

ACTIVITY SNAPSHOT

SUPPORTING AREAS

Sun's energy, rumination, beef, food

ESTIMATED TIME

35–40 minutes

PURPOSE

Students explain the importance of the beef cattle industry, including the products cattle produce, the production process from farm to plate, and how cattle can utilize and obtain energy from grass and other forage.

STATE STANDARDS IT SUPPORTS

SC.5.8.2.A Use models to describe that energy in animals' food (used for body repair, growth, and motion to maintain body warmth) was once energy from the sun.

MATERIALS

- Paper plate with grass and weeds
- Paper plate with pieces of beef jerky
- **Chew It Twice** activity sheet
- Graphic: Sun, Moo, You
- Balanced Animal Nutrition Worksheet
- Cheez-Its
- Cheerios
- Pretzels
- Marshmallows
- M&M's
- Ziploc bags or coffee filters

Sub food as needed for food allergies.

From Sun, to Moo, to You

Activity Summary

Students will discover how ruminant animals in Nebraska convert grass into nutrient-rich foods such as milk and meat. Students will create their own feed ration that identifies the necessary nutrients in a ruminant animal's diet. Students will create a model that makes a connection between meat and milk products to the energy that once came from the sun.

Background Information

Background Information from lessons on National AITC Matrix

The average American consumes 55 pounds of beef each year. As a country, we eat nearly 50 billion hamburgers annually. Not only is beef an important part of the American diet, but it also plays a significant role in our economy. Beef cattle are raised in every state across the nation. Texas, Oklahoma, Missouri, and Nebraska rank as the states with the highest inventory of beef cattle.

Why such a high demand for beef? In addition to being prized for its delicious taste, beef provides many nutrients essential to the human diet. Humans need complete proteins with balanced amino acids to build muscle, nerves, and organ tissue. Animal proteins are one way to fill this nutritional need. Beef is a good source of ZIP: zinc (a mineral that ensures proper functioning of the immune system), iron (a mineral that helps red blood cells carry oxygen to body cells and tissues), and protein (a nutrient that builds, maintains, and repairs body tissues); as well as B12 (a vitamin that promotes healthy skin, nerves, and red blood cells).

Cattle are ruminant animals. Their four-compartment stomach allows them to graze pastures and rangelands, eating grass and plants (that humans are unable to digest) in areas where it would be difficult or impossible to grow other food crops. These grazing animals convert plant cellulose into high-quality food for humans. Because of this ability, as well as their generally calm and manageable demeanor, people have relied on cattle as a food source for thousands of years.

In the United States, cattle were introduced in the early 1500s, coming from Mexico through Texas and California. The English later brought large numbers of cattle when they founded the Jamestown Colony.

Rangelands cover approximately 26 percent (about 587 million acres) of land across America. This land is generally too arid and mountainous to be suitable for cultivation but can sustain grazing of domesticated animals when well managed. The pasture or range is one of the most important resources to a beef producer because it provides the food and water that the animals need at little cost and effort. Producers are allowed to use public lands for grazing and work with the U.S. Forest Service or the Bureau of Land Management (BLM) to ensure that the land remains healthy.

Typically, cattle are turned out to graze on their allotted land late in the spring. Mothers will raise their calves on the open range throughout the summer. The producers will keep a close eye on their cattle, monitoring their growth and health during this time. Sometime in the fall, the cattle will be rounded up. At this point, the cattle that will be saved for breeding stock are separated from the cattle that will go into beef production. The breeding stock includes pregnant mothers who will give birth in the spring and then be returned to the range to complete the cycle all over again.

Some of the animals designated for beef production will be sold to stockers (also called backgrounders). Stockers are cattlemen who raise weaned steers and/or heifers until they are ready to be sent to market or to a feedlot. Most beef cattle will spend four to six months at a feedlot where they are fed a grain-based diet that helps them gain weight quickly. During this “finishing phase,” the cattle’s health is monitored daily. When market weight is reached, the animals are sent to a processing facility. The average beef animal weighs 1,200 pounds (544 kg) and yields approximately 520 pounds (236 kg) of meat. While beef cattle are primarily raised for meat, they also provide valuable by-products such as medicine, paint, adhesives, soap, cosmetics, detergents, and hundreds of other products. Including by-products, as much as 99% of the animal is used.

What’s the Connection to Agriculture?

