Lesson B1–8

Growing and Forcing Bulbs, Corms, and Tubers

Unit B. Floriculture

Problem Area 1. Greenhouse Crop Production

Lesson 8. Growing and Forcing Bulbs, Corms, and Tubers

New Mexico Content Standard:

Pathway Strand: Plant Systems

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

Benchmark: III-A: Apply fundamentals of plant management to develop a production plan.

Performance Standard: 1. Identify and select seeds and plants. 2. Manipulate and evaluate environmental conditions (e.g., irrigation, mulch, shading) to foster plant germination, growth and development. 3. Evaluate and demonstrate planting practices (e.g., population rate, germination/seed vigor, inoculation, seed and plant treatments). 6. Control plant growth (e.g., pruning, pinching, disbudding, topping, detasseling, staking, cabling, shearing, shaping).

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

1. Distinguish differences between bulbs, corms, tubers, and rhizomes.
2. Describe production practices for potted tulips.
3. Explain how potted daffodils are forced.
4. Describe techniques used to force hyacinths.
5. Discuss forcing schedules for crocus, dwarf iris, and grape-hyacinth.
6. Describe forcing techniques used for Asiatic and Oriental lilies.
7. Discuss production practices for amaryllis.
**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:


**Other Resources.** The following resources will be useful to students and teachers:


**List of Equipment, Tools, Supplies and Facilities**

- Writing surface
- Overhead projector
- Transparencies from attached masters
- Computer
- LCD projector
- Bulbs, corms, and tubers

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

- Amaryllises
- Asiatic lilies
- Basal plate
- Bulbs
- Corms
- Crocus
- Daffodils
- Double nose (DN)
- Dwarf iris
- Grape-hyacinth
- Hyacinth
- Non-tunicate bulb
- Nose
- Oriental lilies
- Rhizome
- Rooting room A
- Rooting room B
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.

Bring a variety of bulbs, corms, tubers, and rhizomes to class. Give the students the opportunity to examine the structures. Ask the students whether they can identify any of them. As their interest grows, shift the discussion towards bulb production and what is required to get them to flower at different times of the year.

Summary of Content and Teaching Strategies

Objective 1: Distinguish differences between bulbs, corms, tubers, and rhizomes.

Anticipated Problem: What is the difference between bulbs, corms, tubers, and rhizomes?

I. In the horticulture industry, greenhouse crops that have bulbs, corms, tubers, or rhizomes are often clumped together and called bulbs. However, morphological differences do exist between those structures.

   A. **Bulbs** are short, flattened stems that bear fleshy, food-storage leaves.
      1. They may have a papery covering, known as a **tunic** and be considered a **tunicate bulb** or they may lack the covering and be regarded as a **non-tunicate bulb**.
      2. Bulbs consist of numerous modified leaves that store food and water, known as **scales**, that are held together at the bottom of the bulb by a hardened portion of stem tissue known as the **basal plate**.
   
   B. **Corms** are short, swollen, underground stems.

   C. **Tubers** are defined as underground stems that have no papery coverings or basal plate.

   D. A **rhizome** is a horizontal underground stem.

Assign the section regarding bulbs in Floriculture: From Greenhouse Production to Floral Design as a reading activity for homework or during supervised study. After the students have completed the reading assignment, discuss the differences between common “bulb” structures. Have examples of the bulbs on hand for the students to see and identify. Use TM: B1–8A to show the various bulb, corm, and tuber structures.
Objective 2: Describe production practices for potted tulips.

Anticipated Problem: What are production practices for potted tulips?

III. Tulips are available in nearly every color and are perhaps the best known spring flowering bulb. Pot tulips are very popular between January and mid-May.

A. Tulips are purchased as precooled or non-precooled bulbs. Precooled bulbs require 10–12 weeks of cold treatment, while non-precooled bulbs need 15–16 weeks of cold treatment. (The terms precooled and non-precooled are defined in Lesson B1–7.)

B. Bulbs are potted upon arrival with the flat side of the bulb towards the side of the pot and the nose or tip of the bulb just below the medium.

C. Tulip production is divided into two groups for forcing.

D. Rooting room A involves a schedule that forces flowering before February 14. These bulbs should be obtained and potted in mid-September.

1. Rooting room B involves a production schedule that forces flowering after February 14. Bulbs for later forcing should be potted near the beginning of October.

