Lesson B1–7

Forcing Easter Lilies

Unit B. Floriculture

Problem Area 1. Greenhouse Crop Production

Lesson 7. Forcing Easter Lilies

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. Describe Easter lilies in general.
2. Explain how Easter lilies are propagated.
3. Discuss the pre-cooling treatment Easter lilies are given prior to potting.
4. Explain the major steps in growing and forcing Easter lilies.
5. Identify major Easter lily pests and disorders, as well as controls.

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:

Biondo, Ronald J. and Dianne A. Noland. *Floriculture: From Greenhouse Production to Floral Design.* Danville, Illinois: Interstate Publishers, Inc., 2000.

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

Boodley, James W. *The Commercial Greenhouse,* Second Edition. Albany, New York: Delmar Publishers, 1998.

Ball, Vic. *Ball RedBook,* Sixteenth Edition. Batavia, Illinois: Ball Publishing, 1998.

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

McMahon, Robert W. *An Introduction to Greenhouse Production*. Columbus, Ohio: Ohio Agricultural Education Curriculum Materials Service, The Ohio State University.

List of Equipment, Tools, Supplies and Facilities

Writing surface
Overhead projector
Transparencies from attached masters
Copies of student lab sheet
Computer
LCD projector

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

'Ace'
Basal plate
Bulbs
Bulblets
Case cooled by forcer
Case cooled by supplier
Controlled temperature forcing (CTF)
Easter lilies
Forcing
Leaf counting
Natural cooling
'Nellie White'
Non-precooled bulbs

Non-tunicate bulbs
Precooled bulbs
Scales
Scalettes
Vernalization

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 lily bulb to class. Set it on the front desk or table. Curious students will ask what it is as they enter the classroom. Avoid giving them the answer until the attention and curiosity of the entire class has grown. Then, ask if any of them ever have Easter lilies in the spring. Ask what they know about Easter lilies. The discussion can range from religious uses to Easter lilies that have been planted in the garden. From this point move on by stating the lesson and the objectives to be covered.

Summary of Content and Teaching Strategies

Objective 1: Describe Easter lilies in general.

Anticipated Problem: What is the general background of the Easter lily?

I. ***Easter lilies*** are grown in the United States and Canada as potted plants for the Easter holidays.

   A. They are valued for their large white, fragrant, trumpet-shaped flowers borne on a single stem.

   B. The two most popular varieties are '***Nellie White***' and '***Ace***.'

      1. 'Nellie White' grows shorter than 'Ace.'
      2. 'Nellie White' produces about 7–8 flowers from a 10- to 11-inch bulb, while 'Ace' produces around 9 flowers from a 10- to 11-inch bulb.
      3. 'Nellie White' is cooled at 44 to 46°F, and 'Ace' is cooled at 39–41°F.

   C. Easter lilies are a relatively difficult crop to grow because Easter falls on a different date each year.

   D. Easter lilies are ***bulbs*** or short, flattened stems that bear fleshy, food-storage leaves. More specifically, they are ***non-tunicate bulbs***, meaning they lack a covering that would conceal and protect the scales. The bulbs consist of numerous ***scales***, which are modified leaves that store food and water. The scales are held together at the bottom of the bulb by a hardened portion of stem tissue known as the ***basal plate***.

   E. Easter lilies are produced along the Pacific coast of California and Oregon where the weather is cool and wet all year.

Have the students read the appropriate sections in Floriculture: From Greenhouse Production to Floral Design. As they read the material during supervised study or as homework require them to take notes on the key points. Lead a class discussion on Easter lily bulbs and terms related to bulbs. Require the students to take notes during the discussion. Determine the level of student understanding of the topic through questions asked during the discussion. Use TM: B1–7A for identification of Easter lilies. Use TM: B1–7B for identification of the different parts of a lily bulb.

Objective 2: Explain how Easter lilies are propagated.

Anticipated Problem: How are Easter lilies propagated?

II. Propagation is done asexually by bulblets and scalettes.

A. ***Bulblets*** are small bulbs that form along the underground stem of a mature lily.

B. ***Scalettes*** are small bulbs produced from the scales that have been removed from the basal plate of a bulb and planted.

