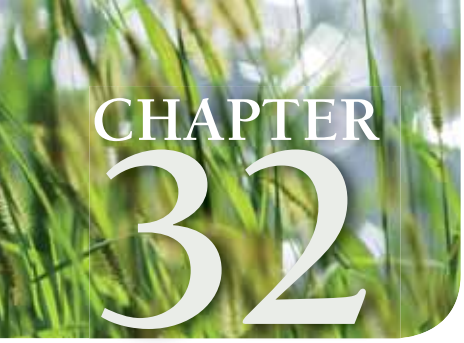

CHAPTER 32

Weeds

Chapter Outcomes

After studying this chapter, you will be able to:

- Describe what constitutes a weed and how weeds impact horticultural systems.
- List the characteristics of weeds.
- List examples of different weed biology.
- Describe the categories for identifying weeds.
- Compare and contrast different weed management methods.

Words to Know

broadleaf weed
bunch-type weed
contact herbicide
nonselective herbicide
no-till
post-emergent herbicide
pre-emergent herbicide
rosette
sedge
selective herbicide
self-compatible weed
solarization
systemic herbicide
tillering

Before You Read

Skim the chapter by reading the first sentence of each paragraph. Use this information to create an outline for the chapter before you read it.




While studying this chapter, look for the activity icon to:

- **Practice** vocabulary terms with Words to Know activities.
- **Expand** learning with identification activities.
- **Reinforce** what you learn by completing Know and Understand questions.

www.g-wlearning.com/agriculture

Since the rise of agriculture nearly 10,000 years ago, men and women have had to wrangle with unwanted plants competing for critical resources, **Figure 32-1**. Whether weeds negatively impact crop yields, species diversity of the natural environment, or even human health, they have an adverse outcome on the economy. Billions of dollars each year are spent on managing weeds and preventing their introduction. Prior to applying different control methods, a grower must be able to identify the weed species and understand its biology. Only then can the best management strategy be implemented.

Sever 180/Shutterstock.com

Figure 32-1. Weeds have been present since the early days of agriculture, nearly 10,000 years ago. One of the most tenacious and well-known is the dandelion. What are common uses for dandelions?

Definition of a Weed

There are numerous definitions of a weed, including a plant that is out of place or a plant growing where it is not wanted. In commercial horticultural production and gardening, weeds compete with plants for water, nutrients, and light and can diminish plant quality and yield. Weed seeds can reduce crop quality by contaminating a harvest with their presence. Some weeds may serve as hosts for crop diseases or provide shelter for insects to overwinter. Other weeds, such as quackgrass, have allelopathic qualities, producing chemical substances that are toxic to crop plants.

Elena Elisseeva/Shutterstock.com

Figure 32-2. Some weeds, such as ragweed, can impact human health by aggravating allergies. What other weeds are common allergens?

Impact of Weeds

Weeds impact agriculture and, more largely, human health and productivity in the following ways:

- Increase crop production and processing costs by higher equipment wear and fuel costs.
- Reduce product/crop quality.
- Add to the amount of water and nutrients required for crop production.
- Act as alternate hosts for insects and diseases.
- Increase animal production costs and product quality and diminishes land values.
- Affect human and animal health (allergies, poisonings), **Figure 32-2**.
- Decrease wildlife habitat.
- Decrease water quality and damage watersheds and systems, which decreases recreational opportunities.

- Displace native, threatened, and endangered species (plants, animals, and insects), **Figure 32-3**.
- Increase costs at industrial and utility sites (to control weeds).

natalia deryabina/Shutterstock.com

Figure 32-3. Purple loosestrife is a nonnative, invasive species that has displaced wildlife habitat and food sources. How was purple loosestrife introduced to the United States?

Costs of Weeds

Cropland and rangeland acreage in the United States constitute nearly 1 billion acres across the country, with each farm needing to manage weeds in some way. Crop production is diminished through the competitive nature of weeds for light, nutrients, and water. As much as a 100% crop failure can occur if weeds are not controlled.

Weed Characteristics

Weeds have a number of characteristics that permit them to survive and allow them to flourish in many different environmental conditions. Weeds often have some or all of the following characteristics:

- Aggressive establishment through rapid growth (deep root system).
- Prolific seed production.
- Vegetative reproductive structures.
- Seed dispersal mechanisms.
- Seed dormancy.
- Staggered germination.
- Long-term survival of buried seeds.
- Adaptation for spreading.

