

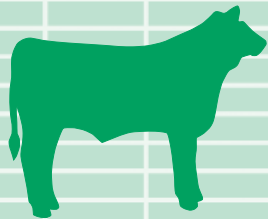


4H1188

Your 4-H Market Beef Project



4-H Youth Development
Michigan State University Extension



Your 4-H Market Beef Project

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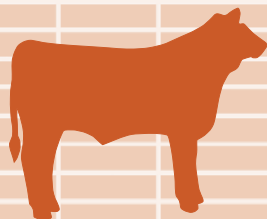
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Introduction

Welcome to an exciting 4-H animal project experience. As a participant in the 4-H market beef project, you are part of a large group of young people who are learning by doing and applying the skills they learn.

Livestock production is part of Michigan's agricultural industry, which is vital to the state's economy and future prosperity. Participating in a 4-H market beef project can set you on the path to a rewarding and successful career in agriculture. You will choose, feed, care for, train, and show your market beef project animal as you learn about beef cattle breeds, selection, grooming, management, marketing, health, and agribusiness careers. In addition to local county events, statewide competitions and educational events provide other opportunities for involvement.

The beef project area offers a variety of ways to participate. You can start your own herd with breeding cattle or raise a market animal that produces a meat product for human consumption. Market animals can include steers, market heifers, prospect or **feeder calves**, and veal calves. This book focuses primarily on raising a market animal to a finish weight. Specifically, it focuses on feeding a **steer** to a market weight of about 1,100 to 1,400 pounds or a **heifer** to a market weight of about 1,025 to 1,325 pounds, and selling it for meat. You may choose to raise one or more animals.

Raising cattle is a large time and financial investment. Don't expect to make a huge profit on your project. Your profit or loss will depend on how much you pay for your calf; the cost

of feed, veterinary care, equipment, and other expenses; and the price you receive when selling your calf.

If you market your beef project at your fair or show, generous people in your community may pay more for your animal than its true market value. This increases your chance for a profit. It's important that you know the difference between market price if sold at a local sale barn and the price you receive at your fair or show sale. If your project brings more than regular market price, the difference is your reward for having participated in the 4-H project and for working hard and carrying out what you learned through the project.

What You Can Learn

In this 4-H beef project, you will have the opportunity to learn:

- How to evaluate a **calf** and choose a suitable project animal.
- How to choose feeds and combine them into a good **diet** for your calf.
- How to figure your expenses and the possible profit from your project.
- How to know when animals are healthy, prevent illness, identify signs and symptoms of illness, and treat sick calves properly.
- How to observe animal behavior.
- How to prepare, exhibit, and show a calf in competition.
- How to care for livestock responsibly and use good **animal well-being** practices.
- How to market livestock and livestock products effectively.

These are just a few of the many things you can learn from your market beef project. While working with your 4-H volunteer leader, you can make your own list of things you want to learn from this project. You can also set goals that you want to reach at the end of the project. This will help you decide how successful your beef project decisions were. You can also decide if you should change anything for future animal projects.

Project & Member Goals

The objective of the 4-H market beef project is to encourage integrity, sportsmanship, cooperation, and communication through activities such as demonstrations, presentations, judging events, exhibitions, tours, and other activities. Your market beef project will give you opportunities to learn about animal and veterinary science, as well as livestock production



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practices. This project will give you the opportunity:

- To understand the science of producing and managing livestock.
- To gain business experience while learning about purchasing, budgeting, record keeping, and marketing.
- To understand the importance of the livestock and meat industry and how it fits into the agricultural and business economy of the state and nation.
- To practice life skills such as planning, organizing, communicating, problem solving, decision making, critical thinking, goal setting, teamwork, leadership, and taking responsibility.
- To explore careers in the livestock industry.



any medication given to your project animal. Use the *Michigan 4-H Animal Treatment Record Sheet* (http://msue.anr.msu.edu/resources/michigan_4_h_animal_treatment_record_sheet) to record treatments.

Record Keeping

Good record keeping is important to any agriculture enterprise. Keeping records on your 4-H market beef project helps you:

- Learn about animals – their health, growth, feed and habits.
- Improve your management practices.
- Determine how much money you have made or lost.
- Plan future projects, including what you would like to learn and achieve.

Document your project by recording information in the *Michigan 4-H Market Animal Project Record Book* (see References at the end of this manual) or other resources that allow you to track animal growth and project expenses. In addition to tracking growth, you should keep records of

Analyze Your Records

See how well you did with your project by using the information you recorded in the *Michigan 4-H Market Animal Project Record Book* to study the following information:

- Weight of each calf at the start of the project.
- Weight of each calf when marketed.
- Total cost or value of the calf at the start of the project.
- Money you received from the sale of your steer or heifer.
- Market value of your calf when sold.
- Total amount of feed used.
- Total cost or value of feed used.
- Total cost of medications and veterinary fees.
- Other expenses.

- Interesting or unusual things that happened to you or your calf during the project year.
- Your goals for coming years.

From that information you can:

- Make a chart or graph showing your calf's growth.
- Figure the average daily rate of gain.
- Determine the cost of feed for each pound of gain.
- Determine the number of pounds of feed required for each pound of gain.

Timeline

Managing your time is an important life skill. To accomplish your goal of a successful animal project, you need to balance the time you spend raising your calf with your other activities.

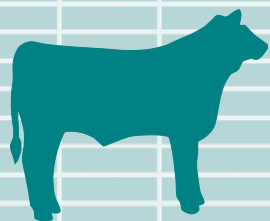
Creating a timeline helps you schedule what you plan to do with your project and keep track of your progress from the time you choose a calf until the time you show or sell it. Make your own timeline including specific dates, weeks, and months for what you plan to do. For example, work back from your show date to figure out when to schedule each step in the timeline needs to halter break and train your calf on time. That way you can be sure you have enough time for all the necessary preparations to be ready for the show. Remember to be flexible. Each animal is different and may require more or less of your time.

Table 1 is a sample monthly timeline to help you get started with your own timeline.

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Table 1. Example Timeline of 4-H Market Beef Project Activities for Exhibiting at a Summer Fair

Special Notes	<p>Each fair and show has deadlines for participation. Pay special attention to the date by which an animal needs to be purchased, weigh-in or tag-in dates, show sign-up deadlines, and other specific event details.</p> <p>Providing clean fresh water and adequate nutritious feed are requirements of properly caring for a market animal.</p>
Month	Activity
October	<p>Prepare facilities, purchase supplies, buy calf.</p> <p>Determine what the calf had eaten previously and slowly adjust the feed ration to fit your goals for growth.</p>
November	<p>After the calf has adjusted to its new home, begin changing feed to a higher energy diet or a diet you and your nutritionist have come up with.</p> <p>Tame your calf and teach it to accept a rope halter. Begin training your calf to lead.</p>
December and January	<p>Consider attending a winter cattle show to observe others showing.</p> <p>Monitor your calf's growth. If it is not meeting your goals for growth, check to see if the diet is high enough in energy or if the calf is sick. Think about treating your calf to prevent lice and mange, as they tend to be worse in Michigan this time of year. Be sure to meet the withdrawal time for any medications used.</p> <p>Work on halter-training your calf, and training it to lead.</p>
February	<p>Your calf should be able to lead well. Whenever you catch the calf, practice setting up its feet and holding it as you would to show it.</p>
March through May	<p>Your calf should be growing well and putting on weight. Weigh the calf to determine exactly how well it is growing.</p> <p>Once the weather becomes warmer, begin giving the calf baths and keep an eye on the amount of feed consumed.</p>
June through September	<p>Trim hooves and work with your calf's hair to continue preparing for exhibition.</p> <p>Weigh your calf to see exactly how well it is growing and adjust its diet if needed.</p>



Selecting Your Calf

The beef industry is diverse, reaching a variety of markets. Cattle are raised for many reasons. Both beef and dairy calves can be market beef projects. Cattle raised for show are bred with traits that are more desirable for competition.

You can obtain cattle from several sources, including:

- Your own or your parents' herd.
- A neighbor's or friend's purebred or commercial herd.
- Club calf auctions across the country.
- Online club calf sales.

Sales in Michigan are often advertised through the Michigan Cattlemen's Association website at <http://www.micattlemen.org>.

Show calves are usually sold by the head, rather than by the pound, so you should have a good idea of how much the calf weighs before buying. An acceptable weight-for-age standard is **500 to 700 pounds at 5 to 7 months old**. A calf that weighs less than that may fail to perform in your desired timeline. Some specific breeds of cattle are smaller framed and will not grow as quickly.

If you feed home-raised calves, weigh them when they start on feed and determine their value using the current market price or place a value on them for their quality if you were to sell them as a show calf. You will need the information to complete your livestock record book and to determine your profit or loss for the market beef project.

Before purchasing a calf, learn about the person selling the animal and their production goals. As you grow in experience, consider studying the genetics of the calves you are interested in purchasing to better predict their growth and **phenotype** (physical appearance) at market weight.

The price of a calf varies greatly, depending on the current market prices for feeder calves at local auction facilities. Additionally, calf prices vary depending on the quality of the calf and the reputation of the farm. It is common to see calf prices range drastically depending on their quality and the market. Do not pay a high price for a calf with the idea that it will assure you of a winning champion. Winning takes a good feeding program, hard work, the right kind of calf, and good showmanship skills.

Selection Criteria

Calf prospects should appear **thrifty**, healthy, vigorous, and alert. Steers should be castrated and healed before purchasing. If you purchase a **bull**, work with the breeder or large-animal veterinarian to have the calf castrated. The most important thing to look for when selecting an animal project is health.

Once you have determined the health of the animals, it will be your turn to be the judge. Select the 4-H project that fits your goals and your price range. Although this can be challenging, you can look for a few simple things to help you select a beef project.

To help you better understand the selection concepts, begin by learning or reviewing the parts of a calf (see Figure 1). Knowing these parts will help you recognize quality calves.

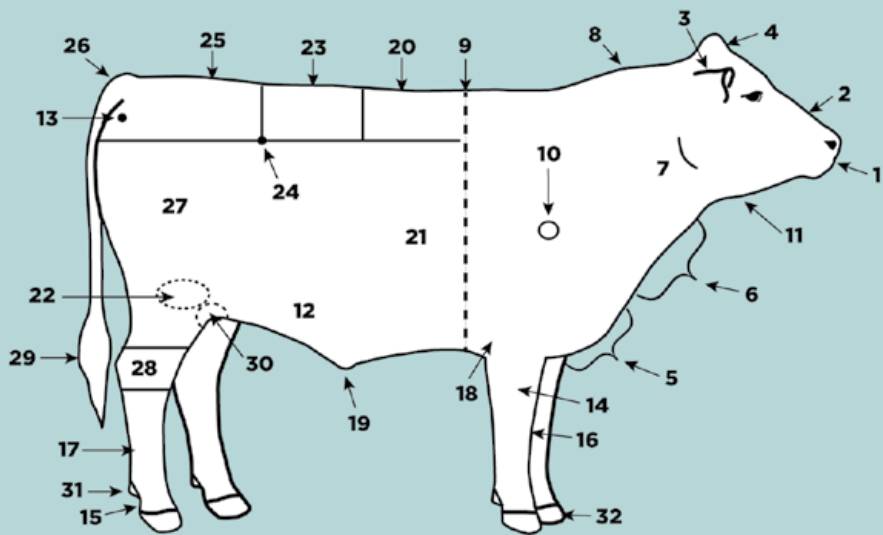
In general, you are looking for a heavy muscled, well-designed calf that is structurally sound and able to move around the pen without any difficulty. At this stage, you have a calf that has the potential to grow and fit the desired timetable you have already determined. As the calf ages, body composition – specifically comparing the amount of muscle to the amount of fat – will also play a role in selection.

Muscle

When viewed from behind, the muscles of the quarter region should be long, thick, and wide with the thickest point through the stifle. There should be width between the hind legs, indicating muscling. The loin should have natural thickness and expression of muscling (muscle thickness) when viewed from the front or rear.

Thickness of muscling refers to the development of muscles compared to skeletal size. If two calves have the same fat thickness, the thicker-muscled calf has more muscle compared to bone – and gets a better **yield grade**. Feeder cattle are labeled by thickness as No. 1, No. 2, No. 3, or No. 4 (see Figure 2). No. 1 feeder cattle are thickest (best) and No. 4 are thinnest (worst).

Figure 1. Parts of beef cattle.



- | | | | |
|----------------|-----------------------|--------------------------------------|---------------------|
| 1. Muzzle | 10. Point of shoulder | 18. Fore flank | 25. Rump |
| 2. Face | 11. Throat | 19. Sheath (steer) or Navel (heifer) | 26. Tailhead |
| 3. Ear | 12. Belly | 20. Back | 27. Quarter (Round) |
| 4. Poll | 13. Pin bone | 21. Ribs | 28. Hock |
| 5. Brisket | 14. Forearm | 22. Stifle | 29. Switch |
| 6. Dewlap | 15. Pastern | 23. Loin | 30. Rear flank |
| 7. Neck | 16. Knee | 24. Hook or hip bone | 31. Dew claw |
| 8. Crest | 17. Cannon bone | 32. Hoof | |
| 9. Heart girth | | | |

Structural Soundness

When evaluating structural soundness, you should look primarily at the calf's feet and legs. The calf's shoulder and front leg structures are very closely associated. Sloping shoulders give the front legs plenty of flex and cushion, which will properly distribute the calf's weight over the entire hoof. A very straight shoulder will cause the calf to be "over on its knees" and force it to stand too upright on its hoof. Similarly, the rear legs should show flexibility and freedom of movement, allowing the calf to take a long flexible stride. Additionally, a calf's topline should be level. Generally, a level-topped calf will be more eye appealing, free moving, and structurally sound.

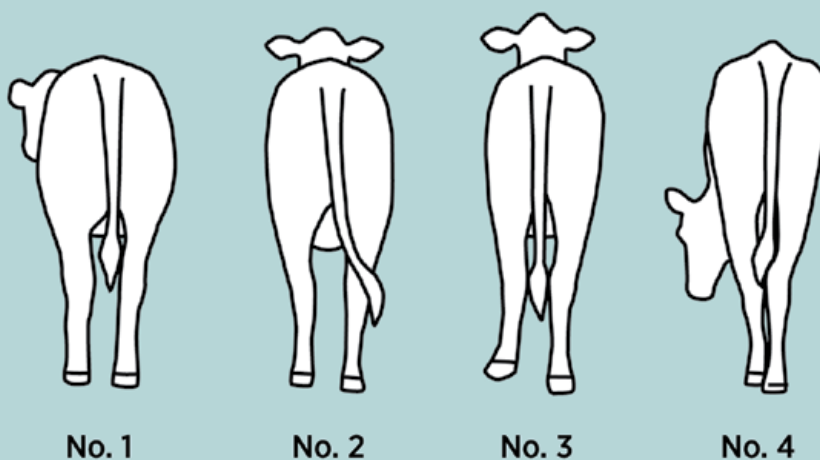
Design

A well-designed animal has a balance that is pleasing to look at. A poorly designed, poorly balanced animal has issues similar to a car built with the engine upside-down and mirrors facing the wrong direction. Although it might have all the pieces you are looking for in a beef project, it lacks the final look. Poor design can also mean that the animal looks ideal when standing still, but when set into motion (asked to move), everything seems to fall apart.

Growth Potential

All animals raised for market projects need to be able to grow. In addition to genetics, one way to help determine potential growth is observing the center portion of the calf. The body cavity should be relatively deep, long, and wide, giving the calf plenty of body capacity. When the calf is viewed from the side, body capacity can be described as the depth of rib and flank. When the calf is viewed from the front, body capacity is the width of the chest floor.

Figure 2. Calf thickness grading.



Body Composition

As your calf continues to grow, it is important for you as a producer to know the difference between muscle and fat. This will help you to adjust the rations and to change the diet of the animal if needed. Begin by evaluating the degree of muscling and **finish** (fat) to determine the body composition.

When evaluating the degree of finish on a finished steer (one that is ready for market), only the fat a steer deposits over its muscles can be seen. Because of this, it is important to determine whether the thickness you see is due to muscle or fat. Cattle commonly deposit fat in the brisket, cod, rear flank, and tailhead.

Breeds

No one breed of cattle is better than others for 4-H market cattle projects. Each breed has a specific purpose and will likely be a good 4-H project with the exception of miniature breeds. Although useful for other purposes, many times these breeds will not fit within the market animal weight requirements for fair. Cross breeding is very common and is a way to increase growth and vigor. When evaluating an animal for a project, select it based on its physical attributes, or traits, and if known, the genetic performance records.

When to Buy Calves

You can usually find the largest selection of calves in the fall or early winter when they are about 6 to 9 months old. The age of the calf should be relative to your fair date with calves not born before January 1 of the previous year when exhibiting at summer fairs. It is best to select

calves that will be 15 to 18 months old at the time of the fair. Starting with a calf in the desired age range will make it easier to finish with a calf at the desired market weight when you want to sell it. You can buy a calf in the spring, but be sure to follow your fair's ownership deadline to be able to exhibit.

