

Lesson C1–3

Packaging Nursery Crops

Unit C. Nursery, Landscaping, and Gardening

Problem Area I. Nursery Production

Lesson 3. Packaging Nursery Crops

New Mexico Content Standard:

Pathway Strand: Plant Systems

Standard: III: Apply fundamentals of production and harvesting to produce plants.

Benchmark: III-B: Apply fundamentals of plant management to harvest, handle and store crops.

Performance Standard: 1. Determine crop maturity. 2. Identify harvesting practices and equipment. 3. Demonstrate common harvesting techniques. 4. Calculate yield and loss. 5. Identify options for crop storage. 6. Maintain quality of plant products in storage. 7. Prepare plants and plant products for distribution.

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

1. Describe the three types of packaging of nursery crops.
2. Describe how to ball and burlap (B&B) stock properly.
3. Explain the advantages and disadvantages of B&B, container, and bare root.
4. Describe the types of storage used for nursery stock.
5. Describe the techniques of defoliation of plants before storage.
6. List and describe the problems that might occur to plants in storage.
7. Describe the process of grading with calipers.

List of Resources. The following resources may be useful in teaching this lesson:

Recommended Resources. One of the following resources should be selected to accompany the lesson:

Schroeder, Charles B., et al. *Introduction to Horticulture*, Third Edition. Danville, Illinois: Interstate Publishers, Inc., 2000.

Other Resources. Some professional organizations include:

American Association of Nurserymen
1250 I Street NW Suite 500
Washington, D.C. 20005-3994
Phone 202-789-2900
Fax 202-789-1893

American Horticultural Society
P.O. Box 0105
Mt. Vernon, VA 22121-0105
Phone 703-768-5700

The Garden Council
500 N. Michigan Ave. #1400
Chicago, IL 60611
Phone 312-661-1700

List of Equipment, Tools, Supplies, and Facilities

Writing surface
Overhead projector
Transparencies from attached masters
Copies of student lab sheets
Graph paper
Rulers
Nursery catalogs—both for equipment and for plant material
Plant resource books
Calipers
Access to a variety of school trees
A Phone book
Access to transportation or a telephone

Terms. The following terms are presented in this lesson (shown in bold italics):

Balled and burlapped
Bare root
Caliper
Cold/refrigerated storage
Common or air-cooled storage
Containerized
Defoliation
Gas chambers
Mechanical beaters
Sweating

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.

Send students home to interview parents the night before beginning this unit. Use LS: C1–3A. They should question their parents about how the trees got in their front yard. Were they from a nursery? Which Nursery? How much did they cost? Was there a charge for planting? How much? How big were the trees when they were first planted? How were they packaged? Have the students discuss their answers in class.

Summary of Content and Teaching Strategies

Objective 1: Describe the three types of packaging of nursery crops.

Anticipated Problem: What are the three types of packaging?

- I. Generally, nursery crops are packaged in one of three ways.
 - A. ***Bare root*** involves harvesting trees without taking soil from the field.
 - B. ***Balled and burlapped*** harvesting plants with a soil ball around the roots. This is usually covered with burlap.
 - C. ***Containerized*** plants that are grown and then sold while in containers. The containers may be made of peat, clay, or plastic.

Begin this objective by reviewing the students' responses from LS: C1–3A—The Family Interview. Reinforce the idea that certain plants will transplant better and be healthier if they are packaged in one of the three ways. Emphasize that there are advantages and disadvantages for each type of packaging. Those will be discussed in Objective 3. Use TM: C1–3A to reinforce the three types of packaging.

Objective 2: Describe how to ball and burlap (B&B) stock properly.

Anticipated Problem: What is B&B? How is it done? What are the rules?

II. Balling and burlapping involves important guidelines and steps in order to be successful.

A. Guidelines for balling and burlapping.

1. This procedure can be done at any time of the growing season, but is most successful in the spring and fall.
2. Remember most of the tree's feeder roots are in the top 12–15 inches of topsoil, and that up to 60 percent of the feeder roots can extend beyond the tree's drip line.
3. B&B plants may lose up to 95 percent of feeder roots during transplanting.
4. The materials needed for B&B are a spade, twine, burlap, nursery pinning nails, a caliper, and a pair of hand pruners or a knife.
5. B&B may also be done with a mechanical digger. It is generally considered more efficient. It is also an expensive piece of equipment, may be limited in where and when it can dig, and may use special baskets and burlap. Employees need to be trained in its use.