C. It takes three years to produce a commercial bulb from a bulblet or scalette.

D. Easter lily bulbs are measured in circumference and sold in sizes of 6½ to 7, 7 to 8, 8 to 9, 9 to 10, and 10 to 11 inches.

Have the students read the section on Easter lily propagation in Floriculture: From Greenhouse Production to Floral Design. Enhance the lesson with hands-on activities. Obtain Easter lily bulbs for the students to dissect in class. Have the students take the bulbs apart, and as they do so, have them note the non-tunicate nature of the bulb and identify the scales and basal plate. Have them place removed scales in moistened perlite and store for several months in a plastic zipper bag. In that period of time scalettes should begin to form. Use TM: B1–7C to illustrate propagation of lilies by scales and to demonstrate how scalettes form on scales.

Objective 3: Discuss the pre-cooling treatment Easter lilies are given prior to potting.

Anticipated Problem: What is the pre-cooling treatment Easter lilies receive prior to planting?

III. Easter lily bulbs require a cold period or ***vernalization*** in order to flower. The vernalization period for Easter lilies is 1,000 hours or around 6 weeks of cold temperatures. Once cooled the bulbs are forced. ***Forcing*** is a term used to describe conditions given to get bulbs to grow and flower.

A. Suppliers provide bulbs that have been pre-cooled or bulbs that are said to be non-precooled.

1. ***Pre-cooled bulbs*** have been given the necessary amount of cold treatment to flower.
2. ***Non-precooled bulbs*** have not been given cold treatment.

B. There are four accepted methods of cooling Easter lilies.

1. ***Controlled temperature forcing (CTF)*** is a method whereby the grower purchases non-precooled bulbs, pots them upon arrival, places at 63°F for three weeks, cools for a thousand hours, then forces.

2. ***Natural cooling*** involves potting non-precooled bulbs upon arrival and cooling them naturally in a polyhouse.
3. ***Case-cooled by supplier*** indicates the supplier has cooled the bulbs in their packing cases. These are potted on arrival and forced.
4. ***Case cooled by forcer*** indicates the bulbs are received by the grower, kept in their packing cases for cooling, then potted and forced.

Have the students read the section on the cooling of Easter lilies in Floriculture: From Greenhouse Production to Floral Design. Review the reading material through class discussion. During the discussion use a chalkboard, overhead projector, or LCD projector to help explain the different cooling treatments used in Easter lily production.

Objective 4: Explain the major steps in growing and forcing Easter lilies.

Anticipated Problem: What are the major steps in growing and forcing Easter lilies?

IV. Growing and forcing occurs after the bulbs have received the required cold treatment.

A. Potting and medium selection are important in Easter lily production.
   1. Six-inch lily pots are commonly used.
   2. The medium should have a high bulk density and have a pH between 6.5 and 7.0.
   3. When potting the bulbs, place them near the bottom of the pot. This encourages the formation of stem roots that help stabilize the plant.

B. Water the Easter lilies infrequently at first, allowing the medium to dry between waterings. Fertilize at 250 ppm nitrogen and potassium if soilless medium is used and 200 ppm N and K if the medium contains soil.

C. For controlled temperature forcing and natural cooled bulbs give the bulbs 50 to 60°F temperatures, cool, then force. Precooled and case cooled bulbs are potted, placed under 50 to 60°F temperatures for one to two weeks, and then forced.
   1. It normally takes between 110 and 115 days to force an Easter lily crop.
   2. Greenhouse temperatures influence the rate of forcing. Warmer temperatures speed development.
   3. Typically, Easter lilies are forced at 63 to 65°F nights.
   4. With late Easters, bulbs are forced at around 60°F nights.
   5. Flower buds should be visible around Ash Wednesday.
   6. ***Leaf counting*** is a practice used to monitor the progress of a crop. It is a two part process that involves marking, counting, and removing leaves.
   7. DIF and growth retardants, including A-rest, are effective in controlling the height of Easter lilies.