"Even the richest soil, if left uncultivated will produce the rankest weeds."
—Leonardo da Vinci

Many weeds grow rapidly as seedlings and have the ability to reproduce very quickly. For example, pigweeds have a C4 photosynthetic pathway. This gives them the capacity to grow and develop rapidly in high temperature and high light conditions, as much as 2"–4" (5 cm–10 cm) in as little as two to three weeks. A number of weeds, such as quackgrass, can reproduce both sexually through seed production and asexually through the vegetative structures of rhizomes.

Weed Seeds

Many weeds, such as the Canadian thistle, have mature seed as soon as two weeks after flowering. Some weeds seeds have very broad germination temperature ranges and germinate much more quickly than their crop counterparts. ***Self-compatible weeds*** are those that do not need to cross-pollinate in order to set seed; they are self-pollinating. Even if there is only one self-compatible weed in a garden, it can still be detrimental through its ability to disperse weed seeds. Weeds that do require cross-pollinators often do not need the aid of a specific pollinator or are wind-pollinated, as in the many grasses that are considered weeds.

Multiple species of weeds have the potential to produce large numbers of seeds and have seed dispersal mechanisms that can fling seeds far and near, **Figure 32-4**.

msnobody/Shutterstock.com

Figure 32-4. Weeds grow rapidly, such as this thistle that can disperse mature seed as soon as two weeks after flowering.

Corner Question

How fast can mile-a-minute weed grow?

Some annual weeds can produce multiple seed crops in a year. Seeds can hold several kinds of dormancy, permitting them to weather unfavorable conditions and germinate at optimal times. Many weeds are viable for considerable periods of time, maintaining a long dormancy and resisting decay.

Environmental Conditions for Weeds

Weeds thrive in a wide range of environmental conditions. Some weed roots can grow deeply into the soil. For example, bindweed roots have reached a depth of 10′ (3 m), accessing water and nutrients beyond the reach of crops. Perennial weeds have roots and storage organs that contain food reserves, allowing them to tolerate environmental stress and cultivation, **Figure 32-5A**. Through other adaptive mechanisms, weeds can tolerate stresses, such as low or excessive levels of certain nutrient elements in the soil; drought; waterlogging; temperature extremes; and repeated grazing, mowing, or tillage. Many weeds have modified structures that thwart the efforts of grazing animals or insects. For example, nettles are covered with small spines along the stems to detract unwanted visitors, **Figure 32-5B**. In some cases, weeds have modified growth habits to compete for resources, such as having a climbing habit, having allelopathic chemicals, or growing as a rosette. A ***rosette*** is a growth habit of many biennials in their first year in which leaves attach in a circle around the base of a stem. Allelopathic plants have the ability to release a chemical into the environment that inhibits growth by other plants. Weeds can be found everywhere in agriculture. They are easily spread and adapt to new areas and habitats. In some cases, invasive species that have been unintentionally introduced to the United States have no natural predators and aggressively populate wild and cultivated lands. Common examples are purple loosestrife and kudzu, **Figure 32-5C**.

Safety Note

Toxic Weeds

Some weeds are edible whereas others are toxic. Entire plants may be poisonous, or the toxicity may be confined only to seeds, roots, berries, or leaves and stems.

A *Richard Griffin/Shutterstock.com*

B *Manfred Ruckszio/Shutterstock.com*

C *Scott Ehardt*

Figure 32-5. A—Dandelions have large, fleshy taproots that enable them to reach and store water. B—Nettles will thwart efforts of predators with their stinging hairs along the stems and leaves. C—Kudzu was originally introduced to stabilize steep banks, but it has rapidly taken over the Southeast.

STEM Connection Seed Viability Experiment

Dr. William James Beal, a professor at Michigan Agricultural College (now Michigan State University) in East Lansing, Michigan, initiated a seed viability experiment in 1879. He started the study "with the view of learning something more in regard to the length of time seeds of some of our most common plants would remain dormant in the soil and yet germinate when exposed to favorable conditions" (Beal, 1886). He selected 50 seeds of 23 different kinds of plants. The seeds were mixed together in moderately moist sand, placed in different jars, and buried on a sandy knoll in hidden locations on campus. One jar would be dug up every five years. Later, this time period was extended to 10 years. The experiment is still going today, and the most recent jar was uncovered in 2000. The next jar will be dug up in 2020, with five more jars remaining.

