

Greenhouse Plant Production and Management

8035 36 weeks

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Acknowledgments

The components of this instructional framework were developed by the following curriculum development panelists:

- Kristin Carr Beery, Instructor, Valley Career and Technical Center, Fishersville
- Ben Casteel, Horticulture Instructor and Program Coordinator, Virginia Highlands Community College, Abingdon
- Dr. David Close, Consumer Horticulture and Master Gardener Specialist, Virginia Tech, Blacksburg
- Dr. Tim Durham, Assistant Professor of Agronomy and Agricultural Science, Ferrum College, Ferrum
- Susan Hilleary, Instructor, Fauquier High School, Fauquier County Public Schools
- Renee Hypes, Instructor, Gloucester High School, Gloucester County Public Schools
- Sarah Knight, Instructor, Virginia High School, Bristol City Public Schools
- Dr. Joyce Latimer, Horticulture Professor, Virginia Tech, Blacksburg
- Heather McAndrew, Instructor, Staunton River High School, Bedford County Public Schools
- Phillip McCroskey, Instructor, Abingdon High School, Washington County Public Schools
- Wendell Terry, Instructor, Patrick County High School, Patrick County Public Schools
- Valerie Webb, Instructor, Spotsylvania High School, Spotsylvania County Public Schools

Correlations to the Virginia Standards of Learning were reviewed and updated by:

- Leslie R. Bowers, English Teacher (ret.), Newport News Public Schools
- Vickie L. Inge, Mathematics Committee Member, Virginia Mathematics and Science Coalition

Anne F. Markwith, New Teacher Mentor (Science), Gloucester County Public Schools
Michael L. Nagy, Social Studies Department Chair, Rustburg High School, Campbell County Public Schools

The framework was edited and produced by the CTE Resource Center:

Averill P. Byrd, Writer/Editor
Kevin P. Reilly, Administrative Coordinator

LaVeta Nutter, Specialist, Agricultural Education and Related Clusters
Dr. Tricia S. Jacobs, CTE Coordinator of Curriculum and Instruction
Dr. David S. Eshelman, Director, Workforce Development and Initiatives
George R. Willcox, Director, Operations and Accountability
Office of Career, Technical, and Adult Education
Virginia Department of Education

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Course Description

Suggested Grade Level: 10 or 11 or 12

Prerequisites: 8034

This course prepares students for postsecondary educational career programs and entry-level positions in the greenhouse plant production and management industry. Instruction includes industry safety in greenhouse plant production, development of plant production facilities, greenhouse management and operations, plant identification, the science of plant production, business management, and marketing skills.

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

Template material omitted: General material used to introduce the task list has been omitted.

For the indicated course(s):

- Tasks/competencies designated by plus icons (+) in the left-hand column(s) are essential
- Tasks/competencies designated by empty-circle icons (○) are optional
- Tasks/competencies designated by minus icons (−) are omitted
- Tasks marked with an asterisk (*) are sensitive.

8035	Tasks/Competencies
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<input checked="" type="radio"/>	Identify the role of supervised agricultural experiences (SAEs) in agricultural education.
<input checked="" type="radio"/>	Participate in an SAE.
<input checked="" type="radio"/>	Identify the benefits and responsibilities of FFA membership.
<input checked="" type="radio"/>	Describe leadership characteristics and opportunities as they relate to agriculture and FFA.
<input type="radio"/>	Apply for an FFA degree and/or an agricultural proficiency award.
<input checked="" type="radio"/>	Follow safety procedures in the greenhouse plant production industry.
<input checked="" type="radio"/>	Analyze career pathways in the greenhouse plant production industry.
<input checked="" type="radio"/>	Differentiate among types of production facilities for ornamental and vegetable crops.
<input checked="" type="radio"/>	Explain hydroponics, aquaponics, and aeroponics.
<input type="radio"/>	Produce a hydroponic crop.
<input checked="" type="radio"/>	Analyze the factors that influence greenhouse site selection.
<input checked="" type="radio"/>	Analyze types and components of greenhouse structures.
<input checked="" type="radio"/>	Compare heating and cooling options.
<input checked="" type="radio"/>	Compare lighting system options.
<input checked="" type="radio"/>	Compare irrigation system options.
<input checked="" type="radio"/>	Identify woody plants.
<input checked="" type="radio"/>	Identify herbaceous plants.
<input checked="" type="radio"/>	Propagate plants sexually.
<input checked="" type="radio"/>	Propagate plants asexually.
<input checked="" type="radio"/>	Manipulate temperature to affect plant growth.
<input checked="" type="radio"/>	Manipulate light to affect plant growth.
<input checked="" type="radio"/>	Manage irrigation.
<input checked="" type="radio"/>	Manage crop substrate.
<input checked="" type="radio"/>	Manage nutrients for plants.
<input checked="" type="radio"/>	Regulate plant growth.
<input checked="" type="radio"/>	Produce horticultural crops.

