# Agricultural and Environmental Systems Career Field

## Animal and Plant Science

**Subject Code: 010125**

**Outcome & Competency Descriptions**

**Course Description:**

Students will apply knowledge of animal and plant science to the agriculture industry. They will be introduced to the value of production animals relative to the agricultural marketplace. Students will engage in animal classification and selection, body systems, along with animal welfare and behavior in relation to the production of animals. Students will learn principles of plant anatomy and physiology, and the role of nutrition, deficiencies and growing environment on plant production. Throughout the course, business principles and professional skills will be examined.

**Strand 1. Business Operations/21st Century Skills**

Learners apply principles of economics, business management, marketing and employability in an entrepreneur, manager and employee role to the leadership, planning, developing and analyzing of business enterprises related to the career field.

**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.

**Competencies**

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

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.

**Competencies**

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

1.2.2. Deliver formal and informal presentations.

1.2.4. Use negotiation and conflict-resolution skills to reach solutions.

1.2.5. Communicate information (e.g., directions, ideas, vision, workplace expectations) for an intended audience and purpose.

1.2.6. Use proper grammar and expression in all aspects of communication.

1.2.7. Use problem-solving and consensus-building techniques to draw conclusions and determine next steps.

1.2.10. Use interpersonal skills to provide group leadership, promote collaboration and work in a team.

1.2.14. Use motivational strategies to accomplish goals.

**Outcome: 1.3. Business Ethics and Law**

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

**Competencies**

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.

**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.

**Competencies**

1.4.1. Use office equipment to communicate (e.g., phone, radio equipment, fax machine, scanner, public address systems).

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).

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

**Outcome: 1.6. Business Literacy**

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

**Competencies**

1.6.1. Identify business opportunities.

1.6.3. Explain the importance of planning your business.

1.6.7. Identify the effect of supply and demand on products and services.

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

**Outcome: 1.7. Entrepreneurship/Entrepreneurs**

Analyze the environment in which a business operates, and the economic factors and opportunities associated with self-employment.

**Competencies**

1.7.7. Create a list of personal strengths, weaknesses, skills and abilities needed to be successful as an entrepreneur.

**Outcome: 1.8. Operations Management**

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

**Competencies**

1.8.2. Select and organize resources to develop a product or a service.

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

**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.

**Competencies**

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

1.9.2. Identify tax obligations.

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

1.9.8. Identify income sources and expenditures.

**Outcome: 1.10. Sales and Marketing**

Manage pricing, place, promotion, packaging, positioning and public relations to improve quality customer service.

**Competencies**

1.10.1. Identify how the roles of sales, advertising and public relations contribute to a company’s brand.

1.10.2. Determine the customer's needs and identify solutions.

1.10.3. Communicate features, benefits and warranties of a product or service to the customer.

1.10.6. Discuss the importance of correct pricing to support a product’s or service’s positioning in the marketing mix.

1.10.10. Demonstrate sales techniques.

**Outcome: 1.11. Principals of Business Economics**

Examine and employ economic principles, concepts and policies to accomplish organizational goals and objectives.

**Competencies**

1.11.3. Use economic indicators to identify economic trends and conditions (e.g., inflation, interest rate fluctuations, unemployment rates).

1.11.4. Determine how the quality, quantity and pricing of goods and services are affected by domestic and international competition in a market economy.

1.11.8. Identify the relationships between economy, society and environment that lead to sustainability.

**Strand 2. Animal Science**

Learners apply principles of animal anatomy, physiology, genetics, behavior, nutrition and production to the research and development, selection and reproduction, health and management of animals in domestic and natural environments.

**Outcome: 2.1. Nutrition**

Analyze, formulate, prepare and administer a ration for a population of specific animal species based on the economics, nutrition and availability of feed stuffs and evaluate the feed’s effects on animals and animal products.

**Competencies**

2.1.2. Describe the role of nutrients and nutritional requirements of different animal life processes and species.

2.1.3. Collect a feedstuff sample and interpret the data to determine the quality.

2.1.4. Identify and address major nutrient deficiency and toxicity symptoms.

**Outcome: 2.2. Body Systems**

Describe the interrelationships of animal body systems with growth, development, health, maintenance, reproduction and production.

