Secondary Curriculum Maps

Cumberland Valley School District

Soaring to Greatness, Committed to Excellence

Principles of Agricultural Science - Plants

The purpose of the Plant Science course is to expose students to the world of agriculture, plant science and career options. The course is structured to enable all students to have a variety of experiences that will provide an overview of the field of agricultural science with a foundation in plant science so that students may continue through a sequence of courses through high school. 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. Students will work in teams, exploring hands-on projects and activities, to learn the characteristics of plant science and work on major projects and problems similar to those that plant science specialists, such as horticulturalists, agronomists, greenhouse and nursery managers and plant research specialists face in their respective careers.

CASE
Curriculum for Agricultural Science Education

Principles of Agricultural Science – Plant Course Description

The *Principles of Agricultural Science – Plant* (ASP) course will expose students to the world of agriculture, plant science, and career options. Students will have experiences in various plant science concepts through exciting "hands-on" activities, projects, and problems. Student experiences will include the study of plant anatomy and physiology, classification, and the fundamentals of production and harvesting. Students will learn how to apply scientific knowledge and skills to use plants effectively for agricultural and horticultural production. Students will discover the value of plant production and its impact on the individual, the local, and the global economy.

Lessons throughout the course will provide an overview of the field of agricultural science with a foundation in plant science. These lessons include working in teams and exploring hands-on projects. Students will work on major projects and problems similar to those that plant science specialists, such as horticulturalists, agronomists, greenhouse and nursery managers, and plant research specialists, face in their respective careers.

The ASP course includes the following units of study:

- Worlds of Opportunity
- Mineral Soils
- Soilless Systems
- Anatomy and Physiology
- Taxonomy
- The Growing Environment
- Sexual Reproduction
- Asexual Reproduction
- Surviving a Harsh Environment
- Crop Production and Marketing

Detailed Course Outline

Unit 1 – Worlds of Opportunity

Lesson 1.1 A World without Enough Plants

1. Many people work in a variety of agricultural enterprises to produce food, fiber, and fuel, which are essential to daily life.
2. The many different types of plant industries provide career opportunities in plant production and management.
3. Plants are used to sustain human existence by providing many essential products, such as food, fiber, fuel, and medicine.
4. Plants have aesthetic value to humans.
5. Environmental factors, such as temperature and rainfall influence crop production and the types of crops grown in different regions of the country.

Unit 2 – Mineral Soils

Lesson 2.1 Understanding Soil Properties

1. Sand, silt, and clay are three sizes of mineral particles that comprise soil texture.
2. Organisms, found in soils, help to form soils and improve soil quality.
3. Soil structure and soil texture are elements that affect soil function.
4. The structure and color of the soil profile determines the effective depth of a soil.
5. Mottling, soil horizon color, and permeability of the soil provide clues for determining internal drainage characteristics of soil.
6. Organic matter influences the porosity and water holding capacity of soils.
7. Soil permeability is influenced by the texture and structure of soil horizons.

Lesson 2.2 Soil Chemistry

1. Soil pH determines the availability of nutrients required for plant growth and health.
2. Soil salinity concentration determines how well plants uptake water, and as a result the ability of plants to absorb the available necessary nutrients.
3. Testing of soil samples detect imbalances related to soil chemistry factors.

4. The optimal pH and salinity level required for plant growth varies among plant species and the levels are adjusted with the use of chemical treatments.

Unit 3 – Soilless Systems

Lesson 3.1 Mixing Media

1. Potting media has specific qualities suited for container crops, such as using lightweight and inexpensive materials that provide the essential components needed for drainage and porosity.
2. Media is sold in cubic feet or cubic yard increments and calculation of usage is an important skill for greenhouse and nursery production.
3. There are many different types of ingredients used in potting soil that provide permeability and porosity needed for container crops.

Lesson 3.2 Hydroponics

1. 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.
2. Hydroponic crop production has advantages over traditional cropping systems, such as efficient use of space and resources.
3. There are many considerations to examine when choosing between hydroponic production and traditional crop production, such as the spread of disease and increased equipment costs.
4. Hydroponic crop production in a greenhouse provides the potential for yearlong crop production regardless of environmental conditions.
5. Careful management and monitoring of water quality in a hydroponic system are necessary to ensure plant health.

