

GREENHOUSE OPERATION AND MANAGEMENT

Unit V: Plant Propagation

Lesson 1: Sexual Propagation

Competency/Objective:

Demonstrate the correct method for sexual propagation in the greenhouse environment.

Study Questions

1. What is sexual propagation?
2. What are some basic considerations for sexual propagation?
3. What are the environmental conditions to germinate seeds?
4. What is dormancy and how is it overcome?
5. What are the basic stages of the germination process?
6. What are the steps for planting seeds?
7. How do monocots and dicots differ in germination?
8. How should seedlings be cared for after germination?
9. When and how are seedlings transplanted?
10. How should seedlings be cared for after transplanting?

References/Supplies/Materials

1. *Greenhouse Operation and Management* (Student Reference). University of Missouri-Columbia: Instructional Materials Laboratory, 2002.
2. Transparency Masters
TM 5.1 Steps in Seed Germination of a Monocot
TM 5.2 Steps in Seed Germination of a Dicot

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3. Activity Sheet

AS 5.1 Transplanting a Seedling

4. Plug trays/seedling tray, growing media, 606 cell pack containers, plastic labels, small trowel, fork, or knife

TEACHING PROCEDURES

IMPORTANT NOTE: Each student needs to have a seedling for AS 5.1, as noted in Suggested Time Frame for Teaching (p. xxxv). Begin sowing fast-growing plants before teaching this lesson.

A. Introduction

A brief review of Lesson 1 from Unit III on plant parts, structures, and functions might be a helpful refresher for students. This unit addresses plant propagation: sexual propagation in Lesson 1 and asexual propagation in Lesson 2.

B. Motivation

Ask student if they observed any differences in their treatment of the seeds sown at the beginning of Unit I. How have various environmental factors - light, water, air, and temperature - affected the growth of the plants?

C. Assignment of Study Questions

D. Supervised Study

Lead students in collecting the information needed to answer and discuss the study questions. The instructor may choose to work on one study question at a time or have students work in a cooperative learning environment and have groups work on different study questions.

E. Discussion

Lead students in a discussion of the study questions. Supplement students' responses and information with additional materials when needed.

1. What is sexual propagation?

Using seeds to start new plants is referred to as sexual propagation.

- A. It is a method by which new plants are produced from seeds.
- B. Environmental conditions must be ideal for germination to occur.

2. What are some basic considerations for sexual propagation?

The quality of seeds and proper storage of seeds are important factors. The other two elements students should know well are containers and growing media.

A. Seed selection

1. Select high-quality seeds that are free of the following:
 - a. Disease and insects
 - b. Broken seeds
 - c. Weed or other seeds
2. Hybrid seeds offer advantages but cost more.
 - a. More resistant to disease
 - b. Generally more vigorous; produce higher yield

B. Seed storage

1. Keep seeds dry and cool.
2. Store seeds in paper packets in sealed glass jars.

C. Containers

1. Should be clean and sturdy
2. Size and material according to type of seeding
 - a. Direct seeding
 - b. Indirect seeding

D. Growing media

1. Clean, free of debris and disease
2. Loose
3. Fine texture

E. Legal considerations

1. Federal law - the Plant Variety Protection (PVP) Act of 1970
 - a. Encourages scientists and breeders to continue biotechnological experiments
 - b. Provides plant breeders with exclusive marketing rights within the United States
 - c. Grants a certificate of protection for 18 years; is analogous to a patent
 - d. Contact information:
Commissioner, Plant Variety Protection Office
Agricultural Marketing Service
National Agricultural Library Bldg., Room 0, 10301
Baltimore Blvd., Beltsville, MD 20705-2351
2. PVP amendments in 1994
 - a. The amended PVP restricts how much seed a grower can save. The law states that the grower may save no more seed than the planting area can accommodate.
 - b. The grower cannot sell saved seed if plans change.
3. State law - Missouri Plant Law
 - a. This requires all who sell, give away, or transport nursery stock in the state of Missouri to submit to inspection.
 - b. The purpose of the inspection is for the state entomologist to examine the plants for insects and diseases.
 - c. Fees for greenhouse inspections are based on the facility's square foot area under glass.

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- d. Contact information:
 - State Entomologist
 - Missouri Department of Agriculture
 - P.O. Box 630
 - Jefferson City, MO 65102-0630
 - Phone: (573) 751-5507
 - Fax: (573) 751-0005

3. What are the environmental conditions to germinate seeds?

Ask the students to name four important environmental factors. As a hint, mention that they were covered in Unit IV. Why do they think these factors are vital to plant propagation?

A. Moisture

1. Water absorption - first step in germination
2. Growing medium
 - a. Should be moist
 - b. Misted with fine spray after seeds are sown
 - c. Covered to retain moisture

B. Temperature

1. Different seeds germinate at different temperatures.
 - a. Warm weather crops
 - b. Cool weather plant
2. General range is 68-86°F.
3. Soil temperature should remain constant.
4. Heating elements can be used to warm soil.

C. Light

1. Some seeds require light to germinate.
 - a. Should be sown shallowly
 - b. Should not be covered
 - c. Example: lettuce
2. Many seeds require no light to germinate. (In some cases, light may inhibit germination.)
 - a. Should be sown more deeply
 - b. May be placed in a dark area
 - c. Example: geraniums

D. Air

1. Germination is an aerobic process (requiring oxygen).
2. Medium must be well aerated.

4. What is dormancy and how is it overcome?

Seeds wait for the ideal environmental conditions before germinating. This resting state is called dormancy. The length of dormancy varies among plants. For example, some varieties of maple have seeds whose dormancy period lasts only a few weeks, whereas some lotus plant seeds germinate after 2,000 years of dormancy. Some hard seeds need some coaxing to germinate. The three methods for overcoming dormancy are described here.

- A. Dormancy
 - 1. Resting stage of seed
 - 2. Prevents seed from germinating until environmental conditions are ideal
- B. Methods of overcoming dormancy
 - 1. Scarification of hard seed coatings
 - a. Mechanical - rubbing with sandpaper or nicking a portion of seed coating
 - b. Chemical - carefully soaking in sulfuric acid to soften seed coating
 - 2. Exposure to cold (stratification) for several weeks
 - 3. Exposure to heat to weaken seed coating

5. What are the basic stages of the germination process?

Four stages signal the germination of plants. Ask students to recall the emergence of their plants from the previous unit and the structures of plants learned in Unit III. What is the first phase?

- A. Water absorption
- B. Enzymatic breakdown
- C. Production of new cells; formation of new tissue
- D. Emergence of seedling

6. What are the steps for planting seeds?

Ask students to recount how they planted the seeds used for Unit IV and what if anything they would do differently.