2. Bulbs are placed in the rooting room kept at 48°F for 4–6 weeks to develop the root systems. The temperature is then lowered to 41°F until the shoots are 1" high. The final stage involves lowering the temperature to 31 to 35°F for the duration of the cold treatment.

E. Potted tulips are forced in the greenhouse at temperatures around 60°F and light intensities between 1,000 and 2,500 foot candles.

Have the students read the appropriate sections in Floriculture: From Greenhouse Production to Floral Design. Have the students pursue additional information through the Internet concerning the history and production of tulips. Lead a class discussion on the tulip production and the importance of the tulip to the floriculture industry. During the discussion cover general information regarding the potted tulips. Use TM: B1–8B for the identification of a potted tulip and TM: B1–8C to discuss the life cycle of a tulip. Require the students to take notes during the discussion. Use questioning during the discussion to determine the level of student understanding of the topic.

Enhance the learning experience for the students by having them force a tulip crop. Purchase bulbs in the fall. Have the students pot the bulbs and develop a forcing schedule, possibly for a holiday sale. TM: B1–8D should be used to show proper potting techniques. Involve students caring, marketing, and selling the crop.
Objective 3: Explain how potted daffodils are forced.

Anticipated Problem: How are potted daffodils are forced?

IV. Potted daffodils are very popular because of their familiar bright yellow flowers. They are forced for sales from January through April.

A. Double nose (DN) bulbs or bulbs with two tips are generally used for potted plants. In the planting process, the nose of the bulb is left uncovered. They are purchased as precooled or non-precooled bulbs.

B. Most varieties require a total of 15–16 weeks of cooling.

C. Potted bulbs are given 48°F for 4–6 weeks for root development. Temperatures are then dropped to 41°F until shoots are 1" high. Then, temperatures are lowered to 32–35°F for the remainder of the cold requirement.

D. Force daffodils at 60–63°F night temperatures and provide 2,500 foot candles of light.

Have the students read portions of Floriculture: From Greenhouse Production to Floral Design that relate to potted daffodils as a homework assignment or during supervised study. Require students to take notes on the major points as they read. Follow the reading assignment with a class discussion on how to schedule and grow a crop. Use visual aids to outline key elements involved in crop production. TM: B1–8E can be used for identification purposes. Use TM: B1–8F to show single, double, and triple nose daffodil bulbs. Monitor students’ mastery of the material through the discussion.

Schedule and force a daffodil crop using a cooler and the school greenhouse. Involve the students in the production of the crop from potting to sale. Have students perform tasks involved in production including the potting, watering, and adjusting temperatures. Where possible, include industry people in the lesson. Seek help from a grower in scheduling and forcing the crop. Arrange to have a grower speak to the class about how to force a crop. Set up a field trip to a commercial greenhouse.

Objective 4: Describe techniques used to force hyacinths.

Anticipated Problem: What techniques are used to force hyacinths?

V. Hyacinths, valued for their fragrant, purple, white, or pink flowers, are bulbs sold primarily in January and February.

A. Prepared bulbs require 10 weeks of cold, while regular bulbs need 13 weeks. Regular bulbs tend to develop into better looking plants than prepared.

B. Pot hyacinths in well-drained medium in short bulb pans. Root the bulbs at 48–50°F for four weeks. Then, drop temperatures to 41°F until shoots are 1” high. Lower the temperature to between 33 and 35°F until it is time to force.

C. Force hyacinths for January and February crops at 65°F. Give December crops 73°F and crops later than February 60°F.
D. One common problem with hyacinths known as splitting occurs when temperatures fluctuate or bulbs freeze. **Splitting** is when the flower stalk separates from the bulb and fails to develop.

Have the students read the appropriate sections in Floriculture: From Greenhouse Production to Floral Design. Follow the reading with a class discussion on the hyacinth production. During the discussion, require the students to take notes. Use questioning to determine the level of student understanding of the topic. Schedule a crop to be forced in the school greenhouse. Show TM: B1–8G for identification of a hyacinth.

**Objective 5:** Discuss forcing schedules for crocus, dwarf iris, and grape-hyacinth.

**Anticipated Problem:** What forcing schedules are used for crocus, dwarf iris, and grape-hyacinth?

VI. **Crocus** (corm), **dwarf iris** (rhizome), and **grape-hyacinth** (bulb) have similar forcing requirements and are therefore, often grouped together.

