

# Agricultural Production Technology

**8010 36 weeks**

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## Course Description

**Suggested Grade Level:** 10 or 11

This course provides instruction in plant and animal science for students interested in career pathways related to agricultural production. Course content also includes safety, mechanics, soil science, precision agriculture, and business. Supervised agricultural experiences (SAEs) and leadership training are integral components. Participation in FFA activities, leadership development events (LDEs), and career development events (CDEs) is encouraged.

*As noted in [Superintendent's Memo #058-17 \(2-28-2017\)](#), this Career and Technical Education (CTE) course must maintain a maximum pupil-to-teacher ratio of 20 students to one teacher, due to safety regulations. The 2016-2018 biennial budget waiver of the teacher-to-pupil ratio staffing requirement does not apply.*

## Task Essentials Table

8010	Tasks/Competencies
<input checked="" type="checkbox"/>	Identify the role of supervised agricultural experiences (SAEs) in agricultural education.
<input checked="" type="checkbox"/>	Participate in an SAE.
<input checked="" type="checkbox"/>	Identify the benefits and responsibilities of FFA membership.
<input checked="" type="checkbox"/>	Describe leadership characteristics and opportunities as they relate to agriculture and FFA.
<input type="checkbox"/>	Apply for an FFA degree and/or an agricultural proficiency award.
<input checked="" type="checkbox"/>	Identify risks/hazards in an agricultural operation.

<input checked="" type="radio"/>	Demonstrate safety in an agricultural operation.
<input checked="" type="radio"/>	Identify public safety issues pertaining to agricultural operations.
<input checked="" type="radio"/>	Perform lockout/tagout (LOTO) procedures in an agricultural production setting.
<input checked="" type="radio"/>	Identify regulations related to labor in the agricultural production operation.
<input checked="" type="radio"/>	Identify marked safety areas.
<input checked="" type="radio"/>	Identify the location and use of eye wash stations.
<input checked="" type="radio"/>	Identify the location of posted evacuation routes.
<input checked="" type="radio"/>	Demonstrate knowledge of SDS.
<input checked="" type="radio"/>	Demonstrate the safe use of chemicals.
<input checked="" type="radio"/>	Demonstrate the safe use of standard and metric hand tools.
<input checked="" type="radio"/>	Demonstrate the safe use of power tools.
<input checked="" type="radio"/>	Demonstrate the safe use of precision standard and metric measuring tools.
<input checked="" type="radio"/>	Demonstrate the use of protective clothing and equipment.
<input checked="" type="radio"/>	Demonstrate the safe use of fire-protection equipment.
<input checked="" type="radio"/>	Demonstrate the safe use of equipment.
<input checked="" type="radio"/>	Demonstrate safe practices in the agricultural mechanics lab/workshop.
<input checked="" type="radio"/>	Demonstrate standard measurement techniques in agricultural mechanics.
<input checked="" type="radio"/>	Calculate a bill of materials.
<input checked="" type="radio"/>	Demonstrate woodworking skills.
<input type="radio"/>	Demonstrate metalworking skills.
<input checked="" type="radio"/>	Construct a section of farm fence.
<input checked="" type="radio"/>	Identify major farm machines common to agriculture production.
<input checked="" type="radio"/>	Describe the soil-formation process and components of soil.
<input checked="" type="radio"/>	Evaluate the physical and chemical properties of soil.
<input checked="" type="radio"/>	Analyze soil characteristics.
<input checked="" type="radio"/>	Create soil amendment recommendations for a given crop or land use.

<input checked="" type="radio"/>	Examine best management practices for improving soil health.
<input checked="" type="radio"/>	Describe erosion, its effects on the environment, and prevention methods.
<input type="radio"/>	Conduct a water percolation test.
<input checked="" type="radio"/>	Demonstrate how to use the USDA Web Soil Survey.
<input type="radio"/>	Devise a soil-management plan to minimize erosion and maximize biodiversity, plant productivity, and the formation of topsoil.
<input checked="" type="radio"/>	Identify grain, oil, and specialty field crops.
<input type="radio"/>	Identify vegetable crops.
<input type="radio"/>	Identify fruit and nut crops.
<input checked="" type="radio"/>	Identify the essential nutrients and their major functions for optimal plant growth and development.
<input checked="" type="radio"/>	Identify common plant nutrient deficiency and toxicity symptoms.
<input checked="" type="radio"/>	Analyze the influence of environmental factors on plant growth.
<input checked="" type="radio"/>	Identify principles and practices of sustainable crop production.
<input checked="" type="radio"/>	Differentiate among approved planting practices.
<input checked="" type="radio"/>	Prepare growing media for use in plant cultivation systems.
<input checked="" type="radio"/>	Develop a management plan for plant production.
<input checked="" type="radio"/>	Cultivate plants based on current industry standards.
<input checked="" type="radio"/>	Evaluate disease-control measures.
<input checked="" type="radio"/>	Develop a plan for integrated pest management (IPM) for plant production.
<input type="radio"/>	Demonstrate crop-sampling techniques.
<input checked="" type="radio"/>	Analyze crop samples.
<input checked="" type="radio"/>	Describe how agriculture and the environment are interrelated.
<input checked="" type="radio"/>	Describe best management practices to protect soil and water resources.
<input type="radio"/>	Describe best management practices for the forest.
<input type="radio"/>	Describe best management practices for wildlife.
<input checked="" type="radio"/>	Determine requirements for establishing and managing an animal enterprise.

<input checked="" type="radio"/>	Explain criteria for selecting poultry and livestock.
<input checked="" type="radio"/>	Describe nutritional requirements for poultry and livestock.
<input checked="" type="radio"/>	Describe poultry and livestock healthcare requirements.
<input checked="" type="radio"/>	Explain the benefits and liabilities of owning an agricultural business.
<input checked="" type="radio"/>	Identify the components of a business plan for an agricultural enterprise.
<input checked="" type="radio"/>	Explore government agencies, regulations, and incentives.
<input checked="" type="radio"/>	Describe marketing options for an agricultural enterprise.
<input type="radio"/>	Explain the importance of establishing and maintaining a financial and production record-keeping system for an agricultural enterprise.
<input checked="" type="radio"/>	Describe technologies used in precision agriculture and their importance.
<input checked="" type="radio"/>	Describe the equipment necessary for a GPS to provide applications used in precision agriculture.
<input checked="" type="radio"/>	Describe the procedure for operating a GPS receiver.
<input checked="" type="radio"/>	Research technologies used in precision agriculture management.
<input type="radio"/>	Collect and apply data in the development of a map.
<input checked="" type="radio"/>	Define <i>biosecurity</i> .
<input checked="" type="radio"/>	Describe biosecurity procedures in agricultural production.
<input checked="" type="radio"/>	Identify biosecurity risks in an agricultural production enterprise.
<input checked="" type="radio"/>	Define <i>agroterrorism</i> .
<input checked="" type="radio"/>	Describe internal and external measures to prevent agroterrorism related to an agricultural enterprise.
<input checked="" type="radio"/>	Identify agroterrorism risks related to an agricultural enterprise.
<input checked="" type="radio"/>	Define <i>cybersecurity</i> as it relates to agricultural production.
<input checked="" type="radio"/>	Describe measures to prevent cybersecurity breaches in an agricultural production enterprise.
<input checked="" type="radio"/>	Identify cybersecurity risks related to an agricultural production enterprise.

Legend:  Essential  Non-essential  Omitted

**Note: Competencies 39-43 have been added to ensure compliance with federal legislation: National FFA Organization's Federal Charter Amendments Act (Public Law 116-7, <https://www.congress.gov/116/plaws/publ7/PLAW-116publ7.pdf>). All inquiries may be sent to**

cte@doe.virginia.gov. Students are provided opportunities for leadership, personal growth, and career success. Instruction is delivered through three major components: classroom and laboratory instruction, supervised agricultural experience (SAE) program, and student leadership (FFA).

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# Curriculum Framework

## Task Number 39

### Identify the role of supervised agricultural experiences (SAEs) in agricultural education.

#### Definition

Identification should include

- defining an SAE program as *an opportunity for students to consider multiple careers and occupations in the agriculture, food, and natural resources (AFNR) industries, learn expected workplace behavior, develop specific skills within an industry, and apply academic and occupational skills in the workplace or a simulated workplace environment*
- researching the Foundational SAE
  - career exploration and planning
  - personal financial planning and management
  - workplace safety
  - employability skills for college and career readiness
  - agricultural literacy
- researching the Immersion SAE
  - entrepreneurship/ownership
  - placement/internships
  - research (experimental, analytical, invention)
  - school business enterprises
  - service learning
- developing a plan to participate in an SAE, based on personal and career goals
- researching available awards and degrees, based on SAE participation.

Teacher resource: [SAE Resources](#), National Council for Agricultural Education

#### Process/Skill Questions

- What are examples of SAEs related to this course and in the AFNR industries?
- Where can a copy of the Virginia SAE Record Book be found?
- What is an Immersion SAE?
- How does a placement/internship SAE differ from an ownership/entrepreneurship SAE?