- A. Prepare growing medium
 - 1. Fill container up to 3/4 in. from the top with moistened germination mixture. Ensure that container has drainage holes.
 - 2. Level off and tap to settle.
 - 3. Make shallow holes or rows according to directions on seed packet.
- B. Set seeds
 - 1. Place seeds in the holes or rows.
 - 2. Label with plant type, variety, and date of planting.
 - 3. Cover with dry medium (generally, with an amount twice the seeds' diameter).
- C. Observe daily
 - 1. Watch for signs of too much or too little moisture.
 - 2. Watch for germination.

7. How do monocots and dicots differ in germination?

TMs 5.1 and 5.2 are good illustrations of the differences in monocot and dicot germination. Ask students what they notice while examining the images. What are the differences between the two types of plants?

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- A. Monocot (See TM 5.1.)
 - 1. Hypogeous germination (Cotyledon remains underground.)
 - 2. Stages
 - a. Seed swells as moisture is absorbed.
 - b. Seed coat ruptures.
 - c. Radicle grows down.
 - d. First internode and epicotyl grow up.
 - e. After epicotyl emerges, new leaves form and food production starts.
 - f. New root system grows just beneath the soil above the first internode.
- B. Dicot (See TM 5.2.)
 - 1. Epigeous germination (Cotyledon emerges aboveground.)
 - 2. Stages
 - a. Seed swells as moisture is absorbed.
 - b. Seed coat splits.
 - c. The radicle emerges and grows down.
 - d. The hypocotyl elongates, forms an arch, and pulls the cotyledon upward.
 - e. When the hypocotyl reaches light, elongation ceases, and the hypocotyl straightens up and pulls the cotyledons out of the soil.
 - f. The cotyledons open, turn green, and provide food until the true leaves develop.
 - g. The first true leaves unfold from the epicotyl, exposing the growth bud.
 - h. The cotyledons die, dry up, and fall off.

8. How should seedlings be cared for after germination?

This question addresses fundamental concerns for the greenhouse operator: environment, irrigation, fertilization, and disease prevention.

- A. Environment
 - 1. Remove cover once seeds have germinated.
 - 2. Move to area that receives bright light.
 - 3. Growing temperature is 10°F cooler than temperature for germination period.
- B. Watering
 - 1. Keep moist but not soggy.
 - 2. Allow drying between watering but do not allow seedlings to wilt at any time.
- C. Fertilizing
 - 1. Fertilize promptly and regularly with a complete fertilizer.
 - a. 20-20-20 is usually appropriate.
 - b. Apply 1/4 of the recommended strength a few days after germination.
 - 2. Too much fertilizer can damage seedlings.
- D. Disease prevention and treatment
 - 1. Prevent disease.
 - a. Use soilless mix or pasteurized medium and sterilized containers.
 - b. Provide sufficient air circulation.
 - c. Allow medium to dry out slightly between waterings.
 - 2. Treat diseases such as damping-off (a fungal disease that attacks at ground line).
 - a. Limited infection - Dig out and discard infected plants and soil.

- b. Widespread infection - Drench entire soil area with fungicide.

9. When and how are seedlings transplanted?

Seedlings are fragile. When transplanting the seedlings, timing, methods, and handling are vital to their survival. Have students complete AS 5.1.

A. Timing

1. Seedlings can be transplanted after they develop the first set of true leaves.
2. Do not delay transplanting.
 - a. Health of the plant suffers.
 - b. Seedlings become overcrowded and spindly.

B. Method

1. Water seedlings.
2. Carefully lift the small plants with a small trowel, fork, or knife.
 - a. Leave some growing medium around roots.
 - b. Do not allow roots to dry out.
3. Fill container with moist growing medium.
4. Make a hole in the medium.
5. Insert seedlings slightly deeper than they were in the previous pot.
6. Gently pat growing medium around base of seedling.
7. Water the plant.

C. Handling

1. Seedlings are fragile and must be handled gently.
2. Handle by leaves, not stems.

10. How should seedlings be cared for after transplanting?

Ask students to consider what kinds of precautions a greenhouse owner should take to ensure successful transplanting of seedlings.

- A. Keep in indoor environment.
- B. Keep in shade or under fluorescent lighting for a few days.
- C. Keep away from intense heat.

F. Other Activity and Strategy

Show the class a video available from CATER (Career & Technical Education Resources), 2 London Hall, University of Missouri-Columbia: *Plant Propagation*, Volume I (AG V46),

G. Conclusion

There are proper procedures and methods involved in sexual propagation. Germinating seeds is affected by several factors and the process varies with monocots and dicots. Caring for seedlings is crucial after germination and transplanting.

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H. Answers to Activity Sheet

Instructor's discretion

I. Answers to Assessment

1. D
2. A
3. D
4. A. Resistant to disease
B. Produce higher yield.
5. Germination in dicot plants wherein the cotyledon grows aboveground.
6. Plants produced from seeds
7. A. Environment
B. Water
C. Fertilizer
D. Disease prevention and treatment
8. After developing the first set of true leaves
9. A. Keep indoors
B. Keep in shade or under fluorescent lighting
C. Keep away from intense heat
10. A. Prepare the growing medium
B. Set the seeds
C. Watch daily
11. To ensure nursery stock is without insect and disease infestations.

UNIT V: PLANT PROPAGATION

Name _____

Lesson 1: Sexual Propagation

Date _____

ASSESSMENT

Multiple Choice: Circle the letter of the best answer.

1. What is the second stage in germination?
 - A. Emergence of seedling
 - B. Absorption of water
 - C. Production of new cells
 - D. Enzymatic breakdown
2. What are temperature, water, air, and light?
 - A. Environmental factors in germination
 - B. Consideration for sexual propagation
 - C. Factors in timing of transplantation
 - D. Methods to overcome dormancy
3. What are three methods to overcome dormancy?
 - A. Chemical, mechanical, and aerobic process
 - B. Mechanical, heat, and enzymatic breakdown
 - C. Stratification, scarification, and water absorption
 - D. Heat, stratification, and scarification

