Exploring Dairy Agriculture and Careers
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Introduction

To All You Amazing Vermont Educators,

If your students like ice cream in the summer, cheese on their pizza, or butter on their toast, chances are they have enjoyed the taste of Vermont dairy.

Vermont dairy products are everywhere, and Vermont would not be the state we love if it weren't for its farms and farmers. Dairy farmers also help keep our state green by maintaining land for growing crops, and providing opportunities for healthy, active kids to bike, hike, ski, or hunt.

We hope that this book is a valuable tool to help students learn about all things dairy, and all things Vermont. Learning about dairy and farming is important to Vermont’s future, and we are grateful that you are taking on this challenge.

Thank you for your leadership in the classroom and offering Vermont’s students an understanding of agriculture in Vermont.

Sincerely,
Anson Tebbetts
Secretary
Vermont Agency of Agriculture, Food and Markets

After more than a century, the enduring quality of the education that 4-H continues to deliver is a key part of the reason our Vermont dairy business remains significant and how our state remains relevant in this sector.

This “Exploring Dairy Agriculture and Careers” curriculum is another tool in the slate of incredible resources provided to our teachers, parents and other influencers who will be further empowered to teach science-based lessons to the next generations of students who will take the baton up and carry Vermont dairy into the foreseeable future.

I applaud the collaborative efforts of UVM 4-H and the Vermont Agency of Agriculture, Food and Markets who have come together to produce this curriculum, and I further offer words of thanks to our Vermont educators who will do the valuable work of ensuring that the lessons are taught, learned and practiced.

I convey hearty thanks to all involved in helping Vermont remain a healthy community of active performers in cutting-edge dairying.

Sincerely,
Roy Beckford
Associate Dean and Director
University of Vermont Extension
Author’s Forward

The purpose of this curriculum is to provide the opportunity for educators and students to explore some of the many jobs that are part of Vermont agriculture. Not all agricultural careers are covered in this publication, but I hope that it opens the door to further career exploration.

In 2020, there were 19.7 million full- and part-time jobs related to the agricultural and food sectors — 10.3 percent of total U.S. employment.* The Vermont agricultural industry is part of this huge sector of U.S. employment opportunities, and the depth of professionals and services who support agriculture in our state and communities is vast.

Thank you for your partnership in helping the next generation of Vermont leaders and farmers understand the value and importance of the dairy industry.

Martha Edwards Manning
UVM Extension 4-H Educator

* USDA Economic Research Service.

How to Use This Curriculum

I hope that you enjoy this curriculum. While designed for students at the middle school level many of the activities may also be enjoyed by older or younger students.

This publication is divided into several key sections:

• **Exploring a Vermont Dairy Farm** explains key topics for any discussion on the dairy industry and includes several fun student activities. The answer keys to activities are located in an appendix at the end of the booklet. Some activities require Internet access to research answers and information.

• **Dairy Industry Careers** highlights six different career clusters which a dairy farmer might rely on to assist with their operations. This section includes a “deeper dig” into each sample career and an exercise interviewing an expert in each career field.

• **Career Directory** provides an introduction and small sampling of dairy industry-related careers, and is intended to inspire students to explore career opportunities.

• **Glossary** provides definitions of many familiar and unfamiliar terms.

• **Answer Key Appendix** provides answers to crossword puzzles and other activities.

The lessons and activities in the Exploring a Dairy Farm and Dairy Industry Careers sections include life skill(s), SET ability, Vermont Science Standards, and employment/career skill(s).

Students will find it helpful to have access to the Career Directory and Glossary sections to research answers to questions in the booklet activities, and a set of Answer Keys (Appendix I) is provided at the end of the booklet.
PART I: EXPLORING A VERMONT DAIRY FARM
There are 7 major breeds of dairy cattle commonly found on Vermont farms: Ayrshire, Brown Swiss, Guernsey, Holstein, Jersey, Milking Shorthorn, and Red and Whites.

The Midwest Dairy “Dairy Cows” website (https://www.midwestdairy.com/sustainability/farm-life/dairy-cows/) explains the origin, characteristics, and fun facts about each breed.

Ask students to complete the following table using information from the Midwest Dairy website or the individual breed registry pages.

<table>
<thead>
<tr>
<th>BREED</th>
<th>COUNTRY OF ORIGIN</th>
<th>COLOR</th>
<th>ONE INTERESTING FACT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ayrshire</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Brown Swiss</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Guernsey</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Holstein</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Jersey</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Milking Shorthorn</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Red &amp; Whites</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Additional discussion points

1. What breed typically produces the most pounds of milk per lactation?
2. What breed is known for producing “golden” milk?
3. What breed is known for producing milk with the highest percent butterfat*?

* Butterfat production is important when making many dairy products especially butter.
Comparing and contrasting human and dairy cow anatomy can be interesting and fun.

Divide students into groups of 2 or 3. Every group should read each description and discuss whether it applies only to human, only to dairy cows, OR if it applies to both humans and cows.

Check the appropriate box that the description applies to. Once every group has completed the chart, review the results as a class and have further discussions.

<table>
<thead>
<tr>
<th></th>
<th>HUMANS ONLY</th>
<th>COWS ONLY</th>
<th>BOTH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Has over 140 feet of intestines</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Has a 1-compartment stomach</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Regurgitates its food as part of the digestion process</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Has a pregnancy of approximately 280 days</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Has a 4-chamber heart</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Is a mammal</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Has the ability to sweat as a means of cooling the body</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Has 49-51 bones in the spine</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Has a normal body temperature of 98.6 degrees F</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Has 2 knees</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Has cloven feet</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Is born with no upper teeth</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Fun facts**

- About 73% of calcium available in the food supply is provided by milk and milk products.
Breeds of Cows—Bovine

For many years there were 6 major breeds of dairy cows in the United States. Dairy cattle first appeared in America in around 1492 with the early explorers. They were used as multi-purpose animals providing milk, meat and draft (pulling) ability. It was in the late 1800s when more people moved into cities and towns that farmers found larger markets for milk and dairy products and this was when the six breeds were imported in their greatest numbers. In later years, Red & Whites would join the list to become the seventh major recognized dairy breed.

Instructions: Match the breed names with their country of origin.

<table>
<thead>
<tr>
<th>Breed Name</th>
<th>Country of Origin</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ayrshire</td>
<td>Netherlands</td>
</tr>
<tr>
<td>Brown Swiss</td>
<td>Isle of Jersey</td>
</tr>
<tr>
<td>Guernsey</td>
<td>Scotland</td>
</tr>
<tr>
<td>Holstein</td>
<td>Isle of Guernsey</td>
</tr>
<tr>
<td>Jersey</td>
<td>England</td>
</tr>
<tr>
<td>Milking Shorthorn</td>
<td>Switzerland</td>
</tr>
</tbody>
</table>
Dairy Anatomy (Level 2)

- Life Skill: Decision-making
- SET Ability: Inquiry skills, Collaboration
- Vermont Science Standard: MS-LS1-8 Information Processing
- Employment / Career Skill: Critical thinking skills

Ask students to match the numbers on the picture of the cow to the parts below.

1. chest floor
2. pins
3. neck
4. poll
5. chine
6. teat
7. elbow
8. point of shoulder
9. heart girth
10. barrel
11. ribs
12. loin
13. thurls
14. back
15. hips
16. tail
17. dewlap
18. stifle
19. fore udder
20. rear udder
21. pastern
22. dewclaw
23. hoof
24. muzzle
Learn more about dairy cow anatomy using the Unified Dairy Scorecard:

The Unified Dairy Scorecard is a tool developed by the Purebred Cattle Association (PDCA) to give specific values to a cow’s Frame, Dairy Strength, Rear Feet and Legs, and Udder.

Instructions: Each area is given a maximum point value on the Unified Dairy Scorecard.

Go to http://www.purebreddairycattle.com to learn more about the PDCA and view the scorecard, then fill in the blanks below with the name of the area on the cow and highest possible score in the category.

Frame: The skeletal parts of the cow, with the exception of the rear feet and legs.

Dairy Strength: A combination of dairyness and strength which supports production and longevity.

Rear Feet and Legs: Evidence of mobility, rear view, side view, and thurl position.

Udder: Major consideration is given to those traits that contribute to high milk yield and a long productive life.

TOTAL %
Keeping animals healthy is a key part of any successful dairy operation. Many farms have a veterinarian they work with on a regular basis and when emergencies happen.

Some farmers use pedometers on their cows to monitor movement. By checking a computer or an app on their phone, the farmer can determine which cows are moving less than normal, an indicator to take a closer look to determine if there are foot problems or other health issues.

The decrease in movement often happens before the farmer notices a potential problem. An increase in movement can also be determined by checking the computer or phone app, and may be an indication of estrus.

**Diagnosis Matching**

Instructions: Ask students to match the term with the diagnosis description. Students may have to research a term before making their selection(s).

