

Unit G: Pest Management

Lesson 3: Managing Weeds

Student Learning Objectives: Instruction in this lesson should result in students achieving the following objectives:

1. Describe types of weeds based on life cycle and growth.
2. Identify ways weeds are spread.
3. Explain the identification of weeds.
4. Describe methods of weed management.
5. Describe the selection of herbicides.
6. Identify herbicide mode of action families.

Recommended Teaching Time: 2 hours

Recommended Resources: The following resources may be useful in teaching this lesson:

- A PowerPoint has also been developed for use with this lesson plan

List of Equipment, Tools, Supplies, and Facilities:

Writing surface
PowerPoint Projector
PowerPoint Slides
Transparency Masters
Copies of Lab Sheets for students

Terms: The following terms are presented in this lesson (shown in bold italics and on PowerPoint Slides 2 and 3):

- Allelopathy
- Artificial weed dispersal
- Auricles
- Collar
- Contact herbicides
- Cotyledons
- Early preplant herbicide
- Herbaceous perennials
- Hypocotyl
- Integrated weed management
- Internode
- Ligule
- Natural weed dispersal
- Nodes
- Nonselective herbicide
- Postemergent herbicide
- Preemergent herbicide
- Preplant and incorporated
- Preplant herbicide
- Preplant surface applied herbicide
- Rhizomes
- Selective herbicide
- Sheath
- Soil sterilants
- Stolons

- Translocated (systemic) herbicides
- Woody perennials

Interest Approach: Use an interest approach that will prepare the students for the lesson. Teachers often develop approaches for their unique class and student situations. A possible approach is included here.

Take students outside and ask them to note any plants they see that appear out of place. Ask them if they can identify them. Lead a class discussion that leads into the objectives for the lesson.

Summary of Content and Teaching Strategies

Objective 1: Describe types of weeds based on life cycle and growth.

(PowerPoint Slide 4)

I. A weed is a plant growing where it is not wanted or a plant out-of-place. Weeds can be divided into three categories based on their life spans and their periods of vegetative and reproductive growth.

A. An annual weed is a plant that completes its life cycle within one growing season. Annuals reproduce from seeds only. Two types of annual weeds occur, depending upon the time of year in which they germinate.

1. Winter annuals germinate in the fall and will actively grow until late spring when they produce seed, and they will die during periods of heat and drought stress.
2. Summer annuals germinate in the late spring and actively grow during the summer months. They produce seed by late summer and die during periods of low temperatures and frost.

B. A biennial weed is a plant that will live for two growing seasons.

1. During the first summer the plant develops a root system and a compact, low-growing cluster of leaves called a rosette.
2. Biennials flower and produce seed during the second summer and die before winter.

(PowerPoint Slide 5)

C. A perennial weed can live for more than two growing seasons and may reproduce by seed and/or vegetative growth. Perennials are classified as either herbaceous or woody, depending whether the stems over winter.

(PowerPoint Slide 6)

1. **Herbaceous perennials** die back to the ground each fall, but their root systems overwinter and the plants resprout the following spring from buds on the root systems.
2. **Woody perennials** have persistent aboveground stems that remain from season to season, although their leaves may die in autumn.

3. A noxious weed is a plant that causes great harm to other organisms by weakening those around it. Most noxious weeds are very difficult to control and require extended periods of treatment followed by close monitoring.

****Use TM: G3-1 as visual material for lecture and discussion. PowerPoint Slide 7 can also be used to illustrate the life cycle of a weed. Have students identify the different type of weeds grown in your area. Then have them classify them using the PowerPoint Slide 7.**

Objective 2: Identify ways weeds are spread.

(PowerPoint Slide 8)

II. Most weeds grow in isolated locations.

A. Dispersal spreads them over wide areas and into places where they have not been a problem before. Dispersal occurs in two major ways: natural and artificial.

1. **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. Heavier seeds may be washed by water runoff or carried in the hair of animals. Seed eaten by birds, rodents, and other animals may pass through the digestive tract undigested and viable. They may be dropped on the land in feces and germinate when conditions are right.
2. **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 a way of weed seed dispersal. Unclean crop seed may contain weed seed and may be planted along with the crop seed. Mulch materials may contain weed seed.

Objective 3: Explain the identification of weeds.