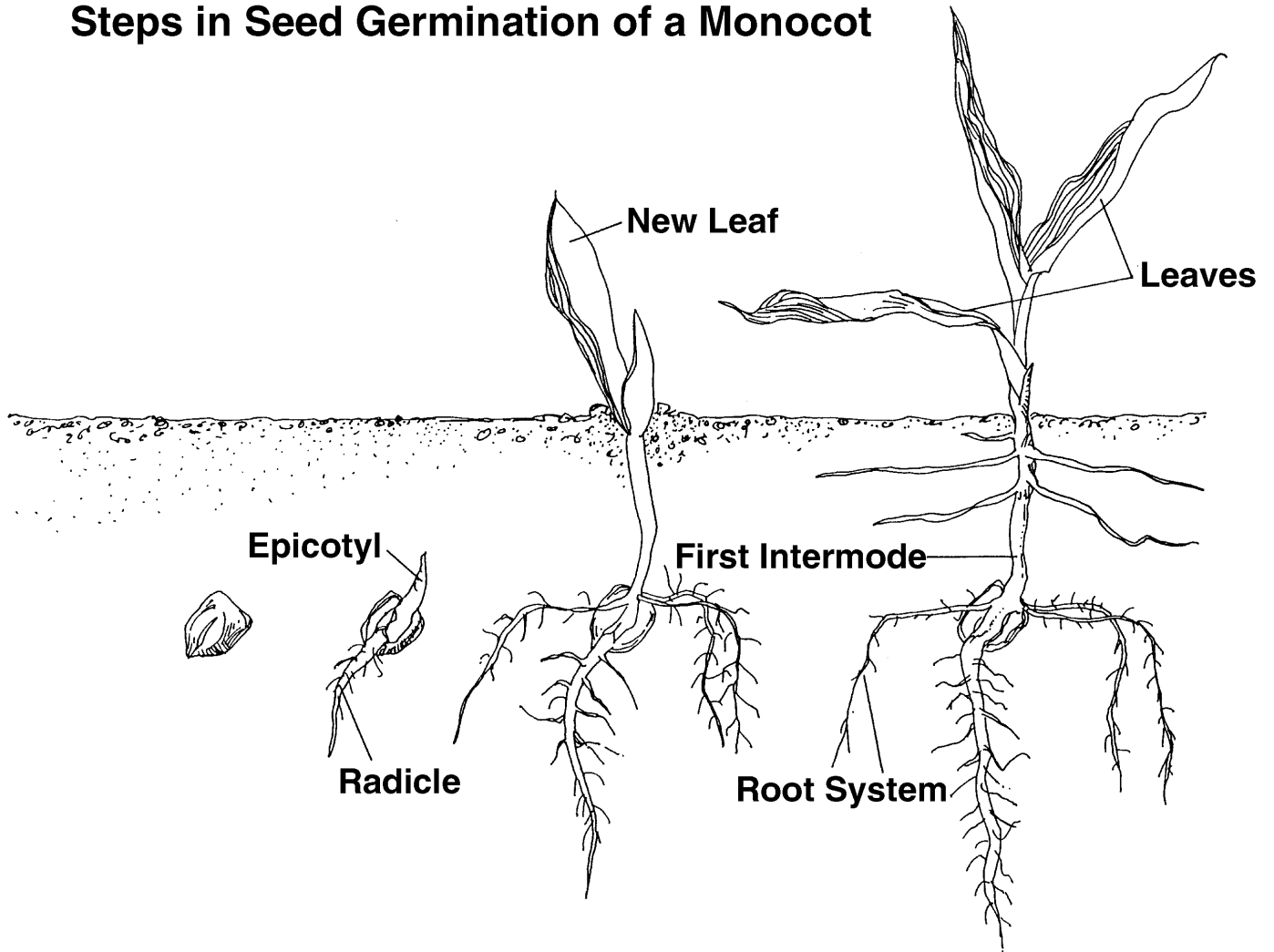
Short-Answer Questions: Write the answers in the space provided.

4. What are two advantages of using hybrid seeds?
 - A.
 - B.
5. What is epigeous germination?
6. What is sexual propagation?

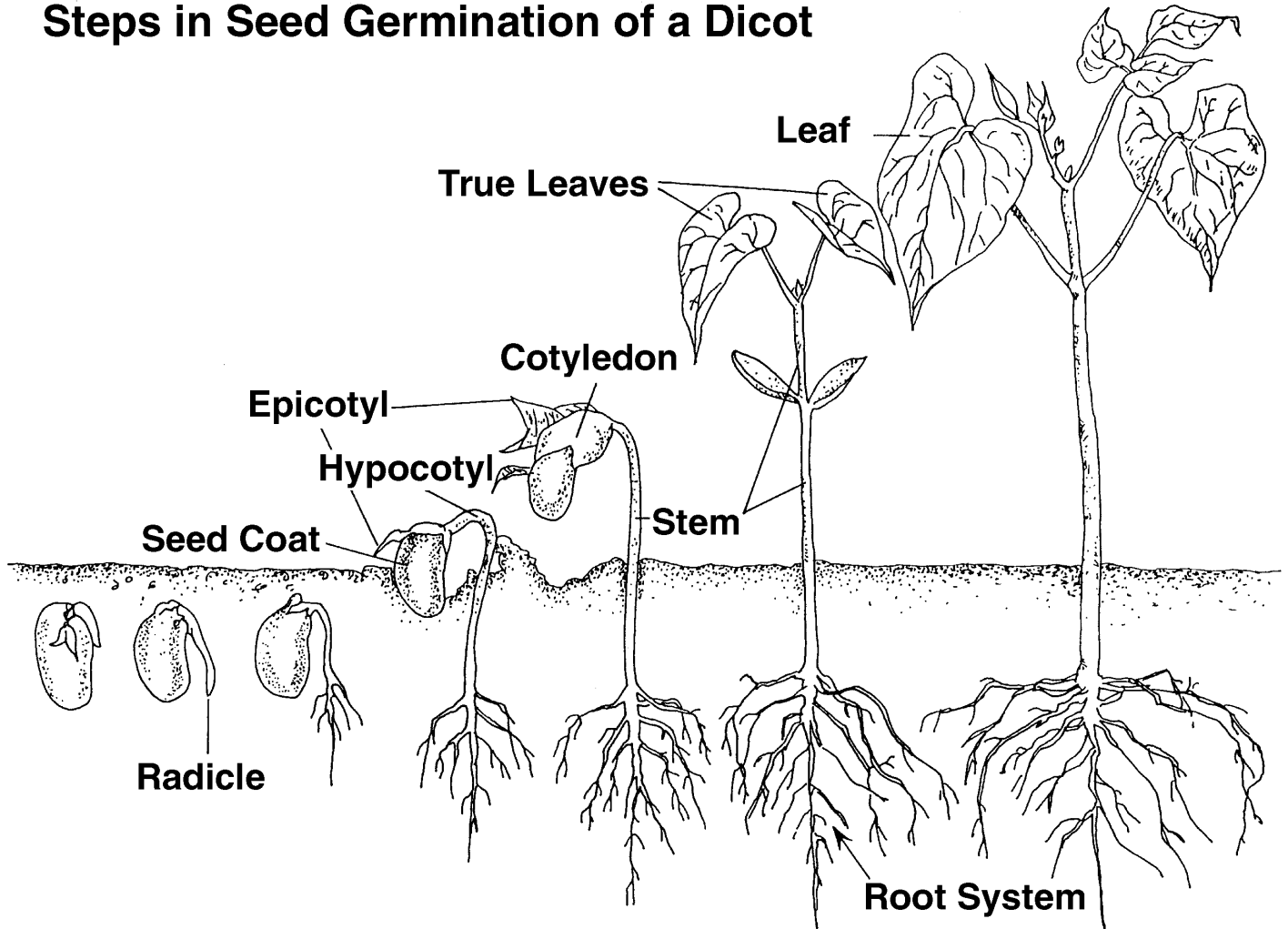
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7. What are four factors to observe in caring for seedlings after germination?
 - A.
 - B.
 - C.
 - D.
8. When can seedlings be transplanted?
9. What are three ways to care for seedlings after transplanting?
 - A.
 - B.
 - C.
10. What are three steps in planting seeds?
 - A.
 - B.
 - C.
11. What is the purpose of the Missouri Plant Law?

