Course: AG-PSB-02.441 Plant Science Biotechnology
Unit 5: Biotechnology

Lesson 6: Forcing Plants

Georgia Performance Standards: AG-PSB-5-(m, n)

Academic Standards: SCSh2, SCSh4, SB1, SCSh6

Objectives:

1. Define forcing.
2. List examples of forcing.
3. Identify why forcing is important to the greenhouse industry.
4. Identify how plants are forced.
5. Identify commonly forced plants in the greenhouse industry.

Teaching Time: **Classroom:** 1 hour
Laboratory: 6 weeks

Grades: 9-12

Essential Question: What is plant forcing?

Unit Understandings, Themes, and Concepts:

Students will learn what plant forcing is and how it is done. Students will gain a broader understanding of why forcing is important and look at plants that are commonly forced.

Primary Learning Goals:

Students will define forcing and list examples of forcing. Students will explain why forcing is important to the greenhouse industry and how plants are forced. Students will identify commonly forced plants in the greenhouse industry.

Students with disabilities: For students with disabilities, the instructor should refer to the individual student's IEP to insure that the accommodations specified in the IEP are being provided within the classroom setting. Instructors should familiarize themselves with the provisions of Behavior Intervention Plans that may be part of a student's IEP. Frequent consultation with a student's special education instructor will be beneficial in providing appropriate differentiation within any given instructional activity or requirement.

Assessment Method/Type:

____ Constructed Response	____ Peer Assessment
_X__ Combined Methods	____ Selected Response
____ Informal Checks	____ Self Assessment

References: Primary Student Texts:

Schroeder, Charles B. & Elisabeth Darmo. *Activity Manual. Introduction to Horticulture Science and Technology*. Interstate Publishers, Inc. Danville, IL. 1997.

Materials and Equipment:

See laboratory exercise material lists

Powerpoints:

Georgia Performance Standards: AG-PSB-5-(m, n)

AG-PSB-5: The student explains technological advancements in plant development, reproduction and protection.

m. Forces plants through the use of cultural practices.
n. Explains why forcing of plants is important to the horticulture and related plant industries.

Academic Standards: SCSh2, SCSh4, SB1, SCSh6

SB2 Students will analyze how biological traits are passed on to successive generations.

SCSh4 Students use tools and instruments for observing, measuring, and manipulating scientific equipment and materials.

SB1 Students will analyze the nature of the relationships between structures and functions in living cells.

SCSh6 Students will communicate scientific investigations and information clearly.

TEACHING PROCEDURE

Introduction and Mental Set

Obtain a plant such as an azalea or lily that is not normally blooming at the present time. Ask the students: How is it possible for the plant to bloom at this time of year. Answer: *Forcing.* Why is it important to make certain plants bloom at certain times of the year?

Discussion

1. **Define forcing.**
   Forcing: the production of a plant that is grown and marketed out of season by manipulating the environmental conditions, such as light or temperature.

2. **What are some examples of forcing?**
   A. Easter lilies are only marketable during the Easter holiday. Since Easter falls on a different Sunday every year it is impossible to grow lilies naturally and maintain a valuable product.
   B. Poinsettias bloom during the fall of the year, but they are only marketable during the Christmas season. Therefore, poinsettias are controlled on the greenhouse so that the will bloom during Christmas.
   C. Azaleas bloom in the spring of the year, but as a potted plant their flowers are needed year round. Hence they are forced in the greenhouse, and they bloom year round.
   D. Asparagus require a dormant period of 1-3 months. This is accomplished during the cold winter months when plants don=t grow, but in Southern California it never gets cold enough to inhibit plant growth. Therefore growers stop all irrigation and essentially thirst the plant into dormancy.

E. Forcing can even be used in the animal industry too. In poultry production the layer hens are tricked into thinking that it is daylight so that they will continue to lay eggs. This is accomplished by using bright lights inside the house.

3. Why do producers force plants?

Producers force plants in order to achieve the greatest profit available for a given plant and to meet customer demand.

4. What are some of the common grown plants that are usually forced into production.

A. Mums
B. Poinsettias
C. Easter Lilies
D. Azaleas
E. Cucumbers
F. Tomatoes

5. What are some common ways that plants are forced?

A. Plants are forced by manipulating their environmental factors. These factors include:
   - $ Temperature
   - $ Light
   - $ Water
   - Nutrients

B. This is accomplished through the use of a controlled atmosphere such as a greenhouse.

6. Laboratory

Use one or more of the following labs to demonstrate forcing.

A. Get some Azaleas from a commercial nursery and place an equal amount outside the greenhouse and inside the greenhouse. The azaleas inside should set flowers provided that weather outside is cool.
B. Place mums in the greenhouse and give them 12 hours or more of darkness. Adjust the thermostat at 65°F. This will hasten the set of flowers.
C. Complete the forcing bulb exercise listed in the reference, *Activity Manual. Introduction to Horticulture Science and Technology*.

SUMMARY

Review the important points of:

Definition and examples of forcing.
Importance of forcing to the greenhouse industry.
Plants that are commonly forced in the greenhouse industry.

Evaluation

Written test
Laboratory activity

Individual Learning Activity

Lesson: Forcing Plants

Assignment: Choose one of the topics below and research it. Write a report on your findings that answers the question or explains the concept and shows why it is relevant to your life.

1. Define forcing.
2. List examples of forcing.
3. Identify why forcing is important to the greenhouse industry.
4. Identify how plants are forced.
5. Identify commonly forced plants in the greenhouse industry

Minimum Requirements:

1. Paper must be typed in 12 point font and at least one page in length. The paper may be double-spaced.

2. At least two credible references must be properly cited.

3. All work must be original. No plagiarism! Any use of another's ideas without giving credit will result in a zero.

4. Papers will be graded on content (amount of good information, accuracy, etc.) and mechanics (grammar, spelling, and punctuation.)