A. Ringworm  _____ Examine and determine what is wrong
B. Pinkeye     _____ An instrument for measuring temperatures
C. Warts       _____ Redness and inflammation of the lining of the eye
D. Lice        _____ The measurement of blood surging through an artery
E. Scours      _____ Infectious skin disease caused by a fungus
F. Thermometer _____ A small growth on the skin
G. Pulse       _____ Causes lameness in an animal
H. Foot Rot    _____ An individual who visits a farm for animal health
I. Balling Gun _____ Manure that is of watery consistence
J. Veterinarian _____ An external parasite
K. Diagnose    _____

**Additional discussion points**

Ask students to consider how a doctor examines a toddler who the parent has brought in because they are not eating and compare that to how a veterinarian would examine a cow who the farmer is concerned about because she is not eating. What steps taken would be similar and what would be different? Create a chart to show students’ ideas.
Vermont dairy farmers must comply with laws and regulations concerning how cow manure is stored and utilized on their farms. When properly stored, manure can be added to soils through spreading or injection, or be composted and added to the soil later. Manure can provide valuable nutrients for plant growth and soil health, and reduce the need to purchase commercial, organic or other types of fertilizer.

In this lesson, students will gain an understanding of the volume of manure produced daily by a single cow.

### Facts Needed To Calculate Manure Production
*(Resource: Learning About Dairy... A Resource for the 4-H Dairy Project)*

- The average cow produces 89 pounds of manure per day per 1,000 pounds of live weight.
- This is approximately 10 gallons of manure per 1,000 pounds weight or 1.32 cubic feet.
- Manure is 87.3% water.

### Questions to consider using the facts above

- If a large mature cow weighs 1,700 pounds, how much manure would she produce per day?
- Your herd has 80 cows this size. How much manure would your herd produce for the month of December?

### How students should arrive at the correct answer

- The average cow produces 89 pounds of manure per day for every 1,000 pounds of body weight, so to calculate how much manure a 1,700-pound cow would produce, follow these steps:
  - 1,700 divided by 1,000 = 1.7
  - 1.7 × 89 = 151.3 pounds of manure per day / single 1,700-pound cow
  - 151.3 × 80 (cows in the herd) = 12,104 pounds of manure per day.
  - 12,104 × 31 (days in December) = 375,224 pounds divided by 2,000 (1 ton) = 187.6 tons of manure!

You can also calculate how much of the 375,224 pounds of manure is water. Removing the water would lessen the needed storage required considerably.
Ask students to do the math to complete the chart below. Remember the facts about each breed needed to calculate manure production**:

1. The average cow produces 89 pounds of manure per day per 1,000 pounds of live weight.
2. This is approximately 10 gallons of manure per 1,000 pounds weight or 1.32 cubic feet.
3. Manure is 87.3% water.

** BREED**  | **AVERAGE LIVE WEIGHT**  | **POUNDS OF MANURE PRODUCED PER DAY**  | **GALLONS OF MANURE PRODUCED PER DAY**  | **GALLONS OF WATER IN MANURE PER DAY**
---|---|---|---|---
Ayrshire | 1,200 lbs. | | | |
Brown Swiss | 1,500 lbs. | | | |
Guernsey | 1,100 lbs. | | | |
Jersey | 1,000 lbs. | | | |
Holstein | 1,500 lbs. | | | |
Milking Shorthorn | 1,250 lbs. | | | |
Red and White | 1,400 lbs. | | | |

** Additional discussion points**

- After students have completed the chart discuss what other factors might impact manure storage space needed on a Vermont dairy farm.
- Consider the impacts of weather, climate, and the types of crops grown on the farm might have on the design of a manure storage structure for a Vermont dairy.
- What else might a farmer add to their manure pit that could influence needed size?

** Resource:** https://www.dairymoos.com/breeds-of-dairy-cattle/
Water Quality and Manure Management

» Life Skill: Critical thinking, Decision-making
» SET Ability: Inquiry skills, Critical thinking
» Vermont Science Standard: MS-LS1-8 Information Processing
» Employment / Career Skill: Decision-making

The Required Agricultural Practices (also referred to as RAPs)¹ are a set of standards which all types and sizes of farms² in Vermont must follow to reduce the impact of agricultural activities on water quality.

The RAPs include required practices and management strategies, some of which apply to all farms and some of which are specific to certain sizes of operations or to certain environmental factors.

Ask students to read the Vermont Department of Agriculture, Food and Markets “A Summary of the Required Agricultural Practices”³. Then ask them to write each of the following definitions and give an example that pertains to Vermont dairy farms.

Example: Buffer zone: An area of perennial vegetation between the cropped area and waterway, ditch, or road.

• Compost:

• Cover crop:

• Erosion:

• Groundwater:

• Nonpoint source pollution:

• Point source pollution:

Additional discussion points

• Why is it important for Vermont dairy farmers to address water quality issues and implement conservation practices?

Refer to the RAPs for information about spreading regulations to answer this question:

• Vermont law requires that spreading of manure not be done between what dates?

Sources: Vermont Department of Agriculture, Foods and Markets
¹ https://agriculture.vermont.gov/rap
Getting Started

1. In order to receive your recommendations early enough to use them for planning the next crop season, it is best to take samples in the fall.

2. Use a sampling probe or auger, available from mail order catalogs and garden or farm supply outlets. Either of these are the best tool for sampling and a necessity if sampling large numbers of fields. You may be able to borrow a probe from your local USDA-NRCS (U.S. Department of Agriculture Natural Resources Conservation Service) or Extension office.

3. The area to be sampled should be as uniform as possible in terms of soil type, cropping and fertilization history. For practical purposes, it should be an area you expect to fertilize as a unit. Take at least 15 soil cores or borings for each composite sample on a field of a maximum size of 20 acres. If a field is more than 20 acres, take two complete samples (30 borings).

4. Insert the probe or auger into the soil to plow depth (at least 6 inches) for hay and other perennial crops. Insert the probe to the plow depth (usually 6–10 inches) for annual crops such as corn. In general, do not sample an area of a field which varies widely from the rest of the field in color, fertility, slope, texture, drainage, or productivity.

5. Discard any plant material and mix soil cores in a clean plastic bucket. Be sure to mix samples well.

6. Take about 1 cup of the mixed soil cores and place in a plastic bag.

7. Identify the bag with your name, field name, and sample number.

8. Record the field, sample location, and date in your records.

9. Fill out the soil test questionnaire and place it in an envelope with the plastic bag along with a check to pay for the testing. If submitting multiple samples, include one check for the total being tested. The sample(s) can be taken directly to the UVM lab or sent to the address below. Results are normally returned in two weeks.

If you need a copy of the soil test form visit [http://pss.uvm.edu/ag_testing](http://pss.uvm.edu/ag_testing). Mail the soil test and form to University of Vermont Agricultural & Environmental Testing Lab, Jeffords Hall, Room 262, 63 Carrigan Drive, Burlington, VT 05405-1737.
Soil Sampling Activity

- Life Skill: Decision-making, Critical thinking
- SET Ability: Inquiry skills, Collaboration
- Vermont Science Standard: MS-LS1-8 Information Processing
- Employment / Career Skill: Collaboration skills, Organizational skills

Using the information from the “Soil Sampling” factsheet, ask students to complete the following activity and questions. Each student needs to look at the field map below and select two fields where they would take soil borings. Write an X on each field. Have students discuss as a group how/why they decided to choose the fields and answer these questions:

1. How many total borings would you take on field 1?
2. What types of areas would you avoid taking borings from?
3. What information would you record on the sample bag?

Additional discussion points:
Take a closer look at the map and discuss areas where you would want to avoid taking soil samples. Discuss why having buffer areas (areas that are not spread with manure) are important. Read more about buffer areas in the Vermont Department of Agriculture, Foods and Markets Required Agricultural Practices materials at https://agriculture.vermont.gov/rap.
Soils Crossword Puzzle

» Life Skill: Decision-making, Critical thinking
» SET Ability: Inquiry skills
» Vermont Science Standard: MS-LS1-8 Information Processing
» Employment / Career Skill: Problem-solving

Ask students to complete the crossword puzzle on the next page. Encourage students to use the Glossary and additional online resources to find answers.

(Puzzle on next page...)
Across
1. A measure of the rate at which water can pass through soil
4. Soil element critical for plant health and growth, seen as K on the soil test
5. A group of microscopic life forms that includes bacteria, archaea, viruses, and eukaryotes like fungi
7. Amendment added to soil to increase the soil pH
8. Tool used to take soil borings
9. Another name for the multiple soil cores taken from a field for analysis
11. Process of collecting soil borings for analysis (2 words)

Down
2. Person who studies soil management and crop production
3. Slang word for soil
6. Plants used to reduce soil erosion after a harvest (2 words)
8. High levels of this nutrient in run-off can cause algae blooms
10. Legume plants have tiny root nodules that can fix this nutrient
Ask students to place the number next to the corresponding definition. Students should research any unfamiliar terms.