Steps in Seed Germination of a Monocot



Steps in Seed Germination of a Dicot



UNIT V: PLANT PROPAGATION

AS 5.1

Lesson 1: Sexual Propagation

Name _____

Transplanting a Seedling

Objective: Demonstrate proper procedures in transplanting a seedling.

Directions: Transplant a seedling. Record all the steps involved. Identify the type of seedling by recording its binomial nomenclature and common name. Record the date the plants were transplanted and note the seedling's progress.

Materials

Growing medium
Pen and paper
Plastic labels
Plug trays/seedling tray
606 cell pack
Small trowel, fork, or knife
Water

Procedures

1. Water seedling.
2. Carefully lift seedling with small trowel, fork, or knife.
3. Fill plant container with moist growing medium.
4. Insert a hole in the growing medium.
5. Insert seedling slightly deeper than it was in previous pot.
6. Pat growing medium around base of seedling.
7. Water seedling.

GREENHOUSE OPERATION AND MANAGEMENT

Unit V: Plant Propagation

Lesson 2: Asexual Propagation

Competency/Objective:

Differentiate between various types of asexual propagation procedures.

Study Questions

1. What is asexual propagation?
2. What are general considerations for asexual propagation?
3. How are plants propagated by budding?
4. How are plants propagated by cuttings?
5. How are plants propagated by division?
6. How are plants propagated by grafting?
7. How are plants propagated by layering?
8. How are plants propagated by tissue culture?

References/Supplies/Materials

1. *Greenhouse Operation and Management* (Student Reference). University of Missouri-Columbia: Instructional Materials Laboratory, 2002.
2. Transparency Masters
 - TM 5.3 Cutting Locations
 - TM 5.4 Cuttings
 - TM 5.5 Division
 - TM 5.6 Grafting
 - TM 5.7 Layering
3. Activity Sheets
 - AS 5.2 Asexual Propagation

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AS 5.3 Budding and Tissue Culture

TEACHING PROCEDURES

A. Review

This lesson continues to discuss propagation by describing six alternative methods of propagation. The content of Lesson 2 reinforces students' knowledge of plants because these techniques rely upon an understanding of which plant parts are cut and why.

B. Motivation

Ask students to justify why a greenhouse grower would want to use propagation methods that did not rely on using seeds. What are the advantages?

C. Assignment of Study Questions

D. Supervised Study

Lead students in collecting the information needed to answer and discuss the study questions. The instructor may choose to work on one study question at a time or have students answer all the study questions before the discussion. Another option is to have students work in a cooperative learning environment and have groups work on different study questions.

E. Discussion

Lead students in a discussion of the study questions. Supplement students' responses and information with additional materials when needed.

1. What is asexual propagation?

Asexual propagation is plant reproduction without seeds. In other words, asexual propagation uses parts of one plant to create another. It is faster than sexual propagation and because the new plant is a clone, the characteristics of the new plant are the same as the parent or original plant.

- A. Asexual propagation uses leaves, stems, or roots of a parent plant to reproduce a new plant.
- B. It is a popular means of reproducing plants.
 - 1. Faster than sexual propagation
 - 2. Produces characteristics identical to parent plant (cloning)

2. What are general considerations for asexual propagation?

Tools, sanitation, greenhouse environment, and proper labeling are examined. Ask students why they think sanitation is a bigger factor in asexual propagation than in sexual propagation.

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- A. Tools
 - 1. Sharp knife
 - a. To cut parts from plants
 - b. To divide plants
 - c. To make wounds in plant materials
 - 2. Dibble (stick) to make holes in growing medium
 - 3. Duster to apply rooting compound
- B. Sanitation
 - 1. Keep tools clean and sterile.
 - a. Disinfect before use.
 - b. Disinfect knives after each cutting.
 - 2. Place cuttings in sterile container until planted.
 - 3. Sterilize rooting solution after each use.
 - 4. Discard any excess plant debris.
- C. Growing medium
- D. Lighting
- E. Temperature
- F. Labeling
 - 1. Labels enable grower to keep track of all plants.
 - 2. Labels should contain detailed information.
 - a. Plant's name and variety
 - b. Date propagated
 - c. Any special treatment
- G. Legal issues
 - 1. Federal law - Plant Patent Act of 1930
 - a. This law covers asexually reproduced plants except for tubers.
 - b. It precludes others from asexually propagating or selling the plant without prior permission from the patent holder.
 - c. Licensing agreements allow growers to grow and sell the specified variety.
 - d. Patent expires after 20 years.
 - e. Amendments to the Plant Patent Act were passed in 1998.
 - i. Explicitly protects the owner of a plant patent against unauthorized sale of plant parts that would be used to propagate the plant
 - ii. Expands protections on par with those for sexually propagated plants covered by the Plant Variety Protection Act
 - f. Contact information:
Assistant Commissioner for Patents, Washington, DC 20231
 - 2. State law - Missouri Plant Law
 - a. This law requires all in the state of Missouri who sell, give away, or transport nursery stock (woody stem plants, perennials, bulbs, roots, crowns, corms, rhizomes, and tubers) to submit to inspection.
 - b. The purpose of the inspection is for the state entomologist to examine the plants for insects and diseases.
 - c. Inspections occur twice a year.
 - d. Fees for greenhouse inspections are based on the facility's square foot area under glass.