Mandatory Cattle Identification Requirements

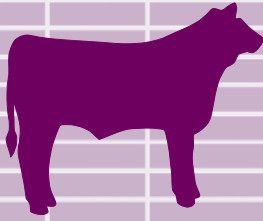
The State of Michigan requires official identification to help the state track cattle in case of a disease outbreak. The ability to verify identity and track animals is called **traceability**. All cattle being moved off a farm in Michigan must have an official radio-frequency identification (RFID) ear tag. Official RFID ear tags should never be removed from an animal except at slaughter, and should never be reused. If an animal loses its official RFID ear tag and must be retagged, producers must update their records to include the old and new tag numbers. This requirement is also in affect for any cattle purchased outside the state. Before you buy any beef animal, make sure it has an RFID ear tag.

If you are raising your own cattle, the federal government requires you to have a premise identification number to purchase and tag your cattle. The official RFID ear tag should be placed in the left ear (the left side of the animal when viewed from behind). The tag should be placed between the cartilage ribs of the ear about one-fourth of the distance from the head. Proper tag placement increases the ability for the tag to be read by reading devices while reducing the possibility of injuring animals when tagging.

Points to Remember

The cattle industry continues to change and diversify. There is a place in the cattle market for almost all healthy animals. When selecting a calf project, avoid extremely small and extremely large framed calves. Smaller framed calves generally will be earlier maturing, getting fat too quickly. Larger framed calves will take too long to reach your desired market weight and will not put on enough finish to grade Choice until they are much too heavy, which may be after your show date. A rule of thumb is calves should grade Choice when they weigh between 1,100 and 1,400 pounds.





Paying for & Predicting the Cost of Your Project

Purchasing your calf will be the largest expense, followed by the cost of feed. Creating a budget will help you prepare for a beef project experience. For that, you will need to know how much money you will need to buy and raise a calf. Then, you will need to determine where to get the money.

Where to Get the Money

There are three major sources of money available to you:

- Your savings.
- Borrowing from your parent(s) or guardian(s).
- Borrowing from a bank or credit union.

Borrowing from a bank or credit union will give you some business training. Your parent(s) or guardian(s) will need to go with you and most likely sign the loan papers along with you. The loan officer will ask you at least three questions:

- How much money will you need?
- How long will you need the money?
- How will you repay your loan if your calf dies or your project loses money?

When you borrow money, you will have to pay it back, along with interest, a fee for using someone else's money. The interest rate will be a percentage of the amount you are borrowing.

Be sure to pay off your loan when it is due so you will have a good reputation as a borrower. Honesty and integrity are important to you as a 4-H'er and to your financial future.

How to Figure Feed Cost

If you need to borrow money to buy feed for a project calf, you need to know how much the calf will eat. If you buy a 500 pound feeder calf and sell it at 1,250 pounds, it will need to gain 750 pounds (1,250 - 500 = 750). As a rule of thumb, it will take about 7 pounds of feed for each pound of gain. Therefore, your calf will need to eat about 5,200 pounds of feed (7 × 750 = 5,250).

You can estimate that a quarter of the total weight of feed is hay (roughage) and three quarters is grain (concentrate). To find a quarter of the total weight of feed, divide the weight by four (5,250 ÷ 4 = 1,312.5). To find three quarters, multiply one quarter by three (1,312.5 × 3 = 3,937.5). You will need 1,312.5 pounds of hay and 3,937.5 pounds of grain. If hay costs \$120.00 a ton, you can figure the cost per pound by dividing \$120.00 by 2,000 because a ton is 2,000 pounds (\$120.00 ÷ 2,000 = \$0.06 per pound).

If your grain mixture costs \$480.00 a ton, find the cost per pound similarly (\$480.00 ÷ 2,000 = \$0.24 per pound).

Adding the cost of hay and grain feed totals \$1,023.25, as shown below.

1,312.5 pounds of hay × \$0.06 per pound	= \$	78.75
3,937.5 pounds of grain × \$0.24 per pound	= \$	945.00
Total cost of hay and grain:		\$ 1,023.25

That means your cost per pound of weight gain is \$1.37 (\$1,023.25 ÷ 750 pounds = \$1.37).

Experienced feeders who feed **supplements** or grow their own grain may have a different cost, but these are good estimates for most 4-H members.

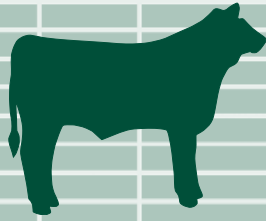
How to Figure Interest on a Loan

You will be charged interest, a fee for borrowing money. How much you are charged depends on how much you borrow. Let's say you are borrowing \$1,025.00 for a year (rounding up the feed cost), and your fee - your interest rate - is 12 percent. That's 12 cents for every dollar you borrow. Twelve percent is written as 0.12 and you figure your fee like this:

Take the amount you are borrowing		\$ 1,025.00
Multiply it by the interest rate	×	0.12
Result is the interest you'll pay		\$ 123.00

To get the total amount you'll repay the lender:

Take the amount you are borrowing		\$ 1,025.00
Add the interest figured above	+ \$	123.00
Result is the total amount you'll repay		\$ 1,148.00



Early Care & Management

The best way to start your market beef project is with a healthy animal. Keep your calf healthy through proper care, which includes reducing the amount of stress placed on your animal. Stress is an animal's physical or psychological reaction to circumstances that frighten, irritate, endanger, or excite it. Hauling, vaccinating, moving an animal to strange surroundings with unknown cattle, and many other factors can stress a calf.

Trucking the Calf Home

Before you leave the producer who raised your calf, try to find out as much as possible about it. Ask about the birth date, whether it's been treated for **parasites**, and what it's been fed.

Handle your calf quietly during loading to avoid getting it too excited. To avoid chilling your calf in cold weather, cover the open sides of your trailer to keep out the wind. Bed the trailer with clean, dry straw or wood shavings.

When you get your calf to its new home, have a clean shelter ready for it. Use dry bedding to make the calf as comfortable as possible during this high-stress period. Help your calf get familiar with its new home so it will know where the feed, water, and shelter are located. If possible, avoid mixing animals from more than one farm for at least 30 days to help reduce the risk of spreading illness. Take every step you can to provide proper care and protect the well-being of your animal.

Proper Castration

If you purchased a **bull** calf, it needs to be properly castrated. Knife **castration** lessens the chance of having a staggy steer. A staggy steer shows many of the same physical features as a bull, such as a very muscular neck and crest, and a broad head. This condition is caused by improper castration or castrating the animal when it is more than 12 months old. Consult your veterinarian to assist with castration.

Dehorning Calves

Cattle with horns can injure people and one another, so many producers dehorn them for safety. Some fairs have a maximum horn or **scur** length for exhibition. If you purchased a calf that has horns or scurs, speak with your veterinarian about the preferred methods of dehorning based on the calf's age.

General Health

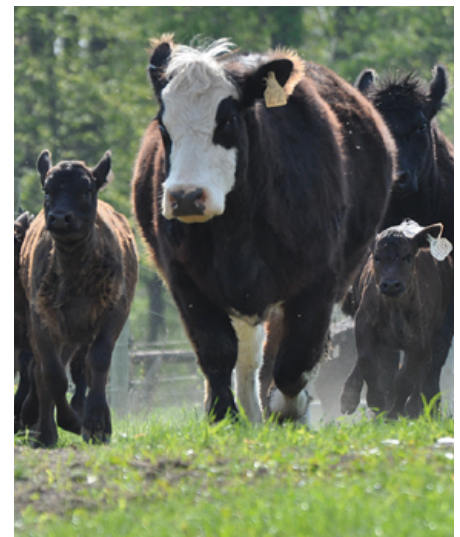
It is important to keep your new calf healthy. The first 2 to 3 weeks are critical, so you should check your calf several times a day during this period. Checking on your calf often allows you to notice any small changes in behavior, which could be a sign of illness.

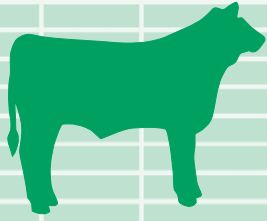
A healthy calf is active and alert, with a strong appetite and a body temperature of 101.5 °F. You can use the B.E.S.T. System to observe the health of your animal by checking the body; eyes, ears, and nose; skin and hair; and temperament.

A calf will give you many clues when it is not feeling well. Some of the clues are poor appetite, extreme thinness, dry muzzle, rough hair coat, pale-looking skin, a dull look in the eyes, excessive coughing, diarrhea, inactivity, and lameness. If you think a calf is sick, take its temperature with a rectal thermometer. If the temperature is 2 degrees or more above normal, separate the calf from other cattle and call a veterinarian immediately. Quick **diagnosis** and treatment can pay off. Always handle sick animals last when working with more than one animal. As with any animal project, continue to treat your animals with care.

B.E.S.T. System to Observe Health

- B – Body
- E – Eyes, ears, and nose
- S – Skin and hair
- T – Temperament (mood, attitude, or behavior)





Common Diseases: Their Prevention & Control

Maintaining the health of your beef animal is critical. Raising a healthy animal involves nutrition, housing, and management. Preventing, diagnosing early, and treating any illness will pay big dividends. To ease a calf's discomfort during illness, give it nutritious feed, plenty of water, and a clean pen protected from dampness and drafts. In addition, you should learn about virology and bacteriology. The study of viruses and **bacteria** is important for animal and human health.

The following sections discuss some common diseases and **parasites** that affect cattle. It's important to ask advice from your veterinarian in identifying a disease and selecting the appropriate treatment. We break diseases into three categories:

- Zoonotic diseases – diseases that can be spread from animals to humans.
- Infectious diseases – diseases that can be spread among cattle, but not to humans.
- Noninfectious diseases – diseases that cannot be spread from one to another.

A parasite is an **organism**, a living thing, that lives in or on another organism (a host – in this case, cattle) and benefits by getting food and protection from the host while causing it harm. Parasites can be internal – living inside the animal's body – or external – living outside the body.

Zoonotic Diseases

Zoonotic diseases, also called zoonoses, are diseases that can be spread from animals to humans.

With many concerns about zoonotic diseases, you need to take extra steps to keep yourself and your animal healthy. Michigan 4-H offers resources on its website (http://msue.anr.msu.edu/resources/zoonotic_disease) to increase awareness and to help people understand the possibilities of transmitting zoonotic diseases. The website includes resources to encourage you to take precautions against spreading disease, an important life skill.

Blackleg and Malignant Edema

Blackleg and malignant edema are two similar diseases caused by related organisms that live in the soil. The organisms can enter the animal's body through the mouth or through open wounds. These organisms produce **toxins**, which cause the signs of disease. Calves aged 6 to 18 months are the most susceptible.

Signs – The first sign is swelling over a heavily muscled area of the body. Beneath the skin in this area are small gas bubbles and fluid. Affected calves show great pain, stiffness, elevated body temperature, and difficulty breathing. Affected calves often die.

Prevention – A vaccination available for these two diseases should be used routinely if the problem exists on your farm or in your area. Avoid grazing cattle on creek pastures and wet lowlands where there is a greater chance for the animals to come into contact with the organisms' spores. To prevent the spread to more animals, dispose of dead animals properly.

Treatment – Large doses of penicillin, if given early under a veterinarian's supervision, may help affected calves recover. Treatment is difficult because of the rapid course and severity of the disease. Consult your veterinarian for chronic cases.

Pinkeye

The name of this disease accurately suggests an eye infection. It's caused by a **bacterium** and, when severe, can permanently blind an animal in one or both eyes. The disease commonly occurs during the summer months when the organism is spread by flies.

Signs – At first, a clear discharge runs from the affected eye down the side of the face. The eye appears red and may bulge. A white spot will appear and may remain if the eye does not heal properly. Affected eyes are sensitive to bright light, and an affected calf may not eat normally. The permanent loss of one or both eyes from a pinkeye infection is a serious hazard to the calf.

Prevention – Separate infected calves from healthy calves. Control flies by spraying, dipping, or dusting calves, and spraying calf pens. Dispose of manure frequently to eliminate places for flies to lay eggs. To avoid getting pinkeye yourself, wash your hands frequently and avoid touching your eyes.

Treatment – Keep affected calves in a cool, darkened pen and give them plenty of feed and water. Apply antibiotic ointments on the affected eyes under the direction of a veterinarian. Severe cases may require additional veterinary treatment.

Pneumonia

Pneumonia, also called pasteurellosis, is caused by a bacterium that affects the **respiratory system**. Animals may contract the disease through contaminated feed and water or by inhaling infective organisms such as parasites.

Signs – Infected calves show signs of depression, fever, excessive drooling, and discharge from the nose.

Prevention – Because so many factors can cause pneumonia, it is difficult to guard against all causes of the disease. Providing a well-ventilated, draft-free environment with as little stress as possible will go a long way toward preventing pneumonia. Minimizing calf stress and using proper vaccinations also help with prevention.

Treatment – Sulfonamide drugs and antibiotics are useful. Because of the wide range of organisms that cause pneumonia, no one treatment will be effective in all cases. If you suspect that your calf has pneumonia, contact your veterinarian about treatment options.

Ringworm

This common disease is an infection of the skin surface caused by a living organism called a fungus (see Figure 3). It spreads slowly through groups of cattle when an infected calf directly contacts a susceptible one. It can also be spread by contact with contaminated objects such as feed bunks, fence posts, and grooming equipment.

Signs – The disease usually first appears on the head, neck, shoulders, or rump. The skin becomes dry and scaly. The hair falls out. A thick, gray scabby patch appears and grows larger. New areas of infection develop on other parts of the body as the disease spreads. Ringworm is common



Figure 3. Active ringworm on the face and neck.

during winter when calves are housed inside because the chances of contact are greater, and the calves are not in the sun as much.

Prevention – Disinfecting equipment brought home from livestock events, as well as carefully monitoring your calf's hair and skin – washing it as you are able, will help prevent ringworm. Once an animal has it, isolating the affected calves can help prevent the spread of ringworm. Once the disease begins, it is difficult to control. Many states, including Michigan, consider ringworm a contagious communicable disease and do not allow affected cattle to be shown or sold.

Treatment – Once recognized, ringworm will continue to spread. With gloves on, scrape the dry, scaly patches and then apply a solution containing iodine or other material your veterinarian recommends. Sunshine will aid the healing process by killing the fungus.

Tuberculosis (TB)

Bovine tuberculosis (bovine TB) is caused by bacteria and affects the respiratory system. It rarely affects humans but is considered zoonotic. With Michigan's history of bovine

TB, the state has restrictions on transporting and exhibiting **bovine** animals in certain parts of the state. Signs of the disease appear 4 to 6 weeks after exposure through inhaling the bacteria or swallowing contaminated feed or water.

Signs – General signs of tuberculosis include a mild

fever, weakness, a hacking cough, and wounds in the chest. There are two ways of determining whether an animal has TB: testing by a veterinarian and necropsy – examining the body to find the cause of death.

Prevention – Try to stop the spread of bovine TB by limiting the exchange of respiratory secretions between infected and uninfected animals. Wildlife interactions are one of the most common ways cattle are exposed. Depending on your location in Michigan, you may need to protect your **feedstuff** and water source from wildlife. This may mean building tall fences to keep deer out and covering feed. To limit the spread of bovine TB, practice **biosecurity** measures including isolating new and ill animals, as well as those animals returning home from exhibition. Other strategies include removing cattle that have been exposed to TB, reducing the number of animals in an area, testing regularly, and practicing **closed-herd management**.

Treatment – There is no treatment available. If an animal tests positive for TB, a second test is completed. The Michigan Department of Agriculture

and Rural Development works with livestock owners to conduct further testing and disposal of animals if needed.

Infectious Diseases

Infectious diseases can spread among cattle. They cannot spread from animals to humans. Infectious diseases are caused by microorganisms, such as viruses or bacteria.

Bovine Respiratory Syncytial Virus (BRSV)

As the name implies, this disease is caused by a **virus** that affects the respiratory system. It is transmitted by exposure to infected cattle or facilities.

Signs – Fever, rapid breathing, nasal and eye discharge, coughing, and slight swelling in the neck and jaw.

Prevention – Vaccinate for BRSV.

Treatment – Administer antibiotics with the advice and supervision of a veterinarian.

Bovine Virus Diarrhea (BVD)

Bovine virus diarrhea is a respiratory and reproductive infection caused by the BVD virus. Most cases of BVD come about when a fetus is infected during its development in the womb. The fetus may be resorbed into the mother's body, spontaneously aborted, or born dead. If the calf is born alive, the BVD infection will persist throughout its life.

Signs – Severe ulcers and sores develop inside the calf's mouth, on its tongue, and inside its esophagus, abomasum, and intestines. The animal often shows signs of severe diarrhea, dehydration, elevated temperature, depression, and complete loss of appetite (also called going off feed). If diarrhea persists, the general condition of the animal deteriorates rapidly.

Affected animals may develop mild or severe pneumonia; those affected most severely are not likely to recover.

Prevention – Ask your veterinarian about recommended vaccinations.

