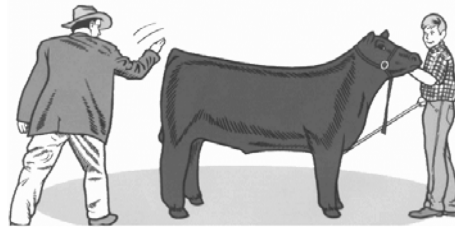


Feeding Market Beef



**Colorado State University
Cooperative Extension and Department of Animal Sciences**

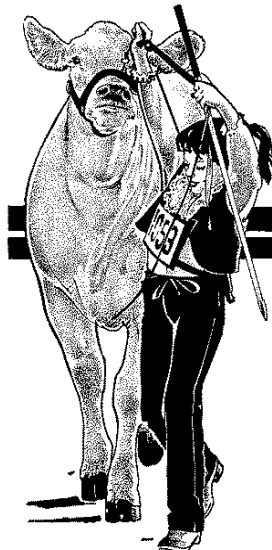
Feeding Market Beef

Table of Contents

Forward.....	2
Financing Your Project.....	2
Feeder Cattle Selection.....	3
Nutrition Concepts.....	6
Common Feeds for Cattle	7
Starting Calves on Feed.....	9
Rations for Cattle	10
Pen Requirements	15
Common Diseases of Cattle	15
Importance of Good Record Keeping.....	17
Worksheet 1 - Budget	18
Appendix 1 – Julian Calendar	19
Appendix 2 – Common Feeds.....	20
Appendix 3 – Nutrient Requirements	22
Appendix 4 – Sample Case.....	23

Revised by Dr. Celina Johnson, Animal Sciences, Colorado State University, Fort Collins, Colorado

Acknowledgment is made to Dr. Tim Stanton for use of some of the material from the previous edition.



Forward

Your market beef animal serves as a dynamic factory that changes hays, silage, grain, and other feed by-products into meat and other products that can be used by people. It is hoped that you will look upon your market beef project as business venture, as well as the fun, learning experience that it is. Commercial beef production relies heavily on profitability, and so should your project.

There are several segments to the commercial beef industry in the United States. The **seedstock segment** is the group of producers who raise registered livestock that provides the genetic base for the remainder of the industry. The **commercial cow-calf segment** is the group of producers who purchase seedstock to improve their genetics. Their primary product to sell is a weaned calf weighing around 350 to 550 pounds. **Stocker or backgrounding operations** purchase the weaned calf from the commercial cow-calf producers. They raise the calves on high forage diets until they are heavy enough to enter the feedlot, which is approximately 600 to 800 pounds. The **feedlot segment** takes these calves and finishes them, usually to a weight of approximately 1250 pounds. Once the cattle have reached their harvest weight in the feedlot, the **packing plant** will harvest the cattle and distribute the meat and other products for sale.

By participating in the market beef projects, you are actually participating in the **stocker** and **feedlot** phases of commercial beef production. These are two segments whose profitability relies heavily on low cost of gain for the cattle. Keep this in mind as you move forward with your project.

Financing Your Project

Like many commercial cattle feeders, the first problem that you will encounter is, "How much money will it take?" The second challenge is "Where do I get the money?" The following are three common sources for financing for youth livestock projects:

YOUR OWN BANKING ACCOUNT.

If you are fortunate to have enough money in your own accounts, this can be used to fund your market beef project.

BORROW THE MONEY FROM YOUR PARENTS.

Most parents are very supportive of their kids. If you do borrow money from your parents, develop a written contract and be prepared to pay them interest. See Figure 1 for a sample contract.

Talk Like a Cattle Feeder!

Principle (P): The amount of money borrowed from a lender.

Interest (I): A percentage of the loan amount that is paid IN ADDITION to the principle borrowed.

Rate (R): The percentage rate used to calculate interest (ex. 8% interest rate)

Time (T): The duration of the loan that the interest is applied to the balance.

For general purposes, the following formula can be used to estimate how much interest will be paid: $I = P \times R \times T$

Ex. You borrow \$100 for 1 month at 10% interest

$$\$110 = 100 \times 0.10 \times 1$$

NOTE: There are many ways of calculating the interest, so make sure that you and your lender are clear on how it is calculated!

APPLY FOR A LOAN FROM A LOCAL BANK.

A great way to learn about financing is to visit a local bank. Ask your county extension agent for some financial institutions that support youth livestock programs. Take your parents or guardians along and discuss your need for a loan with the banker. There are three pieces of information that the banker will need to know:

1. How much money do you really need (principle)?
2. How long will you need the loan (time)?
3. How will the loan be repaid if your calf dies or your project loses money (insurance)?