**Competencies**

2.2.1. Describe external anatomical parts and their functions within different species.

2.2.2. Compare and contrast the anatomical parts of the digestive system(s) and describe their physiology within different species.

2.2.12. Compare and contrast between the male and female reproductive system, structures and function.

**Outcome: 2.3. Care and Management**

Apply animal care, management and record procedures to ensure husbandry and welfare, including managing environmental conditions to ensure animal health and performance.

**Competencies**

2.3.1. Identify species-specific terminology (gender, age, reproductive status).

2.3.2. Identify, classify, evaluate and select animal species or breeds for a desired outcome.

2.3.5. Perform species-specific animal identification techniques for traceability and records.

2.3.8. Evaluate and perform animal care procedures aligned with industry standards throughout the life of the animal.

2.3.9. Monitor and evaluate the quality of an animal’s habitat and implement corrective methods as needed.

**Outcome: 2.4. Recognizing Diseases and Disorders**

Evaluate animal conditions for species-specific diseases and disorders to assess an animal’s health and welfare.

**Competencies**

2.4.5. Describe zoonotic diseases and explain the health risk on humans and animals.

**Outcome: 2.5. Animal Health**

Implement preventive measures, treatment and maintenance options for species-specific diseases and disorders to improve an animal’s health and welfare.

**Competencies**

2.5.3. Recognize the preventative measures or treatments needed to maintain animal health.

2.5.4. Apply basic principles of first aid.

**Outcome: 2.6. Population Management**

Manage reproduction practices in animal populations across habitats to achieve the desired outcomes and specific goals.

**Competencies**

2.6.2. Compare and select superior individuals based on phenotype.

2.6.3. Compare and select superior individuals based on breeding values and heritability of the desired traits.

**Strand 3. Biotechnology**

Learners engage in the scientific process, learn fundamental processes using modern tools and laboratory techniques, adhere to safety protocols, and bring a biotechnology product to the market.

**Outcome: 3.1. Research and Experiments**

Use scientific methodology to conduct problem-based studies, develop products, and interpret results.

**Competencies:**

3.1.1. Design a research plan, including the significance of the problem, purpose, hypotheses, objectives, appropriate controls, independent variables, dependent variables, methods of study and a list of materials.

3.1.2. Examine sources for credibility.

3.1.5. Document results of the experiment in a laboratory notebook, including a statement of purpose, experimental design, observations, results, conclusions and next steps.

3.1.6. Create, interpret, and use tabular and graphical displays and describe the data.

3.1.10. Describe the relationships among variables using correlations and draw conclusions.

3.1.11. Draw conclusions based on observations and data analyses, recognizing that experimental results must be open to the scrutiny of others.

3.1.12. Prepare and present findings using scientific reports.

**Outcome 3.3. Specimen, equipment and chemical handling**

Handle, prepare, transport, store and dispose of specimens and chemicals. Monitor, record and maintain the integrity of equipment and instrumentation, environmental conditions of the facility and inventory.

**Competencies:**

3.3.7. Select personal protective equipment for various laboratory protocols.

**Outcome 3.5. Microbiology Testing and Technology**

Classify, differentiate between, and test for various kinds of microorganisms and microbial by-products.

**Competencies:**

3.5.7. Compare and contrast cellular structure and functions of prokaryotic and eukaryotic cells.

**Outcome 3.6. Molecular-Genetics Technology**

Apply knowledge of genetic inheritance and modification to organisms and use genetic information and bioinformatics to analyze specimens.

**Competencies:**

3.6.1. Use a Punnett Square to predict and explain Mendel's Laws, genotype, and phenotype.

**Strand 5 Elements of Production**

Learners apply principles of practice related to the management and maintenance of food, agriculture and natural resources systems.

**Outcome: 5.15. Animal Behavior**

Apply management practices to assure quality animal welfare considering species-specific behaviors, human safety, social influences, public perception and regulations associated with animal welfare.

**Competencies**

5.15.5. Interpret an animal’s intent based on its vocalization, body posture and chemical means of communication.

5.15.6. Recognize behavior abnormalities and recommend corrective action.

**Outcome: 5.16. Biosecurity**

Connect the sources and causes of contamination and develop the protocols to implement biosecurity procedures.

