# Plant and Horticultural Science
Subject Code: 010155
Course & Unit Descriptions

## Course Description:

This course focuses on skills and technologies essential for agricultural and/or horticultural crop production. Cultural and sustainable production practices will be examined. Students will apply scientific knowledge of plant development, nutrition, and growth regulation. Environmental aspects of irrigation, chemical application and soil conservation will be evaluated. The course will also include equipment and precision technologies used in the industry. Projects and activities will enable students to develop communication, leadership, and business management skills.

## Unit: Soil Science

Students will be able to identify and classify soils based upon its composition, land capability uses, and implement soil conservation practices. Students will also be able to determine soils limitations in regards to rural, ecological, historical, and urban practices.

**Benchmark: 5.1 Soils**
Level 1: Determine and analyze the physical, biological and chemical properties of soils and other plant growing media.

**Indicators**
5.1.01 Classify soil types based on composition (e.g., aggregate size, organic matter, texture)
5.1.02 Inventory soils and determine land use capabilities
5.1.03 Interpret soil survey data to implement conservation practices
5.1.04 Select techniques that reduce soil erosion and compaction based on soil and land properties (e.g., no till, subsurface and watershed drainage)
5.1.05 Evaluate soil limitations (e.g., wildlife/wetlands habitats, septic systems, drainage, agriculture and socioeconomic considerations, preservation easements)
5.1.06 Explain current and historical interactions between human activities and soils (e.g., wetlands use, urbanization, desertification, finite resources, habitat change, climate change)
5.1.07 Identify soil forming factors and explain how they produce variability in soils

**Academic Standards**

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|---|---|
| English: | Use multiple resources to enhance comprehension of vocabulary. (Vocabulary F, 8-10; Vocabulary E, 11-12) |
| Math: | Describe and interpret rates of change from graphical and numerical data. (Algebra J, 8-10) |
| Science: | Describe the finite nature of Earth's resources and those human activities that can conserve or deplete Earth's resources. (Earth and Space Sciences D, 9-10) |
| Social Studies: | Use appropriate data sources and geographic tools to analyze and evaluate public policies. (Geography C, 11-12) |

## Unit: Soil less Systems and Growing Media

Students will be able to demonstrate the principals of growing and maintaining plant life in a soilless medium as found in greenhouse and nursery production. Students will be able to construct and maintain water distribution systems and water quality for crop production.

**Benchmark: 4.15 Water Distribution Systems**
Level 1: Identify tools and materials, design a water supply line with fixture and install

**Indicators**
4.15.03 Describe the types and operating principles of pumps and controls used in water supplies
4.15.04 Calculate water demand for specific applications
4.15.05 Detect, test and repair problems in the water supply system
4.15.08 Perform tests on water supply and drainage systems for pressure and leaks
4.15.10 Protect pipes from freezing and mechanical damage

**Academic Standards**
Math: Estimate, compute and solve problems involving real numbers, including ratio, proportion and percent, and explain solutions. (Number G, 8-10)
Science: Describe the finite nature of Earth's resources and those human activities that can conserve or deplete Earth's resources. (Earth and Space Sciences D, 9-10)

**Benchmark: 5.2 Water**
Level 1: Assess water quality using basic indicators

**Indicators**
5.2.01 Measure pH, dissolved oxygen (DO), biological oxygen demand (BOD), temperature and macroinvertebrate populations to determine water quality
5.2.02 Measure hardness, nitrogen, phosphorus, vegetation and physical characteristics of lentic and lotic waters to determine water quality
5.2.03 Explain the hydrological cycle (e.g., condensation, evaporation, transpiration) and how human activity impacts the cycle
5.2.04 Explain the biotic and abiotic factors affecting water quality
5.2.05 Monitor and analyze water quality and quantity

