THE MYSTERY OF PESTICIDES AND HIGH-YIELD FARMING

THE MYSTERY

How can high-yield farming techniques, like using high levels of fertilizers and pesticides, protect the environment and save lives?

INTRODUCTION

A primary goal of any business is to increase productivity. Increased productivity reduces costs, keeps prices competitive, and helps businesses stay profitable. Farmers and ranchers are no exception—they also want to improve productivity. There are many incentives to make it easier to achieve this goal. The market for some food products has seen a decline in real prices; food producers respond by cutting costs and increasing the productivity of their land.

One major reason for increased food production is the use of pesticides (herbicides, insecticides, rodentcides, and fungicides) and fertilizers. Even with pesticide use, it is estimated that up to twenty percent of the food production is lost to pests and pathogens. This number rises as high as seventy percent if these chemicals are not being used. The use of agricultural chemicals has allowed farmers to get more production from less cultivated land. This practice has reduced the pressure to turn more habitat into agricultural uses. Farm productivity is increasing while the number of acres used for agriculture is decreasing and more people are being fed.

CONTENT OBJECTIVE

Students will use three content ideas from economics to analyze clues and solve a farming mystery. Those key ideas are:

- ✓ Scarcity forces people to choose how to use resources.
- ✓ Incentives influence how people choose to use resources.
- ✓ Property rights provide important incentives to encourage efficient use of resources.

SKILL OBJECTIVE

Students will distinguish between clues (evidence) that are most useful for solving the mystery and those that are least useful as evidence to solving the mystery.

MATERIALS

Handout 1: The Mystery of Pesticides and High-Yield Farming
Handout 2: The Clues

TIME ESTIMATE 45 minutes

DIRECTIONS FOR THE MATERIALS

Provide each group with a copy of the mystery in Handout 1.
Distribute the clues separately. There are 20 clues. Make enough copies of the clues so each student has at least one clue. For example, with 40 students make two sets of clues and give each student one clue.

TEACHING PROCEDURES

1. Explain that the purpose of this lesson is for students to sharpen their critical thinking/economic reasoning skills. To accomplish this, they will use clues to solve a mystery about using pesticides to improve food production.

2. Remind the group to use economic reasoning to solve their mystery. The key reasoning ideas are:

   ✓ We must choose how to use our scarce resources by weighing the expected benefits and expected costs of the viable alternative uses.
   ✓ Once a decision is made, it often becomes clear that all expected benefits and costs to us and particularly to others have not been identified and this complicates the results of our choice.

3. Read the mystery in Handout 1 to the class. Invite students to speculate about what the solution to the mystery might be. Put these speculations on the board as hypotheses. You can revisit these hypotheses at the end of the lesson to check on them for accuracy and to help your students become more sophisticated in the

reasoning process.

4. Divide the students into small groups. Ask each group to select a discussion leader. Distribute a full set of clues to each group by handing each group member at least one clue. *Note: If your groups are smaller than the number of clues provided, some students should receive more than one clue. If groups are larger, there will be some duplicate clues since you will have to make more than one copy of the list of clues.* Then put the groups to work with these directions:

   - ❑ Their task is to propose a solution to the mystery, explaining their solution by using economic reasoning.

   - ❑ They should first sort the clues into the following categories: "could be useful," "not useful." (Note that all clues are true). Ultimately, the students are only to decide which clues are relevant to solving the mystery. Relevance is decided by how closely each clue is associated to farmers making choices about how to use their scarce land. These choices should reflect a deliberate comparison of land-use options with their expected rewards.

   - ❑ Each group member is responsible for evaluating the relevance of his or her clue and for suggesting to the group how it may or may not help solve the mystery.

   - ❑ After all the clues have been presented and discussed, any of the clues still in the "could be useful" category must be accepted as relevant or not.

5. Monitor the group discussion. You will probably find that many students will be eager to have their clues matter. Some will go to extremes of tortured logic to argue that their clues are crucial in solving the mystery. Some will confuse truth with relevance. Remind the students in these cases that this exercise involves sorting out the useful from the not so useful. Not all information is of equal value. (*Note: It is important for the teacher to review the material found in the Introduction and Explanation sections of each lesson before the exercise to be comfortable with the analysis of the clues and their relative importance.*)

6. Once the group has had enough time to sort out their clues and discuss their solution, ask each group leader to report to the whole class the group's solution to the mystery.

SAMPLE STUDENT ANSWER

A correct student answer to the mystery should closely resemble the following statement:

> *Even though high-yield farming has some negative environmental impacts such as water pollution, it is also responsible for higher food production and reduced land use. It has helped feed the world, allowed the world to avoid predicted famines and made it unnecessary to plow additional wildlife habitat, wetlands, and watersheds into farm land.*

EXPLANATION

Although high-yield farming practices such as using pesticides and fertilizers are criticized for their negative consequences to the environment, such as contributing to water pollution, what is often overlooked is its contribution to feeding the world on less land and reducing the pressure to turn more land into farm land. This reduction in the number of acres required to produce food has allowed more land worldwide to remain in its natural state. Many wildlife habitats, wetlands, and watersheds have remained because farmers choose to get more productivity out of their existing fields. This increased productivity from existing land also reduces soil erosion and helps feed the world's increasing human population.

