**Agronomic Systems**

Subject Code: 010620

Course & Unit Descriptions

**Course Description:**

Students will apply knowledge and skills required to research, develop, produce and market major agricultural and horticultural crops. Cultural and sustainable production practices will be examined while students apply scientific knowledge of plant development, nutrition and growth regulation. The knowledge and skills needed to manage water, soils, and pests related to agronomic crops will be assessed. Students will employ technological advances, communication, business, and management strategies appropriate for the industry.

**Unit: Safety**

Students will be able to demonstrate the proper rules and regulations for safety and take corrective measures when hazards arise in the lab. Students will demonstrate first aid and how to properly handle an emergency.

Outcome 1.12

Site and Personal Safety Procedures: Follow site and personal safety procedures in specific situations with specialized tools and equipment, evaluate the situation and take corrective action.

Competency:

1.12.1 Use Occupational Safety and Health Administration (OSHA) defined procedures for identifying employer and employee responsibilities, working in confined spaces, managing worker safety programs, using ground fault circuit interrupters (GFCIs), maintaining clearance and boundaries and labeling.

1.12.2 Interpret safety signs and symbols.

1.12.4 Describe how working under the influence of drugs and alcohol increases the risk of accident, lowers productivity, raises insurance costs and reduces profits.

1.12.5 Identify the location of emergency flush showers, eyewash fountains, Safety Data Sheets (SDSs), fire alarms and exits.

1.12.6 Identify procedures for the handling, storage and disposal of hazardous materials.

1.12.7 Select, use, store, maintain and dispose of personal protective equipment (PPE), appropriate to job tasks, conditions and materials.

1.12.8 Identify safety hazards and take corrective measures.

1.12.9 Identify, inspect and use safety equipment appropriate for the task.

1.12.10 Follow established procedures for the administration of first aid and contact emergency medical personnel when necessary.

**Unit: Plant Biotechnology**

Students will be able to explain the importance of the purpose and impact of government regulations. Students will also research problems and structure a statistical experiment, simulation or study related to the problem. Students will recognize the sources and causes of agents that can contaminate processed and unprocessed food products.

Outcome 1.3

Business Ethics and Law: Analyze how professional, ethical and legal behavior contributes to continuous improvement in organizational performance and regulatory compliance.

Competency:

1.3.1 Analyze how regulatory compliance (e.g., United States Department of Agriculture [USDA], Food and Drug Administration [FDA], United States Department of Interior [USDI], Ohio Livestock Care Standards, water quality standards, local water regulations, building codes) affects business operations and organizational performance.

1.3.4 Identify how federal and state consumer protection laws affect products and services.

1.3.5 Access and implement safety compliance measures (e.g., quality assurance information, safety data sheets [SDSs], product safety data sheets [PSDSs], United States Environmental Protection Agency [EPA], United States Occupational Safety and Health Administration [OSHA]) that contribute to the continuous improvement of the organization.

1.3.8 Verify compliance with computer and intellectual property laws and regulations.

Outcome 3.8

Research and Experiments: Conduct a problem-based study, applying scientific methodology and using descriptive statistics to communicate and support predictions and conclusions.

Competency:

3.8.4 Establish and implement procedures for systematic collection, organization and use of data.

3.8.5 Select and apply sampling methods that appropriately represent the population to be studied.

Outcome 7.1

The Science of Food:Differentiate the structures, functions and sources of basic functional ingredients and the roles they play in the development and manufacturing of food products for human nutrition.

Competency:

7.1.1 Classify the matter in foods by elements, compounds, mixtures, chemical bonds, organic and inorganic properties and physical and chemical changes.

Outcome 7.7

Biosecurity: Connect the sources and causes of contamination and develop the protocols to implement bio-security procedures.

Competency:

7.7.1 Investigate sources and origins of agents that can contaminate processed and unprocessed food products.

7.7.2 Identify activities and biological agents that contribute to the risk of acquiring or preventing a specific disease.

7.7.3 Identify sources of biological and chemical tampering points.

7.7.4 Assess a facility's biosecurity, classify the level of risk and recommend improvements.

7.7.5 Implement biosecurity procedures to prevent cross-site contamination (e.g., proper use and disposal of personal protective equipment [PPE] from site to site, vehicle cleaning between farm and processing site).