**Academic Standards**
English: Apply knowledge of roots, affixes and phrases to aid understanding of content area vocabulary. (Vocabulary D, 11-12)
Math: Apply various measurement scales to describe phenomena and solve problems. (Measurement B, 11-12)
Science: Describe the finite nature of Earth's resources and those human activities that can conserve or deplete Earth's resources. (Earth and Space Sciences D, 9-10)

**Benchmark: 7.1 Plant Nutrition**
Level 1: Select and apply macronutrients, using basic application methods, and recognize the effect on plants and environment

**Indicators**
7.1.01 Compare and contrast organic and inorganic sources of macronutrients and micronutrients
7.1.02 Describe the functions of macronutrients and micronutrients
7.1.03 Determine nutrient requirements for food-grade, non-food-grade and organic plants
7.1.04 Identify symptoms and causes of plant nutrient deficiencies

**Academic Standards**
English: Apply knowledge of roots, affixes and phrases to aid understanding of content area vocabulary. (Vocabulary D, 11-12)
Math: Estimate, compute and solve problems involving real numbers, including ratio, proportion and percent, and explain solutions. (Number G, 8-10)
Science: Explain the structure and function of ecosystems and relate how ecosystems change over time. (Life Sciences F, 9-10)

**Benchmark: 7.4 Plant Production and Management**
Level 1: Manage growth of common types of plants

**Indicators**
7.4.09 Evaluate/select and prepare soil/media for planting

**Academic Standards**
English: Apply knowledge of roots, affixes and phrases to aid understanding of content area vocabulary. (Vocabulary D, 11-12)
Math: Construct convincing arguments based on analysis of data and interpretation of graphs. (Data Analysis F, 8-10)
Science: Explain the flow of energy and the cycling of matter through biological and ecological systems (cellular, organismal and ecological). (Life Sciences D, 9-10)

## Unit: Anatomy and Physiology of Plants

Students will identify plant anatomical structures and tissues along with their physiological functions. Students will also be able to identify the general characteristics of various plants and tissues.

**Benchmark: 7.4 Plant Production and Management**
Level 1: Manage growth of common types of plants

**Indicators**
7.4.02 Identify plant anatomical structures and tissues (e.g., roots, stems, flowers, leaves, fruits, seeds)
7.4.03 Describe physiological functions of plants (e.g., photosynthesis, respiration, transpiration, absorption)
7.4.13 Identify characteristics (e.g., visual appeal, quality, test weights, final usage) of grains, seeds, vegetables, fruits, and ornamental plants

**Academic Standards**
English: Apply knowledge of roots, affixes and phrases to aid understanding of content area vocabulary. (Vocabulary D, 11-12)
Math: Construct convincing arguments based on analysis of data and interpretation of graphs. (Data Analysis F, 8-10)
Science: Explain the flow of energy and the cycling of matter through biological and ecological systems (cellular, organismal and ecological). (Life Sciences D, 9-10)

## Unit: Taxonomy

Students will be able to identify different plant species and their environmental requirements. Students will also identify and classify plants at different stages of growth.

**Benchmark: 7.2 Plant Reproduction**
Level 1: Select and apply basic methods for propagating common types of plants.

**Indicators:**
7.2.06 Compare and contrast variations of plant reproductive systems among plant species and their adaptive and non-adaptive values

**Academic Standards**
English: Use multiple resources to enhance comprehension of vocabulary. (Vocabulary F, 8-10; Vocabulary E, 11-12)
Science: Explain the structure and function of ecosystems and relate how ecosystems change over time. (Life Sciences F, 9-10)

**Benchmark: 7.4 Plant Production and Management**
Level 1: Manage growth of common types of plants

**Indicators**

7.4.01 Identify and classify seeds and plants at all stages of growth
7.4.04 Identify and classify plants using taxonomy
7.4.13 Identify characteristics (e.g., visual appeal, quality, test weights, final usage) of grains, seeds, vegetables, fruits, and ornamental plants