1. Cottage Cheese
2. Yogurt
3. Casein
4. Rennet
5. Pasteurization
6. Homogenization
7. Chevre cheese
8. Low-fat milk
9. Roquefort
10. Butter
11. Blue cheese
12. Lactic acid
13. Raw milk
14. Custard
15. Whey

   1. Enzyme used in cheese making
   2. A milk protein
   3. By-product of cheese making
   4. Cheese made from goat’s milk
   5. Acid that gives milk a sour taste
   6. Milk is churned into this product
   7. Cheese made from sheep’s milk
   8. Coagulated mixture of milk and eggs
   9. Cultured milk product
   10. Soft cheese made with a surface mold
   11. Curds of milk proteins; a soft cheese
   12. Unpasteurized milk
   13. Milk that has been heated to 160° F for 30 minutes
   14. Milk that is 1 to 2% butterfat
   15. Process of breaking up fat particles

**Fun Facts**

- The average American consumes 40.2 pounds of cheese per year.
- The favorite flavor of ice cream in the United States is vanilla.

**Additional discussion points**

- Students can survey classmates and ask their favorite flavor of ice cream then make a bar or pie graph to present the results.
Ask students to place the number next to the corresponding definition. Students should research any unfamiliar terms.

1. Bulk tank _______ First milk a cow produces after giving birth
2. Butter _______ Dairy product made from the fat protein of churned cream
3. Calcium _______ Hard Italian cheese often grated and served on spaghetti
4. Colostrum _______ Powdery outer coating on cheese that forms during aging process
5. Rind _______ Breaking up of fat particles to keep cream from rising to the top
6. Cud _______ The process of aging cheese
7. Homogenization _______ Dairy product used in dips and on baked potatoes
8. Ice cream _______ Nutrient in milk important to bone building
9. Mozzarella _______ Globs of feed regurgitated from a cow’s first stomach compartment
10. Cheese affinage _______ Stainless steel structure where milk is stored
11. Processing plant _______ Facility where milk is prepared before going to retail outlets
12. Sour cream _______ Stringy cheese commonly used on pizza
13. Swiss cheese _______ Frozen dairy treat
14. Parmesan _______ Hard cheese with holes/eyes resulting from carbon dioxide released during the maturation process

Fun Facts

- Milk contains more nutrients than any other single food.
- After hay and grain are eaten by a cow, it takes twelve hours to convert the energy from the feed into milk.
- It takes 10 pounds of milk to make 1 pound of Cheddar cheese.
Dairy Foods Word Search

» Life Skill: Learning to learn
» SET Ability: Inquiry skills
» Vermont Science Standard: MS-LS1-8 Information Processing
» Employment / Career Skill: Creative thinking

Ask students to complete the word search puzzle on the next page.

(Puzzle on next page...)

Bonus Activity: Make a Purple Cow!

Ingredients:

• 2 cups vanilla ice cream
• 6-ounce can frozen grape juice concentrate
• 1-1/2 cups milk

Put all ingredients together in a blender. Mix and enjoy.
Find the dairy foods words below in the puzzle. Words may be horizontal, vertical, or diagonal. They may also be spelled right-to-left or from bottom-to-top. (Note: Spaces between words do not appear in puzzle.)

BULK TANK  BUTTER  BUTTERFAT
CHEESE  CHOCOLATE MILK  CREAM CHEESE
EGGNOG  ICE CREAM  MILKSHAKE
MOZZARELLA  PASTEURIZATION  PIPELINE
SOUR CREAM  WHEY  YOGURT
Exploring Dairy Agriculture and Careers

Dairy Crossword

» Life Skill: Learning to learn
» SET Ability: Inquiry skills
» Vermont Science Standard: MS-LS1-8 Information Processing
» Employment / Career Skill: Creative thinking

Ask students to complete the crossword puzzle on the next page.

(Puzzle on next page...)

Additional Discussion Points

Cows have a four-compartment stomach and the human stomach has one compartment. Ask students to create a chart and discuss some of the feeds that cows can digest which people cannot.

Cow numbers from the 2020 Census of Agriculture, https://www.nass.usda.gov/AgCensus/.
Across

2. A breed of large brown cows (2 words) — originated in the Alps
4. Smallest dairy breed
6. A cow’s female parent
7. A hardy red and white breed of medium stature
9. An annual crop that is chopped and is major feed in a cow’s diet (2 words)
   Hint: First word — people like to eat it off the cob
   Hint: Second word — the resulting product when the first word is fermented

Down

1. A breed of cow that gives golden milk
3. A term for a yearling female
5. A term for a cow’s mammary gland
7. A legume grown for hay or silage
8. A black and white breed of cow
Let’s Make Butter

» Life Skill: Learning to learn
» SET Ability: Inquiry skills
» Vermont Science Standard: MS-LS1-8 Information Processing
» Employment / Career Skill: Creative thinking skills

In this activity, students will make butter from heavy cream.

Supplies and ingredients needed:

• Pint jars with lids — 1 per student
• 6-inch square of cheesecloth — 1 per student
• Rubber bands, large enough to secure cheesecloth over jar
• Heavy cream — 1 cup per student
• Salt — optional
• Plain crackers for tasting

Instructions:

• Measure 1 cup heavy cream into each pint jar.
• Be sure to secure lids tightly.
• Shake jars; notice little bits of butter forming on the sides of the jar.
• Continue shaking until there are curds of butter and the liquidy whey.
• Remove top from jar and secure a piece of cheesecloth over the jar opening with a large rubber band.
• Turn jar over an empty bowl to catch the whey as it drains off the butter.
• When done draining, remove cheesecloth and pour remaining butter into a bowl.
• Optional: Add salt to taste, mixing well to distribute salt throughout the butter.
• Spread on crackers and enjoy.

Additional Discussion Points

• Research how butter is made commercially and what the by-product whey can be used for.
Let’s Make Yogurt

» Life Skill: Learning to learn
» SET Ability: Inquiry skills
» Vermont Science Standard: MS-LS1-8 Information Processing
» Employment / Career Skill: Creative thinking

Many people enjoy Greek yogurt with fruit or granola, with Vermont maple syrup, or plain. Students can make their own Greek yogurt with this simple recipe and a few minimal ingredients.

Ingredients

• ½ gallon whole or 2% milk
• 8 ounces plain live culture yogurt (for the “starter”)
• Slow cooker
• Thermometer
• Cheesecloth
• Colander

Place the entire half gallon of whole milk in the slow cooker. Place on “high” heat with the lid on. Heat to 180° F. This step will take 2 to 3 hours. Check the temperature with the thermometer and when milk reaches 180° F, turn off the heat.

Allow milk to cool without stirring. Cool to 110° F. This will take a few hours. When milk has cooled to 110° F, gently fold 8 ounces of plain live-culture yogurt into the milk.

“Folding” is the process of gently mixing in an up and down motion rather than stirring back and forth.

Replace lid and cover with a large towel. Make sure slow cooker is off and not plugged in. Place in a warm area, free from drafts, and let the mixture sit for approximately 12 hours or overnight. Do not stir during this time and leave it undisturbed.

The warm environment is necessary for the milk to thicken and form yogurt. After 12 hours, line a colander with cheesecloth. Place the colander over a large glass bowl. Pour the yogurt into the lined colander, allow to drain for several hours. The longer the yogurt is strained the thicker it will be. The liquid that is strained off is whey and may be used in baking, shakes, etc.

Store the yogurt in a covered glass container in the refrigerator for up to two weeks. When serving, top with granola or fruit for a delicious treat. Use a cup of this yogurt as a starter for your next batch.

Fun Fact

Animal Care / Health Careers

» Life Skill: Planning/organizing, Goal setting
» SET Ability: Design thinking
» Vermont Science Standard: MS-LSI-8 Information Processing
» Employment / Career Skill: Decision-making

Ask students to consider these questions when deciding if a career in animal care/health:

• Do you enjoy working with livestock?
• Are you willing to work weekends, evenings, and holidays?
• Do you enjoy traveling to different farms daily?

Some careers in animal care/health include:

• Veterinarian
• Veterinary Assistant/Technician
• Artificial Inseminator
• Veterinary Pharmaceutical Sales/Representative

Suggest that students research careers in animal care/health by completing the following table:

<table>
<thead>
<tr>
<th>CAREER</th>
<th>DOES THIS POSITION REQUIRE POST-SECONDARY EDUCATION?</th>
<th>APPROXIMATE COST OF EDUCATION</th>
<th>AVERAGE ANNUAL SALARY</th>
<th>SOMETHING THAT INTERESTS YOU ABOUT THIS CAREER</th>
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<tbody>
<tr>
<td>Veterinarian</td>
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<td>Veterinary Assistant</td>
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<tr>
<td>Artificial Inseminator</td>
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<tr>
<td>Veterinary Pharmaceutical Sales/Representative</td>
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Digging a Little Deeper —
Animal Care/Health Careers: Large Animal Veterinarian

- Life Skill: Communications
- SET Ability: Critical thinking
- Vermont Science Standard: MS–LS1–8 Information Processing
- Employment / Career Skill: Active Listening

Many students dream of becoming a large animal veterinarian. Veterinarians work closely with dairy farmers and are an important resource for any dairy farm system.

