbicides), good coverage is still important. Most postemergence herbicides need to be applied in combination with some type of an adjuvant such as crop oil or a surfactant to improve leaf coverage and aid in herbicide absorption. Also, some labels require the use of ammonium sulfate or liquid nitrogen for best activity.

General Considerations

Weed Characteristics. Stage of growth is critical for best herbicide performance. Preemergence herbicides need to be applied before weeds emerge. Postemergence herbicides are most effective against small emerged weeds and are generally less effective as weeds get larger. Herbicide effectiveness is reduced if weeds are stressed due to drought or excessive temperatures.

Application Rate. Labels provide information on timing and rates to use depending on weed size, soil type, etc. Postemergence control of perennials requires proper timing and application rate so the maximum amount of the herbicide translocates throughout the plant.

Sprayer calibration. The sprayer used to apply herbicides must be properly calibrated so the right amount of herbicide is applied. All sprayers should be calibrated at the beginning of the season and recalibrated when nozzles, hoses, etc. are routinely replaced. It is wise to spray herbicides using lower, as opposed to higher pressures from the output of the spray equipment. Higher pressures cause smaller spray particles (mist) which can drift and cause damage to non-target plants.
Review and Study Questions

- What are the 3 lifecycles found in weeds?
- Why are perennial weeds more difficult to control than annuals?
- What problems do weeds cause in ornamentals?
- What are the cultural methods of weed management?
- What types of mulch materials are most commonly used in landscaping?
- What steps should be used to ensure that mulches control weeds in the landscape?
- What information does a herbicide product label tell the applicator?
- What is the difference between a preemergence and a postemergence herbicide?
- What are 3 main considerations when using a preemergence herbicide?
- What are the 2 main considerations when using a postemergence herbicide?
- What are the 5 steps involved in landscape weed management?
- What is the difference between a selective and a non-selective herbicide?
- What is the difference between a herbicide that translocates and one that does not translocate?

Additional Readings:


Weed Management in Nursery Crops, James Altland, Oregon State University
http://oregonstate.edu/dept/nursery-weeds/startpage.html

Weed Management in Landscapes, C. A. Wilen, UC IPM Program/UC Cooperative Extension, San Diego Co.; and C. L. Elmore, Vegetable Crops/Weed Science, UC Davis
http://www.ipm.ucdavis.edu/PMG/PESTNOTES/pn7441.html

Professional Landscape Maintenance, by Ray D. William
http://weeds.ippc.orst.edu/pnw/weeds?28W_LAND01.dat

Websites of Interest:

Controlling Weeds in Nursery and Landscape Plantings, Ohio State University, Bulletin 867; http://ohioline.osu.edu/b867/b867_3.html

Virginia Tech Weed Identification Guide:
http://www.ppws.vt.edu/scott/weed_id/rightsid.htm

University of Illinois, Weed Identification: http://web.aces.uiuc.edu/weedid/

Iowa State University, Weed Seedling Identification:
http://www.weeds.iastate.edu/weed-id/weedid.htm
Rutgers University, New Jersey Weed identification Guide: 
http://www.rce.rutgers.edu/weeds/default.asp

Weed Fact Sheets from Pennsylvania State University:
http://www.nysipm.cornell.edu/factsheets/weeds/