

Course: AG-PSB-02.441 Plant Science Biotechnology
Unit 10: Environmental Factors Affecting Plant Growth

Lesson 7: Plant Hardiness

Georgia Performance Standards:

AG-PSB-10-p

Academic Standards: ELA10RL1 (a)

Objectives:

1. Define plant hardiness zone and its purpose.
2. Explain cold hardiness in plants.
3. List factors that effect a plant=s hardiness.
4. Classify the types of plant hardiness.
5. Describe the damage to plants due to rapid weather changes.

Teaching Time: Classroom: 2 Hours

Laboratory: 1 Hour

Grades: 9-12

Essential Question: What is plant hardiness?

Unit Understandings, Themes, and Concepts:

Students will learn what plant hardiness is and what factors affect it.

Students will also gain an understanding of the different types of plant hardiness and learn the factors that can impact the hardiness of a plant.

Primary Learning Goals: In this unit students will define plant hardiness zone and its purpose and explain cold hardiness in plants. Students will list factors that affect a plant's hardiness and classify the types of plant hardiness. Students will describe the damage to plants due to rapid weather changes.

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:

- | | |
|--|--|
| <input type="checkbox"/> Constructed Response | <input type="checkbox"/> Peer Assessment |
| <input checked="" type="checkbox"/> Combined Methods | <input type="checkbox"/> Selected Response |
| <input type="checkbox"/> Informal Checks | <input type="checkbox"/> Self Assessment |

References: Primary Student Texts:

Vocational Agriculture Service. College of Agriculture. University of Illinois, 1401 S. Maryland Dr., Urbana, IL. 61801.

Secondary Text for teacher planning and occasional student use:

Barden, John A. *Plant Science*. McGraw-Hill. NY. ISBN: 0-07-003669-1.
Atlas of Georgia (1986) Institute of Community and Area Development, UGA.
The American Horticulture Society: *Encyclopedia of Gardening*. 1993.

Materials and Equipment:

Collards, turnip greens, kudzu, sweet potatoes, lima beans, snapdragons, pansies
Plant hardiness zone map

PowerPoints:

AG-PSB-02.441-10.7p Horticulture_Terms_J_Green_July_2005

Georgia Performance Standards:**AG-PSB-10-p**

AG-PSB-10: The student describes environmental effects on plants, demonstrates ways to manage the environment for production and ornamental use of plants, and match plants to given growing conditions.
p. Utilizes the plant hardiness zoning classifying system for plants.

Academic Standards:**ELA10RL1 (a)**

ELA10RL1 (a) Analyzes and explains the structures and elements of nonfiction works such as newspaper articles and editorials, magazine articles, journal articles, and/or other informational text.

TEACHING PROCEDURE

Introduction and Mental Set

Using a hardiness zone map, show the optimum growth areas for collards, turnip greens, kudzu, sweet potatoes, lima beans, corn, snapdragons, and pansies. Place these plants in a refrigerator at 29 Fahrenheit for 1-2 hours or until browning occurs on the warm loving plants. Ask the students to analyze and explain what has occurred? Answers will vary.

Discussion

- 1. List plants that grow in our area and tell why they don't grow in other places; show on map.**

First settlers, Oglethorpe wanted to grow orange trees. He placed them under oak trees because the oak trees protected the orange trees from frost. How does it protect? Heat from ground comes up and is trapped by live oak branches and leaves.

- 2. Define cold hardiness.**

The ability of the plant to survive low temperatures before injury or death occurs.

- 3. Why is it important to know a plants hardiness? When selecting plants, you should know its hardiness in order to know if it will survive in your climatic region.**

- 4. How many plant hardiness zones are in the United States?**
Eleven

- 5. What temperature must plants in Georgia withstand? In North Georgia approximately 0 to 10 F. In Central and South Georgia approximately 10 to 20 F.**

- 6. What factors affect plant hardiness?**

- A. Adequate plant tissue maturation before exposure to cold.
 - B. Hardiness is greatest when the plants rest period is long duration or not easily broken by temperature.
 - C. Duration and intensity of sunlight. length of growing season, altitude, amount and timing of rainfall, soil characteristics and conditions, humidity, and cultural practices.
 - D. Large bodies of water, soil drainage, and wind exposure.
7. **What is the difference between very hardy, semi-hardy and tender hardy plants for vegetables?**
- A. Very hardy - vegetables that are capable of withstanding hard frosts and freezing temperatures without injury
 - B. Frost tolerant - (semi-hardy) - vegetables which can withstand light frosts and can be planted 2-3 weeks before the average frost-free date
 - C. Tender - vegetables that cannot tolerate frost
8. **What is the difference between chilling-sensitive, chilling-resistant, and cold-hardy plants for woody plants?**
- A. Chilling-sensitive - plants that can be severely injured or even killed by exposure to low temperatures above freezing for a short or long period of time
 - B. Chilling-resistant - plants that can survive brief periods of frost, but will be killed if the freezing conditions continue for more than a few hours
 - C. Cold-hardy - plants that tolerate periods of freezing
9. **What plant damages are caused by weather when plants are not hardy?**
- A. Entire plant death
 - B. Partial plant death
 - C. Ice crystals formation in intercellular spaces
 - D. cell membranes rupture and cells die
 - E. browning or burning of foliage on evergreen plants

