

Lesson A8–1

Determining the Use of Technology in World Food and Fiber Production

Unit A. Mechanical Systems and Technology

Problem Area 8. Technology Systems

Lesson 1. Determining the Use of Technology in World Food and Fiber Production

New Mexico Content Standard:

Pathway Strand: Power, Structural and Technical Systems

Standard: XI: Explain geospatial technology to demonstrate its applications.

Benchmark: XI-A: Employ appropriate techniques to demonstrate application of GIS/GPS systems principles.

Performance Standard: 1. Explain the concept and principles. 2. Describe equipment. 3. List techniques used. 4. Explain the application of GIS/GPS systems with map development output.

Student Learning Objectives. Instruction in this lesson should result in students achieving the following objectives:

1. Explain agricultural technology.
2. Describe technology as it relates to machinery, plants, and animals.
3. Describe the role of computers in agriculture/horticulture.
4. Explain precision farming and its impact on agriculture.

List of Resources. The following resources may be useful in teaching this lesson:

Recommended Resources. One of the following resources should be selected to accompany this lesson:

Cooper, Elmer E. *Agriscience Fundamentals and Applications*. Albany, New York: Delmar Publishers, 1997. (Textbook, Unit 33)

Morgan, Elizabeth, et al. *AgriScience Explorations*, Third Edition. Upper Saddle River, New Jersey: Prentice Hall Interstate, 2004. (Textbook, Chapters 3 and 13)

Other Resources. These resources may be useful to teachers and students:

Lee, Jasper S., and Diana L. Turner. *AgriScience*, Third Edition. Danville, Illinois: Interstate Publishers, Inc., 2003. (Textbook)

Herren. *Exploring Agriscience*. Albany, New York: Delmar Publishers, 1997. (Textbook)

List of Equipment, Tools, Supplies, and Facilities

Writing surface
Overhead projector
Transparencies from attached master

Terms. The following terms are presented in this lesson (shown in bold italics):

Agricultural technology
Aquaculture
Bovine somatotropin (bST)
Biological control
Cloning
Computer
Genetic engineering
Geographic information system (GIS)
Global positioning system (GPS)
Harvester
Herbicide
Hormone
Hybridization
Insecticide
Mass selection
Mechanical technology
Pest
Pesticide
Planter
Plow

Precision farming
Robot
Technology
Transgenic
Variable rate technology (VRT)
Weeds

Interest Approach. Use an interest approach that will prepare the students for the lesson. Teachers often develop approaches for their unique class and student situations. One possible approach is given here.

Have students break into small groups of two or three students. Have each group come up with an invention for the future of agriculture. They should provide an explanation for why it is needed and how it will be used in the agriculture industry. They should specify its advantages and disadvantages. Have each group make a presentation to the rest of the class. Have the class vote on whether the invention should be manufactured or not.

Summary of Content and Teaching Strategies

Objective 1: Explain agricultural technology.

Anticipated Problem: What is agricultural technology?

- I. **Technology** is the use of inventions in working and living. **Agricultural technology** is the technology used in agriculture. Most agricultural technology is based on science. Agricultural technology has resulted in many new ways of producing food, clothing, and shelter. Technology has brought about many advantages in agriculture.
 - A. Technology makes work easier.
 - B. Technology increases productivity.
 - C. Technology increases the standard of living.

Provide students with copies of the suggested references. Have them read Chapter 13 in AgriScience Explorations. Use the classroom writing surface to define technology and outline the advantages of technology in agriculture.

Objective 2: Describe technology as it relates to machinery, plants, and animals.

Anticipated Problem: How does technology relate to machinery, plants, and animals?

- II. Technology has dramatically influenced the use of machinery in agriculture and the production of better plants and animals.