Many veterinarians in Vermont are part of a group where multiple veterinarians work for a single service. This allows for time off and less on-call time at night or on weekends.

For this lesson, students will need to contact a veterinarian who works with dairy animals to conduct an interview. When contacting the office, students should explain that they are doing potential career research and would like to speak to a veterinarian for approximately 10 minutes. Remind students to be polite and prepared, and to practice the questions before conducting the actual interview. When students have completed the interviews, they should share and compare their results. The statements and questions are:

1. Introduce yourself and explain that you are doing research into a potential career.
2. Where did you go to college and what was your undergraduate degree?
3. Where did you go to veterinary school and how many years did you study there?
4. How many years have you been a practicing veterinarian?
5. What do you enjoy most about your job?
6. What do you find most challenging about your job?
7. How often do you have a day off?
8. How many hours do you work in the average week?
9. Can you tell me about one of your most unusual calls?
10. What advice would you give to someone who is considering becoming a large animal vet?
11. Is doing a ride-along a possibility for a young person considering becoming a veterinarian?
12. Thank them for their time.
Plants, Feeds, and Nutrition Careers

- Life Skill: Planning/organizing, Goal setting
- SET Ability: Design thinking
- Vermont Science Standard: MS-LS1-8 Information Processing
- Employment / Career Skill: Decision-making

Ask students to consider these questions when deciding if a career in plants, feed, and nutrition:

- Do you enjoy working outside?
- Would you like helping farmers increase production through improved animal nutrition?
- Do you like sales?

Some careers in plants, feed, and nutrition include:

- Agronomist
- Crops Manager
- Feed Company Sales Representative
- Dairy Nutritionist
- Nutrient Management Specialist

Do the research

Ask students to think about careers in plants, feed, or nutrition and then complete the table below. They can research career opportunities online or ask someone they know who has knowledge about the selected career.

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<thead>
<tr>
<th>CAREER</th>
<th>DOES THIS POSITION REQUIRE POST-SECONDARY EDUCATION?</th>
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<tr>
<td>Agronomist</td>
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<td>Crops Manager</td>
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<tr>
<td>Feed Company Sales Representative</td>
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<tr>
<td>Dairy Nutritionist</td>
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<tr>
<td>Nutrient Management</td>
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Digging a Little Deeper —
Plants, Feed and Nutrition Careers:
Crops Manager

- Life Skill: Communications
- SET Ability: Critical thinking
- Vermont Science Standard: MS-LS1-8
  Information Processing
- Employment / Career Skill: Active Listening

The crops manager on the dairy farm may be the farmer or it may be someone who works for the farm who is specifically responsible for the crops grown on the farm.

The crops manager may work closely with the farmer to determine what specific annual and perennial crops will be grown and how they will fit into the various rations. A crops manager must know when to plant, harvest, and how to store each crop to ensure optimum quality and nutritional value. The crops manager must know the farm's nutrient management plan and keep records to ensure that the farm stays within the boundaries specified in the nutrient management plan.

For this lesson, students will need to contact a dairy farmer and ask if they manage their own cropping decisions or if the farm has a specific crops manager who could be interviewed for approximately 10 minutes. Remind students to be polite and prepared, and to practice the questions before conducting the actual interview. When students have completed the interviews, they should share and compare their results. The statements and questions are:

1. Introduce yourself and explain that you are doing research into a potential career.
2. Did you go to college to learn about crop management or learn on the job?
3. How many years have you been in your current position?
4. What do you enjoy most about your job?
5. What do you find most challenging about your job?
6. What types of crops are grown on this farm?
7. Do you supervise other farm employees? If yes, how many?
8. Can you tell me how the nutrient management plan influences the cropping decisions you make?
9. Can you tell me about what you do in the winter months?
10. What advice would you give to someone who is considering becoming a crops manager?
11. Thank them for their time.
Farm Support Services Careers

» Life Skill: Planning/organizing, Goal setting
» SET Ability: Design thinking
» Vermont Science Standard: MS-LS1-8 Information Processing
» Employment / Career Skill: Decision-making, People skills

Ask students to consider these questions when deciding if a career in farm support services:
• Do you like to work with a variety of people each day?
• Do you like driving truck or working with people?
• What work schedule do you prefer?

Some careers in farm support services include:
• Diesel Mechanic
• Farm Equipment Sales
• Farm Equipment Repairs/Service/Mechanic
• Milk Hauling
• Farm Lender/Loan Officer/Financial Advisor
• Farm Store Employee

Do the research

Ask students to think about careers in farm support services and then complete the table below. They can research career opportunities online or ask someone they know who has knowledge about the selected career.

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<td>Farm Equipment Sales</td>
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<td>Farm Mechanic</td>
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<td>Milk Hauler</td>
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<tr>
<td>Farm Lender / Loan Officer / Financial Advisor</td>
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<tr>
<td>Farm Store Employee</td>
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Digging a Little Deeper — Support Services Careers: Diesel Mechanic

- Life Skill: Communications
- SET Ability: Critical thinking
- Vermont Science Standard: MS–LS1–8 Information Processing
- Employment / Career Skill: Active Listening, People skills

Most diesel mechanics work for machinery dealerships but a few larger farms may also employ on-farm mechanics.

Advances in farm equipment and the use of more robotics and computer programs are helping to advance efficiencies on the farm and are taking diesel and farm mechanics to a new level. AI on farms no longer refers solely to artificial insemination but also Artificial Intelligence — as in robotics, precision agriculture, and more.

As farm equipment becomes more technologically advanced the training for mechanics becomes more focused and may require specialized trainings and tools. Some colleges and trade or tech schools offer special programs with a farm equipment focus.

For this lesson, students will need to contact a local farm equipment dealership, explain that they are doing career exploration and ask if it is possible to interview a mechanic with some specialized training for approximately 10 minutes. Remind students to be polite and prepared, and to practice the questions before conducting the actual interview. When students have completed the interviews, they should share and compare their results. The statements and questions are:

1. Introduce yourself and explain that you are doing research into a potential career.
2. How many years have you been in your current position?
3. Did you go to college to learn about mechanics or learn on the job?
4. How many years have you been in your current position?
5. What do you enjoy most about your job?
6. What do you find most challenging about your job?
7. Have you received specialized training for specific pieces of equipment?
8. What advice would you give to someone who is considering becoming a diesel mechanic?
9. Thank them for their time.
Government Agency Careers

» Life Skill: Communications, Social skills
» SET Ability: Critical thinking
» Vermont Science Standard: MS-LS1-8 Information Processing
» Employment / Career Skill: Active listening, Management skills

Ask students to consider these questions when deciding if a career in government agency:

• Would you like to work with farmers and government programs? Do you like to work with conservation issues?
• Are you interested in farm finances?

Some careers in plants, feed, and nutrition include:

• Farm Service Agency Loan Officer
• Crop Insurance sales
• Natural Resource Conservation Specialist
• Agricultural Engineer
• Farm Regulatory Specialist

Do the research

Ask students to think about careers in a government agency role and then complete the table below. They can research career opportunities online or ask someone they know who has knowledge about the selected career.

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<td>Farm Service Agency Loan Officer</td>
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<tr>
<td>Crop Insurance Sales</td>
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<td>Natural Resource Conservationist</td>
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<td>Agricultural Engineer</td>
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<tr>
<td>Farm Regulatory Specialist</td>
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Digging a Little Deeper — Government Agency Careers: Crop Insurance Sales

- Life Skill: Communications
- SET Ability: Critical thinking
- Vermont Science Standard: MS-LS1-8 Information Processing
- Employment / Career Skill: Active Listening, People skills

Crop insurance agents work with farmers to help limit their financial losses in the event that their crop was to be lost due to weather, disease, drought, fire, flooding or insect damage. The salesperson works with the farmer to determine the type and level of coverage needed and the cost for the policy.

For this lesson, students will need to contact a local crop insurance sales agency, explain that they are doing career exploration and ask if it is possible to interview a crop insurance expert for approximately 10 minutes. Remind students to be polite and prepared, and to practice the questions before conducting the actual interview. When students have completed the interviews, they should share and compare their results. The statements and questions are:

1. Introduce yourself and explain that you are doing research into a potential career.
2. How many years have you been in your current position?
3. Did you go to college to learn about crop insurance sales or learn on the job?
4. How many years have you been in your current position?
5. What do you enjoy most about your job?
6. What do you find most challenging about your job?
7. Have you received specialized training?
8. What advice would you give to someone who is considering a career in crop insurance sales?
9. Thank them for their time.
Science and Research Careers

- Life Skill: Keeping records, Problem solving
- SET Ability: Critical thinking, Problem solving
- Vermont Science Standard: MS-LS1-8 Information Processing
- Employment / Career Skill: Teamwork, Administrative skills

Ask students to consider these questions when deciding if a career in science and research:

• Do you want to help shape the future of dairy farming?
• Do you like to ask questions and then work to find new or different approaches?