Have the students read about growing and forcing Easter 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 PowerPoint presentation from which students would be required to take notes. The best teaching strategy might be the actual growing and forcing of an Easter lily crop. If the school has a greenhouse, purchase pre-cooled bulbs. Pot them and force them for Easter sales. Apply the approved practices discussed in the reading, including correct potting, temperature control, watering, and leaf counting. TM: B1–7D should be used to show how to properly pot Easter lily bulbs. A visit to a local greenhouse operation that produces Easter lilies would give students an opportunity to see how Easter lilies are grown in the industry. Use LS: B1–7A as a class activity to determine the growth rate of lilies in the school greenhouse. TM: B1–7E can be used to illustrate the effect of DIF on Easter lily height.

Objective 5: Identify major Easter lily pests and disorders, as well as controls.

Anticipated Problem: What are major Easter lily pests and diseases and some means of control?

V. Easter lilies have mite, insect, fungus and virus problems.

   A. Bulb mites are a serious problem that can stunt or deform plants. A recommended control is for the forcer to dip the bulbs in a miticide prior to planting.
   B. Insect pests include aphids and fungus gnats.
   C. Root rot caused by a fungus, *Rhizoctonia*, can be a problem, particularly if the growing medium is kept too moist. *Botrytis* can damage the flowers.
   D. Virus infections are also known to deform flowers.

Have the students read the section in Floriculture: From Greenhouse Production to Floral Design related to pest and disorders of Easter lilies. If the students are growing an Easter lily crop, help them set up a schedule for monitoring pest populations. Involve the students in managing the pests and disorders through approved practices.

Review/Summary. At the conclusion of the lesson, restate the student learning objectives. Focus the review of the material covered around those objectives. 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. Use the school greenhouse to have students schedule and grow an Easter lily crop to reinforce student learning.

Application. Application can involve the following student activity using the attached lab sheets:

LS: B1–7A—Monitoring Easter Lily Progress by Leaf Counting

Evaluation. Evaluation should focus on student achievement of the objectives for the lesson. Use various evaluation techniques, such as student performance during oral review of the material, application of skills in the greenhouse setting, completion of the laboratory sheet, and a written exam. A sample written test is included with this lesson and can be adapted to local needs.

Answers to Sample Test:

Part One: Matching

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

Part Two: Completion

1. Nellie White, Ace
2. Controlled Temperature Forcing (CTF)
3. Easter falls on a different date each year
4. Natural cooling
5. Pacific coast of California and Oregon
6. Case cooled by supplier
7. DIF and growth retardants
8. Basal plate
9. Case cooled by forcer
10. Near the bottom, stem roots
11. 110 and 115

Part Three: Short Answer

1. Nellie White' grows shorter than 'Ace.'

   'Nellie White' produces about 7–8 flowers from a 10- to 11-inch bulb, while 'Ace' produces around 9 flowers from a 10- to 11-inch bulb.

   'Nellie White' is cooled at 44 to 46°F, and 'Ace' is cooled at 39–41°F.

2. Easter lily bulbs are measured in circumference and sold in sizes of 6½ to 7, 7 to 8, 8 to 9, 9 to 10, and 10 to 11 inches.

3. Controlled temperature forcing (CTF) is a method whereby the grower purchases non-precooled bulbs, pots them upon arrival, places at 63°F for three weeks, cools for a thousand hours, then forces.

   Natural cooling involves potting non-precooled bulbs upon arrival and cooled naturally in a poly-house.

   Case-cooled by supplier indicates the supplier has cooled the bulbs in their packing cases. These are potted on arrival and forced.

   Case cooled by forcer indicates the bulbs are received by the grower, kept in their packing cases for cooling, then potted and forced.

4. This encourages the formation of stem roots that help stabilize the plant.

5. Bulb mites are a serious problem that can stunt or deform plants.

Insect pests include aphids and fungus gnats.

Root rot caused by a fungus, *Rhizoctonia*, can be a problem, particularly if the growing medium is kept too moist.

Botrytis can damage the flowers.

Virus infections deform flowers.

