

AFNR - Plant Systems

Develop and implement a crop management plan for a given production goal that accounts for environmental factors. PS.01.

1 Determine the influence of environmental factors on plant growth. PS.01.01.

- 1a Identify and summarize the three measurements of light – color, intensity and duration – that affect plant growth. PS.01.01.01.A.
- 1b Analyze and describe plant responses to light color, intensity and duration. PS.01.01.01.B.
- 1c Analyze plant responses to varied light color, intensity and duration and recommend modifications to light for desired plant growth. PS.01.01.01.C.
- 2a Identify and summarize the effects of air and temperature on plant metabolism and growth. PS.01.01.02.A.
- 2b Determine the optimal air and temperature conditions for plant growth. PS.01.01.02.B.
- 2c Design, implement and evaluate a plan to maintain optimal air and temperature conditions for plant growth. PS.01.01.02.C.
- 3a Identify and summarize the effects of water quality on plant growth, (e.g., pH, dissolved solids, etc.). PS.01.01.03.A.
- 3b Analyze and describe plant responses to water conditions. PS.01.01.03.B.
- 3c Analyze plant responses to water conditions and recommend modifications to water for desired plant growth. PS.01.01.03.C.

2 Prepare and manage growing media for use in plant systems. PS.01.02.

- 1a Identify the major components of growing media and describe how growing media support plant growth. PS.01.02.01.A.
- 1b Describe the physical and chemical characteristics of growing media and explain the influence they have on plant growth. PS.01.02.01.B.
- 1c Formulate and prepare growing media for specific plants or crops. PS.01.02.01.C.
- 2a Identify the categories of soil water. PS.01.02.02.A.
- 2b Discuss how soil drainage and water-holding capacity can be improved. PS.01.02.02.B.
- 2c Determine the hydraulic conductivity for soil and how the results influence irrigation practices. PS.01.02.02.C.

3 Develop and implement a fertilization plan for specific plants or crops. PS.01.03.

- 1a Identify the essential nutrients for plant growth and development and their major functions (e.g., nitrogen, phosphorous, potassium, etc.). PS.01.03.01.A.

- 1b Analyze the effects of nutrient deficiencies and symptoms and recognize environmental causes of nutrient deficiencies. PS.01.03.01.B.
- 1c Monitor plants for signs of nutrient deficiencies and prepare a scouting report to correct elements negatively affecting plant growth in a field or greenhouse. PS.01.03.01.C.
- 2a Discuss the influence of pH and cation exchange capacity on the availability of nutrients. PS.01.03.02.A.
- 2b Contrast pH and cation exchange capacity between mineral soil and soilless growing media. PS.01.03.02.B.
- 2c Adjust the pH of growing media for specific plants or crops. PS.01.03.02.C.
- 3a Collect soil and plant tissue samples using generally accepted procedures and explain how incorrect sample collection will affect the results of a laboratory analysis. PS.01.03.03.A.
- 3b Interpret laboratory analyses of soil and tissue samples. PS.01.03.03.B.
- 3c Prescribe fertilizer applications based on the results of a laboratory analysis of soil and plant tissue samples. PS.01.03.03.C.
- 4a Identify fertilizer sources of essential plant nutrients; explain fertilizer formulations, including organic and inorganic; and describe different methods of fertilizer application. PS.01.03.04.A.
- 4b Calculate the amount of fertilizer to be applied based on nutrient recommendation and fertilizer analysis. PS.01.03.04.B.
- 4c Calibrate application equipment to meet plant nutrient needs. PS.01.03.04.C.
- 5a Research and summarize production methods focused on soil management (e.g., crop rotation, companion planting, cover crops, etc.). PS.01.03.05.A.
- 5b Assess and describe the short and long-term effects production methods have on soil. PS.01.03.05.B.
- 5c Devise a plan for soil management for a selected production method. PS.01.03.05.C.
- 6a Summarize the impact of environmental factors on nutrient availability (e.g., moisture, temperature, pH, etc.). PS.01.03.06.A.
- 6b Assess and describe the impact environmental factors have on a crop. PS.01.03.06.B.
- 6c Devise a plan to meet plant nutrient needs based on environmental factors present. PS.01.03.06.C.

