

LESSON 16

We Can't Eat Weeds!

OBJECTIVES

Students will understand the importance of agriculture in Montana and how weeds impact the agricultural industry and the food we all eat.

METHOD

Students search for food produced in Montana and learn how many different types of agricultural products are grown in the state. They calculate production and economic values of different crops using agricultural statistics data, and use economic thresholds to determine whether to use weed controls at different levels of weed infestations.

MATERIALS

- ✎ **We Can't Eat Weeds Worksheets: Montana Farm and Ranch Products Hunt, Crop Production in Montana, and Economic Threshold Estimate**
- ✎ We Can't Eat Weeds Excel Worksheet file from *kNOweeds* CD (optional)

BACKGROUND

Approximately 60 million acres of Montana's 93 million acres are used for farm and ranch production. Most of this land is rangeland used for cattle and sheep, with about 17.5 million acres used for growing crops. The average size of a farm in Montana is 2,120 acres. Additionally, some government land is leased for agricultural purposes. About five percent of Montanans are farmers and ranchers, and a total of 17 percent of the population hold agriculture-related jobs.

Agriculture contributes more than \$ 2.4 billion to the state's economy annually. Of that \$ 2.4 billion, livestock contributes about half. The primary type of livestock in Montana is cattle. There are 2.6 million beef cattle in Montana and about 18,000 dairy cows. Sheep are the second most numerous, and Montana's sheep produce over 4 million pounds of wool annually. Additional livestock include horses, swine, poultry, and llamas. Montana is generally in the top 5 to 10 producers of honey in the United States each year, producing about 9 million pounds annually. Montana's primary crop is wheat. Other crops grown in Montana include barley, oats, berries, cherries, corn, hay, mint, sugar beets, sunflowers, apples, canola, potatoes, dry beans, field peas, flax, grapes, garlic, lentils, safflowers, mustard, squash, alfalfa, and many more.

Montana farmers and ranchers spend \$100 million each year trying to control invasive plants. For example, farmers and ranchers applied 4,737,000 pounds of chemical herbicides to wheat crops alone in Montana in 2008. Unfortunately,

Grade level: 5-12

Subject Areas: Biology, social studies, math, economics

Duration: 2 class sessions

Setting: Classroom

Season: Any

Conceptual Framework Topics:

Agriculture, economics of plants, impacts of invasive plants, invasive plant management

this expensive effort isn't entirely successful, due to the tenacious characteristics of invasive plants. Controlling weeds on agricultural lands is complex. Some agricultural practices, such as tilling, grazing and burning may have either positive or negative effects on weed growth, depending on many factors (see **Lesson 42: Burning Questions** for more on this topic). For example, grazing can reduce native plant coverage, disturb the ground, and introduce weed seeds through hay or manure, all factors that tend to encourage invasive plant growth. However, carefully timed grazing can be an important tool in controlling some weed species.

The effects of invasive plants on crop and forage production are complex and variable. They depend on many variables, including the species and densities of both the desired plants and the weeds (for example, allelopathic species or tall, shading plants will have greater effects); the agricultural methods employed (e.g., different tilling or grazing intensities); the timing of planting or growth of desired species; and factors like weather and growing conditions.

Integrated Pest Management (IPM) is a system for reducing crop losses from insects, weeds and plant diseases. IPM uses all available control practices such as crop rotation (changing what's grown in a field), mechanical cultivation, changing planting and harvesting times, biological control (using other living organisms to control pests), and chemical control. Using several methods of control is usually more effective than relying on a single management practice. One goal of IPM is to reduce pest damage to an acceptable level and minimize the risks of pesticides to human health and the environment.

Scouting fields for weeds and basing treatment decisions on economic thresholds is an important part of IPM. The principle of using economic thresholds is that weeds are not controlled until they reach a level that is economically damaging. The predicted loss from weeds must be more than the cost of control. If the number of weeds are not high enough to cause an economic yield loss, control is not recommended. In some cases, this means that weeds are allowed to remain in the field. However, this course of action often depends on several factors, including the aggressiveness of the plant species, and if it is just initiating invasion and might be quickly controlled, or is already established.

Economic thresholds are based on how much damage a pest may cause if not controlled, the predicted crop yield, the estimated selling price, the cost of control, and other factors.

PROCEDURE

1. Ask your students if they know what Montana's biggest business is in economic terms. Explain that it is agriculture, or farming and ranching. See if they can guess how much of the state land area is farms and ranches, and how much money it contributes to the state's economy each year. How many different agricultural products (crops and livestock) can they list that are grown in Montana? Make a list on the board and see how well their list matches the one on the **Montana Farm and Ranch Products Hunt** sheet. Are they surprised by any that are grown here? Are they surprised by any that aren't?