**Academic Standards**

English: Apply knowledge of roots, affixes and phrases to aid understanding of content area vocabulary. (Vocabulary D, 11-12)
Math: Construct convincing arguments based on analysis of data and interpretation of graphs. (Data Analysis F, 8-10)
Science: Explain the flow of energy and the cycling of matter through biological and ecological systems (cellular, organismal and ecological). (Life Sciences D, 9-10)

## Unit: The Growing Environment

Students will identify the causes and symptoms of plant nutrient deficiencies. Students will be able to collect and analyze test data to calculate nutrient requirements and procedures for applying nutrients. Students will determine optimum management practices to control the growing environment.

**Benchmark: 7.1 Plant Nutrition**

Level 1: Select and apply macronutrients, using basic application methods, and recognize the effect on plants and environment.

**Indicators**

7.1.04 Identify symptoms and causes of plant nutrient deficiencies
7.1.05 Collect and test soil and/or plant tissue
7.1.06 Analyze test data from soil and plant tissue, make inferences and draw conclusions for optimum management
7.1.07 Determine the biotic and abiotic factors that influence and optimize availability of nutrients to plants (e.g., pH, microorganisms, growth media)
7.1.08 Calculate nutrient requirements and select nutrient sources and additives for optimum economic return
7.1.09 Select application methods, determine time of application, and apply nutrients
7.1.10 Interpret fertilizer labels

**Academic Standards**

English: Apply knowledge of roots, affixes and phrases to aid understanding of content area vocabulary. (Vocabulary D, 11-12)
Math: Estimate, compute and solve problems involving real numbers, including ratio, proportion and percent, and explain solutions. (Number G, 8-10)
Science: Explain the structure and function of ecosystems and relate how ecosystems change over time. (Life Sciences F, 9-10)

**Benchmark: 7.4 Plant Production and Management**

Level 1: Manage growth of common types of plants

**Indicators**

7.4.06 Manipulate abiotic and biotic factors (e.g., irrigation, mulch, lighting, temperature, drainage) to alter plant germination, growth and development

**Academic Standards**

English: Apply knowledge of roots, affixes and phrases to aid understanding of content area vocabulary. (Vocabulary D, 11-12)

Math: Construct convincing arguments based on analysis of data and interpretation of graphs. (Data Analysis F, 8-10)
Science: Explain the flow of energy and the cycling of matter through biological and ecological systems (cellular, organismal and ecological). (Life Sciences D, 9-10)

## Unit: Sexual and Asexual Reproduction

Students will be able to identify and describe plant anatomical and physical functions related to reproduction. Students will be able to select and utilize different seed stock for their traits and then use propagation for desired traits. Students will select and use various methods of asexual plant propagation.

**Benchmark: 7.2 Plant Reproduction**
Level 1: Select and apply basic methods for propagating common types of plants

**Indicators**
7.2.01 Identify reproductive anatomy of plants and describe their physiological functions
7.2.02 Determine the biotic and abiotic factors that influence and optimize plant reproduction (e.g., insects, light, temperature, microorganisms, moisture, location)
7.2.03 Select seeds/seed stock for desired traits (e.g., color, drought resistance, chemical resistance, environmental impact)
7.2.04 Select and use methods to create desired traits in seeds and fruits (e.g., detasseling, mechanical pollination)
7.2.05 Select and use methods of asexual plant propagation for desired traits (e.g., grafting, layering, cuttings, cloning)
7.2.06 Compare and contrast variations of plant reproductive systems among plant species and their adaptive and non-adaptive values

**Academic Standards**
English: Use multiple resources to enhance comprehension of vocabulary. (Vocabulary F, 8-10; Vocabulary E, 11-12)
Science: Explain the structure and function of ecosystems and relate how ecosystems change over time. (Life Sciences F, 9-10)

## Unit: Pest Management

Students will identify and classify different plant pests and the interrelationships between plants, pests, humans and the environment. Students will follow integrated pest management practices to determine optimum control methods. Students will utilize the best management safety practices to ensure the safety of the applicator and the environment.