+	Prepare greenhouse and nursery plants for market.	
+	Explain how to manage pests.	
+	Identify common greenhouse pests.	
+	Explain the importance of pesticide labeling.	
+	Explain how to handle pesticides safely.	
+	Design an IPM plan.	
+	Explain various Virginia pesticide licenses.	
+	Analyze business markets.	
+	Evaluate a business plan.	
+	Maintain production and business records.	

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).

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

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?

Gaining an Overview of the Greenhouse Plant Production and Management Industry

Task Number 44

Follow safety procedures in the greenhouse plant production industry.

Definition

Following safety procedures should include

- identifying safety hazards
 - physical
 - chemical
 - biological
 - general safety
 - ergonomic
 - weather
- passing all required safety tests with 100% for tools, machinery and equipment
- following all requirements related to wear and use of personal protective equipment (PPE)
- demonstrating industry-recommended safety procedures and guidelines when using chemicals, tools, machinery, equipment, and other supplies in the classroom, laboratory, greenhouse, and/or land lab
- examining the laws and regulations concerning safety in the horticulture industry
- identifying the Occupational Safety and Health Administration (OSHA), its mission, and the current laws affecting the greenhouse plant production industry
- explaining compliance to the Agricultural Worker Protection Standard (WPS).

Process/Skill Questions

- What clothing and equipment are required for personal safety in the greenhouse plant production industry?
- How do clothing and equipment help keep workers in the greenhouse plant production industry safe?
- Why are there laws regarding safety procedures in the greenhouse plant production industry?
- What are workers' rights?
- How do unions affect employees and businesses?

Task Number 45

Analyze career pathways in the greenhouse plant production industry.

Definition

Analysis should include

- defining careers related to greenhouse plant production and management
- determining the education and experience required for specific careers
- examining the working conditions associated with specific jobs in the greenhouse plant production industry
- developing a plan to gain the necessary education and experience for a career in greenhouse plant production and management.

Process/Skill Questions

- Where can one find job listings for openings in the greenhouse plant production industry?
- What are the working environments/conditions of greenhouse plant production and management employees?
- What are the educational achievements required for careers within the greenhouse plant production and management industry?
- Why is a career plan important?
- What resources are available to help create a career plan?

Operating Plant Production Facilities

Task Number 46

Differentiate among types of production facilities for ornamental and vegetable crops.

Definition

Differentiation should include the characteristics of facilities

- cold frames
- hot beds
- field-grown systems
- outdoor container systems
- high tunnels
- greenhouses
- shade houses.

Process/Skill Questions

- When choosing a site for a greenhouse, what geographic and zoning features must be considered?
- How can a grower determine the best layout and style of greenhouse to construct?
- What are the advantages and disadvantages of the various styles of greenhouse bench and bed systems?
- What factors should be considered when selecting heating, cooling, and ventilation systems for a greenhouse?
- What types of physical structures should be considered when designing a nursery operation?
- What are the common ornamental and vegetable crops?
- How are cost analyses performed to determine which type of facility to use?

Task Number 47

Explain hydroponics, aquaponics, and aeroponics.

Definition

Explanation should include the

- definition of *hydroponics*, *aquaponics*, and *aeroponics*
- definition of *controlled environment agriculture*
- types of systems (e.g., float, nutrient film technique)
- types of crops
- types of facilities.

Process/Skill Questions

- What types of crops are grown using these systems?
- What are the advantages and disadvantages of each system?
- Why would a grower choose to use hydroponic production over standard production?
- What crops are best suited to floating raft technology vs. nutrient film or aggregate media?
- How is vertical agriculture production changing food production?
- How does controlled environment agriculture differ from traditional field production?

Task Number 48

Produce a hydroponic crop.

