

Introduction to Plant Systems

8007 36 weeks

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Course Description

Suggested Grade Level: 9 or 10

Students develop competencies in each of the major areas of the Plant Systems career pathway, including applied botany, plant propagation, and plant care and selection. Instructional content also includes an introduction to the various divisions of the plant systems industry. Students learn agricultural mechanics applicable to plant systems. As with all agriculture courses, students will be exposed to the principles of leadership and opportunities within student organizations, along with Supervised Agricultural Experience opportunities.

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

8007	Tasks/Competencies
+	Identify the role of supervised agricultural experiences (SAEs) in agricultural education.
+	Participate in an SAE.
+	Identify the benefits and responsibilities of FFA membership.
+	Describe leadership characteristics and opportunities as they relate to agriculture and FFA.
○	Apply for an FFA degree and/or an agricultural proficiency award.
+	Explain the characteristics of plants.
+	Illustrate the importance of plant systems in relation to humans.
+	Classify the major divisions of the plant systems.
+	Evaluate the effect of light on plants.

+	Evaluate the effect of temperature on plants.
+	Evaluate the effect of water on plants.
+	Evaluate the effect of carbon dioxide (CO ₂), oxygen, and air flow on plants.
+	Evaluate types and components of greenhouses and plant structures.
+	Identify major plant parts and their functions.
+	Explain the life-sustaining processes by which all plants grow and develop.
+	Explain the process of osmosis.
+	Describe the life cycles and classifications of plants.
+	Examine the advantages and disadvantages of sexual propagation in the production of new plants.
+	Describe how to collect seeds from different types of plants.
+	Explain how new plant varieties can be bred/hybridized.
+	Plant seeds using various methods.
+	Analyze scarification and stratification methods that aid in the propagation process.
+	Describe the germination process.
+	Calculate the germination rates of seeds.
+	Demonstrate how to transplant seedlings.
+	Examine the advantages and disadvantages of asexual propagation in the production of plants.
+	Demonstrate how to produce plants through cuttings.
+	Demonstrate how to produce plants by layering.
+	Demonstrate how to produce plants through division and separation.
+	Describe grafting and budding techniques for woody and herbaceous plants.
+	Describe how to produce plants through micropropagation.
+	Evaluate the cultural practices for vegetable crops grown in a greenhouse.
+	Evaluate the physical properties of soil and growing media.
+	Amend growing media for plant growth.
+	Collect a soil sample for evaluation.

<input checked="" type="radio"/>	Analyze soil sample for nutrients and pH.
<input checked="" type="radio"/>	Describe hydroponic plant production.
<input checked="" type="radio"/>	Evaluate the effects of macronutrients on plant production.
<input type="radio"/>	Evaluate plants for nutrient deficiencies.
<input checked="" type="radio"/>	Describe fertilizer application methods.
<input checked="" type="radio"/>	Classify the common types of insects that affect plant growth in Virginia.
<input checked="" type="radio"/>	Classify the common types of diseases that affect plant growth in Virginia.
<input checked="" type="radio"/>	Classify the common types of weeds that affect plant growth in Virginia.
<input checked="" type="radio"/>	Classify types of animal pests that affect plant growth in Virginia.
<input checked="" type="radio"/>	Explain controls of plant pests.
<input checked="" type="radio"/>	Interpret the information on a pesticide label.
<input checked="" type="radio"/>	Identify the application of different types of pesticides.
<input checked="" type="radio"/>	Identify USDA plant hardiness zones and how the different zones affect plant selection.
<input checked="" type="radio"/>	Explain the importance of plant taxonomy.
<input checked="" type="radio"/>	Evaluate the common tree species of Virginia.
<input checked="" type="radio"/>	Evaluate the common species of agronomic plants grown in Virginia.
<input checked="" type="radio"/>	Evaluate the common species of fruits and vegetables grown in Virginia.
<input checked="" type="radio"/>	Evaluate the common species of nursery and landscape horticulture plants grown in Virginia.
<input checked="" type="radio"/>	Evaluate the common species of turfgrasses grown in Virginia.
<input checked="" type="radio"/>	Evaluate the common species of floriculture crops grown in Virginia.
<input checked="" type="radio"/>	Demonstrate safety procedures in various areas associated with agricultural mechanics in plant systems.
<input checked="" type="radio"/>	Demonstrate equipment safety and operation as they relate to the Plant Systems pathway.
<input checked="" type="radio"/>	Demonstrate standard measurement techniques in plant systems.
<input checked="" type="radio"/>	Demonstrate drawing for agricultural mechanics as it relates to the Plant Systems pathway.
<input type="radio"/>	Examine metalworking operations as they relate to the Plant Systems pathway.

<input type="radio"/>	Examine woodworking operations as they relate to the Plant Systems pathway.
<input type="radio"/>	Examine electrical operations as they relate to the Plant Systems pathway.
<input type="radio"/>	Examine small-engine operations as they relate to the Plant Systems pathway.
<input type="radio"/>	Examine plumbing operations as they relate to the Plant Systems pathway.

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?

Introducing Botany

Task Number 44

Explain the characteristics of plants.

Definition

Explanation should include

- discussing the importance of scientific naming and classifications
- differentiating among genus, species, variety, and cultivar
- describing cellular characteristics
- describing physical characteristics.

Process/Skill Questions

- What are the benefits of knowing the plant kingdom and the major plant characteristics?
- What is the difference between an autotroph and a heterotroph?
- What is the process for identifying a plant using a dichotomous key?
- What other methods are used to identify plants?

The National Council for Agricultural Education: Agriculture, Food and Natural Resources Content Standards

PS.02.01. Classify plants according to taxonomic systems.

PS.02.02. Apply knowledge of plant anatomy and the functions of plant structures to activities associated with plant systems.

Task Number 45

Illustrate the importance of plant systems in relation to humans.

Definition

Illustration should include

- food chain
- fiber production
- ornamentation
- energy
- economics
- environment
- medical
- housing
- recreation.

Process/Skill Questions

- How do humans use plants?
- What plants are used for medical purposes?
- What beneficial plants are in your community?
- What plants are used in fiber production?
- How have selected plant systems contributed to your community's economy?
- How have selected plant systems contributed to Virginia's economy?
- How have selected plant systems contributed to the United States' economy?

The National Council for Agricultural Education: Agriculture, Food and Natural Resources Content Standards

PS.04.01. Evaluating, identifying, and preparing plants to enhance an environment.

Task Number 46

Classify the major divisions of the plant systems.

Definition

Classification should include

- agronomy
- forestry
- horticulture
- botany.

Process/Skill Questions

- What is agronomy? Forestry? Horticulture? Botany?
- What percentage of your community is employed in agronomic jobs? Forestry jobs? Horticultural jobs? Botany jobs?

