THINK of a place around you that is free of weeds. Such a place may be difficult to find. With little effort, you can spot weeds in your home lawn, agriculture fields, school grounds, and just about everywhere else. In the United States, huge amounts of money and countless hours go toward eliminating weeds.

Objective:

☐ Describe weed management.

Key Terms:

allelopathy  hypocotyl  preplant surface applied herbicide
annual weed  integrated weed management  rhizomes
artificial weed dispersal  ligule  selective herbicide
auricles  natural weed dispersal  sheath
biennial weed  nodes  soil sterilantslade  nonselective herbicide  stolons
broadleaf weeds  noxious weed  summer annual
collar  perennial weed  translocated (systemic) herbicides
cotyledons  postemergent herbicide  weed
early preplant herbicide  preemergent herbicide  winter annual
glass-like weeds  preplant and incorporated herbicide  woody perennials
glass weeds  preplant herbicide
herbaceous perennials
The Process of Controlling Weeds

A weed is a plant growing where it is not wanted or an out-of-place plant. Even desirable plants are weeds if they are in the wrong place, such as a corn plant in a soybean field.

Excessive weed populations reduce crop quality and yields because weeds compete with crops or pasture for water, nutrients, light, and space. Weeds can be poisonous, may have thorns, and often interfere with harvests. Weeds can host insects and diseases that can spread and cause harm to crops. Much effort is required to control weeds, which results in increased production costs. For these reasons, weed control is important.

WEED CLASSIFICATION

Weeds can be divided into three categories based on their life spans and their periods of vegetative and reproductive growth. In addition, weeds are classified as grass, grass-like, or broadleaf.

Annual Weeds

An annual weed is a plant that completes its life cycle within one growing season. Annuals only reproduce by sexual means, and annual weeds are further classified by the time of year in which they germinate. Winter annual seeds germinate in the fall, and the plants actively grow until late spring when they produce seeds. The winter annuals die during periods of heat and drought stress. In contrast, summer annual seeds germinate in the late spring, and the plants actively grow during the summer months. They produce seed by late summer and die during periods of low temperatures and frost.

Biennial Weeds

A biennial weed is a plant that will live for two growing sea-
sons. During the first summer, the plant develops a root system and a compact, low-growing cluster of leaves called a rosette. Biennials flower and produce seed during the second summer and die before winter.

**Perennial Weeds**

A *perennial weed* lives for more than two growing seasons and may reproduce by seed and/or vegetative growth. Perennials are classified as herbaceous or woody, dependent upon the stems and if they over-winter.

*Herbaceous perennials* die back to the ground each fall, but their root systems over-winter and the plants re-sprout the following spring from buds on the root systems. *Woody perennials* have persistent above-ground stems that remain from season to season, although the leaves may die in autumn.

**Noxious Weeds**

Some weeds are considered noxious. A *noxious weed* is injurious to crops, people, and livestock. Typically, noxious weeds grow and multiply quickly. Most noxious weeds are difficult to control and require extended periods of treatment followed by close monitoring.

Some noxious weeds are marihuana (*Cannabis sativa L.*), Canada thistle (*Cirsium arvense*), perennial sowthistle (*Sonchus arvensis*), musk thistle (*Carduus nutans*), and kudzu (*Pueraria labata*). Giant ragweed (*Ambrosia trifida L.*) and common ragweed (*Ambrosia artemisiifolia L.*) are problems within the corporate limits of cities, villages, and incorporated towns. Perennial members of the sorghum genus are considered noxious, including Johnsongrass (*Sorghum halepense*), sorghum almum, and other Johnsongrass X sorghum crosses with rhizomes.

**Grass, Grass-like, and Broadleaf Distinctions**

Weeds are separated into the categories of grass, grass-like, and broadleaf plants. Knowing the differences between these categories is important because most herbicides control one type of weed more effectively than another.
Grass weeds have long, narrow leaves with parallel veins. The stems are round or flattened and hollow except at the nodes (joints) where they are solid. Grass-like weeds resemble grasses, but they are not susceptible to the same herbicides as grasses. Yellow nutsedge is an example of a grass-like weed.

The leaves of broadleaf weeds are generally wider than those of grass or grass-like weeds. Leaf shapes vary considerably among species, but the veins of most broadleaf weeds are netlike.

WEED IDENTIFICATION

The ability to identify weeds shortly after emergence is an important part of an integrated weed control program. Seedling identification is needed to control weeds before they cause crop yield losses. Weed seedlings are very small, so identification requires close examination of the plants. The aid of a hand lens is often needed. Most crop scouts look for key vegetative features of the major weeds shortly after their emergence.

