

Plant Systems Pathway Test Blueprint

I. Plant Biology and Ecology

A. Understand plant biology and apply principles in a plant systems production setting.

1. Describe and use plant classification systems.

- a. List the systems used to classify plants (e.g., hierarchical classification system, life cycles, plant use, and monocots or dicots).
- b. Compare and contrast the hierarchical classification of plants to other agricultural plant classification systems (e.g., life cycle, plant use, monocot, dicot, woody, herbaceous, etc.).

2. Identify plants according to different methods of classification and identification.

- a. Identify plant structures and functions (e.g., leaf arrangement, root systems, vascular compounds, leaf shape, etc.).

3. Understand plant growth and development.

- a. Distinguish the growth cycles of plants (e.g., vegetative, germination, dormancy, and vernalization).
- b. Outline the life stages of plants.
- c. Predict how changes in growth factors will affect plant productivity.
- d. Determine the role that humans play in the development of plants that are important to agriculture (e.g., why we fertilize, irrigate, etc.).

4. Understand cell structure and function.

- a. Describe the parts of a plant cell and their functions.
- b. Relate the structure of DNA to its functions.
- c. Relate mitosis and meiosis to plant growth and development.

5. Understand the anatomy and function of plant parts.

- a. Identify the parts of plant organs (e.g., leaves, roots, stems, etc.).
- b. Explain the structure and function that flowers, stems, leaves, and roots play in plant growth and development.
- c. Determine the adaptability of plants to an environment based on variations in morphology (e.g., succulents and water plants).

6. Describe photosynthesis and respiration and the impact they have on plant production.

- a. Describe the basic cellular processes that regulate plant growth (e.g., photosynthesis, respiration, transpiration, translocation, photoperiodism, and assimilation).
- b. List the requirements, products, and byproducts necessary for photosynthesis and respiration.

7. Understand plant processes and effect on production.

Plant Systems Pathway Test Blueprint

a. Diagram the movement of nutrients through the plant processes.
b. Describe signs of proper and improper physiological plant processes.
8. Describe the processes of plant reproduction and replication.
a. Identify the differences between sexual and asexual propagation methods.
b. Describe how to successfully plant seeds, how to use stem cutting propagation, and how to use grafting propagation.
9. Describe the impact of plant genetics on plant production practices.
a. Apply basic concepts in plant genetics (e.g., dominant, recessive, and hybrid).
b. Describe the benefits of improved plant genetics (e.g., disease resistance, improved productivity, etc.).
c. Complete a Punnett square to show how plant characteristics are inherited.
II. Plant Production
A. Describe processes and techniques of plant environmental management.
1. Understand plant environment and impact on plant growth and development.
a. Determine the effects of changes in air, temperature, nutrients, light, and water on plant metabolism and growth.
b. Describe plant responses to changes in the environment (e.g., tropisms, dormancy, photoperiodism, and flowering).
2. Use nutrient identification and management in plant systems.
a. Recognize the 16 essential nutrients and their roles in growth.
b. Describe nutrient deficiency symptoms.
c. Identify nutrient availability in a soil.
3. Manage diseases and pests in plant systems.
a. Apply the disease and pest triangle to pest management.
b. Describe how pests affect plants.
4. Understand and implement an integrated pest management plan.
a. Identify the primary concepts of IPM/PHC (Integrated Pest Management/Plant Health Care).
b. Determine generally accepted control methods and combinations for common insect, disease, and weed groups based on pest life cycles.
5. Understand safety practices and chemical pest control methods.
a. Identify the risks and benefits associated with the materials and methods used in plant pest management (e.g., signal words and symbols).

Plant Systems Pathway Test Blueprint

b. Determine where to find the procedures for the safe handling, use, and storage of pesticides.
c. Evaluate environmental and consumer concerns regarding pest management strategies.
6. Identify pests and diagnose diseases.
a. Define terms for common plant disease signs and symptoms (e.g., stunting, chlorosis, and necrosis).
b. Distinguish between signs and symptoms of pest/diseases.
c. Diagnose unknown pests/diseases using diagnostic processes.
d. Outline how pests become resistant to pesticides.
B. Understand the management of water resources in plant systems.
1. Describe the water cycle.
a. Define water cycle and define how it relates to agriculture.
b. Diagram the water cycle.
2. Understand irrigation methods, systems, and equipment.
a. Identify the role irrigation plays in plant production.
b. Identify common irrigation systems, methods, and equipment used in agriculture.
c. Discuss the advantages and disadvantages of common types of irrigation systems.
3. Determine factors influencing water quality.
a. Identify the major water pollution groups and their ecological impacts.
b. List common water pollution control measures.
4. Explain principles of water conservation.
a. Define water conservation and why it is important in agriculture.
b. Describe how management practices and plant/crop choice are related to water consumption/water conservation.
c. Relate water conservation to common soil and conservation practices (e.g., waterways, runoff, no till, and minimum till).
5. Describe the relationship of watershed and water sources on plant systems.
a. Identify the boundaries of local watersheds.
b. Relate the function of watersheds to natural resources (e.g., vegetative covers' effect on water quality).