- What employment opportunities, from least to greatest, exist in the agronomy, horticultural, forestry, and botany areas?
- Which area shows the most potential for employment?
- What impact do plants have on a community from a recreational standpoint?

The National Council for Agricultural Education: Agriculture, Food and Natural Resources Content Standards

PS.02.02. Apply knowledge of plant anatomy and the functions of plant structures to activities associated with plant systems.

Evaluating the Environmental Stimuli that Affect Plant Growth and Development

Task Number 47

Evaluate the effect of light on plants.

Definition

Evaluation should be made by conducting experiments, incorporating the scientific method, that may involve variables in

- light duration
- light intensity
- light quality
- light color.

Process/Skill Questions

- What impact does light have on plants?
- Why can plants not be grown in the dark?
- What role does light duration, intensity, and quality play in plant growth and development?
- What role does phytochrome play in reproduction?
- Why is light quality important?
- Why do you need a balance light spectrum?
- What role does photoperiodism play in plant reproduction and growth?

The National Council for Agricultural Education: Agriculture, Food and Natural Resources Content Standards

PS.01.01. Determine the influence of environmental factors on plant growth.

PS.02.03. Apply knowledge of plant physiology and energy conversion to plant systems.

Task Number 48

Evaluate the effect of temperature on plants.

Definition

Evaluation should be made by conducting experiments, incorporating the scientific method, that involve variables in

- heating
- cooling
- shading systems
- cool-season vs. warm-season plants
- frost-hardy vs. frost-tolerant plants
- tropical vs. subtropical plants.

Process/Skill Questions

- How can temperature affect biochemical reactions?
- What are the differences between cool-season crops and warm-season crops?
- What is hardening?
- When are dormant plants impacted by temperature?
- Why does cold damage occur?
- What symptoms will a plant display if it is exposed to cold? Heat?
- What effect does temperature have on plant dormancy?
- How does temperature affect germination rate?

The National Council for Agricultural Education: Agriculture, Food and Natural Resources Content Standards

PS.01.01. Determine the influence of environmental factors on plant growth.

PS.01.03. Develop and implement a fertilization plan for specific plants or crops.

Task Number 49

Evaluate the effect of water on plants.

Definition

Evaluation should be made by conducting experiments, incorporating the scientific method, that involve variables in

- drought resistance
- water quality
- irrigation systems
- relative humidity.

Process/Skill Questions

- What plants are drought resistant?
- What are the advantages to the different types of irrigation systems?
- What are factors that influence the type of irrigation system used?
- What role does relative humidity play in the production of plants?
- How does water quality affect plant growth?

The National Council for Agricultural Education: Agriculture, Food and Natural Resources Content Standards

PS.01.01. Determine the influence of environmental factors on plant growth.

PS.01.03. Develop and implement a fertilization plan for specific plants or crops.

Task Number 50

Evaluate the effect of carbon dioxide (CO₂), oxygen, and air flow on plants.

Definition

Evaluation should be made by conducting experiments, incorporating the scientific method, that involve variables in

- air quality
- CO₂ levels in plant production
- plant spacing
- air circulation
- the greenhouse effect.

Process/Skill Questions

- What are the components of air quality in relation to plants?
- How does CO₂ concentration affect photosynthesis?
- How does air flow impact plant growth?
- What is the greenhouse effect?

- What role does the greenhouse effect have on plant production?

The National Council for Agricultural Education: Agriculture, Food and Natural Resources Content Standards

PS.01.01. Determine the influence of environmental factors on plant growth.

PS.03.04. Apply principles and practices of sustainable agriculture to plant production.

Task Number 51

Evaluate types and components of greenhouses and plant structures.

Definition

Evaluation should include

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

Process/Skill Questions

- What are the different styles of greenhouses?
- What are the advantages and disadvantages of the different styles of greenhouses?
- What is the difference between a high tunnel and a greenhouse?
- What are other examples of environmental control systems that can be used for plant production?
- What are the advantages and disadvantages of the following: cold frames, attached greenhouses, detached greenhouses, hotbeds, and lath houses?
- What are the primary plants/crops grown in a greenhouse setting? Why?
- What is the economic importance of the greenhouse industry?

The National Council for Agricultural Education: Agriculture, Food and Natural Resources Content Standards

PS.03.02. Develop and implement a management plan for plant production.

Understanding Plant Anatomy and Physiology

Task Number 52

Identify major plant parts and their functions.

Definition

Identification should include

- leaf
- stem
- roots
- flower
- seed
- fruit.

Process/Skill Questions

- What parts of a plant are involved in reproduction?
- What parts of a plant are involved in respiration?
- What are the signs that a plant has reached maturity?
- What is juvenile growth?

The National Council for Agricultural Education: Agriculture, Food and Natural Resources Content Standards

PS.02.02. Apply knowledge of plant anatomy and the functions of plant structures to activities associated with plant systems.

Task Number 53

Explain the life-sustaining processes by which all plants grow and develop.

Definition

Explanation should include

- photosynthesis reactants and products
- cellular respiration reactants and products
- transpiration.

Process/Skill Questions

- What organisms within plant structures are involved in photosynthesis? In respiration? In transpiration?

- How do plants store energy?
- What role does the vascular system play in food transport within a plant?

The National Council for Agricultural Education: Agriculture, Food and Natural Resources Content Standards

PS.02.03. Apply knowledge of plant physiology and energy conversion to plant systems.

Task Number 54

Explain the process of osmosis.

Definition

Explanation should include

- the movement of water through a semi-permeable membrane from an area of high to low concentration
- osmotic pressure and the results of different tonic solutions (e.g., hypertonic, hypotonic, isotonic).

Process/Skill Questions

- What is osmosis?
- What is the concentration gradient?
- How does osmosis affect the life of a plant?
- What is turgor pressure?
- What is plasmolysis?
- How can plasmolysis impact plant production?
- How is osmosis used by cells?
- What is the function of membranes in osmosis?
- How do solute and solvent concentrations affect osmosis?
- How does saturation affect osmosis?
- What other factors affect osmosis? How?

The National Council for Agricultural Education: Agriculture, Food and Natural Resources Content Standards

PS.02.02. Apply knowledge of plant anatomy and the functions of plant structures to activities associated with plant systems.

Task Number 55

Describe the life cycles and classifications of plants.

Definition

Description should include

- dormancy
- maturity
- reproduction
- comparison of annual, biennial, and perennial life cycles.

Process/Skill Questions

- What is an annual plant?
- What is a biennial plant?
- What is a perennial plant?
- What are examples of plants that are annuals?
- What are examples of plants that are biennials?
- What are examples of plants that are perennials?
- What is senescence?
- What are herbaceous perennials?
- What are monocarpic plants?
- What are polycarpic plants?