Treatment – There is no specific treatment recommended, but managing and caring for BVD properly may help with overall herd health.

Enterotoxemia (Overeating Disease)

This disease is caused by a bacterium that produces a strong toxin. It can grow and produce **toxic** material when the calf is overfed on grains or other high-energy feedstuffs. The disease progresses so quickly that often signs are not noticed before the animal is found dead.

Signs – Signs in less severe cases include depression, weakness, loss of appetite, diarrhea, and rapid weight loss. Recovery depends on the amount of overfeeding and the degree of toxicity.

Prevention – Avoid overfeeding the calf on grains and other feeds it is not accustomed to. A toxoid, which reduces the effect of a toxin, is available for prevention. Increasing the roughage in the diet will also help prevent enterotoxemia.

Treatment – Antitoxin and other treatments counteract the effects of the toxin and the diarrhea. Your veterinarian can help you treat this disease.

Foot Rot

This common disease involves the hoof and surrounding areas becoming tender and swollen. One animal can spread it to others through cross-contamination.

Signs – The soft tissue between or around the toes will become tender if the calf stands in soiled, wet bedding,

muddy yards, or wet pasture ground. An open wound develops in the soft tissues and infection develops in the foot and surrounding joints. Lameness, soreness, and swelling will develop between the toes and in the hairline above the affected hoof.

Prevention – Keep calves in clean, dry pens, and locate water tanks in well-drained areas. Keep yards and pens free of glass, wire, cans, and scrap metal.

Treatment – Prompt attention is necessary and involves cleaning, medicating, and wrapping the affected foot to protect it from more contamination as it heals. Antibiotics are needed to treat the animal. Your veterinarian can inform you about treatment options.

Infectious Bovine Rhinotracheitis (IBR or Red Nose)

This disease is caused by a virus that attacks the upper respiratory system, but other areas of the body such as the eyes, nose, and uterus of cows may also be affected. Because of this, a variety of signs are possible. This disease usually affects young calves during the fall and early winter and can be mild or severe. A calf will usually recover in 10 to 14 days. Once the disease starts, it is difficult to stop because it is easily transmitted to other animals. However, the death rate is usually low.

Signs – Signs include an elevated temperature, excessive discharges from the eyes and nose, depression, and refusal to eat. The calf's eyes become sore and the lining of its nostrils and muzzle appear unusually red and crusted. This explains why the disease is often called "red nose." Signs that show up later include diarrhea, secondary pneumonia, and a deep cough.

Prevention – The vaccine can be given alone or in combination with other vaccines as recommended by your veterinarian.

Treatment – Administer antibiotics on the advice and supervision of a veterinarian.

Parainfluenza (PI)

This disease is common among calves and usually occurs shortly after animals are transported. It is a respiratory disease caused by a virus. If the disease seems to be mild, the calf will often recover on its own, but severe infection must be treated.

Signs – Soon after arrival, a calf may show signs such as a fever, depression, going off feed, a light cough, and nasal discharge. If the condition is not treated, pneumonia, excessive weight loss, and diarrhea will often follow.

Prevention – Stress is placed on a young calf in events such as weaning, vaccination, worming, shipping, changing feed and water, and exposing it to other cattle. Any combination of these stressors can weaken the calf and increase its chances of developing parainfluenza. Try to avoid stressing your calf, especially when you first bring it home. Ask your veterinarian for the best ways to prevent parainfluenza, which may include a vaccination.

Treatment – Parainfluenza readily responds to treatment if diagnosed early. Early treatment and good care will aid recovery. If you treat it with antibiotics or other drugs, follow the instruction provided by your veterinarian.

Warts

Warts are viral infections of the skin.

Signs – The infections cause growths that often look like cauliflower (see Figure 4). Warts commonly appear and



Dan Buskirk

Figure 4. Warts on the neck and shoulders.

spread slowly on the neck, shoulders, and head. Warts sometimes become so large that they break off, bleed excessively, and become infected.

Prevention – Isolating affected calves will help prevent the disease from spreading to others.

Treatment – Small warts often disappear without treatment, but you may need to have larger warts removed. A vaccine is available. Ask your veterinarian for the best treatment. Many states, including Michigan, consider warts an infectious disease and forbid sale or exhibition of cattle with warts.

Noninfectious Diseases

Bloat

Bloat is caused by a combination of factors. Gas is produced in the rumen as part of the normal process of digestion. The calf must eliminate the gas by belching to avoid a buildup of pressure. Bloat often occurs when

cattle graze on green, young alfalfa or clover. It can also occur when they are fed a high-concentrate diet, or when the diet is changed.

Signs – The first sign of bloat is a bulging of the area between the last rib and the hip. As gas pressure increases inside the rumen, the entire abdomen enlarges on both sides of the animal. This causes pressure and pain, resulting in difficulty breathing. Muscular weakness quickly occurs; the mucus membranes turn blue; and the calf dies soon after.

Prevention – Bloat can be prevented by avoiding rich feeds such as lush alfalfa and by feeding adequate amounts of roughage with concentrate. Forgetting to feed your calf or changing its feed abruptly can also cause bloat. Sick calves tend to bloat more easily than healthy ones, so try to keep your calf healthy.

Treatment – When a calf is in great pain, avoid handling or exciting it. Relieve the gas pressure quickly. The objective of treating bloat is to slow

down fermentation in the rumen and help relieve the excess gas pressure. Your veterinarian can tell you what to give your calf to accomplish this. For emergency treatment, give mineral oil by mouth. Another emergency treatment is passing a stomach tube or piece of garden hose into the rumen to release the gas. These practices require skill and should be done only under the supervision of an experienced person. Use a speculum or a wedge in the calf's mouth to help guide the tube and to prevent the animal from biting off a piece of the tube.

Products can be mixed in the feed of calves that bloat repeatedly to reduce or eliminate the gas buildup. Contact your feed sales representative or veterinarian for information on these products.

Urinary Calculi (Water Belly)

This disease of the urinary system can be caused by an improper balance of **calcium** and **phosphorus** in the diet, or not enough vitamin A or water. The disease occurs more often in male cattle than in female cattle. A small, hard stone develops inside the bladder. The stone eventually lodges in the tube leading from the bladder. This causes the flow of urine to be partly or completely blocked, and makes the calf very uncomfortable.

Signs – Signs include uneasiness, stomping the feet, switching the tail, arching the back, and kicking at the belly. If the disease is untreated, the bladder will rupture and the calf will die from uremic poisoning.

Prevention – Making sure your calf has enough water at all times can usually prevent urinary calculi. During the winter months, use heated water tanks so the water will not freeze. Provide recommended levels of vitamin A, calcium, and phosphorus in the diet.

Feeding salt at the rate of .15 to .20 percent of the total diet **dry matter** will also help. This would mean .04 to .06 pounds per day.

Treatment – Certain medications may help pass the stone. They are not always successful, so sometimes surgery may be needed. A successful recovery depends on prompt detection and treatment, which usually leads to a successful recovery.

External Parasites

Pests that are parasites cause infection, pain, stress, blood loss, skin wounds, and the spread of disease. When animals are bothered by pests, they kick or stomp their feet, switch their tails, throw their heads, and try to get away. This uses up their energy and interferes with eating and gaining weight.

External parasites live on the outer surface of the body. Internal parasites live inside the body.

External parasites are a serious problem. They can harm a calf as much as or more than internal parasites or infectious diseases. Calves look and perform better when external parasites are controlled.

Signs – Larger parasites, such as flies and ticks, are easily seen and recognized, but lice and mites may go unnoticed.

Control and Treatment – You should constantly be alert for external parasites. Recommendations on the kind and dosage of insecticides are constantly changing, so consult your veterinarian for the latest information. Insecticides are strong chemicals. It is important that you follow the manufacturer's directions on insecticide labels. Insecticides are

available in spray, pour-on, injectable, and dust preparations. Some are applied directly to the calf; others are mixed with water before application. Be certain to mark containers clearly and use and store chemicals safely.

Cattle Grubs

When present in large numbers, this parasite can severely damage a calf. The life cycle of cattle grubs is complicated and involves the movement of fly larvae inside the calf's body.

Signs – Various organs in the calf become inflamed and the hide over its back is damaged when the grubs come through. Your calf may lose weight.

Control and Treatment – Treat cattle in the fall to prevent infestation by grubs. Various products are available from your veterinarian.



Flies

Many species of flies irritate and torment cattle. Flies prefer warm, moist surroundings that often result from poor sanitation and management.

Signs – Face flies spread the organism that causes pinkeye. Female flies lay eggs in open skin wounds and beneath moist, matted hair. Soon their larvae, called maggots, infect the area.

Control and Treatment – There is no practical way to eliminate flies, but you can minimize their effects. Always keep calves reasonably clean and manage them well. Remove manure regularly and use clean bedding or grass pasture. Spray calves and the building where they are housed.

Lice and Mange Mites

These small external parasites often go unnoticed. Several species of lice and mange mites cause different kinds of damage. Some suck blood through small holes made in the skin, and others merely bite and feed on skin surface debris.

Signs – The results are damaged, unhealthy skin; infection; and loss of hair, blood, and body fluids. Heavy infestations can make a calf unthrifty and can cause serious secondary infections because of changes in its immune system. Lice and mites are difficult to see with the naked eye and often go unnoticed

until the problem becomes serious. If your calf is frequently rubbing against fences, feed bunks, and other surfaces, it may have lice or mange.

Control and Treatment – Check your calf frequently for these parasites. If you suspect it is infected, ask your veterinarian to examine your calf. Parasites can be controlled by using insecticides properly.

Internal Parasites

Cattle can easily become hosts to a variety of internal parasites through the forages they eat. Different species of parasites affect numerous organs in the bodies of cattle. Table 2 lists common worms that infect a calf's stomach and intestines.

Signs – Each worm causes its own type of signs depending on the organ it infests. The degree of infestation can determine the severity of the damage. Signs often include poor weight gain because of loss of appetite, low feed conversion, an unthrifty-appearing coat, diarrhea, or constipation. Severe cases can result in anemia, a lower than normal number of red blood cells in the blood, as often indicated by pale or yellow gums, and lack of appetite.

Control and Treatment – The best way to control parasites is to practice good management. Rotate animals from

pasture to pasture, which will prevent overgrazing. Buy calves that have been treated for parasites, or treat them immediately after purchase. Work with your veterinarian to examine manure routinely for parasites and other problems. Ask your veterinarian about appropriate treatment options. Follow the manufacturer's and veterinarian's recommendations when you use any product.

Coccidiosis

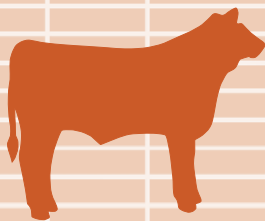
Coccidiosis parasites live in a calf's intestines. Animals contract the disease by eating contaminated feed or drinking contaminated water.

Signs – Coccidiosis can cause diarrhea, loss of blood in the intestines, poor appetite, weakness, loss of weight, and in severe cases, death. The disease can spread rapidly through a group of calves. Younger calves are more susceptible.

Control and Treatment – Practice good herd sanitation and avoid letting manure contaminate feed and water supplies. Treatment will depend on the severity of the infestation. Calves with less severe cases are able to recover without treatment. Calves with more serious cases may need extra fluids as they may become dehydrated. Work with your veterinarian to find the best course of treatment.

Table 2. Stomach and Intestinal Worms

Common Name	Scientific Name	Usual Location
Brown stomach worm	Ostertagia	Abomasum
Whipworm	Trichuris	Abomasum
Roundworm	Cooperia	Small intestine
Tapeworm	Cestodes	Small intestine



Facilities & Equipment

Housing

The most important aspect of housing is getting your calf plenty of fresh air as good ventilation helps prevent respiratory problems. Shelter for your calf does not need to be elaborate or expensive.

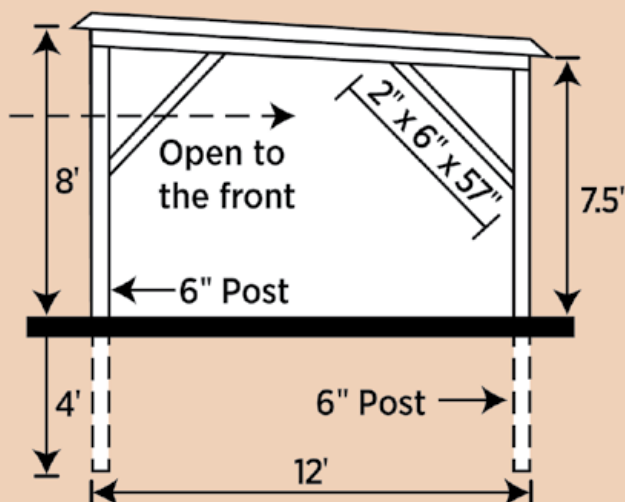
The shelter should provide a dry bed and protection from wind, snow, and freezing rain. Use caution in cold weather to not get your calf too warm. If a calf becomes too warm and is then exposed to extremely cold temperatures, it can get sick and may develop pneumonia.

Old barns can be converted but need to be renovated to provide enough ventilation and light. The calf should have enough room in its pen to exercise and move around.

If you don't have a barn for your calf, an inexpensive, three-sided shelter (see Figure 5) is another housing option. The top and sides can be covered with corrugated steel roofing and the lower four feet of the walls can be hinged to open toward the south for summer ventilation.

You can use a variety of bedding materials. Straw is the best for winter. A 4- to 6-inch layer of sand is best in the summer. Wood shavings and sawdust are also good bedding options. Other materials can be used for bedding, but be sure to monitor animals every day to make sure they do not eat too much of the bedding or have an allergic reaction to it.

Figure 5. Calf shed.



Building a Pen

Cattle need more space than most other livestock need. A calf in an open-front shelter needs enough space to be able to stand up and lie down without touching the sides of the building or other animals. A calf being fed from the time it weighs 500 pounds until it reaches market weight needs about 25 square feet, which could be 5 feet long and 5 feet wide. If you have more than one calf, each should have 25 square feet. Animals that do not have shelter or shade need more than 25 square feet per animal. If at all possible, give animals a way to get outdoors so they can exercise in a larger area.

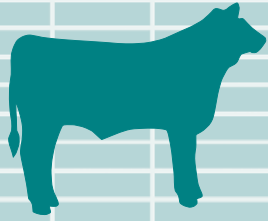
Feeders

You may feed each calf in its own feed trough or pan or with other calves. By feeding calves on their own, you can

better monitor what each calf is eating. If you feed several calves together, you can buy or build a feed bunk. If fed together, each calf should have about 2.5 feet of bunk space. Clean the feed bunks daily, throwing out any stale or moldy feed and any manure that has landed in the bunk.

Waterers

The ideal way to supply fresh, clean water to your calf is through an automatic waterer, but automatic waterers are expensive. Less expensive options are water tanks or barrels. You should clean water tanks and barrels often to make sure your calf always has clean water to drink. To ensure a clean tank, use a solution made up of bleach and water to sanitize the waterer before you purchase a calf.



Digestion & Nutrition

Depending on the cost of your calf, feed will represent approximately 50 percent of the cost of your market beef project. It's a good idea to learn and use the proper terms when referring to cattle feeding programs. Your 4-H market beef project is a great place to begin.

Often, the terms diet and ration are used to refer to the same thing, but there is a difference between the two. A **diet** is a nutritionally balanced mixture of feed ingredients. A **ration** is the amount of feed an animal is allowed to eat in a 24-hour period.

Ruminant Animals

Cattle are **ruminant** animals. Ruminants have special digestive systems consisting of four stomach compartments that allow them to digest feeds other livestock cannot digest – forages such as pasture, hay, and silage. How well they use feed to make meat depends on the quality of feed they eat.

The stomach of a ruminant animal has four compartments (see Figure 6). In the order that feed travels through them, the compartments are the rumen, reticulum, omasum, and abomasum. Each compartment looks different and has a different function. As feed moves through the digestive tract, it is broken down so the calf can use it.

Ruminant animals chew their feed several times through a process called rumination or “chewing the **cud**.” When a ruminant animal such as a calf takes a bite of grass or other

Figure 6. Ruminant digestive system.