- F. unequal shrinkage in trunks of woody plants often results in frost cracks-vertical wounds that appear on susceptible trees when winter temperatures fall below 15 F.

10. Laboratory

Using plant hardiness zone maps, students should identify the hardiness zones. Have students compare different hardiness zone maps and discuss why they are not the same over a period to time.

For discussion, an Oleander (*Nerium Oleander*) will die back in Atlanta every year, while in Kingsland the plants are evergreen.

Why does this occur every year?

SUMMARY

Review with students:

Define cold hardiness.

What is the importance of plant hardiness zones?

What damage is done to plants that are not hardy?

Evaluation

Using a plant hardiness map and a seed and plant catalogues. Have the students identify twenty plants that will grow well in their home, garden and yard. (5 vegetables, 5 flowers/bedding plants, 5 shrubs, and 5 trees)

Individual Learning Activity

Lesson: Plant Hardiness

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 plant hardiness zone and its purpose.
2. Explain cold hardiness in plants.
3. List factors that effect a plant=s hardiness.
4. Classify the types of plant hardiness.
5. Describe the damage to plants due to rapid weather changes.

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

<p>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.</p>	<p>35 pts.</p>
<p>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.</p>	<p>25 pts.</p>
<p>Organization- The paper should have an orderly structure that demonstrates a logical flow of ideas.</p>	<p>15 pts.</p>
<p>Mechanics- spelling, grammar, punctuation, font size, double spacing, citation, etc. Essentially, the paper should meet all specifications and be executed following rules of proper written English.</p>	<p>15 pts.</p>

Group Learning Activity

Lesson: Plant Hardiness

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

1. Define plant hardiness zone and its purpose.
2. Explain cold hardiness in plants.
3. List factors that effect a plant=s hardiness.
4. Classify the types of plant hardiness.
5. Describe the damage to plants due to rapid weather changes.

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: Plant Hardiness

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 plant hardiness zone and its purpose.
2. Explain cold hardiness in plants.
3. List factors that effect a plant=s hardiness.
4. Classify the types of plant hardiness.
5. Describe the damage to plants due to rapid weather changes.

Minimum Requirements:

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.
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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

<p>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.</p>	<p>40 pts.</p>
<p>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.</p>	<p>20 pts.</p>
<p>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 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.</p>	<p>25 pts.</p>
<p>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.</p>	<p>15 pts.</p>

Lesson Evaluation

1. Define cold hardiness.
 2. Why is it important to know plants hardiness?
 3. What factors affect plant hardiness?
 4. What is the difference between very hardy, semi-hardy, and tender hardy?
 5. What plant damages are caused by weather when plants are not hardy?
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Lesson Evaluation Key

1. The ability of the plant to survive low temperatures before injury or death occurs.

 2. When selecting plants, you should know its hardiness in order to know if it will survive in your climatic region.

 3. -Adequate plant tissue maturation before exposure to cold.
-Hardiness is greatest when the plants rest period is long duration or not easily broken by temperature.
-Duration and intensity of sunlight, length of growing season, altitude, amount and timing of rainfall, soil characteristics and conditions, humidity, and cultural practices.
-Large bodies of water, soil drainage, and wind exposure.

 4. -Very hardy - vegetables that are capable of withstanding hard frosts and freezing temperatures without injury
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- Frost tolerant - (semi-hardy) - vegetables which can withstand light frosts and can be planted 2-3 weeks before the average frost-free date
- Tender - vegetables that cannot tolerate frost

5. Entire plant death; partial plant death

- Ice crystals formation in intercellular spaces
 - Cell membranes rupture and cells die
 - Browning or burning of foliage on evergreen plants
 - Unequal shrinkage in trunks of woody plants often results in frost cracks-vertical wounds that appear on susceptible trees when winter temperatures fall below 150 F.
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Teacher Notes

Essential Question:
What is plant
hardiness?

Vocabulary

Cold hardiness