B. Directions for ball and burlapping.

1. Determine which plant is to be dug. Is it the right time for this species?
2. Loosely wrap the plant branches with twine to keep them out of the way while digging.
3. Determine the size of the ball. A good rule of thumb is that the ball should be $\frac{1}{4}$ of the tree height, or, that for every inch of tree caliper the ball should be 12 inches wider. For example—on a 2 inch caliper tree the ball would be 24 inches wide. The ball should be 75 percent of the diameter in depth.
4. Remove debris from the digging area.
5. Mark the diameter of the ball with the spade.
6. Use a spade to dig a one foot deep circle trench around the ball. Try to ensure that the root system remains intact.
7. With the spade, begin tapering the ball and digging under the plant.
8. Place a sheet of burlap in the hole and slide it under the root ball.
9. Secure the burlap with pinning nails and twine.
10. Remove the ball gently from the ground.
11. Transport the ball to a permanent location.

This lesson can be greatly enhanced by actually taking the class outside and balling and burlapping a tree. If this is not possible, a video or classroom discussion about the steps should be used. Use TM: C1–3B to summarize the steps involved in balling and burlapping.

Objective 3: Explain the advantages and disadvantages of B&B, container, and bare root.

Anticipated Problem: What are the advantages and disadvantages associated with each type of packaging?

III. Balling and burlapping, container, and bare root packaging each have distinct advantages and disadvantages. They are as follows:

A. Advantages and disadvantages to B&B packaging are:

1. Advantages:
 - a. Can be dug and held for a period of time.
 - b. Digging and transplanting season can be extended.
 - c. Better for difficult to transplant species.
 - d. Larger plants can be harvested.
2. Disadvantages
 - a. May need specialized equipment.
 - b. Soil conditions can limit work.
 - c. Soil balls are heavy and large.
 - d. Product is hard to move.
 - e. Shipping is expensive.
 - f. More skilled labor is needed.
 - g. Long production cycle (2–10 years).

B. Bare root advantages/disadvantages are:

1. Advantages
 - a. Harvested plants are lightweight.
 - b. Shipping is more economical.
 - c. Initially less expensive to produce.
 - d. Can be dug in dormant seasons.
2. Disadvantages
 - a. Can only be used with smaller stock.
 - b. Limited digging/transplanting time.
 - c. Special storage facilities needed.
 - d. Only successful with certain plants.
 - e. Possible decay in storage.
 - f. Only used with deciduous plants.

C. Containers advantages/disadvantages are:

1. Advantages
 - a. Rapid production cycle.
 - b. Faster turnover of invested capital.
 - c. Plants are more uniform.

- d. Reduced shipping weight.
 - e. No need for land rotation.
 - f. Greater number of plants in a smaller area.
 - g. Less handling damage.
2. Disadvantages
- a. Can only be used with smaller stock.
 - b. Soil dries out quickly.
 - c. Susceptible to cold/winter damage.
 - d. Plants can become pot bound.
 - e. Growing media must be provided
 - f. Susceptible to blowing over.
 - g. More irrigation needed.

Use TM: C1–3C, TM: C1–3D, and TM: C1–3E to summarize the advantages and disadvantages of B&B, container, and bare root packaging. Lead a discussion on which method is used most in your area. Have the class suggest why this is so.

Objective 4: Describe the types of storage used for nursery stock.

Anticipated Problem: How is nursery stock stored?

IV. Types and guidelines of storage

- A. **Common or air-cooled storage**—These are insulated underground or frame structures where air is pulled through to cool the plants, but the air is not cooled mechanically.
- B. **Cold/refrigerated storage**—These are separate buildings or large rooms that are mechanically kept at 27–29°F or 32–40°F, depending upon the stored materials.
- C. Plant tissue must be mature before storing, this usually occurs after the first major fall frost. Leaves are removed before storage.

Preview this unit by discussing why plants are put into coolers—the main reason being to slow down growth. Lead a classroom discussion about the different types of storage. Use TM: C1–3F to summarize the content of the objective.

Objective 5: Describe the techniques of defoliation of plants before storage.

Anticipated Problem: What are the techniques of defoliation and how are they done?

- V. **Defoliation** is the mechanical, chemical, or cultural removal of leaves. It is done before plants are put into storage because if the leaves were to remain on the plant in cold storage the plant would lose too much moisture and would die. The techniques used in defoliation include:

- A. Chemical sprays—Leaf removal occurs in a short time after being sprayed and there is little to no plant damage.
- B. Mechanical beaters—**Mechanical beaters** are machines that the leafy part of the plant is fed into. The action of the beaters removes the leaves. Leaf removal is very quick, but there is more labor involved, more handling of the stock, and a greater chance of plant damage.
- C. **Gas chambers**—Special airtight chambers that are filled with ethylene gas, causing quick leaf drop. This is especially common for rose bushes.
- D. Sweating—**Sweating** is a process where plants are loosely bundled, piled in stacks on pallets, and thoroughly watered. Pallets are wooden structures used for transporting materials. Heat builds up causing leaf defoliation. This can cause damage if plants get overheated.