Unit 4 – Anatomy and Physiology

Lesson 4.1 Cells: Life's Smallest Units

1. Plant cells are comprised of many parts that have essential functions for the survival of plant tissue, such as respiration.
2. Cell organelles can only be seen using a microscope.
3. There are different classifications of cells based on their utility.
4. New plant growth is not possible without meristematic tissues.
5. Cells use water, oxygen, and glucose to produce energy and metabolic by-products of carbon dioxide and water.

Lesson 4.2 The Radicle Root

1. The four major parts of a plant are the root, stem, leaves, and flower; and their functions are vital for plant health and growth.
2. The root has specific anatomical features responsible for anchoring the plant in the soil.
3. Plant roots use differentiated cells that perform specific functions in the root, such as the absorption of water and dissolved nutrients.
4. Specialized plant cells have unique anatomical features, such as a root hair that serve very specific functions.
5. Plants use the process of osmosis for the uptake of water and dissolved nutrients required for plant growth.
6. Water uptake through plant roots is influenced by the turgidity of plant tissues.

Lesson 4.3 Stems, Stalks, and Trunks

1. Stems of plants provide physical support, storage of nutrients, and necessary pathways for translocation of materials throughout the plant.
2. Environmental conditions, such as temperature and precipitation are reflected in the growth rates of plants and evidence of those conditions can be found in woody stems.

Lesson 4.4 Leave it to Leaves

1. Leaves are comprised of several parts that have differences in physical characteristics, such as shape and venation patterns.
2. The understanding of leaf characteristics assists agricultural scientists in identifying species or varieties of plants.
3. Leaf cells contain a specialized pigment known as chlorophyll that is used by the plant to harvest radiant energy from the sun.
4. Leaves produce food in the form of sugars that fuel the metabolic functions of a plant.
5. Leaves produce and store food.

Lesson 4.5 Flower Power

1. Flowers are classified as either complete or incomplete based on the inclusion of either male or female parts, or both.
2. The parts of the flower are the mechanisms for pollination and fertilization and are used by a plant to complete sexual reproduction.
3. Concept maps assist in structuring ideas or concepts and illustrating the various connections between those ideas.

Unit 5 – Taxonomy

Lesson 5.1 Sorting Out Plants

1. Classification of people, places, and things are a basic skill used in daily life, scientific research, and the agricultural industry.
2. Plants and animals are categorized using a hierarchical system to group organisms by anatomical or physiological similarities.
3. Plant parts are used as visual clues for differentiating between plant species often referred to as plant identification.
4. Classification is based on morphology that uses plant forms, such as parts, size, color, and usefulness to sort and group into classes with similar features.

Lesson 5.2 Plant Names

1. Plants are classified and named based upon distinguishing characteristics, such as their physical features.
2. All plants are named using a binomial system, which is a two-word system for naming plants with the first word being the generic name and the second word being the specific name.
3. The scientific names for plants consist of Latin words representing descriptive features associated with the plant.
4. Plant species are often subdivided into varieties and cultivars that will include additional names after the genus and species.

Unit 6 – The Growing Environment

Lesson 6.1 Plant Food

1. Plants require sixteen nutrients for optimal growth and development.
2. Nutrient deficiencies are detected in plants by the examination of anatomical features and chemical test of tissues.
3. Plants obtain required nutrients from the soil provided the soil has the available nutrients.
4. Nutrients can be added to the soil in various ways, such as chemical fertilizers, animal wastes, and organic matter.

Lesson 6.2 All Wet

1. Water is used by plants for the translocation of materials within the vascular systems of plants and used to complete the photosynthesis process.
2. Water is used to help cool the plant during periods of above optimal temperature conditions through the process of transpiration.

3. Different substances that plant containers are made from will affect the rate of water loss by evaporation in potted plants.
4. Water requirements and tolerances vary among plant species.
5. The wilting point is a critical physiological stage that if exceeded can cause permanent damage to the health and physical appearance of plants.