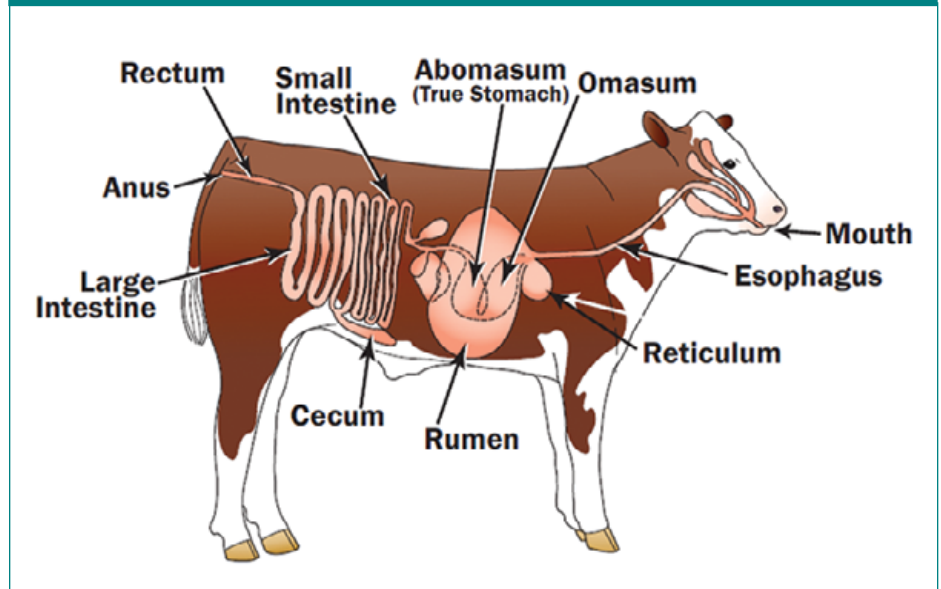


Diagram courtesy of Oklahoma Department of Career and Technology Education, Curriculum and Instructional Materials Center.

food, the animal chews the feed just enough so it can be swallowed. The feed then travels from the mouth down the esophagus to the rumen (the first and largest stomach compartment). From there, it moves to the second compartment, the reticulum. Later, the calf can regurgitate the feed (now called a “bolus” or “cud”) to chew it again to continue breaking down the plant fibers.

The Rumen

The rumen (see figure 7) is the largest compartment of the ruminant stomach and can store up to 50 gallons of digested feed. Food is fermented in the rumen, where the environment is anaerobic, meaning it has no oxygen. That allows for increased microbial action and high concentrations of bacteria, or “rumen bugs.” The

microbes in the rumen are capable of changing poor-quality **protein** to a good-quality microbial protein. To aid in this process, the rumen is selective about how quickly feed particles move from one stomach compartment to the next. If a roughage is difficult to digest, the rumen keeps it longer to allow further breakdown through the process of cud chewing. The rumen has fingerlike projections called “papillae” that increase the surface area on which microorganisms do their work. When a cow eructates (belches), it's releasing the gas products of fermentation, mostly carbon dioxide and methane.

Karen E. Petersen, PhD, Department of Biology, University of Washington.



Figure 7. A close-up view of a rumen.

The Reticulum (Honeycomb)

The reticulum (see Figure 8) is attached to the rumen and is made up of bands of smooth muscle. The walls of the reticulum look like honeycombs, giving it the nickname “honeycomb.” Its main functions are to detect large feed particles that need to be broken down further, and then to regurgitate or force those particles back up the esophagus to the mouth so they can be chewed and swallowed again.

Cattle have an unfortunate habit of accidentally swallowing hardware such as nails and baling wire. These foreign objects are usually deposited in the reticulum and sometimes have to be surgically removed.

Karen E. Petersen, PhD, Department of Biology, University of Washington.



Figure 8. A close-up view of a reticulum.

The Omasum

Many folds or layers of muscle (called “plies”) make up the omasum (see Figure 9). These folds increase the omasum’s surface area, which help it absorb nutrients from feed and water. The omasum squeezes water from the feed particles and continues to break them down into smaller particles.

Karen E. Petersen, PhD, Department of Biology, University of Washington.



Figure 9. A close-up view of an omasum.

The Abomasum (True Stomach)

The abomasum (see Figure 10) is called the “true stomach” because it is similar to the stomach of **monogastric** animals (animals with one stomach compartment, such as humans and swine). This is where digestive juices mix with and prepare feed for breakdown and absorption in the small intestine. The abomasum is the feed’s last stop before entering the small intestine, where the most nutrient absorption takes place in the body.

Karen E. Petersen, PhD, Department of Biology, University of Washington.

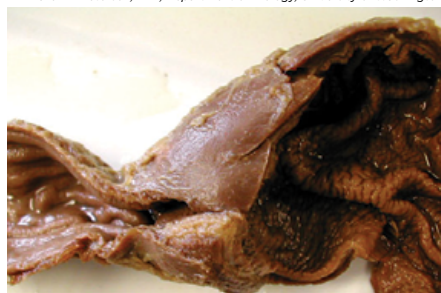


Figure 10. A close-up view of an abomasum.

Nutrients

To feed your beef project correctly, you need to know what the various feed nutrients are and how they help your project grow and stay healthy. Animals need six main classes of nutrients for health: water, proteins, **carbohydrates**, **fats**, **minerals**, and **vitamins**.

Water

Water is the most important part of a calf’s diet. Strictly speaking, water is not a nutrient. However, without it many of your animal’s important body functions cannot happen. Approximately two thirds of the calf’s body is made up of water. Therefore, supply your cattle with as much clean, fresh water as they will drink.

Cattle need water to properly digest feed and carry nutrients to body cells. Water also carries away waste products, lubricates joints, and acts as a built-in cooling system. Cattle can live longer without feed than without water, so it is important to make sure your cattle have clean, fresh water.

Proteins

The protein a calf eats as part of its diet is called **dietary protein**. The calf’s body breaks protein down into **amino acids**. These amino acids are then used by the calf to build **body proteins**, which make up muscles, internal organs, bones, and blood. Body proteins are also part of hair, hooves, skin, and many other body parts. The term **crude protein** is a scientific way to indicate how much protein is contained in the feedstuff based on its nitrogen content.

There are two kinds of amino acids: those the body can make and those the body cannot make on its own. Those the body cannot make are called **essential amino acids**, and must be

included in the calf's diet to maintain a healthy calf with proper growth.

Protein is the main thing that causes animals to grow lean muscle. Grains, such as corn, supply part of the calf's protein (amino acid) needs. A commercial **protein supplement** or soybean, cottonseed, or linseed meal is used to balance the protein (amino acid) part of the diet.

Carbohydrates

Carbohydrates are to a calf what gasoline is to an automobile. They supply the energy or fuel the calf needs to walk, breathe, and grow. Carbohydrates also produce heat to keep the body warm. Energy not used right away is stored as fat until the body needs it.

Sugars and starches are also carbohydrates. Grains such as corn and wheat contain a lot of sugar and starch. Cellulose is one of the more complex carbohydrates, which are harder for animals to digest. Grasses and hays are high in cellulose.

Fats

Fats provide energy for animals to move and stay warm. They produce about 2.25 times more energy than carbohydrates. Fats are also needed to help digest certain vitamins. The calf's body digests fats, but at a slower rate than carbohydrates. Most calf diets contain enough fat, so it does not need to be added.

Minerals

Animals use minerals for general health and growth, to build bones, and to support body functions. Minerals are classified as either macrominerals or microminerals, depending on whether they are found at levels greater than or less than 100 parts per million (ppm) in the animal's body.

Macrominerals, which beef cattle need in larger amounts, include calcium, magnesium, phosphorus, potassium, sodium, chlorine, and sulfur. You can get macrominerals in the diet by including feedstuff such as corn grain, which is high in phosphorus, and hay, which is high in potassium.

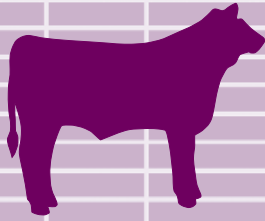
Minerals that are needed in very small amounts are called **microminerals**, or **trace minerals**. Beef cattle need 10 microminerals. Required levels have been set for seven of the ten microminerals: iron, manganese, copper, zinc, selenium, cobalt, and iodine. The microminerals chromium, molybdenum, and nickel do not normally need to be added to mineral mixes because they are found naturally in the environment. Copper, zinc, and selenium are the three most likely to be lacking in a cattle diet. Much of the soil in Michigan is deficient in selenium, so it may need to be added to your animal's diet.

When feeding or storing feed for more than one animal species, pay special attention to microminerals as some of them, particularly copper, can be toxic to some species. Minerals can be added separately to diets or can be supplied as part of a commercial protein supplement.

Vitamins

Vitamins are just as important as other feed nutrients, but they are needed in smaller amounts. Vitamin A is needed for healthy eyes, nasal passages, and lungs. Vitamin D is necessary for strong bones and vitamin K is needed for blood clotting. Calves need other vitamins such as B, C, and E to help other body functions.

A calf's body produces some vitamins. For example, a calf's body makes vitamin D when it is exposed to sunlight. Depending on the diet and environmental conditions, vitamins A, D, and E may need to be supplemented into the diet. Other vitamins may also be added to the diet.



Feed Ingredients

Feed is the second highest cost of raising a beef animal, second only to the cost of the animal. People often do not realize how much feed will cost. It is never appropriate to stop feeding an animal due to the expense of the feed.

As an animal grows, its nutrition requirements change. It is important to understand how to select the right feeds in the right proportions for your calf.

Concentrates

Grains are the most common and the best source of energy for cattle. The following states how grains can be used and how they compare as cattle feeds.

Corn

Corn is an excellent energy feed for cattle. It's an ideal finishing feed because it's high in digestible carbohydrates, low in fiber, and has a pleasant taste. Corn can be fed shelled, whole, ground, steam rolled or flaked, or cracked. Most commonly, cracked or ground corn is fed. Some finely ground grains can cause animals to cough.

Corn contains approximately 9 percent protein. Corn should be supplemented with a protein source that makes up for what it lacks in amino acids. When corn is properly supplemented, it is an excellent cattle feed.

Barley

Barley is an excellent energy feed to use when corn is not available. But because of its higher fiber content, barley has more bulk and is slightly lower in energy than corn. It contains

more protein than corn, but the amino acid balance is not as good. In feeding value, it is worth about 90 percent of corn.

Barley is a good finishing feed and can be coarsely ground or rolled and fed with other grains.

Wheat

Wheat can be used as almost a pound-for-pound substitute for corn; but because of its relatively high cost, it is not widely used as a cattle feed other than grazing. Feeding only wheat can cause a calf to bloat or go off feed. When it's ground too fine, it tends to form a pasty mass in the calf's mouth and become less **palatable** (less appetizing).

Grain Sorghum

Grain sorghum, also called milo, has many of the same pros and cons as corn. The small, hard kernel should be ground before mixing with other ingredients. The feeding value of grain sorghum is about 95 percent as good as corn.

Oats

Oats are a highly palatable feed for cattle of any age. General feed value is considered to be around 80 percent of what corn offers; but if the hulls are removed or it is ground finely, it can improve feed efficiency. Oats are high in fiber and cattle like eating it. Since oats produce more growth than finish in calves, other finishing feeds must be added to the diet.

Cottonseed Hulls

Cottonseed hulls are an excellent source of fiber while still providing

protein. As a by-product of the cotton industry, hulls are available by request at many mills.

Dried Beet Pulp

Dried beet pulp is a by-product of the processing of sugar beets into sugar. It can be used as a source of energy as long as it does not make up more than 40 percent of the diet. Beet pulp has a higher protein level than cottonseed hulls and a higher digestibility rate. Compared to corn, it adds fiber and variety, and helps keep an otherwise heavy grain diet from causing digestive disorders.

Beet Molasses

Beet molasses is used primarily as an energy source in animal diets, but it is also included in rations to improve palatability and to reduce dust. Often, it is added to manufactured feeds as a binder for pelleted feeds. It has about 70 to 95 percent of the feed value of corn, but is low in protein. It may act as a laxative if fed in large amounts, especially while cattle adjust to eating it.

Distillers Grains

If you live near an ethanol plant, distillers grains may be a feed option as it is a co-product of the ethanol distilling industry. Dried distillers grains with solubles (DDGS) can be used for growing and finishing cattle. DDGS available commercially have a higher protein and fiber value than corn. You may consider using DDGS if readily available, but there are some concerns with using DDGS. If you use it, be sure to work with a nutritionist to make sure your calf's nutritional needs are met.

Protein Supplements

All grains fall short in the amount and quality of protein they provide. Because of that, you need to supplement the grains in cattle diets with protein-rich feeds. Usually, youth find it more convenient and cheaper to buy a commercial protein, vitamin, and mineral supplement made especially for cattle. The supplement should contain all the required minerals and vitamins along with the protein (amino acids) missing in the grain ingredients.

If you supplement your calf's diet yourself instead of buying a commercial supplement, choose protein concentrates from the following list:

- **Cottonseed meal** is made after the oil has been removed from cottonseed. It contains approximately 44 percent crude protein and is high in phosphorus.
- **Soybean meal** has less fiber than cottonseed meal and is slightly higher in crude protein, at 46 percent. This is the most widely used protein source for youth to supplement beef cattle feed.

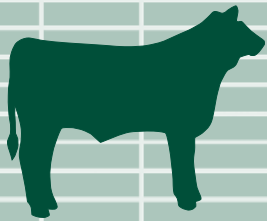
- **Alfalfa hay** provides excellent roughage for cattle. Depending on the quality of the hay, it can contain large amounts of protein, approximately 20 percent crude protein. Alfalfa is a **legume** that is rich in carotene (vitamin A) and calcium. But leafy, high-quality alfalfa hay fed alone acts as a laxative and can cause bloat.
- **Grass hay** is lower in protein than alfalfa hay. If used in a diet, it will generally require a protein supplement. Grass hays are sometimes easier to feed to beef calves on a heavy grain diet because there is less chance of digestive upset than with alfalfa hay.
- **Silage**, either hay or corn silage, can be fed in limited amounts. Corn silage has about 8 percent crude protein and provides more energy and fiber than protein. Hay silage is different from dry hay because of its high water content. It takes about three pounds of silage to equal one pound of dry hay. The crude protein percentage of hay silage varies greatly.

- **Pasture**, with a crude protein varying between 10.8 and 17.1 percent, is another option for cattle producers. If using pasture, it is important to manage it properly to provide a high-quality forage and minimize the parasite population that can infest cattle. Animal pens that have a small amount of pasture can be used for exercise at night, but there is a chance calves will bloat in high-quality legume pastures when dew is still on the leaves. Calves raised on pasture with no supplements will grow, but will be slower to finish and take longer to be prepared for exhibition.

Mineral Supplements

Mineral supplements can be fed **free-choice** for calves on feed, meaning animals choose when to eat them and how much to eat. They could be a commercial mineral supplement or a home-mixed supplement such as dicalcium phosphate and salt.





Feeding Your Calf

Your decision-making is not done when you have selected your 4-H animal. Every day, you will be a nutritionist and mathematician as you apply the science and math that go into raising a healthy animal. The grain and hay that you feed your calf are converted into nutrients for the animal. Your calf will reach its full potential only if it is fed and managed properly.

The success of your project depends on your calf's growing ability inherited from its parents, plus the diet you feed it. A diet must contain the nutrients a calf needs; it may contain only a few feeds or many feeds. Choose feeds that are easy to get in your area (homegrown or locally grown feeds when available), affordably priced, and high quality.

The daily nutrient requirements of a calf during the various stages of its growth are shown in Table 3. The table shows how much of the animal's diet should be crude protein, calcium, and phosphorus.

Measuring feed on a **dry matter basis** (as if the water were removed) is a way of comparing feeds reasonably. Say you want to compare a protein source with a lot of water in it to one with very little water. How can you know which one has more protein? You can adjust for the water content by comparing them on a dry matter basis. It does not mean you have to remove the water from the feed, but you do it mathematically.

Setting Your Goals

Before you decide on a diet for your calf, ask yourself these questions:

- When will I show or sell the calf?
- What weight do I want my calf to reach, ideally?
- What does my calf weigh at the beginning of the project? How many days do I have to help my calf reach its goal weight?

Starting Your Calf

When buying your project animal, ask the owner what they fed the calf. Once you have purchased your animal and taken it home, try to match that diet for the first few days. It will help reduce stress and keep the animal eating something that is familiar. During the next 2 weeks, gradually change the diet to the one you have selected.

If your calf has never been fed grain, begin by offering free-choice hay plus one pound of grain per 100 pounds of the calf's weight each day. After the calf is eating 11 to 15 pounds of hay plus grain each day, increase the grain by a half pound and decrease the roughage by a half pound daily to reach the desired level of roughage. Every day, a calf should eat at least 0.5 pound of hay or 1.5 pounds of silage for each 100 pounds of the calf's weight.

Be careful when increasing the grain. Too much grain can be hard on an animal's stomach. Changing from high

Table 3. Nutrient Requirements for Cattle (dry matter basis)

Nutrient	Percentage of diet needed by cattle 600–800 lb.	Percentage of diet needed by cattle 800–1,000 lb.	Percentage of diet needed by cattle 1,000 lb. and heavier
Crude protein	11.9	9.8	8.7
Calcium	0.46	0.36	0.31
Phosphorus	0.23	0.19	0.17

Adapted with permission from *Nutrient Requirements of Beef Cattle*, Eighth Rev. Ed., 2016, p. 398, by the National Academy of Sciences, courtesy of the National Academies Press, Washington, DC.

Feeding Your Calf

roughage to high concentrate (grain) makes the stomach more acidic, which can overload the stomach and cause **acidosis**.