**Benchmark: 7.3 Pest Management**
Level 1: Identify common types of plant pests and apply basic pest management control

**Indicators**
7.3.01 Identify and classify plant pests (i.e., insects, pathogens, weeds, diseases, animals)
7.3.02 Examine interrelationships between plants, pests, humans and environment (e.g., non-native species, climate change)
7.3.03 Analyze and calculate economic threshold of pest damage
7.3.04 Determine and implement pest management safety practices (e.g., MSDS, EPA, OSHA, PPE)
7.3.05 Develop an integrated pest management plans based on pest life cycles, available treatments and application methods
7.3.06 Select application methods, implement pest control plan (i.e. organic and non-organic) and evaluate effectiveness and impact on environment

**Academic Standards**

English: Standards: Apply knowledge of roots, affixes and phrases to aid understanding of content area vocabulary. (Vocabulary D, 11-12)

Math: Find, use and interpret measures of center and spread, such as mean and quartiles, and use those measures to compare and draw conclusions about sets of data. (Data Analysis D, 8-10)

Science: Explain the structure and function of ecosystems and relate how ecosystems change over time. (Life Sciences F, 9-10)

Social Studies: Evaluate the consequences of geographic and environmental changes resulting from governmental policies and human modifications to the physical environment. (Geography B, 11-12)

## Unit: Crop Production and Marketing

Students will market horticultural products and services to optimize profits. Student's will perform customer service and demonstrate sales for wholesale or retail operations. Students will determine and manage environmental conditions relative to the harvesting, handling, storage and sale of horticultural crops and services.

**Benchmark: 3.1 Marketing**

Level 1: Promote a product or service using basic strategies for packaging, display and publicity

**Indicators**

3.1.01 Select target market and consumers
3.1.02 Research products and service design(s) and determine the technical feasibility of new products
3.1.03 Conduct market research and analysis
3.1.04 Select channels of distribution
3.1.05 Set prices using supply and demand curves and commodity and non-commodity pricing
3.1.06 Identify and evaluate methods of marketing products and services
3.1.07 Promote products and services
3.1.08 Develop public relations campaigns

**Academic Standards**

English: Produce functional documents that report, organize and convey information and ideas accurately, foresee readers' problems or misunderstandings and that include formatting techniques that are user friendly. (Writing Applications C, 11-12)

Math: Use algebraic representations, such as tables, graphs, expressions, functions and inequalities, to model and solve problem situations. (Algebra D, 8-10)

Social Studies: Analyze how scarcity of productive resources affects supply, demand, inflation and economic choices. (Economics A, 11-12)

**Benchmark: 3.2 Sales and Customer Service**

Level 1: Use customer service and sales techniques to foster positive relationships with customers and conduct sales

**Indicators**

3.2.01 Identify key components to organize a sale
3.2.02 Develop sales goals and incentive programs
3.2.04 Prospect for new customers
3.2.08 Build and develop customer relationships
3.2.11 Complete sales transactions and close-out procedures (e.g., handle money, operate cash register, scan bar codes, record sales, write invoices/orders)
3.2.13 Handle customer complaints

**Academic Standards**

English: Use a variety of strategies to enhance listening comprehension. (Communication A, 8-10; Communication A, 11-12)

Math: Estimate, compute and solve problems involving real numbers, including ratio, proportion and percent, and explain solutions. (Number G, 8-10)

**Benchmark: 7.5 Harvesting, Handling and Storage**

Level 1: Harvest, handle and store plants and plant products

**Indicators**

7.5.01 Determine crop maturity
7.5.02 Identify safe harvesting, handling and storage practices
7.5.03 Determine and control environmental conditions relative to harvesting, handling and storage
7.5.04 Demonstrate harvesting, handling and storage techniques to minimize loss and maximize economic return
7.5.05 Calculate yield and loss of harvesting, processing and storage
7.5.06 Maintain and/or enhance quality of plant products in harvesting, handling and storage (e.g., temperature, humidity, retardants, light, chemicals, contamination)
7.5.07 Prepare products for sale, transportation and storage

