



Plant Science I

Course Number	491340
Grade Level	9-12
Career Cluster	Agriculture
Pathway	Plant Systems
Course Sequence	Level 2
CTSO	FFA
Industry Recognized Credential	https://forms.act.org/certificate/pdf/NCRC-InformationFlyer.pdf
Minimum Equipment List	LINK
Course Description	

CIP Codes	CIP Title
1.0601	Applied Horticulture/Horticulture Operations, General
1.0603	Ornamental Horticulture
1.0604	Greenhouse Operations and Management
1.0605	Landscaping and Groundskeeping
1.0608	Floriculture/Floristry Operations and Management
1.1101	Plant Sciences, General
1.1102	Agronomy and Crop Science
1.0000	Agriculture, General

SOC Codes	SOC Title
19-1013	Soil and Plant Scientists
45-2092	Farmworkers and Laborers, Crop, Nursery, and Greenhouse
37-3011	Landscaping and Groundskeeping Workers
45-2091	Agricultural Equipment Operators
19-4013	Agricultural Technicians
45-1011	First-Line Supervisors of Farming, Fishing, and Forestry Workers
27-1023	Floral Designers
19-1032	Foresters
37-1012	First-Line Supervisors of Landscaping, Lawn Service, and Groundskeeping Workers



Course Standards

Plant Science I Domain 1 Evaluate and implement the steps and requirements to pursue a career opportunity in Plant Science	
Standard 1.1 Evaluate and implement the steps and requirements to pursue a career opportunity in Plant Science.	
Performance Indicators	
1.1.1	Examine the educational, training, and experiential requirements to pursue careers in plant science, including degrees, certifications, and internships.
1.1.2	Analyze personal skillset and create a plan for obtaining the required education, training and experiences to obtain a career in Plant Science.
Standard 1.2 Assess the opportunities in Plant Science available through Career Development Events, Supervised Agricultural Experiences and other FFA activities.	
Performance Indicators	
1.2.1	Examine the Nursery and Landscape, Floriculture or Agronomy Career Development Events for opportunities to exhibit skills needed in Plant Science.
1.2.2	Research ways that plant science skills may be implemented as Supervised Agricultural Experiences and identify other FFA activities involving plant science.
Domain 2 Investigate the role of plants in society and their environmental relationships	
Standard 2.1 Analyze the importance of plants in meeting human needs.	
Performance Indicators	
2.1.1	Investigate the roles of cultivated plants in meeting food, fiber, shelter, fuel, medicinal, chemical, scientific, aesthetic, and occupational needs of society.
2.1.2	Identify and describe different domains of the horticulture and plant production industries.



2.1.3	Examine current issues and trends affecting plant science professionals in Arkansas and regional industries.
Standard 2.2 Evaluate the impact of plants on humans and the environment.	
Performance Indicators	
2.2.1	Distinguish between psychological and physiological benefits of plants on human health and well-being.
2.2.2	Summarize the impact of environmental factors on plant biodiversity and ecosystem stability.
2.2.3	Describe the ways plants are connected to people, animals, and the environment.
2.2.4	Explain how plants have adapted to meet the needs of people, animals, and the environment.
Domain 3 Apply knowledge of plant anatomy and physiology to plant growth and development	
Standard 3.1 Identify and analyze plant cell structures and their functions.	
Performance Indicators	
3.1.1	Identify structures in typical plant cells.
3.1.2	Summarize the functions of the structures in typical plant cells.
3.1.3	Compare and contrast plant cells with animal cells and explain the unique characteristics of plant cells.
Standard 3.2 Analyze plant anatomy and relate structures to their functions.	
Performance Indicators	
3.2.1	Classify plants according to taxonomic systems.
3.2.2	Identify and summarize components, types, and functions of plant roots in nutrient and water uptake.
3.2.3	Identify and summarize components and functions of plant stems in transport and support.



