



SCIENCE ON THE FARM ANSWER KEYS

Use these answer keys to guide discussion when reviewing student responses to the activity questions.

ACTIVITY 1 FARM TECHNOLOGY

PART 1

A. What is precision farming, and how does it help the environment?

Precision farming is the use of digital technologies to improve farm management. Precision farmers use technologies like GPS and GIS to reduce use of pesticides and commercial fertilizers, which helps protect the environment.

B. How do Global Positioning Systems help farmers?

Global Positioning Systems (GPS) help farmers map their fields, guide farm equipment in the field, and check crops.

C. How do Geographic Information Systems help farmers?

Geographic Information Systems (GIS) help farmers analyze soil conditions, estimate their harvest, and determine where and how much fertilizer and/or pesticide they need to apply.

D. How do robotic milking machines benefit the cows and the farmers on a dairy farm?

Robotic milking machines allow cows to be milked whenever they want, which enhances cow comfort and can increase milk yield for the farmer.

ACTIVITY 2 FARM BIOLOGY

Selective Breeding and Genetic Engineering

Similarities: Both processes alter the DNA of an organism to create a new organism with different genetic traits.

Differences: Selective breeding operates through natural reproductive and growth processes. Genetic engineering operates by scientific manipulation of an organism's DNA.



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ACTIVITY 3 FARM ECOLOGY

Sustainable Farming Practice	Conserves Energy	Conserves Water	Reduces Waste and Pollution	Builds Soil Health	What I Can Do
1. Cow manure is used in place of commercial fertilizer to improve soil quality.	Energy is needed to manufacture commercial fertilizers and transport them to farmers. Using manure from the farm reduces energy consumption and costs.	Many commercial fertilizers need to be mixed with water, but cow manure contains water that helps fertilize the fields.	Using manure to fertilize crops makes it a resource rather than a waste product.	Cow manure is a natural fertilizer that feeds crops. Manure application also provides carbon and nutrients to the soil, increases soil productivity, and increases the soil's ability to absorb water.	Compost at home and use that compost to fertilize your garden, trees, shrubs, etc.
2. Methane digesters use the gas given off by cow manure as fuel to generate electricity.	The use of anaerobic methane digesters reduces a farm's use of electricity generated with fossil fuels and other non-renewable sources.		When released to the atmosphere, methane is a potent greenhouse gas. But when methane is used to generate electricity, it produces water and carbon dioxide, a less potent greenhouse gas. In addition, methane does not produce the potentially harmful pollutants released by other energy sources, such as coal and oil.	A byproduct of methane digestion is concentrated nutrients from manure. Those nutrients can be applied to fields where they fertilize the soil.	Conserve energy at home. Turn off lights and appliances when not in use, use energy efficient light bulbs, etc. (See https://blog.constellation.com/2016/01/01/31-ways-to-save-energy-in-your-home/ for numerous other suggestions)

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<p>3. Some dairy farmers use a device called a plate cooler to cool the milk as it comes from a cow. As cold water passes through the plate cooler, it absorbs heat from the warm milk. Farmers then re-use this water in different ways: as drinking water for cows (who prefer warm water); to cool the cows with a fine spray when air temperature is high; to wash farm equipment and clean the barn floor.</p>		<p>Water is used over and over instead of drawing fresh water for each activity.</p>	<p>As it goes through the barn, the water may pick up things like manure from the barn floor. When applied to fields, the manure in the water serves to fertilize crops, thereby making it a resource rather than a waste product.</p>	<p>When used on the fields, this recycled water has added nutrients because it is mixed with cow manure.</p>	<p>How can you conserve water? Turn off the faucet when brushing your teeth, take shorter showers, collect rainwater to water indoor plants.</p>
<p>4. Natural groundcover along stream banks reduces runoff from fields into the stream.</p>		<p>Helps keep streams flowing free and clean.</p>	<p>Vegetation and groundcover help to filter pollutants such as pesticides and sediment from field runoff.</p>	<p>Groundcover keeps the nutrients in the field which keeps the soil healthy and productive for many years</p>	<p>Participate in events organized to plant vegetation along stream banks, lakefronts, etc. Plant vegetation in your yard, school grounds, etc. Some schools and homeowners construct rain gardens (https://www.epa.gov/soakuptherain/soak-rain-rain-gardens).</p>

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5. Solar panels on barn roofs generate electricity for use on the farm.	Reduces the need for energy produced by fossil fuels.		Solar power does not emit greenhouse gases or other air pollutants.		Conserve energy at home. Turn off lights and appliances when not in use. Use energy efficient light bulbs, etc. (See https://blog.constellation.com/2016/01/01/31-ways-to-save-energy-in-your-home/ for numerous their suggestions) Consider using solar power for your home.
6. Shredded waste paper and peanut shells are recycled to provide bedding for the cows.	In some cases, using these materials reduces the need to truck in sand or other bedding materials, thus reducing fuel consumption and costs.		Keeps these materials out of landfills.		How can you recycle – can you use the back side of printed papers for note-taking instead of a fresh sheet? Can you start a home compost pile with food waste to help feed your garden?
7. Orange peels, cotton seeds, and other leftovers are mixed with grain to provide nutritious cow feed.			Keeps these “leftovers” out of landfills.		Compost “leftovers” at home and use that compost to fertilize your garden, trees, shrubs, etc.