- A. **Mechanical technology** is using physical force to do work. Devices are used to pull, push, or rotate objects.
1. A **plow** is a tool that loosens the soil. Thomas Jefferson used mathematics to study the designs of plows. His findings were released in 1793. The heavy soils of the Midwest required a plow that would run the soil and not quickly wear out. John Deere of Illinois developed the first steel plow in 1837.
 2. A **planter** is a device that places seed in the soil. Many planters operate at high speeds, covering the seeds with the right amount of soil.
 3. A **harvester** gathers or picks crops. A major advancement in grain harvesting was made by Cyrus McCormick of Virginia. He built the first reaper in 1834. Many improvements have been made since then. Today, the reaper is a combine that can harvest many acres of grain a day.
- B. Plant technology has been widely used to raise improved products and produce plants that meet certain needs.
1. Gregor Mendel studied the heredity of peas in an Austrian garden in the mid-1800s. He concluded that traits are passed from one generation to another.
 2. **Mass selection** is saving seed from the best plants. In the mid-1900s hybridization began. **Hybridization** involves cross-breeding plants to combine the highest quality traits from each breed.
 3. Pest control technology has improved the quality of many agriculture products. A **pest** is anything that causes injury to animals, plants, or property. Pests may include insects, diseases, or weeds. **Weeds** are plants that grow in an unwanted place.
 - a. Pesticides have made great strides from scientific research. A **pesticide** is a substance that controls pests. A pesticide can be a chemical or biological control.
 - (1) **Biological control** involves using living organisms to control pests.
 - (2) A **herbicide** is a chemical used to control weeds.
 - (3) An **insecticide** is a chemical substance used to control insect pests.
 - b. Some plant varieties are being altered to resist pests. An example is Bt corn. A gene from the *Bacillus Thuringensis* bacteria has been transferred into the corn, resulting in corn that is resistant to the corn borer. The corn produces its own pesticide.
 4. Cloning and genetic engineering are being used in plant production and improvement.
 - a. **Cloning** is making two or more organisms out of one using tissue.
 - b. **Genetic engineering** is artificially changing the genetic makeup of an organism.
 - (1) Genes are transferred from one organism to another.
 - (2) The resulting plant is transgenic. **Transgenic** means that the organism has genes from two different species of organisms.
 - (3) A practical example of genetic engineering is the development of Roundup Ready corn and soybeans.
- C. Technology has dramatically influenced the production of animals.

1. New developments with fish have created a new area for agriculture, called aquaculture. **Aquaculture** is the production of fish or plants for human consumption.
2. Some animals are given hormones to increase productivity. A **hormone** is a substance produced by an organism that has a specific effect on the organism's growth or behavior. **Bovine somatotropin (bST)** is a hormone that can be given to dairy cows to increase the amount of milk they produce. This hormone naturally occurs in cows and is present in all milk. Research has shown that cows will produce 25% more milk when given bST.
3. With further research the use of animal technology will increase in the future.

Provide students with copies of the suggested references. Have them read Unit 33 in Agriscience Fundamentals or Chapters 7 and 11 in AgriScience. Use the classroom writing surface to summarize the major items in the lesson. Lead the class in a discussion of the role of technology in the areas of mechanics, plants, and animals. Use student comments to determine any topics that may need reteaching.

Objective 3: Describe the role of computers in agriculture/horticulture.

Anticipated Problem: What is the role of computers in agriculture/horticulture?

- III. A **computer** is a machine that performs informative activities at a high speed. Computers are widely used in agriculture and horticulture.
 - A. Many of today's agricultural machines have computers that regulate how they operate.
 - B. Computers are used to operate robots. A **robot** is a machine that can do various tasks. The robot receives its instructions from a computer which has been programmed a certain way.
 - C. Computers are also used in agribusiness to prepare plans for building new equipment, send messages, and design landscapes.

Provide students with copies of the suggested references. Have them read the "Computers" section in Chapter 3 of AgriScience Explorations. Lead a discussion on the many uses of computers in the agriculture industry. Have students name examples of specific tasks that are completed with the assistance of computers. Discuss how these tasks would be much more difficult and time-consuming if computers were not available.

Objective 4: Explain precision farming and its impact on agriculture.

Anticipated Problem: What is precision farming? How does it impact agriculture production?

- IV. **Precision farming** is an information- and technology-based crop management system. It takes into account differences in the needs of crops in specific sites within a field. Four areas of technology are used in precision farming.
 - A. Microcomputers in offices and on equipment are used to better process information.

- B. **Geographic information systems (GIS)** are used to map fields into small areas known as grids. Maps of the grids are used with global positioning to locate and control equipment operating in a field.
- C. **Global positioning systems (GPS)** connect satellites orbiting the earth with a ground receiver in a field or on a piece of equipment. GPS allows exact locations on the earth to be determined. These locations are used with GIS grid maps to help control machinery operating in the field.
- D. Machinery controllers are used on applicators and other implements to apply varying amounts of crop inputs. These controllers are used together with GIS and GPS information. This system is also known as **variable rate technology (VRT)** because each grid within the field receives the exact amount of input needed.

Students should be provided with copies of the suggested resources. Have them read the appropriate sections in the textbooks on precision farming. Use TM: A8–1A to lead an introductory discussion of GPS. Use the classroom writing surface to summarize the benefits of precision farming. Also, ask students to identify possible disadvantages of precision farming.

Teacher’s Note: Lesson A8–4: Determining the Role of Precision Technology provides a more in-depth lesson plan on these concepts.

Review/Summary. Focus the review and summary of the lesson around the student learning objectives. Call on students to explain the content associated with each objective. Use their responses as the basis for determining any areas that need reteaching. Questions at the end of each chapter in the recommended textbooks may also be used in the review/summary. Use the lab activities in reviewing and reinforcing student learning.