Lead a classroom about the different types of storage. Ask students to determine which method is least expensive. Also, have them consider what environmental regulations might apply. Use TM: C1–3F to assist in reinforcing the content.

Objective 6: List and describe the problems that might occur to plants in storage.

Anticipated Problem: How are plants handled in storage and what are some problems nurserymen might run into?

- VI. The storage of plants requires careful handling guidelines in order to prevent problems.
 - A. Storage guidelines and information.
 - 1. In the initial handling after plants have been harvested, they are immediately graded and sorted, and then either stored or merchandised.
 - 2. Before they are bundled they are labeled and graded by size. Small sized, 1-year liners are usually bundled in 50's or 100's. Fruit trees and deciduous shrubs are usually bundled in 10's.
 - 3. When storing, plants are usually stacked on wooden pallets in ricks (stalls) laid horizontally, with their roots to the aisles.
 - B. Storage problems
 - 1. Drying of roots—A relative humidity of 80–85 percent, and covering the roots with sphagnum moss, cedar or fir shavings should help to prevent this.
 - 2. Mold development—The best way to prevent this is to only store clean, disease free stock, and to watch for mold development. Dusting with a fungicide or using ultraviolet lights in the storage area can help prevent mold growth.

Visit a local nursery to watch the handling and storage of stock. Ask the nursery manager to describe the importance of proper handling and storage.

Objective 7: Describe the process of grading with calipers.

Anticipated Problem: How and why do we measure trees with a caliper?

VII. Calipers are an important tool used in the nursery industry.

- A. A **caliper** is a tool shaped like a pair of tweezers. It is opened and placed so that each “arm” is touching the trunk. A measurement of inches is read off of the caliper. Remember to measure your tree 12" off of the ground if it is over a 4-inch diameter trunk, and 6 inches off of the ground if it is a 4-inch diameter trunk or less.
- B. It is a standard form of measurement in the industry. It assures the consumer that a given tree can be compared to a similar tree. It also helps in pricing and evaluation of a tree.

Use LS: C1–3B to help students understand the use of a caliper. Also, have them read the appropriate sections in the suggested reference. Use classroom discussion to identify any areas that need to be covered again.

Review/Summary. Focus the review and summary of the lesson around the learning objectives. Call on students to explain the content and particularly the vocabulary associated with each objective. Use their responses as the basis for determining any areas that need re-teaching. Teacher generated questions or the questions at the end of the chapters in the recommended textbook may also be used as review

Application.

LS: C1–3A—Family Tree Questionnaire

LS: C1–3B—Caliper a School Tree

Evaluation. Sample Test and Lab Sheet responses and products produced.

Answers to Sample Test:

Part One: Matching

1=e, 2=b, 3=g, 4=a, 5=c, 6=f, 7=d

Part Two: Completion

1. Gas chambers, chemical sprays, and mechanical beaters
2. 80 to 85 percent
3. Dusting with fungicide and ultraviolet light
4. Store only clean, disease free stock, and watch for mold development
5. Grading

Part Three: Short Answer

1. The roots should be covered to keep them from drying out.
2. Sweating is a process where plants are loosely bundled, piled in stacks on pallets, and thoroughly watered. Heat builds up causing leaf defoliation.
3. Chemical sprays, mechanical beaters, and gas chambers. Sweating is also acceptable.
4. Common or air-cooled storage—These are insulated under ground or frame structures where air is pulled through to cool the plants, but the air is not cooled mechanically.
Cold/refrigerated storage—These are separate buildings or large rooms that are mechanically kept at 27–29°F or 32–40°F, depending upon the stored materials.
5. Bare root—Harvesting without taking soil from the field.
Balled and burlapped—Harvesting plants with a soil ball around the roots. This is usually covered with burlap.
Containerized—Plants that are grown and then sold while in containers. The containers may be made of peat, clay, or plastic.
6. Advantages—Rapid production cycle, faster turnover of invested capital, plants are more uniform, reduced shipping weight, no need for land rotation, greater number of plants in a smaller area, less handling damage.
Disadvantages—Can only be used with smaller stock, soil dries out quickly, susceptible to cold/winter damage, plants can become pot bound, growing media must be provided, susceptible to blowing over, more irrigation needed.

Test

Lesson C1–3: Packaging Nursery Crops

Part One: Matching

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

- | | |
|----------------------|-------------------------|
| a. mechanical beater | e. balled and burlapped |
| b. caliper | f. bare root |
| c. defoliation | g. container |
| d. sweating | |

- _____ 1. harvesting plants with a soil ball around the roots.
- _____ 2. used to measure the diameter of a tree trunk.
- _____ 3. growing and then selling plants while they are in containers.
- _____ 4. a machine that defoliates plants.
- _____ 5. a process of removing leaves.
- _____ 6. harvesting without taking soil from the field.
- _____ 7. a process of removing leaves by the buildup of heat.