After 120 years, seedlings emerged within a week after being planted in a seed-sand mixture with seeds continuing to germinate over the next 39 days. After flowering, the plants were positively identified as *Verbascum blattaria*, *Verbascum thapsus*, and *Malva neglecta*. This experiment illustrates the sheer longevity that some seeds have to remain viable. Some seeds were still germinating nearly 1.5 months later. Weeds behave similarly, with long viabilities and staggered germination. The implications for weed control are persistence in management and continual monitoring.

Benefits of Weeds

"A weed is but an unloved flower."
—Ella Wheeler Wilcox

Although weeds can wreak devastating havoc in farms and gardens, they can also provide significant benefits. Some of the benefits weeds can provide include:

- Soil stabilization. Weeds readily populate bare soil, such as after a wildfire, construction, or other land-disturbing event.
- Habitat and food for wildlife. Many honey bees and other native bees will forage among weeds, such as clover, mustards, bindweeds, and other weeds.
- Soil enrichment. Weeds decompose and add organic matter to the soil as well as fix nitrogen (in the case of vetches and clovers).
- Genetic reservoir. Many modern-day cultivars are crossed with wild-type plants, including some weeds.
- Medicinal uses. Traditional healing draughts made from weeds have managed illnesses that range from mild depression to rheumatism to bleeding.
- Food for people. Foragers can find edible weeds, including dandelions, nettles, lambs quarters, henbit, and many others.
- Aesthetic qualities. Goldenrod and Queen Anne's lace are often considered weeds, but both are also used in floral design, **Figure 32-6**.
- Employment opportunities. Annually, weed control costs billions of dollars for the United States. Weed management offers job opportunities with chemical companies and as chemical applicators and crop consultants.

A *Madlen/Shutterstock.com*

B *iofoto/Shutterstock.com*

Figure 32-6. A—Goldenrod may be considered a weed by some, but others enjoy it as a cut flower. B—Queen Anne's lace may also be used in floral designs.

A *www.ansci.cornell.edu/plants/medicinal/portula.html*

B *Severyn Bogdana/Shutterstock.com*

Figure 32-7. A—Purslane is a summer annual that germinates as soil temperatures warm in the late spring and early summer. B—Chickweed is a common winter annual weed that prefers cooler temperatures.

Weed Biology

The life cycle of a weed influences how it may be a problem and which methods may be effective for management. Weeds can be classified by their biology as an annual—either winter or summer, biennial, or perennial.

Annuals

An annual plant will complete its life cycle from seed germination, flowering and fruit set, and seed maturity in one growing season. Annual weeds tend to grow quickly and produce large numbers of seeds. They can be easier to control than perennial weeds. Summer annual weeds will germinate in the spring with warmer soil temperatures and grow throughout the spring and summer, **Figure 32-7A**. They will flower and set seeds in mid to late summer and die in the fall. Winter annual weeds will germinate in the fall or early winter and grow during the spring. They flower and mature seeds in the late spring or early summer before dying, **Figure 32-7B**.

Biennials

A biennial is a plant that completes its life cycle over two growing seasons. Seeds germinate and grow vegetatively throughout the season. Plants overwinter in a rosette stage. They then complete life the following year, which is an important consideration for control. Biennials can be managed prior to flowering.

"What would the world be, once bereft,
Of wet and wildness?
Let them be left.
O let them be left;
wildness and wet;
Long live the
weeds and the
wilderness yet."
—Gerald Manley Hopkins

Perennials

Perennial weeds can persist and grow for many years. They are divided into two groups: simple and creeping. Simple weeds normally spread by seeds. If a shoot is injured, simple perennial weeds may grow a new plant through vegetative means. Creeping perennials generally reproduce by stolons, rhizomes, tubers, aerial bulblets, and bulbs. They also reproduce by seed, **Figure 32-8**.

Corner Question

How many seeds can pigweed produce?

A *Olivier Pichard*

B *komkrit Preechachanwate/Shutterstock.com*

Figure 32-8. A—Curly dock is a simple perennial weed that can generate a new plant from a very small piece of cut root. B—Bermuda grass is a creeping weed that readily propagates by both stolons and rhizomes.

Parasitic Weeds

Parasitic weeds use host plants as sources for nutrients and water, **Figure 32-9**. A parasitic plant directly attaches to another plant through a haustorium, or modified root that forms a link between the parasite and host plant. The parasitic plant draws nutrients and water from the host plant through the haustorium. There are two main types of parasitic plants: stem parasites and root parasites. Parasitic weeds are a challenge to manage. Chemicals and extended fallow periods are the primary means of control.

luckytonyom/Shutterstock.com

Figure 32-9. Dodder is a parasitic weed that absorbs nutrients and water from its host plant.

