

# Greenhouse Management 18058

## **Rationale Statement:**

Greenhouse Management helps prepare students for careers in plant production, greenhouse operation and management of the greenhouse and greenhouse business. As populations continue to expand, the importance of food production in a condensed, climate-controlled environment increases. Understanding the integrated principles needed for the successful management of a greenhouse will allow the agricultural industry to continue to produce the quality and quantity of food and fiber needed in the 21st century. Classroom and laboratory content will be enhancing by utilizing appropriate equipment and technology. Mathematics (geometry and algebra), science (physical, biology, botany), English and human relations skills will be reinforced in the course. Worked-based learning opportunities appropriate for this course are school based enterprise and field trips. Opportunities for application of clinical and leadership skills are provided by participation in FFA activities, conferences and skills competitions. Each student will be expected to complete a Supervised Agricultural Experience program and/or Internship Project.

**Suggested grade level: 10<sup>th</sup> – 12<sup>th</sup>**

## **Topics covered:**

- Greenhouse industry
- Careers
- Greenhouse technology
- Greenhouse structures
- Plant taxonomy
- Controlling and operating the greenhouse (lighting, watering/irrigation)
- Plant production and propagation
- Root media
- Plant nutrition
- Greenhouse production plans
- Hydroponics

**Indicator #1: Explain the historical and economic impact of the greenhouse industry.**

<b>Bloom's Taxonomy Level</b>	<b>Standard and Examples</b>
Understanding	<p><b>GH1.1 Discuss the greenhouse industry, greenhouse careers and related technology of greenhouse production.</b></p> <p>Examples:</p> <ul style="list-style-type: none"> <li>• Describe the economic importance of floriculture.</li> <li>• Identify the major segments of the floriculture industry.</li> <li>• Name the leading states in floriculture production in the United States.</li> <li>• Describe available careers in floriculture.</li> </ul>

**Indicator #2: Discuss plant taxonomic classifications to depict anatomy and physiology.**

<b>Bloom's Taxonomy Level</b>	<b>Standard and Examples</b>
Understanding	<p><b>GH 2.1 Explain plant classifications based on plant anatomy and physiology.</b></p> <p>Examples:</p> <ul style="list-style-type: none"> <li>• Identify plant structures (e.g., seeds, stems, roots and leaves).</li> <li>• Describe physiological functions of plants (respiration, photosynthesis).</li> <li>• Describe germination process and conditions for good germination.</li> <li>• Classify plants as monocots or dicots.</li> <li>• Classify plants as annuals, biennials or perennials.</li> <li>• Classify plants according to growth habit (cool season vs. warm season).</li> </ul>

**Indicator #3: Identify the parts of the greenhouse structures, controls for the greenhouse environment, lighting, equipment and irrigation systems.**

<b>Bloom's Taxonomy Level</b>	<b>Standard and Examples</b>
Understanding	<p><b>GH 3.1 Identify the components of various greenhouse structures.</b></p> <p>Examples:</p> <ul style="list-style-type: none"> <li>• Identify suitable locations for greenhouses when factoring in elements such as wind, light and water supply.</li> <li>• Determine space requirements for plant production.</li> <li>• List the types of greenhouse structures.</li> <li>• Describe the major glazing used on greenhouse and the advantages and disadvantages of each.</li> <li>• Determine the importance of light to greenhouse crops.</li> </ul>
Understanding	<p><b>GH 3.2 Identify the different methods for controlling the greenhouse environment.</b></p> <p>Examples:</p> <ul style="list-style-type: none"> <li>• Describe the forms of heat loss from a greenhouse.</li> <li>• Describe methods of controlling heat levels in greenhouses.</li> <li>• Identify the common heating systems and the advantages and disadvantages of each.</li> <li>• Describe the importance and function of carbon dioxide generators.</li> </ul>
Understanding	<p><b>GH 3.3 Explain the correct operation of greenhouse equipment and lighting.</b></p> <p>Examples:</p> <ul style="list-style-type: none"> <li>• Identify major types of greenhouse benching materials.</li> <li>• Describe the major systems of supplement lighting and use of each.</li> <li>• Describe the three major photoperiodic lighting techniques (long day, short day and neutral day plants).</li> <li>• Determine plant light needs as related to photoperiod.</li> <li>• Explain how to calculate aisle space and useable growing area.</li> <li>• Explain the calculation of foot-candles needed for adequate lighting.</li> </ul>

Understanding	<p><b>GH 3.4 Explain the use of different greenhouse watering and irrigation methods.</b></p> <p>Examples:</p> <ul style="list-style-type: none"> <li>• Determine plant’s water needs.</li> <li>• Determine required physical and chemical quantity of water (pH, calcium carbonate).</li> <li>• Identify commonly used watering equipment.</li> <li>• Discuss the use of intermittent mist systems.</li> <li>• Identify water quality monitoring devices.</li> </ul>
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**Indicator #4: Demonstrate the relationship between growing media, plant nutrition and environmental conditions as they relate to plant growth and production.**

Bloom’s Taxonomy Level	Standard and Examples
Applying	<p><b>GH 4.1 Illustrate how root media and containers affect plant production.</b></p> <p>Examples:</p> <ul style="list-style-type: none"> <li>• Illustrate the functions of root medium.</li> <li>• Select organic and inorganic components of soil medium.</li> <li>• Examine the difference between soil based and soilless root media.</li> <li>• Employ amendments commonly added to root media.</li> <li>• Illustrate the process of and need for pasteurization of root media.</li> </ul>
Applying	<p><b>GH 4.2 Demonstrate how plant nutrition affects plants growth.</b></p> <p>Examples:</p> <ul style="list-style-type: none"> <li>• Interpret the essential elements for plant growth and categorize them as microelements or macroelements.</li> <li>• Dramatize the effect of pH on the availability to plant of the essential elements.</li> <li>• Illustrate the forms in which fertilizer are commonly applied to greenhouse crops.</li> <li>• Illustrate nutrient deficiency symptoms in plants.</li> <li>• Interpret fertilizer bag labels.</li> <li>• Mix fertilizer solution.</li> <li>• Apply fertilizer.</li> </ul>