- How does an SAE provide relevant work experience and contribute to the development of critical thinking skills?
- How is the SAE an extended individualized instructional component of a student's Career Plan of Study?
- How can an SAE be used to provide evidence of student growth and participation in authentic, work-related tasks?
- What are the four types of SAEs?
- What are the advantages of participating in work-based learning experiences and projects?
- How does one choose an appropriate SAE in which to participate?

## Task Number 40

### Participate in an SAE.

#### Definition

Participation should include

- developing, completing, or continuing a plan to participate in an SAE as a work-based learning experience, based on personal and career goals
- documenting experience, connections, positions held, and competencies attained, using the *Virginia SAE Record Book*
- researching available awards and degrees, based on SAE participation.

Teacher resources:

[FFA SAE](#)

[The Agricultural Experience Tracker](#)

#### Process/Skill Questions

- What are the advantages of participating in work-based learning experiences and projects?
- How do SAEs help prepare students for the workforce?
- What are some examples of SAEs in AFNR?

## Exploring Leadership Opportunities through FFA

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## Task Number 41

### Identify the benefits and responsibilities of FFA membership.

#### Definition

Identification should include

- benefits
  - listing opportunities to participate in community improvement projects and career development events (CDEs) and leadership development events (LDEs)
  - exploring leadership development opportunities
- responsibilities
  - researching the responsibilities of FFA officers, committees, and members
  - locating resources that guide participation in FFA activities
  - explaining the FFA Creed, Motto, Salute, and mission statement
  - explaining the meaning of the FFA emblem, colors, and symbols
  - explaining significant events and the history of the organization.

### **Process/Skill Questions**

- How does one become an FFA member?
- What is the FFA's mission and how does it accomplish its mission?
- What are the benefits and responsibilities of FFA membership?
- What five FFA activities are available through the local chapter?
- What are some significant events in FFA history? How have these events shaped membership over time?
- What is the FFA program of activities (POA), and how is it used?

## **Task Number 42**

### **Describe leadership characteristics and opportunities as they relate to agriculture and FFA.**

#### **Definition**

Description should include

- examples of successful leaders
- types of leadership
  - autocratic
  - participative
  - laissez-faire
  - servant
  - followership
- positive leadership qualities and traits of successful leaders
- opportunities for participating in leadership activities in FFA
- demonstrating methods for conducting an effective meeting.

### **Process/Skill Questions**

- Who are some successful leaders in the agriculture industry?
- What qualities make a successful leader?



- What are leadership traits?
- What is the difference between positive and negative leadership?

## **Task Number 43**

### **Apply for an FFA degree and/or an agricultural proficiency award.**

#### **Definition**

Application should include

- identifying types of FFA degrees
  - Greenhand
  - Chapter
  - State
  - American
- identifying proficiency award areas
  - entrepreneurship
  - placement
  - combined
  - agriscience research
- exploring CDEs and LDEs related to this course
- identifying all SAE criteria to be eligible for the award
- identifying the type of award
- applying for an FFA award.

Teacher resource: [FFA Agricultural Proficiency Awards](#)

#### **Process/Skill Questions**

- Where are the awards and their application criteria located?
- What are the benefits of winning an FFA award?
- What are the benefits and requirements of an FFA degree?
- What FFA awards are available?
- How does the FFA degree program reward FFA members in all phases of leadership, skills, and occupational development?
- What is the highest degree that can be conferred upon an FFA member at the national level?
- What are the requirements for a Greenhand FFA degree?

## **Demonstrating Safety Skills in Agricultural Production**

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## **Task Number 44**

# Identify risks/hazards in an agricultural operation.

## Definition

Identification should include

- farm equipment and machinery hazards
- chemical hazards
- biological hazards, including arboviral, zoonotic, and other animal-borne infection hazards
- respiratory hazards (e.g., acute and chronic air contaminants, organic dust, pesticide drift, spores)
- electrical hazards
- livestock hazards
- structural hazards
- confined space hazards
- heat hazards
- noise hazards
- water hazards (e.g., ditches, sloughs, rain barrels, farm ponds).

Teacher resource: [AgSafety4u Certificate Course](#)

## Process/Skill Questions

- What are some hazards related to tractor operation?
- Why is the power takeoff (PTO) on a tractor so dangerous?
- What are some ways to minimize hazards?
- What are some hazards inherent to working around livestock?

## Task Number 45

# Demonstrate safety in an agricultural operation.

## Definition

Demonstration should include using all safety procedures, personal protective equipment (PPE), and protocols related to

- farm equipment
- chemical hazards
- biological hazards, including arboviral, zoonotic, and other animal-borne infection hazards
- respiratory hazards (e.g., organic dust, pesticide drift, spores)
- electrical hazards
- livestock hazards
- structural hazards
- confined space hazards
- heat hazards
- noise hazards
- water hazards.

Teacher Resources:

- [Safety and Prevention, Workplace Safety and Health Topics, National Institute for Occupational Safety and Health \(NIOSH\), Centers for Disease Control and Prevention \(CDC\)](#)
- [Agricultural Operations, Safety and Health Topics, Occupational Safety and Health Administration \(OSHA\), United States Department of Labor \(DOL\)](#)
- [Personal Protective Equipment, Safety and Health Topics, OSHA, DOL](#)

### **Process/Skill Questions**

- How do safety glasses protect a worker in an agricultural operation?
- From what hazards do they protect the worker?
- What should one check for when conducting a hazard analysis?
- What categories of PPE are used to protect an agricultural worker?
- How can one's attitude affect one's safety?

## **Task Number 46**

**Identify public safety issues pertaining to agricultural operations.**

### **Definition**

Identification should include an awareness of public safety issues pertaining to

- chemical handling
- air emissions/releases (e.g., organic dust)
- surface and ground water contamination/farm runoff
- crop production
- production of livestock, poultry, and aquaculture (e.g., beef, dairy, swine, and poultry)
- animal/hazardous waste disposal
- equipment and livestock transportation.

Teacher resource: [Agriculture: Laws and Regulations that Apply to Your Agricultural Operation by Farm Activity, United States Environmental Protection Agency \(EPA\)](#)

### **Process/Skill Questions**

- How can applying fertilizers/pesticides affect the community around a farm?
- What are the dangers of farm runoff?
- What agencies help educate the public about these hazards?
- What are the laws associated with farm use and off-road vehicles?

## **Task Number 47**

**Perform lockout/tagout (LOTO) procedures in an agricultural production setting.**

## Definition

Performance should include

- defining *lockout/tagout*
- identifying area-specific procedures for lockout/tagout.

Teacher resource: [Lockout/Tagout Program, Control of Hazardous Energy, OSHA, DOL](#)

## Process/Skill Questions

- Why is lockout/tagout important?
- What are the procedures for lockout/tagout?

## Task Number 48

### Identify regulations related to labor in the agricultural production operation.

#### Definition

Identification should include

- Occupational Safety and Health Administration (OSHA)
- licensing for pesticide
- Safety Data Sheets (SDS)
- youth labor limitations/laws
- income and payroll tax.

Identification should also include applicable local, state, and federal laws/regulations.

Teacher resources: [United States Department of Agriculture's \(USDA\) National Institute of Food and Agriculture: Farm Safety](#) and [DOL's Wage and Hour Division: State Child Labor Laws Applicable to Agricultural Employment](#).

#### Process/Skill Questions

- Where in the agricultural shop would you find SDS materials?
- What limitations exist for youth laborers under age 16?
- What are the most hazardous tasks for agricultural workers, statistically speaking?
- What is a federal work visa?

## Applying Safety Practices for Carpentry and Metalworking in Agriculture

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## **Task Number 49**

### **Identify marked safety areas.**

#### **Definition**

Identification should include describing and translating signage and special markings (e.g., floor paint) for designated work and caution areas.

#### **Process/Skill Questions**

- What are the different types of work zones?
- When is additional safety equipment or clothing required to enter a safety area?
- How are walkways identified in the lab/workshop area?

## **Task Number 50**

### **Identify the location and use of eye wash stations.**

#### **Definition**

Identification should include describing the signage and operating procedures for the unit.

#### **Process/Skill Questions**

- What is the color of the sign that signifies an eye wash station?
- When should one use an eye wash station?
- What safety equipment provides additional eye protection?

## **Task Number 51**

### **Identify the location of posted evacuation routes.**

#### **Definition**

Identification should include

- events that could trigger an evacuation
- the location and interpretation of posted evacuation routes
- the destination and procedures for evacuation.

#### **Process/Skill Questions**

- What procedures should be followed in the event of an evacuation?

- Where is the evacuation route posted?
- Why is it important to establish a meeting place in case of an evacuation?

## **Task Number 52**

### **Demonstrate knowledge of SDS.**

#### **Definition**

Demonstration should include identifying

- the purpose of SDS
- the location of the SDS within the agricultural mechanics lab/workshop
- the administration's (ownership's) responsibility for workers' health and safety
- laws, regulations, and practices affecting workers' health and safety
- health and safety hazards
- health and safety programs
- the responsibility for environmental stewardship
- environmental laws, regulations, and practices
- sustainability initiatives.

#### **Process/Skill Questions**

- What environmental concerns should an industry address?
- What environmentally friendly practices and resources are available to an industry?
- What methods can be used to motivate employees to become involved in effective health, safety, and environmental practices?