Identification of Grass Weeds

The major vegetative parts of the grasses used in identification include the blade, sheath, ligule, auricles, collar, stolons, and rhizomes. The leaf is composed of the blade and the sheath. The blade is the broadest part of a leaf. The sheath encloses the stem and is connected to the blade at the junction formed by the collar, which is located on the outer side of the leaf. The ligule points upward on the inner side of the leaf and resembles a continuation of the sheath where it joins the blade. Auricles, which are present in only a few species, are finger-like projections of the collar that extend around the shoot. Stolons are modified above-ground stems that grow horizontally over the ground. Stolons develop roots at swelled stem joints called nodes. Nodes also give rise to new plants. Rhizomes are modified underground stems that produce new plants from the nodes. The arrangement of the leaf or leaves in the budshoot can also be used to identify grasses. The leaf or leaves are classified as rolled or folded in the budshoot.

Identification of Broadleaf Weeds

The major vegetative parts of broadleaf weed seedlings are cotyledons, true leaves, hypocotyl, and roots. Cotyledons are the seedling leaves of the broadleaf plant. Dicotyledonous weeds have two cotyledons. They appear opposite each other on the stem. If a plant is a perennial and emerges from vegetative parts, the shoot will lack cotyledons because these are found only in seedlings. The true leaves consist of all leaves produced after the cotyledon leaves. Leaf arrangement and the shape of the cotyledons and true leaves are generally the first characteristics used to identify weed species. The hypocotyl is the portion of the stem between the cotyledons and the seedling roots.
WEED DISPERSAL

Most weeds grow in isolated locations. Dispersal spreads them over wide areas and into places where they have not been a problem previously. Dispersal occurs naturally and artificially.

Natural Dispersal

Natural weed dispersal is the movement of weeds by wind, water, and wildlife. Weed seeds often have stickers or feathery features that make natural dispersal easy. Lighter seeds may be blown by the wind, and heavier seeds may travel by water runoff or by animal fur. Seeds eaten by birds, rodents, and other animals may pass through the digestive tract undigested and viable. These seeds may be dropped on the land in feces and germinate when conditions are right.

Artificial Dispersal

Artificial weed dispersal is accomplished by people and the activities they carry out in producing and harvesting crops. Both seed and vegetative parts of weeds may be dispersed. Machinery can transport weeds as they move from one field to another. Using crop seeds that are impure is one way of weed seed dispersal. Unclean crop seed may contain weed seed and may be planted along with the crop seed. Mulch materials also may contain weed seed.

WEED MANAGEMENT

Integrated weed management provides a systematic program for determining the best management practices for weed control. It involves mechanical, cultural, biological, and chemical means to control weeds. The best method or implement for weed control depends on the type and size of weeds present, the soil moisture level, the amount of residue on the soil surface, and the erodibility of the soil.

Mechanical Control

Mechanical weed control involves the physical destruction or removal of weeds. Mechanical weed control is accomplished mostly through tillage, but it can involve mowing, burning, or some other method.

Tillage is designed to bury weeds/weed seeds or to cut weed roots. Burial is more effective with annual weeds than it is with biennial or perennial plants. The best tillage method varies
from field to field and from year to year. However, thorough knowledge of the soil and weeds is necessary to maximize weed control.

Mowing can be very effective on tall annual weeds, and repeated mowing of perennial weeds can be effective in depleting the food reserves of the underground stems or roots. Mowing is mainly used in non-crop areas and typically is not practical with most field crops.

Burning can kill small weeds, but it may have little effect on older weeds or perennial weeds. The complete burning of cropland is not recommended because the removal of plant residues can increase soil erosion. Burning also pollutes the air. Yet the burning of rangeland, which is mostly comprised of warm-season plants in the early spring, can help to control undesirable cool-season plants and woody perennials.

**Cultural Control**

Cultural weed control involves the use of crop management practices that give the crop a competitive edge over the weeds or that disrupt the weed’s life cycle.

Crop rotation can be an effective weed control method. Weeds tend to infest crops that closely match their life cycle. As a result, growing different crops in the same field in different years changes the timing of tillage operations, seeding, and harvest dates; the type of herbicide used; and other practices. The changes disrupt the life cycle of most weeds.

Seeding the crop at the optimum date and rate of population will increase its chances of gaining a competitive advantage over weeds that will grow in the field. A good practice is to sow crop seed when the soil temperature reaches the minimum for germination, which increases the crop’s chance of becoming established before the weeds.

Follow the proper seeding rate. The resulting crop plant population will fill most of the ecological niches in the field and leave little room for weeds, without providing too much competition of the crop plants with each other.

Matching the row spacing to the growth habit of the crop is valuable in controlling weeds. It maximizes shading of the soil surface and prevents weeds from becoming established. Proper row spacing is determined by the leaf area produced by the plant and by the extent of leaf spread between the rows.

**Biological Control**

Biological weed control uses insects, diseases, predators, or other plants that are harmful to the weeds but that do not damage the crops. The primary purpose of biological control is to
put the weed at a competitive disadvantage while putting crop plants at a competitive advantage.

Allelopathy is an interaction that has a negative effect on one organism while affecting the other organism very little. It involves the release of a metabolic byproduct of one plant that inhibits the growth and development of another plant.