**Academic Standards**

Math: Estimate, compute and solve problems involving real numbers, including ratio, proportion and percent, and explain solutions. (Number G, 8-10)

## Unit: Business Operations

Students will develop business goals and objectives using real-world examples of various organizational and business structures. Students will budget resources, evaluate outcomes, and forecast future budgetary needs according to standard business principles.

**Benchmark: 3.11 Research and Analysis**

Level 1: Conduct a study or survey, select descriptive statistics, create graphical displays and draw conclusions

**Indicators**

3.11.03 Establish and implement procedures for systematic collection, organization, and use of data
3.11.05 Create, interpret and use tabular and graphical displays and descriptive statistics to describe data
3.11.07 Describe the relationships among variables using correlations and draw conclusions
3.11.08 Draw conclusions based on observations and/or data analysis and disseminate information to interested parties

**Academic Standards**

English: Formulate open-ended research questions suitable for inquiry and investigation and adjust questions as necessary while research is conducted. (Research A, 8-10; Research A, 11-12)

Math: Use algebraic representations, such as tables, graphs, expressions, functions and inequalities, to model and solve problem situations. (Algebra D, 8-10)

Science: Participate in and apply the processes of scientific investigation to create models and to design, conduct, evaluate and communicate the results of these investigations. (Scientific Inquiry A, 9-10)

**Benchmark: 3.4 Finance**

Level 1: Budget and monitor income and expenses of an enterprise

**Indicators**
3.4.01 Identify sources of capital and explain considerations in selecting among them
3.4.02 Analyze investment options (e.g., buy, lease, finance, risk)
3.4.03 Evaluate credit uses and options
3.4.04 Evaluate and select banking services
3.4.05 Budget resources (e.g., capital, human, financial, time)
3.4.06 Manage assets for optimum utilization
3.4.07 Manage risk of liabilities
3.4.08 Maintain financial records and interpret and analyze financial statements
3.4.09 Determine cost of doing business (e.g., personnel, depreciation, materials, freight, quality)
3.4.10 Calculate and analyze return on investment (ROI)
3.4.11 Forecast future budgetary needs

**Academic Standards**
English: Demonstrate comprehension of print and electronic text by responding to questions (e.g., literal, inferential, evaluative and synthesizing). (Reading Process B, 8-10; Reading Process B, 11-12)
Math: Estimate, compute and solve problems involving real numbers, including ratio, proportion and percent, and explain solutions. (Number G, 8-10)
Social Studies: Analyze how scarcity of productive resources affects supply, demand, inflation and economic choices. (Economics A, 11-12)

## Unit: Communication and Information Management

Students will research and conduct presentations using a variety of computer applications including Internet. Students will utilize personal information management to develop recordkeeping and communication skills. Students will organize information accurately and practice workplace communication techniques.

**Benchmark: 3.6 Information Management**
Level 1: Select and use a computer and computer application for a specific purpose

**Indicators**
3.6.01 Utilize technology to maintain and monitor business records
3.6.02 Conduct research using the Internet
3.6.03 Create and utilize documents using word processors, spreadsheets, databases and electronic mail
3.6.04 Conduct oral/visual presentation using presentation software
3.6.05 Create and post a basic web page
3.6.06 Utilize personal information management/productivity applications
3.6.08 Adhere to common security guidelines for technology

**Academic Standards**
English: Prepare writing for publication that follows an appropriate format and uses a variety of techniques to enhance the final product. (Writing Process F, 11-12)
Math: Use algebraic representations, such as tables, graphs, expressions, functions and inequalities, to model and solve problem situations. (Algebra D, 8-10)

