

# **CASE**

## **(Curriculum for Agricultural Science Education)**

### **Principles of Agricultural Science - Plant Science**

Students participating in The Principles of Agricultural Science - Plant™ course will have experiences in various plant science concepts, exciting “hands-on” activities, projects, and problems. These experiences are based on the Project Lead The Way® activity-based, project-based, and problem-based learning. Students’ experiences will involve the study of plant anatomy and physiology, classification, and the fundamentals of production and harvesting. Coursework will also require students to acquire knowledge and skills required to utilize plants effectively. Students will research the value of plant production and its impact on the individual, the local, and the global economy. In addition, students will understand specific connections between the Plant Science lessons and Supervised Agricultural Experience, FFA, and Life-Knowledge components that are important for the development of an informed agricultural education student. Students will investigate, experiment, and learn about documenting a project, solving problems, and communicating their solutions to their peers and members of the professional community. *Prerequisite: None*

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Crop Production and Marketing

# **Principles of Agricultural Science – Plant (CASE)**

## **Content Guideline**

(The Student will be able to...)

### **Unit one - Worlds of Opportunity**

1. Investigate a variety of agricultural enterprises to produce food, fiber, and fuel, which are essential to daily life.
2. Examine Agricultural education as it pertains to learning about agriculture systems, natural resource management, science, business, communication, and leadership.
3. Examine the opportunities provided by The National FFA Organization to build necessary life skills, such as leadership and personal character.
4. Plan and Develop a Supervised Agricultural Experience programs (SAE)
5. Explore the many different types of plant industries provide career opportunities in plant production and management.
6. Investigate the uses of plants to sustain human existence by providing many essential products, such as food, fiber, fuel, and medicine.
7. Describe the aesthetic value plants have to humans.
8. Investigate the environmental factors, such as temperature and rainfall and how they influence crop production and the types of crops grown in different regions of the country.

### **Unit 2 - Mineral Soils**

1. Survey Mineral matter, air, water, and organic matter which are found in different proportions within a soil and define soil quality.
2. Describe the three different soil particle sizes, specifically sand, silt, and clay.
3. Investigate organisms, found in soils and determine how they help to form soils and improve soil quality.
4. Analyze how geographical features and environmental factors influence the formation process of soils and impacts soil quality.
5. Distinguish between characteristics from different layers in a soil profile.
6. Examine how soil color can vary due to the parent material it was derived from and environmental forces that formed it.
7. Examine how soil erosion results in the loss of quality top soil and is a concern in the study of mineral soils.

8. Distinguish between Sand, silt, and clay.
9. Describe how soil structure and soil texture affect soil functions.
10. Examine how the structure and color of the soil profile determines the effective depth of a soil.
11. Examine how mottling, soil horizon color, and permeability of the soil provide clues for determining internal drainage characteristics of soil.
12. Describe how organic matter influences the porosity and water holding capacity of soils.
13. Investigate soil permeability as it is related to the texture and structure of soil horizons.
14. Examine how Soil pH determines the availability of nutrients required for plant growth and health.
15. Determine the relationship between soil salinity concentration and plant function.
16. Investigate soil samples and detect imbalances related to soil chemistry factors.
17. Determine the optimal pH and salinity level required for plant growth.

### **Unit 3 - Soilless Systems**

1. Investigate and describe different types of potting media used for container crops.
2. Calculate media in cubic feet or cubic yard increments.
3. Distinguish among the many different types of ingredients used in potting soil that provide permeability and porosity needed for container crops.
4. Investigate how growing crops with a hydroponic method relies on using water with or without potting media instead of mineral soil to provide the necessary growth requirements.
5. Describe the advantages which hydroponic crop production has over traditional cropping systems.
6. Examine the potential which hydroponic crop production in a greenhouse provides the for yearlong crop production regardless of environmental conditions.
7. Analyze why careful management and monitoring of water quality in a hydroponic system are necessary to ensure plant health.

#### **Unit 4 - Anatomy and Physiology**

1. Describe the similarities and differences between plant cells and animal cells.
2. Identify the parts of the plant cells.
3. Distinguish between the different classifications of cells based on their utility.
4. Analyze the importance of meristematic tissues to plant development.
5. Describe the process of photosynthesis.
6. Identify the four major parts of a plant (root, stem, leaves, and flower) and Describe their functions.
7. Describe the features of roots which allow them to anchor the plant in the soil.
8. Determine how plant roots use differentiated cells that perform specific functions in the root, such as the absorption of water and dissolved nutrients.
9. Describes specialized plant cells which have unique anatomical features that serve very specific functions.
10. Describe the process of osmosis.
11. Analyze why water uptake through plant roots is influenced by the turgidity of plant tissues.
12. Describe the ways which the stems of plants provide physical support, storage of nutrients, and necessary pathways for translocation of materials throughout the plant.
13. Describe how environmental conditions, such as temperature and precipitation are reflected in the growth rates of plants.
14. List the parts of the leaf and describe the differences in physical characteristics, such as shape and venation patterns.
15. Explain how leaf characteristics can assist agricultural scientists in identifying species or varieties of plants.
16. Describe the role of chlorophyll as it pertains to the process of photosynthesis.
17. Determine what roll leaves play in the production of food.
18. Distinguish between complete and incomplete and incomplete flowers.
19. List the parts of the flower and describe its roll in sexual reproduction.

