Lesson A7–8

Determining the Role of Precision Technologies

Unit A. Agricultural Literacy

Problem Area 7. Recognizing the Impact of Technology on Agriculture

Lesson 8. Determining the Role of Precision Technologies

New Mexico Content Standard:

Pathway Strand: Agribusiness Systems

Standard: **V:** Utilize technology to accomplish AFNR business objectives.

Benchmark: **V-A:** Use technology and information technology strategies for business improvement.

Performance Standard: **1.** Utilize leading technology; (e.g., Global Positioning System (GPS), Geological Information System (GIS), Personal Data Application (PDA), cellular). **2.** Create and use documents using word processors, spreadsheets, databases, and electronic mail. **3.** Conduct research using the Internet. **4.** Conduct oral/visual presentations using presentation software.

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

1. Explain precision farming.
2. Describe the benefits of precision farming 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:

Biondo, Ronald J. and Jasper S. Lee. *Introduction to Plant and Soil Science and Technology*, Second Edition. Danville, Illinois: Interstate Publishers, Inc., 2003. (Textbook and Activity Manual, Chapters 2 and 9)

Lee, Jasper S. and Diana L. Turner. *AgriScience,* Third Edition. Danville, Illinois: Interstate Publishers, Inc., 2003. (Textbook and Activity Manual, Chapter 2)

Other Resources. The following resource will be useful to students and teachers:

The Precision-Farming Guide for Agriculturists. Moline, Illinois: Deere & Company, 1997.

List of Equipment, Tools, Supplies, and Facilities

Hand-held GPS receiver
Computer
Computer software
Overhead projector
Transparencies from attached masters
Copies of Student Lab Sheets

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

Geographic information system (GIS)
Global positioning system (GPS)
GPS receiver system
Grid
Machinery controller
Precision farming
Remote sensoring
Site specific farming
Trilateration (triangulation)
Variable rate technology (VRT)
Yield sensing

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. A possible approach is included here.

Ask the students what they know about satellites, when the first one was placed in orbit, and what purpose they serve (communications, photographic ability, military, etc.). Depending on their responses, you may have to direct the discussion to technology as it is being used in the agriculture industry.

Summary of Content and Teaching Strategies

Objective 1: Explain precision farming.

Anticipated Problem: What is precision farming?

I. Science and technological developments are enhancing cropping practices through environmentally sound ***site specific farming***.

   A. ***Precision farming*** is a site specific crop management system based on the needs of the land and technology.

      1. ***Geographic information systems (GIS)*** are used to map fields in small areas or grids.
      2. ***Global positioning systems (GPS)*** are used in precision farming to locate exact points in the field.
         a. Twenty-four Navstar satellites orbiting the earth send radio signals.
         b. Exact points are located by determining the distance from three or more points. This is know as ***trilateration*** or triangulation.
         c. ***Grids*** are the division of a field or area into uniform squares using vertical and horizontal lines.
      3. ***Remote sensoring*** involves gathering and recording data about the crop fields from satellites.
      4. A ***GPS receiver system***, including antennae and software, collects signals from satellites and calculates latitude, longitude, and altitude.
      5. Each grid in precision farming can be given a different rate of fertilizer or other crop inputs, a practice known as ***variable rate technology (VRT)***.
      6. The ability to adjust the rates of application is provided by computerized ***machinery controllers*** on the farm equipment.
      7. Another application of precision farming technology is ***yield sensing*** or the practice of monitoring yields as crops are harvested.

Introduce the students to the basic concepts of precision technologies. Use TM: A7–8A to help guide the discussion. Invite a representative from a GPS/GIS company to appear as a guest speaker for your class. Prepare the students in advance for the speaker and encourage them to compose questions. Assign LS: A7–8A, Working with Maps and Map Scale. Have students work together in small groups to complete

the assignment. If available, ask an industry person to demonstrate the application of GPS/GIS technology.

Provide the students with instruction on the uses of the hand-held GPS unit and experiences using a hand-held GPS receiver around the school property or in the land lab. Then, divide the class into small groups to complete LS: A7–8B, Locating Your Position. In advance to this lab activity, locate eight distinct sites students will be asked to pinpoint. Some examples are a large oak tree, the southeast corner of the land lab, and the school flag pole. Download the findings of each group in the computer and review their routes with the entire class.