Weed Identification

Weeds are generally categorized into three large groupings: grassy weeds, sedges, and broadleaf weeds. A ***sedge*** is a type of weed that is characterized by parallel venation and a triangular, solid stem. A ***broadleaf weed*** is a dicot plant with net venation and multiple leaf arrangements and structures. These groupings have implications for control. Effective weed management requires proper identification of weeds. If a weed is wrongly identified, the methods for control may not work and may result in wasted money and time. For example, a chemical control that works on a broadleaf weed does not work on a grassy weed. Many books, cooperative extension agency publications, and websites feature photo galleries of weeds at various stages to aid in correct identification.

STEM Connection Mistletoe

Mistletoe is an evergreen parasite that can damage and even kill its host plant. It grows on a number of ornamental landscape tree species, including alder, ash, birch, box elder, cottonwood, locust, silver maple, walnut, oaks, and zelkova.

Female flowering mistletoe plants produce berries that are small, sticky, and white. They are an attractive food source for a number of birds. The birds feed on berries, digesting the pulp and excreting the seeds, which stick tightly to any branch on which they land. The seed begins to germinate and eventually grows through the bark and into the cambial layers. There the haustoria develop. The haustoria slowly extend up and down within the branch as the mistletoe grows. If the visible portion of the mistletoe is removed, new plants often resprout from the haustoria.

Mistletoe takes both water and mineral nutrients from its host trees. Healthy trees can withstand a few mistletoe infections, but affected branches may weaken or die. Profoundly infested trees may be reduced in vigor, stunted, or even killed, often in combination with other stresses such as drought or disease.

The most effective treatment is mechanical removal of mistletoe before it produces seed and spreads to other limbs or trees. Pruning infested branches can stop the spread in healthy trees. Severely infested trees should be removed and replaced with less susceptible species to protect surrounding trees.

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Martin Fowler/Shutterstock.com

Grassy Weeds

Grassy weeds are monocots. They have long, narrow leaves with veins running parallel to each other and similar leaf shapes among species. (Leaves do have a netlike pattern.) Grasses are wind-pollinated and do not have showy or colorful flowers. The ability to identify grasses depends on recognizing growth habits, certain vegetative features, and seed heads. Grasses have round, oval, or flat stems with hollow internodes.

A s74/Shutterstock.com

B igor.stevanovic/Shutterstock.com

Figure 32-10. A—Tillers are new stems produced by a grass that allows it to spread. B—Johnsongrass is a major weed that spreads through underground rhizomes.

The growth habit of grasses can be divided into three different classes: ***bunch-type weeds***, rhizomatous weeds, and stoloniferous weeds. Grasses with a bunch-type growth habit produce new stems through ***tillering*** (sending out of new stems by a mother plant), **Figure 32-10A**. A tiller is a stem that arises from a bud in the crown. Although all grasses produce tillers, those that spread by tillering are categorized as bunch-type grasses. Plants considered rhizomatous grow through horizontal creeping underground stems called *rhizomes*, **Figure 32-10B**. Stoloniferous grasses are similar to rhizomatous grasses except that lateral growth occurs by horizontal creeping of aboveground stems called *stolons*.

Tamara Kulikova/Shutterstock.com

Figure 32-11. Sedges are perennial grass-like plants that have triangular stems.

Sedges

Sedges are annual or perennial grass-like plants with aerial flower-bearing stems, **Figure 32-11**. In annual forms, the stem is solitary and has mostly basal leaves. Perennial forms have a thick rootstock or an underground rhizome, usually with shortened internodes. Sedges usually have triangular stems with leaves arranged in groups of three. Root systems are fibrous in some plants, including species such as yellow and purple nutsedge, and produce rhizomes and tubers. Sedges can be very competitive with a desired crop for water, nutrients, and space.

mimohe/Shutterstock.com

Figure 32-12. There are many broadleaf weeds, including these lamb's quarters.