## **Unit 5 - Taxonomy**

1. Describe how taxonomy plays a role in daily life, scientific research, and the agricultural industry.
2. Explain how plants and animals are categorized using a hierarchical system to group organisms by anatomical or physiological similarities.
3. Determine how plant parts are used as visual clues for differentiating between plant species.
4. Describe how classification of organisms can be used to sort and group into classes with similar features.
5. Explain how plants are classified and named based upon distinguishing characteristics.
6. Describe the binomial system which is used for naming plants.

## **Unit 6 - The Growing Environment**

1. List the sixteen nutrients required by plants for optimal growth and development.
2. Determine how nutrient deficiencies in plants are detected.
3. Discuss how plants obtain required nutrients from the soil.
4. Explain ways in which nutrients can be added to the soil.
5. Water is used by plants for the translocation of materials within the vascular systems of plants and used to complete the photosynthesis process.
6. List the ways in which plants use water during the process of transpiration.
7. Water requirements and tolerances vary among plant species.
8. Discuss the effect which light has during the photosynthesis process.
9. Discuss the environmental factors which affect photosynthesis.
10. Identify how the growth of plants is altered by light intensity.
11. Discuss the importance of the length of daily dark periods to plant physiological processes.
12. Examine the effect of plants to the ecosystems.
13. Distinguish the difference between cool season and warm season plants.
14. Discuss how temperature affects transpiration, respiration, and photosynthesis.
15. Explain how temperature is a principle determinant for plant dormancy.

## **Unit 7 - Sexual Reproduction**

1. Describe the factors which play a role in the germination rate in seeds.
2. Define the role of viability in terms of seed germination.
3. Define the role of dormancy in terms of plant germination.
4. Distinguish between monocotyledon and dicotyledon.
5. Describe how enzymes are used during the germination process.
6. Investigate the different ways in which pollination can take place.
7. Discuss the role of fertilization as it pertains to plant reproduction.
8. Discuss the role which meristematic tissues have on plants growth.
9. Distinguish between meiosis and mitosis.
10. List and describe the five distinct phases of mitosis.
11. Investigate how Genetic variation in plants is achieved by cross-pollination.
12. Examine how dominant and recessive genes determine the phenotypic characteristics of plants.
13. Examine how plants perpetuate the species over time.
14. Describe the role of fruits as it pertains to plant reproduction.
15. Distinguish between the various types of fruits.
16. Describe methods of seed dispersal in plants.
17. Investigate the effects which animals have on pollination.

## **Unit 8 - Asexual Reproduction**

1. Explain the term hybrid as it pertains to plant production
2. Investigate why plant hybrid genotypes can vary from the parent plant.
3. Describe asexual propagation.
4. List and describe the various methods of asexual reproduction.
5. Discuss safety issues when using tools and equipment required to perform asexual propagation.

## **Unit 9 - Surviving a Harsh Environment**

1. Investigate the negative effects which pests have on plant growth.
2. Discuss the various pests which affect plants.
3. Describe how to detect symptoms of plant pest threats.
4. Discuss methods for eradication or deterring pests.
5. Explain how an Integrated Pest Management plan assures that the management of pests is economically and environmentally sound.
6. Discuss the life cycles of plant pests as it relates to employing proper control measures.
  1. Discuss how disease-causing agents can be detrimental to the health of plants.
  2. Plant disease-causing agents are microscopic and damage plants in various ways.
  3. Plant diseases cause visible symptoms in plant growth, such as defoliation, abscesses, growths, and decaying of plant tissue.
  4. Knowledge of disease prevention and treatment is important to protect plants from infection.

## **Unit 10 - Crop Production and Marketing Lesson 10.1 Tools of Plant Production**

1. Specialized equipment is required for soil tillage and the planting, harvesting, and transporting of agronomic crops.
  2. The growing environment for plants may be altered by structures, such as greenhouses to provide optimal temperature requirements.
  3. Irrigation is critical for many commercial plant species.
  4. Methods of irrigation vary and each method has advantages and disadvantages related to the impact on the environment.
1. Product, placement, price, and promotion are the four keys to marketing products.
  2. Agronomy, floriculture, forestry, and nursery and landscape are the four major classifications of plant-based industries.
  3. There are many products produced within plant-based industries and all require careful planning to ensure the marketability of the product.
  4. Basic steps, such as analyze the situation, decide on your objective, develop a plan, and measure the results are key components of a business plan.