Definition

Hydroponic production should include

- crop selection
- system selection
- harvesting the crop
- marketing the crop
- pest management.

Process/Skill Questions

- What are the benefits of using a hydroponic production system?
 - How can hydroponic crops be marketed?
 - How can Integrated Pest Management (IPM) be used in hydroponic production?
-

Task Number 49

Analyze the factors that influence greenhouse site selection.

Definition

Analysis should include

- type of operation (e.g., retail, wholesale, both)
- topography
- accessibility (i.e., transportation needs, marketing concerns)
- water availability and quality
- available utilities
- soil drainage
- laws/zoning
- orientation of the structure.

Process/Skill Questions

- How does climate affect heating and cooling costs?
- What are the economics of site selection?
- What additional factors might influence site selection?
- How does the direction of the front-facing wall of the greenhouse affect its productivity and longevity?

Task Number 50

Analyze types and components of greenhouse structures.

Definition

Analysis should include

- comparing greenhouse styles (e.g., Quonset, gutter-connected, retractable-roof)
- contrasting glazing (e.g., glass, polyethylene, acrylic, polycarbonate)
- describing benches and beds (e.g., benching arrangements, bench materials, roll-out beds, floor production).

Process/Skill Questions

- How can a grower determine the best layout and style of greenhouse to construct?
- What are the advantages and disadvantages of the various styles of greenhouse bench and bed systems?
- What geographic features must be investigated when choosing a site for a new greenhouse operation?
- What physical structures should be considered when designing a greenhouse operation?
- How does local competition affect a new greenhouse business?

Task Number 51

Compare heating and cooling options.

Definition

Comparison should include

- the types of greenhouse cooling systems
- the types of greenhouse heating systems.

Process/Skill Questions

- How do costs affect sustainability?
- What are the different types of heating systems?
- What are the different types of cooling systems?

Task Number 52

Compare lighting system options.

Definition

Comparison should include

- factors that influence lighting selection
- photoperiodism needs
- types of systems
 - incandescent
 - light-emitting diode (LED)
 - high-intensity discharge (HID) (e.g., metal halide, high-pressure sodium)

Process/Skill Questions

- How does light affect photoperiodism?
- How can flowering be manipulated by lighting?
- How does light color, intensity, and duration affect plant growth?
- When is one type of lighting system preferable over another?

Task Number 53

Compare irrigation system options.

Definition

Comparison should include

- hand watering
- overhead/sprinkler
- drip
- ebb and flow.

Process/Skill Questions

- When should hand watering be used instead of overhead options?
- What are the advantages and disadvantages of hand watering?
- What are the advantages and disadvantages of an ebb and flow system?
- How do plant growth requirements affect irrigation system selection?

Identifying Plants

Task Number 54

Identify woody plants.

Definition

Identification should include categorizing common woody plants according to

- landscape use
- climate
- production practices
- exotic invasive species.

Process/Skill Questions

- How does temperature play a role in a plant's life cycle?
- What is the importance of the USDA's cold hardiness and heat hardiness research?
- Why is cultivar development valuable in the horticulture industry?
- Which woody plants are common to greenhouses and nurseries in the region?

Task Number 55

Identify herbaceous plants.

Definition

Identification should include

- categorizing plants according to landscape use
- categorizing plants according to climate
- categorizing plants according to production practices
- assessing the characteristics of herbaceous plants
- distinguishing among perennials, annuals, biennials, and vegetables
- distinguishing among exotic invasives, natives, and naturalized plants.

Process/Skill Questions

- What are five categories of floriculture plants?
- Which herbaceous plants are common to greenhouses and nurseries in the region? Why?
- What makes a plant an exotic invasive?
- What are the pros and cons of native vs. non-native (exotic) plants?

Demonstrating Plant Production

Task Number 56

Propagate plants sexually.

Definition

Propagation should include

- explaining the production of plants from seed, including managing seed storage, pretreatments (e.g., stratification, scarification, pelleted, coated), substrate, temperature, light, water, and diseases
- determining the viability and germination rate of seeds.

Process/Skill Questions

- What factors help determine whether a grower should propagate his/her own plants or purchase young plants from a propagation specialist?
- Why can seeds of some plants be collected and propagated while seeds of other plants cannot and must be purchased?
- What environmental factors influence plant propagation? How can a grower control these factors?
- What are the advantages of seed pretreatments?
- What are the advantages and disadvantages of growing plants from seeds?