## **Task Number 53**

### **Demonstrate the safe use of chemicals.**

#### **Definition**

Demonstration should include the different types of solvents, soaps, cleaning solutions, fuel, oils, lubricants, specialty additives, and gases.

Demonstration should also emphasize the correct use, hazards, and precautions associated with each, in accordance with manufacturers' instructions and government regulations.

#### **Process/Skill Questions**

- Why is it important to read the manufacturer's directions when using chemicals?
- What may be the effects of using chemicals incorrectly?
- Where should chemicals be stored in the lab/workshop?

## **Task Number 54**

# Demonstrate the safe use of standard and metric hand tools.

## Definition

Demonstration should include the various types of hand tools used in agricultural mechanics. Demonstration should emphasize the correct use, hazards, precautions, and maintenance procedures associated with each, in accordance with manufacturers' instructions and government regulations. Hand tools could include

- socket set components
- wrenches
- screwdrivers
- pliers
- hammers
- punches
- chisels
- specialty cutting tools (e.g., hacksaw, tubing cutter, hand reamer, file)
- specialty electrical system tools (e.g., volt/ohmmeter, dwell/tachometer, continuity light, timing light, remote starter switch)
- battery specialty tools (e.g., cable puller, terminal and post cleaner, battery lifting or carrying strap)
- lubrication specialty tools (e.g., transmission funnel, oil filter-removing tool, grease gun)
- miscellaneous specialty tools (e.g., air nozzles, C-clamp, puller set, pressure gauge, screw extractor).

## Process/Skill Questions

- Why is it important to use the proper hand tool for each job?
  - Why should a wrench always be pulled toward the body?
  - Why is it necessary to keep hand tools clean and free of grease?
- 

## Task Number 55

# Demonstrate the safe use of power tools.

## Definition

Demonstration should include types of power tools encountered in agricultural mechanics.

Demonstration should emphasize the correct use, hazards, precautions, and maintenance procedures associated with each, in accordance with manufacturers' instructions and government regulations. Power tools could include

- air impact gun
- air hammer
- air ratchet
- air drill
- electric drill
- electric grinder.

## Process/Skill Questions

- What is the purpose of a dead man switch and/or kill switch on power tools?
  - What is the purpose of an emergency stop (e-stop) or emergency power off (EPO) on power tools?
  - How should adjustments be made to power tools?
  - Why is training on the use of a power tool necessary before using it?
- 

## Task Number 56

### Demonstrate the safe use of precision standard and metric measuring tools.

#### Definition

Demonstration should include

- micrometers
- dial indicators
- torque wrenches
- other specialty tools.

## Process/Skill Questions

- How does heat affect the micrometer?
  - Why are standard and quality tools necessary when repairing agricultural machinery and equipment?
  - What is *torque*? Why is proper torque important?
- 

## Task Number 57

### Demonstrate the use of protective clothing and equipment.

#### Definition

Demonstration should include

- protective clothing and equipment for the
  - eyes
  - respiratory system
  - auditory functions
  - feet
  - hands
  - body
- safety measures related to grooming/hygiene



- tying long hair
- avoiding loose clothing/jewelry
- cleaning greasy hands, shoes, or clothing
- never using dirty or scratched eye protection.

Demonstration should include the correct use, hazards, and precautions associated with each, in accordance with manufacturers' instructions and government regulations concerning hazardous materials and lab safety.

### **Process/Skill Questions**

- What hazards exist due to loose-fitting clothing or long hair?
  - When is it advisable to use goggles in an agricultural mechanics lab/workshop?
  - Would it ever be necessary to wear ear protection in an agricultural mechanics lab/workshop? Explain.
  - Why are boots, or shoes covering the entire foot, worn in agricultural mechanics labs/workshops?
- 

## **Task Number 58**

### **Demonstrate the safe use of fire-protection equipment.**

#### **Definition**

Demonstration should include

- types of fires encountered in the agricultural science and mechanics field (i.e., Class A, B, C, and D)
- appropriate types of extinguishers to use with each fire
- hazards and the precautions associated with each
- fire emergency procedures that follow government regulations and instructor's guidelines.

### **Process/Skill Questions**

- What are the types of fire extinguishers?
  - What type of fire extinguisher is appropriate for each class of fire?
  - What procedure should students follow in case of an emergency or accident?
- 

## **Task Number 59**

### **Demonstrate the safe use of equipment.**

#### **Definition**

Demonstration should include the types of equipment used in the agricultural mechanics field, along with the correct use, hazards, and precautions associated with each, in accordance with manufacturer's specifications and instructor's guidelines. Equipment could include

- pneumatic equipment (e.g., tire machine, pneumatic jack)
- hydraulic equipment (e.g., floor jack, lift rack, hydraulic press, engine hoist)
- electrical equipment (e.g., bench grinder, drill press, battery testers and chargers).

### Process/Skill Questions

- What are unsafe uses of air compressors in the agricultural lab/workshop?
- What is the safest way to hold a part in a vise?
- When is the cleaning tank used?

## Task Number 60

### Demonstrate safe practices in the agricultural mechanics lab/workshop.

#### Definition

Demonstrating safe practices must include

- passing written tests with 100 percent accuracy on
  - general lab/workshop safety
  - safety and operating procedures for all tools, equipment, and machinery
  - the major parts of all tools, equipment, and machinery
- passing a proficiency/performance test with 100 percent accuracy for all tools, equipment, and machinery
- following manufacturer’s instructions and reviewing safety manuals, when applicable
- following all safety guidelines and procedures when using tools, equipment, and machinery in the agricultural mechanics lab/workshop
- selecting appropriate PPE for each operation
- following the safety standards and regulations of
  - EPA
  - OSHA
  - Equipment and Engine Training Council (EETC) Education Committee
  - SDS.

### Process/Skill Questions

- What information should be shared with emergency responders if a chemical is splashed in a student’s eye or wound?
- Why are state and national safety standards followed in school labs/workshops? Explain.
- What agency requires labs/workshops and businesses to use the services of companies such as Safety Clean?
- What are the dangers of running an engine in a confined space without proper ventilation?
- Why is it important to achieve 100 percent accuracy on tests regarding safety and operating procedures before using tools, equipment, and machinery?

# Using Mechanics in Agricultural Production

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## Task Number 61

### **Demonstrate standard measurement techniques in agricultural mechanics.**

#### **Definition**

Demonstration may include

- defining terminology related to measurement
- identifying common units of measurement
- comparing the U.S. customary system and the metric system
- conducting measuring exercises
- reading a ruler with graduations in standard and metric units
- calculating volume and area
- using conversion factors (e.g., fractions to decimals, pints to quarts, feet to meters)
- using calculations of basic decimals and fractions.

#### **Process/Skill Questions**

- What are the various measurement techniques used in agricultural mechanics?
- Why is it important to be able to use conversion factors?
- What are consequences of not measuring correctly?
- What is the difference between actual and nominal size for materials (e.g., dimensional lumber)?

## Task Number 62

### **Calculate a bill of materials.**

#### **Definition**

Calculation should include

- selecting a project
- determining all items/materials needed to construct the project
- determining each component needed
  - item or part name
  - number of pieces
  - type of material
  - size of pieces (e.g. dimensions of structural metal and lumber)
  - description of parts

- board feet calculation
- unit cost
- total component cost
- determining total cost of project using the bill of materials.

### **Process/Skill Questions**

- What is a bill of materials?
  - What factors should be considered when selecting materials, hardware, and supplies?
  - How can the cost of a project be determined using a price sheet or current pricing of materials?
  - What is the actual cost of the project?
- 

## **Task Number 63**

### **Demonstrate woodworking skills.**

#### **Definition**

Demonstration should include

- following all safety procedures for woodworking
- following measurement procedures
- interpreting a set of plans
- using hand and power tools
- using a bill of materials
- constructing a selected woodworking project.

### **Process/Skill Questions**

- How can carpentry skills be used in agriculture?
- Why is it important to learn and follow all safety procedures and guidelines while woodworking?
- Why does one need plans and a bill of materials before starting a woodworking project?

## **Task Number 64**

### **Demonstrate metalworking skills.**

#### **Definition**

Demonstration should include

- following all general safety procedures for the lab/shop
- following all recommended safety guidelines for cold and hot metalworking procedures, such as welding (e.g., arc, oxy-fuel gas) and cutting
- identifying hazards encountered in welding

- fire hazards (e.g., combustibles)
- specific burn and eye hazards
  - heat
  - sparks
  - high voltage
  - hot metal
  - flammable material
  - arc flash
- electrical hazards
- machinery and tool hazards
- fumes and airborne contaminants
- confined space
- compressed gases
- hazardous waste
- identifying various types of metalworking (i.e., cold, hot) used in production agriculture
- using welding equipment in production agriculture to perform a
  - butt joint
  - lap joint
  - corner joint
  - T-joint
  - edge joint
- utilizing a weld beads (e.g., stringer bead, weave bead) and passes to create the joint
- constructing a metalworking project, including bill of materials.