Give your students the **Montana Farm and Ranch Products Hunt** worksheet and go over the directions with them. Ask them if they think it will be difficult to find the items on the list. Give them however much time you think they will need to complete it. If they are only going to look for items at home, they can complete it in one night. If they are going to go to the store you may need to give them a few days.

2. When they have returned with their sheets, discuss what they found. Were they able to find many items that were actually grown in Montana? Can they think of any advantages of being able to buy products grown in Montana? (Shipping expenses, energy use, supporting state's economy, etc.)

3. Give your students the **Crop Production in Montana** sheet and make sure they understand all the information. Go over an example to show them how to calculate the production and value amounts. Have them complete the work and answer the questions. (Option: import the data from the table into a spreadsheet and have them do the calculations that way). When they have finished, discuss the following:

Does this mean that crops with the highest yields and/or values brought in the most income? Why or why not? (*Costs are not considered in this calculation*)

What are some factors that might impact how much a farmer makes from crops?
What are the costs associated with crop production?

What kinds of things might affect how much a farmer produces?

Ask your students what kinds of challenges there are to growing crops and livestock in Montana. They may mention weather, pests, weeds, predators, and drought. Discuss how weeds might impact agriculture. They should understand that invasive plants compete with crops for water, soil nutrients, sunlight and space. Can they affect livestock? Many invasive plants are unpalatable to livestock or even toxic, and they can reduce the amount of good forage plants, such as native bunchgrasses, available for livestock to eat.

Extensions

Have your students research the agricultural production in their county. How does it compare to Montana as a whole? Which products are most abundant? Which noxious weeds are found in their county?

Have them research the effects of weeds on Montana crop or forage species and the current, true costs of some weed control methods and make decisions about areas based on infestation rates.

4. Now your students can use economic thresholds to decide if weed control, such as an herbicide application, is necessary for particular crop and weed situations. Explain to them that growers must consider economic factors when deciding if and when to control an invasive plant species. They must determine whether the cost of controlling weeds is less than the cost of letting them grow. Ask how they would determine that. What information would they need to have? When they have figured out as much as they can, give them the **Economic Threshold Estimate** sheet and have them work out the problems.

Follow up with a discussion:

What are the advantages to using an Economic Threshold model? (*Save money, controls such as chemicals are used only when necessary, reducing environmental impacts, etc.*)

What are some potential problems with using this method? (*Some pests may be allowed to become too abundant and eventually more difficult or costly to control; may not take long-term effects into consideration, etc.*)

What are some other factors a producer might want to consider?

Name _____

Montana Farm and Ranch Products Hunt

Directions: Look in your kitchen or at the supermarket to find the foods made from, or that have an ingredient made from the kinds of crops and livestock that are raised in Montana. See how many of these crops you can find. Try to find three foods or ingredients for each – write down the ingredients or products that are made from each group. Note if you find evidence that the ingredients were actually grown in Montana.

Crop				Produced in Montana?
wheat	_____	_____	_____	_____
barley	_____	_____	_____	_____
oats	_____	_____	_____	_____
berries	_____	_____	_____	_____
cherries	_____	_____	_____	_____
corn	_____	_____	_____	_____
mint	_____	_____	_____	_____
sugar beets	_____	_____	_____	_____
sunflowers	_____	_____	_____	_____
apples	_____	_____	_____	_____
canola	_____	_____	_____	_____
potatoes	_____	_____	_____	_____
dry beans	_____	_____	_____	_____
field peas	_____	_____	_____	_____
flax	_____	_____	_____	_____
grapes	_____	_____	_____	_____
garlic	_____	_____	_____	_____
lentils	_____	_____	_____	_____
safflowers	_____	_____	_____	_____
mustard	_____	_____	_____	_____
squash	_____	_____	_____	_____
beef	_____	_____	_____	_____
chicken	_____	_____	_____	_____
pork	_____	_____	_____	_____

Name _____

Crop Production in Montana

This table shows some of the most abundant crops grown in Montana. Fill in the blank columns to answer the questions at the bottom of the page.

Commodity	Acres Planted	Acres Harvested	Amount per acre	Total Production in State	Price per unit	Total Value in Dollars
Wheat	5,170,000	5,065,000	29.6 bushels		\$7.60 / bushel	
Barley	900,000	720,000	44 bushels		\$4.25 / bushel	
Dry Beans	18,300	16,600	1,670 pounds		\$24.20 / 100 lbs	
Chickpeas (Garbanzo)	8,500	8,200	1,190 pounds		\$16.20 / 100 lbs	
Safflower	38,000	36,500	830 pounds		\$16.50 / 100 lbs	
Flaxseed	21,000	20,000	9 bushels		\$13.10 / bushel	
Corn for Grain	84,000	38,000	140 bushels		\$4.75 / bushel	
Hay		2,600,000	1.96 tons		\$76.00 / ton	
Oats	75,000	35,000	50 bushels		\$2.55 / bushel	
Potatoes	11,300	11,200	33,000 pounds		\$9.85 / 100 lbs	
Lentils	87,000	85,000	1,150 pounds		\$17.10 / 100 lbs	
Peas	235,000	217,000	1,700 pounds		\$9.50 / 100 lbs	

Which crop was the most abundant in the state in bushels? _____

Which crop produced the most in weight? _____

Which crop had the highest total monetary value in the state? _____

Which had the highest value per acre? _____

Name _____

Economic Threshold Estimate

Table 1 shows three different weeds and the effects they can have on crop yield if they are not controlled.