The National Council for Agricultural Education: Agriculture, Food and Natural Resources Content Standards

PS.02.01. Classify plants according to taxonomic systems.

Examining the Method of Sexual Propagation in the Production of Plants

Task Number 56

Examine the advantages and disadvantages of sexual propagation in the production of new plants.

Definition

Examination should include

- impacts on production
- economic value
- hybridization.

Process/Skill Questions

- What does the process of sexual propagation in plants entail?
- What is the result of sexual propagation?
- What are the economic benefits of propagating from seeds?
- How are plants produced from seed genetically different from those produced from asexual propagation?

The National Council for Agricultural Education: Agriculture, Food and Natural Resources Content Standards

PS.03.01. Demonstrate plant propagation techniques in plant system activities.

Task Number 57

Describe how to collect seeds from different types of plants.

Definition

Description should include collection and storage techniques that apply to different seed types.

Process/Skill Questions

- Why is seed collecting important?
- How are seeds harvested?
- What are the optimal conditions for seed storage?
- How do storage conditions affect germination rates of seeds?
- How does collecting and propagating from seed encourage diversity?

The National Council for Agricultural Education: Agriculture, Food and Natural Resources Content Standards

PS.02.02. Apply knowledge of plant anatomy and the functions of plant structures to activities associated with plant systems.

Task Number 58

Explain how new plant varieties can be bred/hybridized.

Definition

Explanation should include conventional and molecular breeding.

Process/Skill Questions

- What is a hybrid?
- What is the value of hybrids?
- Why are hybrids important to the plant industry?
- What are plant patents?
- How do plant patents affect commercial growers?

The National Council for Agricultural Education: Agriculture, Food and Natural Resources Content Standards

PS.02.02. Apply knowledge of plant anatomy and the functions of plant structures to activities associated with plant systems.

Task Number 59

Plant seeds using various methods.

Definition

Planting should include

- demonstration of planting seeds according to instructions and requirements
- different methods of seed dispersal.

Process/Skill Questions

- How are seeds dispersed in nature?
- How should seeds be planted for maximum germination?
- What are the environmental requirements for germination?
- How do heat and moisture affect germination rates of seeds?
- What practices can be used to increase germination rates in seeds?

The National Council for Agricultural Education: Agriculture, Food and Natural Resources Content Standards

PS.03.01. Demonstrate plant propagation techniques in plant system activities.

Task Number 60

Analyze scarification and stratification methods that aid in the propagation process.

Definition

Analysis should include

- definition of *scarification* and *stratification*
- description of why this improves plant production
- methodology of seed treatment.

Process/Skill Questions

- Why are scarification and stratification necessary for some seeds to germinate?
- What processes or tools can be used to scarify seeds?
- What are the benefits of the scarification method?
- What methods of stratification are used in the commercial production of plants?
- What are the benefits of the stratification method?

The National Council for Agricultural Education: Agriculture, Food and Natural Resources Content Standards

PS.03.01. Demonstrate plant propagation techniques in plant system activities.

Task Number 61

Describe the germination process.

Definition

Description should include the steps of the germination process, including factors that can affect the process.

Process/Skill Questions

- What are the requirements for germination?
- What environmental factors control germination?
- What are the stages of germination?
- What part of the plant emerges first?
- What is *germination rate*?

The National Council for Agricultural Education: Agriculture, Food and Natural Resources Content Standards

PS.03.01. Demonstrate plant propagation techniques in plant system activities.

PS.03.02. Develop and implement a management plan for plant production.

Task Number 62

Calculate the germination rates of seeds.

Definition

Calculation should include a test of germination percentages over fixed durations.

Process/Skill Questions

- How does one measure a rate?
- How does one calculate a percentage?
- Why is germination rate important?
- Why is a germination test date important?
- Where is the germination rate and test date found?

The National Council for Agricultural Education: Agriculture, Food and Natural Resources Content Standards

PS.03.01. Demonstrate plant propagation techniques in plant system activities.

PS.03.02. Develop and implement a management plan for plant production.

Task Number 63

Demonstrate how to transplant seedlings.

Definition

Demonstration should include

- making a small hole for each seedling to be planted
- removing a seedling from its container, making sure to keep the root mass and soil intact
- spreading the roots out and checking their condition
- filling each of the planting holes with a small amount of water and liquid fertilizer
- placing seedlings in the hole
- covering soil around the roots, and gently tamping the soil down
- creating a small basin around the plant to hold water
- keeping the soil around the plants adequately watered until plants are well established
- adhering to sanitation best practices for equipment and workers.

Process/Skill Questions

- When should you transplant a seedling?
- How should you handle a seedling?
- Why should you transplant seedlings?
- What are the effects of transplant stress?
- What care should be taken with transplants to reduce stress and improve growth?

The National Council for Agricultural Education: Agriculture, Food and Natural Resources Content Standards

PS.03.02. Develop and implement a management plan for plant production.

Demonstrating the Method of Asexual Propagation in the Production of Plants

Task Number 64

Examine the advantages and disadvantages of asexual propagation in the production of plants.

Definition

Examination should include

- impacts on the production of plants
- economic value of cloning plants.

Process/Skill Questions

- What is asexual propagation?
- How does asexual propagation affect biodiversity?
- What is the value of asexual propagation to the plant industry?
- What is a plant patent?
- How do plant patents affect commercial growers?

The National Council for Agricultural Education: Agriculture, Food and Natural Resources Content Standards

PS.03.01. Demonstrate plant propagation techniques in plant system activities.

Task Number 65

Demonstrate how to produce plants through cuttings.

Definition

Demonstration may include using

- leaf cuttings
- stem cuttings
- root cuttings
- hardwood or softwood cuttings
- division.

Process/Skill Questions

- What are the sanitary procedures to follow when taking cuttings?
- What determines the type of cutting you should take?
- How should you care for recent cuttings?
- What is a rooting hormone? Why should it be used?
- When should cuttings be transplanted?

The National Council for Agricultural Education: Agriculture, Food and Natural Resources Content Standards

PS.03.01. Demonstrate plant propagation techniques in plant system activities.

Task Number 66

Demonstrate how to produce plants by layering.

Definition

Demonstration may include methods of

- air layering
- tip layering
- mound layering (e.g., for blackberries, rubber plants).

Process/Skill Questions

- What is layering?
- What is the purpose of layering?
- What are the steps to follow when layering plants?
- What plants respond best to layering methods?
- How do environmental conditions affect the success of layering?

The National Council for Agricultural Education: Agriculture, Food and Natural Resources Content Standards

PS.03.01. Demonstrate plant propagation techniques in plant system activities.

Task Number 67

Demonstrate how to produce plants through division and separation.