### **Process/Skill Questions**

- How are metalworking skills used in agriculture?
- Why does one need plans and a bill of materials before starting a metalworking project?
- What should be done to the weld joint prior to welding?
- How does one decide which metalworking process to use to make repairs in production agriculture?
- Why would one choose to use shielded metal arc welding (SMAW) or stick welding, instead of a gas metal arc welding (GMAW) when repairing farm machinery?

## **Task Number 65**

### **Construct a section of farm fence.**

#### **Definition**

Demonstration should include

- identifying various type of fences used in production agriculture (including electrified fences)
- identifying fencing materials, equipment, and tools
- identifying safety issues relevant to constructing a farm fence
- determining when to use a specific fence to meet the need of a specific agricultural operation
- designing a fence
- calculating the cost of a given fence
- exploring Virginia fencing law

- assembling the section of fence.

### **Process/Skill Questions**

- Why are fences used in production agriculture?
- Why should one be aware of Virginia's fencing laws before replacing an old fence or constructing a new one?
- What factors must be considered when building fences to construct lots or grazing systems?
- What are three different types/styles of livestock fencing commonly used in Virginia?

## **Task Number 66**

### **Identify major farm machines common to agriculture production.**

#### **Definition**

Identification should include

- naming types of farm machinery
- classifying farm machinery based on use
- selecting farm machinery for a specific task to be completed on the farm
- researching technological advancements
- projecting how farm machinery may evolve in the future.

### **Process/Skill Questions**

- How is farm machinery classified?
- How has farm machinery changed the agricultural industry?
- What advances may occur to farm machinery in the future?
- What factors should be considered when selecting farm machinery for a specific operation?

## **Using Soil Science in Agricultural Production**

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## **Task Number 67**

### **Describe the soil-formation process and components of soil.**

#### **Definition**

Description should include

- defining *soil*
- discussing the importance of soil

- explaining soil-forming factors (e.g., physical weathering, chemical weathering, biological weathering, parent material, climate, organisms, topography, time)
- exploring soil origins (e.g., alluvial deposits, colluvial deposits, eolian deposits, marine deposits, lake deposits, volcanic deposits, Great Plains material, glacial drift, organic deposits)
- explaining related terms and concepts (e.g., micronutrients, macronutrients, minerals, sand, silt, clay, organic matter, pore space, bedrock, humus, topsoil, weathering, soil profile, soil horizons, subsoil).

### Process/Skill Questions

- What is *pedology*?
- What are the five soil-formation factors and their effects on soil formation?
- What could be considered the sixth soil-formation factor?
- How is the material content of soil determined?
- What natural processes create soil?
- How does the composition of soil affect its fertility?
- How is soil formation influenced by organisms such as plants, micro-organisms (bacteria and fungi), burrowing insects, animals, and humans?
- What is a loam?

## Task Number 68

### Evaluate the physical and chemical properties of soil.

#### Definition

Evaluation should include the description of

- soil texture and its importance, using the soil triangle and mechanical analysis and/or the ribbon or feel test
  - proportion of sand, silt, and clay
  - water-holding capacity and aeration
  - effect of particle size
  - specific surface area
  - soil pores
- soil permeability and related properties
- soil color
- soil structure and formation
- soil consistency, compaction, and tilth
- soil bulk density
- cation exchange capacity (CEC)
- organic matter
- carbon-to-nitrogen ratio (C:N).

### Process/Skill Questions

- What are the soil particles/separates, from smallest to largest?
- What is a soil survey?

- What is soil classification? Why is it important to classify soil? What are the USDA's six levels of soil classes? What are the twelve soil orders?
- What are the land capability classes and why are they important?
- How can soil color be utilized as an indicator of soil conditions?
- What is the Munsell system?
- What are soil aggregates, peds, and clods and how do they affect soil structure, function, and fertility?
- Why do soils with a pH below 6 result in an increase in aluminum?
- Why is this information important?
- How is a soil triangle used?
- How is the ribbon method used?
- What is the purpose of determining soil texture and soil properties?
- How does soil texture affect its fertility?

## **Task Number 69**

### **Analyze soil characteristics.**

#### **Definition**

Analysis should include

- proper collection and care of the sample
- use of appropriate tools and equipment
- a sample free from contaminants and organic debris
- cores taken in a random pattern that is uniform across the area being sampled
- removal of sample cores to an appropriate depth
- a thorough mixing of the sample
- analyzing the soil for macronutrients, micronutrients, pH, and organic matter.

#### **Process/Skill Questions**

- What is the purpose of conducting a soil test prior to planting?
- How can the pH of soil be adjusted to increase or decrease acidity/alkalinity?
- What effect does pH have on nutrient availability?
- What plant species typically grow in acidic conditions? What plant species typically grow in alkaline conditions?

## **Task Number 70**

### **Create soil amendment recommendations for a given crop or land use.**

#### **Definition**

Creation of soil amendment recommendations should be based on soil analysis results and should consider the quality (chemical, physical, and biological) of the soil tested and result in the calculation of the amount of fertilizer to apply to a given area of land.



## Process/Skill Questions

- What results/information are given in a soil analysis?
- How many pounds of fertilizer will one need to apply to one's lawn at a rate of 1 pound of nitrogen per 1,000 square feet of a 50-pound bag of 26-5-10?
- How much phosphate and potash is one applying to a lawn when one applies 3.8 pounds of 26-5-10 fertilizer per 1,000 square feet?
- How much area can be covered with a 50-pound bag of 26-5-10 fertilizer at the rate of 1 pound of nitrogen per 1,000 square feet?
- How many 50-pound bags of 26-5-10 will one need to fertilize a 30,000-square-foot lawn at 1 pound of nitrogen per 1,000 square feet?
- What are the differences between chemical, physical, and biological properties of the soil?
- Why is knowledge of a plant species important when making nutrient recommendations?

## Task Number 71

### Examine best management practices for improving soil health.

#### Definition

Examination should include

- the current state of the soil (e.g., organic matter, macronutrient and micronutrient availability)
- the planned use of the soil
- soil management practices (e.g., no-till farming, conservation tillage, crop rotation, cover cropping, mulching, grassed waterways, buffer strips).

Teacher resource: [Agriculture: Programs, Best Management Practices and Topics of Interest, EPA](#)

## Process/Skill Questions

- What is organic matter?
- What effect does organic matter have the physical and chemical properties of soil?
- What soil conservation practices can producers utilize to prevent soil degradation and build organic matter?
- What are the environmental costs to not using best management practices for a given area?
- Why is no-till farming recommended by soil scientists as a best practice?
- Why is rotational grazing recommended for increasing soil health?

## Task Number 72

### Describe erosion, its effects on the environment, and prevention methods.

#### Definition

Description should include the

- process of erosion by water, wind, ice, or human activity
- types of water erosion (e.g., rill, sheet, gully)
- effects of erosion on agricultural production
- effects of erosion on water quality
- physical properties of soil that allow for wind erosion
- conditions that are favorable to wind erosion
- effects of wind erosion on soil
- methods to protect soil from eroding (e.g., the use of vegetation, geotextiles, mulch, retaining walls, windbreaks, cover crops, buffer strips).

### **Process/Skill Questions**

- What effect does erosion have on production capability?
- What are the best management practices for reducing and controlling water and wind erosion?
- What is *sedimentation*?
- How does water erosion affect the environment? How does wind erosion affect the environment?

## **Task Number 73**

### **Conduct a water percolation test.**

#### **Definition**

Conducting a water percolation test should include

- defining *water percolation*
- determining a quality percolation rate
- analyzing of the results of a percolation test.

### **Process/Skill Questions**

- What does a water percolation test determine? Why is this important?
- What time span indicates adequate water percolation?
- What types of soils typically indicate good water percolation?
- How does water percolation affect agricultural production and ecosystems?

## **Task Number 74**

### **Demonstrate how to use the USDA Web Soil Survey.**

#### **Definition**

Demonstration should include use of the [USDA Web Soil Survey](#) program.

### **Process/Skill Questions**

- What information is included in a soil survey?

- What do soil surveys commonly determine?
- Where can one find soil surveys?
- What are the limitations of a soil survey?

## **Task Number 75**

### **Devise a soil-management plan to minimize erosion and maximize biodiversity, plant productivity, and the formation of topsoil.**

#### **Definition**

Devising a soil-management plan should encompass practices that improve soil performance, to include

- adding organic matter
- avoiding excessive tillage and soil compaction
- managing pests and nutrients efficiently
- utilizing ground covers
- increasing diversity
- monitoring soil performance.

#### **Process/Skill Questions**

- How does the addition of organic matter improve soil performance?
- What is soil quality?
- How does excessive tillage affect soil quality?
- How is soil performance monitored?

## **Using Plant Science in Agricultural Crop Production**

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## **Task Number 76**

### **Identify grain, oil, and specialty field crops.**

#### **Definition**

Identification should include most common grain, oil, and specialty field crops in the United States and Virginia, such as

- field crops in Virginia
  - grain crops
    - corn (FFA Emblem)
    - wheat
    - barley

- oats
- rye
- rice
- grain sorghum
- oilseed crops
- cereal crops
- seed-legume crops
- root crops
- sugar crops
- tuber crops
- stimulant crops
- fiber crops
- seed crops
- forage and pasture crops
  - legumes
  - grasses
  - corn
  - oats.