For example, start a 500-pound calf on a hay-grain diet made up of 7.5 pounds of hay plus 5 pounds of grain. Gradually decrease the hay and increase the grain until the calf is eating about 2.5 pounds of hay and 10 pounds of grain. If the calf will eat more than that, gradually increase the feed until the calf is eating up to 3 percent of its body weight. Be careful not to feed more than the calf's normal limit because it may go off feed.

For best results, feed your calf twice a day at the same times each day. Feeding at odd times can cause a calf to go off feed. Normally, a calf eats

about three-quarters of its grain in the first 30 minutes and nearly all of it within about 60 minutes. If grain is still left in the bunk at the next feeding, remove it, replace it with fresh feed and consider reducing the amount fed. Never let old feed build up in the bunk because it may cause the calf to go off feed.

Your calf should always have access to clean, fresh water. Always remove manure, bedding, and other debris from the water. During the winter, it is important to keep the water from freezing so the calf can drink at any time. A calf will drink less water when the water temperature is near freezing.

Just as your calf needs more feed as it grows, it needs more water as it puts on weight. Each day, your

calf will consume about 1 gallon per 100 pounds of body weight during cold weather and nearly 2 gallons per 100 pounds of body weight during hot weather. A gallon of water weighs a little more than 8 pounds, so translating that to gallons, cattle will drink about 5 to 25 gallons of water each day, depending on the air temperature.

Selecting a Ration

Table 4 lists common feed ingredients and the nutrients they include. **Net energy for gain** is the nutrient value that a feedstuff offers beyond the animal's need for maintenance.

Table 4. Nutrient Composition of Common Feeds (based on dry matter composition)

Feed Type	Net Energy for Gain (NE _g) Mcal/kg*	Crude protein (CP) % of Dry Matter	Calcium (Ca) % of Dry Matter	Phosphorus (P) % of Dry Matter	Percentage Normal Dry Matter
Corn	1.49	8.79	0.03	0.29	87.22
Barley	1.4	12.78	0.08	0.38	89.69
Oats	1.37	11.55	0.1	0.38	89.86
Grain sorghum (milo)	1.45	11.64	0.06	0.34	88.7
Wheat	1.47	13.76	0.08	0.36	88.94
Cottonseed hulls	0.15	6.68	0.22	0.16	91.43
Dried beet pulp	0.93	9.55	0.96	0.08	91.49
Soybean meal	1.33	46.53	0.37	0.66	91.68
Corn silage	0.96	8.24	0.24	0.23	33.07
Cottonseed meal	1.02	44.98	0.28	1.13	88.59
Beet molasses	1.16	10.86	.11	0.14	N/A
Alfalfa hay	0.59	19.81	1.47	0.26	87.03
Hay silage	0.83	20.11	1.56	0.30	44.04
Grass hay (timothy, full bloom)	0.64	9.44	0.42	0.21	87.83
Dried distillers grain (corn)	1.52	30.79	0.05	0.86	89.99

* Mcal/kg (calories per kilogram) is used here, but feed tags show NE_g as Mcal/lb (calories per pound).

Adapted with permission from *Nutrient Requirements of Beef Cattle*, Eighth Rev. Ed., 2016, pp. 307-335, by the National Academy of Sciences, courtesy of the National Academies Press, Washington, DC.

Basic Grain Rations

Four basic grain rations using common feed ingredients are listed in Table 5.

Table 5. Basic Grain Rations

Ration 1

- 69.5% Corn silage
- 5.0% Commercial protein supplement
- 25.0% Dried distillers grain
- 0.5% Mineral supplement

Ration 2

- 30.0% Rolled corn
- 15.0% Oats
- 5.0% Commercial protein supplement
- 20.0% Dried beet pulp
- 20.0% Alfalfa hay
- 5.0% Soybean meal
- 5.0% Molasses

Ration 3

- 40.0% Rolled corn
- 45.0% Grass silage
- 5.0% Commercial protein supplement
- 10.0% Soybean meal

Ration 4

- 55.0% Rolled corn
- 40.0% Alfalfa hay
- 5.0% Commercial protein supplement

Example basic grain rations created by Daniel Buskirk, PhD, Michigan State University.

Feeding Rations

Just like humans, the nutritional needs of calves change as they grow and develop. You may want to consider using two or more of the different rations. This may involve feeding a lower energy diet during the first half of the feeding period, then switching to a higher energy diet when the calf reaches about half of its expected weight gain.

For example, if you start a 500-pound **crossbred** calf that is large framed, it can start with a lower energy diet, but will need to be moved to a higher energy ration to finish correctly for exhibition. Gradually transition to a different ration over 1 to 2 weeks rather than changing the diet all at once. Once you have experience with using and transitioning diets, you will be able to feed numerous diets throughout the year.

If your calf is an extremely large-framed type, it probably should not be put on a lower energy ration. Instead, feed it a higher energy diet from start to finish. Most large-framed calves should be fed a higher energy diet. If you are aiming for an early county fair, you will need to feed a higher energy diet.

It's generally not a good idea to feed a lower energy diet through the entire feeding period because the calf may not grow adequately to meet weight requirements. The exception is if you are feeding smaller-framed cattle to show at a later show.

Normal Feed Consumption

Average daily gain, feed efficiency, and dry matter feed intake are three ways to determine how much your animal is consuming and how effectively it is using the nutrients.

Average daily gain (ADG) is the amount of weight an animal gains per day. To figure ADG, divide the animal's total weight gain by the number of days it took to gain that weight. For example, if a calf weighs 600 pounds on June 1 and weighs 750 pounds on July 31 of the same year, it gained 150 pounds in 60 days. Divide 150 pounds by 60 days, and the ADG works out to 2.5 pounds per day. A fast-growing calf has a high average daily gain (150 pounds ÷ 60 days = 2.5 pounds per day ADG).



Feed efficiency value measures the amount of feed a calf eats to gain 1 pound. A feed efficiency value, sometimes called feed-to-gain ratio, of 7 means a calf had to eat 7 pounds of feed to increase its body weight by 1 pound. The lower the feed efficiency value, the better, because it means the animal is making good use of the money you spend on feed.

Looking closer at the amount of feed an animal consumes, the dry matter feed intake is the place to start. Table 6 lists the amount of dry matter that cattle of different weights are

anticipated to consume. Most dry grain and hay average about 87 percent dry matter with the rest existing as moisture. Doing the math, you will actually be feeding about 13 percent more pounds than the dry matter weight listed in Table 6.

Cattle fed corn silage will eat slightly less dry matter daily. They will eat about 0.1 to 0.2 percent less of body weight per day. So if feeding corn silage, subtract 0.1 to 0.2 from the figure in column 3, Intake as a Percentage of Body Weight.

If Your Calf Goes Off Feed

Watch your calf for signs of going off feed (refusing to eat what it is fed). Changes in weather may cause your animal to eat less. In hot summer months, you may need to feed your calf earlier in the morning and later in the evening to allow for cooler, more comfortable eating conditions.

Try to prevent this situation, but if your calf does go off feed, take the following steps:

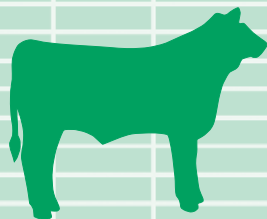
1. Cut the concentrate feed in half and continue to feed hay. Feed this amount until the calf eats it readily.
2. When the calf eats its feed readily, increase the amount slowly until it's eating nearly as much as it did when it went off feed. Watch the calf closely as you make further increases and continue to feed hay.

Table 6. Daily Dry Matter Feed Intake of Growing-Finishing Cattle

Body Weight in Pounds	Dry Matter Intake in Pounds	Intake as a Percentage of Body Weight
500	15.56	3.1
600	17.02	2.8
700	18.45	2.6
800	19.88	2.5
900	21.32	2.4
1000	22.75	2.3
1100	24.16	2.2
1200	25.60	2.1
1300	27.03	2.1
1400	28.46	2.0

Note: Weights are based on a beef steer example (as converted from kg from the equation dry matter intake = 3.830 + 0.0143 x **shrunk body weight**).

Adapted with permission from *Nutrient Requirements of Beef Cattle*, Eighth Rev. Ed., 2016, p. 165, by the National Academy of Sciences, courtesy of the National Academies Press, Washington, DC.



Exhibiting Your Calf

Many young people choose to exhibit and show, and then sell their 4-H project animals at a local or county fair. If you do so, be sure to read and follow all the rules for the shows you participate in. You will need to pay attention to registration dates or deadlines, which may be many months before the fair.

If you have a chance, attend other shows or fairs before your own to learn about showing and exhibiting animals. You can learn from watching others, asking questions, and listening to judges' reasons for placing showmanship classes.

To exhibit your calf properly and enjoy your experience in the showing, you must begin preparing for the show when you start your project. Your calf must be healthy and free from internal and external parasites. Additionally, at many fairs, the calf must weigh within a certain range to be eligible to show.

You and your project animal will be evaluated in two different classes: market and showmanship. In the market class, the judge will determine the health and care of the animal and its place within the animal industry based on its meat quality. In the showmanship class, the judge evaluates both you and your animal for how well you work as a team. He or she will also judge you on how knowledgeable you are about your project and how well it was cared for.

Halter Breaking

Assuming that your calf is eating properly and is healthy, the first step in

preparing it to show is halter breaking. Do this as early as possible, as animals are much easier to halter break and train when they are smaller and younger.

After your calf has adjusted to its new environment (it will take about 7 to 10 days), you can begin halter breaking it. You will need a sturdy rope halter. Confine the calf in a small pen (about 12 feet by 12 feet). Squeeze the calf between two gates or put it in a chute to halter it the first few times. Use caution to not get the calf too excited or upset.

Some people let a calf simply wear a rope halter and drag the rope for a few days before tying it to a sturdy fence post or gate. This is a good way for the calf to become accustomed to the halter. Some people instead prefer to tie the calf immediately. In either case, it is important to stay calm and be patient when working with your calf.

Tie your calf securely to a sturdy fence where the rope won't slide back and forth along a rail. During the first week, tie the calf for short periods each day. Be sure the halter does not cut into its hide over the bridge of the nose or under the jaw. If this happens, adjust the halter to a different area on the calf's nose. Allow the calf only 1.5 to 2 feet of rope when tied.

After your calf becomes accustomed to being tied, try scratching its shoulder or topline with your hand or a scotch comb. Once the calf realizes you are not going to hurt it and that the scratching, rubbing, or combing feels good, this motion will help calm and relax it.

To ensure your calf's safety in the early stages of halter breaking, never leave it unattended.

Training to Lead and Show

Once your calf is halter broken and comfortable with your presence when you brush and comb it, the next step is training it to lead. Begin by trying to lead the calf in a small pen for a few minutes before removing the halter and turning the calf loose for the day.

Another method is to halter and tie the calf after it finishes the morning feed. After the calf has been tied for a few hours, place a bucket of water or hay in the opposite corner of the pen and try to lead the calf to that area. After a few tries, the calf will begin to associate your leading it with a drink of water or a small treat. Once you gain the calf's trust, the process becomes easier.

Next, teach your calf to stop with its head up and to respond to the use of a show stick. Use the show stick to position the calf's legs so it stands squarely on all four legs. Positioning it like that is called "setting it up." At first the calf may shy away from the show stick, so the best time to introduce the show stick is when the animal is tied. Begin by scratching its belly with the show stick. Next, use the point or the hook of the show stick to set it up – to position the calf's feet properly.

Continue to lead and set up the calf daily to prepare for exhibition. With practice and time, your calf will learn to set up on its own when you stop. There is no shortcut to accomplishing this,

but with practice, you and the calf will become a good team.

After your calf begins to respond to being led, you can ease into training it for show. It is important to work with your calf repeatedly, performing the actions you will do in the showring. This includes walking the calf in a clockwise circle, stopping and setting up the calf's legs, and imagining a judge centered in the circle. While leading your calf, be sure you always know what it is doing. You will want to practice with your calf enough to anticipate its actions. The connection you build with your calf is important in showing.

Ask a 4-H volunteer leader, family member, or friend to help you prepare for showing by acting as the judge. They can signal you to walk, stop, and pull your calf into a lineup. This will allow you to practice moving with your animal and maintaining eye contact with the judge.

Lead your animal from its left side, with the show stick in your left hand and the lead strap in your right hand (see Figure 11). Hold the strap about 4 inches from the animal's head. Walk at the speed at which the animal looks its best. Always lead the calf in a clockwise circle, unless you are instructed by the judge or ring person to do otherwise.

Generally, cattle are lined up side by side at the beginning of the class. Leave plenty of room between animals and place the calf's front feet on higher ground than its rear feet if possible. You should survey the ground far enough ahead so you won't be forced to set up the animal in a low spot where the ground or floor may be uneven.



Figure 11. Leading a beef animal.

Attempt to set your animal up as quickly as possible while remaining calm. If you pull up on the animal's head by pulling up on the lead just before stopping, the calf will usually stop with its front feet placed correctly. In many instances, one hind foot will also be placed correctly, leaving only one hind foot to place.

To set the feet, start by moving the show stick to your right hand while still holding onto the halter. Then move the halter into your left hand, keeping the show stick in your right hand. Next turn your body (and feet) toward the calf's brisket at a 90 degree angle. Scratch the animal's underline with the show stick once or twice to calm it, and then place its feet. Make sure your calf's topline is straight and its head is up. Continue to stand like this (see Figure 12), scratching the animal's stomach until instructed to move.



Figure 12. Setting up a beef animal.

Grooming for Show

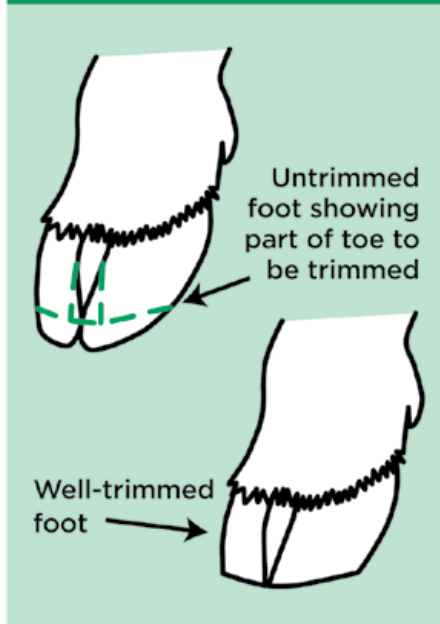
Hoof Trimming and Foot Care

Care of the calf's feet is important. Proper hoof trimming can change the position and set of the legs, changing the entire balance and lines of an animal. Consider trimming the hooves at least 4 to 6 weeks before the show. Many cattle will need routine or corrective hoof trimming.

Trim the inside toe and heel before trimming the outside because the inside toe generally grows faster and longer than the outside toe (see Figure 13). This is probably the major reason for trimming.

Proper trimming is needed not only for show, but for the overall health of your calf to help it grow properly and meet its potential. Your 4-H volunteer leader or 4-H staff can direct you to hoof trimmers to help care for your animal's hooves.

Figure 13. Hoof trimming.



Hair Care

A good hair coat that has shine and luster shows that a calf is healthy and well cared for. It also can help cover or mask some conformation or structural faults of the animal.

The most important tool for working with hair is a rice root brush. The brush will enable you to work the hair and stimulate growth of new hair at a relatively low cost.

If you plan to exhibit cattle beyond the local level, you will need a cattle blower. A blower is like a large hair dryer that can be used for drying and shaping hair. It is also a great tool for daily hair care and removing dust and bedding. You will want to make sure your calf is comfortable with having its hair blown at home so you can avoid injuring or stressing your animal.

If you have access to a blower, try these steps for getting your calf used to it:

1. First, stand at a distance from the animal with the blower on so your calf can hear the noise, but do not point the blower at your calf.
2. Begin to allow your calf to feel the air lightly, and then more intensely, bit by bit. Move closer as the calf gets used to the noise and feeling of the air blowing.
3. Once the animal is used to the blower, use it to drive the water and moisture away from your calf's skin to allow it to dry. Always blow the hair in a forward direction toward the neck and head.

All cattle have longer, denser hair coats in the fall and winter months. As spring brings warmer temperatures and longer days, the winter hair coat will begin to shed. The quicker the winter hair sheds, the quicker the new hair coat will begin to grow. You can hasten the process by brushing and combing your calf often.

Another way to increase new hair growth is to clip or shear the calf's entire body. In most cases, it is best to clip downward (in the direction of hair growth) to remove old, dead hair. The new hair that grows in will have a higher luster and shine. If you plan to shear your calf, do it several months before the show and leave the hair on the legs and tailhead.

As the weather starts to warm in the spring, you can begin rinsing your calf with water while it is tied to a secure post and fence. This will keep the hair coat clean and encourage hair growth. Rinse your calf daily, or even more often if possible. This will help tame your calf as it learns to enjoy the routine, especially in hot weather. Periodically, wash your calf with a mild livestock soap or dish soap. Laundry detergents are too harsh on the hair and hide. It is not necessary to use soap every day. Be sure to rinse all soap out of the animal. Avoid getting water in your calf's ear canals because it will cause the ears to hang down unnaturally. If your calf has dandruff or scales, mix one pint of white vinegar with three gallons of water, apply it to the calf's body, and rub it in. Leave this on the skin and it will help ease the dandruff problem.