Applying	<p><b>GH 4.3 Interpret nutritional requirements and environmental conditions to develop and implement a fertilization plan.</b></p> <p>Examples:</p> <ul style="list-style-type: none"> <li>• Choose nutrient sources.</li> <li>• Interpret plant nutrient requirements for optimum growth.</li> <li>• Illustrate function of plant nutrients in plants.</li> <li>• Interpret the environmental factors that influence and optimize plant growth.</li> <li>• Apply nutrients to plants for economic growth.</li> <li>• Illustrate nutrient application methods and appropriate practices.</li> </ul>
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**Indicator #5: Apply the principles of integrated pest management and chemical pest control methods.**

<b>Bloom's Taxonomy Level</b>	<b>Standard and Examples</b>
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Applying	<p><b>GH 5.1 Demonstrate a plan for integrated pest management (IPM).</b></p> <p>Examples:</p> <ul style="list-style-type: none"> <li>• Demonstrate pest management safety practices.</li> <li>• Employ a pest control plan with appropriate treatments.</li> <li>• Use an IPM pest control plan (yellow sticky tabs, plant inspection, biological controls).</li> <li>• Use sanitary measures to prevent pest infestations.</li> <li>• Appraise pest population numbers.</li> <li>• Illustrate the serious nature of pesticide hazards to people.</li> <li>• Appraise chemical/cultural/biological control options.</li> </ul>
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**Indicator #6: Experiment with methods of plant growth and reproduction.**

<b>Bloom's Taxonomy Level</b>	<b>Standard and Examples</b>
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Evaluating	<p><b>GH 6.1 Test appropriate materials to manage soil/media nutrients.</b></p> <p>Examples:</p> <ul style="list-style-type: none"> <li>• Interpret tests of soil/media and/or plant tissue.</li> <li>• Evaluate soil/media permeability and water-holding capacity.</li> <li>• Determine the chemical properties of soil/media.</li> <li>• Determine the biological functions of microorganisms in soil/media.</li> </ul>
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Analyzing	<p><b>GH 6.2 Differentiate the basic methods for reproducing and propagating plants.</b></p> <p>Examples:</p> <ul style="list-style-type: none"> <li>• Examine the role of genetics in plants.</li> <li>• Examine the components and functions of plant reproductive parts.</li> <li>• Experiment with methods of asexual/sexual plant propagation.</li> <li>• Examine the principles of plant micro-propagation.</li> <li>• Apply principles and practices of biotechnology to plant propagation.</li> </ul>
Understanding	<p><b>GH 6.3 Explain how plant height is control by DIF (DIFference between the day temperature (DT) and night temperature (NT)).</b></p> <p>Examples:</p> <ul style="list-style-type: none"> <li>• Discuss the effects of DIF on plant growth.</li> <li>• Experiment with DIF on greenhouse crops to control plant height.</li> <li>• Describe circumstances which limit the application of DIF.</li> <li>• List greenhouse crops that can be height-limited by DIF.</li> <li>• Describe the advantages of the use of DIF.</li> <li>• Discuss the data necessary to solve problems relevant to plant height control by DIF.</li> </ul>
<p><b>Indicator #7: Examine the fundamentals of production and harvesting to produce greenhouse crops.</b></p>	
<p><b>Bloom's Taxonomy Level</b></p>	<p><b>Standard and Examples</b></p>
Analyzing	<p><b>GH 7.1 Distinguish plant management practices for a production plan.</b></p> <p>Examples:</p> <ul style="list-style-type: none"> <li>• Discriminate between various seeds and plants.</li> <li>• Experiment with environmental conditions to foster plant germination, growth and development.</li> <li>• Examine planting practices.</li> <li>• Examine transplanting practices.</li> </ul>

Applying	<p><b>GH 7.2 Demonstrate bedding plant production.</b></p> <p>Examples:</p> <ul style="list-style-type: none"> <li>• Choose major bedding plant species.</li> <li>• Demonstrate favorable conditions for seed germinations.</li> <li>• Demonstrate sowing of bedding plant seed in flat and in plug trays.</li> <li>• Demonstrate commercially up-to-date methods of producing bedding plants for sale.</li> <li>• Employ a production schedule.</li> <li>• Demonstrate disease and pest management methods.</li> </ul>
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**Indicator #8: Discuss the principles of specialized growing techniques.**

Bloom's Taxonomy Level	Standard and Examples
Understanding	<p><b>GH 8.1 Discuss the basics of hydroponics and the operation of a hydroponics system.</b></p> <p>Examples:</p> <ul style="list-style-type: none"> <li>• Discuss the history of hydroponics.</li> <li>• Discuss why hydroponics is more prevalent in other countries than here in the United States.</li> <li>• Explain the components of a suitable hydroponics site.</li> <li>• Identify basic techniques used in growing hydroponics crops.</li> <li>• Discuss the commercial crops grown hydroponically.</li> </ul>
Understanding	<p><b>GH 8.2 Demonstrate the operation of different hydroponics systems.</b></p> <p>Examples:</p> <ul style="list-style-type: none"> <li>• List different types of growth medium including rockwool, perlite bag culture, wood based, gravel and sand.</li> <li>• Discuss pH requirements.</li> <li>• Discuss the different hydroponics system (ebb &amp; flow, tube, dutch pots).</li> </ul>