(PowerPoint Slide 9)

III. The ability to identify weeds shortly after emergence is an important part of an integrated weed control program.

A. Seedling identification is needed for the most effective use of postemergence herbicides to control weeds before they cause crop yield losses.

1. Weed seedlings are very small, so identification requires close examination of the plants, often with the aid of a hand lens.
2. Most crop scouts are not expert taxonomists, but by knowing the key vegetative features of the major weeds found in field crops, the

scout can learn to identify most of the problem weeds shortly after their emergence.

B. Weeds are separated into the categories of grass, grasslike, and broadleaf plants. Knowing the differences between these categories is important because most herbicides control one type of weed more effectively than another.

1. Grass plants have long narrow leaves with parallel veins. The stems are round or flattened and hollow except at the nodes (joints), where they are solid. Grasslike plants resemble grasses, but they are not susceptible to all of the same herbicides as grasses.
2. The leaves of broadleaf plants are not generally as long and narrow as those of grass or grasslike plants, although the shapes vary considerably among species. The veins of most broadleaf plants are netlike.

(PowerPoint Slide 10)

C. Vegetative identification of grass weeds. The major vegetative parts of the grasses used in identification include the blade, sheath, ligule, auricles, collar, stolons, bud-shoot, and rhizomes. The leaf is composed of the sheath and the blade.

1. The **sheath** encloses the stem and is connected to the blade at the junction formed by the collar. The **collar** is located on the outer side of the leaf and the ligule points upward on the inner side of the leaf. The **ligule** resembles a continuation of the sheath where it joins the blade.
2. **Auricles**, which are present in only a few species, are fingerlike projections of the collar that extend around the shoot.
3. **Stolons** are modified above-ground stems that grow horizontally over the ground. Stolons develop roots at the nodes, giving rise to new plants. **(PowerPoint Slide 11)**

Joints of the stems are called **nodes**. The part between two adjacent nodes is called an **internode**. **Rhizomes** are modified underground stems that produce new plants from the nodes.

4. 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.

(PowerPoint Slide 12)

D. Vegetative identification of broadleaf weeds. The major vegetative parts of the seedling broadleaves include the cotyledons, true leaves, hypocotyl, and roots.

1. **Cotyledons** are the seedling leaves of the broadleaf plant, which are two in number with dicotyledonous weeds. 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.
2. The rhizomes, tubers, bulbs, or budding roots of perennials can help identify the plants.

(PowerPoint Slide 13)

3. The true leaves consist of all leaves produced after the cotyledon leaves.
4. Leaf arrangement and shape of the cotyledons and true leaves are generally the first characteristics used to separate weed species.
5. The *hypocotyl* is the portion of the stem between the cotyledons and the seedling roots.

****Use TM: G3-2 and G3-3 as visual material for lecture and discussion. PowerPoint Slide 14 and 15 can also be used to illustrate the information presented in this objective.**

Objective 4: Describe methods of weed management.

(PowerPoint Slide 16)

IV. There are many ways or methods to control weeds.

A. ***Integrated weed management*** provides a systematic program for determining the best management practices for weed control.

1. Mechanical weed control involves the physical destruction or removal of weeds. Mechanical weed control is mostly tillage but can also involve mowing, burning, or some other method.
2. Tillage is designed to bury weeds or weed seeds, or to cut the roots of weeds. Burial is more effective with annual weeds than it is with biennial or perennial plants.

(PowerPoint Slide 17)

B. 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.

1. The best tillage method varies from field to field, and from year to year. Thorough knowledge of the soil and weeds is necessary to maximize weed control.
2. Mowing can be very effective on tall annual weeds. 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 is not practical with most field crops.
3. Burning can kill small weeds, but may have little effect on older weeds or perennial weeds. Complete burning of cropland is not recommended because the removal of plant residues can increase soil erosion.
4. 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.

(PowerPoint Slide 18)

C. Cultural weed control involves the use of crop management practices which give the crop a competitive edge over the weeds, or which disrupt the weed's life cycle.

(PowerPoint Slide 19)

1. Crop rotation can be very effective in helping to control weeds. Weeds tend to infest those crops which closely match their life cycle.
2. By seeding different crops in the same field in different years, the timing of tillage operations, seeding, and harvest dates, type of herbicide used, and other practices will vary from year to year, which disrupts the life cycle of most weeds.