After washing or rinsing, brush and comb your calf's hair forward (from rear to front) and slightly upward (see Figure 14). This brushing and combing will stimulate hair growth. A longer hair coat gives the calf a smoother appearance. Be sure to comb all of the hair, including the inside and outside of the legs. Continue brushing until the calf is nearly dry.

In warm weather, try to keep your calf cool to help preserve the hair you have worked on all summer. To do this, you may need to rinse your calf more frequently, provide shade, and use fans to give your animal a cool, brisk breeze.

Figure 14. Direction to brush the hair coat.



Clipping the Hair

You cannot change the size or conformation of an animal, but clipping it can greatly enhance its appearance. Clipping an animal like a professional takes a lot of time and patience. Use great care in this part of **fitting** your animal because once hair is cut off, you can't put it back.

To clip the hair coat, most people place the calf in a metal chute with a headgate. It holds the animal still and reduces the time it takes to groom your animal.

Before clipping, clean your animal and then comb and brush its hair properly. It is a good idea to wash the calf the day before you clip. Never try to clip a wet animal, as it will look different after the hair dries.

Your calf has five areas that should be clipped short: the brisket, dewlap, head, belly, and tail. There is some variation among breeds as to how much of the animal's head should be clipped. Check with the specific breed association for recommendations.

In most breeds, the head is shaved in front of a line that starts directly behind the ear. Clip forward to the nose and clip the entire forehead. Some hair may be left on the poll to make it more prominent. Clip the long

hair around the ears, but not inside the ears. Shape the two ears uniformly. Some people leave the hair on the side of the face or cheek. In any case, where there is a transition between short hair and longer hair, blend carefully, with the clipper at an angle, to make the transition smooth.

Clip the brisket and dewlap areas, then blend with the unclipped area. To clip the belly, start blending in the brisket. Following the natural curve of the belly, clip to the rear flank, removing the long hairs, and then clipping tight the hairs around the navel.

When clipping the tail, view the calf from the rear. Starting one third of the way down the length of the tail from the tailhead, clip upward. This will draw a cleaner attention to the calf's rump when viewed from the rear and make it appear square when viewed from the side.

After clipping these areas, clip and block any long hair on the topline and on the sides. Use patience and blend in these areas carefully. Your goal is to highlight the positive features using the hair to make the calf appear smooth, muscular, well balanced, and structurally correct. Clipping is an art and takes time. Even the most skilled show people may spend several hours clipping an animal.

Preparing for the Show

Beginning at least 2 weeks before the show, try to accustom your calf to things that will occur at the show or fair. Make certain the calf is used to eating from feed pans and drinking from a water bucket like you intend to use at the fair. Get the calf used to unfamiliar sounds by playing a radio in the barn; it may also help keep your animal calm during exhibition when speaker systems are used.

It is important that the calf is familiar with a leather show halter with a chain that goes under the jaw. When using a show halter on a calf for the first time, place it over the top of the rope halter. Lead the calf with both halters a few times. This will get it used to the chain. Be sure to train your calf to lead with the leather halter at least two weeks before the show. Eventually, lead your calf with only the show halter. If the calf is irritated by the chain, wrap the chain portion that is under the chin with veterinary wrap to make the chain softer and quieter.

In preparation for the show, make sure you gather the following items:

- Completed show entry forms, with any fees paid
- Cattle health papers prepared by your veterinarian, if necessary
- Fan, if necessary
- Blocking chute, if necessary
- Blower, optional
- Registration papers
- Bedding (unless provided by the show)
- Feed
- Water (optional; some exhibitors bring water from the animal's home in case the animal will not drink water it is unfamiliar with)
- Show box packed with:
 - Extra rope halter
 - Neck rope
 - Show halter
 - Show stick
 - Scotch comb
 - Rice root brush
 - Brush and soap for washing
 - Garden hose
 - Paper towels or rags
 - Feed pan and water bucket

- Pitchfork, rake, shovel, and broom for removing manure and keeping aisles clean
- Extension cords
- Clippers
- Spray adhesive
- Spray paint (if allowed)
- Sheen (or hair oil)

Transporting Cattle

Transport show cattle in a low stress manner. Most trailers work well when they are used properly and cattle are not overcrowded. In the trailer, good footing, including basic bedding, is needed. If cattle are hauled a great distance, they should be tied so they can lie down. Long trips should be planned so cattle can be watered at specific points along the drive and have at least a day or two to rest before the show. This will allow them to regain their shrunk body weight and appear in a more natural condition.

It is best to feed and water your calf lightly, feeding about half of the normal amount, the day before leaving for the show. Cattle will travel better and be more responsive to eating and drinking once they have arrived at the show.

Arriving at the Show

When you arrive at the show, find your stall and place suitable bedding in the space provided. Unload your calf and lead it to the stall to let it rest and get settled. Once in the stall, tie both the halter and the neck rope securely for safety. Cattle tend to rub their heads, which can cause the halter to slip off. The neck rope serves as insurance for keeping your calf where it belongs. Wash your calf as soon as you are able to keep the stall clean and present your

animal to the public to the best of your ability.

Be sure to check with the show office or superintendent to get any needed information about the show, such as weighing and check-in times, show time, and show order.

Do not leave a water bucket or feed pan in the pen all day. It can make the stall messy and possibly make the animal uncomfortable. Instead, feed your calf on the same schedule as at home and offer fresh water throughout the day. This will allow you to monitor your animal more closely and monitor its feed and water consumption.

While at the show, you and your animal are on display. Visitors who are eager to learn more about cattle and agriculture may stop and ask questions. Be courteous and polite to visitors and try to answer questions to the best of your ability. Keep your calf comfortable and the stall and bedding areas clean.

Exercise and Tie-Outs

To keep your calf relaxed and looking its best under the stress of transportation and showing, tie it outside in the evenings if an area is available. You can tie it at a tie-out provided by the show or to your trailer if allowed in the rules. Give your calf proper bedding that is approved by the exhibition both at the tie-out and in the stall. Keep both of the beds clean and dry. Tying out and walking the cattle when it is cooler can help keep them relaxed at the show. Tie-outs may not be available at all shows.

Show Day

On show day, wake up early and give yourself about 3 hours to complete your chores and other preparations. Make sure your calf is properly fed and watered and has a chance to walk to receive some exercise. Rinse the calf with water to remove any dust and dirt and then brush and comb your calf.



Allow enough time to dry the calf's hair and for the calf to rest before final preparation for showing. Grooming will depend on the length of the calf's hair, but you should generally allow at least 45 minutes.

To prepare your calf for the showing, you must first know the rules about exhibiting your animal, knowing what you can and cannot do. Some of the following steps may not be allowed by some show rules. To stay organized and not forget any steps, consider using the following approach:

1. Place the show halter on the calf, then place the rope halter over the top to tie the calf as you groom it. You will remove the rope halter just before entering the showing.
2. Place the calf in a blocking chute, if necessary, to restrain it.
3. Blow or brush all the dust from the calf's hair.
4. Make sure the hooves are clean.
5. Pull up the leg hair all around the legs after spraying with adhesive. This gives the calf a stouter-boned, squarer appearance. Clip the long hair on the legs to blend the legs.
6. Spray adhesive on the tailhead and pull up the hair. Clip the hair with clippers to give the rump a square and level appearance.
7. Comb out the tail. Cut long strands off the switch to make the bottom of the tail even with the bottom of the brisket when looking at the calf from the side.
8. Brush or comb the body hair forward to give the calf a smoother appearance. If the calf has a long, dense hair coat, it may be possible to pull the hair upward. A blower can help you work the hair upward or forward.

9. Spray a light amount of oil mist on the calf's head and body to give it shine and luster. Be careful that oil is not applied where adhesive was used earlier. Oil tends to dissolve adhesive.
10. Before going to the ring, allow the calf to drink water again if it would like. Use caution to not let the bucket tip over on the fitted calf.

Before going into the showing, make sure you have a scotch comb in your back pocket (with the teeth pointed toward your jeans), your exhibit or entry number (if needed), and a show stick. You should be dressed appropriately as described under What to Wear below.

If possible, watch a class before you show to observe the routine of the judge and the ring staff. You will then have a better idea of what the judge expects when it is time for your class.

What to Wear

Dress in a way that does not divert attention away from your calf, but rather complements the exhibit, so you

look like a team. Your clothing should be clean, attractive, and practical. Dress pants or denim jeans, and a shirt or blouse are recommended. Some shows may have a uniform dress code that includes a collared shirt or a specially designed T-shirt. Check the rules before the show.

Shorts, skirts, or dresses are not appropriate clothing for the showing unless required by religious affiliation. Leather footwear such as boots should be worn in the showing. This is primarily for safety reasons. Athletic shoes or higher heeled fashion boots are not appropriate footwear for the showing. Pants should not be tucked inside western boots, because this may detract from the exhibit. It is suggested that you wear a belt.

Your clothing should be clean, attractive, practical, and professional. Leave hats and caps back at the stalls. Additionally, your hair should be well combed or brushed and not falling in your face while showing.



Exhibitor Attitude

Your attitude in the showing should reflect that of going into a job interview. You should act in a courteous and professional manner. This includes how you interact with the judge as well as other exhibitors. Additionally, turn your cell phone off or leave it with someone else during your class. Moreover, do not chew gum while in class. Your attitude will leave an impression on the judge and spectators.

Showring Procedures

Enter the showing on time when your class is called, with the calf under control at all times. Show your calf to the best of your ability as learned through practicing at home. Lead your animal from its left side, with the show stick in your left hand and the lead strap in the right. Know where the judge is at all times.

Generally, cattle are lined up side by side at the beginning of the class. Leave plenty of room between animals and place the calf's front feet on higher ground than its rear feet if possible. When leading your calf around the ring, use the most of the ring, staying close to the outside edge. If the calf in front of you slows down or if its exhibitor seems to need help, be courteous and help move the animal by placing your show stick in your right hand (with the halter) and twisting the calf's tail. It is not appropriate to use your show stick to push on the calf ahead of you.

Follow the directions of the judge and ring staff when they inform you to stop or move. When stopping, make sure that your calf is in a straight line with the other cattle. Then switch hands,

face the rear of your calf, and set it up as quickly as possible.

As the judge walks around the cattle, be alert and calmly scratch your calf's belly with the show stick. Remain at the front and left side of your calf (see Figure 15). If the judge moves to view the front of your calf, take a short step back toward the shoulder of your calf to allow the judge a better view. If the judge handles your calf, calmly scratch its belly with the show stick and maintain control. After the judge walks away and begins to handle the next calf in line, use the scotch comb to straighten any hair that he or she moved.

When the judge signals you to move to another position, promptly pull out of line and move to that spot. Repeat the process of setting your animal up and exhibiting it to the best of your ability. Throughout the class, relax and let the judge view your animal. Remember that you are showing the animal, not yourself. Continue to show your animal from the time you enter the ring until you walk out the gate.

Sportsmanship

Sportsmanship is a representation of your character and attitude in and outside of the showing. Whether you win or lose, be humble and gracious. Congratulate the winners and be sincere. In a similar fashion, if you are fortunate enough to win a class or a show, accept congratulations from others humbly and sincerely.

After the Show

When the show is over, replace the show halter with the rope halter and wash your calf. There are products specifically designed for removing



Figure 15. Posing a calf in the showing.

the adhesive that was applied earlier. These products should be applied to the hair to break down the adhesive before washing, as soap and water alone will not remove adhesive. It is important to remove the adhesive and wash the calf soon after the show, as some hair-care products can cause the calf to get warmer and possibly irritate the skin.

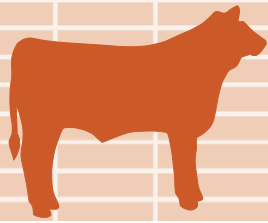
After returning home from the show, be sure to express appreciation with a thank-you note or letter to the people who helped you. Some of the people to thank may include:

- Show management officials
- Project superintendent(s)
- 4-H staff and volunteer leaders
- Other 4-H members who helped you
- Donors of trophies and awards
- The buyer of your calf, if sold
- Auctioneer, if you sold your calf

Guidelines for Fitting and Showing Beef Cattle

As an exhibitor, you will be evaluated. Evaluation includes the indication of care and preparation of the animal and the appearance of the exhibitor. Note: These guidelines are written for exhibitors who use their own animals in the show. However, the general principles also apply in contests where animals are provided for exhibitors.

Item or Technique Being Judged	Perfect Score
<p>Appearance of the Exhibitor</p> <ul style="list-style-type: none"> • Exhibitor and his or her clothing should be neat and clean. • Clothing should be appropriate for the task and should not attract undue attention to the exhibitor or the exhibit. • Boots or leather shoes should be worn for protection. Canvas shoes should not be worn. • Exhibitor should have a scotch comb and show stick when entering the ring. • Hair should be neat in appearance with no hat worn. 	10
<p>Attitude of the Exhibitor</p> <ul style="list-style-type: none"> • Exhibitor should have a professional attitude like that of going into a job interview (for example, refraining from chewing gum or using a cell phone). 	20
<p>Appearance of the Animal</p> <ul style="list-style-type: none"> • The animal should give every indication of being healthy and free of disease and parasites. • The animal should show evidence of proper nutrition. • The animal must be clean and free of dirt, manure, and bedding. • Hair should be clipped to enhance the appearance of the animal. • Hooves should be trimmed and shaped to enable the animal to stand squarely. • The hair coat should be clean and free of stains, which are especially evident in cattle with light colored hides. • Hair should be brushed or combed in a way that emphasizes the animal's strong points. • The leather show halter should be clean and properly sized to the animal. 	35
<p>Showing Procedures</p> <ul style="list-style-type: none"> • Cattle should enter the ring promptly in a clockwise direction when the class is called. Each animal should be led from the left side with the exhibitor holding the lead strap in the right hand. • When posing or standing, the exhibitor should face the calf and change the lead strap to the left hand. The exhibitor should use the show stick in the right hand to set the animal's legs. • Exhibitor should never do anything that will divert attention from another exhibitor's animal. • Exhibitor should be alert at all times and know where the judge is. • The exhibitor should be courteous to the judge and try to do as he or she asks. • Exhibitor should not leave the ring until the class has been placed, properly recorded, reasons given, and awards presented. 	35
Total	100



Beef Quality Assurance

In addition to learning about selecting, showing, and managing beef animals, it is important to focus on the end product, as beef cattle are raised for human consumption. You have to make sure the product you produce is safe and wholesome (healthful) for consumers. To ensure this quality, follow the guidelines of the **beef quality assurance** program.

Continuous Quality

When consumers purchase a product such as beef, they place trust in the cattle producers to provide them with safe, wholesome products and an enjoyable eating experience. While people buy beef for many reasons, consistency and quality are two main elements. As a cattle producer practicing beef quality assurance, this means that you are ensuring there are no **drug residues** or other concerns that will decrease the quality of the meat product.

Many things contribute to a successful beef quality assurance program. Especially important is following medicine instructions and withdrawal times. Various organizations, such as consumer groups, cattle producers, and government agencies, all work together to ensure that beef products are wholesome and safe. As a producer, you must take the necessary steps in your production practices to avoid residue. To carry out these production practices, you need to know the medicines you are using and their withdrawal times. You will also need to work with your veterinarian to ensure that they are properly administered.

Additionally, you should keep thorough records of treated cattle with proper animal identification. The National Cattleman's Beef Board, listed in Resources, has additional resources on how you can carry out a successful quality assurance program.

Avoid Drug Residue

What is drug residue? Imagine mixing a bowl of chocolate pudding. If you finish making chocolate pudding and then make vanilla pudding in the same bowl without rinsing it, your vanilla pudding may taste faintly of chocolate. That is because some chocolate residue remained in the bowl. Residue refers to what is left.

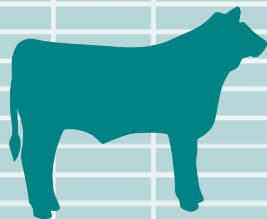
A drug residue is the tiny amount of a medication that remains in an animal's body tissue after the medication is given. Substances that leave residues can enter the animal when injected through shots, applied to the body, given as a feed or water additive, or accidentally consumed. It may take only a few hours for some medications to leave an animal's body; other medications may take months or may never completely leave certain body tissues.

All medications are different, so the safe level may be different for each drug. Some drugs are safe at a level that might be harmful if it were another drug. Most medications have a legal limit, meaning after an animal is harvested, the residue has to be below the level set for the medication. For some medications, residues are not a concern so they do not have a required withdrawal time.

The U.S. Department of Agriculture (USDA) and the U.S. Food and Drug Administration (FDA) work together to create standards that all animal producers must follow. These strict guidelines help protect our food supply. Specifically, random testing for drug residues at harvest facilities can find any producers who do not follow the rules. If illegal levels of residue are found in a harvested animal, the USDA has the authority to prevent a facility from accepting cattle from its producer until the producer's herd tests at or below the legal limit for any residue.