**Competencies:**

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

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

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

**Strand 6. Environmental Science**

Learners apply earth, life, and physical sciences to the production, extraction, processing, protection, use, and renewal of both renewable and non-renewable resources.

**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.

**Competencies**

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 and describe factors (e.g., climate, soil texture, mineralogy, soil organisms, drainage co-efficient, land use, vegetation types, management practices) affecting organic matter and its function in soil quality.

6.1.5. Determine land use and identify land capabilities classes.

6.1.6. Identify and describe soil conservation practices to reduce soil erosion and compaction.

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

6.1.9. Evaluate soil survey data and implement management decisions.

**Outcome: 6.2. Water Quality**

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

**Competencies**

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).

6.2.5. Explain the biotic and abiotic factors affecting water quality.

6.2.7. Identify and describe best management and industry (e.g., agriculture, timber production, construction) production practices that maintain or improve water quality.

**Outcome: 6.4. Water Use and Management**

Collect, analyze and interpret data for a localized water use and management plan.

**Competencies**

6.4.2. Describe the geological and meteorological principles affecting water supplies.

6.4.9. Identify and describe best management practices that conserve and sustain water.

**Strand 7. Food Science**

Learners apply principles of biology, chemistry and physics to the research, development, production, processing and distribution of food products meeting food safety and quality assurance standards in a secure system.

**Outcome: 7.5. Food Product Development**

Apply principles of nutrition and human behavior to create a new food prototype.

**Competencies**

7.5.2. Identify consumer preferences, trends and opportunities affecting food product development.

**Strand 8. Plant Science**

Learners apply principles of plant anatomy, physiology, nutrition and genetics to the research and development, selection and reproduction, planting, fertilization, health, harvesting and management of plants in a domestic and/or natural environment.

**Outcome: 8.1. Plant Nutrition**

Select and apply macronutrients and micronutrients based on deficiencies identified from the use of industry-driven testing, application, methods and optimum management strategies that account for environmental factors.

**Competencies**

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. Identify and describe the nutrient recommendations of a plant for a desired production setting.

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

8.1.8. Calculate nutrient requirements and select nutrient sources and additives for the highest potential yield.

8.1.12. Describe and apply the 5 R’s of nutrient management: (1) right source of fertilizer at the (2) right rate at the (3) right time in the (4) right place with the (5) right irrigation method.

**Outcome: 8.2. Plant Reproduction**

Propagate plants and cultivars for specific performance characteristics under a variety of production systems.

**Competencies**

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 plant reproduction.

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

8.2.5. Select and apply methods of asexual plant propagation.

**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.

**Competencies**

8.3.1. Identify and classify insect, weed, pathogen, animal pests, and describe the damages they cause.

8.3.2. Examine the interrelationships of the disease triangle among host, pathogen and environment.

8.3.4. Determine the components of an integrated pest management plans and related safety practices.

8.3.6. Describe the types and functions of biological, mechanical, and chemical control methods.

**Outcome: 8.4. Growth and Management**

Explain, manage and manipulate plants through all stages of growth and development.

**Competencies**

8.4.1. Identify and classify plants using taxonomy.

8.4.2. Identify plant anatomical structures and their functions.

8.4.3. Identify and classify seeds.

8.4.4. Identify and classify plants and describe management decisions at all stages.

8.4.5. Explain the requirements of photosynthesis and identify the products and byproducts.

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

8.4.8. Explain primary and secondary plant growth.

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

8.4.12. Understand and evaluate the process by which plants are selected in relation to production use.

8.4.13. Evaluate and implement planting practices.

8.4.16. Control plant growth through mechanical and chemical means.

8.4.17. Analyze plant water requirements and describe methods of irrigation.

8.4.18. Compare and contrast inorganic and organic production practices.

**Outcome: 8.5. Harvesting**

Describe and implement harvesting methods.

**Competencies**

8.5.1. Determine crop readiness for salability and environmental conditions that can impact crop quality at harvest.

8.5.4. Calculate and evaluate potential yield and loss due to harvesting.

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