(PowerPoint Slide 20)

3. Seeding the crop at the optimum date and rate of population will increase its chances at gaining a competitive advantage over weeds that will occur in the field.
4. A crop that is seeded as soon as the soil temperature reaches the minimum for germination will have a good chance of getting a jump on the weeds.

(PowerPoint Slide 21)

- D. Every location in a field can support a certain amount and type of plant growth depending on the supply of water, nutrients, and other factors.
1. The proper seeding rate will result in a population of crop plants that 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.
 2. Matching the row spacing to the growth habit of the crop is valuable in controlling weeds because it maximizes shading of the soil surface and prevents weeds from getting established. The proper row spacing is determined by the leaf area produced by the plant and also by the width of spread of the leaves between the rows.

(PowerPoint Slide 22)

- E. Biological weed control uses insects, diseases, predators, or other plants that are harmful to weeds without causing damage to crops. The primary purpose of biological control is to put the weed at a competitive disadvantage with the other plants it is associated with, including crop plants.
1. **Allelopathy** is an interaction which has a negative effect on one organism while affecting the other organism very little. It is the release of a metabolic by-product of one plant that inhibits the growth and development of another plant. Certain concepts must be followed if biological control of weeds or any pest is to be successful.

(PowerPoint Slide 23)

2. If an insect or disease is being introduced it must be host specific to the weed, and should not easily adapt to other plants when the weed population has been reduced.
3. One concept 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 is, and repeated attempts at

introducing the biological control are necessary before success, if any, is achieved.

4. It must not completely eliminate the weed, instead it must simply control it below economic thresholds. If the insect or disease completely eliminated its host plants, it would be eliminated itself.

(PowerPoint Slide 24)

F. Chemical weed control involves the use of chemicals, called herbicides, for the control of weeds. Chemical weed control is a very common method of weed control in industrialized agriculture.

G. Herbicides are primarily used to eliminate or replace tillage operations for weed control, which partly compensates their cost. Proper use of herbicides can provide better weed control than tillage.

****Use TM: G3-4 as visual material for lecture and discussion. PowerPoint Slide 25 can also be used.**

Objective 5: Describe the selection of herbicides.

(PowerPoint Slide 26)

V. Effective chemical weed management depends on selecting the best herbicide.

A. Herbicides are classified according to the way they destroy weeds. Herbicides can be classified as selective, nonselective, or as a soil sterilant.

1. 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 nontoxic substance.
2. A **nonselective herbicide** is one that will kill any plant it contacts. Nonselective herbicides can be used with growing crops but extreme caution must be used to prevent crop damage. Nonselective herbicides are also used in noncrop areas such as right-of-ways and around buildings where total control of vegetation is desired. Nonselective herbicides may have little or no residual activity after application.
3. **Soil sterilants** are herbicides that prevent any vegetation from growing for a period of months or even years. Soil sterilants are never used on cropland, but rather are used in noncrop areas where complete control of vegetation is desired for a long period of time.
4. Whether a herbicide is classified as selective, nonselective, or as a soil sterilant will depend on the rate that it is applied to the soil or plant.

(PowerPoint Slide 27)

B. Herbicides can be classified by their site of action.

1. **Translocated (systemic) herbicides** are taken into the plant through the roots or leaves and moved to a sensitive area such as a growing point or storage organ. Translocated herbicides are important in controlling perennial weeds with underground storage organs, but timing is important.
2. **Contact herbicides**, also called nontranslocated herbicides, are not moved within the plant but simply kill the plant tissue it contacts. Most contact herbicides are nonselective.
3. Herbicides can be classified by their mode of action. The method by which a herbicide kills depends on how the plant translocates and metabolizes the chemical.
4. 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.

(PowerPoint Slide 28)

- C. The time that herbicides are applied can also be used to classify them and is important in determining how they are used in the overall management of a crop.
1. **Preplant herbicide** is applied before the crop is seeded and is usually applied as part of seedbed preparation.
 2. **Early preplant herbicide** is applied 10 to 30 days before seeding and may or may not be incorporated into the soil.
 3. **Preplant surface applied herbicide** is applied up to 10 days before seeding and is not incorporated into the soil.
 4. **Preplant and incorporated** is applied up to 10 days prior to seeding and immediately incorporated because it will evaporate or be broken down by sunlight.
 5. **Preemergent herbicide** is applied before the weeds and/or crop emerges but after the crop has been seeded.
 6. **Postemergent herbicide** is applied after the crop and weeds have emerged from the soil.