Some careers in plants, feed, and nutrition include:

• Animal Geneticist
• Plant Geneticist
• Soil Scientist
• Genomic Researcher
• Biochemist

Do the research

Ask students to think about careers in science and research and then complete the table below. They can research career opportunities online or ask someone they know who has knowledge about the selected career.

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<td>Animal Geneticist</td>
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<tr>
<td>Plant Geneticist</td>
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<tr>
<td>Soil Scientist</td>
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<tr>
<td>Genomic Researcher</td>
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<tr>
<td>Biochemist</td>
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Biochemistry is a broad field which includes studying how genetics will be a factor in future generations of plant and animal production. A biochemist may work to develop new strains of seeds that are disease resistant or that are higher yielding. An animal biochemist studies chemical reactions within animals. They may work on metabolism/nutrition, drug development, studying cellular reactions to disease and more — it is a vast field.

For this lesson, students will need to contact a biochemist, explain that they are doing career exploration, and ask if it is possible to interview them for approximately 10 minutes. Remind students to be polite and prepared, and to practice the questions before conducting the actual interview. When students have completed the interviews, they should share and compare their results. The statements and questions are:

1. Introduce yourself and explain that you are doing research into a potential career.
2. How many years have you been in your current position?
3. Where did you go to college and what was your undergraduate degree?
4. How many years did you study to become a biochemist?
5. How many years have you been in your current position?
6. What do you enjoy most about your job?
7. What do you find most challenging about your job?
8. What advice would you give to someone who is considering becoming a biochemist?
9. Thank them for their time.
Dairy Technology Careers

- Life Skill: Communications, Problem solving
- SET Ability: Critical thinking, Engineering design
- Vermont Science Standard: MS-LS1-8 Information Processing
- Employment / Career Skill: Active listening, People skills

Ask students to consider these questions when considering dairy technology careers:

- Do you want to help shape the future of dairy farming?
- Are you interested in robotics and artificial intelligence?

Some careers in plants, feed, and nutrition include:

- Robotics Programmer
- Robotic Sales/Repairs
- Meteorologist
- Drone Data Analyst
- Dairy Technical Specialist
- Process Development Engineer
- Information Technology Manager
- Food Engineer

Do the research

Ask students to think about careers in dairy technology and then complete the table below. They can research career opportunities online or ask someone they know who has knowledge about the selected career.

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<tr>
<td>Information Technology Manager</td>
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<td>Drone Data Analyst</td>
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<tr>
<td>Robotic Milker Sales Representative</td>
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<tr>
<td>Meteorologist</td>
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<td>Food Processing Engineer</td>
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Digging a Little Deeper — Dairy Technology Careers: Robotic Milker Sales

- Life Skill: Communications
- SET Ability: Critical thinking
- Vermont Science Standard: MS-LS1-8 Information Processing
- Employment / Career Skill: Active Listening, People skills

A robotic salesperson works as a company representative and is the liaison between the company that manufactures the robotic milking equipment and the farmers they are trying to persuade to purchase the equipment. The person must have outstanding communication skills, be a good listener, and self-motivated. A robotic salesperson must have in-depth knowledge of the items they are offering for sale and keep up to date on changing technologies. They spend the majority of their time working with farmers trying to sell them their line of products.

For this lesson, students will need to contact a representative in robotic milking sales, explain that they are doing career exploration, and ask if it is possible to interview them for approximately 10 minutes. Remind students to be polite and prepared, and to practice the questions before conducting the actual interview. When students have completed the interviews, they should share and compare their results. The statements and questions are:

1. Introduce yourself and explain that you are doing research into a potential career.
2. How many years have you been in your current position?
3. Did you go to college to learn about mechanics or did not learn on the job?
4. How many years have you been in your current position?
5. What do you enjoy most about your job?
6. What do you find most challenging about your job?
7. Have you received specialized training for specific pieces of equipment?
8. What advice would you give to someone who is considering becoming a crops manager?
9. Thank them for their time.
Career Directory

The following directory is only a small sampling of the careers available within the dairy industry. This list is meant as an introduction and to inspire further career exploration.

Ag Economist
Someone who understands the economic activity that happen in agricultural markets, projects trends with markets, understands futures markets and other forward sales options. These individuals have some type of advanced degree in economics.

Agricultural Engineer
A wide field that includes the design of agricultural structures and facilities as well as storage and processing facilities for agricultural products. Another field of agricultural engineering looks at solving problems like making agricultural equipment more energy efficient as well as equipment design.

Agronomist
Someone who studies plants including how they are grown, how to increase yields, and other research pertaining to plants.

Animal Geneticist
Someone who studies the genetic makeup of animals. Geneticists also study animal health in relation to genetics.

Artificial Insemination Technician
Someone who is responsible for the storage, transportation and preparation of semen prior to insemination. This person must have an understanding of bull reports and be able to assist the farmer with sire selections.

Auctioneer
Someone who helps the farmer prepare and plan for a sale, does the advertising, and keeps records pertaining to the sale. Many auctioneering services now also offer online options for buyers and must have a knowledge of such options to maximize sales. Many auctioneers who specialize in farm auctions have an in-depth knowledge of livestock, as well as machinery.

Biochemist
Someone who studies and researches chemical and physical principals of living things. They also study growth, heredity and disease.

Cheese Cave Manager
The person who manages and maintains cheese caves while the cheese goes through the aging process. Maintains the correct environment in the cave to ensure proper aging and quality.

Cheese Maker
Person who takes raw milk through the processing regimen with the final product being cheese ready to market or age.
Class A CDL (Commercial Driver’s License) Driver
A person who is licensed to drive trucks of all sizes. Many milk truck drivers as well as over-the-road truckers are Class A certified.

Climatologist
Someone who studies the atmosphere of the earth looking for weather patterns and their affects.

Commodity Sales
Someone who sells agricultural products and commodities on the wholesale or retail level.

Cooperative Field Representative
Someone who works for a cooperative and helps the member farmers identify problems, solve quality issues, and keep the farmers informed of cooperative policies.

Crop Insurance Adjuster
Someone who inspects fields where an insurance claim has been filed. They may be looking for damage caused by insects, disease, weather, or natural disaster.

Crops Manager
Person who determines either independently or in cooperation with the farmer when and type of specific crops to be planted, monitored and harvested.

Custom Cropping Service
This person owns and operates equipment doing specific jobs on dairy farms. Manure spreading, cover-crop planting, mowing, merging, etc. are a few of the jobs that a farmer might hire a custom operator to do. Hiring a custom operator means that the farmer does not have to own certain pieces of equipment thus lowering their equipment investment.

Custom Manure Spreaders
Person who is hired by farmers to agitate and spread manure on land owned or leased by the farmer. Custom manure spreaders must know regulations pertaining to spreading near ditches, waterways and buffer zones. Custom manure spreaders must maintain their equipment and keep records that are part of the farms nutrient management plan.

Dairy Cattle Fitter
Person who prepares animals for shows.

Dairy Farm Calf Manager
This person is responsible for calf care from birth. On larger dairy farms this person may be responsible for all levels of calf care, feeding, vaccination schedules, and cleaning from birth to breeding age. On smaller farms this person may be responsible for the calves from birth until they enter the milking herd. This person must be detail oriented and observant.

Dairy Farm Feeder
Person who works with the nutritionist that formulates the rations. While the nutritionist determines the formula (recipe) it is the feeder who mixes all the ingredients and delivers the rations to the animals.
Dairy Farm Inspector
A farm must pass certain inspections to ship milk. The dairy farm inspector visits individual farms and checks milking equipment, bulk tanks, and facilities for cleanliness and other standards of operation. They record their findings and generate a report for each farm indicating their score and what changes are required.

Dairy Farm Robotic Herd Manager
This person monitors a cow’s production using computer software. Must be computer savvy and on-call to respond to calls from the robotic milkers as needed. They are responsible for training new cows to the system and ensuring that cows are being milked at the correct interval. Must also have knowledge of robotic milking system and ability to perform maintenance and repairs.

Dairy Processing Plant Inspector
Person who is responsible for the inspection of dairy facilities to ensure that rules and regulations pertaining to cleanliness, sanitation, storage, temperature, quality, and more are followed to ensure safe and healthy food products are being sold to consumers.

Dairy Product Development Specialist
Person who develops new uses for dairy products to expand the market and demand on a local or global market.

Dairy Technology Sales Representative
Person who sells technology related items like robotic milking units, robotic calf feeding systems, pedometers, computer software, drones, precision cropping systems, and more.

Dairy Nutritionist
Person who reviews feed sample analysis and formulates the rations based on the age, production level desired and analysis of feedstuffs available either on farm or available for purchase.