Energy from the Sun is Stored in Food

Plants get the energy they need to make food from the sun. Plants are able to grow by rearranging carbon dioxide from the air and water from their roots into sugar. Plants use sunlight to rearrange the atoms in carbon dioxide and water into the sugars they use to build their bodies and make them grow. This process is called photosynthesis. Carbon dioxide from the air passes through small pores (holes) in the leaves. These pores are called stomata. Water is absorbed by the roots and passes through vessels in the stem on its way to the leaves. The veins in leaves move water to each part of the leaf that is making sugar by photosynthesis. The sunlight needed to put together the carbon dioxide and water is absorbed by a green chemical in the leaves.

Changes in Photosynthesis

The photosynthesis process takes place in the leaves of plants. The leaves are made up of very small cells. Inside these cells are tiny structures called chloroplasts. Each chloroplast contains a green chemical called chlorophyll which gives leaves their green color. Leaves absorb the sun's energy. It is this energy that is used to split water molecules into hydrogen and oxygen. Oxygen is released from the leaves into the atmosphere. Hydrogen and carbon dioxide are used to form sugar or food for plants. Some of the sugar is used to provide energy for the growth and development of plants while the rest is stored in leaves, roots, or fruits for later use by plants.

Cattle Get Energy and Matter from Grass

Cattle have special stomachs that contain a bacteria called rumen. The cow first takes a bite of grass and swallows it with very little chewing. After the cow's stomach is full, the cow will repeatedly un-swallow and re-swallow their food. This process is commonly called chewing the cud or rumination. In this complex four-compartment stomach, the cellulose from grass is digested by the bacteria that humans and other animals do not have in their stomachs. The energy and matter from the sun creates food for cattle to eat such as grass and other non-digestible grains. This allows cattle to utilize energy from the sun and transform the food created for grass into energy they need to survive.

Interest Approach

Beef Jerky or Grass? (5 Minutes)

1. Place two plates at the front of the room: one with a photo of grass and the other a photo of beef jerky.
2. Ask students, "Come stand behind the plate that you would rather eat for a snack; grass or beef jerky."
3. After students have time to line up behind the snack that they would prefer. Ask students, "Why did the majority of us gravitate towards the plate with beef jerky?"
4. Ask students, "Could we eat this grass even if it seemed appetizing?" No
5. Ask students, "What can convert grass into foods like meat, milk, and other dairy products?"
6. The answer is livestock. Specifically, animals like sheep, goats, and cattle have a unique digestive system allowing them to break down the cellulose in plants. Today we will be learning about the digestive system of cattle and other ways cattle recycle and conserve resources while producing nutrient-rich food.

Activity Procedure

Activity 1: The Remarkable Ruminant (5 minutes)

1. Ask students, "How many people currently live on the earth?" Accept an answer of approximately 8.3 billion. Follow up by asking students if the world population is expected to increase or decrease in coming years. Increase
2. Conclude with students that it is and will become increasingly important to use our land wisely to provide homes, food, space, and resources for a growing population.
3. Ask, "Can we use ALL of our open space to grow crops for food?" No
4. Lead a discussion about land use and food production. Use the following questions to guide the discussion:
 - Why can't we grow food on all the land on Earth?
 1. Most crops cannot grow in soil that is too rocky, wet, or dry or in places that are too hot or cold.
 - Does our food only come from agricultural land? Where else does food come from?
 1. Most of our food comes from agricultural land, but food like fish and shellfish comes from water like oceans, rivers, and lakes. Food can also be grown in home gardens and greenhouses.
5. Explain to students that because the amount of habitable land where we can live and produce our food is extremely limited, we need to use it wisely and protect it.
6. Ask students to think back to what they have learned so far. Could the land that is unsuitable for crop farming be used by cattle to produce food?
 - Yes! Tell students that this is possible due to a unique digestive system.