****Use TM: C10–4D as visual material for lecture and discussion. Ask students if they have applied an herbicide to their crops before. Ask them why kind and when they applied it. Have them explain their experience.**

Objective 6: Identify herbicide mode of action families.

(PowerPoint Slide 29)

- VI. The method by which a herbicide kills depends on how the plant translocates and metabolizes the chemical.
- A. The different types of chemicals available as herbicides give the producer many choices to kill a wide variety of weeds in a wide variety of crops.
1. Some herbicides inhibit lipid or amino acid synthesis, chlorophyll formation, or photosynthetic reactions. Other herbicides act as

- growth regulators and interfere with normal metabolism, while others will disrupt cell membranes.
2. Crop plants that are not affected by a particular herbicide are able to break down the chemical thus rendering it harmless.

****Have the students complete LS: G3-1 when you are finished presenting the information. You will need to get 4 plant specimens prior to doing this lab.**

Review/Summary: Use the student learning objectives as a guide to summarizing the lesson. Have students explain terms, processes outlined in the lesson, and the content associated with each objective. Student responses can be used in determining which objectives require greater review or whether further instruction is necessary. Questions on PowerPoint Slide 30 can also be used.

Application: Use the lab sheet that accompanies this lesson to help students apply the content.

Evaluation: Focus the evaluation of student achievement on mastery of the objectives stated in the lesson. Measure student performance on classroom participation, laboratory assignments, and written tests or quizzes.

Answers to Sample Test:

Part One: Matching

1 = j, 2 = k, 3 = g, 4 = l, 5 = i, 6 = a, 7 = e, 8 = d, 9 = b, 10 = h, 11 = f, 12 = c

Part Two: Completion

1. Integrated weed management
2. physical
3. Mechanical weed
4. sheath
5. collar
6. Natural weed
7. nodes
8. Artificial weed
9. ligule
10. Rhizomes
11. Cultural weed
12. stolons.
13. hypocotyl
14. Chemical weed

Test

Unit G Lesson 3: Managing Weeds

Part One: Matching

Instructions. Match the term with the correct response. Write the letter of the term by the definition.

- | | | |
|------------------|--------------------------|---------------------|
| a. Allelopathy | e. Cotyledons | i. Summer annuals |
| b. Annual weed | f. Herbaceous perennials | j. Weed |
| c. Auricles | g. Noxious weed | k. Winter annuals |
| d. Biennial weed | h. Perennial weed | l. Woody perennials |

- _____ 1. A plant growing where it is not wanted or a plant out-of-place.
- _____ 2. Germinates in the fall and will actively grow until late spring when it produces seed and die during periods of heat and drought stress.
- _____ 3. Plant that causes great harm to other organisms by weakening those around it.
- _____ 4. Persistent aboveground stems that remain from season to season.
- _____ 5. Plants that germinate in the late spring and actively grow during the summer months.
- _____ 6. Interaction between plants which has a negative effect on one organism while affecting the other organism very little.
- _____ 7. Seedling leaves.
- _____ 8. Plant that will live for two years.
- _____ 9. Plant that completes its life cycle within one year.
- _____ 10. Plant that lives for more than two years.
- _____ 11. Weeds that die back to the ground each fall, but their root systems overwinter and the plants re-sprout the following spring from buds on the root systems.
- _____ 12. Finger-like projections of the collar that extend around the shoot.

Part Two: Completion

Instructions. Provide the word or words to complete the following statements.

1. _____ provides a systematic program for determining the best management practices for weed control.
2. Mechanical weed control involves the _____ destruction or removal of weeds.
3. _____ control is mostly tillage but can also involve mowing, burning or some other method.
4. The _____ encloses the stem and is connected to the blade at the junction formed by the collar.
5. The _____ is located on the outer side of the leaf.
6. _____ dispersal is the movement of weeds by wind, water and wildlife.
7. Joints of the stems are called _____.
8. _____ dispersal is by people and the activities they carry out in producing and harvesting crops.
9. The _____ resembles a continuation of the sheath where it joins the blade.
10. _____ are modified underground stems that produce new plants from the nodes.
11. _____ control involves the use of crop management practices which give the crop a competitive edge over the weeds, or which disrupt the weed's life cycle
12. _____ are modified aboveground stems that grow horizontally over the ground.
13. The portion of the stem between the cotyledons and the seedling roots is called _____.
14. _____ control involves the use of chemicals, called herbicides, for the control of weeds.