Task Number 57

Propagate plants asexually.

Definition

Propagation should include

- differentiating between types of asexual propagation methods
- demonstrating correct asexual propagation methods
- researching micropropagation procedures.

Process/Skill Questions

- What are some methods of asexual plant propagation, other than rooting cuttings?
- Why has micropropagation become an increasingly popular and economically important method of propagation?
- What factors help determine whether a grower should propagate his/her own plants or purchase young plants from a propagation specialist?

Task Number 58

Manipulate temperature to affect plant growth.

Definition

Manipulation should include

- establishing optimum and tolerable air temperature ranges
- calculating average daily temperature
- researching temperature recommendations
- regulating substrate temperature
- stratifying seeds
- chilling bulbs
- explaining how to control stem elongation through DIF and DIP.

Process/Skill Questions

- When must a grower regulate the temperature of growing plants?

- Why would a grower manipulate soil temperature?
- How is temperature manipulated?
- How do DIF and DIP affect plant growth?

Task Number 59

Manipulate light to affect plant growth.

Definition

Manipulation should include

- measuring light
- differentiating among color, intensity, and duration
- interpreting daily light integral (DLI) measurements
- defining *light saturation* and *light compensation*
- acclimatizing plants
- describing how photoperiodism affects growth
- exploring the use of time clock devices set for night-interruption and day-extension lighting
- exploring the use of black cloth for night extension.

Process/Skill Questions

- How can a grower regulate light intensity and duration?
- What types of plants must be acclimatized?
- How is the use of LED light changing plant growth?

Task Number 60

Manage irrigation.

Definition

Management should include

- evaluating sources of irrigation water
- testing and adjusting water quality
- describing the importance of testing electrical conductivity, hardness, salinity, and pH
- managing moisture levels
- listing types of water treatments
- describing backflow prevention
- comparing types of irrigation systems for greenhouse and nursery production, including hand watering, microtube, in-line drippers, perimeter nozzles, flood and trough, capillary mat, and overhead.

Process/Skill Questions

- How can water be delivered to plants?

- What measures must be taken if water quality needs improvement?
- How can a grower manage water runoff?
- What are the environmental implications of poorly managed runoff?
- What are the best irrigation methods for selected crops?

Task Number 61

Manage crop substrate.

Definition

Management should include

- evaluating substrate components, including peat moss, bark, coir, soil, vermiculite, perlite, sand, compost, wetting agents, and mycorrhiza
- assessing substrate moisture level and optimum levels
- handling substrate
- preparing a substrate sample for testing and evaluating
- testing substrate pH and electrical conductivity (EC).

Process/Skill Questions

- How do the components of a substrate influence plant growth?
- What is the importance of using sterilized substrate?
- How should substrates be stored?
- Why is it important to understand how various substrates differ in water-holding capacity?
- Which substrates use biological agents to maximize nutrient uptake?

Task Number 62

Manage nutrients for plants.

Definition

Management should include

- identifying essential elements
- differentiating between organic and inorganic
- identifying sources of nutrients, including types of fertilizers
- identifying deficiency and toxicity symptoms of macronutrients and micronutrients
- comparing methods of fertilizer application
- determining appropriate nutrient levels for each developmental stage.

Process/Skill Questions

- How do plants obtain the necessary elements for healthy growth?
- What symptoms do plants exhibit when major nutrients are lacking?

- What are methods of fertilizer delivery?
- Why would one use fertigation?

Task Number 63

Regulate plant growth.

Definition

Regulating plant growth should include

- pinching
- practicing recommended pruning procedures for selected plants
- identifying and comparing plant growth regulators, including auxins, gibberellins, abscisic acid, cytokinins, and ethylene
- identifying and comparing commercially available growth inhibitors of the above hormones
- managing plant growth and flowering by chemical and/or nonchemical means
- varying the spacing of plants.

Process/Skill Questions

- Under what circumstances does a crop require the use of plant-growth regulation?
- How can plant growth be managed with chemicals?
- How can plant growth be controlled environmentally?

Task Number 64

Produce horticultural crops.

Definition

Production could include exploring techniques for production of the following horticultural crops and the selection of the appropriate container for each:

- Bedding plants
- Foliage plants
- Cut flowers
- Woody plants
- Herbaceous perennials
- Hardy groundcovers
- Vegetables

Production should also include following good agricultural practices (GAP) for produce food safety.