**Benchmark: 3.7 Communication Skills**
Level 1: Integrate a variety of communication techniques to gather and convey information to an individual or small group

**Indicators**
3.7.01 Apply techniques to participate in/facilitate a group discussion
3.7.02 Apply active listening strategies

3.7.03 Develop and deliver formal and informal presentations
3.7.04 Articulate ideas and impact audience through verbal and nonverbal communication
3.7.05 Communicate directions in an organized manner appropriate to the audience
3.7.06 Use consensus-building techniques, including parliamentary procedure, to make decisions and compile summary of meeting minutes, conclusions, and next steps
3.7.07 Extract relevant, valid information from materials and cite sources of information
3.7.08 Develop reports and documents that organize information accurately and use formatting techniques for user friendliness
3.7.09 Select and use appropriate channel for workplace communication
3.7.10 Practice etiquette when using communication techniques

**Academic Standards**

English: Produce functional documents that report, organize and convey information and ideas accurately, foresee readers' problems or misunderstandings and that include formatting techniques that are user friendly. (Writing Applications C, 11-12)

Math: Use algebraic representations, such as tables, graphs, expressions, functions and inequalities, to model and solve problem situations. (Algebra D, 8-10)

Social Studies: Evaluate the reliability and credibility of sources. (Social Studies Skills and Methods A, 9 - 10)

## Unit: Business Leadership and Interpersonal Skills

Students will develop critical thinking and problem solving skills through the use of a variety of practical scenarios. Students will demonstrate leadership skills through participation with peer groups, support services, and professional organizations.

**Benchmark: 3.8 Business Leadership**

Level 1: Determine appropriate leadership style for a specific situation and apply to the situation

**Indicators**

3.8.01 Identify the purpose of leadership, the ethical dimensions of leadership and the relationship between leaders and team members
3.8.02 Identify leadership styles and traits of leaders
3.8.03 Identify the impact of individual differences and different situations on the practice of leadership
3.8.04 Assess strengths and weaknesses of leaders and team members and employ team-building techniques
3.8.05 Participate in and lead a small group with an interdependent task
3.8.06 Think critically and use problem-solving skills to analyze complex and diverse concepts
3.8.07 Use reasoning, judgment and imagination to create new possibilities in situations
3.8.08 Manage time with organizational tools and prioritize objectives, responsibilities and tasks
3.8.09 Apply conflict-resolution skills
3.8.10 Recognize/reward others for their efforts and contributions
3.8.11 Develop relationships with peer groups, support services, and professional organizations

**Academic Standards**

English: Use a variety of strategies to enhance listening comprehension. (Communication A, 8-10; Communication A, 11-12)

Math: Locate and interpret mathematical information accurately, and communicate ideas, processes and solutions in a complete and easily understood manner. (Mathematical Processes H, 8-10)

Social Studies: Critique data and information to determine the adequacy of support for conclusions. (Social Studies Skills and Methods B, 11-12)

**Benchmark: 3.9 Emotional Intelligence**

Level 1: Exhibit desirable personal and professional appearance, attitudes, behaviors, and work habits

**Indicators**

3.9.01 Conduct an interpersonal and intrapersonal inventory
3.9.02 Identify how individual actions impact others
3.9.03 Manage personal emotions, behavior and appearance to maintain professionalism
3.9.04 Describe and exhibit appropriate ethical behavior
3.9.05 Accept and use constructive feedback to improve work habits
3.9.06 Employ appropriate coping skills to prevent/handle workplace conflicts
3.9.07 Recognize, respect and utilize the diversity among people and cultures
3.9.08 Foster positive working relationships

**Academic Standards**

English: Use a variety of strategies to enhance listening comprehension. (Communication A, 8-10; Communication A, 11-12)

Social Studies: Analyze how issues may be viewed differently by various cultural groups. (People in Societies A, 11-12)