Due Date:
Points/Grade Available:

Individual Learning Activity Rubric

Content - offers current information on the topic chosen, thoroughly covers each aspect of the question, and demonstrates understanding and mastery of the lesson. The paper should include information and issues of state and local importance.	35 pts.
Critical Analysis - logical process of analyzing and reporting information that examines and explains the topic selected. The paper should go beyond simply listing facts and must include why the concept is relevant to the student's life.	25 pts.
Organization- The paper should have an orderly structure that demonstrates a logical flow of ideas.	15 pts.
Mechanics- spelling, grammar, punctuation, font size, double spacing, citation, etc. Essentially, the paper should meet all	15 pts.

specifications and be executed following rules of proper written English.	

Group Learning Activity

Lesson: Forcing Plants

Assignment: Choose one of the topics below and research it. With your group, prepare a presentation to teach the class your concept.

1. Define forcing.
2. List examples of forcing.
3. Identify why forcing is important to the greenhouse industry.
4. Identify how plants are forced.
5. Identify commonly forced plants in the greenhouse industry.

Your presentation should include the following:

1. **A lesson plan outlining exactly what your group will teach and how the information will be taught**
2. **A Power Point of at least twelve slides**
3. **Notes containing the information the class will be responsible for (these can be printed and given to the class, written on the board, or part of the Power Point). A copy of the notes will be turned in to the instructor.**
4. **Some type of interactive activity for the class (game, problem solving activity, interactive model, etc.)**
5. **Your group must also prepare an assessment for the class. This assessment can be written or oral, but should show**

the instructor that the class understands and has retained the material being taught.

Due Date:

Points/Grade Available:
All work must be original. No plagiarism! Any use of another's ideas without giving credit will result in a zero.

Group Learning Activity Rubric

Lesson Plan – The group submits a thorough, detailed lesson plan highlighting the content and organization of their lesson.	10 pts.
PowerPoint – The group presents a Power Point of at least twelve slides that contains information and pictures vital to the lesson with additional information or examples for enhancement.	20 pts.
Interactive Activity – Some type of interactive activity is used to help teach the lesson. The activity should contribute to the mastery of content and involve the entire class in some way.	15 pts.
Assessment – A fair, thorough assessment is prepared and administered based on the information presented to the class. Poor grades on the assessment by a few members of the class are excusable, but if the entire class has difficulty, the points awarded in this category may be lowered at the discretion of the instructor.	15 pts.
Content – The group should cover the concept (within reason) in entirety. The group may study actual lesson plans to help decide what should be emphasized.	25 pts.

Overall Effect – The group is prepared, enthusiastic, and interesting, and the lesson flows smoothly.	15 pts.

Presentation Learning Activity

Lesson: Forcing Plants

Assignment: Choose one of the topics below, research it, and prepare a presentation that answers the question or explains the concept and shows why it is relevant to your life.

1. Define forcing.
2. List examples of forcing.
3. Identify why forcing is important to the greenhouse industry.
4. Identify how plants are forced.
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Oral Report Option

1. **Write a paper on one of the topics and orally present your work to the class.**
2. **Paper may be double-spaced and should be at least one page in length, resulting in a two to five minute presentation.**
3. **At least two references must be properly cited.**
4. **The presentation of the report will be graded secondary to the content of the paper.**

PowerPoint Option

1. **Presentation should be at least ten slides in length**
2. **Presentation should include at least four photos.**
3. **Presentation should be two to five minutes in length.**
4. **Grammar and spelling will be graded by the same standards as any other written assignment.**
5. **At least two references must be properly cited.**

Poster Option:

1. **Prepare a poster that answers/explains one of the topics. You will present your poster to the class.**
2. **Your poster should include both text and graphics that help communicate your research.**
3. **At least two sources of information should be properly cited on the back of the poster.**
4. **Neatness and appearance of the poster will be graded.**
5. **Poster presentation should last two to five minutes.**

Due Date:

Points/Grade Available:

For all presentations: All work must be original. No plagiarism! Any use of another's work or ideas without giving proper credit will result in a zero.

Presentation Learning Activity Rubric

Content- offers current information on the topic chosen, thoroughly covers each aspect of the question, and demonstrates understanding and mastery of the lesson. The presentation should include information and issues of state and local importance.	40 pts.
Critical Analysis/Organization – The presentation shows a logical process of analyzing and reporting information that examines and explains the topic selected. The presentation should go beyond simply listing facts and must include why the concept is relevant to the student's life.	20 pts.
Presentation – The student makes a genuine effort to present, not just read the material. The student should present with confidence using techniques like eye contact and voice inflexion to	25 pts.

make his or her point. Although content takes precedence over presentation, the experience of successfully presenting in front of a class is part of the basis of this assignment.	
Mechanics- spelling, grammar, punctuation, font size, double spacing, citation, etc. Essentially, the presentation should meet all guidelines set forth and should be executed in proper written English. For the poster, this includes neatness and appearance.	15 pts.

Lesson Evaluation

1. **Define forcing.**

2. **What are some examples of forcing?**

3. **Why do producers force plants?**

4. **What are some of the common grown plants that are usually forced into production.**

5. **What are some common ways that plants are forced?**

Lesson Evaluation Key

1. **Define forcing.**
   the production of a plant that is grown and marketed out of season by manipulating the environmental conditions, such as light or temperature.

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   - $ Light
   - $ Water
   - Nutrients

B. This is accomplished through the use of a controlled atmosphere such as a greenhouse.

Essential Question:

What is plant forcing?

Vocabulary

Forcing

Azaleas

Cucumbers

Tomatoes