WHICH CLUES SOLVE THE MYSTERY?

Clues 11, 15, 17, and 20 provide important information to explain the food production portion of the mystery. Farmers choose to change the use of resources to produce food because their increasing revenues covered the changing costs of high yield farming practices. They were able to use high-yield farming practices to produce more food on less land.

Clue 16 is important to explain the second part of the mystery. High-yield farming practices uses less land to produce more food. It means we do not have to plow under additional wild habitat, wetlands, or watersheds to create more farms to feed the world.

Clues 1, 3 and 7 demonstrate the concern that rising populations will lead to famine and starvation. These clues do not help explain the mystery.

Clues 2, 10, 18, and 19 provide information about the growth of agriculture but they do not explain the mystery.

Clues 4, 5, 6, 8, and 9 provide information that the food production has grown more rapidly than population growth but they do not explain the mystery.

Clues 12, 13, and 14 explain the environmental concerns people have but they do not explain the mystery.

Handout 1

The Mystery of the Pesticides and High-Yield Farming

How can high-yield farming a technique, like using high levels of fertilizers and pesticides, protect the environment and save lives?

Handout 2

The Clues

1. In 1970 Paul Ehrlich predicted that 65 million Americans and 4 billion other people would die from starvation between 1980 and 1989 because of the rapid growth of the world's population.

2. More than 8,000 years ago people began farming to provide a consistent food supply and avoid starvation.

3. In 1798, Thomas Malthus predicted that population growth would exceed food production growth and people were destined to live at the edge of starvation.

4. Technology advances like irrigation, fertilizer, pest control, and farm machinery have allowed food production to grow faster than population growth.

5. About 42% of all the world's farm crops are damaged by pests. Without pest controls and pesticides, that damage is estimated to be 70% of all crops.

The Clues (continued)

6. In 1800, it took an estimated 33 minutes of work time to create a pound of bread; by 1900 it took an estimated 16 minutes and by 1990 it took about 4 minutes.

7. The world population is predicted to peak at about 8.5 billion people by 2050 and then is expected to decline after that time.

8. Today, most famine problems do not result from lack of food production. They result from civil and political conflicts that make it difficult to distribute the food.

9. The United Nations Food and Agricultural Organization (FAO) predicts that there will be more food for more people in 2010, 2015 and 2030. The World Bank has reached the same conclusion. Both organizations predict lower food prices in the future.

10. During the last 50 years food production costs have fallen rapidly.

The Clues (continued)

11. Increasing yields per acre can help farmers reduce the per item cost of production. For example, if it costs the farmer $100 to plant and raise 100 bushels of wheat per acre, the cost is $1 per bushel. If it costs $110 per acre to grow wheat using more fertilizer and pesticides and the acre produces 220 bushels, then the cost is $.50 per bushel.

12. Irrigation, fertilizers and pesticides contribute about 60% of the pollution in the nation's river and streams and about 45% of the pollution in the lakes.

13. Biodiversity and habitat preservation is an important goal to most citizens.

14. High-yield agricultural land is often poor habitat.

15. Using fertilizers and pesticides, farmers can increase yields per acre and feed more people on less land.

The Clues (continued)

16. To produce the amount of food necessary to feed the 1998 world's population using 1961 levels of technology, fertilizer use and pesticides, would have required doubling the amount of land under cultivation. An additional area about the size of South America would have been plowed under to create the necessary food for 1998.

17. Farmers can increase their income, even with lower prices for farm products, if they reduce their costs with technology and increase the yields (productivity) on their land.

18. In North America, Native Americans began farming between 2500-1500 BC. By 1000 AD, the main crops were corn, beans and squash.

19. Agriculture started in the Fertile Crescent of southwest Asia—an area now occupied by Iran, Iraq, and Jordan.

20. Farmers tend to improve their production techniques when the changes reduce their costs to produce.

SOURCES FOR MORE INFORMATION AND CLUES

Ecological Agrarian: Agriculture's First Evolution in 10,000 Years, by J. Bishop Grewell and Clay Landry, forthcoming, Purdue University Press 2003, Chapters 1, 2, 3, 6, and 7.

Agriculture and the Environment: Searching for Greener Pastures, by Terry L. Anderson and Bruce Yandle, Hoover Institution Press, Stanford University, Stanford California, 2001.

http://www.sustainableworld.com/agagre.html

http://www.ucsusa.org/food/ind.ag.html

http://www.ducks.ca/news/2002/020704.html

Notes