Sample Test Name_____

Test

Lesson B1–7: Forcing Easter Lilies

Part One: Matching

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

a. bulblets
b. Easter lily
c. forcing
d. leaf counting
e. non-precooled
f. non-tunicate bulb
g. precooled
h. scales
i. scalettes
j. vernalization

_____ 1. Small bulbs that form along the underground stem of a mature lily.

_____ 2. A cold period required for flowering.

_____ 3. Grown in the United States and Canada as potted plants for the Easter holidays.

_____ 4. Bulbs that have not been given cold treatment.

_____ 5. A practice used to monitor the progress of a crop.

_____ 6. Small bulbs produced from the scales that have been removed from the basal plate of a bulb and planted.

_____ 7. Bulbs that have been given the necessary amount of cold treatment to flower.

_____ 8. Modified leaves that store food and water.

_____ 9. A term used to describe conditions given to get bulbs to grow and flower.

_____ 10. Bulbs that lack a covering that would conceal and protect the scales.

Part Two: Completion

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

1. The two most popular varieties of Easter lilies are _____ and _____.
2. _____is a method whereby the grower purchases non-precooled bulbs, pots them upon arrival, places at 63°F for three weeks, cools for a thousand hours, then forces.

3. Easter lilies are a relatively difficult crop to grow because _____ _____.
4. _____ involves potting non-precooled bulbs upon arrival and cooled naturally in a poly-house.
5. Easter lilies are produced along the _____ and _____ where the weather is cool and wet all year.
6. _____ indicates the supplier has cooled the bulbs in their packing cases.
7. _____, including A-rest, are effective in controlling the height of Easter lilies.
8. The scales are held together at the bottom of the bulb by a hardened portion of stem tissue known as the _____.
9. _____ indicates the bulbs are received by the grower, kept in their packing cases for cooling, then potted and forced.
10. When potting the bulbs, place them _____ of the pot to encourages the formation of _____that help stabilize the plant.
11. It normally takes between _____days to force an Easter lily crop.

Part Three: Short Answer

Instructions. Provide information to answer the following questions.

