

Plant and Soil Science 2

Exam Information	Description
Exam number 143 Items 41 National Career Cluster Agriculture Certification available Yes	The Plant and Soil Science 2 industry certification exam assesses knowledge and skills in advanced areas of plant and soil science, including range resource management. Learners demonstrate their understanding of the importance of biotechnology in crop production and identify common weeds, diseases, and insect pests.

Exam Blueprint and Performance Skills

Standard	Percentage of exam score
1. Leadership Development*	4%
2. Work-Based Learning*	4%
3. Plant Physiology Concepts	16%
4. Range Resource and Agronomics*	20%
5. Integrated Pest Management*	36%
6. Biotechnology in Plant Science*	20%

*Includes performance skill evaluation

Standard 1 - Leadership Development (4% of exam score)

Candidates will participate in personal and leadership development activities through the FFA.

Objective 1 Candidates will use communication skills to effectively communicate with others.

1. Understand when it is appropriate to listen and to speak.
2. Understand and follow verbal and written instructions for classroom and laboratory activities.
3. Will practice communication skills through public speaking using one or more of the following activities: memorized speech, prepared speech, extemporaneous speech, parliamentary practice, group presentation, or serving in a leadership capacity.

Objective 2 Candidates will effectively use teamwork to respectfully work with others.

1. Identify and understand different roles in working with a team.
2. Lead a group discussion or serve in a leadership capacity.

Objective 3 Candidates will use critical thinking and problem-solving skills.

1. Analyze the cause of the problem.
2. Develop a solution to address the problem.
3. Implement the plan.
4. Evaluate the effectiveness of the plan.

Objective 4 Candidates will be dependable, reliable, steady, trustworthy, and consistent in performance and behavior.

1. Set and meet goals on attendance and punctuality.
2. Prioritize, plan, and manage work to complete assignments and projects on time

Objective 5 Candidates will be accountable for results.

1. Use an achievement chart for activities and behaviors in class that encourages a personal evaluation of classroom performance.
2. Use reflection to describe what was learned, what went well, what could have been improved, and what are the implications to the learning process.
3. Track and communicate progress toward completion of assignments and projects.

Objective 6 Be familiar with the legal requirements and expectations of the course.

1. Be familiar with the course disclosure statement and all requirements for successful completion of the course.
2. Demonstrate workplace ethics, e.g., fair, honest, disciplined.

Optional: Standard performance evaluations on the final page of this document

Standard 2 - Work-Based Learning (2%)

Candidates will participate in work-based learning activities through the Supervised Agricultural Experience (SAE) Program.

Objective 1 Candidates will demonstrate employability skills.

1. Use a career search network to find career choices.
2. Identify the appropriate CTE pathways for selected career choices.
3. Prepare for entry into the workforce by completing one of the following: a list of required skills needed for a career choice, a resume including a list of demonstrated skills, a cover letter or letter of application, a job application, or participate in an actual or simulated job interview.

Objective 2 Candidates will participate in a work-based learning experience outside the classroom.

1. Candidates will plan and implement a Supervised Agricultural Experience Program:
2. Foundational SAE: Career exploration and planning, employability skills for college and career readiness, personal financial management and planning, workplace safety, and agricultural literacy.
3. Immersion SAE: Ownership/entrepreneurship, placement/internship, research, school-based enterprise, and/or service-learning experiences.

Objective 3 Candidates will develop a job portfolio specific to their selected SAE/WBL experience.

1. Candidates will keep a personal record/journal/log of their SAE/WBL experience; including pictures, financial records or log of their hours, skills learned, goals, reflection, etc.

Optional: Standard performance evaluations on the final page of this document

Standard 3 - Plant Physiology Concepts (16%)

Candidates will describe plant physiology concepts.

Objective 1 Explain plant physiology concepts and energy conversion in plants.

1. Explain cell differentiation and the functions of the major types of plant cells.
2. Relate the active and passive transport of minerals into and through the root system.
3. Describe the processes of translocation.
4. Explain the process of secondary plant growth.
5. Explain the light-dependent and light-independent reactions that occur during photosynthesis and apply the knowledge to plant management.
6. Explain the four stages of aerobic respiration, and relate cellular respiration to plant growth, crop management, and post-harvest handling.

Standard 4 - Range Resource and Agronomics (20%)

Choose ONE of the following three areas of focus:

1. Candidates will explain range resources and management practices

Objective 1 Describe practices associated with range management.

1. Evaluate range management systems, economics, and improvement techniques.
2. Determine livestock and wildlife use on rangeland.
3. Describe range management practices related to plant growth and development.
4. Establish a range transect and use it to evaluate a specific location.

Objective 2 Collect and prepare plant tissue and soil samples for analysis and interpret test results.

1. Explain the reasons for analyzing plant tissue and soil samples.
2. Describe the procedures in collecting and preparing plant tissue and soil samples for analysis.
3. Test soil samples for nutrient content.
4. Interpret Test results from plant tissue and soil samples.

2. Candidates will explain forestry resources and management practices.

Objective 1 Describe practices associated with forest management.

1. Evaluate forest management systems, economics, and improvement techniques.
2. Determine livestock and wildlife use on forest land.
3. Describe forest management practices related to plant growth and development.
4. Establish a forest transect and use it to evaluate the types and numbers of plant species in a specific area.

Objective 2 Collect and prepare plant tissue and soil samples for analysis and interpret test results.