Plant Systems Pathway Test Blueprint

C. Identify and explain the principles of crop production.
1. Understand planting methods and procedures.
a. Describe favorable conditions for seed germination.
b. Identify methods of seed handling to overcome seed dormancy mechanisms and maintain vigor.
c. Calculate necessary seed quantity based on seeding rates, purity, and germination.
d. Identify propagation methods used for various crops (e.g., sexual or asexual).
2. Understand harvest methods.
a. Determine harvest methods for major crops.
b. Assess the stage of growth to determine crop maturity.
3. Describe the principles of crop storage.
a. Identify storage methods and conditions for plants and plant products.
b. List the reasons for preparing plants and plant products for distribution, including grading, handling, and packaging.
4. Understand the role and importance of a management plan in crop production.
a. Determine the components of a management plan (e.g., environment, procedure, calendar, and pest management).
III. Plant/Agriculture and Society
A. Understand the structure and significance of plant agriculture systems.
1. Examine the meaning and application of plant systems.
a. Describe the scope of plant sciences and plant systems.
b. Explain the impact of plant systems locally, nationally, and globally.
c. Explain how plant science affects other agricultural pathways (e.g., animal systems, agriculture business, biotechnology, environmental, etc.).
d. Describe the evolution of technological advances in plant systems.
2. Understand the distribution channels (i.e., inputs and outputs) of the plant agriculture industry and relate these to the efficiencies of production.
a. Define the plant system process from producer to consumer (e.g., wholesalers, local markets/direct markets (CSA), retailers, governments/institutional school lunch, and prison lunch).
b. Describe the movement of products through channels.
c. Illustrate the impact of the distribution channels on producers and consumers.

Plant Systems Pathway Test Blueprint

B. Understand issues and trends in the plant systems pathway.

1. Understand the impact of organic production on agriculture and society.

- a. Define certified organic crop production.
- b. Analyze the advantages and disadvantages of organic production.
- c. Compare and contrast the potential ecological and economic impact of various agriculture practices (e.g., organic, conventional, natural, etc.).

2. Understand the impact of biotechnology on agriculture and society.

- a. Define biotechnology.
- b. Recognize some current uses in biotechnology in plant systems (e.g., Roundup Ready corn, sugar beets, etc.).
- c. Compare and contrast the potential impact of crops produced through biotechnology and conventional plant breeding (e.g., production practices, economics, food supply, and public perception).

3. Understand the impact of sustainability on agriculture and society.

- a. Define sustainability.
- b. Evaluate crop diversity in economic and ecological terms.

IV. Soil Science

A. Understand management practices for soils.

1. Understand soil formation factors.

- a. Identify the components of soil (e.g., water, mineral particles, air, and organic matter).
- b. Describe the process of soil formation through the five soil forming factors: time, topography, weathering, soil organisms, and climate.
- c. Differentiate soils based on soil horizons, parent material, etc.

2. Evaluate soil physical characteristics.

- a. Identify physical properties of soil (e.g., bulk density, aeration/drainage, water movement, water-holding capacity, texture, structure, and color).
- b. Relate soil formation and soil physical characteristics to suitable land uses or land capability classes.

3. Explain how soil water-holding capacity and movement relates to soil management.

- a. Describe how soil serves as a reservoir for plant-available water.
- b. Compare the different categories of soil water (i.e., plant-available, plant-unavailable).
- c. Compare the relationship between root volume and soil water available to the plant.