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- e. Contact information:
State Entomologist
Missouri Department of Agriculture
P. O. Box 630
Jefferson City, MO 65102-0630
Phone: (573) 751-5507
Fax: (573) 751-0005

3. How are plants propagated by budding?

As one of the techniques of asexual propagation, budding is a specialized form of grafting (discussed below).

- A. A single bud from one plant is inserted into the bark of another variety.
- B. It is similar to grafting but uses only a single bud as the scion.
- C. A commercial plant propagator usually performs specialized grafting techniques.

4. How are plants propagated by cuttings?

Cuttings taken from the stem or leaves of a parent plant are used in this form of propagation. See TMs 5.3 and 5.4.

- A. Cuttings of parent plant rooted to form new plants
- B. Types of cuttings
 - 1. Stem cuttings
 - a. Taken from section or tip of stem
 - b. Softwood, herbaceous, semihardwood, hardwood, conifer
 - 2. Leaf cuttings
 - a. Piece or entire leaf
 - b. Leaf vein
 - c. Leaf bud
 - 3. Stem cuttings
- C. Steps
 - 1. Begin with clean cutting tools, containers, and growing medium.
 - 2. Make cuts according to the type of cutting used.
 - 3. Treat base of cutting with a rooting hormone.
 - 4. Plant the cutting in moist soilless growing medium.
 - 5. Place in high-humidity environment to reduce moisture loss.
 - a. Enclosed in a plastic bag
 - b. On misting bench
 - 6. Provide appropriate amounts of sunlight.
 - 7. Keep temperature between 65 and 75°F.
- D. Root growth can be encouraged with rooting hormones.
 - 1. Purpose
 - a. Increases percentage of cuttings that root
 - b. Helps plants root more quickly and uniformly

- c. Stimulates formation of more vigorous roots
- 2. Methods of application
 - a. Dust with rooting powder.
 - i. Apply small amount to base of cutting.
 - ii. Excessive amounts can cause stem to rot.
 - b. Dip or spray hormone solutions. Dip base of cutting into solution for short period of time.
 - c. Be aware that pathogenic organisms can be spread from diseased cuttings to healthy cuttings via the solution. Discard any leftover solution after dipping.

5. How are plants propagated by division?

The term “division” refers to splitting plant parts to grow new plants. Corms, bulbs, rhizomes, tubers, and crowns are excellent examples of division. If possible, bring in one of the above to show the class. (See TM 5.5.)

- A. Division is the separation of clumps of a plant into small groups, each having roots, stems, buds, and leaves or the potential to develop these parts.
- B. Division is a natural means of reproducing for some plants (e.g., tulips, daffodils).

6. How are plants propagated by grafting?

This procedure involves melding two different plants together. It is most often used for trees and roses. (See TM 5.6.)

- A. Buds, twigs, or shoots (known as scions) are taken from one plant and inserted into the stems or roots of a similar plant (known as the rootstock), matching cambiums in the process.
- B. There are two types of grafting.
 - 1. Whip (or tongue) grafts join small scion to similar sized rootstock.
 - 2. Cleft and bark grafts join small scion to large rootstock.
- C. Grafting is used most often for trees and roses.

7. How are plants propagated by layering?

Layering is a method of propagating that does not split the new plant from the parent until the roots are established. There are six different types of layering. Two of these types are illustrated in TM 5.7. After students have investigated all of the propagation methods (except tissue culture), have them complete AS 5.2.

- A. Layering is the process of establishing new roots on the stem while the stem remains attached to the parent plant.
- B. Layering is a technique commonly used to propagate many houseplants.
- C. It involves wounding a piece of plant stem and burying it.
- D. There are several types of layering.
 - 1. Simple: A portion of the stem is wounded, treated, and buried; the tip is left exposed.
 - 2. Air: A portion of the stem is removed and rooting is induced at the wounded area.

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3. Tip: Terminal tip is wounded, treated, and buried.
4. Serpentine or compound: Stem is covered and exposed.
5. Mound: Stem is cut back and buried while dormant.
6. Trench: Entire plant, except for tip, is bent and buried.

8. How are plants propagated by tissue culture?

This is a technical way of cloning plants by using very little plant material but very specific and sterile conditions. Orchids and lilies are two crops grown in this manner. Have students complete AS 5.3.

A. Also referred to as micropropagation

B. Highly technical method

1. Use one or more cells from the tissue of a plant to produce a new plant.
2. Pieces of plants are grown in sterile conditions in artificial media.
3. This allows mass production of plants in a short period of time.

F. Other Activity and Strategy

Show the class videos from CATER (Career & Technical Education Resources), 2 London Hall, University of Missouri-Columbia: *Plant Propagation* (AG V47) and *Plant Tissue Culture Part II* (AG V170).

G. Conclusion

Asexual propagation involves several methods and procedures. Each technique provides various alternatives for reproducing plants.

H. Answers to Activity Sheets

AS 5.2 Asexual Propagation

Instructor's discretion

AS 5.3 Budding and Tissue Culture

Instructor's discretion

I. Answers to Assessment

1. E
2. D
3. F
4. B
5. A
6. C

7.
 - A. Quicker method of propagation
 - B. Produces characteristics identical to parent plant
8.
 - A. Simple: Portion of stem is wounded, treated, and buried
 - B. Air: Portion of stem is removed and rooting is induced at wound
 - C. Tip: Tip is wounded, treated, and buried.
 - D. Serpentine or compound: Stem is covered and exposed in several places.
 - E. Mound: Stem is cut back and buried when dormant.
 - F. Trench: Entire plant except for tip is bent and buried.
9. Joins scion to a larger rootstock
10. Students may list any two of the following:
 - A. Use one or more cells to produce new plant.
 - B. Grow in sterile conditions in artificial media.
 - C. Mass production in short period of time.
11. Budding is a form of grafting that uses only buds as a scion.
12. Students may list any four of the following:
 - A. Sharp knife
 - B. Dibble stick
 - C. Sterile equipment
 - D. Proper growing medium
 - E. Duster
 - F. Labels
13. Root hormone
14. Tubers
15. Based on square feet under glass in the greenhouse

UNIT V: PLANT PROPAGATION

Name _____

Lesson 2: Asexual Propagation

Date _____

ASSESSMENT

Match the statement on the left with the propagation method on the right. Write the letter in the space provided.