How do you avoid problems with drug residues? Follow medication withdrawal times. A **withdrawal time** is the amount of time a producer must wait after a medication is administered, or given, to an animal before it can be harvested, or slaughtered. Withdrawal times listed on drug labels tell you when to stop medicating an animal to prevent illegal residues. Withdrawal times are different for every medication. They can be anywhere from several hours to several months.

Read the label on all medications for the **treatment protocol**. You need to know what medications you give your animal and their withdrawal times. Work with your veterinarian to be sure medications are administered properly. Plan ahead to stop giving medications to an animal you will show at the fair so you will meet all rules by show day. Be sure to tell your veterinarian your plans to sell or exhibit your animal before he or she treats the animal. Keep good records of treatments given to cattle with treatment times, withdrawal times, and animals identified properly.



Marketing & Beef Products

Cattle producers, like other business operators, are working to produce and sell a high-quality product. Marketing is the activities involved in getting goods from a producer to consumers, the people who buy and use the product. To properly market your cattle and decide on a market price for them, you must be able to determine their quality.

A **carcass** is the muscular and skeletal system of an animal. **Carcass traits** are measured after the calf has been harvested. If you know where your calf is being processed, consider requesting carcass information or looking at the calf hanging on the rail at the processing facility. Work with local 4-H volunteers and staff to learn more about the processing facilities in your area.

The following section describes the physical measurements and characteristics of cattle known as carcass traits.

- **Dressing percentage** is the portion of live weight that is represented as carcass weight. To calculate dressing percentage, divide the carcass weight by the live weight and multiply by 100. A normal dressing percentage for a market steer is approximately 60 percent.
- **Backfat depth** is measured at the thirteen rib. The most desirable backfat depth on a market calf is between 0.2 and 0.5 inches.
- **Ribeye area** is determined by cutting the loin crosswise at the thirteenth rib and measuring the area of the muscle face. Ribeye area is a good indicator of the total amount or degree of muscling in an animal. A typical ribeye area of a market steer

is between 13 and 15 square inches. An average beef market animal will have one square inch of ribeye per one hundred pounds of bodyweight.

- **Yield grades** are the grades assigned to carcasses based on **cutability**. This helps us understand how much of the beef carcass is edible meat. Grades are assigned as a numerical value with yield grade 1 representing the highest cutability and yield grade 5 the lowest cutability (the fattest). Table 7 shows that carcasses with more desirable yield grades have higher cutability percentages.
- **Quality grades** are the USDA's grades assigned to the carcasses or cuts to categorize meat on the basis of consumer acceptability and palatability (eating quality). Quality grades look specifically at the eating experience of the cooked meat including tenderness, flavor, and juiciness. The quality grade is based mostly on **marbling** (the flecks of fat within the muscle) and the age

Table 7. Relationship Between Yield Grade and Cutability

Yield Grade	Cutability
1.0	53.6%
2.0	51.3%
3.0	49.0%
4.0	46.7%
5.0	44.4%

(maturity) of the cattle. The eight beef quality grades are listed in order of highest value to least: Prime, Choice, Select, Standard, Commercial, Utility, Cutter, and Canner. You should raise an animal that rates at a minimum of Select to ensure a positive eating experience. Some of the grades are further divided into high, average, and low, as in High Choice, Choice, and Low Choice.



Selling Your Market Animal

Most 4-H members sell their market beef animals at their county fair or show sale. If you sell cattle by this method, think ahead to invite buyers to the auction. Remember that it takes at least two buyers for the price of your calf to increase, so invite at least two buyers to the auction – the more buyers, the better. Consider hand-delivering buyer invitations as well as other efforts such as including photos of you and your project in the invitation.

Send a thank-you letter to the buyer of your 4-H project as soon as you get home from the show. This lets the buyer know you appreciate his or her efforts and encourages the person to support future sales. Be creative and

work with other members of your club or group, and your volunteer leader to brainstorm other ideas. Michigan State University (MSU) Extension has a great resource available for purchase to help you continue to improve your animal marketing skills. Consider purchasing the Youth Business Guide to Success: Make the Most of Your 4-H Market Animal Project (http://msue.anr.msu.edu/program/info/youth_business_guide_to_success).

If you do not sell your animal at your county fair sale, you can sell it at a livestock auction barn. Another option is portioning a beef animal and dividing the meat among a few people. Be sure to check with your MSU Extension office to get more recommendations and learn about the laws that affect selling fresh or frozen meat.

Beef Products

The final step in beef production is processing beef cattle carcasses to get a lean, nutritious, wholesome product for human consumption. After the beef animal has been harvested, carcasses are cut into seven **primal cuts**, or **wholesale cuts**. The seven primal cuts are the chuck, rib, loin, round, brisket, plate and flank (see Figure 16).

Each wholesale cut is trimmed of excess fat and separated into **retail cuts**. Retail cuts of beef are sold in grocery stores and restaurants. Some common retail cuts are shown in Figure 17. It's important that you know all of the wholesale and at least the more popular retail cuts of beef. This will give you a greater understanding of the need to produce lean, well-muscled market animals.

Figure 16. Wholesale cuts of beef.

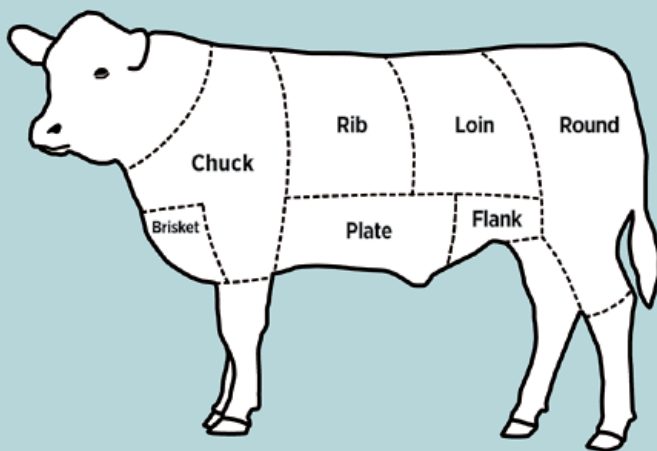
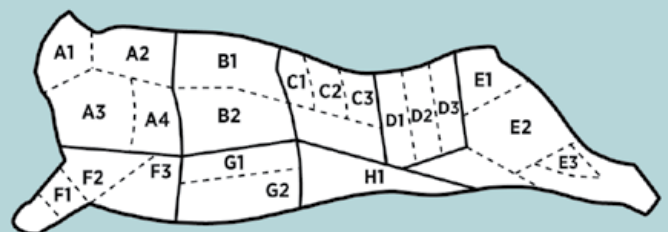
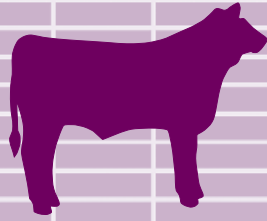


Figure 17. Common retail cuts of beef.



A1	Ground beef for stew	C1	T-bone steak	E3	Ground beef
A2	Blade Roast	C2	Filet mignon	F1	Shank Cross Cut
A3	Chuck Eye Roast	C3	Porterhouse steak	F2	Ground beef for stew
A4	Chuck roast	D1	Sirloin steak	F3	Beef brisket
B1	Ribeye steak	D2	Flat iron steak	G1	Stew beef
B2	Back Ribs	D3	Strip steak	G1	Short ribs
		E1	Rump roast	G2	Ground beef
		E2	Round steak (top or bottom)	G2	Skirt steak
		H1	Flank steak		



Animal Care & Well-Being

What Is Animal Welfare or Well-Being?

Animal welfare, or **animal well-being**, is a hot topic. More than ever before, consumers are questioning the way food animals are raised. New laws are being passed with guidelines for housing, transportation, care, and **euthanasia** (intentionally ending life). All of these factors may affect you and your 4-H animal science projects.

When you are at fairs, shows, and other animal events, you will be in contact with the public, most of whom consume animal products, but often know little about raising livestock. People may question why you use certain production practices, and you will want to be prepared with answers.

The terms **animal welfare** or **animal well-being** are heard a great deal, but what do they actually mean? The World Organisation for Animal Health (OIE) (2015) defines animal welfare as:

... how an animal is coping with the conditions in which it lives.

An animal is in a good state of welfare if (as indicated by scientific evidence) it is healthy, comfortable, well nourished, safe, able to express innate behavior, and if it is not suffering from unpleasant states such as pain, fear, and distress.

Good animal welfare requires disease prevention and veterinary treatment, appropriate shelter, management, nutrition, humane handling, and humane slaughter or killing. Animal welfare refers to the state of the animal; the treatment

an animal receives is covered by other terms such as animal care, animal husbandry, and humane treatment (Chapter 7.1, Article 7.1.1).

The American Veterinary Medical Association (AVMA) (n.d.) explains:

... a human responsibility that includes consideration for all aspects of animal well-being, including proper housing, management, nutrition, disease prevention and treatment, responsible care, humane handling, and, when necessary, humane euthanasia (¶12).

There are numerous perspectives on animal welfare that are influenced by a person's values and experiences. There are also various means of measuring animal welfare, including (but not limited to) health, productivity, behavior, and physiological responses (¶13).

The preceding definitions come from two important papers in the history of animal welfare, which introduced the Five Freedoms of Animal Care and the Three Circles Model. Both will be discussed in the next sections.

Five Freedoms of Animal Care

As a response to animal production concerns raised in the book *Animal Machines* by Ruth Harrison, a scientific committee in Great Britain, presented a report in 1965 that said animals should have the freedom "to stand up, lie down, turn around, groom themselves and stretch their limbs" (Farm Animal Welfare Council, 1979). These freedoms became known as "The

Five Freedoms." They are five ideals that consider the basic physical and mental needs of animals. As a result of the report, the Farm Animal Welfare Advisory Committee was created to monitor the livestock production sector. In 1979, the name was changed to the Farm Animal Welfare Council, and by the end of that same year, the Five Freedoms had been written into the following format.

The Five Freedoms, which includes considerations for the physical and mental state of animals, are:

1. **Freedom from Hunger and Thirst:** by ready access to fresh water and a diet to maintain full health and vigor.
2. **Freedom from Discomfort:** by providing an appropriate environment including shelter and a comfortable resting area.
3. **Freedom from Pain, Injury, or Disease:** by prevention or rapid diagnosis and treatment.
4. **Freedom to Express Normal Behavior:** by providing sufficient space, proper facilities, and company of the animal's own kind.
5. **Freedom from Fear and Distress:** by ensuring conditions and treatment which avoid mental suffering.

(Farm Animal Welfare Council, 1979)

The Five Freedoms are used by veterinarians and other groups across the world. Most of the animal welfare audits developed for use on farms and in processing facilities are based on the Five Freedoms. The items on the list are easily understood, common-sense considerations that caretakers routinely provide their animals.

The Three Circles Model of Animal Welfare

The Three Circles Model was introduced by David Fraser, Dan Weary, Ed Pajor, and Barry Milligan (1997) in a paper titled, “A Scientific Conception of Animal Welfare That Reflects Ethical Concerns.” It addresses three concepts to evaluate animal welfare: basic health and functioning, natural living, and affective states (emotional conditions) (see Figure 18). The concepts presented in this model take the Five Freedoms to a deeper level, showing how they can both overlap and separate at the same time. You can think of this model as a window people look through to better understand their own thoughts about animal well-being and how others think about it.

Defining the Concepts of the Three Circles Model

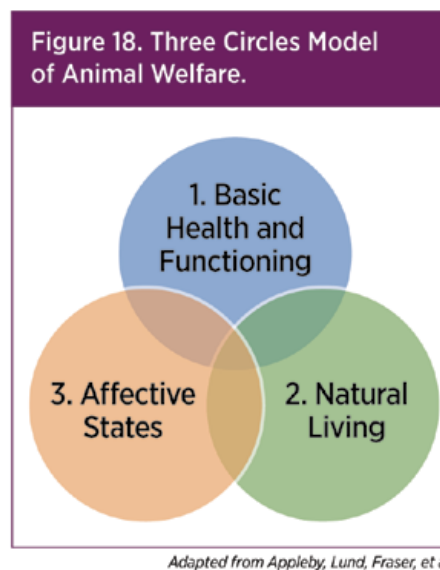
1. Basic Health and Functioning –

This concept addresses the physical fitness of the animal, including good health, normal body function, and normal growth and development. This circle relates back to the freedoms from hunger and thirst (Freedom 1); discomfort (Freedom 2); and pain, injury, and disease (Freedom 3).

2. Natural Living – This circle emphasizes that animals should be able to lead reasonably natural lives. This includes being able to perform important, normal behaviors (for example, dust bathing for chickens or grazing for horses) and to have some natural elements in their environment (for example, sunlight, fresh air, or social contact for herd species). This concept relates back to the freedom to express normal behavior (Freedom 4).

3. Affective States – This circle considers the emotional state of the animal in that animals should feel mentally well and should not

be subjected to excessive negative emotions. Negative emotions include unpleasant states such as pain, hunger, and distress. Beyond just avoiding the negative, animals should be able to experience positive emotions in the forms of pleasure or contentment (for example, play or social contact). Affective States relate to freedom from hunger and thirst (Freedom 1); pain, injury, and disease (Freedom 3); and fear and distress (Freedom 5).



What Does This Mean for You and Your Animal?

All of this shows that animal welfare is complicated. The condition of the animal is most important, but people’s attitudes and beliefs are part of the conversation, too. We use scientific observation, looking and listening, to evaluate animal welfare through the window of our values.

Animal welfare *is not the same as animal rights*. **Animal rights** are about the legal and moral standing of animals in society. Animal rights activists

seek to stop all use of animals by humans, including use for food, fiber, entertainment, and even as pets.

Often times, you will find it challenging to determine how these freedoms and viewpoints fit into your day-to-day actions and care of your animals. The following example works through one scenario of two steers raised by a 4-H member and incorporates both the Five Freedoms and the Three Circles Model to assess the animals’ welfare.

Example: 4-H Market Beef Project

A 4-H member is raising two market steers to show at a fair in central Michigan. One weighs 855 pounds and the other 830 pounds. The steers are kept in an outside pen that is 10,000 square feet with a packed-dirt floor and a three-sided lean-to that is 48 square feet.

There is one 40-inch-long feed trough, a 20-inch-long hay feeder, and a 50-gallon water tank in the pen. The steers have unlimited access to hay, which is refilled once a week. Twice a day, the two steers are fed 18 pounds of commercial concentrate (corn, oats, barley, minerals, and molasses bought at a local feed store). The water tank is cleaned three times a year and refilled as needed weekly, with debris removed daily. The heavier steer is more aggressive and often eats more feed than the lighter-weight steer.

The heavier steer is often found standing or lying completely under the lean-to, while the smaller one is only half in the shaded area. Manure is removed from the pen once a week. The youth works with each steer twice a week for 45 minutes, so the animals are accustomed to being handled and will be ready to be shown in the summer. Veterinary visits are scheduled when needed.

Animal Welfare Assessment of the Example Scenario

The following assessment uses the Five Freedoms and the Three Circles Model.

Basic Health and Functioning

The steers are fed a balanced diet for growing market animals and always have access to fresh water (Freedom 1). Cleaning the pen weekly helps improve the steers' environment and minimize disease (Freedoms 2 and 3). Veterinary care is given to the animals when needed (Freedom 3). The packed-dirt floor is cooler and softer than concrete – an advantage for resting animals (Freedom 2). Shade coverage is important to make sure animals are not heat stressed during hot summers and to give them shelter during bad weather like thunderstorms and extreme wind. All of these points help provide proper welfare for the steers.

There are areas that can be improved, starting with the shelter. The lean-to should be large enough that both fully grown steers can stand or lie under it. That will do a better job of meeting Freedoms 2 and 4. When the animals were bought, they were smaller and probably fit under the shelter, but as they grow, they need more space. More shelter should be provided so both steers can get out of direct sunlight and bad weather if needed. It would be a good idea to consider adding another method of cooling, such as a fan, to supplement air movement.

The feeding trough may be a little too short. Some sizes work for smaller animals, but as the steers grow, there is not enough room for both to eat comfortably and have the same access to their feed. Adjusting the length of the feeder or adding a second feeder would help meet Freedom 4.

Natural Living

Housing animals in groups helps meet the steers' social needs (Freedom 4). Cattle are herding animals, meaning they are most comfortable living in a group with other cattle. When cattle are housed in groups, it is normal for one animal in the pen to dominate, however it does not mean there is not a negative impact on the non-dominant animal. The fact that a behavior is natural or normal does not mean it is desired for animals raised by humans. Depending on how dominant the heavier steer is, the lighter-weight steer may have short-term stress, long-term stress, or both.

As stated in the scenario, the heavier steer takes up most of the space in the lean-to and has better access to feed, which could affect the lighter-weight steer by limiting its access to food (impairing Freedom 1), increasing its exposure to weather, reducing choice of resting space (impairing Freedom 2), and creating a stressful environment the steer cannot avoid (impairing Freedom 5). Increasing shelter and feed trough space benefits not only an animal's basic health and functioning, it also benefits its natural behaviors. Making these changes may not end the dominance of one steer, but it could help reduce it.