Apply principles of classification, plant anatomy, and plant physiology to plant production and management. PS.02.

1 Classify plants according to taxonomic systems PS.02.01.

- 1a Identify and summarize systems used to classify plants based on specific characteristics. PS.02.01.01.A.
- 1b Compare and contrast the hierarchical classification of agricultural and ornamental plants. PS.02.01.01.B.

- 1c Classify agricultural and ornamental plants according to the hierarchical classification system. PS.02.01.01.C.
 - 2a Describe the morphological characteristics used to identify agricultural and herbaceous plants (e.g., life cycles, growth habit, plant use and as monocotyledons or dicotyledons, woody, herbaceous, etc.). PS.02.01.02.A.
 - 2b Identify and describe important plants to agricultural and ornamental plant systems by common names. PS.02.01.02.B.
 - 2c Identify and describe important plants to agricultural and ornamental plant systems by scientific names. PS.02.01.02.C.
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2 Apply knowledge of plant anatomy and the functions of plant structures to activities associated with plant systems. PS.02.02.

- 1a Identify structures in a typical plant cell and summarize the function of plant cell organelles. PS.02.02.01.A.
- 1b Compare and contrast mitosis and meiosis. PS.02.02.01.B.
- 1c Apply the knowledge of cell differentiation and the functions of the major types of cells to plant systems. PS.02.02.01.C.
- 2a Identify and summarize the components, the types and the functions of plant roots. PS.02.02.02.A.
- 2b Analyze root tissues and explain the pathway of water and nutrients into and through root tissues. PS.02.02.02.B.
- 2c Correlate the active and passive transport of minerals into and through the root system to plant nutrition. PS.02.02.02.C.
- 3a Identify and summarize the components and the functions of plant stems. PS.02.02.03.A.
- 3b Analyze and describe the difference in arrangement of vascular tissue between monocot and dicot plant stems. PS.02.02.03.B.
- 3c Evaluate the function of the xylem, phloem and cambium tissues and the impact on plant systems. PS.02.02.03.C.
- 4a Research and summarize leaf morphology and the functions of leaves. PS.02.02.04.A.
- 4b Analyze how leaves capture light energy and summarize the exchange of gases. PS.02.02.04.B.
- 4c Devise a plan for plant management practices that takes into account leaf structure and functions. PS.02.02.04.C.
- 5a Identify and summarize the components of a flower, the functions of a flower and the functions of flower components. PS.02.02.05.A.
- 5b Apply knowledge of flower structure to differentiate between the types of flowers and flower inflorescence (e.g., complete, incomplete, perfect, imperfect). PS.02.02.05.B.
- 5c Evaluate flower structures and analyze the impact of plant structure on plant breeding, production and use. PS.02.02.05.C.

- 6a Identify and summarize the functions and components of seeds and fruit. PS.02.02.06.A.
 - 6b Analyze and categorize the major types of seeds and fruit. PS.02.02.06.B.
 - 6c Evaluate the impact of different seed and fruit structures to plant culture and use. PS.02.02.06.C.
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3 Apply knowledge of plant physiology and energy conversion to plant systems. PS.02.03.