7.7.6 Screen and test animals and plant products for infectious agents or contamination.

7.7.7 Select bio-containment practices (e.g., quarantine, eradicate, showering into facilities) to manage pests and diseases.

7.7.8 Manage the biosecurity of raw materials and finished products during transportation (e.g., security seals, chain of custody).

**Unit: Air, Soil & Water Quality**

Students will classify different soil types and determine land capability, conservation practices, and land limitations. Students will also measure water and air quality plus implement practices to improve the quality and interactions between human activity and the earth’s systems.

Outcome 6.1

Soils: Apply knowledge of soil characteristics and soil information resources to overcome any existing soil use limitations while maintaining or improving soil quality.

Competency:

6.1.1 Identify soil forming factors and explain how they produce variability in soils.

6.1.2 Describe the relationship among physical properties of soils.

6.1.3 Collect, test and analyze soil samples for physical and chemical properties.

6.1.4 Identify factors (e.g., climate, vegetation, soil texture, drainage, management practices, landscape) affecting organic matter and its function in soil quality.

6.1.5 Determine land use and identify land capabilities classes.

6.1.6 Apply soil conservation practices to reduce soil erosion and compaction.

6.1.7 Compare and contrast the causes and effects of soil erosion.

6.1.8 Describe soil limitations in agronomic, urban and natural resource practices.

6.1.9 Evaluate soil survey data and implement management decisions.

6.1.10 Assess basic processes of soil reclamation.

Outcome 6.2

Water Quality: Analyze, interpret and manage the biological, chemical and physical properties of water quality.

Competency:

6.2.1 Assess and explain the interactions between human activities and the Earth’s hydrosphere (e.g., septic systems, desalinization, point and non-point source pollution).

6.2.2 Measure pH, dissolved oxygen (DO), biological oxygen demand (BOD), temperature and macroinvertebrate populations to determine water quality.

6.2.3 Measure hardness, nitrogen, phosphorus, vegetation and physical characteristics of lentic and lotic waters to determine water quality.

6.2.4 Explain the hydrological cycle (e.g., condensation, evaporation, transpiration) and how human and animal activity impacts the cycle.

6.2.5 Explain the biotic and abiotic factors affecting water quality.

6.2.6 Monitor and analyze water quality and quantity.

6.2.7 Implement procedures and management practices that maintain or improve water quality.

Outcome 6.3

Air Quality: Analyze, interpret and manage the biological, chemical and physical properties of air quality.

Competency:

6.3.2 Explain biogeochemical cycles (e.g., nitrogen, oxygen, sulfur) and how they relate to the biosphere, geosphere and atmosphere.

6.3.4 Analyze the importance of air quality to humans and other living organisms.

6.3.5 Explain human and natural factors (e.g., volcanic eruptions, forest fires, greenhouse gases, farming practices, transportation) affecting air quality.

6.3.6 Monitor and evaluate air composition, quality and quantity with direct reading instruments (e.g., combustible gas indicator, oxygen meter).

6.3.7 Assess the potential for air contamination at a specific site.

**Unit: Environmental Science**

Students will collect, treat and analyze waste materials and those risks associated with accumulating and disposal. Students will also implement practices to improve the quality and interactions between human activity and the earth’s systems.

Outcome 6.7

Solid Waste and Renewable Resource Management: Control and process solid waste using current and alternative technologies.

Competencies:

6.7.1 Collect, analyze and treat solid waste materials (e.g., mortalities, manure, garbage).

6.7.2 Distinguish the risks associated with solid waste accumulation, utilization and disposal.

6.7.3 Determine an acceptable site for solid waste disposal.

6.7.4 Compare the processes of aerobic and anaerobic waste decomposition.

6.7.5 Describe and monitor solid waste disposal procedures (e.g., landfill, compost).

6.7.6 Describe and implement solid waste management methods (e.g., composting, incineration, recycling, burial).

6.7.7 Explain the control processes and potential uses for solid waste byproducts (e.g., leachate, ash, landfill gas, sludge, methane, manure).