Process/Skill Questions

- What are the necessary steps involved in the design of a complete crop production schedule?

- How do the production needs of perennials differ from those of annuals?

Task Number 65

Prepare greenhouse and nursery plants for market.

Definition

Preparation could include

- comparing packaging and shipping options
- applying GAP for produce food safety
- researching restrictions and regulations in marketing and shipping greenhouse and nursery plants
- harvesting and packaging
- value-added products and services.

Process/Skill Questions

- How are commercially grown flowers, foliage, and other plants packed for shipment?
- What are the standards by which plants are packed for shipment?
- What are the common ways to dress pots?

Managing Pests

Task Number 66

Explain how to manage pests.

Definition

Explanation should include

- IPM
- types of pest management (e.g., biological, mechanical, cultural, sterilization, and chemical)
- pesticide action
- use of pesticide safety information, including
 - centralized bulletin board
 - personal pesticide safety training
 - EPA-approved warning signs
 - PPE
 - safety data sheets (SDS)
 - chemical storage, disposal, and mixing areas
 - pesticide labels

- identifying sensitive environments
- pesticide movement
- discussing pesticide formulations (e.g., liquid, dry, fumigants, adjuvants)
- discussing the use of pesticide application equipment, including hand-pump sprayer, backpack sprayer, gas or electric sprayer, foggers, and granule dispensers
- discussing the timing of pesticide application
- discussing pesticide formulations, including wettable powders, emulsifiable concentrate, dusts, aerosols, fogs, smokes, and granules
- pesticide compatibility
- discussing disposal methods
- pest resistance to chemicals
- phytotoxicity
- discussing the use of chemicals to manage pests, including
 - mixing liquid pesticides
 - applying pesticides, using a backpack sprayer
 - calibrating pesticide application equipment
- discussing granular pesticide application methods
- discussing organic chemicals and biological controls.

Process/Skill Questions

- What are the key components of IPM?
- How can a grower determine whether a contact poison or a systemic poison should be applied?
- What are the environmental hazards associated with irresponsible pesticide use?
- What safety precautions must be observed when handling pesticides?
- What information is printed on every pesticide label?
- What is pesticide compatibility?
- When is the application of a chemical pesticide justified?
- What PPE is associated with pesticide application?

Task Number 67

Identify common greenhouse pests.

Definition

Identification should include

- identification of insect and animal pests and damage, including aphids, fungus gnats, mealybugs, mites, scale insects, thrips, and whiteflies
- identification of plant diseases and symptoms, including viruses, bacteria, and fungi (botrytis, damping-off, and root rot)
- identification of weeds and the economic damage caused by them.

Process/Skill Questions

- What are the five basic pest groups?
- What pathogens cause the most diseases in plants?

- What sort of symptoms do viral plant diseases cause?

Task Number 68

Explain the importance of pesticide labeling.

Definition

Explanation should include

- registration limitations with pesticide labeling
- the active ingredient concentration in end-use products
- signal words on labels
- the required parts of a label.

Teacher resource: [Pesticide Environmental Stewardship](#)

Process/Skill Questions

- What PPE is required for mixers, applicators, and loaders?
- How can one tell whether the pesticide is a restricted-use product?

Task Number 69

Explain how to handle pesticides safely.

Definition

Explanation of safe handling of pesticides should include

- identifying federal, state, and local laws governing pesticide use and the regulating agencies involved
- identifying WPS
- determining factors when choosing a pesticide
- describing the benefits of pesticide scheduling and recordkeeping
- describing prescribed practices for storing and disposing of pesticides
- demonstrating basic calculations for pesticide application rates
- discussing how to calibrate a sprayer or spreader
- explaining how to mix and load pesticides
- discussing the factors that affect application rates
- discussing the importance of accurate measurements
- reviewing best practices for cleaning up spills.

Process/Skill Questions

- What are the possible consequences of inaccurate measurement of pesticides?
- When might one need to refer to pesticide records?
- What are the most common mistakes in handling pesticides?

- What is FIFRA?
- What happens if the application exceeds the label rate of application?

Task Number 70

Design an IPM plan.