- 1a Summarize the importance of photosynthesis to plant life on earth and the process of photosynthesis, including the types (c3, c4, Cam), its stages (e.g., light-dependent and light independent reactions), and its products and byproducts. PS.02.03.01.A.
 - 1b Apply knowledge of photosynthesis to analyze how various environmental factors will affect the rate of photosynthesis. PS.02.03.01.B.
 - 1c Evaluate the impact of photosynthesis and the factors that affect it on plant management, culture and production problems. PS.02.03.01.C.
 - 2a Summarize the stages of cellular respiration including their products and byproducts. PS.02.03.02.A.
 - 2b Analyze the factors that affect cellular respiration processes and rate in a crop production setting. PS.02.03.02.B.
 - 2c Evaluate the impact of plant respiration on plant growth, crop management and post-harvest handling decisions. PS.02.03.02.C.
 - 3a Summarize primary growth and the role of the apical meristem. PS.02.03.03.A.
 - 3b Analyze plant growth and assess the process of secondary plant growth. PS.02.03.03.B.
 - 3c Relate the principles of primary and secondary growth to plant systems. PS.02.03.03.C.
 - 4a Identify and categorize the five groups of naturally occurring plant hormones and synthetic plant growth regulators. PS.02.03.04.A.
 - 4b Analyze and identify the plant responses to plant growth regulators and different forms of tropism. PS.02.03.04.B.
 - 4c Select and defend the use of specific plant growth regulators to produce desired responses from plants. PS.02.03.04.C.
 - 5a Compare and contrast the effects of transpiration, translocation and assimilation on plants. PS.02.03.05.A.
 - 5b Identify and analyze the factors affecting transpiration, translocation and assimilation rate and products. PS.02.03.05.B.
 - 5c Devise plans for plant management that applies knowledge of transpiration, translocation and assimilation on plant growth. PS.02.03.05.C.
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Propagate, culture and harvest plants and plant products based on current industry standards. PS.03.

1 Demonstrate plant propagation techniques in plant system activities. PS.03.01.

- 1a Identify examples of and summarize pollination, cross-pollination and self-pollination of flowering plants. PS.03.01.01.A.
- 1b Examine and apply the process of plant pollination and/or fertilization. PS.03.01.01.B.
- 1c Select and defend the use of pollination methods and practices used to maximize crop pollination. PS.03.01.01.C.
- 2a Demonstrate sowing techniques for providing favorable conditions to meet the factors of seed germination. PS.03.01.02.A.
- 2b Handle seed to overcome seed dormancy mechanisms and to maintain seed viability and vigor. PS.03.01.02.B.
- 2c Conduct tests associated with seed germination rates, viability and vigor. PS.03.01.02.C.
- 3a Summarize optimal conditions for asexual propagation and demonstrate techniques used to propagate plants by cuttings, division, separation, layering, budding and grafting. PS.03.01.03.A.
- 3b Manage the plant environment to support asexual reproduction. PS.03.01.03.B.
- 3c Evaluate asexual propagation practices based on productivity and efficiency. PS.03.01.03.C.
- 4a Define micropropagation, discuss advantages associated with the practice and summarize the main stages of the process. PS.03.01.04.A.
- 4b Demonstrate aseptic micropropagation techniques. PS.03.01.04.B.
- 4c Propagate plants by micropropagation. PS.03.01.04.C.
- 5a Summarize the principles of recombinant DNA technology and the basic steps in the process. PS.03.01.05.A.
- 5b Compare and contrast the potential risks and advantages associated with genetically modified plants. PS.03.01.05.B.
- 5c Evaluate the impact of using genetically modified crops on other production practices. PS.03.01.05.C.

2 Develop and implement a management plan for plant production. PS.03.02.

- 1a Research and summarize the importance of starting with pest- and disease-free propagation material. PS.03.02.01.A.
- 1b Inspect propagation material for evidence of pests or disease. PS.03.02.01.B.
- 1c Produce pest- and disease-free propagation material. PS.03.02.01.C.
- 2a List and summarize the reasons for preparing growing media before planting. PS.03.02.02.A.
- 2b Prepare soil and growing media for planting with the addition of amendments. PS.03.02.02.B.