Identification should also include the most common factors to consider in the selection of field, forage, and pasture crops (e.g., biotic factors, climate, soil conditions, topographic factors, varietal adaptability, labor requirements, equipment requirements, production costs, marketability, profitability, availability of water, security, resistance to pests and diseases) and

- uses of Virginia field crops
- common weeds and weed control management programs
- applicable harvesting and storage methods.

### **Process/Skill Questions**

- What are specialty crops?
- What are grain crops? Why are they so important?

## **Task Number 77**

### **Identify vegetable crops.**

#### **Definition**

Identification should include most common vegetable crops produced in the United States and Virginia, and should include

- botanical classification
- plant parts (i.e., fruits, seeds, leaves, stems, roots, and flowers).

Identification should also include the most common factors to consider in the selection of vegetable crops (e.g., biotic factors, climate, soil conditions, topographic factors, varietal adaptability, labor requirements, equipment

requirements, production costs, marketability, profitability, availability of water, security, resistance to pests and diseases) and

- uses of vegetable crops
- common weeds and management program
- applicable harvesting and storage methods.

### **Process/Skill Questions**

- What is *olericulture*?
- What are *angiosperms*?
- What are the differences between monocotyledons and dicotyledons?
- What is a cool-season and warm-season crop and what are the differences between the two?

## **Task Number 78**

### **Identify fruit and nut crops.**

#### **Definition**

Identification should include most common types of fruit crops (e.g., tree fruits, small bush and cane fruits, vine fruits) and nut crops in the United States and Virginia.

#### **Process/Skill Questions**

- What is *pomology*?
- What is the difference between a pome and drupe?

## **Task Number 79**

### **Identify the essential nutrients and their major functions for optimal plant growth and development.**

#### **Definition**

Identification should include

- the essential nutrients plants need for optimal growth
  - macronutrients
    - carbon (C)
    - hydrogen (H)
    - oxygen (O)
    - nitrogen (N)
    - phosphorus (P)
    - potassium (K)
    - calcium (Ca)
    - magnesium (Mg)

- sulfur (S)
- micronutrients
  - Iron (Fe)
  - Manganese (Mn)
  - Boron (B)
  - Molybdenum (Mo)
  - Copper (Cu)
  - Zinc (Zn)
  - Chlorine (Cl)
  - Nickel (Ni)
  - Cobalt (Co)
  - Sodium (Na)
  - Silicon (Si)
- pH
- geographical location/local considerations.

### **Process/Skill Questions**

- Can nitrogen, phosphorous, and potassium use by plants be controlled? Explain.
- How do fertilizers deliver nutrients to plants?
- How can the fertilizer grade or guaranteed analysis on a fertilizer package be useful to a producer?

## **Task Number 80**

### **Identify common plant nutrient deficiency and toxicity symptoms.**

#### **Definition**

Identification should include

- evaluating plant for
  - stunted growth
  - chlorosis
  - interveinal chlorosis
  - purplish-red coloring
  - necrosis
- explaining how the nutrients that are deficient are associated with the symptom.

### **Process/Skill Questions**

- What are the symptoms of a nitrogen deficiency?
- What are the symptoms of a magnesium deficiency?
- What are the symptoms of a phosphorus deficiency?

## **Task Number 81**

### **Analyze the influence of environmental factors on plant growth.**

## Definition

Analysis should include

- using the steps in the scientific method
- analyzing plant responses to varied light color, intensity, and duration
- recommending modifications to light for desired plant growth
- analyzing plant responses to water conditions
- recommending modifications to water for desired plant growth
- analyzing plant responses to various nutrient deficiencies, including nitrogen, phosphorus, and potassium, and to various micronutrients.

## Process/Skill Questions

- What environmental factors most affect plant growth in Virginia?

## Task Number 82

### Identify principles and practices of sustainable crop production.

#### Definition

Identification should include researching, preparing, and defending plans for a plant systems enterprise that aligns with [USDA sustainable practices criteria](#).

The term *sustainable agriculture* (U.S. Code Title 7, Section 3103) means an integrated system of plant and animal production practices having a site-specific application that will, over the long-term,

- satisfy human food and fiber needs
- enhance environmental quality and the natural resource base upon which the agriculture economy depends
- make the most efficient use of nonrenewable resources and on-farm resources and integrate, where appropriate, natural biological cycles and controls
- sustain the economic viability of farm operations
- enhance the quality of life for farmers and society as a whole.

#### Process/Skill Questions

- What is sustainable crop production? How are sustainable crops grown?
- What are some sustainable farming practices utilized in field crop production? What are some sustainable practices utilized in nursery crop production?
- Why is the focus on soil health a critical component of sustainable agriculture?

## Task Number 83

### Differentiate among approved planting practices.

## **Definition**

Differentiation should include advantages and disadvantages of

- no-till practices
- conservation tillage
- conventional tillage
- crop rotation
- green manuring and cover cropping
- crop residues
- organic matter additions
- soil amendments
- use of integrated pest management (IPM)
- integrated plant nutrient management
- best management practices.

## **Process/Skill Questions**

- What are examples of no-till planting?
- When is conservation tilling optimal?
- What crops do well with conventional tilling?
- What is sustainable crop production?

## **Task Number 84**

### **Prepare growing media for use in plant cultivation systems.**

#### **Definition**

Preparation should include formulating and preparing growing media for specific plants or crops.

#### **Process/Skill Questions**

- How does one amend growing media to provide the appropriate physical and chemical properties necessary for plant growth?
- How do growing media differ for orchids and cacti?

## **Task Number 85**

### **Develop a management plan for plant production.**

#### **Definition**

Development should include

- preparing soil for planting with the addition of amendments



- determining the seeding rate needed for a specified plant population or the desired quantity of a given crop
- observing and recording environmental conditions during the germination, growth, and development of a crop.

### **Process/Skill Questions**

- How does one determine the seeding rate needed for a particular plant?
- Why are management plans important?

## **Task Number 86**

### **Cultivate plants based on current industry standards.**

#### **Definition**

Cultivating plants should include

- selecting propagation methods
- selecting pollination methods and practices used to maximize crop pollination
- demonstrating sowing techniques for providing favorable conditions to meet the requirements of seed germination
- comparing the risks and advantages associated with genetically modified plants
- evaluating crop yield and loss data
- making recommendations to reduce crop loss
- harvesting.

### **Process/Skill Questions**

- What are some pollination methods used to maximize crop production?
- What are the advantages and disadvantages of using genetically modified plants?

## **Task Number 87**

### **Evaluate disease-control measures.**

#### **Definition**

Evaluation should include

- identification of common weeds, diseases, and pests
- biological and cultural control practices
- analyzing integrated pest management (IPM) practices used to control various pests.

### **Process/Skill Questions**

- What properties would lead to a plant being classified as a weed?

- How do weeds affect row crops and pastures?
- Which weeds most commonly affect the soybean crop?
- What are the most common weed pests of crops in your area?
- What common diseases and pests have developed in the past 50 years?
- How does the U.S. Environmental Protection Agency (EPA) define integrated pest management?
- Why must a producer consider the Clean Water Act and Endangered Species Act for his/her region?

## **Task Number 88**

### **Develop a plan for integrated pest management (IPM) for plant production.**

#### **Definition**

Development should include

- identifying and categorizing plant pests, diseases, and disorders
- identifying and analyzing major local weeds, insect pests, and infectious and noninfectious plant diseases
- devising solutions for plant pests, diseases, and disorders
- predicting potential pest and disease problems, based on environmental conditions and pest life cycles
- employing pest management strategies to manage pest populations, assess the effectiveness of the plan, and adjust the plan as needed
- explaining procedures for safe handling, use, and storage of pesticides, including personal protective equipment and re-entry interval (REI).

#### **Process/Skill Questions**

- What is integrated pest management, and why is it important?
- What is re-entry interval? How does it help protect workers entering a greenhouse that has been fumigated?
- What is a restricted-use pesticide?

## **Task Number 89**

### **Demonstrate crop-sampling techniques.**

#### **Definition**

Demonstration should include using sampling techniques in accordance with industry-accepted procedures for sampling and determining the quality of

- field crops
- forages (i.e., silage, haylage)
- fruits and tree nuts
- vegetable crops
- herbs, spices, tea leaves, hops.

## Process/Skill Questions

- Can soil and forage samples have different results in the same planting area? Explain.
- What information can an examination of plant tissues reveal?
- In what ways can this information be beneficial?

## Task Number 90

### Analyze crop samples.

#### Definition

Analysis could include items such as

- moisture content
- foliage size
- pod size
- kernel/seed size/damage
- stage of maturity
- color
- odor (e.g., musty, moldy, sour)
- cut characteristics
- foreign material (e.g., excreta, metals, stones)
- weed content
- shape/markings
- other characteristics as identified in the [FFA Agronomy Career Development Event \(CDE\)](#).

## Process/Skill Questions

- Why is it important to analyze a crop sample?
- How does moisture content affect the price/quality of a crop?
- How does moisture content affect the storability of a crop?
- How can producers identify nutrient deficiency symptoms by analyzing crop samples?

