



## CTSO Course Alignments: Greenhouse Management

Below you will find standards for the Greenhouse Management course aligned with competitive events from appropriate career and technical student organizations (CTSOs). Knowing the aligned events for your organization will allow you to have additional tools for teaching course standards, as well as increase student engagement and preparation in your CTSO activities. The final column recommends potential tools from other CTSO organizations. Even if your students are not participating in these organizations, available rubrics, tools, and materials can also add to the instructional resources at your disposal for best teaching your content.

**Important to note:** While the aligned activities below can be important tools in teaching course standards, it is important to note that events may not cover a standard in its entirety and should not be the sole instructional strategy used to address a standard.

	STANDARD	ALIGNED FFA COMPETITIVE EVENTS/PROGRAMS	OTHER POTENTIAL CTSO TOOLS & RESOURCES
1	Analyze the global nature of the horticulture industry and assess the economic impact and technological advancements associated with greenhouse production practices. Create a timeline to summarize the history and development of the greenhouse production industry, citing specific textual evidence. (TN Reading 1, 2; TN Writing 4)		
2	Review common laboratory safety procedures for tool and equipment operation in the agricultural and biosystems engineering laboratories, including but not limited to accident prevention and control procedures. Demonstrate the ability to follow safety and operational procedures in a lab setting and complete a safety test with 100 percent accuracy. (TN Reading 3; ARNR CS)		<ul style="list-style-type: none"> <li>• <b>HOSA:</b> Biomedical Laboratory Science</li> <li>• <b>SkillsUSA:</b> Occupational Health and Safety</li> <li>• <b>TSA:</b> Biotechnology Design</li> </ul>
3	Apply the concepts of occupational safety and industry safety prevention and control standards by interpreting information from industry manuals: <ol style="list-style-type: none"> <li>Assess the purpose of worker protection standards and obtain the worker protection standards student industry certification.</li> <li>Review common laboratory safety procedures for tool and equipment operation in horticulture laboratories, including but not limited to accident prevention and control procedures. Demonstrate the ability to follow safety and operational procedures in a lab setting and complete a safety test with 100 percent accuracy. (TN Reading 3)</li> </ol>		<ul style="list-style-type: none"> <li>• <b>HOSA:</b> Biomedical Laboratory Science</li> <li>• <b>SkillsUSA:</b> Occupational Health and Safety</li> <li>• <b>TSA:</b> Biotechnology Design</li> </ul>