Broadleaf Weeds

Broadleaf weeds have noticeably different physical features from grasses. They have distinct leaf shapes, netlike venation, and branching stems, **Figure 32-12**. Leaf structure, arrangement, and other surface characteristics, such as hairs or spines, can be used in identification. Leaves are alternately or oppositely arranged. Some broadleaf weeds grow in a rosette, with leaves in a circular pattern from a central growing point located at or beneath the soil surface. Others grow and spread by means of creeping above stolons or below rhizomes. Broadleaf weeds can produce a fibrous root system or a root system dominated by a large, fleshy taproot. Broadleaf weeds often bear colorful flowers of different sizes and shapes. At certain times of the year, flowers can be very useful identification aids.

Weed Management

Managing weeds involves a combination of methods that prevent an initial introduction of weeds and additional techniques that control weed populations. These control methods for weeds used in integrated pest management (IPM) include mechanical, cultural, biological, and chemical controls.

Prevention

Weeds are constantly moving by means of a plant's own dispersal mechanisms and with the aid of animals or birds. Human practices, such as moving contaminated seed or machinery, also contribute to weed dispersal. By implementing effective preventative measures, weeds may be stopped before they become a problem. Some methods for prevention include:

- Purchasing seed free of weed seeds.
- Cleaning equipment before moving it among fields and farms.
- Preventing weed seed production by removing flowers.
- Buying clean hay for animals. (Many animal feeds are contaminated with weed seeds.)
- Preventing vegetative spread of perennial weeds.
- Scouting for new weeds.
- Treating small plots to prevent weeds from spreading.
- Identifying weeds properly, **Figure 32-13**.

Nadezhda Kulikova/Shutterstock.com

Figure 32-13. Properly identifying a weed is the first step in determining control methods.

Mechanical Control

Mechanical control of weeds requires a knowledge of weed identification and is often most effective at a particular stage of weed growth. It can be costly with labor, time, equipment, and fuel inputs, but it is an essential component of IPM. Mechanical methods for control include:

- Tillage.
- No-till.
- Mowing.
- Hand pulling.
- Weeding tools.
- Flaming.
- Solarization.
- Mulching.

"A weed is a plant that has mastered every survival skill except for learning how to grow in rows."
—Doug Larson

Tillage

Tillage involves cultivating the soil with a tractor or tiller to bury weeds, separate roots from shoots, dry out vegetation, and exhaust storage reserves. It is especially effective for perennial weeds. Tillage may also bring up dormant seeds.

No-Till

No-till involves the planting of new plants in the crop residue from the previous season's growth. This form of conservation tillage is primarily practiced to limit soil erosion. In fields with low weed populations, research has shown that this can further reduce weed populations over time.

alexkich/Shutterstock.com

Figure 32-14. Mowing can remove the flowers before weed seeds have the opportunity to mature.

Alexander Lukatskiy/Shutterstock.com

Figure 32-15. Hand weeding or hoeing remain viable strategies in weed management, especially in organic production and home gardening.

Linda Hughes/Shutterstock.com

Figure 32-16. Mulch will prevent weeds from growing and provide a pleasing appearance in landscape beds.

Mowing

Mowing removes shoot growth and prevents seed production. In some cases, mowing can deplete perennial storage reserves over time, **Figure 32-14**.

Hand Pulling

Hand pulling and weeding tools are particularly efficient in gardens and landscape beds. Weeding tools, such as hoes, weed whackers, and cultivators are especially useful in organic production, **Figure 32-15**.

Flaming

Flaming uses high temperatures from a flame weeder to disrupt cellular membranes and causes dehydration, which results in plant death.

Solarization

Solarization uses the radiant heat from the sun to kill weed populations. Plastic sheets are placed on the beds, trapping solar radiation to raise temperatures.

Mulching

Mulching excludes light, preventing shoot growth by weeds. A number of different mulches are used, depending on the situation. Examples include plastic, paper, shredded bark, decomposed leaves, and aged manure, **Figure 32-16**.

Cultural Control

Understanding how a crop is grown, the soil, weed history, and environmental factors can influence how to manage weeds. Some methods of cultural control for weeds include:

- Crop competition. Many crops can outgrow their weed competitors. Cropping patterns, such as high-density planting, intercropping, soil amendments, and no-till, give crops a boost over weeds.
- Planting date. Early crop planting or delayed crop planting may provide a competitive advantage for the crop over weeds.
- Cover crops. Cover crop plantings can be killed or used as a living mulch. A new crop can be planted into the cover crop, **Figure 32-17**.
- Crop rotation. Certain weeds associate with certain crops more than others, and rotating fields can reduce weed populations.

yuratosno3/Shutterstock.com

Figure 32-17. Cover crops, such as a winter rye, may suppress weed growth.

