

Name: Alicia Jost

Date: Thurs. March 21st, 2013

Subject/Grade:9-12th Environmental Studies

Unit: Ag. & IPM – Case Study of Agriculture

Period: 1st & 4th (42 minutes)

PA Standards:

- 4.4.10 A: Explain the relationship between and among the components of the food and fiber systems (i.e. production, processing, research and development, marketing, distribution, and regulations).
- 4.4.10 C: Analyze how agricultural sciences and technologies strive to increase efficiency while balancing the needs of society with the conservation of our natural resources.
- 4.4.10 D: Evaluate the use of technologies to increase plant and animal productivity.
- 4.4.10 E: compare and contrast scientific theories. Know that both direct and indirect observations are used by scientists to study the natural world and universe. Identify questions and concepts that guide scientific investigations. Evaluate and revise explanations and models using logic and evidence. Recognize and analyze alternative explanations and models.
- 4.4.12 C: Analyze research and development initiatives as they relate to agriculture.
- 4.4.12 D: Describe how policies, regulations, and laws affect the technologies adopted in agriculture.

Essential Questions:

- How does the government protect the environment?
- How do farmers take care of their land?
- What is the decision- making process as to how to control pests affecting agriculture?
 - What factors are involved?

Understanding:

- Students will understand that...
 - This material is applicable to everyday life.
 - Multiple factors are considered and weighed when regarding the best method of pest management.
- Students will be able to...
 - Apply these concepts and decision making skills to a hypothetical example of a scenario.
 - Rationalize the pest management decisions of specific situations.
 - Utilize their understanding of human impacts on the environment in order to judge the consequences of using a particular agricultural method.

Objectives:

Now that students have covered the general basics of pest management and their consequences, they will apply this knowledge to a case study scenario.

Assessments:

- Informal: Observation and class discussion will be used to provide ample feedback about students' progress and understanding. Students will also be given guided notes which can be used as informal assessment.
- Formal: Students will submit a worksheet based on this scenario which will be used to judge if they understand the sequence of events and factors that are considered in an example like this.

Procedure:

- Class will begin with a short review of what we know about the agriculture industry as it relates to pest management.
- Students will be allowed to get into pairs and work on the worksheet entitled "To be or not Bt corn?"
- After completing the activity, students may work on back work and/or we will continue with the power point depending on the amount of time at the end of the period.
- If there is time at the end of the period, a video discussing genetically modified salmon will be shown. This will relate to this issue of pest management and productivity because of the connection between genetically modified corn and genetically modified fish. s
- Class will end with a summary of the rest of the week.

Differentiation:

- Students will be allowed to work at their own pace on the worksheet.
- Students will also hear the material in the words of their peers instead of the teacher reiterating the facts.

Check for Understanding:

- The worksheets will be collected and checked for student understanding of the decision making process involved in pest management.

Closure:

- The class will end with either a brief discussion of the worksheet or a preview of the schedule for the rest of the week.

Name: _____
Environmental Science pd. _____

Date: _____
Ms. Jost

To be or not Bt corn?

Scenario 1:

Farmer John Smith is getting ready to choose what types of corn he would like to plant for next year's crop. John will be making these decisions based on a sound IPM management program. John along with his agronomist scout fields all summer to determine types of pests and infestation rates of particular pests.

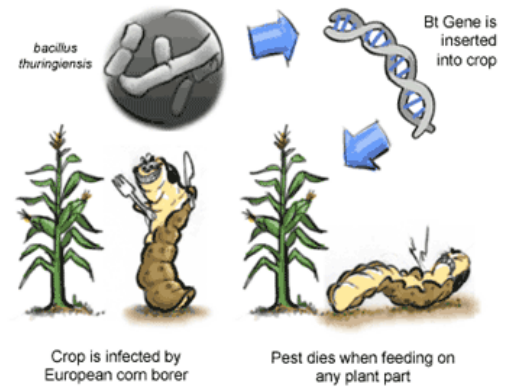
Based on this information, John determines what types of pest control programs to use both for insect and weed control in his corn fields. This year John tried something new. In 2 out of 5 of John's corn pieces had a corn borer problem last year.