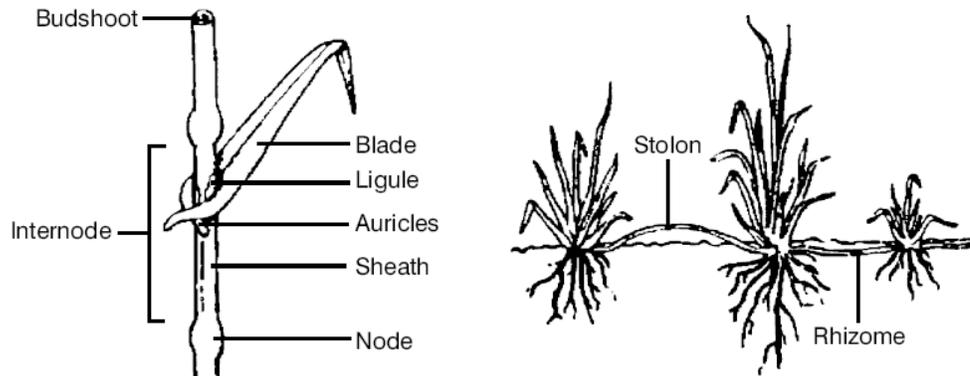
TM: G3-1

LIFE CYCLES OF A WEED

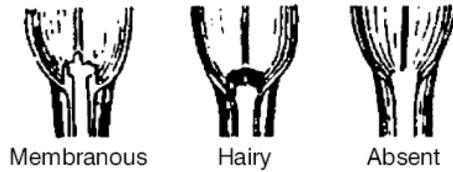
	Spring	Summer	Fall	Winter	Spring	Summer	Fall	Winter	
SUMMER ANNUALS									
WINTER ANNUALS									
BIENNIALS									
PERENNIALS									Cycle repeats until plant dies