## Managing Natural Resources

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### Task Number 91

### Describe how agriculture and the environment are interrelated.

#### Definition

Description should include

- types of farms and their effects on the environment
- stewardship of the land and the effects of
  - soil management
  - water management
  - whole farm systems
  - pest management
- sustainability practices.

### Process/Skill Questions

- What is *nonpoint source pollution*?
- What is *point source pollution*?
- What sustainability practices can farmers and ranchers utilize to ensure minimal environmental degradation?
- What types of pollutants can be attributed to farms?

## Task Number 92

### Describe best management practices to protect soil and water resources.

#### Definition

Description should include

- types and sources of water and soil pollution
- waste management
- riparian buffers
- fencing creeks and other water sources
- conservation tillage.

### Process/Skill Questions

- What are the most common sources of water for home and industrial uses?
- What government agencies provide resources to help farmers and ranchers protect soil and water?

## Task Number 93

### Describe best management practices for the forest.

#### Definition

Description should include

- defining *nonpoint source pollution* and *point source pollution*
- planning for forestry operations
  - communication of expectations

- harvest – maximum return
- site productivity
- minimal environmental impact
- compliance with federal, state, and local laws
- enhancement of habitat for wildlife diversity
- identifying endangered species
  - Virginia Department of Game and Inland Fisheries
  - Virginia Department of Conservation and Recreation (DCR), Division of Natural Heritage
  - U.S. Fish and Wildlife Service
- identifying Streamside Management Zones (SMZs)
- explaining timber harvesting (e.g., logging system selection and application, forest roads, skid trails, stream crossings, log landings)
- identifying erosion control measures
- defining reforestation and revegetation
- exploring current regulations
  - Federal Clean Water Act—Mandated Road Best Management Practices for Wetlands
  - Silvicultural Operations in Chesapeake Bay Preservation Areas
  - Silviculture Water Quality Law (Virginia)
  - Debris in Streams Law
- identifying relevant agencies
  - Virginia Department of Forestry
  - Virginia Marine Resources Commission
  - Virginia Department of Game and Inland Fisheries
  - Virginia Department of Conservation and Recreation – Division of Natural Heritage
  - Virginia Department of Environmental Quality
  - Department of Mines, Minerals and Energy
  - U.S. Army Corps of Engineers
  - DCR Division of Chesapeake Bay Local Assistance
- explaining silvicultural chemical treatments
- identifying methods for fire management
- discussing wetlands and watersheds
- discussing methods for planting and harvesting trees in a sustainable manner
- explaining pest-management techniques and the treatment of common diseases.

## Process/Skill Questions

- What are common forest products, and for what are they used?
- What is *timber stand improvement (TSI)*?
- How is the volume of standing timber on a given tract estimated?
- What are some common tree disorders and their causes?
- Why is it important to be able to use a compass when managing a tract of timber?

## Task Number 94

### Describe best management practices for wildlife.

#### Definition

Description should include an emphasis on the importance of

- establishing permanent vegetation for wildlife
- controlling noxious weeds and non-native invasive plants
- creating snags and tree shelters
- improving forest edges
- identifying herbaceous forest openings
- identifying nesting structures
- releasing trees and shrubs
- managing spring seep
- protecting the environment (e.g., riparian buffers)
- managing wildlife populations (e.g., game, waterfowl, fish)
- managing nuisance animals.

### **Process/Skill Questions**

- What species of game, waterfowl, and fish are common to Virginia?
- How do riparian buffers protect the environment?
- What are some endangered wildlife species in Virginia?
- What are three tree species that exhibit high timber value and provide significant benefit to wildlife?

## **Exploring Livestock and Poultry Production**

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### **Task Number 95**

#### **Determine requirements for establishing and managing an animal enterprise.**

##### **Definition**

Determining requirements should include

- identifying available resources and assets
  - land
  - facilities (e.g., shed space, lot space, feed bunk, water, manure, acres of pasture)
  - capital
  - knowledge of selected animal enterprise
- identifying markets to support the enterprise
- creating a livestock management plan.

### **Process/Skill Questions**

- What are examples of land, facilities, capital, and knowledge resources for an animal enterprise?
- What markets might yield better support for an enterprise?

- What might be the consequences of not having a livestock management plan?

## **Task Number 96**

### **Explain criteria for selecting poultry and livestock.**

#### **Definition**

Explanation should include

- breeds of beef cattle, dairy cattle, sheep, goats, horses, poultry, and specialty and exotic livestock
- production characteristics of breeding and feeder/market animals
- importance of genetic diversity and variation in livestock management
- importance of heritability of traits in genetic improvement and management of livestock and poultry.

#### **Process/Skill Questions**

- How might criteria for selecting animals vary depending on the type of operation?
- How do desirable production characteristics differ between breeder animals and feeder/market animals?
- What role do genetics and heritability of traits play in selecting dairy cattle?

## **Task Number 97**

### **Describe nutritional requirements for poultry and livestock.**

#### **Definition**

Description should include

- explanation of the ruminant and monogastric digestive systems
- feed ingredients and nutritional content
- ingredients to create low-cost/high-efficiency feed rations needed to supply daily nutrient requirements of a selected animal.

#### **Process/Skill Questions**

- In what ways do various feeds differ?
- Why is it important to feed animals quality feed?

## **Task Number 98**

### **Describe poultry and livestock healthcare requirements.**

#### **Definition**

Description should include

- signs of healthy livestock
- livestock diseases and the symptoms of each disease
- common parasites and related control methods
- applicable vaccination schedules and livestock health plan for an enterprise (e.g., Beef Quality Assurance [BQA], Pork Quality Assurance [PQA], and Meat Animal Quality Assurance [MAQA]).

### **Process/Skill Questions**

- What should a livestock producer do at the first signs of poor animal health?
- What is the estimated cost of maintaining healthy livestock?
- What role does a relationship with a veterinarian play, especially with recent Veterinary Feed Directive (VFD) requirement changes?

## **Developing Business Aspects of an Agricultural Enterprise**

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### **Task Number 99**

**Explain the benefits and liabilities of owning an agricultural business.**

#### **Definition**

Explanation should include an assessment of the benefits (e.g., personal satisfaction, creativity, financial freedom, job security) vs. the liabilities (e.g., operating expenses, debt, various risks and unforeseen conditions).

#### **Process/Skill Questions**

- What are the benefits of owning an agricultural business?
- What are the disadvantages of owning a business?
- Why should one research the market carefully before buying or opening an agricultural business?
- What strengths, weaknesses, opportunities, and threats (SWOT) come with owning an agricultural business?

### **Task Number 100**

**Identify the components of a business plan for an agricultural enterprise.**

#### **Definition**

Identification should include the following:



- Business description
  - History and location
  - Products and services
  - Organizational structure
  - Resource inventory
    - Human
    - Land
    - Equipment
    - Capital
    - Commodities
    - Natural resources
  - Strengths, weaknesses, opportunities, and threats (SWOT) analysis
  - Mission statement
  - Objectives and goals
  - Production plan
  - Financial plan
  - Market plan
  - Legal and liability issues
    - Insurance
    - Succession and estate planning
- Sources of financing
- Local marketing opportunities
- Enterprise budget
  - Expenses
  - Incomes/revenues
- Risk management

Teacher resource: [Risk Management: Business Plans for Agricultural Producers, AgriLife Extension, Texas A&M System](#)

### **Process/Skill Questions**

- Why is having a business plan important?
- Why is it important to analyze marketing opportunities prior to engaging in an agricultural enterprise?

## **Task Number 101**

### **Explore government agencies, regulations, and incentives.**

#### **Definition**

Exploration should include government agencies such as

- county zoning/administration office
- Virginia Department of Agriculture and Consumer Services (VDACS)
- EPA
- USDA
  - Farm Service Agency (FSA)

- Natural Resource Conservation Service (NRCS)
- Animal and Plant Health Inspection Service (APHIS).

Exploration should include regulations and incentives such as

- local zoning ordinances
- environmental regulations
- commodity subsidies
- cost-sharing opportunities.

### **Process/Skill Questions**

- What agencies are involved in the regulatory aspects of an agricultural enterprise?
- How do the NRCS and the FSA benefit agricultural producers?
- How do land-grant universities benefit producers?
- What services do county extension agents provide to producers?
- What is the contact information for the local Natural Resource Conservation Service and USDA Farm Service Center?
- What is an example of an educational/outreach idea that would help prevent farmer/community conflict in developed areas?

## **Task Number 102**

### **Describe marketing options for an agricultural enterprise.**

#### **Definition**

Description should include

- grade classification systems for each species
- local, regional, national, and international markets available to livestock producers (e.g. wholesale, retailers, direct sales, value-added)
- appraisal of market livestock using pricing grids and retail pricing from USDA reports.

#### **Process/Skill Questions**

- How do marketing options vary according to the number and type of livestock?
- What resources are available to the producer when it comes to selecting a marketing option?
- What role does agritourism play as a marketing option?