Definition

Demonstration should include

- procedure for separation
- procedure for division
- appropriate plant species for each method (e.g., day lilies, hostas, cannas, ornamental grasses).

Process/Skill Questions

- Why are plants separated?
- What are the steps to follow when dividing or separating plants?
- What are the indicators of when a plant can be divided or separated?
- What are the benefits of division to the parent plant?
- What is the best time of year to divide plants?

The National Council for Agricultural Education: Agriculture, Food and Natural Resources Content Standards

PS.03.01. Demonstrate plant propagation techniques in plant system activities.

Task Number 68

Describe grafting and budding techniques for woody and herbaceous plants.

Definition

Description should include

- a variety of grafting/budding techniques
- equipment needed to propagate plants
- plant species appropriate for each given propagation method (e.g., tomatoes, apple trees, roses, Japanese maples, grapes).

Process/Skill Questions

- What are grafting and budding?
- Why do agriculturists use grafting or budding?
- What are the steps to follow for grafting or budding?
- What tools and equipment are necessary for grafting and budding?
- How do you care for grafts?
- What is scion wood?
- What is rootstock?
- How can rootstocks affect the growth rate, mature size, and production of grafted plants?

The National Council for Agricultural Education: Agriculture, Food and Natural Resources Content Standards

PS.03.01. Demonstrate plant propagation techniques in plant system activities.

Task Number 69

Describe how to produce plants through micropropagation.

Definition

Description should include using a lab-based procedure involving tissue culture of popular house plants (e.g., African violets, day lilies, ferns).

Process/Skill Questions

- What is *micropropagation*?
- Why do agriculturists use micropropagation?
- What are the steps to follow for micropropagation?
- What materials are necessary to perform micropropagation?
- Why is a sterile environment important to micropropagation?

The National Council for Agricultural Education: Agriculture, Food and Natural Resources Content Standards

PS.03.01. Demonstrate plant propagation techniques in plant system activities.

Task Number 70

Evaluate the cultural practices for vegetable crops grown in a greenhouse.

Definition

Evaluation should include

- pruning
- removal of unwanted growth points, suckers, and runners
- removal of old and undesirable leaves
- removal of undesirable fruit and produce
- training and trellising
- nutrient management
- pest control
- light management.

Process/Skill Questions

- What are some vegetable crops commonly grown in greenhouses?
- What are the advantages of greenhouse production vs. traditional field-grown production?
- Why is pruning a desirable practice for greenhouse crops?
- What are some common types of container production for greenhouse crops?
- How do hybrids developed for the greenhouse differ from the heirloom varieties?
- What pests are common to greenhouse crops?
- What are some IPM methods of control for greenhouse pests?
- How can the need for light be addressed in year-round greenhouse production?

The National Council for Agricultural Education: Agriculture, Food and Natural Resources Content Standards

PS.03.02. Develop and implement a management plan for plant production.

Managing Plants with Growing Media

Task Number 71

Evaluate the physical properties of soil and growing media.

Definition

Evaluation should include identifying

- soil profile
- texture
- composition
- plot size
- depth of topsoil layer
- effect of topography on garden sites and soil plots
- media components
- texture
- use of organic and inorganic amendments in potting media.

Process/Skill Questions

- What are the important characteristics of soil?
- How is land classified?
- What is the composition of the “ideal” soil?
- What are four things that plants receive from soil?
- What components are commonly used in potting media, and what are their functions?

The National Council for Agricultural Education: Agriculture, Food and Natural Resources Content Standards

PS.01.02. Prepare and manage growing media for use in plant systems.

PS.01.03. Develop and implement a fertilization plan for specific plants or crops.

PS.03.02. Develop and implement a management plan for plant production.

Task Number 72

Amend growing media for plant growth.

Definition

Amendment should include commonly used materials that aid in

- drainage
- aeration
- moisture retention

and should also include

- organic and inorganic soil amendments (e.g., limestone, compost)

- slow-release fertilizers.

Process/Skill Questions

- What are some examples of amendments that are used to increase moisture retention?
- What are some common amendments used in the landscaping industry?
- What are some common ingredients found in growing media that lacks soil?
- What are some examples of amendments that are used to increase drainage in growing media?

The National Council for Agricultural Education: Agriculture, Food and Natural Resources Content Standards

PS.01.02. Prepare and manage growing media for use in plant systems.

PS.01.03. Develop and implement a fertilization plan for specific plants or crops.

PS.03.02. Develop and implement a management plan for plant production.

Task Number 73

Collect a soil sample for evaluation.

Definition

Collection should include

- determining when to sample the soil
- using necessary sampling equipment
- following best practices for soil sampling to ensure reliable results.

Process/Skill Questions

- Where can you obtain a soil test kit? Why is following the kit's directions important?
- Why is soil testing important?
- How do you collect a reliable soil sample?
- How do you prepare soil for testing?
- Why is it important to use clean tools when soil sampling?
- What equipment is needed when collecting a soil sample?

The National Council for Agricultural Education: Agriculture, Food and Natural Resources Content Standards

PS.01.03. Develop and implement a fertilization plan for specific plants or crops.

Task Number 74

Analyze soil sample for nutrients and pH.

Definition

Analysis may include

- use of commercial soil test kit
- use of private lab/extension facilities.

Process/Skill Questions

- What macronutrients and micronutrients are evaluated in a soil sample?
- What is the ideal pH range of soil?
- What is the electrical conductivity (EC) of soil?

The National Council for Agricultural Education: Agriculture, Food and Natural Resources Content Standards

PS.01.01. Determine the influence of environmental factors on plant growth.

PS.01.03. Develop and implement a fertilization plan for specific plants or crops.

Task Number 75

Describe hydroponic plant production.

Definition

Description should include an explanation of the production of plants using conventional hydroponic techniques.

Process/Skill Questions

- What are the advantages of hydroponics?
- What are the key pieces of media in hydroponics systems?
- What are some examples of hydroponic systems, and how does each operate?

The National Council for Agricultural Education: Agriculture, Food and Natural Resources Content Standards

PS.03.02. Develop and implement a management plan for plant production.

Investigating the Main Principles of Using Nutrients and Fertilizers with Plants

Task Number 76

Evaluate the effects of macronutrients on plant production.

Definition

Evaluation should include identifying types of macronutrients and listing their effects on plant growth and development.

Process/Skill Questions

- Which three primary macronutrients are essential for plant growth?
- Why is N-P-K expressed as a ratio in fertilizer?
- What are the symptoms of nutrient deficiency?
- How can you treat a nutrient deficiency?
- What other macronutrients are essential for plant growth?

The National Council for Agricultural Education: Agriculture, Food and Natural Resources Content Standards

PS.01.03. Develop and implement a fertilization plan for specific plants or crops.

Task Number 77

Evaluate plants for nutrient deficiencies.

