

NATIONAL SCIENCE STANDARD

- Science and Technology: Abilities of technological design

OBJECTIVES

The student will:

1. identify the risk and benefits of crop protection.
2. calculate the economic benefits of crop protection.

BACKGROUND

To grow the most amount of food as possible on the limited land resource, many farmers use crop protection chemicals called pesticides. If left untreated, weeds and insects would decrease food production by half.

3 KINDS OF PESTICIDES

- HERBICIDES
(CONTROL WEEDS)
- INSECTICIDES
(CONTROL INSECTS)
- FUNGICIDES
(CONTROL FUNGUS)

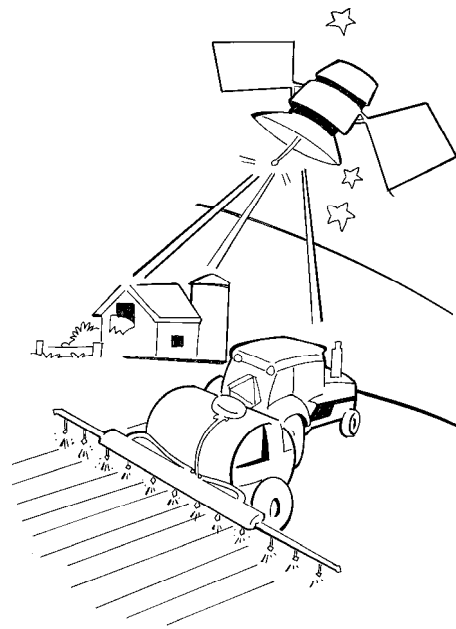
Herbicide use is only 60 years old, but societal changes have occurred that make it impossible to return to previous weed control practices. The amount of labor required to prevent yield loss would be an estimated 70 million workers. Migration of workers from rural areas has created shortages of farm workers.

The average wage rate for farm workers has increased by 7000% in the last 60 years. Farmers who paid \$10/acre for hand weeding in the 1940s would now face a labor cost of \$700/acre. The use of herbicides at \$30-\$50/acre remains the most cost-effective alternative.

Every activity carries some risk and some benefits. Sometimes the benefits so outweigh the risks we proceed without a second thought. We cannot prove with absolute certainty that there is no health risk associated with a chemical. What scientists and government officials do is attempt to estimate relative potential risk of a pesticide based on extensive testing and measure them against known benefits.

Pesticides are thoroughly tested for safety:

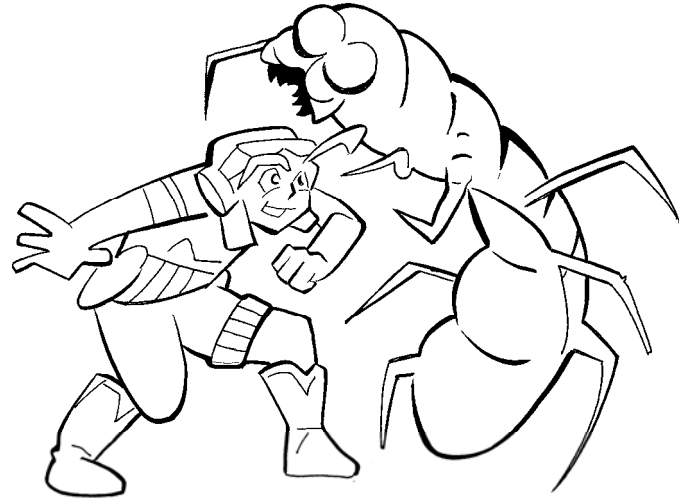
- Only 1 in 20,000 chemicals makes it from the lab to the farmer's field.
- Each pesticide is tested by up to 120 different safety tests.
- It takes 8-10 years for a chemical to be approved as a pesticide.



BACKGROUND, CONTINUED...

The Environmental Protection Agency (EPA) allows a pesticide to be used only when it is shown to pose negligible risk to human health and the environment. The EPA determines the greatest amount of residue that can be consumed safely, and then sets a limit of 100 to 1,000 times less than this amount.

In an ideal world—one where weeds, insects, and disease do not compete with crops for scarce water, sun, light, space, and soil nutrients—pesticides would not be required. Under real world conditions, however, pesticides play an essential role enabling farmers to produce sufficient quantities of food and fiber economically and safely.



Eliminating agricultural chemicals also means that the consumption of healthy fruits and vegetables would be limited due to decrease in supply and increase in cost.

The average American life expectancy has increased by nine years in the 40 years that pesticides have been used.

Minimizing the Risk

To decrease the risks associated with pesticides, the law requires that pesticides be used only in the manner indicated on the label. Many professionals who apply pesticides attend training. The management system, **Integrated Pest Management**, is used by farmers to insure pesticides are being used properly. It includes careful monitoring of pests and weeds with the use of a mixture of control methods such as natural predators, crop rotation and chemicals.

Risks

Spills resulting from misuse of pesticides exposing people to large doses in a concentrated form.

Increase human risk of disease by no more than one in one million.

Benefits

Protect the farmers investment in seed, soil, labor and other crop inputs

Consumers benefit from a daily bountiful supply of relatively inexpensive, healthy and wholesome farm produce.