## **Task Number 103**

### **Explain the importance of establishing and maintaining a financial and production record-keeping system for an agricultural enterprise.**

#### **Definition**

Explanation should include

- types of records
  - financial records
  - production records
- the importance of record keeping
  - Internal Revenue Service (IRS) (e.g., proof of income, expenses, inventory, and depreciation on tax returns)
  - decision-aids
    - balance sheets
    - cash flow statements
    - income statements
- institutional requirements
- environmental regulations
- selecting an applicable record-keeping system
- comparing paper and digital record-keeping systems
- importance of analyzing the agricultural enterprise's records
- creating a production record-keeping system using computer software
- evaluating the enterprise using financial and production records.

### Process/Skill Questions

- What could be some of the consequences of not maintaining records for an animal enterprise?
- What are some of the record-keeping categories for health, breeding, and production?
- What systems are available to assist producers in maintaining records?

# Understanding Precision Agriculture Management and Technologies

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## Task Number 104

### Describe technologies used in precision agriculture and their importance.

#### Definition

Description should include defining *precision agriculture* as site-specific farming involved in collecting timely geospatial information on soil-plant-animal requirements and prescribing and applying site-specific treatments to increase agricultural production and protect the environment.

Additionally, description should include information on

- variable rate technology (VRT)

- mapping technology
- global positioning system (GPS)
- geographic information systems (GIS)
- guidance technology
- remote sensing (RS) technology
- unmanned aerial vehicles (UAV) (e.g., drones).

### **Process/Skill Questions**

- What precision technologies are available in agriculture production that were not available five years ago?
- What does GPS stand for, and how does it acquire its signal?
- How is GPS being used with robotics in the agriculture industry?

## **Task Number 105**

**Describe the equipment necessary for a GPS to provide applications used in precision agriculture.**

### **Definition**

Description should include

- user segment/GPS navigation device/receiver
- space segment/GPS satellites
- control segment/global tracking stations
- geographic information systems (GIS) remote sensing
- yield monitors
- guidance systems for variable rate application.

### **Process/Skill Questions**

- What is an example of computer software that is used in agricultural applications? For what purpose(s) is it used?
- What level of accuracy is needed in GPS equipment for agricultural applications?
- How do position-correction systems work?

## **Task Number 106**

**Describe the procedure for operating a GPS receiver.**

### **Definition**

Description should include how to use a handheld or vehicle-mounted GPS unit to plot points, measure distances, and calculate area.

## **Process/Skill Questions**

- What are the steps to determine the area of a field, using GPS?
- How has precision technology helped make production agriculture more efficient?

## **Task Number 107**

### **Research technologies used in precision agriculture management.**

#### **Definition**

Research could include, but is not limited to,

- field mapping
- soil sampling
- tractor guidance
- crop scouting
- variable rate applications
- yield mapping
- computer-guided systems
- UAVs
- real-time data collection and management of geospatial data.

## **Process/Skill Questions**

- What new precision technologies are available in agriculture production that were not available five years ago?
- What does GPS stand for, and how does it get its signal?

## **Task Number 108**

### **Collect and apply data in the development of a map.**

#### **Definition**

Collection and application of data should include

- plotting points
- determining distance
- calculating area, using given points at a location.

## **Process/Skill Questions**

- What is the procedure for developing a map of a given area?
- How is area calculated?

# Exploring Security in Agricultural Industries

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## Task Number 109

### Define *biosecurity*.

#### Definition

Definition should include the concept that biosecurity is security from exposure to, and spread of, harmful biological agents.

#### Process/Skill Questions

- Why is biosecurity important?
- How can the lack of biosecurity affect a farm enterprise?

## Task Number 110

### Describe biosecurity procedures in agricultural production.

#### Definition

Description could include preventive procedures such as

- preventive quarantine (e.g., for new animals)
- species-specific concerns (e.g., birds and poultry)
- entering/exiting procedures for agricultural facilities
- clothing requirements and PPE
- hygiene considerations.

Additionally, description should include response procedures such as quarantine and should consider the effects of loss in an agricultural production enterprise.

#### Process/Skill Questions

- What is PPE?
- Why would changing clothing make a difference when traveling from farm to farm? What are the risks of cross-contamination if one fails to do so?

## Task Number 111

### Identify biosecurity risks in an agricultural production enterprise.

## **Definition**

Identification should include risks inherent in areas such as, but not limited to,

- livestock production (e.g., zoonotic diseases, regulated livestock diseases)
- crop production (e.g., cross contamination, insects, disease transmission, non-native/invasive species)
- events, fairs, and exhibitions
- food processing.

## **Process/Skill Questions**

- What are possible biosecurity risks in livestock production?
- What are possible biosecurity risks in crop production?
- Why should one not wear one's farm clothes when attending a county fair?

## **Task Number 112**

### **Define *agroterrorism*.**

#### **Definition**

Definition should include the concept that agroterrorism is any terrorist act intended to disrupt or damage agricultural sectors, especially through the use of a biological agent against crops or livestock.

#### **Process/Skill Questions**

- Why is agroterrorism important to understand?
- What groups are known to have perpetrated acts of agroterrorism?

## **Task Number 113**

### **Describe internal and external measures to prevent agroterrorism related to an agricultural enterprise.**

#### **Definition**

Description should include

- physical controls (e.g., gates, fences)
- sign-in sheets
- policies
- documentation of personnel (e.g., identification badges)
- vaccination schedules/regular veterinary care for livestock
- early detection for diseases or pathogens
- IT protocols (e.g., passwords, etc.)

- communication between agencies, farmers, government officials, etc. (e.g., create a call list for pertinent agencies such as the U.S. Department of Homeland Security [DHS] inspector general’s office).

### **Process/Skill Questions**

- What are the benefits of sign-in sheets?
- What physical controls would one expect to see in an agricultural production operation?

## **Task Number 114**

### **Identify agroterrorism risks related to an agricultural enterprise.**

#### **Definition**

Identification should include the concept that activities of agroterrorism could arise from foreign countries and/or domestic threats.

### **Process/Skill Questions**

- What resources exist to assist with the identification of agroterrorism risks?
- What groups have engaged in agroterrorism?

## **Task Number 115**

### **Define *cybersecurity* as it relates to agricultural production.**

#### **Definition**

Definition should include the concept that cybersecurity is the protection of information and data—which includes information systems (e.g., networks, hardware, and software), the human element, and physical elements—from risks associated with threats, attacks, hazards, or physical damage.

### **Process/Skill Questions**

- How does cybersecurity relate to agricultural production?
- What role do employees play in maintaining cybersecurity?

## **Task Number 116**

### **Describe measures to prevent cybersecurity breaches in an agricultural production enterprise.**

#### **Definition**

Description should include measures such as, but not limited to,



- employee policies (e.g., acceptable use policies [AUPs])
- physical security controls
- legal/oversight requirements
- incident (i.e., breach) response procedures.

Description should also include the concept that prevention and protections against cyberattacks change as the targets, vulnerabilities, and threats change.

### Process/Skill Questions

- What is an example of a cybersecurity breach?
- How do employee policies relate to the prevention of cybersecurity breaches?

## Task Number 117

### Identify cybersecurity risks related to an agricultural production enterprise.

#### Definition

Identification should include the risk of

- agroterrorism
- pandemics
- cyber threats
- technical failures
- other evolving threats.

### Process/Skill Questions

- What is the difference between a pandemic and an epidemic?
- How can a cybersecurity breach result in a technical failure?
- What government agencies monitor cybersecurity risks?

## SOL Correlation by Task

39	Identify the role of supervised agricultural experiences (SAEs) in agricultural education.	English: 10.3, 10.5, 11.3, 11.5
40	Participate in an SAE.	English: 10.5, 10.8, 11.5, 11.8
41	Identify the benefits and responsibilities of FFA membership.	English: 10.5, 10.6, 10.7, 10.8, 11.5, 11.6, 11.7, 11.8
42	Describe leadership characteristics and opportunities as they relate to agriculture and FFA.	English: 10.5, 11.5  History and Social Science: VUS.8, VUS.9, VUS.10, VUS.11, WHII.8, WHII.10, WHII.11

43	Apply for an FFA degree and/or an agricultural proficiency award.	English: 10.5, 11.5
44	Identify risks/hazards in an agricultural operation.	English: 10.5, 11.5  History and Social Science: VUS.6, VUS.8
45	Demonstrate safety in an agricultural operation.	English: 10.5, 10.8, 11.5, 11.8
46	Identify public safety issues pertaining to agricultural operations.	English: 10.5, 10.8, 11.5, 11.8  History and Social Science: VUS.8
47	Perform lockout/tagout (LOTO) procedures in an agricultural production setting.	English: 10.3, 10.5, 10.8, 11.3, 11.5, 11.8
48	Identify regulations related to labor in the agricultural production operation.	English: 10.5, 10.8, 11.5, 11.8  History and Social Science: VUS.1, VUS.8, WHI.8  Science: CH.1
49	Identify marked safety areas.	English: 10.5, 11.5
50	Identify the location and use of eye wash stations.	English: 10.5, 11.5  Science: CH.1
51	Identify the location of posted evacuation routes.	English: 10.5, 11.5
52	Demonstrate knowledge of SDS.	English: 10.5, 11.5
53	Demonstrate the safe use of chemicals.	Science: CH.1
54	Demonstrate the safe use of standard and metric hand tools.	
55	Demonstrate the safe use of power tools.	
56	Demonstrate the safe use of precision standard and metric measuring tools.	
57	Demonstrate the use of protective clothing and equipment.	
58	Demonstrate the safe use of fire-protection equipment.	
59	Demonstrate the safe use of equipment.	
60	Demonstrate safe practices in the agricultural mechanics lab/workshop.	English: 10.5, 10.6, 10.7, 11.5, 11.6, 11.7
61	Demonstrate standard measurement techniques in agricultural mechanics.	English: 10.3, 10.5, 11.3, 11.5  Science: CH.1
62	Calculate a bill of materials.	
63	Demonstrate woodworking skills.	English: 10.5, 11.5
64	Demonstrate metalworking skills.	English: 10.5, 11.5
65	Construct a section of farm fence.	English: 10.5, 11.5
66	Identify major farm machines common to agriculture production.	English: 10.3, 10.5, 10.8, 11.3, 11.5, 11.8
67	Describe the soil-formation process and components of soil.	English: 10.3, 10.5, 10.8, 11.3, 11.5, 11.8  Science: ES.8
68	Evaluate the physical and chemical properties of soil.	English: 10.5, 11.5  Science: ES.8