Definition

Design should include

- focus on prevention
- monitoring and scouting
- identification and diagnosis of plant problems
- control methods
- keeping and maintaining records.

Process/Skill Questions

- What are the components of an IPM plan?
- What are the possible consequences of not maintaining records?

Task Number 71

Explain various Virginia pesticide licenses.

Definition

Explanation should include

- the process for obtaining a pesticide license
- the types and categories of pesticide licenses, including the specific areas for which each license is appropriate
- the difference between Registered Technician, Commercial Applicator (for and not for hire), and Private Applicator
- training requirements
- license renewal requirements
- recertification requirements.

Teacher resource: [Virginia Tech Pesticide Programs](#) and [Virginia Department of Agriculture and Consumer Services](#)

Process/Skill Questions

- How long is a license valid?
- How is a license renewed?
- What type of pesticide license is required for various activities?

Understanding Marketing and Business Management

Task Number 72

Analyze business markets.

Definition

Analysis should include

- comparing wholesale markets with retail markets, which may include
 - garden centers
 - farmers markets
 - roadside stands
 - on-farm sales
 - landscape contractor sales
 - mass markets
 - florists
- developing advertising and promotional strategies, which may include
 - writing a news release
 - designing a printed advertisement
- locating markets.

Process/Skill Questions

- Where do growers sell plants?
- How are companies structured to meet the needs of different markets?
- What types of advertising are effective for horticulture businesses?
- What are the four Ps of marketing?
- How does customer service affect marketing?

Task Number 73

Evaluate a business plan.

Definition

Evaluation should include

- identifying the components of a business plan
- analyzing the realistic expectations of the plan

- investigating the advantages and disadvantages of sole proprietorships, partnerships, and corporations
- developing and analyzing a market survey
- investigating sources of capital
- analyzing an organizational plan
- researching laws and regulations
- researching methods for advertising
- creating financial records, to include a balance sheet, cash flow statement, profit and loss statement, and inventory report
- identifying the break-even point and determining the profit margin
- demonstrating appropriate forms of business communication, to include business letters, phone calls, and emails
- estimating profits and growth over a duration of time
- creating a contingency plan.

Process/Skill Questions

- What are ways to raise funding for the proposed budget in the business plan?
- What other concerns, beyond the business plan, should new small-business owners consider?
- How is return on investment calculated?
- How is the profit margin determined?
- What types of insurance should be considered for this business?

Task Number 74

Maintain production and business records.

Definition

Maintenance should use current technology and include

- inventory records
- purchases (e.g., supplies, equipment)
- production records
- pest management practices
- reconciliation of received merchandise and invoices
- sales records (e.g., sales tickets, payments received).

Process/Skill Questions

- Why is an accurate inventory important?
- How are production records valuable to the grower?
- What purchasing records must be maintained?

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, 12.3, 12.5
40	Participate in an SAE.	English: 10.5, 10.8, 11.5, 11.8, 12.5, 12.8
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, 12.5, 12.6, 12.7, 12.8
42	Describe leadership characteristics and opportunities as they relate to agriculture and FFA.	English: 10.5, 11.5, 12.5 History and Social Science: VUS.8, VUS.9, VUS.10, VUS.11, WHIL.8, WHIL.10, WHIL.11
43	Apply for an FFA degree and/or an agricultural proficiency award.	English: 10.5, 11.5, 12.5
44	Follow safety procedures in the greenhouse plant production industry.	English: 10.5, 11.5, 12.5 History and Social Science: VUS.14
45	Analyze career pathways in the greenhouse plant production industry.	English: 10.3, 10.5, 11.3, 11.5, 12.3, 12.5
46	Differentiate among types of production facilities for ornamental and vegetable crops.	English: 10.5, 11.5, 12.5
47	Explain hydroponics, aquaponics, and aeroponics.	English: 10.3, 10.5, 11.3, 11.5, 12.3, 12.5
48	Produce a hydroponic crop.	
49	Analyze the factors that influence greenhouse site selection.	English: 10.5, 11.5, 12.5
50	Analyze types and components of greenhouse structures.	English: 10.5, 11.5, 12.5
51	Compare heating and cooling options.	English: 10.5, 11.5, 12.5
52	Compare lighting system options.	English: 10.5, 11.5, 12.5
53	Compare irrigation system options.	English: 10.5, 11.5, 12.5
54	Identify woody plants.	English: 10.5, 11.5, 12.5 History and Social Science: WG.1, WG.2, WG.3
55	Identify herbaceous plants.	English: 10.5, 11.5, 12.5
56	Propagate plants sexually.	English: 10.5, 11.5, 12.5 Science: BIO.4
57	Propagate plants asexually.	English: 10.5, 10.8, 11.5, 11.8, 12.5, 12.8
58	Manipulate temperature to affect plant growth.	English: 10.8, 11.8, 12.8 Science: BIO.1
59	Manipulate light to affect plant growth.	English: 10.3, 11.3, 12.3 Science: BIO.1
60	Manage irrigation.	English: 10.5, 11.5, 12.5
61	Manage crop substrate.	Science: BIO.1
62	Manage nutrients for plants.	English: 10.5, 11.5, 12.5 Science: BIO.1, BIO.2
63	Regulate plant growth.	English: 10.5, 11.5, 12.5 Science: BIO.4