(Adapted from the University of Illinois Extension's *Natural Resources, The Environment and Ecosystems*)

Steps to Follow in Activity

1. Count the average number of weeds per 100 feet of a crop row.
2. Refer to Table 1 to find the estimated yield loss for that number of weeds.
3. Estimate the potential crop yield for the field.
4. Multiply the estimated yield loss by the predicted crop yield. This equals yield loss if weeds are not controlled.
5. Multiply yield loss by expected cash price per bushel.
6. Determine cost of weed control.
7. Subtract the cost of weed control from the cost of yield loss to determine if weed control, such as herbicide treatment, is economical.

Example

You scout a wheat field and find an average of 8 Giant Wheatkillers per 100 feet of row. Should you apply an herbicide to control these weeds?

TABLE 1

Kind of weed	Number of weeds in 100 feet of row					
Giant Wheatkiller	1	2	4	6	8	10
Kernel Smother	2	4	6	10	15	20
Boogeyweed	2	5	8	11	14	17
% of yield reduction	1%	2%	3%	6%	8%	10%

(For example: 4 wheatkiller plants in 100 feet of row will reduce wheat yield by 3%)

- Expected Yield: 30 bushels/acre
- Expected cash price per bushel: \$7.60
- Cost of weed control (herbicide application, biocontrol, mechanical removal): \$15.00 / acre

Step 1: 8 giant wheatkillers

Step 2: 8% yield loss (from Table 1)

Step 3: 30 bushels/acre

Step 4: $(0.08) \times 30$ bushels = 2.4 bushels (over)

Step 5: 2.4 bushels X \$7.60/bushels = \$18.24

Step 6: \$15.00/acre

Step 7: Net gain or loss: \$18.24 - \$15.00 = \$3.24/acre loss

Decision: Apply weed control according to economic threshold model

You scout a wheat field and find an average of 10 wheatkiller plants per 100 feet of row.

- Expected Yield: 28 bushels/acre
- Expected cash price per bushel: \$5.00
- Cost of weed control: \$15.00

1. *Should you take action to control these weeds?*
2. *If the price for wheat goes up to \$8.00/bushel, should you control the weeds?*
3. *If the cost of weed control drops to \$10.00/acre, should you control the weeds?*

TEACHER'S COMMODITIES TABLE KEY

Commodity	Acres Planted	Acres Harvested	Amount per acre	Total Production	Price per unit	Total Value in Dollars
Wheat	5,170,000	5,065,000	29.6 bushels	149,820,000 bushels	\$7.60 / bushel	1,138,176,000
Barley	900,000	720,000	44 bushels	31,680,000 bushels	\$4.25 / bushel	134,640,000
Dry Beans	18,300	16,600	1,670 pounds	27,800,000 lbs	\$24.20 / 100 lbs	6,728,000
Chickpeas (Garbanzo)	8,500	8,200	1,190 pounds	9,639,000 lbs	\$16.20 / 100 lbs	1,634,000
Safflower	38,000	36,500	830 lbs	30,295 lbs	\$16.50 / 100 lbs	4,999,000
Flaxseed	21,000	20,000	9 bushels	180,000 bushels	\$13.10 / bushel	2,358,000
Corn for Grain	84,000	38,000	140 bushels	5,320,000 bushels	\$4.75 / bushel	26,173,000
Hay		2,600,000	1.96 tons	5,090,000 tons	\$76.00 / ton	393,173,000
Oats	75,000	35,000	50 bushels	1,750,000 bushels	\$2.55 / bushel	4,641,000
Potatoes	11,300	11,200	33,000 lbs	369,600,000 lbs	\$9.85 / 100 lbs	36,406,000
Lentils	87,000	85,000	1,150 lbs	97,800,000 lbs	\$17.10 / 100 lbs	14,398,000
Peas	235,000	217,000	1,700 lbs	368,900,000 lbs	\$9.50 / 100 lbs	35,046,000

Which crop was the most abundant in the state in bushels? **Wheat**

Which crop produced the most in weight? **Hay**

Which crop had the highest total value in the state? **Wheat**

Which had the highest value per acre? **Potatoes**