- 2c Analyze how mechanical planting equipment performs soil preparation and seed placement. PS.03.02.02.C.
- 3a Determine seeding rate need for specified plant population or desired quantity of finished plants. PS.03.02.03.A.
- 3b Apply pre-plant treatments required of seeds and plants and evaluate the results. PS.03.02.03.B.
- 3c Adjust and calibrate mechanized seeding and/or planting equipment for desired seed application rate. PS.03.02.03.C.
- 4a Observe and record environmental conditions during the germination, growth and development of a crop. PS.03.02.04.A.
- 4b Monitor the progress of plantings and determine the need to adjust environmental conditions. PS.03.02.04.B.
- 4c Prepare and implement a plant production schedule based on predicted environmental conditions and desired market target (e.g., having plants ready to market on a specific day such as Mother's Day, organic production, low maintenance landscape plants, etc.). PS.03.02.04.C.
- 5a Summarize the stages of plant growth and the reasons for controlling plant growth. PS.03.02.05.A.
- 5b Demonstrate proper techniques to control and manage plant growth through mechanical, cultural or chemical means. PS.03.02.05.B.
- 5c Prepare plant production schedules utilizing plant growth knowledge to get plants to their optimal growth stage at a given time. PS.03.02.05.C.
- 6a Identify and categorize structures and technologies used for controlled atmosphere production of plants. PS.03.02.06.A.
- 6b Compare and contrast the types of technologies used for controlled atmosphere production. PS.03.02.06.B.
- 6c Research, select and defend technology for use in controlled atmosphere production. PS.03.02.06.C.
- 7a Summarize the use of hydroponic and aquaponic systems for plant production. PS.03.02.07.A.
- 7b Compare and contrast the types of systems used in hydroponic and aquaponic plant production. PS.03.02.07.B.
- 7c Research, select and defend the use of a hydroponic or aquaponic plant system. PS.03.02.07.C.

3 Develop and implement a plan for integrated pest management for plant production. PS.03.03.

- 1a Identify and categorize plant pests, diseases and disorders. PS.03.03.01.A.
- 1b Identify and analyze major local weeds, insect pests and infectious and noninfectious plant diseases. PS.03.03.01.B.
- 1c Devise solutions for plant pests, diseases and disorders. PS.03.03.01.C.

- 2a Diagram the life cycle of major plant pests and diseases. PS.03.03.02.A.
 - 2b Predict pest and disease problems based on environmental conditions and life cycles. PS.03.03.02.B.
 - 2c Design and implement a crop scouting program. PS.03.03.02.C.
 - 3a Identify and summarize pest control strategies associated with integrated pest management and the importance of determining economic threshold. PS.03.03.03.A.
 - 3b Demonstrate pesticide formulations including organic and synthetic active ingredients and selection of pesticide to control specific pest. PS.03.03.03.B.
 - 3c Employ pest management strategies to manage pest populations, assess the effectiveness of the plan and adjust the plan as needed. PS.03.03.03.C.
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4 Apply principles and practices of sustainable agriculture to plant production. PS.03.04.

- 1a Compare and contrast the alignment of different production systems (conventional and organic) with USDA sustainable practices criteria. PS.03.04.01.A.
 - 1b Analyze the alignment of modern technologies used in production systems (e.g., precision agriculture, GE crops, etc.) with USDA sustainable practices criteria. PS.03.04.01.B.
 - 1c Research, prepare and defend plans for a plant systems enterprise that aligns with USDA sustainable practices criteria. PS.03.04.01.C.
 - 2a Summarize national/international and local/regional food production systems. PS.03.04.02.A.
 - 2b Compare and contrast the impact on greenhouse gas, carbon footprint of the national/international production system with local/regional production system markets. PS.03.04.02.B.
 - 2c Select and defend the use of nationally/internationally grown or locally/ regionally grown for a production operation system. PS.03.04.02.C.
 - 3a Identify and summarize impacts of environmental conditions on plants. PS.03.04.03.A.
 - 3b Compare and contrast differing research conclusions related to environmental factors and their effect on plants. PS.03.04.03.B.
 - 3c Evaluate evidence supporting claims on how environmental conditions effect plants. PS.03.04.03.C.
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5 Harvest, handle and store crops according to current industry standards. PS.03.05.