64	Produce horticultural crops.	English: 10.5, 10.8, 11.5, 11.8, 12.5, 12.8
65	Prepare greenhouse and nursery plants for market.	English: 10.5, 10.8, 11.5, 11.8, 12.5, 12.8 History and Social Science: GOVT.15, WG.16
66	Explain how to manage pests.	English: 10.1, 10.5, 11.1, 11.5, 12.1, 12.5 History and Social Science: VUS.13, VUS.14
67	Identify common greenhouse pests.	English: 10.5, 11.5, 12.5 Science: BIO.4
68	Explain the importance of pesticide labeling.	English: 10.5, 11.5, 12.5
69	Explain how to handle pesticides safely.	English: 10.5, 11.5, 12.5
70	Design an IPM plan.	English: 10.5, 11.5, 12.5
71	Explain various Virginia pesticide licenses.	English: 10.5, 11.5, 12.5
72	Analyze business markets.	English: 10.5, 10.6, 10.7, 10.8, 11.5, 11.6, 11.7, 11.8, 12.5, 12.6, 12.7, 12.8 History and Social Science: GOVT.1
73	Evaluate a business plan.	English: 10.5, 10.8, 11.5, 11.8, 12.5, 12.8 History and Social Science: GOVT.15 Mathematics: A.1, A.4, PS.8*, PS.9*
74	Maintain production and business records.	English: 10.5, 10.6, 11.5, 11.6, 12.5, 12.6 Mathematics: COM.1

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

- BASF Plant Science Certification Examination
- College and Work Readiness Assessment (CWRA+)
- Customer Service Examination
- Customer Service Specialist (CSS) Examination
- Greenhouse Operators Certification Examination
- Horticulture-Landscaping Assessment
- National Career Readiness Certificate 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 (8072/18 weeks)
- Applied Agricultural Concepts (8073/36 weeks)
- Biological Applications in Agriculture (8086/36 weeks)
- Biotechnology Applications in Agriculture (8087/36 weeks)
- Biotechnology Foundations in Agricultural and Environmental Science (8085/36 weeks)
- Floriculture (8038/36 weeks)
- Horticulture Sciences (8034/36 weeks)
- Introduction to Plant Systems (8007/36 weeks)
- Landscaping I (8036/36 weeks)
- Landscaping II (8039/36 weeks)
- Operating the Farm Business (8014/36 weeks)

Career Cluster: Agriculture, Food and Natural Resources	
Pathway	Occupations
Agribusiness Systems	Agricultural Commodity Broker Agricultural Economist Agricultural Loan Officer Agricultural Products Sales Representative Farm Products Purchasing Agent and Buyer Farm, Ranch Manager Farmer/Rancher Feed, Farm Supply Store Sales Manager Sales Manager
Environmental Service Systems	Secondary School Teacher Toxicologist Turf Farmer
Natural Resources Systems	Forest Manager, Forester Forest Technician

Career Cluster: Agriculture, Food and Natural Resources

Pathway	Occupations
Plant Systems	Agricultural Products Sales Representative Botanist Certified Crop Advisor Crop Grower Custom Harvester Farm, Ranch Manager Farmer/Rancher Floral Designer Floral Shop Manager Forest Geneticist Nursery and Greenhouse Manager Ornamental Horticulturist Plant Breeder/ Geneticist Secondary School Teacher Soil and Plant Scientist Tree Surgeon Turf Farmer