Corner Question

What is the oldest weeding tool?

Biological Control

Biological control involves using living organisms to reduce the population of weeds. For example, a natural enemy of the weed may be introduced into the weed's environment. Biocontrol agents may be insects, fungi, bacteria, or even animals. For example, kudzu has successfully been controlled in certain areas by the use of grazing animals, such as goats and sheep. Much of the research on biocontrol with insects has shown success in control of invasive weed species rather than in agricultural applications.

Chemical Control

Herbicides are chemicals used to kill plants. They play a significant role in managing weeds in agricultural settings. Herbicides have a number of advantages and disadvantages just as any other weed control strategy. Herbicides require much less time and labor to broadcast or spray across a crop than removing weeds by hand. They can be selectively used to target certain weeds. For example, a broadleaf weed in turfgrass can be controlled without harming the turf. They can provide comprehensive and effective weed control.

Herbicides can also be costly to purchase and use, requiring specialized equipment to properly apply. Herbicides can cause toxicity in humans if the proper protective gear is not used or worn to protect the applicator, **Figure 32-18**. Historically, some herbicides were persistent in nature, which means they stay in the environment a long time. This is true less often with newer formulations. Weeds can develop resistance to herbicides, especially if chemical control is the primary method of weed management.

overcrew/Shutterstock.com

Figure 32-18. Always practice safe use and wear personal protective equipment when using herbicides.

Herbicides are classified as selective or nonselective. ***Selective herbicides*** will kill some weeds, but they will not impact other plants. Herbicides labeled for control of weeds in lawns, for example, will kill broadleaf weeds (dandelions and thistles) but will not kill grasses. Other herbicides are specifically formulated to kill grassy weeds and would not be appropriate to use in a lawn area. A ***nonselective herbicide*** is a chemical that kills or damages every type of plant. These are often used useful for killing weeds growing in sidewalk cracks and driveways. When a weed and an ornamental plant are growing side by side, nonselective herbicides should be applied very carefully to avoid damaging the ornamental plant.

Herbicides can also be divided into pre-emergent herbicides or post-emergent herbicides. A ***pre-emergent herbicide*** is a chemical applied (usually to the soil) prior to germination to kill any weeds that start to grow. It is used mostly for controlling annual weeds. A ***post-emergent herbicide*** is a chemical applied to actively growing weeds to kill the plants. They can be contact herbicides or systemic herbicides. ***Contact herbicides*** kill only the parts of the plant on which they are sprayed. ***Systemic herbicides***, however, translocate from the point of contact throughout the plant to kill it. They are most effective in controlling perennial weeds where new growth can emerge from underground shoots. For optimal weed control, herbicides should be applied at the time of year when weeds are most susceptible.

Whenever chemicals are used, the herbicide label should be strictly followed. These labels show legal requirements for use and contain detailed information on how to use the product correctly. Labels share information on potential hazards associated with the herbicide and instructions you should follow in the event of a poisoning or spill. Following label instructions will allow you to minimize the risks and maximize the benefits. These instructions relate to protective gear and equipment, application rate, proper timing, storage, and disposal.

Careers in Weed Management

As mentioned previously, due to the constant need to control weeds, various job opportunities are available in weed management. These careers include chemical applicators and crop consultants.

AgEd Connection

Weed Identification

As part of a career development event, students must identify major local weeds in horticultural systems. Weeds may be presented as intact specimens, with a photograph, or as preserved specimens. The list of weeds includes annual bluegrass, broadleaf plantain, buckhorn plantain, chickweed, crabgrass, dandelion, henbit, nutsedge, oxalis, purslane, and white clover. Use the e-flashcards on your textbook's student companion website at www.g-wlearning.com/agriculture to help you study and identify these weeds.

Chemical Applicators

Chemical applicators work with herbicides that help control or kill weeds. Chemical applicators are responsible for identifying where chemical treatment is needed, and then they complete this task. They mix the chemicals needed before performing the application. Chemical applicators need to have knowledge of these chemicals as well as an understanding of the safe handling of these materials. To become a chemical applicator, you must have an associate degree, followed by training resulting in certification.