A corn borer is a moth that originated in Europe. In its caterpillar stage, it damages the ears and stalks of corn by chewing tunnels into the plants. This causes it to fall over from lack of structural support. Naturally, these pests are controlled by a specific type of fungus that uses the caterpillar as a host, or varieties of stingless wasps that lay eggs in the caterpillar.



1. What is a corn borer?
2. How does it affect corn plants?
3. What are all the available methods of pest management could Farmer John use to counter this problem?

John, being a clever farmer, has an IPM program. In this IPM program he decided to plant those 2 fields with corn that has been genetically modified. This type of corn has the Bt gene added. The Bt gene is a gene removed from the Bt bacteria. This bacteria produces crystals that when eaten by the corn borer, attacks the digestive track of the caterpillar causing it to die. In Bt corn, scientists isolated the gene that creates these crystals in the bacteria and transferred it into the corn's DNA.



4. What will happen to corn borers that feed on Bt corn?

Next you will need to determine if the Bt corn was effective in controlling the borer problem, and whether or not John should choose to plant Bt corn next corn season, and if so how much you recommend he should plant. Your answer should be based on the following corn borer scouting data:

2011 Data:	Average # of borers for the two infected fields <u>without</u> Bt gene	Number of damaged corn stalks out of 55		2012 Data:	Average of the two infected Fields <u>with</u> the Bt gene	Number of damaged corn stalks out of 55
5/31	10	2		5/31	10	2
6/15	25	5		6/15	25	4
7/01	45	10		7/01	50	12
7/15	75	15		7/15	27	10
8/01	125	35		8/01	40	13
8/15	155	40		8/15	29	8
9/01	175	52		9/01	47	11
9/15	175	53		9/15	28	9

5. At what point is the borer a problem for the corn? The answer to this question is what is referred to as the economic threshold for the corn borer.

6. At what date did the Bt gene start to affect the borer worms?

7. Make a hypothesis about why the modified corn did not affect the worms before this date.

8. Was the Bt corn effective at controlling the borer problem?

9. Based off your answer to the previous question, how much Bt corn should John plant next year?

10. Are there any risks involved with using all Bt corn instead of a mixture of Bt and normal corn?

As part of a good IPM strategy, John is also on a crop rotation pattern to break the cycle of many pests that plague his area; however the European corn borer continues to be a problem in the two fields we mentioned. John had an option to spray chemicals on his field this year or try the Bt corn. He decided to use the genetically modified corn.

11. What are some of the reasons why John chose Bt corn over pesticide application?

Extra Credit:

If the 3 unaffected fields last year were planted with corn for the first time this year, do you think that corn borer pressure would be a problem in those fields ...and why? (5 extra points)

Scenario 2:

John's wife, Kathy runs a bakery out of the farmhouse. She sells a variety of items ranging from homemade donuts to ice cream cakes. One day while baking scones, Kathy heard a strange scratching sound from behind the wall. Thinking it might just be the wind, she ignored it until a month later when she found two chewed through boxes of cake mix in the food pantry. Unfortunately, Kathy has no idea how to handle the mouse problem.



1. What options does Kathy have to handle the mouse?

Chemical control:

Biological control:

Physical control:

Cultural control:

2. Which do you think would be the most effective method to control the mouse problem? Why?



After discussing the issue with John, Kathy decided to set mouse traps around the house. She set 10 traps around the house, three of which were in the kitchen and checked them every other day. After two weeks, she only heard an occasional scratching behind the walls. In her traps, she found she had caught two mice. Feeling that the situation was resolved, she removed the traps. Two months later Kathy found one mouse running across her kitchen floor, one eating through her pancake mix, and another in her flour bin.

3. Why do you think the mouse traps didn't work?

Furious, Kathy went out and bought a pound of rat poison. By Christmas she noticed that the mice droppings and scratching noises were less frequent. After Easter dinner, Kathy and John were still plagued with mice in the house.

4. List at least two reasons that the mice were not exterminated by the rat poison?

As a last resort, John brought home a cat which finished off the problem.

5. What type of pest control would the cat follow under?