1. List three differences between 'Nellie White' and 'Ace.'

2. How are Easter lilies measured?

3. Identify and define the four accepted methods of cooling Easter lilies.

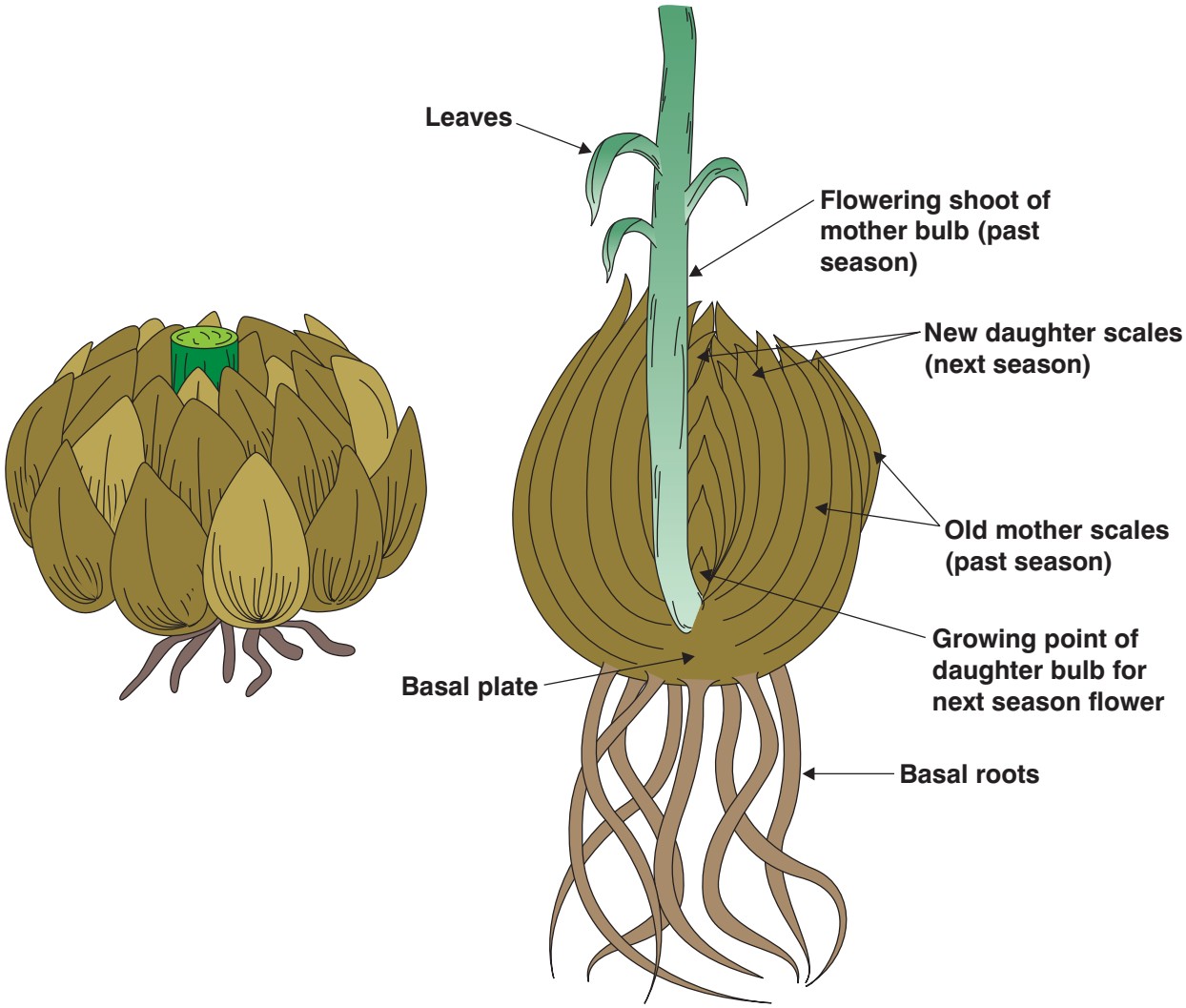
4. Why are lily bulbs placed near the bottom of the pot when potting.

5. Identify three pests and three diseases that cause problems with Easter lilies.

TM: B1–7A

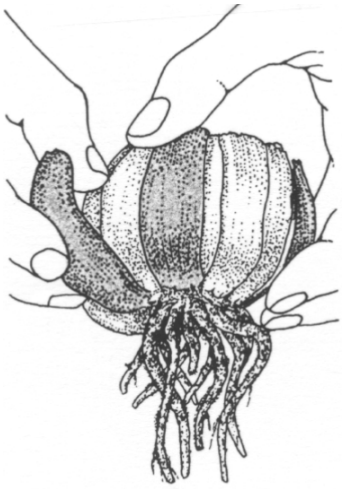
(Courtesy, International Flower Bulb Centre)

PARTS OF A LILY BULB

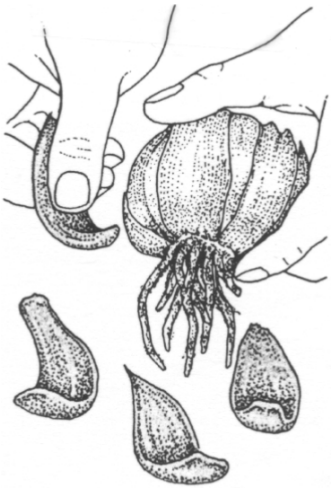


(Courtesy, Interstate Publishers, Inc.)

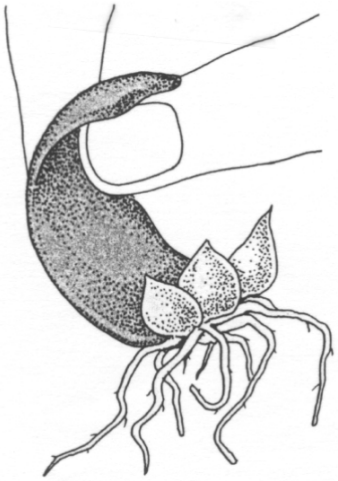
LILY PROPAGATION BY SCALETTES



1. Select mature, outer scales.



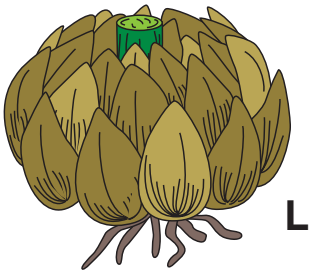
2. Snap scales from the basal plate and plant them in a damp, well-aerated medium.