Definition

Evaluation should include identifying the physical symptoms that are the result of the deficiency.

Process/Skill Questions

- What are the foliar symptoms of nutrient deficiency?
- What are the symptoms of nitrogen deficiency?

- What are the symptoms of phosphorus deficiency?
- What are the symptoms of potassium deficiency?

**The National Council for Agricultural Education: Agriculture, Food and Natural Resources
Content Standards**

PS.01.03. Develop and implement a fertilization plan for specific plants or crops.

Task Number 78

Describe fertilizer application methods.

Definition

Description should include

- broadcast/drop
- banding/spreading
- injection.

Process/Skill Questions

- When would you use fertilizer application method?
- When would you use broadcast spreading of fertilizers?
- How does a fertilizer injector work?
- What is the constitution of a slow release fertilizer?
- What are some methods of fertilizing landscape plants?
- What are some methods of fertilizing bedding plants that are grown in the greenhouse?

**The National Council for Agricultural Education: Agriculture, Food and Natural Resources
Content Standards**

PS.01.03. Develop and implement a fertilization plan for specific plants or crops.

**Using Basic Scientific Skills and Principles in Pest
Management with Plants**

Task Number 79

Classify the common types of insects that affect plant growth in Virginia.

Definition

Classification should include

- definition of an *insect*
- beneficial vs. non-beneficial insects of Virginia that have a significant effect on plants
- chewing insects vs. sucking insects
- anatomy and physiology of insects
- life cycle of insects
- damage incurred by insects.

Process/Skill Questions

- What are economic benefits and costs associated with insect control?
- What are the major insects that impact Virginia agriculture?
- What is a beneficial insect?
- What are the basic body parts of an insect?
- What are the life-developmental stages of insects?

The National Council for Agricultural Education: Agriculture, Food and Natural Resources Content Standards

PS.03.02. Develop and implement a management plan for plant production.

PS.03.03. Develop and implement a plan for integrated pest management for plant production.

Task Number 80

Classify the common types of diseases that affect plant growth in Virginia.

Definition

Classification should include viral, fungal, bacterial, infectious, and noninfectious diseases.

Process/Skill Questions

- What are common plant viruses that impact Virginia agriculture?
- What are common plant fungal infections that impact Virginia agriculture?

- What are common plant bacterial infections that impact Virginia agriculture?
- What are the stages of plant disease development?
- What abiotic agents can cause disease?

The National Council for Agricultural Education: Agriculture, Food and Natural Resources Content Standards

PS.03.02. Develop and implement a management plan for plant production.

PS.03.03. Develop and implement a plan for integrated pest management for plant production.

Task Number 81

Classify the common types of weeds that affect plant growth in Virginia.

Definition

Classification could include

- definition of a *weed*
- major weeds affecting Virginia
- broad leaf vs. grass
- perennial, annual, and biennial.

Process/Skill Questions

- What types of weeds impact Virginia agriculture?
- Which characteristics of weeds determine their classification?
- How do weeds affect plant growth?
- What are the methods of weed control?
- What are noxious weeds?

The National Council for Agricultural Education: Agriculture, Food and Natural Resources Content Standards

PS.03.02. Develop and implement a management plan for plant production.

PS.03.03. Develop and implement a plan for integrated pest management for plant production.

Task Number 82

Classify types of animal pests that affect plant growth in Virginia.

Definition

Classification should include

- mammals
- birds
- nematodes
- mollusks
- arachnids
- reptiles
- amphibians
- fish.

Process/Skill Questions

- How are animal pests controlled?
- What symptoms indicate animal pest damage to plants?
- What are the most common animal pests found in Virginia?
- What is the economic impact of animal pests on Virginia's agriculture industry?
- How does urban sprawl contribute to animal-pest problems?

The National Council for Agricultural Education: Agriculture, Food and Natural Resources Content Standards

PS.03.02. Develop and implement a management plan for plant production.

PS.03.03. Develop and implement a plan for integrated pest management for plant production.

Task Number 83

Explain controls of plant pests.

Definition

Explanation should include

- integrated pest management
- mechanical, biological, chemical, environmental, and cultural controls
- economic threshold.

Process/Skill Questions

- What is integrated pest management?

- What are the different types of control methods?
- How do agriculturists decide which control method to use?
- What are some examples of biological control?
- What cultural methods are used in pest control?

The National Council for Agricultural Education: Agriculture, Food and Natural Resources Content Standards

PS.03.02. Develop and implement a management plan for plant production.

PS.03.03. Develop and implement a plan for integrated pest management for plant production.

Task Number 84

Interpret the information on a pesticide label.

Definition

Interpretation should include instructions on

- personal protective equipment (PPE) requirements
- ingredients--inert and active
- storage and disposal methods
- first-aid responses
- directions for use.

Process/Skill Questions

- What information should be on a pesticide label?
- What is an active ingredient?
- What personal precautions should you take when applying pesticide?
- What are the signal words found on pesticide labels?
- What are the standard first-aid responses to pesticide exposure?

The National Council for Agricultural Education: Agriculture, Food and Natural Resources Content Standards

PS.03.03. Develop and implement a plan for integrated pest management for plant production.

Task Number 85

Identify the application of different types of pesticides.

Definition

Identification should include

- fumigant
- formula-based types
 - emulsifiable concentrate
 - granular
 - dust
 - wettable powder
 - soluble powder
 - ready-to-use
- types of pesticide application equipment
- safety precautions for the various types of equipment.

Process/Skill Questions

- How are different types of pesticides applied?
- How do you determine which application method to use?
- What are the advantages and disadvantages of each application method?
- What types of pesticide application equipment are available?
- What procedures should be followed when using various application methods?

The National Council for Agricultural Education: Agriculture, Food and Natural Resources Content Standards

PS.03.03. Develop and implement a plan for integrated pest management for plant production.

Using Basic Scientific Skills and Principles in Plant Selection

Task Number 86

Identify USDA plant hardiness zones and how the different zones affect plant selection.

Definition

Identification should include

- determining local zone(s)
- discussing the factors that create USDA hardiness zones
- reading a plant/seed tag to evaluate suitability for planting in a specific zone.

Process/Skill Questions

- What is a hardiness zone?
- What other factors need to be considered during plant selection?
- How does the plant hardiness zone impact the plants you can grow?

The National Council for Agricultural Education: Agriculture, Food and Natural Resources Content Standards

PS.01.01. Determine the influence of environmental factors on plant growth.

PS.03.04. Apply principles and practices of sustainable agriculture to plant production.

Task Number 87

Explain the importance of plant taxonomy.

Definition

Explanation should include classifying plants by kingdom, phylum, class, order, family, genus, species, variety, and cultivar.

Process/Skill Questions

- What is taxonomy?
- Why is taxonomy important?
- What are the components of plant taxonomy?