69	Analyze soil characteristics.	English: 10.5, 11.5
70	Create soil amendment recommendations for a given crop or land use.	English: 10.5, 11.5
71	Examine best management practices for improving soil health.	English: 10.5, 11.5
72	Describe erosion, its effects on the environment, and prevention methods.	English: 10.5, 11.5 Science: ES.7
73	Conduct a water percolation test.	English: 10.3, 10.5, 11.3, 11.5
74	Demonstrate how to use the USDA Web Soil Survey.	English: 10.5, 10.8, 11.5, 11.8
75	Devise a soil-management plan to minimize erosion and maximize biodiversity, plant productivity, and the formation of topsoil.	English: 10.1, 11.1
76	Identify grain, oil, and specialty field crops.	English: 10.5, 11.5
77	Identify vegetable crops.	English: 10.5, 11.5
78	Identify fruit and nut crops.	English: 10.5, 11.5
79	Identify the essential nutrients and their major functions for optimal plant growth and development.	English: 10.5, 11.5
80	Identify common plant nutrient deficiency and toxicity symptoms.	English: 10.5, 11.5
81	Analyze the influence of environmental factors on plant growth.	English: 10.5, 11.5
82	Identify principles and practices of sustainable crop production.	English: 10.5, 10.8, 11.5, 11.8
83	Differentiate among approved planting practices.	English: 10.5, 11.5
84	Prepare growing media for use in plant cultivation systems.	English: 10.5, 11.5
85	Develop a management plan for plant production.	English: 10.5, 11.5
86	Cultivate plants based on current industry standards.	English: 10.5, 11.5
87	Evaluate disease-control measures.	English: 10.5, 11.5
88	Develop a plan for integrated pest management (IPM) for plant production.	English: 10.5, 11.5
89	Demonstrate crop-sampling techniques.	English: 10.5, 11.5
90	Analyze crop samples.	English: 10.5, 11.5
91	Describe how agriculture and the environment are interrelated.	English: 10.5, 11.5
92	Describe best management practices to protect soil and water resources.	English: 10.5, 11.5
93	Describe best management practices for the forest.	English: 10.1, 10.3, 10.5, 11.1, 11.3, 11.5 Science: BIO.8, ES.8
94	Describe best management practices for wildlife.	English: 10.5, 11.5
95	Determine requirements for establishing and managing an animal enterprise.	English: 10.5, 11.5
96	Explain criteria for selecting poultry and livestock.	English: 10.5, 11.5
97	Describe nutritional requirements for poultry and livestock.	English: 10.5, 11.5
98	Describe poultry and livestock healthcare requirements.	English: 10.5, 11.5
99	Explain the benefits and liabilities of owning an agricultural business.	English: 10.5, 11.5

100	Identify the components of a business plan for an agricultural enterprise.	English: 10.5, 11.5
101	Explore government agencies, regulations, and incentives.	English: 10.5, 10.8, 11.5, 11.8
102	Describe marketing options for an agricultural enterprise.	English: 10.5, 11.5
103	Explain the importance of establishing and maintaining a financial and production record-keeping system for an agricultural enterprise.	English: 10.5, 11.5 History and Social Science: VUS.13 Mathematics: COM.1, COM.7
104	Describe technologies used in precision agriculture and their importance.	English: 10.5, 11.5 History and Social Science: VUS.14
105	Describe the equipment necessary for a GPS to provide applications used in precision agriculture.	English: 10.5, 11.5 History and Social Science: VUS.14
106	Describe the procedure for operating a GPS receiver.	English: 10.5, 11.5 History and Social Science: VUS.14
107	Research technologies used in precision agriculture management.	English: 10.8, 11.8
108	Collect and apply data in the development of a map.	Mathematics: G.3, G.14
109	Define <i>biosecurity</i> .	English: 10.3, 11.3
110	Describe biosecurity procedures in agricultural production.	English: 10.5, 11.5
111	Identify biosecurity risks in an agricultural production enterprise.	English: 10.5, 11.5 History and Social Science: VUS.8
112	Define <i>agroterrorism</i> .	English: 10.3, 11.3
113	Describe internal and external measures to prevent agroterrorism related to an agricultural enterprise.	English: 10.5, 11.5
114	Identify agroterrorism risks related to an agricultural enterprise.	English: 10.5, 11.5
115	Define <i>cybersecurity</i> as it relates to agricultural production.	English: 10.3, 11.3
116	Describe measures to prevent cybersecurity breaches in an agricultural production enterprise.	English: 10.5, 11.5
117	Identify cybersecurity risks related to an agricultural production enterprise.	English: 10.5, 11.5

## FFA Information

The National FFA is an organization dedicated to preparing members for leadership and careers in the science, business, and technology of agriculture. Local, state, and national activities and award programs provide opportunities to apply knowledge and skills acquired through agriculture education.

For additional information about the student organization, see the [National FFA website](#) and the [Virginia FFA Association website](#).

## Entrepreneurship Infusion Units

Entrepreneurship Infusion Units may be used to help students achieve additional, focused competencies and enhance the validated tasks/competencies related to identifying and starting a new business venture. Because the unit is a complement to certain designated courses and is not mandatory, all tasks/competencies are marked “optional.”

# Appendix: Credentials, Course Sequences, and Career Cluster Information

## Industry Credentials: Only apply to 36-week courses

- Animal Systems Assessment
- Beef Quality Assurance Examination
- College and Work Readiness Assessment (CWRA+)
- Customer Service Specialist (CSS) Examination
- National Career Readiness Certificate Assessment
- Production Agriculture Assessment
- Workplace Readiness Skills for the Commonwealth Examination

**Concentration sequences:** *A combination of this course and those below, equivalent to two 36-week courses, is a concentration sequence. Students wishing to complete a specialization may take additional courses based on their career pathways. A program completer is a student who has met the requirements for a CTE concentration sequence and all other requirements for high school graduation or an approved alternative education program.*

- Agricultural Business Fundamentals I (8022/36 weeks)
- Agricultural Business Management III (8026/36 weeks)
- Agricultural Business Operations II (8024/36 weeks)
- Applied Agricultural Concepts (8073/36 weeks)
- Applied Agricultural Concepts (8072/18 weeks)
- Ecology and Environmental Management (8045/18 weeks)
- Equine Science (8015/18 weeks)
- Introduction to Animal Systems (8008/36 weeks)
- Introduction to Natural Resources and Ecology Systems (8040/36 weeks)
- Introduction to Plant Systems (8007/36 weeks)
- Introduction to Power, Structural, and Technical Systems (8016/36 weeks)
- Livestock Production Management (8012/36 weeks)
- Operating the Farm Business (8014/36 weeks)

<b>Career Cluster: Agriculture, Food and Natural Resources</b>	
<b>Pathway</b>	<b>Occupations</b>
<b>Agribusiness Systems</b>	<b>Farm, Ranch Manager</b> <b>Sales Manager</b>
<b>Animal Systems</b>	<b>Agricultural Products Sales Representative</b> <b>Animal Breeder, Husbandry</b> <b>Animal Geneticist</b> <b>Animal Nutritionist</b> <b>Animal Scientist</b> <b>Aquacultural Manager</b> <b>Poultry Manager</b> <b>Veterinarian</b> <b>Veterinary Technician</b>
<b>Environmental Service Systems</b>	<b>Toxicologist</b> <b>Turf Farmer</b>
<b>Food Products and Processing Systems</b>	<b>Biochemist</b> <b>Food Scientist</b>

<b>Career Cluster: Agriculture, Food and Natural Resources</b>	
<b>Pathway</b>	<b>Occupations</b>
<b>Natural Resources Systems</b>	<b>Fisheries Technician</b>
<b>Plant Systems</b>	<b>Certified Crop Advisor Soil and Plant Scientist</b>
<b>Power, Structural, and Technical Systems</b>	<b>Agricultural Engineer Agricultural Equipment Operator Agricultural Equipment Parts Manager Agricultural Equipment Parts Salesperson Machinist Parts Manager Welder</b>