- | | |
|---|-------------------|
| ___1. Bury pieces of plant while still attached to parent plant | A. Tissue culture |
| ___2. Attaching a piece of one plant to another | B. Budding |
| ___3. Planting a piece of stem or leaf | C. Division |
| ___4. Attaching a bud to another plant | D. Grafting |
| ___5. Growing plants from cells | E. Layering |
| ___6. Separating plant parts | F. Cutting |

Short-Answer Questions: Write the answers in the space provided.

7. What are two advantages to asexual propagation?
- A.
 - B.
8. What are six types of layering? Describe two of them.
- A.
 - B.
 - C.
 - D.
 - E.
 - F.

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9. What is a cleft and bark graft?

10. What are two features of micropropagation?
 - A.
 - B.

11. What is the difference between budding and grafting?

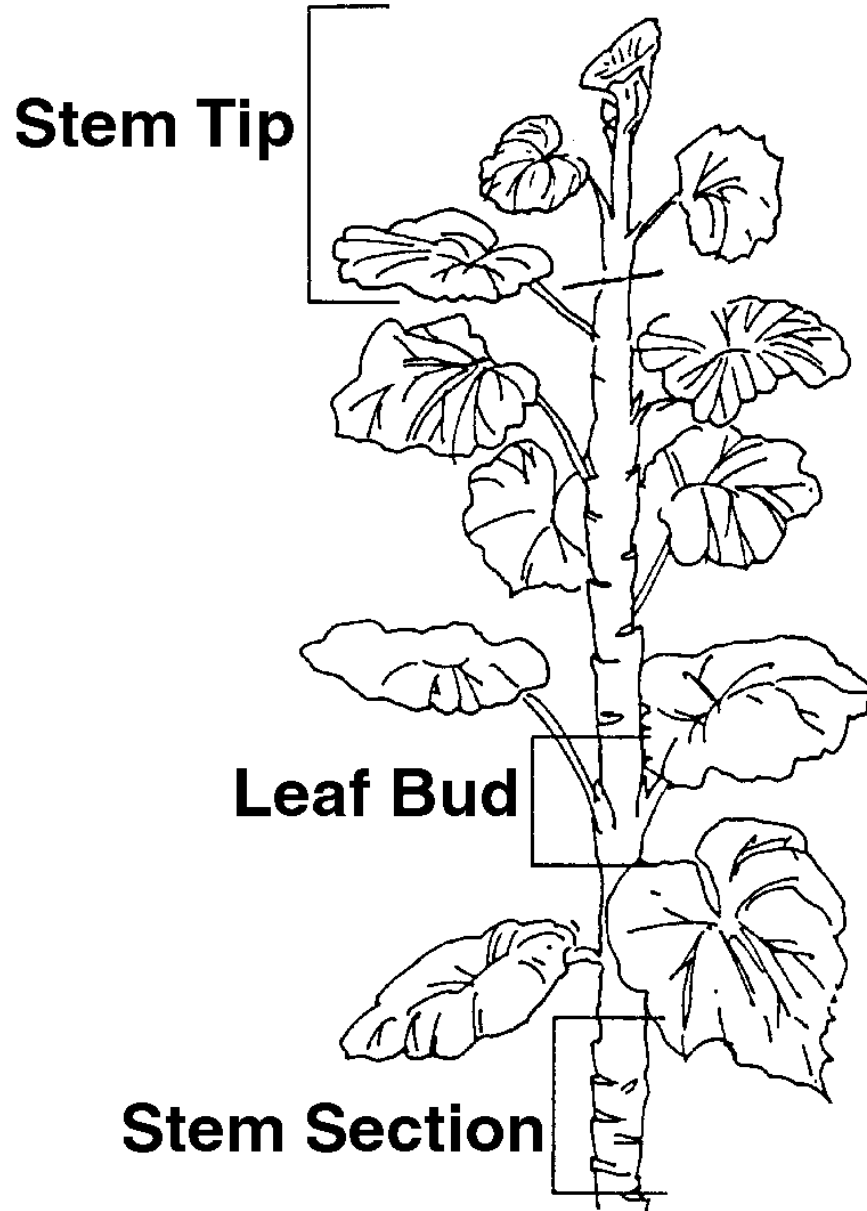
12. What are four tools a greenhouse owner needs to asexually propagate plants?
 - A.
 - B.
 - C.
 - D.

13. How is root growth encouraged when using cuttings?

14. What type of asexually reproduced plant is **not** covered by the Plant Patent Act?

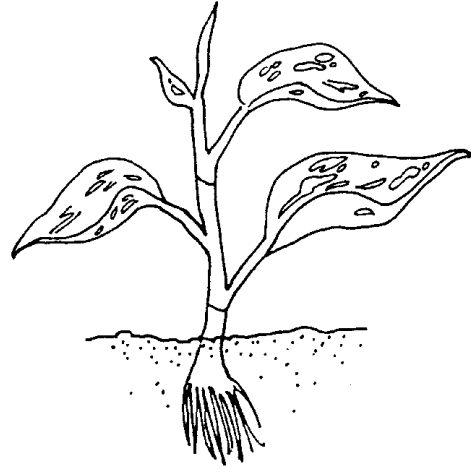
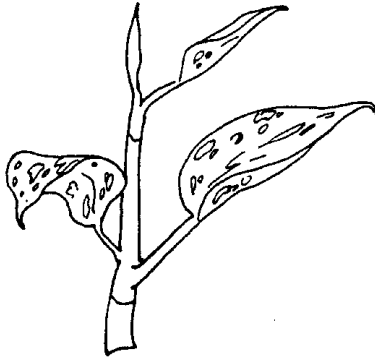
15. How is the inspection fee for greenhouses determined under the Missouri Plant Law?