6.7.8 Describe standard operating procedures and identify design requirements for specific purposes (e.g., landfill, lagoon, leachate treatment).

6.7.9 Evaluate site closure methods and post-closure monitoring.

6.7.10 Determine type and volume of solid waste generated by an operation or facility.

Outcome 6.8

Contaminants and Pollution Control: Assess an affected area, determine the source and type of contaminant and respond.

Competency:

6.8.1 Collect, record and analyze environmental samples and interpret the results.

6.8.2 Determine the types, sources and impact of natural and man-made contaminants.

6.8.3 Monitor, analyze and quantify levels of contaminants from point and non-point sources.

6.8.7 Identify, comply with and implement contaminant control, remediation and prevention practices (e.g., biological, sanitation, buffer strips).

6.8.10 Develop and implement various emergency response plans.

6.8.11 Identify and contact local emergency response teams.

6.8.12 Analyze environmental conditions that influence environmental response.

Outcome 6.10

Ecosystems:Evaluate biotic and abiotic components and relationships in ecosystems to apply restoration and conservation practices that maintain functionality.

Competency:

6.10.1 Describe ecological levels, including population, community, ecosystem and biosphere.

6.10.2 Distinguish the flow of energy through ecosystems.

6.10.3 Identify and classify interactions among organisms, including predation, symbiosis and competition, to determine species interdependent relationships.

6.10.4 Describe the process of succession and its impact on ecosystems.

6.10.5 Connect biotic interactions with the abiotic environment.

6.10.6 Describe biogeochemical cycles (e.g., carbon, nitrogen, phosphorous, hydrological) and their roles in maintaining equilibrium in an ecosystem.

6.10.7 Identify interactions of ecosystems to differentiate biomes.

6.10.8 Select and implement restoration ecology practices to repair damaged ecosystems.

6.10.9 Determine the impact of native and non-native invasive species on ecosystems.

6.10.10 Describe the relationship between evolution and ecosystems.

Outcome 6.11

Habitat Management and Restoration:Develop a plan for the management and restoration of a specific habitat.

Competency:

6.11.10 Develop a management plan for the sustainability of a specific habitat using environmental practices.

**Unit: Plant Nutrients**

Students will identify the functions and sources of macronutrients and micronutrients. Students will be able to identify the symptoms and causes of plant nutrient deficiencies plus test the soil and tissue. Students will identify and calculate nutrient requirements along with the different application methods.

Outcome 8.1

Plant Nutrition:Select and apply macronutrients and micronutrients based on deficiencies, identified using testing application methods and optimum management that account for environmental factors.

Competency:

8.1.1 Compare and contrast organic and inorganic sources of macronutrients and micronutrients.

8.1.2 Describe the functions of macronutrients and micronutrients in plants and the role that microorganisms play in plant nutrition.

8.1.3 Determine the nutrient requirements of plants.

8.1.4 Identify symptoms and causes of plant nutrient deficiencies and toxicities.

8.1.5 Collect soil and plant tissue for testing and analysis.

8.1.6 Analyze and draw conclusions from soil and plant tissue test data.

8.1.7 Distinguish between biotic and abiotic factors (e.g., minerals, pH, microorganisms) that influence and optimize the availability of nutrients for plants.

8.1.8 Calculate nutrient requirements and select nutrient sources and additives for optimum economic return.

8.1.9 Determine the nutrient content of organic and inorganic fertilizers.

8.1.10 Select the methods and time of nutrient application and apply nutrients.

**Unit: Plant Physiology and Growth**

Students will identify the reproductive anatomy of plants and describe their physiological functions along with the factors that influence and optimize plant reproduction. Students will be able to identify and describe a plant’s anatomical and physical functions. Students will be able to select and utilize different seed stock for their traits and be able to use propagation.

Outcome 8.2

Plant Reproduction:Propagate and cultivate plants for specific characteristics and economic variables for both greenhouses and crops.

Competency:

8.2.1 Identify the reproductive anatomy of plants and describe their physiological functions.

8.2.2 Describe how biotic and abiotic factors (e.g., insects, light, temperature, microorganisms, moisture, location) influence and optimize plant reproduction.