The National Council for Agricultural Education: Agriculture, Food and Natural Resources Content Standards

PS.02.01. Classify plants according to taxonomic systems.

Task Number 88

Evaluate the common tree species of Virginia.

Definition

Evaluation should include

- identification of species
- classification of tree species (e.g., native, non-native, invasive, ornamental)
- growth requirements
- measurement of species
- overall uses
- economic impact.

Process/Skill Questions

- What are the major uses of trees grown in Virginia?
- What does each require for optimal growth?
- How do management techniques vary for ornamental vs. forest tree species?
- What are differences between native, non-native, and invasive tree species?

The National Council for Agricultural Education: Agriculture, Food and Natural Resources Content Standards

PS.02.01. Classify plants according to taxonomic systems.

Task Number 89

Evaluate the common species of agronomic plants grown in Virginia.

Definition

Evaluation should include

- identification of species
- growth requirements
- overall uses
- economic impact.

Process/Skill Questions

- What products are made from Virginia's agronomic crops?
- What is the economic impact of Virginia's agronomic crops?
- What are examples of agronomic crops specific to Virginia's physiographic regions?

The National Council for Agricultural Education: Agriculture, Food and Natural Resources Content Standards

PS.02.01. Classify plants according to taxonomic systems.

Task Number 90

Evaluate the common species of fruits and vegetables grown in Virginia.

Definition

Evaluation should include

- identification of species
- growth requirements
- overall uses
- economic impact.

Process/Skill Questions

- What are some alternative market outlets for Virginia's fruits and vegetables?
- How has the economic impact of fruits and vegetables changed in recent years?

The National Council for Agricultural Education: Agriculture, Food and Natural Resources Content Standards

PS.02.01. Classify plants according to taxonomic systems.

Task Number 91

Evaluate the common species of nursery and landscape horticulture plants grown in Virginia.

Definition

Evaluation should include

- identification of species
- growth requirements
- overall uses
- economic impact.

Process/Skill Questions

- What are non-native plants, and when are they used?
- What environmental requirements are needed to grow common species of nursery horticulture plants grown in Virginia?

**The National Council for Agricultural Education: Agriculture, Food and Natural Resources
Content Standards**

PS.02.01. Classify plants according to taxonomic systems.

Task Number 92

Evaluate the common species of turfgrasses grown in Virginia.

Definition

Evaluation should include

- identification of species
- growth requirements
- overall uses
- economic impact.

Process/Skill Questions

- What are factors that determine turfgrass selection? Turf seed selection?
- How do mowing practices affect turf quality?
- What are common practices for turf establishment?
- What are the differences between warm- and cool-season grasses?
- What are examples of warm-season grasses? Cool-season grasses?

**The National Council for Agricultural Education: Agriculture, Food and Natural Resources
Content Standards**

PS.02.01. Classify plants according to taxonomic systems.

Task Number 93

Evaluate the common species of floriculture crops grown in Virginia.

Definition

Evaluation should include

- identification of species
- growth requirements
- overall uses
- economic impact.

Process/Skill Questions

- What purpose do floriculture crops serve?
- What environmental requirements are needed to grow floriculture crops in Virginia?
- What specialized equipment is needed to grow floriculture crops in Virginia?

The National Council for Agricultural Education: Agriculture, Food and Natural Resources Content Standards

PS.02.01. Classify plants according to taxonomic systems.

Incorporating Mechanical Skills as Related to the Plant Systems Pathway

Task Number 94

Demonstrate safety procedures in various areas associated with agricultural mechanics in plant systems.

Definition

Demonstration should include

- explanation of
 - safety rules as applied to tools and equipment
 - basic fire safety
 - basic lab safety
 - safe lifting techniques
- 100 percent achievement on state/local safety test
- proper identification and use of tools and equipment
- adherence to housekeeping standards.

Process/Skill Questions

- Why is it important to have every student achieve 100 percent on the state/local safety test?
- What are some examples of basic housekeeping standards?
- What is the appropriate procedure for selecting and using a fire extinguisher?
- What do the colors in the safety color-coding system indicate relative to the degree of hazard?

The National Council for Agricultural Education: Agriculture, Food and Natural Resources Content Standards

PS.03.05. Harvest, handle, and store crops according to current industry standards.

PST.01.02. Apply physical science and engineering principles to design, implement, and improve safe and efficient mechanical systems in AFNR situations.

Task Number 95

Demonstrate equipment safety and operation as they relate to the Plant Systems pathway.

Definition

Demonstration should include

- using PPE
- using language, symbols, and procedures related to the operation of equipment
- operating approved equipment.

Process/Skill Questions

- What is PPE?
- Why are symbols used for the operation of equipment?
- Where can you find the safety rules for using the equipment at your school?

The National Council for Agricultural Education: Agriculture, Food and Natural Resources Content Standards

PS.03.05. Harvest, handle, and store crops according to current industry standards.

PST.01.02. Apply physical science and engineering principles to design, implement, and improve safe and efficient mechanical systems in AFNR situations.

Task Number 96

Demonstrate standard measurement techniques in plant systems.

Definition

Demonstration may include

- accurately 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 measurement techniques are frequently used in plant science?
- Why is it important to be able to use conversion factors?

The National Council for Agricultural Education: Agriculture, Food and Natural Resources Content Standards

PS.03.01. Demonstrate plant propagation techniques in plant system activities.

PS.03.02. Develop and implement a management plan for plant production.

PS.03.03. Develop and implement a plan for integrated pest management for plant production.

PS.03.05. Harvest, handle, and store crops according to current industry standards.

Task Number 97

Demonstrate drawing for agricultural mechanics as it relates to the Plant Systems pathway.

Definition

Demonstration may include

- identifying and selecting equipment and supplies for drawing
- drawing views of objects and landscaping plans
- drawing a laboratory project plan
- exploring Computer-Aided Design (CAD) programs.

Process/Skill Questions

- What views of objects can be drawn?
- What are the steps in drawing an object?
- What is the purpose of a project plan?
- What CAD programs are used in plant sciences?
- What are the advantages of using CAD programs?

The National Council for Agricultural Education: Agriculture, Food and Natural Resources Content Standards

PS.04.01. Evaluating, identifying, and preparing plants to enhance an environment.

PS.04.02. Create designs using plants.

Task Number 98

Examine metalworking operations as they relate to the Plant Systems pathway.

Definition

Examination may include

- identifying metals by physical properties
- identifying metalworking tools, equipment, and supplies
- identifying the processes involved in changing the physical property of metals
- identifying and selecting tools, equipment, and supplies for tool fitting
- reconditioning an agricultural mechanics tool
- identifying arc and gas welding tools, equipment, and supplies
- using the arc and gas welding equipment properly
- explaining the procedures for down-hand welding
- estimating a bill of materials
- constructing an approved metalworking project
- preparing and properly applying finish.