Activity 2: Chew it Twice Demonstration (5 minutes)

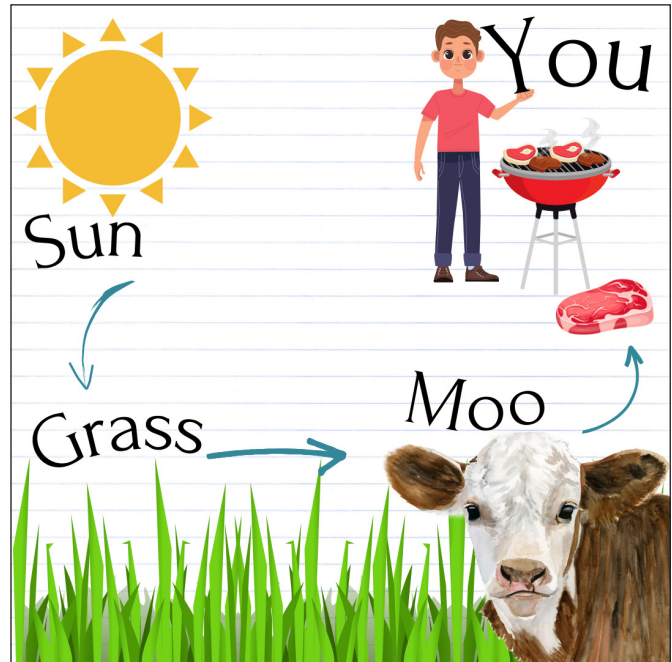
1. Show the class the Chew it Twice worksheet. Walk them through the process of ruminant digestion.
2. Ask students the following questions to review:
 - a. Why can ruminant animals eat grass and humans can't?
 - i. *Ruminant animals have a 4-compartment stomach that can break down the cellulose in grass and humans are monogastric (single-stomached) and we can't break down the cellulose.*
 - b. How can a ruminant animal help farmers and ranchers conserve the small amount of agricultural land available to us?
 - i. *Grazing livestock allows farmers to utilize native grasses to provide consumers with nutrient-rich foods.*

c. How does cattle grazing connect with the energy we get from the sun?

- i. *The grass and crops that ruminant animals consume are grown from energy that comes directly from the sun. Without energy from the sun, our livestock wouldn't have food and in return, neither would humans.*

3. Provide students with a blank worksheet and instruct them to work as a group to create a model that represents the process of energy coming from the sun to create milk and meat products from livestock.

- a. Energy from the sun aids in growing grass and other crops.
- b. Livestock graze pasture and crops to receive energy.
- c. Livestock are utilized for meat and milk production. Share Beef By-Product Poster.



Activity 3: Nutritional Snack (20 minutes)

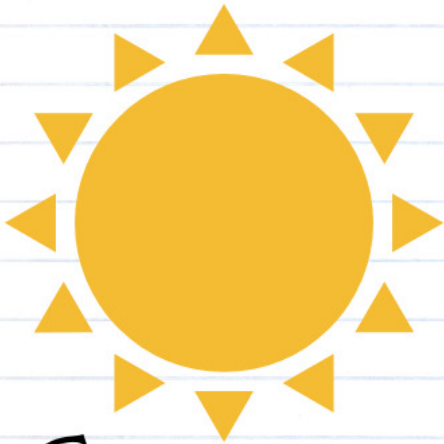
1. Explain to students that they will use what they've learned about ruminant animals to create a ration that represents the nutritional needs of beef cattle in Nebraska.
2. Distribute supplies and make rations.
 - a. Distribute and discuss "Balanced Animal Nutrition" worksheet.
 - b. As a class, complete the "Balanced Animal Nutrition" worksheet.
 - c. Have students create the cattle ration in the zipper bag and add the indicated amount of each food item that the beef cattle need.

Concept Elaboration and Evaluation (5 Minutes)

1. What is the function of the different nutrients discussed?
 - i. *Carbohydrates: energy source.*
 - ii. *Protein: building and repairing body tissues.*
 - iii. *Fat: energy source increases absorption of fat-soluble vitamins.*
 - iv. *Water: maintain homeostasis, transport nutrients to cells, and remove waste from the body.*
 - v. *Vitamins: essential for overall health, cell function, and growth and development.*
 - vi. *Minerals: build bones and teeth, helps the body grow, develop, and stay healthy.*