4	Describe characteristics of successful greenhouses and create a list of factors for planning and designing greenhouse facilities. Factors must include physical location, market potential, utilities, climatic conditions, and production goals. (TN Writing 4)	<ul style="list-style-type: none"> <li>• <b>FFA:</b> Agricultural Technology and Maintenance</li> </ul>	<ul style="list-style-type: none"> <li>• <b>FCCLA:</b> Entrepreneurship</li> <li>• <b>HOSA:</b> Prepared Speaking, Extemporaneous Writing</li> <li>• <b>SkillsUSA:</b> Occupational Health and Safety</li> <li>• <b>TSA:</b> Prepared Presentation, Extemporaneous Presentation</li> </ul>
5	Classify greenhouse structures by comparing and contrasting greenhouse construction materials, including but not limited to frames, coverings, and glazing materials. Justify selection of greenhouse construction materials based on cost effectiveness, stability, maintenance, and function. (TN Reading 8, 9; TN Writing 9)	<ul style="list-style-type: none"> <li>• <b>FFA:</b> Agricultural Technology and Maintenance</li> </ul>	<ul style="list-style-type: none"> <li>• <b>HOSA:</b> Prepared Speaking, Extemporaneous Writing</li> <li>• <b>TSA:</b> Prepared Presentation, Extemporaneous Presentation</li> </ul>
6	Create an annotated model representing research-based practices in greenhouse planning and design and justify the process outlined in the model. The design must include at least the following items: structure materials, layout, lighting, bench arrangements, traffic flow, and physical location. (TN Reading 7; TN Writing 4, 8)	<ul style="list-style-type: none"> <li>• <b>FFA:</b> Agricultural Technology and Maintenance</li> </ul>	<ul style="list-style-type: none"> <li>• <b>TSA:</b> Architectural Renovation</li> </ul>
7	Compare general maintenance and upkeep requirements for a variety of greenhouses in relation to the type of structure and associated systems. Create a checklist of prescribed maintenance, preventative maintenance, monitoring, and troubleshooting schedules for greenhouse facilities and equipment. Demonstrate the mechanical skills needed for the general maintenance and repair of greenhouses and associated systems (such as basic wiring, plumbing, and general construction). (TN Reading 2, 3; TN Writing 4, 8)	<ul style="list-style-type: none"> <li>• <b>FFA:</b> Agricultural Technology and Maintenance</li> </ul>	<ul style="list-style-type: none"> <li>• <b>SkillsUSA:</b> Building Maintenance Technology</li> </ul>
8	Compare and contrast the attributes of growing mediums. Write an informative essay to describe the major components of soil, and identify basic physical and chemical characteristics of soil including structure and texture. (TN Reading 9; TN Writing 2)	<ul style="list-style-type: none"> <li>• <b>FFA:</b> Land Evaluation</li> </ul>	<ul style="list-style-type: none"> <li>• <b>HOSA:</b> Researched Persuasive Speaking</li> </ul>
9	Identify and provide written justification to describe the effects of soil and soilless composition (pH, organic matter content, and mineral content) on plant health and growth. Perform basic soil sampling and testing techniques and interpret test data to formulate corrective actions as needed. (TN Reading 1, 3; TN Writing 7, 9; TN Math S-ID)	<ul style="list-style-type: none"> <li>• <b>FFA:</b> Land Evaluation</li> </ul>	
10	Explain the principles of media preparation; develop a check sheet to guide media preparation. Describe the purpose, methods, and importance for sterilizing media. Compare and contrast the cost effectiveness of premix and personal mix media to soil media. (TN Reading 7; TN Writing 8)	<ul style="list-style-type: none"> <li>• <b>FFA:</b> Floriculture, Nursery and Landscape</li> </ul>	<ul style="list-style-type: none"> <li>• <b>HOSA:</b> Prepared Speaking, Extemporaneous Writing</li> <li>• <b>TSA:</b> Prepared Presentation, Extemporaneous Presentation</li> </ul>

11	Apply concepts of scientific taxonomy and industry-specific terminology in distinguishing different species and types of plants. Create a visual chart, brochure, or fact sheet that identifies common plant species used in greenhouse production by classification, care, and use. (TN Reading 4)	<ul style="list-style-type: none"> <li>• <b>FFA:</b> Agricultural Communications</li> </ul>	<ul style="list-style-type: none"> <li>• <b>TSA:</b> Desktop Publishing</li> </ul>
12	Research the basic plant structure components and create an illustrative plant model to identify and differentiate among components. Demonstrate a working knowledge of plant physiology, including: <ul style="list-style-type: none"> <li>a. The relationship between form and function for major plant structures</li> <li>b. The anatomical and physiological differences of specific plant species</li> </ul> (TN Biology II 7)	<ul style="list-style-type: none"> <li>• <b>FFA:</b> Floriculture</li> </ul>	
13	Select relevant technical information to analyze and support claims regarding the relationships between light, temperature, and water on plant growth. Draw conclusions about the interrelationships between plant life processes (such as photosynthesis, respiration, and transpiration), plant growth, and maintenance. (TN Reading 8; TN Biology I 2; TN Biology II 7)	<ul style="list-style-type: none"> <li>• <b>FFA:</b> Floriculture</li> </ul>	<ul style="list-style-type: none"> <li>• <b>HOSA:</b> Researched Persuasive Speaking</li> </ul>
14	Compare and contrast current industry approved methods to regulate plant growth including, but not limited to, environmental, physical, genetic and chemical. Demonstrate in a live setting or in a presentation the ability to apply the best growth regulator to specific plants to obtain selected outcomes. (TN Reading 3, 8, 9; TN Biology II 7)	<ul style="list-style-type: none"> <li>• <b>FFA:</b> Floriculture</li> </ul>	<ul style="list-style-type: none"> <li>• <b>FCCLA:</b> Advocacy</li> </ul>
15	Analyze the nutrient requirements of plants and assess the importance of the 17 essential plant nutrients for plant health. Identify the chemical and biological processes needed to make nutrients available for growth and maintenance, and distinguish among nutrient deficiency and toxicity signs and symptoms in plants. (TN Biology II 7)	<ul style="list-style-type: none"> <li>• <b>FFA:</b> Agronomy, Floriculture</li> </ul>	<ul style="list-style-type: none"> <li>• <b>TSA:</b> Biotechnology Design</li> </ul>
16	Research case studies to cite specific textual evidence determining the significance of safety hazards associated with fertilizer use. In an informative essay, justify the use of different precautions for the prevention or management of hazards and evaluate the efficacy of prevention measures. (TN Reading 1, 8, 9; TN Writing 2, 4, 7, 9)	<ul style="list-style-type: none"> <li>• <b>FFA:</b> Floriculture</li> </ul>	<ul style="list-style-type: none"> <li>• <b>HOSA:</b> Researched Persuasive Speaking</li> <li>• <b>SkillsUSA:</b> Occupational Health and Safety</li> </ul>