Process/Skill Questions

- How is metalworking used in agriculture?
- What safety measures must be taken when working with metals?
- What steps are involved in changing the physical property of metals?
- What are the appropriate procedures for each application of tool fitting?
- What are the steps involved in reconditioning an agricultural mechanical tool?
- Why is tool reconditioning important?
- What safety precautions should be taken when arc welding?
- What steps should be followed when arc welding?
- What safety precautions should be taken when gas welding?
- What is the procedure for correctly performing down-hand welding?
- What steps are involved in constructing a metalworking project?

The National Council for Agricultural Education: Agriculture, Food and Natural Resources Content Standards

PST.01.03. Apply physical science principles to metal fabrication using a variety of welding and cutting processes (e.g., SMAW, GMAW, GTAW, fuel-oxygen and plasma arc torch, etc.).

Task Number 99

Examine woodworking operations as they relate to the Plant Systems pathway.

Definition

Examination may include

- identifying and using hand tools/hand-power tools, woodworking tools, and supplies
- selecting and using wood fasteners
- estimating a bill of materials
- constructing an agricultural woodworking project, using hand tools/hand-power tools
- preparing and properly applying finishes.

Process/Skill Questions

- What safety precautions apply to the use of hand tools/hand-power tools? Woodworking tools?
- What types of wood fasteners are available?
- What are the steps in estimating a bill of materials?
- What is the purpose of a bill of materials in a project plan?
- What are the steps in constructing a woodworking project?

The National Council for Agricultural Education: Agriculture, Food and Natural Resources Content Standards

PST.04.03. Follow architectural and mechanical plans to construct, maintain, and/or repair AFNR structures (e.g., material selection, site preparation and/or layout, plumbing, concrete/masonry, etc.).

Task Number 100

Examine electrical operations as they relate to the Plant Systems pathway.

Definition

Examination may include

- explaining the principles, language, and symbols of electricity
- using tools and equipment related to electricity
- using calculations related to electricity
- constructing an approved electrical project.

Process/Skill Questions

- What are the tools used in electrical work?
- What electricity projects would relate to the plant industry?
- How are watts, volts, and amperes calculated?
- What is Ohm's law?
- How does Ohm's law apply to electricity?
- What is the proper depth to bury underground wiring?
- What class of wire or cable should be used for underground use?
- Why is contacting Miss Utility Virginia essential before excavating?

The National Council for Agricultural Education: Agriculture, Food and Natural Resources Content Standards

PST.04.03. Follow architectural and mechanical plans to construct, maintain, and/or repair AFNR structures (e.g., material selection, site preparation and/or layout, plumbing, concrete/masonry, etc.).

PST.04.04. Apply electrical wiring principles in AFNR structures.

Task Number 101

Examine small-engine operations as they relate to the Plant Systems pathway.

Definition

Examination may include

- explaining the principles, language, and theory of small engines
- explaining the safety measures that should be followed and the PPE that should be used when repairing small engines
- using tools and equipment related to small engines
- completing an approved small-engine project (e.g., troubleshooting, maintaining, servicing).

Process/Skill Questions

- What are the symbols used in small-engine work?
- What are the tools used in small-engine work?
- What small-engine projects would relate to the Plant Systems pathway?
- Why is an annual engine maintenance program important?

The National Council for Agricultural Education: Agriculture, Food and Natural Resources Content Standards

PST.02.01. Perform preventative maintenance and scheduled service to maintain equipment, machinery, and power units used in AFNR settings.

PST.03.01. Troubleshoot, service, and repair components of internal combustion engines using manufacturers' guidelines.

Task Number 102

Examine plumbing operations as they relate to the Plant Systems pathway.

Definition

Examination may include

- explaining the principles, language, and symbols of plumbing
- explaining the safety measures that should be followed when conducting plumbing operations
- using tools and equipment related to plumbing
- using calculations related to plumbing
- completing an approved plumbing project.

Process/Skill Questions

- What are the tools used in plumbing work?
- What plumbing projects would relate to the Plant Systems pathway?

The National Council for Agricultural Education: Agriculture, Food and Natural Resources Content Standards

PST.04.03. Follow architectural and mechanical plans to construct, maintain, and/or repair AFNR structures (e.g., material selection, site preparation and/or layout, plumbing, concrete/masonry, etc.).

SOL Correlation by Task

39	Identify the role of supervised agricultural experiences (SAEs) in agricultural education.	English: 9.3, 9.5, 10.3, 10.5
40	Participate in an SAE.	English: 9.5, 9.8, 10.5, 10.8
41	Identify the benefits and responsibilities of FFA membership.	English: 9.5, 9.6, 9.7, 9.8, 10.5, 10.6, 10.7, 10.8
42	Describe leadership characteristics and opportunities as they relate to agriculture and FFA.	English: 9.5, 10.5 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: 9.5, 10.5
44	Explain the characteristics of plants.	English: 9.5, 10.5 History and Social Science: WG.2 Science: BIO.4c
45	Illustrate the importance of plant systems in relation to humans.	History and Social Science: WG.2 Science: BIO.8a, BIO.8b
46	Classify the major divisions of the plant systems.	English: 9.5, 10.5 History and Social Science: WG.2 Science: BIO.6
47	Evaluate the effect of light on plants.	Science: BIO.1, BIO.2d
48	Evaluate the effect of temperature on plants.	Science: BIO.1, BIO.4b
49	Evaluate the effect of water on plants.	Science: BIO.1, BIO.4b
50	Evaluate the effect of carbon dioxide (CO ₂), oxygen, and air flow on plants.	Science: BIO.1, BIO.4b, BIO.8b
51	Evaluate types and components of greenhouses and plant structures.	
52	Identify major plant parts and their functions.	English: 9.5, 10.5 Science: BIO.4c
53	Explain the life-sustaining processes by which all plants grow and develop.	English: 9.5, 10.5 Science: BIO.2d
54	Explain the process of osmosis.	English: 9.5, 10.5 Science: BIO.3d
55	Describe the life cycles and classifications of plants.	English: 9.5, 10.5 Science: BIO.6
56	Examine the advantages and disadvantages of sexual propagation in the production of new plants.	English: 9.5, 10.5 Science: BIO.5a, BIO.5f
57	Describe how to collect seeds from different types of plants.	English: 9.5, 10.5 Science: BIO.1a
58	Explain how new plant varieties can be bred/hybridized.	English: 9.5, 10.5 Science: BIO.5c, BIO.5d, BIO.5f
59	Plant seeds using various methods.	
60	Analyze scarification and stratification methods that aid in the propagation process.	English: 9.3, 9.5, 10.3, 10.5
61	Describe the germination process.	English: 9.5, 10.5 Science: BIO.5a, BIO.5c