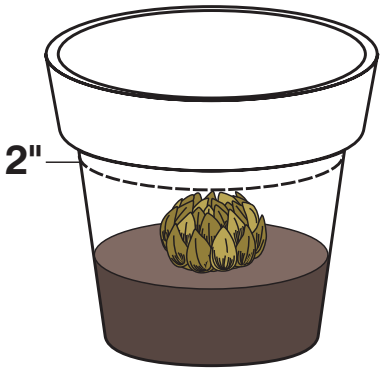
3. Scalettes form.

4. Remove scalettes and immediately replant young bulbs.

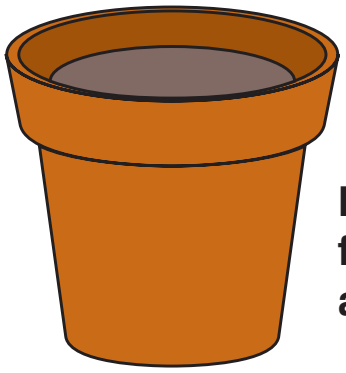
POTTING LILIES



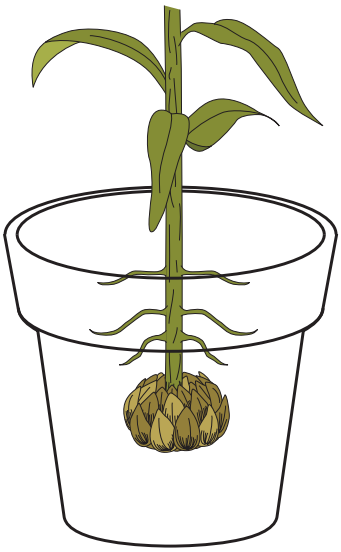
LILY



Use a standard pot. Fill with enough soil so the nose of the bulb is about 2" below the rim.



Fill with soil, firm the soil, and water.