8.2.3 Compare and contrast variations of plant reproductive systems among plant species.

8.2.4 Select seeds and seed stock for desired traits.

8.2.5 Select and apply methods that create desired traits in seeds.

8.2.6 Select and apply all methods of asexual plant propagation for desired traits (e.g., grafting, layering, cutting, cloning).

**Unit: Plant Production and Management**

Students will be able to identify and classify plant pests along with their interrelationships between plants, humans and the environment. Students will identify and classify at all stages of growth seeds and plants along with studying their anatomical structures and tissues. Students will be able to determine crop maturity and the safe handling, storage, and harvesting of crops.

Outcome 8.3

Pest Management:Develop and implement an integrated pest management (IPM) plan by scouting and identifying specific plant pests and the damage they cause and apply specialized control methods.

Competency:

8.3.1 Identify and classify insect, weed, disease and animal pests.

8.3.2 Examine the interrelationships among plants, pests, humans and the environment.

8.3.3 Analyze and calculate the economic threshold of pest damage.

8.3.4 Determine and implement pest management safety practices (e.g., safety data sheets [SDSs], United States Environmental Protection Agency [EPA], United States Occupational Safety and Health Administration [OSHA], personal protective equipment [PPE], worker protection standards [WPS], refuge management strategy).

8.3.5 Evaluate the effectiveness of a pest management plan.

8.3.6 Describe genetic adaptations and modifications (e.g., Bt corn, glyphosate resistant soybean) that have led to fungal, bacterial and insect resistance in plants.

8.3.7 Describe the types and functions of biological and mechanical control methods.

8.3.8 Describe the types and functions of chemical pesticide control measures.

8.3.9 Develop an IPM plan, based on pest life cycles, available treatments, application methods and the impact on the environment.

8.3.10 Select application methods and implement an IPM plan.

8.3.11 Evaluate IPM plans and applications for their impact on the environment and their effectiveness.

Outcome 8.4

Growth and Management:Manage and manipulate plant development through the selection, planting and growing of seeds and plants, based on global demand, economic importance and growing conditions.

Competency:

8.4.1 Identify and classify plants using taxonomy.

8.4.2 Identify plant anatomical structures and tissues.

8.4.3 Identify and classify seeds and plants at all stages of growth.

8.4.4 Explain requirements necessary for photosynthesis to occur and identify the products and byproducts of photosynthesis.

8.4.5 Understand aerobic respiration and its relationship to plant growth and management.

8.4.6 Identify the principles of primary and secondary plant growth.

8.4.7 Identify the plant responses to plant growth regulators and different forms of tropism.

8.4.8 Understand the influence of environmental factors on plant growth, development and maintenance.

8.4.9 Manipulate natural and artificial factors to influence plant germination, growth and development.

8.4.10 Select, evaluate and prepare soil or media for planting.

8.4.11 Understand and evaluate the process by which plants are selected.

8.4.12 Evaluate and implement planting practices (e.g., population rate, germination, seed vigor, inoculation, seed and plant treatments, type of planter, cuttings, pot in pot).

8.4.14 Control plant growth through mechanical and chemical means.

8.4.15 Analyze plant water requirements and provide water through artificial or natural means.

8.4.16 Explain the process and importance of transpiration in plant growth and development.

8.4.17 Recognize plant disease symptoms, prevention, avoidance and treatments.

**Unit: Crop Harvesting**

Students will learn how to properly harvest various production crops.

Outcome 8.5

Harvesting:Evaluate and implement harvesting methods to maximize yield.

Competency:

8.5.1 Identify characteristics of grains, seeds, vegetables, fruits and ornamental plants that indicate crop maturity.

8.5.2 Describe safety precautions to take when harvesting.

8.5.3 Adjust to environmental conditions to enhance the harvesting of plant products.

8.5.4 Evaluate techniques to maximize yield through mechanical or hand harvesting methods.

8.5.5 Calculate potential yield and loss due to harvesting.

8.5.6 Evaluate the impact of harvest techniques on the quality of plants and plant products.

8.5.7 Identify harvesting methods and harvesting equipment.

8.5.8 Assess the stage of growth to determine the maturity and salability of grains, seeds, vegetables, fruits and ornamental plants.