A. Pot the bulbs immediately upon arrival, just covering the tops of the bulbs with medium.

B. Provide 48°F temperatures until the roots emerge through the bottoms of the pots, usually after 4–6 weeks. Lower the temperature to 41°F until the shoots elongate to about 1”. At that point, give the bulbs required cold treatment at 32–35°F. Pre-cooled bulbs need about 9–10 weeks while non-precooled bulbs need 15–16 weeks.

C. Crocuses and dwarf iris force very quickly, while grape-hyacinths take longer. Force these bulbs at 55–60°F nights and 60–63°F days. Provide 1,000 to 2,500 foot candles of light.

Have the students read portions of Floriculture: From Greenhouse Production to Floral Design related to the forcing of crocus, dwarf iris, and grape-hyacinth as a homework assignment or during supervised study. Require students to take notes on the major points as they read and during a class discussion that should follow. Use visual aids to outline key elements involved in crop production. Use TM: B1–8H, TM: B1–8I, and TM: B1–8J for the purpose of identifying potted crocus, dwarf iris, and grape-hyacinths respectively.

Schedule, pot, and force crocus, dwarf iris, and grape-hyacinth in the school greenhouse. Involve the students throughout the process. Arrange to have a grower speak to the class about how to schedule a crop or set up a field trip to a commercial greenhouse. Prepare students in advance to ask the grower questions regarding production.
Objective 6: Describe forcing techniques used for Asiatic and Oriental lilies.

Anticipated Problem: What forcing techniques are used for Asiatic and Oriental lilies?

VII. Asiatic lilies and Oriental lilies varieties produce bright yellow, white, red, and orange flowers. They are forced throughout the year.

A. The supplier precools most Asiatic and Oriental lilies so no cooling is required by the forcer.
B. Bulbs should be potted in deep pots with a well-drained medium.
C. Force Asiatic lilies at 55–60°F nights and 70°F days.
D. Force Oriental lilies at 65–67°F nights and 75°F days.
E. Employing DIF can effectively control the height of the lilies.

Have the students read about growing and forcing Asiatic and Oriental lilies in Floriculture: From Greenhouse Production to Floral Design. Review the reading material through class discussion. During the review have the students take notes. Enhance the discussion by building an outline of key points on a chalkboard or with an overhead projector. Another suggestion is to show a multi-media presentation from which students would be required to take notes. Use TM: B1–8K to identify an Asiatic lily and TM: B1–8L to identify an Oriental lily.

Objective 7: Discuss production practices for amaryllis.

Anticipated Problem: What production practices are used for amaryllis?

VII. Amaryllises are a tropical bulb with large, colorful flowers. They are grown like houseplants and no cooling is required.

A. Pot amaryllis bulbs upon arrival leaving the shoulders of the bulb uncovered.
B. Grow the bulbs at 70–80°F with light intensities between 2,500 and 5,000 foot candles. Amaryllis flower about 8 weeks after potting.
C. Amaryllis can be re-forced in the home. In September, stop watering and place the plants in 50–60°F. The bulbs go dormant and can be cleaned and re-potted for a new growing cycle.

Prepare the students by having them read related sections in Floriculture: From Greenhouse Production to Floral Design. Follow the reading with a discussion on scheduling and forcing and amaryllis crop. Use the discussion as a way to monitor students’ mastery of the material.

Enhance the learning experience on how to schedule and force amaryllis by involving the students in the production practices including the potting, watering, fertilizing, adjusting and temperatures. TM: B1–8M can be used for identifying an amaryllis.
**Review/Summary.** Focus the review and summary of the lesson around the student learning objectives. During class discussions, call on students to explain the content associated with each objective. Use their responses as the basis for determining any areas that need re-teaching. Questions at the end of the chapters in the textbook may also be used in the review/summary. Reinforce student learning by scheduling and forcing bulb crops in the school greenhouse.

**Application.** Force bulbs in the school greenhouse. Give the students the responsibility for scheduling and caring for the bulbs. Have them keep records on the tasks they perform. Students should research the specific cultural requirements for the bulbs grown and follow the recommended guidelines for forcing.

**Evaluation.** Focus on student achievement of the objectives set for the lesson when evaluating student performance. Use various evaluation techniques, such as student performance during oral review of the material, practical application of skills in the greenhouse setting, completion of laboratory sheets, and a written exam. A sample written test is attached.