Crop Consultants

Crop consultants must have a great breadth of knowledge to advise growers about efficient crop growth. They must understand the different types of growing media and recognize various plant diseases to be able to advise appropriately. Efficient crop growth includes prevention and control of weeds. Consultants must be able to collect data, write reports, and present on their findings. They also need to be able to problem-solve and instruct the growers on what changes to make to their techniques. Crop consultants are typically certified and require a bachelor degree as well as continuing education.

Career Connection Dr. Carol Somody

Senior Stewardship Manager, Syngenta LLC

Dr. Carol Somody

Carol Somody grew up in a crowded city and never saw a farm until she was a teenager. When she was young, her grandfather planted the seed for her love of growing things. Carol eventually went to the land grant university in her state, Rutgers University, to pursue a career in agriculture. As a young woman studying agronomy in the 1970s, Carol was continually discouraged by some school advisors and urged to pursue something "more appropriate" for her gender and upbringing. A key turning point occurred in her college career when she met a professor who mentored and encouraged her. This professor, who was a weed scientist, encouraged Carol to reach her goal by becoming a weed scientist herself. Building on a foundation of a bachelor's in agronomy, Carol then focused her energies solely on weed science and ultimately obtained a PhD.

Fieldwork, spending long hot hours behind a hoe, gave Carol critical experience and insight into weed biology. Her work also gave her the understanding that weed management requires the consideration of every tool in the IPM toolbox. Since 1982, Carol has worked for Syngenta and its legacy companies that invest in developing pesticides, seeds, and other technologies that support growers in maximizing crop yields in an environmentally sound and economically efficient manner.

Carol focuses on education of all audiences on the safe use of pesticides within the framework of IPM. She is an advocate for the science behind pesticides and their use, tirelessly promoting the need for proper management of pesticides from purchase to disposal, and protection of applicators, farm workers, and the environment.

CHAPTER 32

Review and Assessment

Chapter Summary

- A weed is a plant that is out of place or a plant growing where it is not wanted. In horticultural production and in gardening, weeds compete with desired plants and crops for water, nutrients, and light, resulting in diminished plant quality and yield.
- Weeds have a number of characteristics that permit them to grow in many different environmental conditions. Some of these characteristics include rapid growth, prolific seed production, reproduction vegetatively, long seed dormancy, staggered germination, and adaptations for spreading.
- Weeds provide a number of benefits, such as soil stabilization, habitat and food for wildlife, aesthetic qualities, soil enrichment, genetic diversity, medicinal uses, and food for people. Many job opportunities are associated with weed control.
- Weeds vary in their biology. They can be characterized by having an annual, biennial, or perennial life cycle. Some weeds are parasitic.
- Weeds are categorized as grassy weeds, sedges, or broadleaf weeds. They can be controlled based on their grouping.
- Weed management starts with prevention, which includes using seeds and hay that are free of weed seeds, scouting, and treating small populations of weeds. Cleaning equipment before moving it among fields and farms also helps in prevention.
- Mechanical weed control might include tillage, no-till, mowing, hand pulling, flaming, solarization, and mulching.
- Cultural control of weeds involves using crop competition, planting dates that are early or delayed, cover crops, and crop rotation.
- Biological control involves using living organisms to reduce the population of weeds. Biocontrol agents may be insects, fungi, bacteria, or even animals.
- Chemical control involves using herbicides to prevent or kill weeds. Herbicides can be selective or nonselective. Whenever chemicals are used, the herbicide label should be strictly followed to avoid hazards to people, animals, and the environment.

Words to Know

Match the key terms from the chapter to the correct definition.

A. broadleaf weed
B. bunch-type weed
C. contact herbicide
D. nonselective herbicide
E. no-till
F. post-emergent herbicide
G. pre-emergent herbicide
H. rosette
I. sedge
J. selective herbicide
K. self-compatible weed
L. solarization
M. systemic herbicide
N. tillering

1. A chemical that is applied (usually to the soil) prior to weed germination to kill any weeds that start to grow.
2. The process of new stems or tillers being created by a mother plant.
3. A type of weed that is characterized by parallel venation and a triangular, solid stem.
4. A type of grassy weed that produces new stems through tillering.
5. A chemical that is applied to actively growing weeds to kill the plants.
6. A weed that does not need to cross-pollinate in order to set seed; a self-pollinating weed.
7. A chemical that will kill all kinds of plant.
8. A dicot weed with net venation and multiple leaf arrangements and structures.
9. A growth habit of many biennials in their first year in which leaves attach in a circle around the base of a stem.
10. A weed control technique that uses the radiant heat from the sun to kill weed populations.
11. A chemical that is sprayed on the weed foliage and kills only the plant tissue it touches.
12. The practice of planting new plants in the crop residue from the previous season's growth.
13. A chemical that can kill some types of plants but not others.
14. A chemical that can translocate or move within the plant from the point of entry to kill the plant.