8.5.11 Evaluate crop yield and loss data.

8.5.12 Implement management practices to reduce loss.

**Unit: Crop Handling and Storage**

Students will learn how to handle and store production crops while minimizing yield loss.

Outcome 8.6

Handling and Storage: Handle and store plants and plant products to maximize quality.

Competency:

8.6.1 Describe safety precautions in handling and storage practices.

8.6.2 Adjust to environmental conditions to enhance the handling and storage of plant products.

8.6.3 Apply harvesting, handling and storage techniques to minimize loss and maximize economic return.

8.6.4 Calculate potential yield and loss due to processing and storage.

8.6.5 Explain the proper conditions to maintain the quality of plants and plant products held in storage.

8.6.6 Maintain and enhance the quality of plant products through the manipulation of handling and storage techniques (e.g., temperature, humidity, retardants, light, chemicals, contamination).

8.6.7 Prepare products for sale, transportation and storage.

8.6.8 Identify storage methods for plants and plant products.

8.6.9 Monitor environmental conditions in storage facilities for plants and plant products.

8.6.10 Explain the reasons for preparing plants and plant products for distribution.

8.6.11 Implement and evaluate techniques for grading, handling, packaging and loading plants and plant products for distribution or transportation.

**Unit: Equipment Operations**

Students will perform inspections on stationary and mobile equipment while following the manufacturer’s recommended operating procedures and adjustment specifications. Students will also describe health and safety practices to reduce risks from hazardous materials and hazardous materials disasters.

Outcome 4.1

Tool, Stationary and Mobile Equipment Maintenance: Inspect, clean, maintain and perform planned preventative maintenance on tools, machinery, implements and equipment.

Competency:

4.1.1 Identify the types of hand tools, power tools and stationary equipment and describe their functions.

4.1.2 Ensure the presence and functionality of safety systems and hardware.

4.1.3 Identify potential hazards and limitations related to the use of hand tools, power tools and stationary equipment.

4.1.4 Maintain machinery, equipment, instrument and facility cleanliness, appearance and safety.

4.1.5 Inspect and service the electrical connections and lamps.

4.1.6 Inspect for fluid leakage, fluid levels and the condition of fluids.

4.1.7 Clean, lubricate and adjust machinery and equipment.

4.1.8 Select fluids, maintain fluid levels and replace system filters.

4.1.9 Inspect and maintain fluid conveyance and storage components (e.g., hoses and lines, valves, nozzles).

4.1.10 Inspect and replace drive belts.

4.1.11 Calibrate metering, monitoring and sensing equipment.

Outcome 4.2

Equipment Operations:Operate and maintain mechanical equipment and power systems.

Competency:

4.2.1 Follow manufacturer’s recommended operating procedures and adjustment specifications.

4.2.2 Differentiate among the functions, limitations and proper use of equipment, equipment controls and instrumentation.

4.2.3 Perform pre- and post-operation inspections and adjustments and report malfunctions.

4.2.4 Perform appropriate start-up, operating and shut-down procedures.

4.2.5 Select and operate the equipment and attachments needed to complete the task including levers, pedals or valves.

Outcome: 6.9

Hazardous Materials and Waste Management: Follow and apply handling, storage and recording procedures for hazardous materials and waste.

Competency:

6.9.1 Identify and differentiate solid waste, hazardous waste, toxic waste and radioactive waste streams.

6.9.2 Describe health and safety practices for reducing risks from hazardous materials (e.g., safety data sheet [SDS], employer notification forms, personal protective equipment [PPE]).

6.9.3 Demonstrate appropriate responses for major types of hazardous materials disasters (e.g., chemical releases, fires, explosions).

6.9.4 Obtain and use information addressing hazardous substance discharge.

6.9.5 Demonstrate safe management, handling, disposal and recycling procedures for hazardous materials and waste.

6.9.6 Perform site assessments to detect and identify the presence and storage of hazardous materials.

6.9.7 Collect and evaluate samples of hazardous materials and waste.

6.9.8 Prepare hazardous materials for transportation and storage in accordance with regulations.

6.9.9 Prepare and maintain hazardous material handling documentation.

6.9.10 Identify hazardous materials that can be recycled.

**Unit: Precision Agriculture**

Students will develop skills in the utilization of technology in today’s crop production. Global Positioning and surveying and mapping skills will be learned to better utilize production inputs.