An insect or disease can be introduced that attacks certain weed species. It must be host-specific to the weed and should not easily adapt to other plants when the weed population has been reduced. One concept to consider is the ease by which the insect or disease can become established in the area. Sometimes the weed is better adapted to the region than the predator, and repeated attempts at introducing the biological control are necessary before success (if any) is achieved. The pest must not completely eliminate the weed; instead, it must simply control the weed below economic thresholds. If the insect or disease completely eliminated the host plants, it would eliminate itself.

**Chemical Control**

Chemical weed control involves the use of chemicals (herbicides). Chemical weed control is a very common method of weed control in industrialized agriculture. Herbicides are primarily used to eliminate or replace tillage operations for weed control, which partly compensates the cost. Proper herbicide use can provide better weed control than tillage, but effective chemical weed management depends on selecting the best herbicide.

**HERBICIDE CLASSIFICATION**

Herbicides are chemicals specifically designed to kill weeds; they interrupt normal plant growth and cause injury and death. Herbicides provide a more effective means of controlling weeds than hoeing or cultivation and can be classified by their selectivity, site of action, timing of use, and mode of action.

**Classification by Selectivity**

A **selective herbicide** is one that will kill only certain types of plants. Most herbicides used on cropland are selective because they control weeds while doing little, if any, damage to
the crop. A selective herbicide is not toxic to some plants because it can be metabolized into a non-toxic substance.

A **nonselective herbicide** is one that will kill any plant it contacts. These herbicides can be used with growing crops, but extreme caution must be used to prevent crop damage. Nonselective herbicides are used in non-crop areas, such as around buildings where total control of vegetation is desired, and may have little or no residual activity after application.

**Soil sterilants** are herbicides that prevent any vegetation from growing for a period of months or years. Soil sterilants are never used on cropland. Instead, they are used in non-crop areas where complete control of vegetation is desired.

### Classification by Site of Action

**Translocated (systemic) herbicides** are taken into the plant through the roots or leaves and moved to a sensitive area (e.g., a growing point or storage organ). Translocated herbicides are important in controlling perennial weeds with underground storage organs, and the timing of application is extremely important.

**Contact herbicides** (nontranslocated herbicides) are not moved within the plant; these herbicides simply kill the plant tissue with which they come in contact. Most contact herbicides are nonselective.

### Classification by Timing

**Preplant herbicide** is applied before the crop is seeded and is usually applied as part of seedbed preparation.

**Early preplant herbicide** is applied 10 to 30 days before seeding and may or may not be incorporated into the soil.

**Preplant surface applied herbicide** is applied up to 10 days before seeding and is not incorporated into the soil.

**Preplant and incorporated herbicide** is applied up to 10 days prior to seeding and is immediately incorporated because it will evaporate or be broken down by sunlight.

**Preemergent herbicide** is applied before the weeds and/or crop emerges but after the crop has been seeded.

**Postemergent herbicide** is applied after the crop and weeds have emerged from the soil.
Classification by Mode of Action

Herbicides can be classified by their mode of action. The method by which an herbicide kills depends on how the plant translocates and metabolizes the chemical. Some herbicides inhibit lipid or amino acid synthesis, chlorophyll formation, or photosynthetic reactions. Other herbicides act as growth regulators and interfere with normal metabolism or disrupt cell membranes.

Summary:

A weed is a plant growing where it is not wanted or an out-of-place plant. Weeds compete with crops or pasture for water, nutrients, light, and space. They reduce crop quality and yields and increase production costs. Weeds can be poisonous, may have thorns, often interfere with harvests, and host insects and diseases that are harmful to crops.

Weeds are classified as summer annuals, winter annuals, biennials, perennials, noxious, and as grass, grass-like, or broadleaf.

The ability to identify weeds is an important part of an integrated weed control program. Seedling identification is needed to control weeds before they cause crop yield losses.

Weed dispersal occurs naturally and artificially.

Integrated weed management provides a systematic program for determining the best management practices for weed control: mechanical, cultural, biological, and chemical means.

Herbicides are chemicals specifically designed to kill weeds and are classified by their selectivity, site of action, timing of use, and mode of action.

Checking Your Knowledge:

1. What is a weed?
2. How are weeds classified?
3. What features are used in identifying weeds?
4. What methods are used to control weeds?
5. How are herbicides classified?
Expanding Your Knowledge:

Collect, press, and preserve weed specimens for identification purposes. Select specimens that are representative of the species. Include flowers and the root system (if possible) when collecting. Press the samples between layers of newspaper, and change the paper every day or two to reduce the chance of mold developing. Mount the specimens on high-quality paper, and label the specimens for future reference.

Web Links:

**Herbicide Families**  
http://www.extension.umn.edu/distribution/cropsystems/components/6967_01f.html

**Weed Identification**  
http://weedid.aces.uiuc.edu/

**Weed Management Guide**  
http://edis.ifas.ufl.edu/TOPIC_GUIDE_Weed_Management_Guide

**Weed Resources**  
http://www.ipm.uiuc.edu/weeds.html