Application. Application can involve various techniques. The Activity Manual for AgriScience contains several activities which can be used for application.

Evaluation. Evaluation should focus on student achievement of the objectives for the lesson. Various techniques can be used, such as student performance on the application activities. A sample written test is attached.

Answer to Sample Test:

Part One: Matching

1=f, 2=e, 3=a, 4=c, 5=b, 6=d, 7=g, 8=h, 9=i, 10=j

Part Two: Completion

1. global positioning system
2. variable rate technology
3. pest

4. weed

Part Three: Short Answer

1. Bt corn contains a gene from the *Bacillus Thuringensis* bacteria. This results in the corn being resistant to the corn borer. Bt corn produces its own pesticide.
2. A global positioning system connects satellites orbiting the earth with a ground receiver in a field or on a piece of equipment and allows exact locations on the earth to be determined.
3. Biological pest control involves using living organisms to control pests.

Test

Lesson A8–1: Determining the Use of Technology in World Food and Fiber Production

Part One: Matching

Instructions. Match the term with the correct response. Write the letter of the term by the definition.

- | | | |
|----------------|--------------|---------------|
| a. technology | e. hormone | i. transgenic |
| b. insecticide | f. computer | j. cloning |
| c. plow | g. herbicide | |
| d. harvester | h. bST | |

- _____ 1. Machine that performs informative activities at a high speed.
- _____ 2. A substance produced by an organism that has a specific effect on the organism's growth or behavior.
- _____ 3. The use of inventions in working and living.
- _____ 4. Tool used to loosen soil.
- _____ 5. A chemical substance used to control insect pests.
- _____ 6. A device that gathers or picks crops.
- _____ 7. A chemical substance used to control weeds.
- _____ 8. Increases milk production.
- _____ 9. An organism that has genes from two different species of organisms.
- _____ 10. Making two or more organisms out of one using tissue.

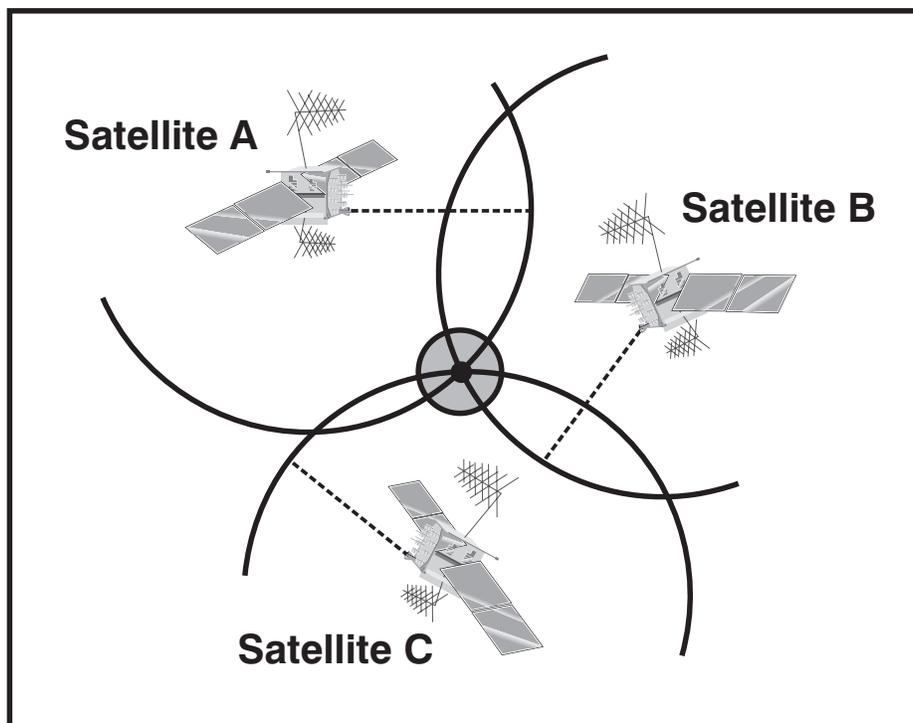
Part Two: Completion

Instructions. Provide the word or words to complete the following statements.

1. GPS stands for _____.
2. VRT stands for _____.
3. A _____ is anything that causes injury to plants, animals, or property.
4. A _____ is a plant that is growing in an unwanted area.

GLOBAL POSITIONING SYSTEM (GPS)

USING TRIANGULATION TO MEASURE DISTANCES ON THE EARTH



- ◆ **Triangulation is used to identify a single point on earth.**
- ◆ **Distances between the satellites and earth are quickly handled by computers.**
- ◆ **Positioning information is used by machinery controllers to vary rates of materials application or record harvest yields.**