TM: G3-2

CHARACTERISTICS OF PROBLEM GRASSES



LIGULE



Membranous

Hairy

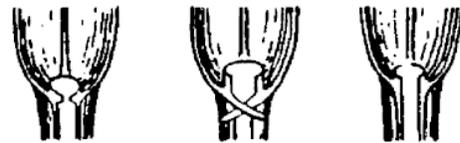
Absent

BUDSHOOT



Rolled in the bud

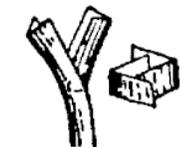
AURICLE



Short, stubby

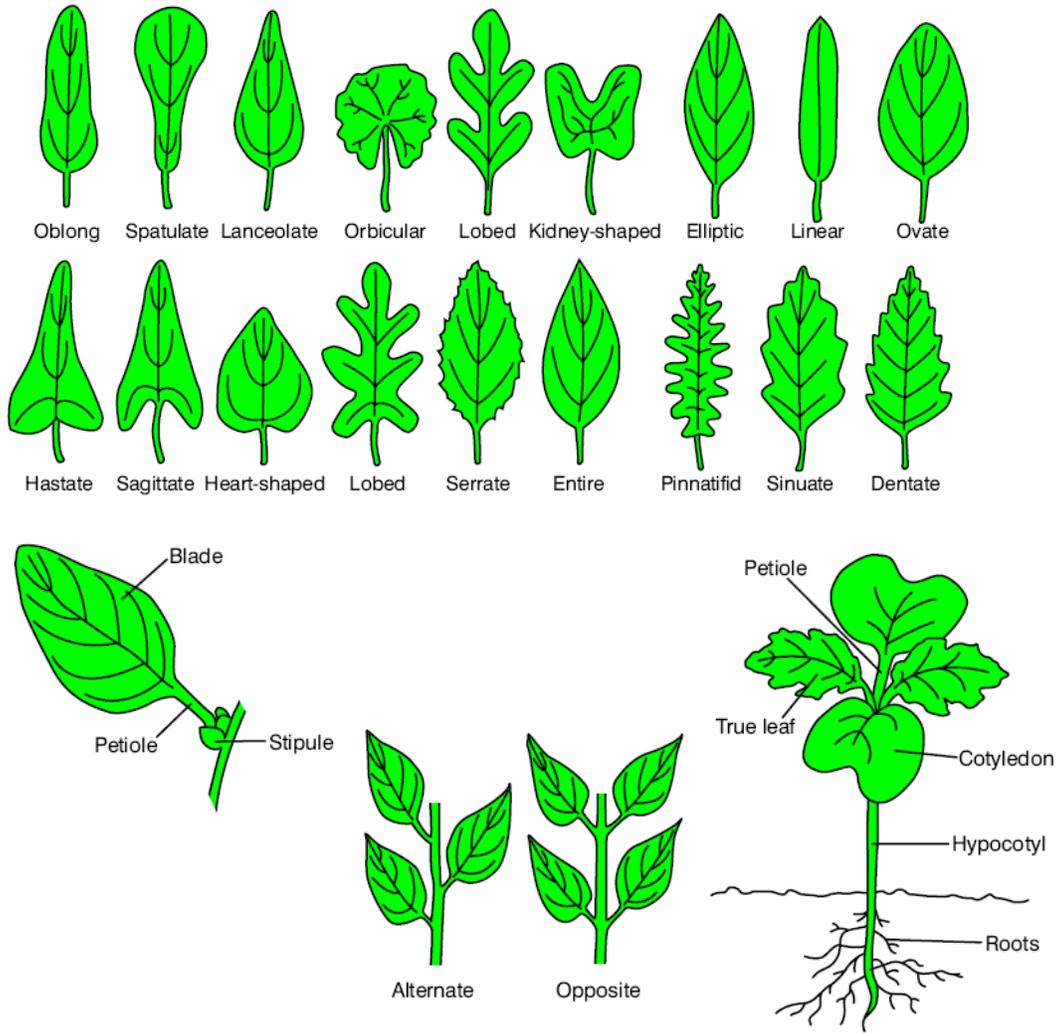
Long, clawlike

Absent



Folded in the bud

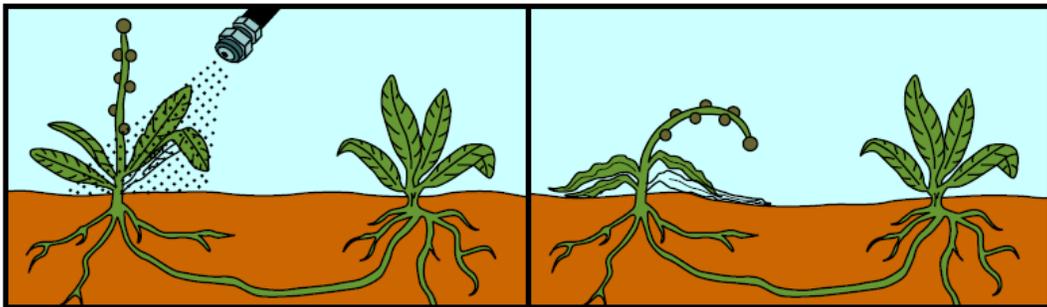
LEAF ARRANGEMENT AND SHAPE OF COTYLEDONS



SYSTEMIC AND CONTACT HERBICIDES

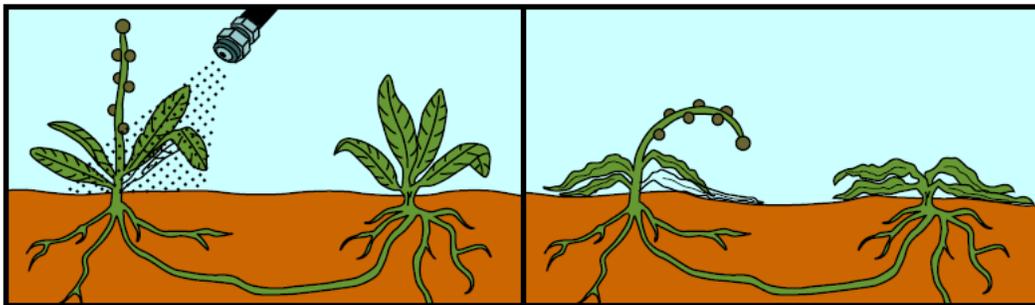
CONTACT

Sprayed tissue is killed.



SYSTEMIC

Entire plant is killed.



Lab Sheet

Identifying Weeds

Materials:

Clip board, paper, pencil and crop scouting guide or class notes, field or weed samples

Procedure:

1. Using the given specimens, determine (key) the type of weed(s) present. Show all your steps in determining the weed.

Sample #1

Sample #2

Sample #3

Sample #4