Affective States

Because cattle are herding animals that naturally form groups, it is important

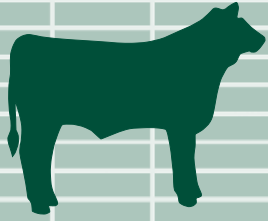
they are housed with other cattle, even when there may be dominance issues. Living apart from other animals could be very stressful for an animal, which would impair Freedoms 4 and 5. The youth training and interacting with the steers so they know what is expected of them at the show meets Freedom 5. Giving animals a positive experience, exercise, mental stimulation, and enrichment improves their welfare.

The fighting may distress the non-dominant animal in the pen because the dominant one works to maintain its dominance, while the other animal just tries to avoid negative interactions. This may mean the heavier animal is having Freedom 5 met, but Freedom 5 is impaired for the lighter-weight animal. One strategy could be to offer the commercial feed to the lighter-weight animal while the youth works with the heavier one. This would eliminate competition and can allow both animals to have positive, though very different, experiences.

Points to Remember

As this example illustrates, animal welfare is complicated, but that makes it fun! There are many different ways to look at and analyze an animal's situation. An exercise like this gives you an opportunity to practice your skills in critical thinking, evaluation, and communication as you discuss your ideas with peers and adults.





Other Activities & Opportunities

Dairy Beef Projects

In Michigan and other states with high populations of dairy cattle, some fairs may have divisions in which dairy-influenced or purebred dairy steers can be exhibited. Although this resource focuses on feeding market beef cattle with beef breed-based genetics, the information can be adapted to feeding dairy steers. Specific similarities include:

- Setting goals for your 4-H project animal
- Selecting your calf
- Paying for your project
- Early care and management
- Preventing illnesses and diseases
- Facilities and equipment used in a cattle project
- Exhibiting your calf at a show or fair
 - Note: Show dairy steers like you show market beef steers – using a show stick and walking forward while leading the animal, as described in Exhibiting Your Calf.
- Beef quality assurance
- Marketing and beef products
- Animal care and well-being

The dairy steer is different from beef-based genetics in two areas, feeding and fitting:

- **Feeding:** In many cases, fair rules allow for higher weight dairy steers as they need to be able to consume more grain to have the correct degree of finish or fat. When using the feeding information provided in this book, increase dry matter feed

intake on a percentage of weight basis. The dairy steer will need more feed compared to a beef animal. This will increase your feed costs.

- **Fitting:** In most cases, dairy steers have hair that is shorter and harder to train. You can still follow the strategies in the Exhibiting Your Calf section to prepare your calf for the showring. However, you will have more challenges blending hair and pulling up leg hair. In some cases, youth choose to body clip the calf ahead of show time so all hair is the same length. For assistance, ask teen leaders and 4-H volunteer leaders from your county how dairy steers are usually exhibited at your fair.

Opportunities

Raising animals is a unique opportunity that can open the door to numerous other possibilities. Your 4-H market beef project can allow for personal development as well as skill enhancement. Here are some suggestions of ways to get more from your 4-H market beef project:

- Analyze the information recorded in your record book and make decisions from the information for future years.
- Participate in other related 4-H projects.
- Give presentations.
- Use social media to teach consumers about beef and agriculture.
- Participate in livestock judging or meat judging contests.
- Compete in fitting and showing contests.

- Attend 4-H trips and tours.
- Explore careers in animal science.
- Become an entrepreneur with your own beef business.
- Become a peer mentor to younger members.
- Serve as a teen leader and attend workshops for teen leaders.
- Participate in the statewide 4-H recognition program.

Other 4-H Projects

A 4-H market beef project is more than just owning and caring for cattle. Participating in other projects will broaden your experiences and help you learn more from your market beef project. Possibilities include:

- **Veterinary science** – Study how to keep your calf healthy.
- **Crop science** – Produce forages and grain for your animal.
- **Photography** – Tell the story of your market beef project with photographs.
- **Entomology** – Learn about parasites of cattle.
- **Environmental science** – Research ways to continue to increase cattle production efficiencies.

Give Presentations

Speeches, demonstrations, and illustrated talks give you the chance to speak in front of a group. A demonstration is showing (demonstrating) how to do something. An illustrated talk is giving information.

Both are ways of sharing useful information with the help of visuals such as models, cutouts, pictures, charts, and posters. Public speaking is giving a speech without visual aids to inform, explain, persuade, inspire, or entertain an audience.

Giving presentations helps you learn useful skills in expressing yourself in front of a group. You might choose a topic you do not know much about and use the opportunity to learn more about beef cattle. You can give presentations at meetings of a 4-H club or other groups, at the county fair, or in a contest.

Work with your 4-H volunteer leader to brainstorm other topics and ways to enhance your 4-H experience.

Judging Contests

Livestock judging contests will help you learn to observe, evaluate, problem solve, and make decisions. It will give you a chance to see quality livestock and meet other 4-H members.

Additionally, giving oral reasons will help you become comfortable with expressing yourself and defending your rationale.

Meat judging contests will assist you in understanding and evaluating beef carcasses, wholesale cuts, and retail cuts. Similarly, with livestock judging, you will learn to make decisions efficiently and defend them in a set of oral reasons.

4-H Trips & Tours

You can learn a lot by visiting or touring businesses related to your project area. Here are some ideas for trips and tours you might want to take with your 4-H club or group:

- Tour 4-H members' barns to observe their market beef project animals and production methods.
- Visit one of the animal science teaching and research centers at Michigan State University.
- Tour a feed manufacturing plant or a local grain and feed elevator, with a nutritionist discussing how livestock feeds are produced and diets are formulated.
- Visit one or more of the breed association field days that take place during the summer.
- Visit a restaurant, meat market, or grocery store to learn about cuts of meat.

- Visit a large livestock show or sale, evaluate the quality of the animals you see, and observe how people exhibit their animals.

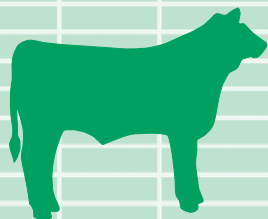
Careers in Animal Science

Use your 4-H market beef project as a chance to explore careers in animal science. Many professionals, such as farm managers, herdsman, nutritionists, geneticists, cattle buyers, and veterinarians, work directly with animals. Others develop, produce, or sell products or services used in beef production – such as feed, artificial insemination products, health products, or equipment. Other professionals, such as food scientists, meat cutters, meat inspectors, food service providers, and chefs, work with animal products.

With the help of your 4-H volunteer leader, make a list of all the careers you can think of relating to animal science. Choose three or four careers from your list to research. You may want to present what you learn at your 4-H club or group meeting so others can benefit from your research.

Ideas for Presentations

Speeches	Demonstrations	Illustrated Talks
<ul style="list-style-type: none"> • The beef industry in Michigan • The importance of beef cattle to the American people • The nutritional value of beef • Why I chose a 4-H market beef project • How all youth can benefit from 4-H 	<ul style="list-style-type: none"> • How to make a rope halter • How to prevent injuries when loading cattle • How to vaccinate a calf • How ruminant digestion functions • How to prepare a diet for a calf 	<ul style="list-style-type: none"> • How to choose a feeder calf • The parts of a calf • How to control parasites in beef cattle • Cuts of beef • How to prevent zoonotic diseases • By products of beef production



Resources

Practices used in the beef cattle industry change as new technology becomes available. As you make decisions about your 4-H market beef project, you will need to get the most up-to-date information. Information is available from many sources, including those listed below.

- American Meat Science Association has resources on meat science: <http://www.meatscience.org>
- Michigan 4-H Youth Development: Animal Science Programs website includes information about and resources for 4-H Animal and Veterinary Science Camp, livestock judging, meat judging, project areas, scholarships, and recognition: http://msue.anr.msu.edu/topic/info/animal_science
- Michigan Cattlemen's Association provides information and educational materials about the beef industry: micattlemen.org
- Michigan State University Extension county offices have information about educational activities at the county, district, and state levels.
- National Cattlemen's Beef Association offers information about beef quality assurance and related topics: <http://www.beefusa.org>
- *Youth Business Guide to Success: Make the Most of Your 4-H Market Animal Project* is a curriculum, available for purchase, that teaches about marketing and advertising products. Participants explore and practice production, management, and distribution skills; explore what it takes to be successful in business;

and view the world of animal science and agribusiness as a career option: http://msue.anr.msu.edu/program/info/youth_business_guide_to_success

U.S. Beef Cattle Breed Associations

Breed associations offer resources, events, and research information to promote the beef industry within their breed. The tools and resources are a member service to help youth and adults continue to learn and improve their beef-management skills. Some of the major national breed associations are:

American Angus Association

3201 Frederick Ave.
St. Joseph, MO 64506
Phone: 816-383-5100
Email: angus@angus.org
Website: www.angus.org

American Chianina Association

1708 N. Prairie View Rd.
Platte City, MO 64079
Phone: 816-431-2808
Email: jennifer@chicattle.org
Website: chicattle.org

American Gelbvieh Association

350 Interlocken Blvd., Suite #200
Broomfield, CO 80021
Phone: 303-465-2333
Email: info@gelbvieh.org
Website: www.gelbvieh.org

American Hereford Association

1501 Wyandotte
Kansas City, MO 64101
Phone: 816-842-3757
Email: aha@hereford.org
Website: www.hereford.org

American International Charolais Association

11700 NW Plaza Circle
Kansas City, MO 64153
Phone: 816-464-5977
Email: dhobbs@charolaisusa.com
Website: charolaisusa.com

American Maine-Anjou Association

204 Marshall Rd., PO Box 1100
Platte City, MO 64079
Phone: 816-431-9950
Email: Lindsey@amaapc.com
Website: www.maine-anjou.org

American Shorthorn Association

7607 NW Prairie View Rd.
Kansas City, MO 64151
Phone: 816-599-7777
Email: info@shorthorn.org
Website: <https://shorthorn.org>

American Simmental Association

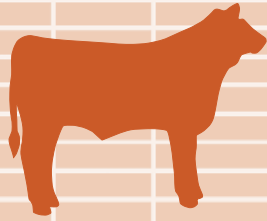
One Genetics Way
Bozeman, MT 59718
Phone: 406-587-4531
Email: simmental@simmgene.com
Website: simmental.org

North American Limousin Foundation

6 Inverness Court East, Ste. 260
Englewood, CO 80112
Phone: 303-220-1693
Email: limousin@nalf.org
Website: nalf.org

Red Angus Association of America

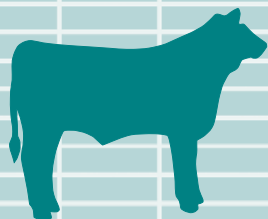
4201 N. Interstate 35
Denton, TX 76207
Phone: 940-387-3502
Email: info@redangus.org
Website: redangus.org



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Glossary

acidosis – nutritional disorder caused by a sudden switch of diet from roughage to high concentrates (grain)

amino acids – small compounds that are the building blocks of proteins

animal rights – societal and value-based view of animal care

animal welfare – scientific understanding of meeting an animal's physical, environmental, nutritional, behavioral, and social needs

animal well-being – See animal welfare.

average daily gain (ADG) – a measure of an animal's daily growth, calculated by dividing the calf's total weight gain by the number of days required to achieve that gain

backfat depth – the measurement of subcutaneous (under the skin) fat at the thirteenth rib

bacteria (plural) – single-celled living microorganisms that can cause disease

bacterium (singular) – a single-celled living microorganism that can cause disease

beef quality assurance – the conscious effort of beef producers to provide high-quality and wholesome products

biosecurity – the set of steps taken to prevent animals from being infected with or spreading pathogens

bloat – abnormal condition in ruminants caused by gas buildup, seen on the animal's upper left side

body proteins – amino acids linked together to form protein molecules that make up muscles, skin, internal organs, bones, blood, hair, and hooves

bovine – a general family grouping of cattle, buffalo, bison, and yaks; all have cloven hooves (split into two toes)

bull – an intact male, not castrated

calcium – a macromineral needed to build bones and teeth and to support other life processes

calf – young bovine animal

carbohydrates – source of energy found in feedstuff including starch, sugar, and cellulose

carcass – the muscular and skeletal system of the body of an animal

carcass traits – characteristics, such as muscling and leanness, that can be estimated on live animals and accurately measured only on the carcass

castration – surgical removal of the testicles in male animals

closed-herd management – management strategy to decrease disease by not allowing new animals from other farms to enter a herd

conformation – an animal's physical form

crossbred – an animal with parents of two different breeds

crude protein – the level of protein contained in a feedstuff based on its nitrogen content

cud – feed that ruminants regurgitate to be chewed again

cutability – amount of closely trimmed retail cuts from a carcass

diagnosis – identifying a disease from its signs and symptoms

diet – nutritionally balanced mixture of feed ingredients

dietary protein – protein in feeds used as a source of amino acids

dressing percentage – the portion of live weight that is represented as carcass weight, calculated by dividing live weight into carcass weight and multiplying the result by 100

drug residue – the amount of a medication that can remain in an animal's body tissue after the medication is administered

dry matter – the part of a feed that would remain if all the water was removed

dry matter basis – a way of comparing feeds reasonably by adjusting for the water content

essential amino acids – amino acids that must be present in the diet

euthanasia – intentionally ending a life to prevent or relieve pain and suffering

fats – a dietary compound that supplies energy for animals and aids in digestion of certain vitamins

feeder calf – an animal that needs further feeding before it can be marketed as a finished animal

feedstuff – any edible material that has nutritional value

feed efficiency value – a measure of the pounds gained, divided by the pounds of feed consumed, in a given period

finish – the fat cover on an animal

fitting – final preparation of an animal for show

free-choice – a feeding system that offers feed ingredients cafeteria-style; animals choose whether or not to eat the feed and how much of it to eat

Glossary

heifer – a young female, less than 2 years old, that has not had a calf

laxative – a medicine or food that makes it easier for solid waste to pass through the body

legume – type of plant with root nodules containing bacteria that fix nitrogen

macrominerals – minerals required by an animal in large amounts because they make up the largest percentage of minerals in the body

marbling – intramuscular fat deposits between muscle fibers, the flecks of fat visible in the lean cut surface

market price – the normal selling price on any given day

Mcal – abbreviation for megacalorie, which is a measurement of energy

microminerals – minerals that animals require in very small amounts

microorganism – a microscopic living organism, so small it can be seen only with a microscope

minerals – substances that animals need to build bones and teeth and to support other life processes

monogastric – animals with one stomach compartment

net energy for gain (NE_g) – an estimate of the energy value of a feed used for weight gain above what the animal needs for maintenance (body function)

nutrition – the process of eating the right kind of feed to grow properly

nutritionist – an expert who gives advice about feeding

off feed – when an animal loses its appetite and is reluctant to eat or refuses to eat

organism – a living thing

palatability – the pleasure provided by foods or drinks; palatable feed ingredients help make feed acceptable or appetizing

parasite – an organism, often an insect, that lives in or on another organism and feeds on it

phenotype – physical appearance based on observations

phosphorus – a macromineral that animals need to build bones and teeth and to support other life processes

pneumonia – inflammation of the lungs, which causes breathing difficulties

primal cuts – often called wholesale cuts, the seven parts of a beef carcass that are further divided into retail cuts

protein – a dietary nutrient that supplies amino acids to an animal

protein supplement – an ingredient added to the diet to supply the amino acids missing in the grain, often added with vitamins and minerals

quality grade – an estimation of the eating quality of meat products

ration – the amount of feed consumed by an animal in one day

respiratory system – the lungs and the passages that move air into the lungs

retail cuts – cuts of meat sold in grocery stores and restaurants, made by cutting wholesale cuts into smaller parts

ribeye area – area of the major muscle in the loin, determined by cutting a carcass crosswise through the loin and measuring the area of the exposed muscle

ruminant – an animal that has four stomach compartments (the rumen, reticulum, omasum, and abomasum) to digest its feed

scur – an incompletely developed horn

shrunk body weight – body weight without the last meal, approximately 96 percent of the animal's current weight

steer – a male bovine (bull) that has been castrated

supplements – ingredients added to feed to make up for needed nutrients that are missing

thrifty – a healthy animal able to gain weight normally

toxic – poisonous

toxin – poison produced by organisms

trace minerals – See microminerals.

traceability – ability to track animals in case of emergency such as a disease outbreak

treatment protocol – guide for medical treatment of an ailment provided by a veterinarian or drug label

Veterinary Feed Directive (VFD) – a U.S. Food and Drug Administration rule that requires a written statement from a licensed veterinarian to allow an animal caretaker to get and use specific medications in or on animal feed

virus – organism that causes disease and spreads from one animal to another

vitamins – dietary nutrients needed in very small amounts for bodily functions, growth, and development

wholesale cuts – See primal cuts.

withdrawal time – the amount of time a producer must wait after a medication is given before the animal can be harvested

yield grade – an estimation of the edible product in a beef carcass

zoonotic – diseases that are shared between humans and animals



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