Cutting Locations

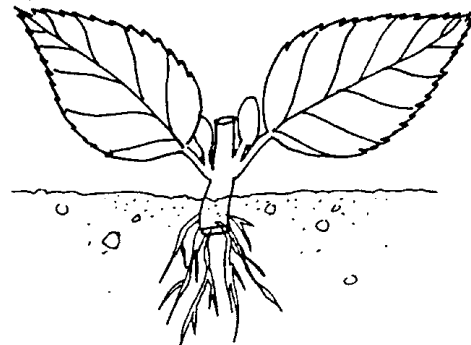
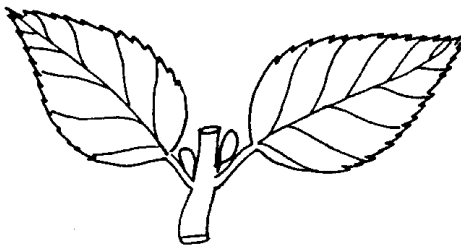


Cuttings

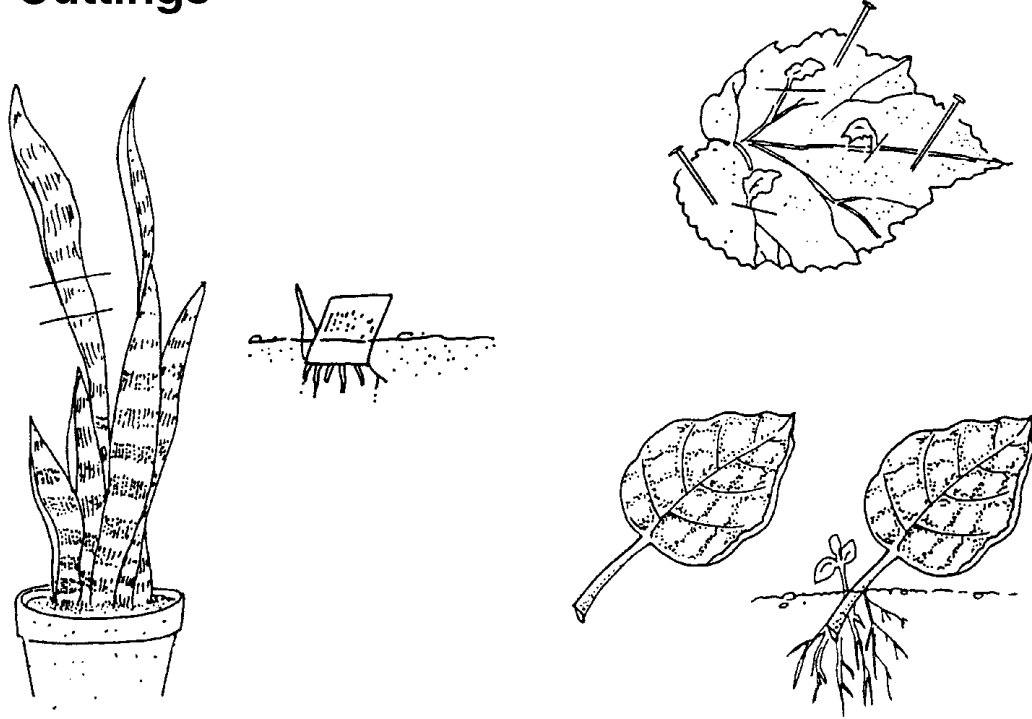
Stem Tip Cutting



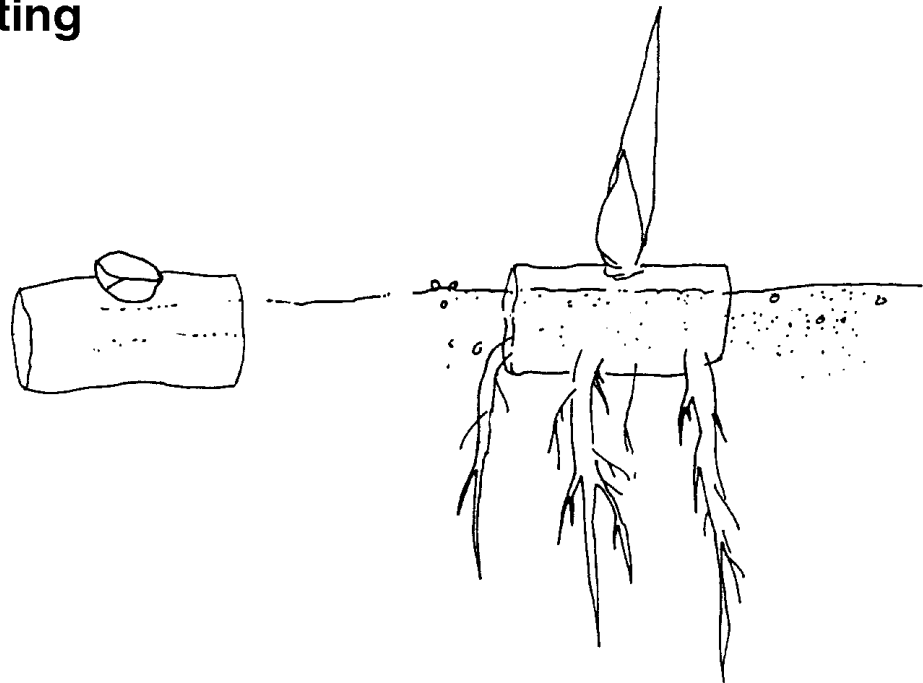
Leaf and Bud Cutting



Leaf Cuttings

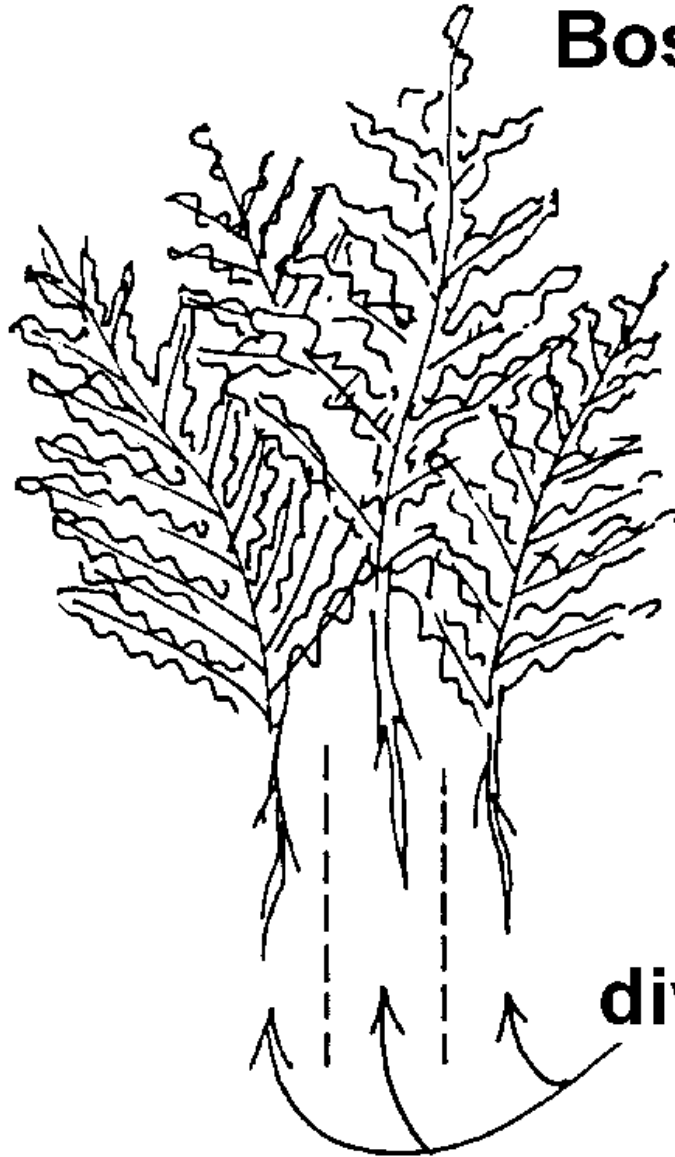


Stem Cutting



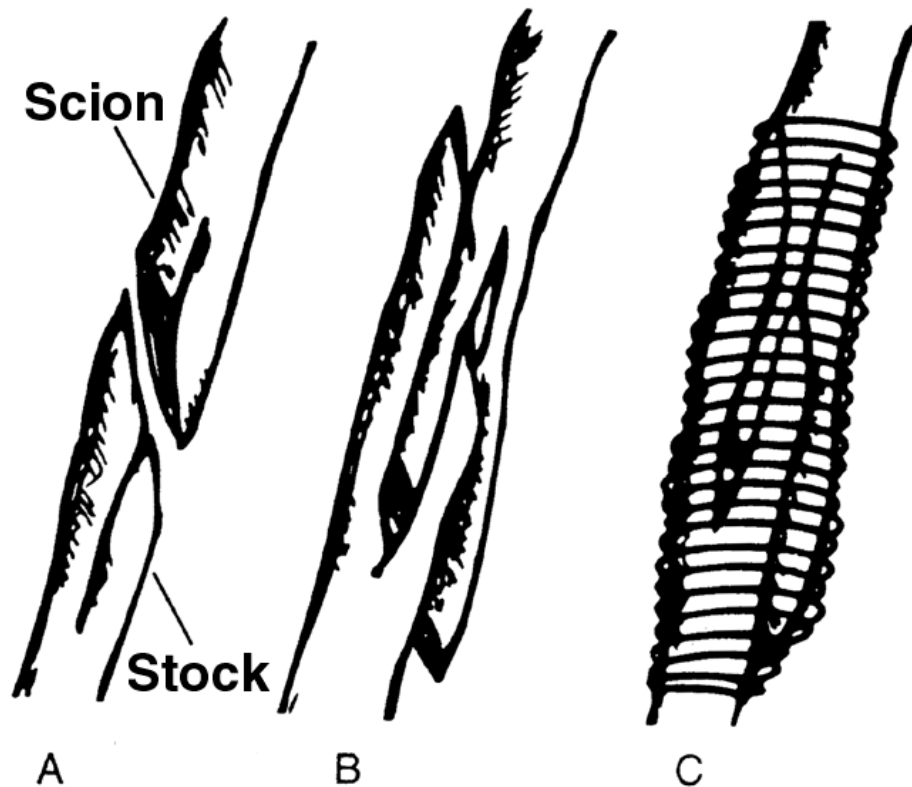
Division

Boston Fern



divisions

Grafting



A - Stock and scion are prepared.

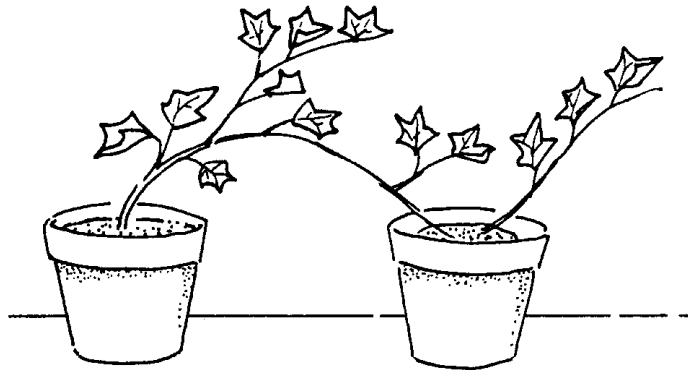
B - The two parts are unified.

C. - The graft is wrapped with waxed string.

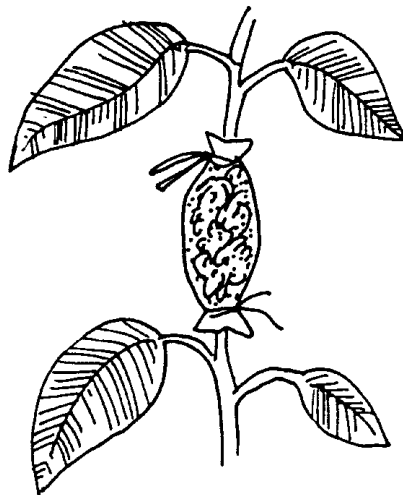
Adapted from Boodley, James W. *The Commercial Greenhouse*, 2nd ed. Albany, NY: Delmar Publishers, 1996.

Layering

Simple Layering



Air Layering



UNIT V: PLANT PROPAGATION

AS 5.2

Lesson 2: Asexual Propagation

Name _____

Asexual Propagation

Objective: Demonstrate a method of asexual propagation.

Directions: Select a plant to propagate. Gather the growing medium, root hormone, a bulb duster, sharp knives, and dibble sticks. Label the plant and the method of propagation.

1. What is the common name of the plant?

2. What is its binomial nomenclature?

3. What is the preferred method of propagation for this plant?

4. What method of asexual propagation did you use?

5. What are the steps involved?

6. How long does it take for the plant to propagate?

UNIT V: PLANT PROPAGATION

AS 5.3

Lesson 2: Asexual Propagation

Name _____

Budding and Tissue Culture

Objective: Differentiate between budding and tissue culture.

Directions: Answer the following questions about budding and tissue culture.

1. What is budding?
2. What steps are involved?
3. Budding is used on what type of plants? List at least three plants and give both the common name and binomial nomenclature.

Common Name

Binomial Nomenclature

A.

A.

B.

B.

C.

C.

4. Is this the only method applicable for this plant?
5. How cost-effective is it?
6. What is tissue culture?
7. What steps are involved?

Greenhouse Operation and Management

8. What equipment is needed?
9. Any there other special considerations or needs for this method of propagation?
10. Tissue culture is used on what type of plants? List at least three plants and give both the common name and binomial nomenclature.

Common Name

Binomial Nomenclature

A.

A.

B.

B.

C.

C.

11. Is this the only method used for this plant?
12. How cost-effective is it?
13. What equipment is needed?
14. Does this method of propagation require any other special considerations or needs?