- 1a Identify and summarize harvesting methods and equipment. PS.03.05.01.A.
- 1b Assess the stage of growth to determine crop maturity or marketability and demonstrate proper harvesting techniques. PS.03.05.01.B.
- 1c Analyze the processed used by mechanical harvesting equipment. PS.03.05.01.C.

- 2a Research and summarize reasons for calculating crop loss and or damage. PS.03.05.02.A.
- 2b Evaluate crop yield and loss data and make recommendations to reduce crop loss. PS.03.05.02.B.
- 2c Implement and evaluate the effectiveness of plans to reduce crop loss. PS.03.05.02.C.
- 3a Research and summarize how safety is ensured at each stage of the following processes: harvesting, processing and storing. PS.03.05.03.A.
- 3b 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.). PS.03.05.03.B.
- 3c Research laws and apply regulations to ensure the production of plants and plant products that are safe for distribution and use. PS.03.05.03.C.
- 4a Identify and categorize plant preparation methods for storing and shipping plants and plant products. PS.03.05.04.A.
- 4b Analyze the proper conditions required to maintain the quality of plants and plant products held in storage and during shipping. PS.03.05.04.B.
- 4c Monitor and evaluate environmental conditions in storage facilities for plants and plant products. PS.03.05.04.C.
- 5a Summarize the reasons for preparing plants and plant products for distribution. PS.03.05.05.A.
- 5b Demonstrate techniques for grading, handling and packaging plants and plant products for distribution. PS.03.05.05.B.
- 5c Evaluate techniques for grading, handling and packaging plants and plant products. PS.03.05.05.C.

Apply principles of design in plant systems to enhance an environment (e.g. floral, forest landscape, and farm). PS.04.

1 Evaluating, identifying and preparing plants to enhance an environment. PS.04.01.

- 1a Identify and categorize plants by their purpose (e.g., floral plants, landscape plants, house plants, etc.). PS.04.01.01.A.
- 1b Demonstrate proper use of plants in their environment (e.g., focal and filler plants in floriculture, heat tolerant and shade plants in a landscape design, etc.). PS.04.01.01.B.
- 1c Install plants according to a design plan that uses the proper plants based on the situation and environment. PS.04.01.01.C.
- 2a Summarize the applications of design in agriculture and ornamental plant systems. PS.04.01.02.A.
- 2b Create a design utilizing plants in their proper environments. PS.04.01.02.B.
- 2c Evaluate a design and provide feedback and suggestions for improvement (e.g., a floral arrangement, a landscape or a landscape plan, etc.). PS.04.01.02.C.

2 Create designs using plants. PS.04.02.

- 1a** Research and summarize the principles and elements of design for use in plant systems. **PS.04.02.01.A.**
- 1b** Apply principles and elements of design that form the basis of artistic impression. **PS.04.02.01.B.**
- 1c** Analyze designs to identify use of design principles and elements. **PS.04.02.01.C.**
- 2a** Identify and categorize tools used for design (e.g., computer landscape software, drawing tools, florist tools, etc.). **PS.04.02.02.A.**
- 2b** Demonstrate the use of tools used for creating designs. **PS.04.02.02.B.**
- 2c** Choose and properly use appropriate tools to create a desired design. **PS.04.02.02.C.**
- 3a** Explain the concept of landscape ecology and summarize factors that shape the ecology of a landscape (e.g., composition, structure, function, etc.). **PS.04.02.03.A.**
- 3b** Research and provide examples of ecological factors incorporated into landscape designs. **PS.04.02.03.B.**
- 3c** Utilize green technologies and sustainable practices that prevent or limit negative environmental impacts. **PS.04.02.03.C.**