2. How do animals and humans have similar dietary needs?
 - i. *Animals and humans alike need nutrients in proper balance to stay strong and healthy.*
3. How does the food that our livestock in Nebraska eat directly connect to the energy we receive from the sun?
 - i. *Without energy from the sun, the pastureland and crops that make up the balanced diet of our livestock animals wouldn't be able to grow properly. We need energy from the sun to provide food to our livestock and in turn, humans receive energy from livestock meat and milk products.*
4. Why is it important to feed animals a properly balanced diet?
 - i. *Farmers want their animals to be healthy, comfortable, and grow quickly. A top priority for farmers is their animals' welfare. Farmers also want to use their inputs (feed, water, medicine, etc.) in a fiscally responsible way.*
5. Why is livestock raised in Nebraska?
 - i. *Several inputs needed for raising livestock are found in Nebraska. Refer back to the ration sheet and notice that corn and soybeans are primary ingredients in animal rations. Those crops are grown in Nebraska, which makes transportation and processing easier. There is also space for animal production in Nebraska. Because our state has a low population density, there is pastureland available.*
6. What is something you would share with your friends and family about animal nutrition?
 - i. *Proper nutrition is essential in raising healthy and productive animals. Animal products are all around us—the food we eat, medicine we use, and clothes we wear, contain animal products. It is important to know that animals require proper maintenance and nutrition, and our farmers and ranchers are providing that for animals.*

Graphic: Sun, Moo, You



Sun



Grass



Moo



You

Balanced Animal Nutrition Worksheet

This ration is for a 1,000-pound heifer. A heifer is a female that has not had a calf. Nutrition is important for an animal's growth. Daily, this heifer needs to eat 2.5 pounds of feed per 100 pounds of body weight and drink 1 gallon of water per 100 pounds of body weight. Approximately 91% of the cow's diet would be carbohydrates and 9% of the diet would be protein. Trace amounts of minerals and vitamins need to be added.

CATTLE NUTRITIONAL NEED	CATTLE EAT/DRINKS	REPRESENTED BY
Hydration	Water	Cheez-its
Carbohydrates	Corn	Cheerios
Protein	Corn Gluten	Pretzels
Minerals	Minerals	Marshmallows
Vitamins	Vitamins	M&M's

1. How much water does the heifer need each day?
2. How many total pounds of feed is the heifer eating daily?
3. How many pounds of corn does the heifer need each day? Round to the nearest pound.
4. How many pounds of corn gluten does the heifer need each day? Round to the nearest pound.
5. How much does the heifer need for vitamins and minerals?
6. Build a ration for two heifers using a zipper bag and the snack items. Use one piece of candy to equal one gallon or one pound. For trace amounts of vitamins and minerals, round up to one piece of candy per heifer per nutritional need.

Balanced Animal Nutrition Worksheet - Key

This ration is for a 1,000-pound heifer. A heifer is a female that has not had a calf. Nutrition is important for an animal's growth. Daily, this heifer needs to eat 2.5 pounds of feed per 100 pounds of body weight and drink 1 gallon of water per 100 pounds of body weight. Approximately 91% of the cow's diet would be carbohydrates and 9% of the diet would be protein. Trace amounts of minerals and vitamins need to be added.

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1. How much water does the heifer need each day?

$$1,000 \text{ lbs.} / 100 = 10 \text{ gallons}$$

2. How many total pounds of feed is the heifer eating daily?

$$1,000 \text{ lbs.} / 100 = 10 \quad \bullet \quad 10 \times 2.5 \text{ lbs.} = 25 \text{ lbs. of feed per day}$$

3. How many pounds of corn does the heifer need each day? Round to the nearest pound.

$$.91 \times 25 = 22.75 \text{ lbs. of corn (round up to 23 lbs.)}$$

4. How many pounds of corn gluten does the heifer need each day? Round to the nearest pound.

$$0.09 \times 25 = 2.25 \text{ lbs. corn gluten (round down to 2 lbs.)}$$

5. How much does the heifer need for vitamins and minerals?

Trace amounts

6. Build a ration for two heifers using a zipper bag and the snack items. Use one piece of candy to equal one gallon or one pound. For trace amounts of vitamins and minerals, round up to one piece of candy per heifer per nutritional need.

10 gallons of water	$\times 2 \text{ heifers} = 20 \text{ gallons of water (20 Cheezits)}$
23 lbs. corn	$\times 2 \text{ heifers} = 46 \text{ lbs. corn (46 Cheerios)}$
2 lbs. corn gluten	$\times 2 \text{ heifers} = 4 \text{ lbs. corn gluten (4 Pretzels)}$
1 mineral	$\times 2 \text{ heifers} = 2 \text{ minerals (4 Marshmallows)}$
1 vitamin	$\times 2 \text{ heifers} = 2 \text{ vitamins (4 M \& M's)}$