Use text material to strengthen student understanding of concepts. Recommended readings include Chapter 2 in AgriScience, and Chapters 2 and 9 in Introduction to Plant and Soil Science and Technology. Also, obtain publications from the agriculture industry as teaching supplements.

Objective 2: Describe the benefits of precision farming on agriculture.

Anticipated Problem: How has precision farming benefited agriculture?

II. Precision farming increases production efficiency, promotes sustainable agriculture, and protects the environment.
   A. Precision farming increases production efficiency by dividing large fields into smaller areas based on such factors as soil fertility and water holding capacity. This promotes a more efficient use of the land and production inputs resulting in increased profits.
   B. Sustainable agriculture is promoted by improving the precision at which fertilizers and other chemical inputs are applied to a field.
   C. Chemicals are used more efficiently with reduced risk of runoff or drift that can have a negative impact on the environment.

Lead a class discussion as to how precision technologies are being applied in the agriculture industry. Include highlights of the advantages and disadvantages of precision technologies. Encourage active participation of the students.

Use text material to strengthen student understanding of concepts. Recommended readings include Chapter 2 in AgriScience, and Chapters 2 and 9 in Introduction to Plant and Soil Science and Technology. Also, obtain publications from the agriculture industry as teaching supplements.

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 ends of the chapters 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 one or more of the following student activities using the attached lab sheets:

Working with Maps and Map Scale—LS: A7–8A

Locating Your Position—LS: A7–8B

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.

Answers to Sample Test:

1=g, 2=e, 3=a, 4=c, 5=i, 6=f, 7=b, 8=d, 9=h, 10=k, 11=j

Sample Test Name_____

Test

Lesson A7–8: Determining the Role of Precision Technologies

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

a. geographic information system (GIS)
b. yield sensing
c. variable rate technology (VRT)
d. site specific farming
e. precision farming
f. global positioning system
g. remote sensing
h. GPS receiver system
i. machinery controllers
j. trilateration
k. grids