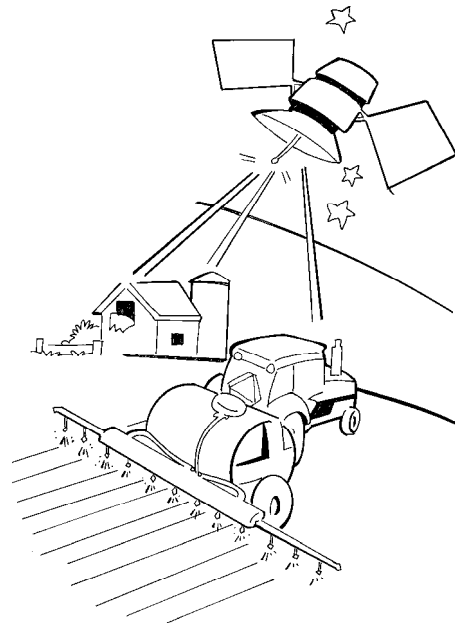
BACKGROUND, CONTINUED...

Satellite Technology

Global Positioning Satellite (GPS) technology was originally developed for the U.S. Department of Defense, but it has found many civil uses, including agriculture.

GPS uses a satellite in outer space to take special pictures of a farmer's field. Different parts of a farmer's fields have different needs.

The field monitor can determine a farmer's yield (the amount of food grown in a specific area). If the yield is adequate, the farmer knows he does not have a pest problem, which in turn eliminates the unnecessarily spraying pesticides. GPS as a navigational tool can also be used to direct a combine to harvest a field without a driver!



INSTRUCTIONAL PROCEDURE

1. Review background information.
2. Discuss with students how some words are created from combinations of other words. An example is the word pesticide. The root "cide" means "to kill." When combined with the word "pest" it means to kill pests.
3. Ask the students to give the meaning of "risk" and "benefit". Have students give examples of different actions and list the different risks and benefits of them.
4. Discuss how some common daily activities carries risks to which we rarely give any thought.
5. Have the students complete Activity 1 and Activity 2.

ASSESSMENT

1. Discuss with students what it would be like weed a field by hand—hot, dirty, physically exhausting—compared with using pesticides.
2. Using the pictures in Activity 2, discuss what protection pesticides give to a farmer's crops.

NAME _____

ACTIVITY 1: THE COST OF CROP PROTECTION

THINK FOR YOURSELF

The average U.S. farm in 2003 was 441 acres. With the following figures calculate the cost of farming with and without herbicides.

1. In 1940 it cost \$10.00 to hand weed one acre of farmland. How much would it have cost to weed 5 acres of soybeans?
2. It requires 90 hours of labor to weed one acre of farmland. At today wage rates, it costs \$700 to hand weed one acre of farmland. How much would it cost to weed 5 acres of soybeans?
3. Modern farmers use herbicides to control weed growth. On average farmers use 2 pounds of the active herbicide ingredient at a cost of \$30.00 per acre. How much would it cost to treat 5 acres of soybeans?
4. Discuss what would happen to food costs if herbicides were not used? How would that affect your life?



FAST FACT

ONE ACRE IS ABOUT
THE SIZE OF A
FOOTBALL FIELD!

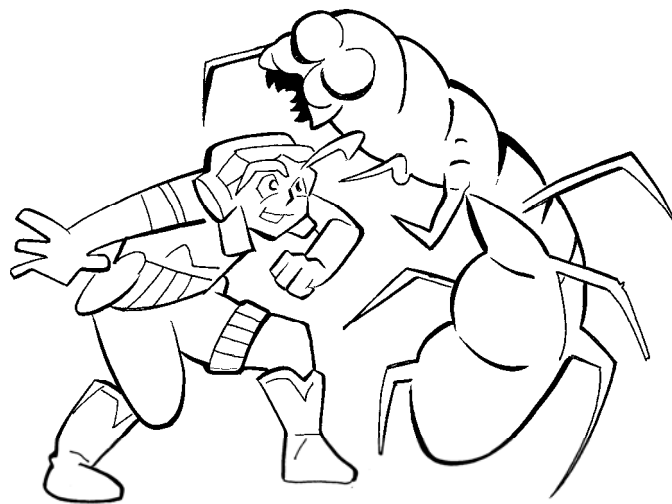
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ACTIVITY 2 — RISKS VS. BENEFITS

WHICH ONE IS IT?

The use of pesticides has both risks and benefits. Identify whether each statement is a risk or benefit.

1. _____ More healthy fruits and vegetables are available for people to eat.
2. _____ If pesticides are used improperly, a farmer may become ill.
3. _____ Pesticides help the US have the most abundant supply of safe food in the world.
4. _____ Pesticides can lower crop productions costs for farmers.
5. _____ EPA strictly regulates allowable pesticide residues on food.
6. _____ Insecticides destroy disease-carrying insects.
7. _____ Excessive us of pesticides may run off into water the source or be blown onto other plants.



NAME _____

ACTIVITY 2 — RISKS VS. BENEFITS CONTINUED...

TRUE OR FALSE

Look at the Weedy Fields and Pest Portraits pictures.

Determine whether the following statements are true or false.

1. _____ Weeds can block needed sunlight from a newly sprouted corn.
2. _____ Insects can make a corn cob unfit to eat.
3. _____ Insects are only a problem above ground.
4. _____ Weeds will not interfere with proper air circulation needed to prevent disease.
5. _____ Insect are large and easy to detect by sight.

WEEDY FIELDS



PEST PORTRAITS



Above: Corn Borer Feeding



Above: Corn Borer



Above: Root Worm Damage



Above: Western Bean Cutworm



Above: Western Bean Cutworm Size