17	Identify the basic types of fertilizers and their applications for greenhouse production crops. Differentiate the effects of fertilizer ratios on plant growth and health to hypothesize possible outcomes of each ratio. Calculate proper formulations of fertilizers based upon label directions using systems of equations. Demonstrate in a live setting or in a presentation the ability to follow fertilizer label procedures precisely as they pertain to selection, handling, application, storage, and disposal. (TN Reading 3; TN Math N-Q, A-CED)	<ul style="list-style-type: none"> <li>• <b>FFA:</b> Floriculture, Nursery and Landscape</li> </ul>	
18	Differentiate between the methods of sexual and asexual plant propagation by summarizing valid research. Compare and contrast the different techniques of propagation, explaining advantages and disadvantages of each in an informative text. Conduct at least the following: cutting, budding, layering, sowing, germination rate calculation, and seed viability. (TN Reading 2, 8; TN Writing 4, 9)	<ul style="list-style-type: none"> <li>• <b>FFA:</b> Floriculture, Nursery and Landscape</li> </ul>	
19	Assess the procedures required for producing multiple commercial plant species in a controlled environment, and apply these procedures to produce a variety of specific greenhouse crops. Evaluate environmental factors that affect greenhouse crops to justify management methods. (TN Reading 2; TN Writing 4)	<ul style="list-style-type: none"> <li>• <b>FFA:</b> Agronomy, Floriculture, Nursery and Landscape</li> </ul>	
20	Evaluate the greenhouse climate and recommend the proper climate control equipment to maintain an optimum growing climate, including but not limited to ventilation, humidifiers, heating, cooling, and shading. Provide written justification for each recommendation. (TN Writing 1, 4)	<ul style="list-style-type: none"> <li>• <b>FFA:</b> Floriculture, Nursery and Landscape</li> </ul>	<ul style="list-style-type: none"> <li>• <b>HOSA:</b> Researched Persuasive Speaking</li> <li>• <b>SkillsUSA:</b> HVAC</li> </ul>
21	Demonstrate effective methods to meet water requirements for healthy plant growth. Examine and explain how water pH influences plant growth. Research from multiple technical texts the function and operating principles of greenhouse irrigation systems (such as misting, drip, and overhead systems) to meet watering requirements for the purposes of maintaining optimum moisture level for a variety of plants. (TN Reading 3; TN Writing 8; TN Biology II 7)	<ul style="list-style-type: none"> <li>• <b>FFA:</b> Agricultural Technology and Maintenance</li> </ul>	
22	Determine the economic and aesthetic impact of plant diseases, disorders, and pests. Identify and diagnose the symptoms of common plant diseases, disorders, and pests, and summarize methods of prevention, treatment, and control by drawing evidence from informational texts and relevant scientific literature. (TN Writing 2, 9; TN Biology II 7)	<ul style="list-style-type: none"> <li>• <b>FFA:</b> Agronomy, Floriculture, Nursery and Landscape</li> </ul>	<ul style="list-style-type: none"> <li>• <b>TSA:</b> Essays on Technology</li> </ul>
23	Identify the types of pesticides and their applications for greenhouse production. Research the safety hazards associated with pesticide use for multiple greenhouse pesticides. Calculate proper formulations of pesticides based upon label directions for specific pests by creating systems of equations that describe numerical relationships. (TN Reading 1; TN Writing 1, 4, 7, 9; TN Math N-Q, A-CED)	<ul style="list-style-type: none"> <li>• <b>FFA:</b> Agronomy, Floriculture, Nursery and Landscape</li> </ul>	<ul style="list-style-type: none"> <li>• <b>FCCLA:</b> Environmental Ambassador, Advocacy</li> </ul>