1. Explain the reasons for analyzing plant tissue and soil samples.
2. Describe the procedures in collecting and preparing plant tissue and soil samples for analysis.
3. Test soil samples for nutrient content.
4. Interpret test results from plant tissue and soil samples.

3. Candidates will explain agronomics, the science of the cultivation of land, soil management, and crop production.

Objective 2 Describe practices associated with the cultivation of land, soil management, and crop production.

1. Evaluate specific cultivation practices and determine the economic value of each, e.g., till, no till, crop rotation, cover crops, integrated pest management, integrating livestock and crops, etc.
2. Evaluate how different tillage operations (plowing, chiseling, harrowing, disking, rototilling, etc.) affects the soil and water conservation, soil fertility, percolation, plant growth and development.
3. Describe input management practices related to plant growth and development, e.g., seed, fertilizer, irrigation, pest control, etc.

Objective 2 Collect and prepare plant tissue and soil samples for analysis and interpret test results.

1. Explain the reasons for analyzing plant tissue and soil samples.
2. Describe the procedures in collecting and preparing plant tissue and soil samples for analysis.
3. Test soil samples for nutrient content.
4. Interpret test results from plant tissue and soil samples.

Optional: Standard performance evaluations on the final page of this document

Standard 5 - Integrated Pest Management (36%)

Candidates will describe integrated pest management on agronomic, range or forest lands.

Objective 1 Describe the principles of integrated pest management (IPM).

1. Explain IPM.
2. Identify benefits of IPM.
3. Describe pest control strategies associated with IPM.

Objective 2 Identify and manage plant pests and diseases.

1. Identify types of plant pests and disorders.
2. Describe the classification of weeds.
3. Explain the classification of insects and nematodes.
4. Explain the classification of plant diseases.
5. Identify weeds, insect pests, and infectious and noninfectious plant diseases.
6. Explain scouting of field crops for pests.

Objective 3 Explain procedures for the safe handling, use, and storage of pesticides.

1. Explain risks and benefits associated with the materials and methods used in plant pest management.
2. Interpret pesticide labels.
3. Explain procedures for mixing and storing pesticides.
4. Describe types of pesticide controls and formulations.
5. Explain the safety practices in applying pesticides.
6. Calibrate equipment used in applying pesticides.
7. Describe the proper disposal of surplus pesticides and empty containers.
8. Evaluate environmental and consumer concerns regarding pest management strategies.

Optional: Standard performance evaluations on the final page of this document

Standard 6 - Biotechnology in Plant Science (20%)

Candidates will investigate principles of biotechnology as related to plant science.

Objective 1 Explain biotechnology.

1. Define biotechnology and explore its historic impact on agriculture.
2. Describe current applications of biotechnology in agriculture.
3. Describe the role of agencies that regulate biotechnology.
4. Identify examples of ethical, legal, social, and cultural biotechnology issues.
5. Describe benefits and risks associated with biotechnology.

Objective 2 Explain selective plant breeding.

1. Explain how to estimate the heritability of certain traits.
2. Predict the genotypes and phenotypes from monohybrid and dihybrid crosses by using the Punnett square.
3. Describe sex determination, linkage, crossover, and mutation.
4. Describe how biotechnology tools are used to monitor and direct plant breeding.

Objective 3 Examine genetic engineering of plants.

1. Explain the reasons for genetic modification of plants.
2. Identify transgenic plants on the market.
3. Describe the processes and techniques used to produce transgenic plants.
4. Describe how biotechnology can be used to evaluate existing transgenic plants.

Objective 4 Describe micropropagation techniques.

1. Define micropropagation and its importance.
2. Explain applications of micropropagation.
3. Describe procedures used in micropropagation.

Optional: Standard performance evaluations on the final page of this document

Performance Skills Evaluation

Exam name: Plant and Soil Science 2

Candidate Name: _____

Performance assessments may be completed and evaluated any time before the certification is issued. The following performance skills can be used in connection with the associated standards and exam. The evaluator will function as the subject matter expert to determine if the candidate meets the skills requirements with a Yes/No for passing.

Standard 1 – Leadership Development Candidates will practice communication skills through public speaking using one or more of the following activities: memorized speech, prepared speech, extemporaneous speech, parliamentary practice, group presentation, or serving in a leadership capacity.	Pass:
Standard 2 – Work-Based Learning Candidates will keep a personal record/journal/log of their SAE/WBL experience; including pictures, financial records or log of their hours, skills learned, goals, reflection, etc.	Pass:
Standard 4 – Choose ONE of the three sections: Range Resources and Management Practices - Evaluate range management systems, economics, and improvement techniques. - Establish a range transect and use it to evaluate a specific location. - Develop a plan for multiple use of rangeland for both wildlife and livestock. - Prepare plant and soil samples for analysis. Forestry Resources and Management Practices. - Evaluate forest management systems, economics, and improvement techniques. - Establish a forest transect and use it to evaluate a specific location. - Develop a plan for multiple use of forest land for both wildlife and livestock. Prepare plant and soil samples for analysis. Agronomics, the science of the cultivation of land, soil management, and crop production - Select a cultivation practice and/or tillage operation to mitigate an agronomic challenge in your area. - Develop a plan for the integration of livestock on cropland. - Prepare plant and soil samples for analysis.	Pass:
Standard 5 – Integrated Pest Management Develop an Integrated Pest Management Plan.	Pass:
Standard 6 – Biotechnology in Plant Science - Design and conduct experiments to support known principles of genetics. - Demonstrate tissue culturing. - Research and debate ethical issues in modern biotechnology..	Pass:

Evaluator Name: _____

Date: _____