Arkansas CTE

Biological Plant Science: Grades 10, 11, 12

Adopted 2006

Biological Science in Our Lives

1.1 Define terms

1.2 Discuss areas of science that are a part of the biological plant sciences

1. List and differentiate areas of the biological plant sciences to include biology and botany as well as those in agriculture (agronomy, horticulture, forestry, soil, entomology, and others) 1.2.1
2. Review college offerings (catalog or online) in areas of the biological plant sciences to determine the nature of the subjects and educational opportunities 1.2.2

1.3 Identify ways in which the biological plant sciences affect our everyday lives

1. Collect magazine and newspaper articles related to the topic 1.3.1
2. Prepare a poster or bulletin board that depicts the biological plant sciences in our lives 1.3.2
3. Plan an experiment that involves the plant biological sciences 1.3.3

1.4 List career opportunities in the plant biological sciences

1. Research a career in the plant biological sciences to determine educational requirements, working conditions, and salary 1.4.1
2. Prepare a written report on a career in the plant biological sciences 1.4.2
3. Provide an oral report on a career in the plant biological sciences 1.4.3
4. Create a current, business-style resume 1.4.4

1.5 Discuss FFA and supervised experience opportunities for students interested in the plant biological sciences

1. Use the Official FFA Manual, National FFA Organization Web site, and other resources to identify opportunities 1.5.1
2. Plan and/or expand supervised experience to include areas of the biological plant sciences 1.5.2
3. Shadow a plant scientist in his or her work for a day 1.5.3
4. Keep appropriate records of all activities 1.5.4

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Safety in the Biological Plant Sciences

2.1 Define terms

2.2 Discuss the meaning and importance of safety and safe work in the biological plant sciences

1. Relate examples of safety hazards in the biological plant sciences 2.2.1
2. Identify plant allergies and the precautions to follow to minimize risk 2.2.2

2.3 Identify hazards in the biological plant sciences

1. Identify hazardous situations in the biological plant sciences and implement appropriate safety measures to eliminate or reduce the risk of the hazards 2.3.1
2. Identify laboratory risks and take actions to minimize the hazards 2.3.2

2.4 Describe the importance of personal safety in the biological plant sciences

1. Identify and properly use appropriate PPE, including protective clothing and safety footware 2.4.1
2. Calculate the cost of PPE for an individual involved in the biological plant sciences 2.4.2
3. Work together with others to promote safety in the biological plant sciences 2.4.3
4. Take a test that documents an understanding of safety in the biological plant sciences 2.4.4

Conducting Experiments and Research

3.1 Define terms

3.2 Discuss procedures in conducting experimental research

1. Practice writing and interpreting hypotheses in areas of the biological plant sciences 3.2.1
2. Plan an experiment in the biological plant sciences that specifies objectives for the research 3.2.2
3. Plan an experiment in the biological plant sciences identifying experimental and control groups 3.2.3
4. Identify and practice using appropriate personal protective safety equipment for laboratory experiments 3.2.4
5. Conduct an experiment using a microscope, test tube, beaker, balance/digital scales, and petri dish 3.2.5
6. Review a report of experimental research and locate these steps in that research 3.2.6

3.3 Explain how the research process is applied to lab and field experiments

1. Conduct a simple experiment following approved methods 3.3.1
2. Observe safety practices in the conduct of experiments 3.3.2
3. Identify appropriate experiments with plants 3.3.3

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4. Identify appropriate measurements for the experiment 3.3.4

3.4 Discuss the collection of data

1. Collect and record data in a log book or appropriate computer program 3.4.1
2. Compile, tabulate, and analyze data to draw meaning from the experiment 3.4.2

Summarizing and Reporting Research

4.1 Define terms

4.2 Explain the difference between findings, conclusions, and recommendations

1. Review a report of experimental research and identify the findings, conclusions, and recommendations 4.2.1
2. Note the treatment of data, including tables and graphs 4.2.2
3. Explain why a report must stay within the findings of an experiment and not go beyond what was observed 4.2.3

4.3 Discuss the components and preparation of a research report

1. Identify the major parts of a research report 4.3.1
2. Prepare a research paper on the experiment from Unit 3 following appropriate style 4.3.2
3. Demonstrate the correct use of tables, graphs, and other approaches to illustrate findings 4.3.3
4. Construct a bibliography/reference page, table of contents, and title page for a research report 4.3.4
5. Produce a professionally-appearing report using computer word processing 4.3.5
6. Bind the report to have a professional document 4.3.6

Plant Genetics and Heritability

5.1 Define terms

5.2 Discuss the role and importance of genetics and heritability in the biological plant sciences

1. Identify traits in plants that grow in the local area that reflect dominant and recessive traits 5.2.1
2. Investigate how dominant and recessive genes affect the characteristics of plants 5.2.2

5.3 Illustrate the importance of the various plant breeding schemes

1. Conduct research to determine how cross pollination and selective breeding influence color, size, and fruit and flower quality 5.3.1
2. Investigate positive and negative aspects of various plant breeding schemes 5.3.2

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5.4 Explain how genetic principles are used to improve agricultural production

1. Identify local ornamental and agronomic crops that are planted with seeds of improved varieties 5.4.1
2. Investigate the use of asexual reproduction to have desired qualities that may not result through genetics 5.4.2