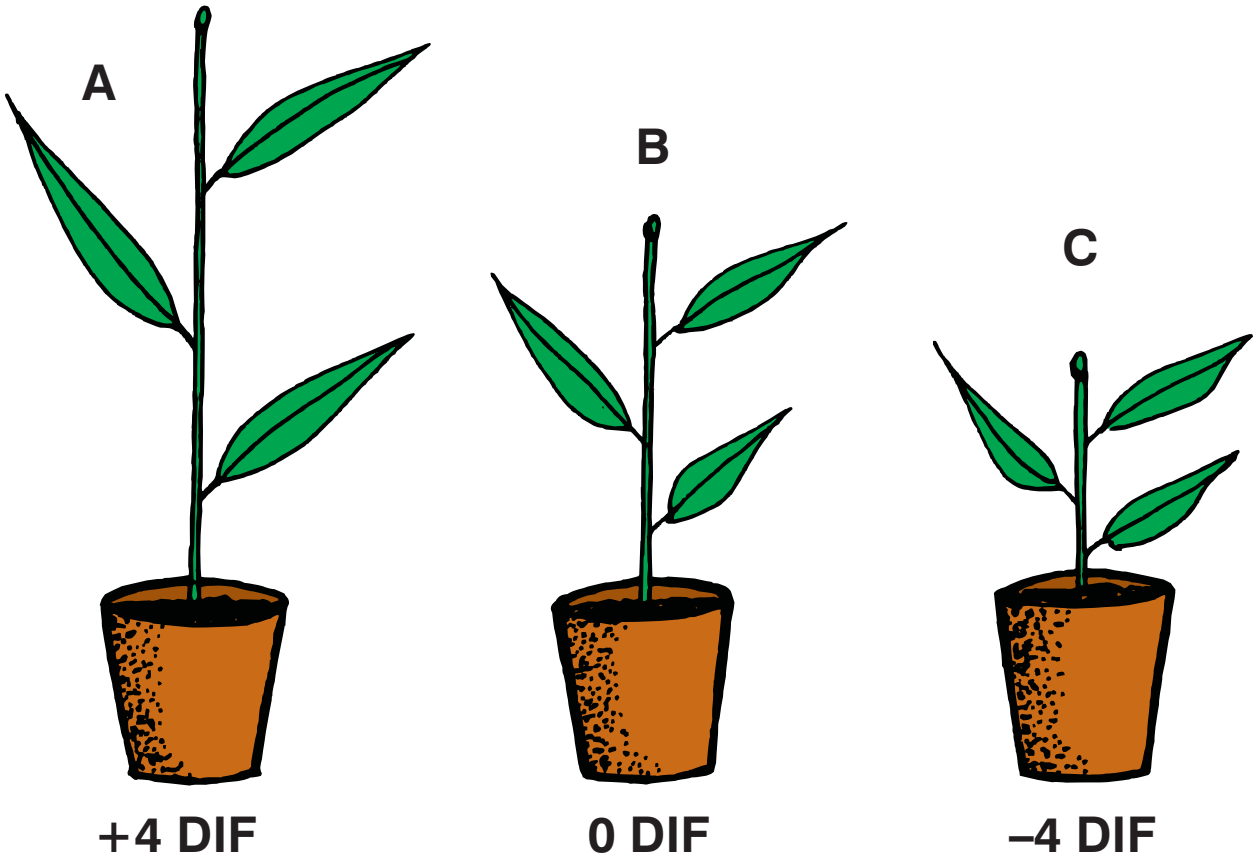


Roots develop along the stem, which anchor the plant and absorb nutrients.

(Courtesy, Interstate Publishers, Inc.)

TM: B1–7E

EFFECT OF THREE DIFFERENT DIF VALUES ON THREE SIMILAR PLANTS



Lab Sheet

Monitoring Easter Lily Progress by Leaf Counting

Purpose:

Students will monitor the progress of Easter lily development in the greenhouse by leaf counting. They will then be able to determine whether the growth rate needs to be slowed or increased.

Instructions:

Follow the steps outlined below.

Leaf counting

Part 1 – Determining the desired rate for leaves to unfold

1. Between January 15 and 20, select 3–5 plants to be the representatives for the crop.
2. Identify the uppermost unfolded leaf and mark it with a marking pen.
3. Count all of the leaves from the base of the plant up to the unfolded leaf. Record this figure. (Example: 46 leaves)
4. Remove and count all of the unfolded leaves. A magnifying lens and tweezers help with the smallest leaves. Record this figure. (Example: 48 unfolded leaves)
5. Compute the number of leaves that must unfold to meet the schedule. To do this count backward from Easter to the date flower buds should be visible. Six weeks is the usual time period before Easter. (Example: If Easter is on April 4, flower buds should be visible February 21.)
6. There are 37 days from January 15 to February 21. Divide the total number of leaves yet to unfold by 37. The result is the number of leaves that must unfold per day in order to see flower buds by February 21. (Example: 48 divided by 37 = 1.3 leaves per day)

Part 2 — Determining the rate of unfolding leaves

1. Select 3–5 plants to be the representatives for the crop. Place a label in the pots.
2. Identify the uppermost unfolded leaf and mark it with a making pen or notch it.
3. Wait 4–5 days and identify the new uppermost unfolded leaf and mark it with a marking pen or notch it.

4. Count the number of leaves that unfolded between the two marked leaves.
5. Calculate the number leaves unfolding per day by dividing the number of new leaves unfolded by the days. (Example: 5 newly unfolded leaves divided by 4 days = 1.25 leaves unfolding per day.)
6. Previously in the example we determined that 1.3 leaves need to be unfolding per day to meet the schedule. The rate of 1.25 leaves that are actually unfolding is a little bit slow. Therefore, temperatures should be raised a bit to speed development.
7. By counting the leaves every 4–5 days, the rate of development can be monitored.