Diesel mechanic
Person who maintains and repairs farm equipment. The maintenance of some more modern high-tech implements may require special training and specific tools.

Director of Sustainability
This position focuses on member relations with member farmers and dealing with farm audits. The position also looks at the environmental impact from manufacturing operations and works with co-op dairy partners to reduce methane and other byproducts that the dairy produces.

Ecologist
A person who studies living things and the ecosystems they live in. This is a very broad field of study with many sub-categories.

Electrician
Many pieces of equipment on dairy farms and in processing facilities are electrically powered. It is the job of an electrician to ensure that these machines are working safely and efficiently to ensure the safety of the humans and the animals.

Entomologist
Person who studies insects.
Environmental Attorney
A specialized area of law that may include handling legal issues related to water quality, environmental regulations, and climate. They generally work for the protection of the environment.

Extension Dairy Specialist
An employee of a land-grant university who works with dairy farmers to try research-based initiatives which help make changes and improvements.

Farm Equipment Repair/Service
Person who puts machinery together after it arrives from the manufacturing facility and prepared it for sale, or repairs/services equipment owned by others who pay for the repair service.

Farm Equipment Sales
Person who knows the details about a piece of equipment and its specific uses, and who can communicate with prospective buyers about it.

Farm Lender/Loan Officer
Person who understands economics, finance, business operations as well as spreadsheets, inventory lists, and balance sheets and works with farmers to determine credit and loan options that are suitable for their situation.

Farm Regulatory Specialist
Someone who makes sure that farms follow specific guidelines and regulations.

Farm Service Agency Loan Officer
An employee of the United States Department of Agriculture (USDA) Farm Service Agency (FSA) who helps with federal program options.

Farm Store employee
A person who works with the public, stocks shelves, provides customer service, and has a basic understanding of the products they sell.

Feed Company Sales Representative
A person who sells feed, grain, and supplements to farmers. Understands animal nutrition and knows how to balance a ration for the specific age and type of animal.

Financial advisor
A person who works with farmers, examines their financial records, cash flow statements, balance sheets and other financial documents to advise them how to invest or plan for financial stability and security. An understanding of forward contracting, hedging and other financial strategies is also needed.

Food Processor Employee
Any person who works in the processing of food, from a raw product such as milk to a ready to purchase product like cheese. There are many types of food processing employees such as: Laboratory workers, production line workers, workers who maintain the product line equipment, customer relations, sales and more.

Genomic Researcher
A scientist who studies genes and their impact on physical traits. They also study how combinations of genes influence development and growth rates.
Herder/Herdsperson
Person responsible for the health, care, breeding, and milking of the herd. They may supervise other staff such as milkers, feeders, etc. and work with the veterinarian, breeding, nutritionist, crops manager, and others to manage the overall health of the herd.

Ice Cream Manufacturing
Person who works in food production taking condensed cream and producing ice cream ready for market. This industry may include several different jobs including machinery operator, research and development, refrigeration/freezing systems maintenance, and other positions in ice cream manufacturing facilities.

Journalist
Person who gathers information, conducts interviews, writes stories, and works with editors for print media, social media, radio, podcasts, and more.

Hoof Trimmer
Person who travels from farm to farm providing hoof care and trimming, and treatment for foot problems.

Hydrologist
Person who studies how water moves through soil.

Livestock Dealer
Person who is licensed to purchase and sell livestock. They may go from farm-to-farm purchasing livestock and selling them to others at a profit.

Mating Specialist
Person who looks at the pedigree of an animal, inspects the animal to determine their physical strengths and weaknesses, and selects a potential mate for that animal with the goal of improving upon the most desired traits.

Meteorologist
Also called atmospheric scientists, they study weather conditions to make weather forecasts and predictions.

Milker
Person who does the actual milking of the cows on a farm. This is also the first line observation person who may identify health issues because of identified changes in a cow’s production levels. Attention to detail and the ability to follow strict on-farm procedures and protocols are important. Milkers may also administer some medications to cows, if needed.

Milk Plant Maintenance Mechanic
Person who keeps the equipment in the milk processing plant working and repaired. Mechanical engineering and electrical engineering training may be needed.

Natural Resource Conservation Specialist
Person who works with farmers to design and implement systems that reduce run-off and erosion, provide buffer areas, and improve waste handling, manure storage, and environmental improvement.
Nutrient Management Specialist
Person who works with farmers to determine the health of the soil and to manage the available nutrients, including manure on the farm, to lessen the amount of nutrients purchased.

Plant Geneticist
A person who studies plant genetics to develop new varieties that are more productive, less prone to disease, and tolerate adverse weather conditions.

Plant Pathologist
A person who studies diseases of plants.

Quality Assurance Specialist
Person who is responsible for inspecting and monitoring production to ensure that quality standards are being met.

Rotational Grazing Specialist
Person who works with farmers and landowners to explain and help implement a rotational grazing system.

Risk Management Specialist
Person who is responsible for looking at situations and then determining and recommending changes that can reduce risk, potential hazards, and potential injury to create a safer work environment.

Soil Scientist
Person who studies soil health, composition, and environmental impacts on soil. Soil scientists study how changes in soil health can impact crop growth and production.

Toxicologist
Person who studies chemicals and other substances to determine if they are safe for the environment, humans, animals, and in areas of food production.

Veterinarian
Person who diagnoses injuries and illnesses in animals. They also assist the owners with preventative health care.

Veterinary Assistant
Person who works for a veterinarian or veterinary technician.

Veterinary Pharmaceutical Sales/Representative
Person who works for a pharmaceutical company and calls on prospective customers.

Veterinary Technician
Licensed professional who works under the supervision of a veterinarian (like a physician's assistant being supervised by a doctor). A veterinary technician must pass a credentialing examination.

Vocational Agriculture Teacher
Teacher who works with high school students exploring a variety of agricultural fields.
Glossary

Abomasum
Fourth stomach chamber of a ruminant. Also called the true stomach because of its similarity to the stomach of a monogastric.

AI (Artificial Insemination)
When semen is placed into the female reproductive tract by a technician rather than through natural service.

AI (Artificial Intelligence)
Predictive software used on dairy farms that can lead to more futuristic tools which save labor, collect data, and allow for analytic decision-making. A key part of precision agriculture.

Alfalfa (Medicago sativa, scientific name)
A perennial legume forage crop. Stands may live more than five years and are known for their deep root system.

Ayrshire
A breed of dairy cow which originated in the county of Ayrshire in southwestern Scotland.

Balance Sheet
A financial report which lists the assets and liabilities for a business at a certain point in time. A lender may require a balance sheet when someone is applying for a loan.

Balling Gun
A tool that is used to administer boluses or capsules down the throats of cattle.

Bedding
Material that is placed in areas where cattle rest. Desirable bedding products need to be clean, absorbent, and dry. Common forms of bedding include sawdust, straw, and sand. Other materials may also be used.

Borings
Multiple soil cores taken from a field for analysis.

Brown Swiss
Breed of dairy cow that originated in the Alps region of Europe where it is known as the Braunvieh (Swiss Brown). Known for their large stature, grazing ability, and milk high in desirable components for cheesemaking.

Butterfat
Common term for the natural fat found in milk.

Calf
General term for the young/offspring of a cow and less than one year old. A heifer calf is a female baby cow under one year of age. A bull calf is a male baby cow under one year of age.
**Cash Flow Statement**
A financial report that shows how cash or cash equivalents enter and exit a business. Cash may enter a business through sales of an item or product, and leave to pay the expenses such as labor, insurance, etc.

**Colostrum**
The first milk produced by a mammal after giving birth. This milk is nutrient dense and high in antibodies needed by the newborn to strengthen its immune system.

**Dam**
In cattle, the dam is the mother of the calf.

**DHIA (Dairy Herd Improvement Association)**
An organization that assists farmers with the collection of milk samples for use in determining milk quality, individual cow production, and herd production records.

**Diagnosis**
To identify an illness or problem after examination and review of the symptoms.

**Estrus**
Also called “standing heat.” It is the period during the heat cycle when there is a high level of estrogen in the blood that can cause behavior changes such as mounting other cows, willingness to stand while mounted by other cows, and increased activity. A pedometer on a cow will record this increase in activity.

**Foot Rot**
A smelly bacterial infection of the hoof, usually between the toes. Can cause lameness in cattle and become debilitating if untreated.

**Freshen**
When a cow’s milk production starts after giving birth.

**Genomics**
The study of the DNA structures, makeup, and mapping in animals.

**Guernsey**
A breed of dairy cow that originated in the Island of Guernsey in the Channel Islands in Europe. Known for producing milk characterized by its golden color because of its B-carotene content.

**Hardware Disease**
The common term used for traumatic gastritis and traumatic reticulitis. When a metal or sharp object is ingested by a cow, generally in the feed and punctures the wall of the reticulum, diaphragm, or the paracardial sac. Symptoms include loss of appetite, abnormal heart sounds, pooling of fluid in the brisket area. Hardware disease can be life threatening for a dairy animal.