Plant Systems Pathway Test Blueprint

d. Identify methods used to improve soil drainage and water-holding capacity.
e. Discuss how water moves into and through soil and how it is retained.
f. Describe evapotranspiration and the factors associated with it (e.g., temperature, wind, residue, and shading).
4. Explain soil physical properties and their relation to soil management.
a. Identify the main types of soil structures (e.g., blocky, prismatic, granular, platy, etc.).
b. Describe how soil structure is related to soil treatment (e.g., plowing, cultivation, organic matter amendments, etc.).
c. Diagnose and prescribe treatments for potential plant growth-related problems associated with soil structure (e.g., pans, compaction, etc.).
d. Identify types and conditions for soil erosion.
e. Define soil compaction and its effects on growing conditions.
f. Determine prevention and control methods for different types of soil erosion.
5. Explain soil texture and relate it to soil management.
a. Identify different methods of determining soil texture (e.g., soil ribbon test, the USDA soil texture triangle, and solids separation).
b. Recognize potential plant growth problems associated with soil texture (e.g., tightness, poor drainage, temperature variations, etc.).
c. Recognize the role of soil solids (e.g., organic matter, sand, silt, and clay) on soil characteristics (e.g., fertility, pH, drainage, and erodibility).
6. Explain soil pH and its management.
a. Identify how soil pH affects crop choice, soil health, nutrient availability, and productivity.
b. Describe how soil pH can be adjusted.
7. Explain soil nutrient cycling.
a. Diagram and explain the N, P, and K cycle.
b. Describe how nutrients are "gained" and "lost" in the soil nutrient cycle.
c. Diagram the carbon cycle.
d. Explain the importance of soil organisms on soil quality.
8. Understand and apply soil surveys.
a. Use the USDA soils survey to assess soil variation.
b. Determine appropriate land use based on soil survey information.
9. Explain soil-testing procedures.

Plant Systems Pathway Test Blueprint

- a. List the steps in collecting, documenting, and submitting composite soil samples.
- b. Calculate a fertilizer application based on soil test recommendations.

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V. Greenhouse Management

A. Understand and apply principles of greenhouse management.

1. Understand greenhouse function, design, materials, and structure.

- a. Explain the purposes of greenhouse production.
- b. Compare and contrast structures, framework, and their applications.
- c. Select glazing material based on physical properties and cost.
- d. Recommend the best type of greenhouse structure and glazing material for different scenarios.

2. Understand selection of greenhouse environmental systems.

- a. Identify the factors that are involved with the climate of a greenhouse (e.g., heating, cooling, humidity, and light).
- b. Describe the purpose and use of common environmental controls (i.e., manual and automatic).
- c. Recommend the best type of heating, cooling, and ventilation in different scenarios.

3. Understand selection of greenhouse irrigation systems.

- a. Identify the types of irrigation systems used in greenhouse production.
- b. Compare and contrast irrigation systems.

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c. Recommend the best type of irrigation in different scenarios.
4. Understand the process for selection of greenhouse-growing media.
a. Describe properties and components of growing media.
b. Recommend the best type of growing media in different scenarios.
5. Understand and apply practices for greenhouse plant nutrition and growth.
a. Describe plant nutrition and the importance of nutrient management in a greenhouse setting.
b. Identify micro- and macronutrients.
c. Identify nutrient-deficiency symptoms and remediation by fertilization practices by using available plant nutrient sources (e.g., water soluble, slow release, and organic).
d. Calculate fertilization practices based on product labels and specifications (e.g., application methods, injection, and concentration).
6. Understand practices for greenhouse disease and pest management.
a. Identify major plant diseases and pests in greenhouse production.
b. Describe methods of control for major plant diseases and pests in greenhouse production.
7. Apply greenhouse operation practices.
a. Demonstrate safety procedures when completing common greenhouse tasks.
b. Identify common automated systems.
8. Understand the principles of propagation techniques.
a. Identify reasons crops are sexually or asexually propagated.
b. Compare and contrast sexual and asexual propagation.
c. Identify proper sanitation techniques during asexual propagation.
9. Identify and describe different growth regulators used in plant systems.
a. Identify growth regulators and their uses in production.
b. Describe the impact of growth regulators on plant growth and development.
VI. Turf and Landscape Management
A. Understand practices for establishing and maintaining turf and landscape areas.
1. Explain utilization of landscape drafting tools and equipment.
a. Identify the uses of traditional landscaping design tools.
b. Calculate dimensions to scale.
2. Explain landscape water use.

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a. Identify common types of irrigation systems and their components.
b. Demonstrate how to set an irrigation timer and set irrigation zones to turn on at the proper time.
c. Define xeriscaping and explain its benefits.
d. Compare water usage between traditional and xeriscaped areas.
3. Understand the selection and utilization of turf grasses in the landscape.
a. Identify common turf grasses and classify to growth type.
b. Analyze turf grass species for specific uses or location.
c. Calculate the amount of seed or sod needed for a specific area.
4. Understand the selection and placement of plant materials in the landscape.
a. Interpret the USDA zone map.
b. Select appropriate plant materials for specific landscape situations.
5. Perform identification and treatment of plant injuries and diseases.
a. Identify common turf and landscape plant injuries caused by insects or the environment.
b. Describe integrated pest management and how it can be applied to turf and landscape maintenance.
6. Understand practices for turf and landscape maintenance.
a. Identify the steps for proper landscape, including pruning, mowing, aerating, and fertilization.
b. Describe how to maintain equipment to ensure the proper health of the turf.
c. Compare lawn mower types and their applications, advantages, and disadvantages.