____ 1. Gathering and recording data about the crop fields from satellites.

____ 2. A site specific crop management system based on the needs of the land and technology.

____ 3. Used to map fields in small areas or grids.

____ 4. Giving a different rate of fertilizer or other crop inputs to each grid in precision farming.

____ 5. The computers on farm equipment that adjust the application rates.

_____ 6. Used in precision farming to locate exact points in the field with 24 satellites sending radio signals.

____ 7. The practice of monitoring yields as crops are harvested.

____ 8. Science and technological developments that enhance cropping practices through environmentally sound practices.

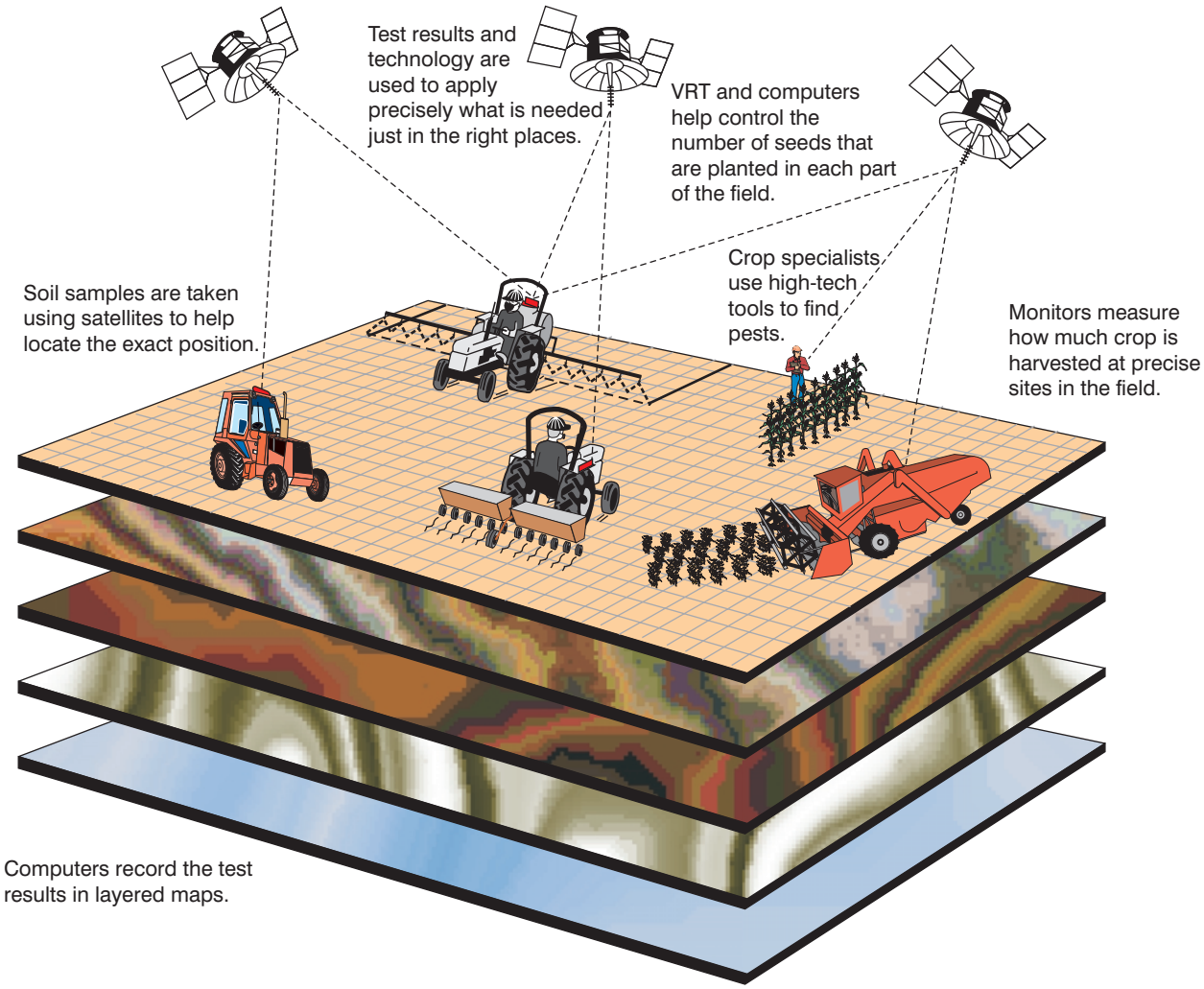
____ 9. Includes antennae and software to collect signals from satellites and calculate latitude, longitude, and altitude.

____ 10. The division of a field or area into uniform squares using vertical and horizontal lines.

____ 11. Determining distance from three or more points.

TM: A7–8A

Global Positioning System (GPS)



Name _____

Lab Sheet

Working with Maps and Map Scale

In this laboratory exercise you will become more familiar with the relationship of scale used in map making and the actual land area represented by a map. You will also learn the importance of mapping as related to precision farming.

Materials:

Tape measure
Clipboard
Pencil
Scale (architect's or engineer's)

Instructions:

1. Work in groups of four students.
2. On a separate sheet of paper, create a map of an area specified by the instructor at the scale specified by the instructor. Examples: the ag science classroom at 1/8-inch scale (1/8 inch equals 1 foot), or the entrance to the school at 1/16-inch scale. Provide detailed maps locating as many features as possible.
3. Locate a north arrow on the map.
4. Label the site mapped and scale used.

Name _____

Lab Sheet

Locating Your Position

In this laboratory exercise you will locate the exact position of certain locations indicated on a map using a hand-held GPS receiver. Practice the skills learned from your instructor on the application of the hand-held GPS receiver.

Materials:

Hand-held GPS receiver
Map

Instructions:

1. Review the map, indicating the positions to be located with your instructor.
2. Identify the longitude and latitude of locations noted on the map from readings determined by the global positioning systems.

Stop	Latitude	Longitude	Features of Location
1			
2			
3			
4			
5			
6			
7			
8			

Bonus: At stop 8, what would be the direction and distance you would need to travel in order to return to stop 3?

Web Site: http:\\www.ag.hawkeye.cc.ia.us/PrAEN/praencurrlectout%202B.html