**Hay**
Herbaceous plants such as grasses and legumes that have been cut and dried for animal forage.

**Haylage**
Herbaceous plants such as grasses and legumes that have been cut and stored in a method that limits oxygen. Haylage is higher in moisture than dried hay and is subject to mold if oxygen is not limited.
Heat Stroke
Heat stroke in cattle is a later stage of heat stress characterized by rapid, shallow breathing with mouth open, neck extended, lethargic state, body temperature 106° F or higher. At 108° F permanent brain damage may occur.

Heifer
A female cow that has not yet given birth.

Holstein
A breed of dairy cow that originated in the Netherlands. Easily identifiable by their distinct black and white or red and white markings. The highest producing of dairy cattle breeds.

Homogenization
The process that milk goes through to emulsify the fat particles so that the cream does not rise to the top and the fat particles stay evenly distributed.

Insemination
The process of placing sperm cells into the female reproductive tract. Artificial insemination places the sperm with mechanical tools and natural insemination is also call live cover.

Intravenous
Administered into a vein.

Jersey
The smallest breed of dairy cow that originated from the Island of Jersey in the British Channel Islands. This breed is known for producing milk with the highest percentage of butterfat.

Ketosis (Acetonaemia)
Metabolic disorder also known as keto acidosis which commonly occurs within two weeks after calving when energy demands exceed energy intakes resulting in low blood glucose. Characterized by fruity smelling breath and elevated ketone levels. Treatment is important so recovery can happen.

Lactation
Starting with the birth of the calf, lactation is the period during which a cow produces milk. For comparison purposes, lactations are mathematically standardized to 305 days. The two-month period that cows are not milked prior to calving is referred to as the dry period.

Legume
Plants from the pea family, Fabaceae, which have the ability to fix nitrogen from the air on root nodules, important to improving soil fertility. Legumes include alfalfa, peas, and beans.

Lice
A form of parasite. Both sucking and biting lice may affect cattle. Untreated lice infestations may result in lower milk production. Easily treatable with pour-on, spray, or injectable products. Lice are species specific and are not transmittable to humans.

Lime
Amendment added to soil to increase the soil pH.

Longevity
Length of life.
Mammal
Warm-blooded vertebrates that produce milk.

Mammary Gland
In a dairy cow, the mammary gland consists of four external glands each with a teat. Together the four glands make up the udder.

Mastitis
An inflammation of the udder that may result in visibly abnormal milk, clinical mastitis, or nonvisible, subclinical mastitis. Decreased production, inflammation of the udder, and sensitivity to touch are all symptoms.

Microbes
A group of microscopic life forms that include bacteria, archaea, viruses and eukaryotes like fungi.

Milk Fever (Hypocalcaemia)
A metabolic disorder caused by low calcium levels in the blood, most common within one to two days post calving. It is usually treated easily by increasing blood calcium.

Milking Shorthorn
Breed of dairy cow that originated in Great Britain and known for their superior grazing characteristics.

Monogastric
One compartment stomach as in a person or pig.

Necropsy
An examination of an animal post-mortem (after death) which may be done to help determine the cause of death. Necropsy is post-mortem for animals while autopsy is post-mortem for humans.

Omasum
One of the four compartments in the ruminant stomach. Commonly called the many-plies compartment, it absorbs water from the partially digested feedstuff.

Parasite
May be an internal or external organism that lives in or on the host taking nutrients from the host for the benefit of the parasite.

Parturition
The act of giving birth.

Pasteurization
Process developed in 1862 by French microbiologist Louis Pasteur to heat milk to a certain temperature for a specified amount of time and kill microorganisms. Today, cold raw milk, direct from the farms is heated until it reaches 161° F. It is then held at that temperature for about 15 seconds and then rapidly cooled back to 39° F.

Pathogen
An organism that causes disease.

Pedigree
A record of ancestry presented in a standard format.
**Per Capita**  
Latin term meaning per person.

**Permeability**  
The rate at which water can pass through soil.

**Pinkeye (Infectious Bovine Keratoconjunctivitis)**  
A highly contagious bacterial infection of the eye that can be spread by flies, flicking tails, or other contact. Causes inflammation, runny eyes, and temporary or permanent blindness.

**Pneumonia**  
A bacterial or viral infection of the respiratory tract.

**Post-Dipping**  
Occurs immediately after milking when each individual teat is dipped or sprayed with a disinfectant to kill bacteria on the teat-end.

**Pre-Dipping**  
Prior to milking each individual teat is dipped or sprayed with a disinfectant to kill bacteria on the teat-end to prevent bacteria from getting into the milk supply.

**Probe**  
A tool that is used to take soil borings.

**Protein**  
Amino acid chains responsible for growth, lactation, and reproduction in dairy cattle.

**Pulse**  
Can be taken on the left side of the cow with a stethoscope placed on the chest behind the elbow. Normal rates for a healthy mature cow are 48 to 84 beats per minute.

**Ration**  
The amount of feed given to an animal in a 24-hour period.

**Regurgitate**  
Part of the digestion process of cows. Feed goes through the rumen (stomach chamber 1) then to the second chamber (the reticulum), and then is regurgitated and brought back to the mouth and oral cavity in the form of cuds where it is rechewed and re-swallowed for additional digestion.

**Respirations**  
The number of breaths taken per minute. Can be taken by observing the rise and fall of the chest. In a healthy cow, the normal range is 26 to 50 breaths per minute.

**Reticulum**  
The second chamber of the ruminant digestive system. Commonly called the honeycomb chamber. Dense or heavy feed and or objects may settle here and it is where most incidences of hardware disease are found. The reticulum plays an important role in digestion by sorting the partially digested feed based on particle size.
**Ringworm**
A fungal infection of the hair and surface areas of the skin that is highly transmissible. A zoonotic condition meaning it can spread from animals to humans.

**Riparian Buffer**
An area adjacent to a brook, stream, lake, or wetland that is made up of perennial plants to provide conservation benefits and lessen the incidence of erosion.

**Roughage**
Plant-based feedstuffs which usually have a higher fiber content than forages.

**Rumen**
The large muscular first compartment of the cow's stomach commonly referred to as the fermentation vat.

**Ruminant**
An animal with a four-compartment stomach.

**Scours**
Diarrhea in young calves that can cause dehydration and even death if untreated. May be bacterial or viral.

**Semen**
Fluid from the male reproductive tract that contains sperm cells.

**Silage**
Fermented feed.

**Sire**
The male parent of an animal.

**Subcutaneous**
Placed or injected under the skin but not into the muscle.

**Temperature**
Normal temperature of a healthy dairy cow is 100° to 102.5° degrees F. Calves may be slightly higher.

**Udder**
A large bag-shaped organ consisting of four milk-producing glands which each drain into separate teats.

**Vaccination**
Administering a vaccine to increase immunity against a specific disease.

**Veterinarian**
A person trained to treat diseases or injuries of animals. May also provide preventative care to animals.

**Warts (Infectious Papillomatosis)**
Caused by the papilloma virus, warts appear as dry scaley patches on raised areas on the skin. Contagious and can spread to other animals.

**Zoonotic**
An infectious disease that can be spread between species from animals to humans or from humans to animals.
Appendix 1 – Answer Keys

Dairy Cow Breeds (page #)

<table>
<thead>
<tr>
<th>BREED</th>
<th>COUNTRY OF ORIGIN</th>
<th>COLOR</th>
<th>ONE INTERESTING FACT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ayrshire</td>
<td>Scotland</td>
<td>Red &amp; white</td>
<td>A good grazer</td>
</tr>
<tr>
<td>Brown Swiss</td>
<td>Switzerland</td>
<td>Silvery brown</td>
<td>High cheese yield milk</td>
</tr>
<tr>
<td>Guernsey</td>
<td>Isle of Guernsey</td>
<td>Fawn to red &amp; white</td>
<td>High betacarotene milk</td>
</tr>
<tr>
<td>Holstein</td>
<td>Netherlands</td>
<td>Black &amp; white, red &amp; white</td>
<td>Highest producer</td>
</tr>
<tr>
<td>Jersey</td>
<td>Isle of Jersey</td>
<td>Fawn to brown</td>
<td>Higher butterfat</td>
</tr>
<tr>
<td>Milking Shorthorn</td>
<td>England</td>
<td>Often roan, red &amp; white</td>
<td>Their roan color</td>
</tr>
<tr>
<td>Red &amp; Whites</td>
<td></td>
<td></td>
<td>A color breed</td>
</tr>
</tbody>
</table>

Additional discussion points:

1. What breed typically produces the most pounds of milk per lactation? **Holstein**
2. What breed is known for producing “golden” milk? **Guernsey**
3. What breed is known for producing milk with the highest percent butterfat? **Jersey**

Dairy Anatomy Comparison (page #)