Lesson 6.3 Lighting it Up

1. Light is absorbed by chlorophyll and used by plants to convert carbon dioxide and water into glucose and oxygen through the process of photosynthesis.
2. Photosynthetic rate is affected by environmental factors, such as light exposure, availability of carbon dioxide, and temperature.
3. The level of red and blue-violet light emitted in a spectrum determines the quality of a light source intended for plant use.
4. Growth of plants is altered by light intensity and poor light exposure can create undesirable physical characteristics.
5. Plants respond to the length of daily dark periods to trigger physiological processes, such as flowering.
6. Plants and animals are codependent in ecosystems.

Lesson 6.4 Chilly Lilies

1. Plants are classified as cool season or warm season plants based on their temperature requirements.
2. Temperature affects the metabolism rate of plants including transpiration, respiration, and photosynthesis.
3. Plant maturity is determined by the accumulation of thermal units during a growing season.
4. Temperature is a principle determinant for plant dormancy of some seeds, bulbs, specialized roots, and species of perennial plants.

Unit 7 – Sexual Reproduction

Lesson 7.1 Kernels of Life

1. Germination rate in seeds is largely determined by the proper balance of environmental conditions, such as temperature, oxygen, and water.
2. Not all seeds are viable and therefore do not have the potential to germinate.
3. Dormancy is a strategy plants utilize to ensure some offspring will germinate at optimal times and plants rely on special treatments, such as light, cold temperatures, and scarification to break seed dormancy.

4. The germinating seed has visible anatomical parts and structures from embryo to seedling stages that are used to identify the plant as either a monocotyledon or a dicotyledon.
5. Plant seeds convert starch into glucose by the use of enzymes during the germination process.

Lesson 7.2 Pollination and Fertilization

1. Flower pollination can happen with the assistance of several different pollination agents, such as wind, water, insects, and animals.
2. Fertilization is a necessary step for seed development.
3. The majority of plant growth happens in meristematic tissues of plants.
4. Plant egg cells require meiosis and mitosis for development.
5. Mitosis has five distinct phases necessary for cell division.
6. Genetic variation in plants is achieved by cross-pollination.
7. Dominant and recessive genes determine the phenotypic characteristics of plants.

Lesson 7.3 Fruits, Nuts, and Monkeys

1. Plants use seeds to multiply species exponentially over time.
2. Seeds are protected or supported by specialized anatomical structures called fruit.
3. There are different types of fruit structures that can be used to identify or classify plant species.
4. Plants require methods of seed dispersal to ensure their survival in nature.
5. The existence of some plant species may be threatened if they depend on a specific animal for seed dispersal.

Unit 8 – Asexual Reproduction

Lesson 8.1 Plant Multiplication

1. Some plant hybrids will produce seeds with genetic characteristics that are inconsistent with the parent plant genotype; therefore, asexual propagation methods are required for reproducing the desired traits.
2. Using asexual propagation methods, such as grafting, division, budding, layering, or cuttings are efficient ways to produce new plants exhibiting desired characteristics of a parent plant.
3. The tools and equipment required to perform asexual propagation on plants may create safety hazards for producers if not properly used.

Unit 9 - Surviving a Harsh Environment

Lesson 9.1 Pesky Bugs and Plants

1. Pests have negative effects on plant growth, such as yield and quality.
2. Plant pests include several organisms including insects, mollusks, nematodes, vertebrates, and weeds.
3. Proper detection of symptoms can determine plant pest threats.
4. Biological, chemical, and mechanical methods as well as cultural practices are options for eradication or deterring pests.
5. An Integrated Pest Management plan assures that the management of pests is economically and environmentally sound.
6. Life cycles of plant pests must be considered prior to employing proper control measures.

Lesson 9.2 Diving into Diseases

1. Plant disease-causing agents, such as bacteria, fungi, and viruses cause detrimental health effects on 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.

Lesson 10.2 Planting Seeds of Fortune

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.