Outcome 1.4

Knowledge Management and Information Technology: Demonstrate current and emerging strategies and technologies used to collect, analyze, record and share information in business operations**.**

Competency:

1.4.2 Select and use software applications to locate, record, analyze and present information (e.g., word processing, e-mail, spreadsheet, databases, presentation, Internet search engines).

1.4.3 Verify compliance with security rules, regulations and codes (e.g., property, privacy, access, accuracy issues, client and patient record confidentiality) pertaining to technology specific to the industry pathway.

1.4.4 Use system hardware to support software applications.

1.4.5 Use information technology tools to maintain, secure and monitor business records.

1.4.6 Use an electronic database to access and create business and technical information.

Outcome 5.4

Surveying and Mapping:Perform surveying procedures to construct a site plan.

Competency:

5.4.2 Interpret maps, topographic site plans, deeds and aerial or satellite imagery for site planning.

5.4.4 Integrate map and surveying data into geographic information system (GIS) or computer aided design (CAD) software.

5.4.5 Identify topographical and existing features of areas, including property lines, benchmarks, utilities, streets and setbacks, on survey maps, parcel maps and plats.

Outcome: 5.5

Geographic Information Systems (GIS): Employ GIS computer applications to interpret data, maps and land use.

Competency:

5.5.1 Interpret and evaluate the accuracy of digital imagery and aerial photography.

5.5.2 Explain map projections and the use of scales.

5.5.3 Describe GIS data structures (e.g., vector, grid, triangulated irregular network [TIN]).

5.5.8 Determine one’s position on the earth using GPS.

5.5.9 Integrate GPS data into GIS applications.

**Unit: Business Management**

Students will learn the skills and knowledge essential to managing a crop production operation.

Outcome 1.6

Business Literacy: Develop foundational skills and knowledge in entrepreneurship, financial literacy and business operations.

Competency:

1.6.3 Explain the importance of planning your business.

1.6.11 Describe how all business activities of an organization work within the parameters of a budget.

Outcome: 1.8

Operations Management: Plan, organize and monitor an organization or department to maximize contribution to organizational goals and objectives.

Competency:

1.8.1 Forecast future resources and budgetary needs using financial documents (e.g., balance sheet, demand forecasting, financial ratios).

1.8.3 Analyze the performance of organizational activities and reallocate resources to achieve established goals.

1.8.9 Develop a budget that reflects the strategies and goals of the organization.

1.8.10 Analyze how business management and environmental management systems (e.g., health, safety) contribute to continuous improvement and sustainability.

Outcome 1.9

Financial Management:Use financial tools, strategies and systems to develop, monitor and control the use of financial resources to ensure personal and business financial well-being.

Competency:

1.9.1 Create, analyze and interpret financial documents (e.g., budgets, income statements).

1.9.3 Review and summarize savings, investment strategies and purchasing options (e.g., cash, lease, finance, stocks, bonds).

**Unit: Leadership and Communications**

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.

Outcome 1.1

Employability Skills: Develop career awareness and employability skills (e.g., face-to-face, online) needed for gaining and maintaining employment in diverse business settings.

Competency:

1.1.1 Identify the knowledge, skills and abilities necessary to succeed in careers.

1.1.2 Identify the scope of career opportunities and the requirements for education, training, certification, licensure and experience.

1.1.3 Develop a career plan that reflects career interests, pathways and secondary and postsecondary options.

1.1.4 Describe the role and function of professional organizations, industry associations and organized labor and use networking techniques to develop and maintain professional relationships.

Outcome 1.2

Leadership and Communications: Process, maintain, evaluate and disseminate information in a business. Develop leadership and team building to promote collaboration.

Competency:

1.2.1 Extract relevant, valid information from materials and cite sources of information.

1.2.2 Deliver formal and informal presentations.

1.2.3 Identify and use verbal, nonverbal and active listening skills to communicate effectively.

1.2.12 Use technical writing skills to complete forms and create reports.