<table>
<thead>
<tr>
<th>Has over 140 feet of intestines</th>
<th>HUMANS ONLY</th>
<th>COWS ONLY</th>
<th>BOTH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Has a 1-compartment stomach</td>
<td></td>
<td>√</td>
<td></td>
</tr>
<tr>
<td>Regurgitates its food as part of the digestion process</td>
<td></td>
<td>√</td>
<td></td>
</tr>
<tr>
<td>Has a pregnancy of approximately 280 days</td>
<td></td>
<td></td>
<td>√</td>
</tr>
<tr>
<td>Has a 4-chamber heart</td>
<td></td>
<td>√</td>
<td></td>
</tr>
<tr>
<td>Is a mammal</td>
<td></td>
<td>√</td>
<td></td>
</tr>
<tr>
<td>Has the ability to sweat as a means of cooling the body</td>
<td></td>
<td>√</td>
<td></td>
</tr>
<tr>
<td>Has 49-51 bones in the spine</td>
<td></td>
<td>√</td>
<td></td>
</tr>
<tr>
<td>Has a normal body temperature of 98.6 degrees F</td>
<td></td>
<td>√</td>
<td></td>
</tr>
<tr>
<td>Has 2 knees</td>
<td></td>
<td></td>
<td>√</td>
</tr>
<tr>
<td>Has cloven feet</td>
<td></td>
<td>√</td>
<td></td>
</tr>
<tr>
<td>Is born with no upper teeth</td>
<td></td>
<td></td>
<td>√</td>
</tr>
</tbody>
</table>
Breeds of Cows—Bovine

Ayrshire              (C — Scotland)
Brown Swiss           (F — Switzerland)
Guernsey              (D — Isle of Guernsey)
Holstein              (A — Netherlands)
Jersey                (B — Isle of Jersey)
Milking Shorthorn     (E — England)
Dairy Anatomy Level 2 (page #)

- 1. Chest floor
- 2. Pins
- 3. Neck
- 4. Poll
- 5. Chin
- 6. Teat
- 7. Elbow
- 8. Point of shoulder
- 9. Heart girth
- 10. Barrel
- 11. Ribs
- 12. Loin
- 13. Thurls
- 14. Back
- 15. Hips
- 16. Tail
- 17. Dewlap
- 18. Stifle
- 19. Fore udder
- 20. Rear udder
- 21. Pastern
- 22. Dewclaw
- 23. Hoof
- 24. Muzzle
Unified Dairy Scorecard (page #)

**Frame**: The skeletal parts of the cow, with the exception of the rear feet and legs.  

**15%**

**Dairy Strength**: A combination of dairyness and strength which supports production and longevity.  

**25%**

**Rear Feet and Legs**: Evidence of mobility, rear view, side view, and thurl position.  

**20%**

**Udder**: Major consideration is given to those traits that contribute to high milk yield and a long productive life.  

**40%**

**100%**  
**TOTAL %**

Dairy Health (page #)

A. Ringworm  
B. Pinkeye  
C. Warts  
D. Lice  
E. Scours  
F. Thermometer  
G. Pulse  
H. Foot Rot  
I. Balling Gun  
J. Veterinarian  
K. Diagnose

- **K** Examine and determine what is wrong  
- **F** An instrument for measuring temperatures  
- **B** Redness and inflammation of the lining of the eye  
- **I** A device used to give cattle boluses  
- **G** The measurement of blood surging through an artery  
- **A** Infectious skin disease caused by a fungus  
- **C** A small growth on the skin  
- **H** Causes lameness in an animal  
- **J** An individual who visits a farm for animal health  
- **E** Manure that is of watery consistence  
- **D** An external parasite
## Manure Management (page #)

<table>
<thead>
<tr>
<th>BREED**</th>
<th>AVERAGE LIVE WEIGHT</th>
<th>POUNDS OF MANURE PRODUCED PER DAY</th>
<th>GALLONS OF MANURE PRODUCED PER DAY</th>
<th>GALLONS OF WATER IN MANURE PER DAY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ayrshire</td>
<td>1,200 lbs.</td>
<td>$1.2 \times 89 = 106.8$</td>
<td>$1.2 \times 10 = 12$</td>
<td>$12 \times .873 = 10.5$</td>
</tr>
<tr>
<td>Brown Swiss</td>
<td>1,500 lbs.</td>
<td>$1.5 \times 89 = 133.5$</td>
<td>$1.5 \times 10 = 15$</td>
<td>$15 \times .873 = 13.1$</td>
</tr>
<tr>
<td>Guernsey</td>
<td>1,100 lbs.</td>
<td>$1.1 \times 89 = 97.9$</td>
<td>$1.1 \times 10 = 11$</td>
<td>$11 \times .873 = 9.6$</td>
</tr>
<tr>
<td>Jersey</td>
<td>1,000 lbs.</td>
<td>$1.0 \times 89 = 89$</td>
<td>$1.0 \times 10 = 10$</td>
<td>$10 \times .873 = 8.7$</td>
</tr>
<tr>
<td>Holstein</td>
<td>1,500 lbs.</td>
<td>$1.5 \times 89 = 133.5$</td>
<td>$1.5 \times 10 = 15$</td>
<td>$15 \times .873 = 13.1$</td>
</tr>
<tr>
<td>Milking Shorthorn</td>
<td>1,250 lbs.</td>
<td>$1.25 \times 89 = 111.25$</td>
<td>$1.25 \times 10 = 12.5$</td>
<td>$12.5 \times .873 = 10.9$</td>
</tr>
<tr>
<td>Red and White</td>
<td>1,400 lbs.</td>
<td>$1.4 \times 89 = 124.6$</td>
<td>$1.4 \times 10 = 14$</td>
<td>$14 \times .873 = 12.2$</td>
</tr>
</tbody>
</table>
Soils Crossword Answers (page #)

**Across**

1. A measure of the rate at which water can pass through soil

4. Soil element critical for plant health and growth, seen as K on the soil test

5. A group of microscopic life forms that includes bacteria, archaea, viruses, and eukaryotes like fungi

7. Amendment added to soil to increase the soil pH

8. Tool used to take soil borings

9. Another name for the multiple soil cores taken from a field for analysis

11. Process of collecting soil borings for analysis (2 words)

**Down**

2. Person who studies soil management and crop production

3. Slang word for soil

6. Plants used to reduce soil erosion after a harvest (2 words)

8. High levels of this nutrient in run-off can cause algae blooms

10. Legume plants have tiny root nodules that can fix this nutrient
### Dairy Foods (page #)

1. Cottage Cheese  4  Enzyme used in cheese making
2. Yogurt  3  A milk protein
3. Casein  15  By-product of cheese making
4. Rennet  7  Cheese made from goat's milk
5. Pasteurization  12  Acid that gives milk a sour taste
6. Homogenization  10  Milk is churned into this product
7. Chevre cheese  9  Cheese made from sheep's milk
8. Low-fat milk  14  Coagulated mixture of milk and eggs
9. Roquefort  2  Cultured milk product
10. Butter  11  Soft cheese made with a surface mold
11. Blue cheese  1  Curds of milk proteins; a soft cheese
12. Lactic acid  13  Unpasteurized milk
13. Raw milk  5  Milk that has been heated to 160° F for 30 minutes
14. Custard  8  Milk that is 1 to 2% butterfat
15. Whey  6  Process of breaking up fat particles

### Dairy Foods Part 2 (page #)

1. Bulk Tank  4  First milk a cow produces after giving birth
2. Butter  2  Dairy product made from the fat protein of churned cream
3. Calcium  14  Hard Italian cheese often grated and served on spaghetti
4. Colostrum  5  Powdery outer coating on cheese that forms during aging process
5. Rind  13  Hard cheese with holes/eyes resulting from carbon dioxide released during the maturation process
6. Cud  7  Breaking up of fat particles to keep cream from rising to the top
7. Homogenization  10  The process of aging cheese
8. Ice cream  12  Dairy product used in dips and on baked potatoes
9. Mozzarella  3  Nutrient in milk important to bone building
10. Cheese affinage  6  Globs of feed regurgitated from a cow’s first stomach compartment
11. Processing plant  1  Stainless steel structure where milk is stored
12. Sour cream  11  Facility where milk is prepared before going to retail outlets
13. Swiss cheese  9  Stringy cheese commonly used on pizza
14. Parmesan  8  Frozen dairy treat
**Across**

2. A breed of large brown cows (2 words) — originated in the Alps

4. Smallest dairy breed

6. A cow’s female parent

7. A hardy red and white breed of medium stature

9. An annual crop that is chopped and is major feed in a cow’s diet (2 words)
   - Hint: First word — people like to eat it off the cob
   - Hint: Second word — the resulting product when the first word is fermented

**Down**

1. A breed of cow that gives golden milk

3. A term for a yearling female

5. A term for a cow’s mammary gland

7. A legume grown for hay or silage

8. A black and white breed of cow