24	Demonstrate in a live setting or in a presentation the ability to follow pesticide procedures precisely according to label and safety guidelines, including selection, handling, personal protective equipment (PPE), application, storage, and disposal. (TN Reading 3)	<ul style="list-style-type: none"> <li>• <b>FFA:</b> Floriculture, Nursery and Landscape</li> </ul>	
25	Evaluate the basic principles and assess the overall effectiveness of integrated pest management (IPM) for controlling greenhouse pests and diseases. Compare with traditional chemical controls.	<ul style="list-style-type: none"> <li>• <b>FFA:</b> Agronomy, Floriculture, Nursery and Landscape</li> </ul>	
26	Examine the roles of hydroponic systems in greenhouse crop production. Describe essential elements of hydroponic systems; explore recent trends and advancements to design a hydroponic system for a specific greenhouse crop. (TN Reading 7; TN Writing 8)	<ul style="list-style-type: none"> <li>• <b>FFA:</b> Agricultural Technology and Maintenance</li> </ul>	
27	Apply basic principles of hydroponics to compare hydroponic and soil-based growing methods for providing nutrients to plants. Summarize the advantages and disadvantages of using soilless media systems to evaluate the efficacy for specific crops. (TN Reading 7; TN Writing 8)	<ul style="list-style-type: none"> <li>• <b>FFA:</b> Agriscience Fair</li> </ul>	
28	Debate laws and regulations affecting horticulture businesses. Demonstrate the use of general business and recordkeeping skills necessary to manage a horticultural business, including but not limited to marketing, advertising, product displays, scheduling, inventory control, merchandise handling and profit and loss statements. (TN Reading 1, 9; TN Writing 2, 9)	<ul style="list-style-type: none"> <li>• <b>FFA:</b> Agricultural Issues</li> </ul>	<ul style="list-style-type: none"> <li>• <b>DECA:</b> Accounting Applications, Financial Services Team Decision Making, Principles of Finance, Business Services Series, Business Finance Series, Personal Financial Literacy, Entrepreneurship Innovation Plan, Entrepreneurship Participating, Entrepreneurship Written, Entrepreneurship –Growing Your Business, Financial Consulting</li> <li>• <b>FBLA:</b> Business Ethics, Agribusiness, Banking &amp; Financial Systems, Business Calculations, Business Financial Plan, Business Math, Business Plan, Business Procedures, Desktop Publishing, Digital Design &amp; Promotion, Digital Video Production, Economics, Sales Presentation, Spreadsheet Applications, and Website Design</li> <li>• <b>FCCLA:</b> Advocacy, Entrepreneurship</li> <li>• <b>HOSA:</b> Biomedical Debate</li> <li>• <b>SkillsUSA:</b> Entrepreneurship</li> <li>• <b>TSA:</b> Debating Technological Issues</li> </ul>
29	Research, develop, and implement greenhouse production schedules for a representative sampling of greenhouse crops that includes at least the following: plant selection, plant material cost (seed, plug, cuttings), growth media, fertilizers, water, testing kits, pricing guides, profit margin, labor, and other expenses. (TN Reading 3; TN Writing 4; TN Math S-ID, Modeling)	<ul style="list-style-type: none"> <li>• <b>FFA:</b> Marketing Plan</li> </ul>	

<b>ALL</b>	<b>CAN BE USED WITH ALL/MOST STANDARDS</b>	<ul style="list-style-type: none"><li>• <b>FFA:</b> Floriculture, Nursery and Landscape</li></ul>	<ul style="list-style-type: none"><li>• <b>FCCLA:</b> Illustrated Talk, Chapter in Review Display, Chapter in Review Portfolio</li><li>• <b>HOSA:</b> Extemporaneous Writing, Prepared Speaking</li><li>• <b>SkillsUSA:</b> Career Pathways Showcase, Job Skills Demonstration A, Job Skills Demonstration O, Prepared Speech, Extemporaneous Speaking, Chapter Display</li><li>• <b>TSA:</b> Prepared Presentation, Extemporaneous Presentation</li></ul>
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