62	Calculate the germination rates of seeds.	Science: BIO.1d
63	Demonstrate how to transplant seedlings.	
64	Examine the advantages and disadvantages of asexual propagation in the production of plants.	English: 9.5, 10.5 Science: BIO.5a, BIO.5f
65	Demonstrate how to produce plants through cuttings.	Science: BIO.1a, BIO.1h
66	Demonstrate how to produce plants by layering.	Science: BIO.1a, BIO.1h
67	Demonstrate how to produce plants through division and separation.	Science: BIO.1a, BIO.1h
68	Describe grafting and budding techniques for woody and herbaceous plants.	English: 9.5, 10.5 Science: BIO.1a, BIO.1h
69	Describe how to produce plants through micropropagation.	Science: BIO.1a, BIO.1h
70	Evaluate the cultural practices for vegetable crops grown in a greenhouse.	English: 9.5
71	Evaluate the physical properties of soil and growing media.	Science: ES.1a, ES.8a
72	Amend growing media for plant growth.	Science: ES.8a
73	Collect a soil sample for evaluation.	
74	Analyze soil sample for nutrients and pH.	Science: BIO.1h, BIO.1i, ES.1a, ES.1b
75	Describe hydroponic plant production.	English: 9.5, 10.5
76	Evaluate the effects of macronutrients on plant production.	English: 9.5, 10.5 Science: BIO.2, BIO.1h, BIO.1i
77	Evaluate plants for nutrient deficiencies.	English: 9.5, 10.5 Science: BIO.8b
78	Describe fertilizer application methods.	English: 9.5, 10.5 Science: BIO.1h
79	Classify the common types of insects that affect plant growth in Virginia.	English: 9.3, 9.5, 10.3, 10.5 Science: BIO.6, BIO.8a
80	Classify the common types of diseases that affect plant growth in Virginia.	English: 9.5, 10.5
81	Classify the common types of weeds that affect plant growth in Virginia.	English: 9.3, 9.5, 10.3, 10.5 Science: BIO.6, BIO.8e
82	Classify types of animal pests that affect plant growth in Virginia.	English: 9.5, 10.5 Science: BIO.6, BIO.8e
83	Explain controls of plant pests.	English: 9.5, 10.5
84	Interpret the information on a pesticide label.	Science: BIO.1
85	Identify the application of different types of pesticides.	Science: BIO.1h
86	Identify USDA plant hardiness zones and how the different zones affect plant selection.	Science: BIO.1m
87	Explain the importance of plant taxonomy.	English: 9.5, 10.5

		Science: BIO.6
88	Evaluate the common tree species of Virginia.	Science: BIO.8a
89	Evaluate the common species of agronomic plants grown in Virginia.	Science: BIO.8e
90	Evaluate the common species of fruits and vegetables grown in Virginia.	Science: BIO.8e
91	Evaluate the common species of nursery and landscape horticulture plants grown in Virginia.	Science: BIO.8e
92	Evaluate the common species of turfgrasses grown in Virginia.	Science: BIO.8e
93	Evaluate the common species of floriculture crops grown in Virginia.	Science: BIO.8e
94	Demonstrate safety procedures in various areas associated with agricultural mechanics in plant systems.	History and Social Science: GOVT.16
95	Demonstrate equipment safety and operation as they relate to the Plant Systems pathway.	History and Social Science: GOVT.16
96	Demonstrate standard measurement techniques in plant systems.	
97	Demonstrate drawing for agricultural mechanics as it relates to the Plant Systems pathway.	
98	Examine metalworking operations as they relate to the Plant Systems pathway.	Science: CH.2h
99	Examine woodworking operations as they relate to the Plant Systems pathway.	
100	Examine electrical operations as they relate to the Plant Systems pathway.	Science: PH.11
101	Examine small-engine operations as they relate to the Plant Systems pathway.	Science: PH.5g, PH.11c
102	Examine plumbing operations as they relate to the Plant Systems pathway.	

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](#).

The following leadership development events are available for this course:

- [Agricultural Issues](#)
- [Conduct of Chapter Meetings](#)
- [Creed Speaking](#)
- [Employment Skills](#)
- [Extemporaneous Public Speaking](#)
- [Parliamentary Procedure](#)

- [Prepared Public Speaking](#)

The following career development events are available for this course:

- [Agricultural Technology and Mechanical Systems](#)
- [Agronomy](#)
- [Floriculture](#)
- [Forestry](#)
- [Nursery/Landscape](#)

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

- Agricultural Biotechnology Assessment
- BASF Plant Science Certification Examination
- College and Work Readiness Assessment (CWRA+)
- Customer Service Specialist (CSS) Examination
- Floriculture: Greenhouse Assessment
- 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)
- Agricultural Production Technology (8010/36 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)
- Biotechnology Foundations in Health and Medical Sciences (8344/36 weeks)
- Ecology and Environmental Management (8045/18 weeks)
- Ecology and Environmental Management (8046/36 weeks)
- Floral Design I (8055/36 weeks)
- Floral Design II (8056/36 weeks)
- Floriculture (8038/36 weeks)
- Forestry Management (8042/36 weeks)
- Foundations of Agriculture, Food, and Natural Resources (8006/36 weeks)
- Greenhouse Plant Production and Management (8035/36 weeks)
- Horticulture Sciences (8034/36 weeks)
- Landscaping I (8036/36 weeks)
- Landscaping II (8039/36 weeks)
- Livestock Production Management (8012/36 weeks)
- Operating the Farm Business (8014/36 weeks)
- Turfgrass Management (8051/36 weeks)
- Turfgrass Management, Advanced (8054/36 weeks)

Career Cluster: Agriculture, Food and Natural Resources	
Pathway	Occupations
Agribusiness Systems	Agricultural Commodity Broker Agricultural Economist

Career Cluster: Agriculture, Food and Natural Resources	
Pathway	Occupations
	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	Agricultural Products Sales Representative Environmental Compliance Inspector Environmental Sampling and Analysis Technician Hazardous Materials Handler Secondary School Teacher Toxicologist Turf Farmer Water Conservationist
Food Products and Processing Systems	Biochemist Food Scientist
Natural Resources Systems	Ecologist Forest Manager, Forester Forest Technician Microbiologist Outdoor Recreation Guide Park Manager Park Technician Range Technician Wildlife Manager
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 Golf Course Superintendent Nursery and Greenhouse Manager Ornamental Horticulturist Plant Breeder/ Geneticist Secondary School Teacher Soil and Plant Scientist Tree Surgeon Turf Farmer
Power, Structural, and Technical Systems	Agricultural Engineer Agricultural Equipment Parts Manager Agricultural Equipment Parts Salesperson