Plant Growth Processes

6.1 Define terms

6.2 Discuss processes and requirements for plant growth

1. Explain the process of nitrogen fixation in legumes 6.2.1
2. Examine the roots of legume plants that grow in the local area for the presence of nodules 6.2.2
3. Investigate the role of plant systems in life processes and requirements 6.2.3
4. Investigate the purposes and methods of seed inoculation 6.2.4
5. Inoculate a sample of seed 6.2.5
6. Compare nodule formation on roots of inoculated legumes with roots of plants from non-inoculated seeds 6.2.6
7. Explore the meaning and importance of plant tropisms 6.2.7

6.3 Discuss plant anatomy and physiology

1. Identify the external parts of plants and give the major functions of each 6.3.1
2. Explore the internal structure of a plant by dissecting cross-sections of leaves, stems, and roots; identify the structures that are observed 6.3.2
3. Indicate the major physiological processes of plants and how these processes support plant growth and productivity 6.3.3
4. Investigate the roles of translocation, photosynthesis, respiration, and transpiration in plant productivity 6.3.4

Plant Reproduction

7.1 Define terminology

1. List advantages and disadvantages of sexual and asexual reproduction 7.1.1

7.2 Discuss the meaning and use of sexual and asexual plant reproduction

1. List advantages and disadvantages of sexual and asexual reproduction 7.2.1
2. Identify examples in the local community, school greenhouse, or other location of the use of sexual and asexual plant reproduction 7.2.2

7.3 Describe plant parts and processes involved in sexual reproduction

1. Label the parts of a flower on a line drawing 7.3.1
2. Dissect a flower to determine major parts 7.3.2
3. Distinguish between complete and incomplete flowers 7.3.3
4. Explain pollination and relate its role in sexual reproduction 7.3.4

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7.4 Discuss the meaning and importance of seed viability

1. Calculate germination percentages of seed samples using the rag doll or other method 7.4.1
2. Store and otherwise handle seed to maintain viability 7.4.2
3. Determine proper seeding depth and rate for efficient germination and economical plant production 7.4.3

7.5 Discuss the common methods of asexual plant propagation

1. Identify plant species most readily asexually propagated 7.5.1
2. Explain how cuttings are used in propagation and demonstrate the procedure for taking and placing cuttings 7.5.2
3. Demonstrate the steps involved in budding 7.5.3
4. Demonstrate the steps involved in grafting 7.5.4
5. Demonstrate other methods of asexual plant propagation including air layering and dividing 7.5.5

Hydroponics Systems

8.1 Define terms

8.2 Discuss the meaning and use of hydroponics

1. Explain how plants are produced using hydroponics 8.2.1
2. List advantages and disadvantages of hydroponics 8.2.2
3. Create a plan for a hydroponics growing area 8.2.3
4. Identify plants most often produced using hydroponics 8.2.4

8.3 Identify the various types of hydroponics systems

1. Write a paper comparing and contrasting ebb and flow, nutrient film technique/NGT, media-based system, and aeroponic types of hydroponics systems 8.3.1

8.4 Explain the need/importance of using hydroponics

1. Make an oral presentation on the uses of hydroponics products 8.4.1
2. Tend plants being produced in a hydroponics system in the school greenhouse or local community 8.4.2

Plant Tissue Culture

9.1 Define terms

9.2 Explain the meaning and techniques used in tissue culture

1. List plant species most commonly propagated using tissue culture 9.2.1
2. Use tissue culture to propagate a plant 9.2.2
3. Assess the role of asepsis in tissue culture 9.2.3

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9.3 Identify the advantages and disadvantages of tissue culture

1. Prepare a poster that lists advantages and disadvantages of tissue culture `9.3.1`

9.4 Discuss the sterile technique

1. Establish a work environment that promotes asepsis `9.4.1`

9.5 Describe processes used in tissue culturing

1. List the steps in tissue culture on a poster `9.5.1`
2. Demonstrate the process of tissue culture using a plant species that is commonly propagated using tissue culture `9.5.2`
3. Care for tissue cultures to assure liveability and productivity `9.5.3`
4. Calculate the number of explants potentially produced for a given period of time `9.5.4`
5. Determine the number of explants needed to reach a desired production level `9.5.5`

Biological Engineering

10.1 Define terms

10.2 Discuss the meaning and process of genetic engineering

1. Explain the basic method of gene transfer `10.2.1`
2. Observe gene transfer used in science applications, including the particle gun and bacterial insertion `10.2.2`
3. Identify the advantages and disadvantages of genetic engineering `10.2.3`
4. Debate the advantage or disadvantage of most consequence `10.2.4`

10.3 Identify and investigate issues associated with genetic engineering

1. Make a survey of students to determine their opinions about genetic engineering `10.3.1`
2. Debate the issues associated with genetic engineering `10.3.2`

Plants and Chemicals

11.1 Define terms

11.2 Explain the use and meaning of integrated pest management (IPM)

1. Research and prepare an oral report on integrated pest management `11.2.1`
2. Identify pest management alternatives using IPM `11.2.2`
3. Investigate the role of IPM in reducing the release of chemical substances into the environment `11.2.3`

11.3 Discuss the role and importance of chemical products in the biological plant sciences

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1. List chemical products used in plant production, including insecticide, herbicide, fungicide, and growth regulator including defoliant `11.3.1`
2. Explain the reasons chemical products are used in plant production `11.3.2`
3. Identify a pest, and select the appropriate pest management approach `11.3.3`

11.4 Explain various modes of action for pesticides

1. Observe the effect of different herbicides on plants `11.4.1`

11.5 List and identify common plant hormones and growth regulators

1. Compare the effects of different growth regulators on plants `11.5.1`