3.2.4	Research and summarize leaf morphology and functions of leaves in photosynthesis and gas exchange.
3.2.5	Identify and summarize components of flowers, their functions, and the functions of flower parts in reproduction.
3.2.6	Differentiate between monocotyledon and dicotyledon plants, including root, stem, and leaf modifications.
3.2.7	Identify and summarize the functions of the components of seeds and fruit.
3.2.8	Analyze and categorize the major types of seeds and fruits.
Standard 3.3 Apply knowledge of plant physiology to understand plant growth processes.	
Performance Indicators	
3.3.1	Summarize the importance and process of photosynthesis, including light-dependent and light-independent reactions and their products.
3.3.2	Summarize the stages of cellular respiration, including products and byproducts and their relationship to plant energy needs.
3.3.3	Summarize primary growth and the role of apical meristems in plant development.
3.3.4	Compare and contrast the effects of transpiration, translocation, and assimilation on plant growth and development.
3.3.5	Identify and categorize the five groups of naturally occurring plant hormones and synthetic plant growth regulators.
3.3.6	Analyze and identify the plant responses to plant growth regulators and different forms of tropism.
Domain 4 Analyze environmental factors and their influence on plant growth	
Standard 4.1 Determine the influence of environmental factors on plant growth and development.	
Performance Indicators	
4.1.1	Identify and summarize the three measurements of light – color, intensity, and duration– that affect plant growth.
4.1.2	Analyze and describe plant responses to variations in light color, intensity, and duration.



4.1.3	Identify and summarize the effects of air quality and temperature on plant metabolism and growth rates.
4.1.4	Identify and summarize the effects of water quality on plant growth, including pH and dissolved solids.
Standard 4.2 Evaluate soil and growing media properties affecting plant growth.	
Performance Indicators	
4.2.1	Identify major components of growing media and describe how different media support plant growth.
4.2.2	Describe physical and chemical characteristics of growing media and explain their influence on plant growth.
4.2.3	Evaluate the physical and chemical properties of soils using technical procedures to test pH, texture, permeability, and water-holding capacity.
4.2.4	Identify categories of soil water and discuss how soil drainage and water-holding capacity can be improved.
Domain 5 Develop and implement plant nutrition and fertilization practices	
Standard 5.1 Analyze essential plant nutrients and their functions.	
Performance Indicators	
5.1.1	Identify essential nutrients for plant growth and development and describe their major functions, including nitrogen, phosphorus, and potassium.
5.1.2	Analyze effects of nutrient deficiencies and recognize symptoms and environmental causes of nutrient deficiencies.
5.1.3	Distinguish between signs of different nutrient deficiencies in plants and recommend appropriate treatments.
Standard 5.2 Evaluate factors affecting nutrient availability and plant uptake.	
Performance Indicators	
5.2.1	Discuss the influence of pH and cation exchange capacity on the availability of nutrients to plants.
5.2.2	Contrast pH and cation exchange capacity between mineral soils and soilless growing media.



5.2.3	Summarize the impact of environmental factors on nutrient availability (e.g., moisture, temperature, and pH).
Standard 5.3 Develop and implement fertilization plans for plant production.	
Performance Indicators	
5.3.1	Identify the sources of essential plant nutrients in fertilizers and explain the formulations, including both organic and inorganic options.
5.3.2	Describe different methods of fertilizer application and calculate fertilizer formulations for specific plant needs.
5.3.3	Collect soil and plant tissue samples using accepted procedures and interpret the laboratory analyses of these samples.
Domain 6 Demonstrate plant propagation and production techniques	
Standard 6.1 Demonstrate sexual plant propagation techniques.	
Performance Indicators	
6.1.1	Identify examples of and summarize pollination, cross-pollination, and self-pollination of flowering plants.
6.1.2	Analyze stages of sexual reproductive development in plants, including the development of male and female gametophytes.
6.1.3	Demonstrate sowing techniques for providing favorable conditions to meet the factors of seed germination.
Standard 6.2 Demonstrate asexual plant propagation techniques.	
Performance Indicators	
6.2.1	Evaluate vegetative plant propagation techniques utilized in agriculture and horticulture production.
6.2.2	Summarize optimal conditions for asexual propagation and demonstrate techniques for propagating plants (e.g., cuttings, division, separation, layering, budding, and grafting).
6.2.3	Compare advantages and disadvantages of sexual versus asexual propagation methods for different plant species.