Part Two: Completion

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

1. _____, _____, and _____ can be used to defoliate plants.
2. Relative humidity of _____ to _____ percent is needed for optimum storage.
3. _____ and _____ can help to prevent mold growth.
4. The best way to prevent mold is to _____ and to _____.
5. Arranging or sorting plants according to size is called _____.

Part Three: Short Answer

Instructions. Provide information to answer the following questions.

1. Why should the roots of stored plants be covered?
2. What is the purpose of sweating and how is it done?
3. List three ways plants are defoliated before storage.
4. How does common storage differ from cold storage?
5. Describe the three types of packaging.
6. List the advantages and disadvantages of container plants.

CONTAINER, BARE ROOT, AND B&B



Containerized

Bare root

Balled and burlapped

(Courtesy, Interstate Publishers, Inc.)

Container—container plants describes plants that are grown in a container filled with a special media, rather than in a field.

Bare root—Bare root describes plants that are grown in a field and then dug up with out a soil ball. Bare root plants have exposed roots, are usually sold in bundles, and are usually liner plants or hedge type plants.

Balled and burlapped—B&B describes plants that are grown in a field, dug up with a ball of soil surrounding their root system and then covered with a burlap material.

BALLING AND BURLAPPING TREES

- 1. Determine which plant is to be dug.**
- 2. Loosely wrap the plant branches with twine to keep them out of the way.**
- 3. Determine the size of the ball.**
- 4. Remove debris from the digging area.**
- 5. Mark the diameter of the ball with the spade.**
- 6. Use a spade to dig a 1 foot deep circle trench around the ball. Try to keep the root system intact.**
- 7. With the spade begin tapering the ball and digging under the plant.**
- 8. Place a sheet of burlap in the hole and slide it under the root ball.**
- 9. Secure the burlap with pinning nails and twine.**
- 10. Remove the ball gently from the ground.**
- 11. Transport the ball to a permanent location.**

ADVANTAGES AND DISADVANTAGES OF B&B

Advantages

- Can be dug and held for a period of time.
- Digging and transplanting season can be extended.
- Better for difficult to transplant species.
- Larger plants can be harvested.

Disadvantages

- May need specialized equipment.
- Soil conditions can limit work.
- Soil balls are heavy and large.
- Product is hard to move.
- Shipping is expensive.
- More skilled labor is needed.
- Long production cycle (2–10 years).

ADVANTAGES AND DISADVANTAGES OF BARE ROOT

Advantages

- **Harvested plants are lightweight.**
- **Shipping is more economical.**
- **Initially less expensive to produce.**
- **Can be dug in dormant seasons.**
- **Possible decay in storage.**

Disadvantages

- **Can only be used with smaller stock.**
- **Limited digging/transplanting time.**
- **Special storage facilities needed.**
- **Only successful with certain plants.**
- **Only used with deciduous plants.**

ADVANTAGES AND DISADVANTAGES OF CONTAINERS

Advantages

- Rapid production cycle.
- Faster turnover of invested capital.
- Plants are more uniform.
- Reduced shipping weight.
- No need for land rotation.
- Greater number of plants in a smaller area.
- Less handling damage.

Disadvantages

- Can only be used with smaller stock.
- Soil dries out quickly.
- Susceptible to cold/winter damage.
- Plants can become pot bound.
- Growing media must be provided.
- Susceptible to blowing over.
- More irrigation needed.

STORAGE AND DEFOLIATION

- I. Storage**
 - A. Common or air-cooled storage**
 - B. Cold/refrigerated storage**
- II. Defoliation—Leaves are removed before storage**
 - A. Chemical sprays**
 - B. Mechanical beaters**
 - C. Gas chambers**
 - D. Sweating**

Lab Sheet.

Caliper School Trees

This lab sheet is intended to teach the student how to caliper a tree.

Objective:

This is an opportunity for the student to learn how to caliper a tree.

Materials:

caliper
access to a variety of school trees

Procedure:

1. Teacher and students should locate trees on the school grounds.
2. The teacher should demonstrate the process of calipering a tree.
3. Students either individually or in small groups should be sent to caliper a tree.
4. The teacher should check for accuracy.
5. Remember, measure your tree 12 inches off of the ground if it is over a 4 inch diameter trunk, and 6 inches off of the ground if it is a 4 inch diameter trunk or less.

Questions:

1. What was your tree caliper?
2. What was the name of your tree?
3. Where was your tree located?
4. Where did you measure your tree? Why?