Know and Understand

Answer the following questions using the information provided in this chapter.

1. What is a weed, and how do weeds affect desirable plants and crops?
2. What nine impacts do weeds have on agriculture?
3. What eight key characteristics do weeds have that permit them to survive in many environments?
4. How can just a few self-compatible weeds be detrimental to a garden?
5. What are some stresses that weeds can tolerate due to their adaptive mechanisms?
6. How does allelopathy benefit weeds?
7. What are four benefits that weeds can bring?

8. What are three ways weeds are classified by their biology?
9. Describe the life cycle of annual weeds.
10. Describe the life cycle for biennial weeds.
11. How does a parasitic weed feed on other plants?
12. Weeds are generally categorized into what three large groupings?
13. List the three categories of grassy weeds and describe the growth habit of each type.
14. What are the characteristics of a broadleaf weed?
15. What types of control methods for weeds are used in integrated pest management?
16. What are eight methods of weed prevention?
17. Describe the tillage mechanical weed control method.
18. Describe four methods of cultural control for weeds.
19. Describe biological control methods for weeds.
20. Describe safe procedures for using herbicides.
21. What are some of the weeds you might be asked to identify in the FFA CDE for Nursery and Landscape?

Thinking Critically

1. You find a population of weeds growing in your garden and take appropriate measures to eliminate the weeds. A few weeks later, the weeds return, and you have to start over. What do you think happened? What could you do differently?
2. Why is it important for growers to understand the biology of the weeds they are trying to control?

STEM and Academic Activities

1. **Science.** Investigate the science behind allelopathy. Write a three-page report explaining the reasons plants exude certain chemicals and how different species may use different chemicals.
2. **Science.** Investigate current research programs in biological control of weeds. Choose a research program that interests you. Prepare a report on the scientific methods used in this program and how the results affect the horticultural industry.
3. **Technology.** Visit a local commercial nursery and ask about the technology used to provide weed control. If there are no commercial nurseries in your area, research this topic on the Internet. Write a short report of your findings.
4. **Engineering.** Mechanical control of weeds may require the use of a weeding tool. Research examples of different weed tools, such as a hoe, rake, or other implement. Design a new weeding tool that would require less physical strength and be as equally as effective.
5. **Language Arts.** Imagine that you are the marketing director for a large company that sells herbicides. One of your job responsibilities is to write articles for the grower's information center. Write an article about how to choose the best herbicide. Focus on the characteristics of at least three different types of herbicides.

Communicating about Horticulture

1. **Listening and Speaking.** In small groups, discuss with your classmates—in basic, everyday language—your knowledge and awareness of the weeds in your everyday surroundings. Take notes on the observations expressed. Review the points discussed, factoring in your new knowledge of weeds. Develop a summary of what you have learned about weed biology and their presence in our everyday surroundings. Present your findings to the class, using the terms that you have learned in this chapter.
2. **Listening and Speaking.** Visit a local company that works in weed science. Ask to interview their experts on weeds. Prepare a list of questions before your interview. Here are some questions you might ask: What is your work environment like? What are your job duties? What type of research are you currently doing? What type of facilities do you use for your research? What impact will your research have on the weed industry? Ask if you can have a tour of their facilities. Report your findings to the class, giving reasons why you would or would not want to pursue a career similar to that of the person you interviewed.

SAE Opportunities

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1. **Exploratory.** Job shadow a scientist who studies weeds. What are the daily responsibilities of his or her job? What do you like or not like about this position? What education and experiences are required to have this position?
2. **Exploratory.** Inventory the number of different weed species on your school campus and their populations. What could you do to decrease the numbers of weeds?
3. **Exploratory.** Research what herbicides could be used in your school landscape. Are they easily available? How effective are they? What are the benefits and costs of using these methods to control weeds?
4. **Exploratory.** Visit a local produce farm. Ask the farmer to share his or her weed management practices. Go into the fields and see what weeds you can identify. Think through possibilities for control. Write a short report and share it with your teacher.
5. **Exploratory.** Create a weed collection for your teacher. Collect, press, and create herbarium specimens for as many weed species as you can find. How will this be a useful tool in learning about horticulture?