**Answers to Sample Test:**

*Part One: Matching*

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

*Part Two: Completion*

1. precooled, non-precooled
2. flat side of the bulb
3. Asiatic lilies, Oriental lilies
4. Re-forced
5. Crocus, dwarf iris
6. Nose
7. Bulbs
8. Scales
9. Rhizome
10. Corms

*Part Three: Short Answer*

<table>
<thead>
<tr>
<th>Bulb crop</th>
<th>Rooting treatment</th>
<th>Cold treatment</th>
<th>Forcing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amaryllis</td>
<td>None</td>
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<td>70–80°F with light intensities between 2,500 and 5,000 foot candles.</td>
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Test

Lesson B1–8: Growing and Forcing Bulbs, Corms, and Tubers

Part One: Matching

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

a. Amaryllis  e. Hyacinth  i. Tulip
b. Daffodil  f. Rooting room A  j. Tunicate bulb
c. Double nose  g. Rooting room B
d. Dwarf iris  h. Splitting

1. Bulb valued for its fragrant, purple, white or pink flowers, sold primarily in January and February.
2. Rhizome plant with similar forcing requirements as crocus and grape-hyacinth.
3. Bulbs that have a papery covering, known as a tunic.
4. Bulbs with two tips recommended for use as potted daffodils.
5. When the flower stalk of a hyacinth separates from the bulb and fails to develop.
6. Involves a schedule that forces tulip flowering before February 14.
7. Available in nearly every color and are perhaps the best known spring flowering bulb.
8. Very popular bulbs because of their familiar bright yellow flowers. They are forced for sales from January through April.
9. Involves a production schedule that forces tulip flowering after February 14.
10. Tropical bulb with large, colorful flowers. They are grown like houseplants and no cooling is required.

Part Two: Completion

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

1. Tulips are purchased as ____________ or ______________ bulbs.
2. Tulip bulbs are potted upon arrival with the _______________towards the side of the pot.

3. _______________ and _______________ produce bright yellow, white, red, and orange flowers, and are forced throughout the year.

4. Amaryllis can be ______________ in the home.

5. _______________ and _______________ force very quickly.

6. The tip of the bulb is known as the _______________.

7. _______________ are short, flattened stems that bear fleshy, food-storage leaves.

8. _______________ are modified leaves that store food and water.

9. A _______________ is a horizontal underground stem.

10. Short, swollen, underground stems are called _______________.

**Part Three: Short Answer**

*Instructions.* Provide information to answer the following questions.

1. Complete the table below by filling in the blank spaces in the columns.

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BULBS

DAFFODIL

LILY

TULIP

CORMS

GLADIOLUS

FREESIA

CORUS

TUBERS

CALADUIM

GLOXINIA

TUBEROUS BEGONIA

(scale, basal plate, roots, bud, dry leaf bases, basal plate, roots, root, bud, bud, bud, roots, root, bud, root, root)

(Courtesy, Interstate Publishers, Inc.)
POTTED TULIP

(Courtesy, International Flower Bulb Centre)
BULB GROWTH CYCLE

BULB CLUSTERS ARE DIVIDED

FLOWERS FORM AND DEVELOP

BULBS ARE PLANTED AND ROOT

MOTHER BULB FLOWERS

BULBS OVERWINTER

BULBETS ENLARGE

MAIN BULB

SPRING

SUMMER

WINTER

FALL
POTTING TULIPS

Fill container to within 2" of the top of the pot with planting medium.

Place bulbs so the nose of each is about even with the top of the container. The flat side of the tulip bulbs should face outward.

Cover the bulbs with planting medium.

SYSTEM OF LABELING POTS OR FLATS

FLOWERING PERIOD
GROUP NUMBER

CT-1
3
CULTIVAR NAME
DAFFODIL
DAFFODIL BULBS

Single Nose  Double Nose  Triple Nose
HYACINTH
CROCUS

(Courtesy, International Flower Bulb Centre)
DWARF IRIS

(Courtesy, International Flower Bulb Centre)
GRAPE HYACINTH

(Courtesy, International Flower Bulb Centre)
ASIATIC LILY

(Courtesy, International Flower Bulb Centre)
ORIENTAL LILY

(Courtesy, International Flower Bulb Centre)
AMARYLLIS

(Courtesy, DeVroomen Holland Garden Products)