Standard 6.3 Develop and implement basic plant production plans.	
Performance Indicators	
6.3.1	Research and analyze practices used to maintain a safe product through harvest, processing, storage and shipment (e.g., Food Safety Modernization Act, Good Agricultural Practices, etc.).
6.3.2	Research and summarize the importance of starting with pest and disease-free propagation material.
6.3.3	Determine seeding rates needed for specified plant populations or desired quantities of finished plants.
6.3.4	Observe and record environmental conditions during germination, growth, and development of crops.
6.3.5	Summarize stages of plant growth and identify reasons for controlling plant growth through cultural practices.
6.3.6	Apply principles of design in plant systems and identify and categorize tools used for design (e.g., computer landscape software, drawing tools, florist tools, etc.).
Standard 6.4 Identify and categorize structures and technologies used for controlled atmosphere production of plants.	
Performance Indicators	
6.4.1	Identify controlled environments for plants, such as greenhouses, to provide optimal growing requirements.
6.4.2	Examine methods of irrigation and their advantages and disadvantages related to the impact on the environment.
6.4.3	Examine how agricultural producers use sensors and automated controls to increase production efficiencies.
Domain 7 Identify and manage plant pests, diseases, and disorders	
Standard 7.1 Identify common plant pests, diseases, and disorders.	
Performance Indicators	
7.1.1	Identify and categorize plant pests, diseases, and disorders commonly found in Arkansas plant production systems.
7.1.2	Identify and analyze major Arkansas weeds, insect pests, and infectious and noninfectious plant diseases.



7.1.3	Research principles of disease and pest control and analyze effects of different types of plant pests and diseases on plant health.
Standard 7.2 Develop integrated pest management strategies.	
Performance Indicators	
7.2.1	Diagram life cycles of major plant pests and diseases to understand their development and vulnerable stages.
7.2.2	Identify and summarize pest control strategies associated with integrated pest management and the importance of determining economic thresholds.
7.2.3	Prescribe methods for pest and disease prevention and treatment using integrated pest management principles.
Standard 7.3 Demonstrate safe handling and application of pest control materials.	
Performance Indicators	
7.3.1	Demonstrate understanding of common classes of chemicals used for pest management in plant systems.
7.3.2	Discuss the impact of different types of pest management on the environment.
7.3.3	Gather and evaluate information regarding personal protective equipment (PPE) for chemical application and demonstrate appropriate PPE use.
7.3.4	Create checklists for safe storage and handling of pesticides and other plant protection chemicals.
Domain 8 Explore basic plant genetics and breeding principles	
Standard 8.1 Analyze basic genetic principles in plant breeding.	
Performance Indicators	
8.1.1	Investigate the role of DNA and heritability in plant characteristics and breeding programs.
8.1.2	Identify desirable traits in various plant species and predict probable outcomes of genetic crosses based on Mendel's laws.
8.1.3	Describe how mutation, gene flow, and adaptation influence plant populations and breeding programs.



Standard 8.2 Examine plant biotechnology applications.	
Performance Indicators	
8.2.1	Discuss the different types of plant biotechnology techniques (e.g., genetic engineering, tissue culture, and gene editing).
8.2.2	Distinguish between the branches of science that influence plant biotechnology and summarize important historical achievements.
8.2.3	Examine the role and importance of genetic principles in improving plant characteristics through traditional and modern breeding methods.
8.2.4	Research current and emerging plant biotechnologies and evaluate their applications in horticulture and agriculture.
Domain 9 Investigate production systems and sustainable practices	
Standard 9.1 Evaluate hydroponic and aquaponic production systems.	
Performance Indicators	
9.1.1	Evaluate the significance of hydroponics, aeroponics, and aquaponics technology as related to sustainable practices and principles.
9.1.2	Compare and contrast production systems and techniques utilized in hydroponics, aeroponics, and aquaponics, including structures, equipment, and methods.
9.1.3	Identify common plant species used for hydroponic production and distinguish between their structural and physiological differences.
Standard 9.2 Analyze soilless growing media and water quality factors.	
Performance Indicators	
9.2.1	Assess functions, attributes, and desirable properties of soilless growing media and describe major components and characteristics.
9.2.2	Examine the role that water chemistry plays in the development of water quality for plant production systems.
9.2.3	Demonstrate ability to perform common tests to evaluate water quality factors (e.g., pH, dissolved oxygen, and nutrient levels).



Standard 9.3 Compare production systems and sustainable practices.	
Performance Indicators	
9.3.1	Compare and contrast the alignment of different production systems (conventional and organic) with sustainable agriculture practices and criteria.
9.3.2	Identify equipment utilized for soil tillage and the planting, harvesting, and transportation of crops.
9.3.3	Research and summarize production methods focused on sustainable soil management, including crop rotation, companion planting, and cover crops.

Contributors

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