Figure 1. Sample Contract for Loan from Parents.

Today's Date	
Amount borrowed:	_____
Interest rate:	_____
Duration of loan:	_____
I, _____ (borrower) agree to pay back the above principle plus interest accrued to _____ (lender) within _____ months of the completion of my project. I also agree to insure my animal in the event of my animal dies.	
_____ Signature/date Borrower	_____ Signature/date Lender

If you are borrowing money from someone (either your parents or a bank), the first piece of information you will need is to determine how much principle (money) you will need to borrow. Use Worksheet 1 to determine your estimated costs for the project.

The second parameter that you need to determine is the length of the loan. Generally, this will be the time from purchase of the animal until you sell it at your local junior livestock show and sale.

Finally, the lender will want to know if you will insure the animal in case it dies. Ask your county extension agent for insurance companies that insure junior livestock projects.

Feeder Cattle Selection

Two factors affect commercial cattle feeder's profitability. The first is how cheap they can purchase the feeder cattle. The second is how much they can sell them for at the end of the feeding period. Like commercial cattle feeders, you will need to know:

- When you need to purchase your animal, relative to your fair date,
- What that animal needs to weigh at the beginning of the project,
- What is a fair price for the animal.

When you and your market beef animal arrive at the fair, the judge will be evaluating your project on the following traits:

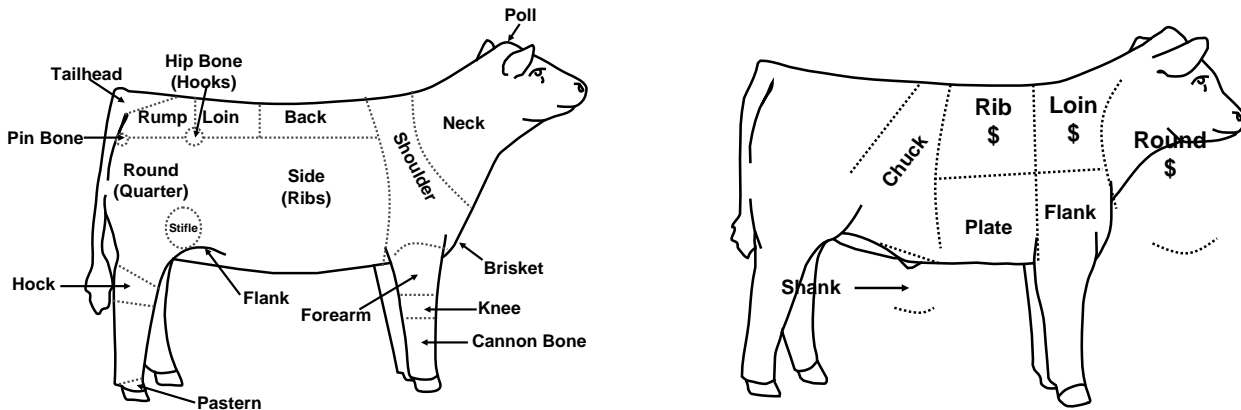
- Muscling
- Finish (how much fat your animal has)
- Structural correctness and design

Talk Like a Cattle Feeder!

It is important to know the parts of your animal. This is the foundation of the vocabulary of beef cattle selection and evaluation.

Figure 2 shows both the basic anatomy of the beef animal and the wholesale cuts of a market beef animal.

Figure 2. Anatomy of the beef animal and the wholesale cuts of the beef animal. The dollar sign (\$) indicates the three highest valued wholesale cuts of the beef carcass.



So, when you are purchasing your project animal you will need to consider the same factors that the judge will. It is helpful to know what the ideal market beef animal looks like and how it performs. This helps you to establish your own production and showing goals. Current industry standards for the ideal market steer are shown in Table 1.

You now know what the judge will be evaluating your market animal for at the fair, it's time to find your project animal. The United States Department of Agriculture (USDA) has developed a system of feeder cattle grading that may be of some help to you.

The USDA Standards for Grades of Feeder Cattle uses frame size and muscling to classify feeder cattle. Figure 3 shows the various frame sizes and muscle scores.

The frame score estimates the minimum weight the steer or heifer needs to be to grade choice. When you are selecting your project animal, you will want Large to Medium framed cattle that are No.1 for muscling. Figure 4 shows where you need to evaluate cattle for muscling, volume, fat, and structural correctness. It is also important to consider the animal's attitude. Wild or nervous calves are more difficult to manage than calm calves. They are more likely to stop eating if they are frightened.

You will need to know what weight of an animal you need to purchase. To determine the optimal beginning weight, you need several pieces of information:

- Estimated show weight or final weight

Trait	Range	Goal
Live weight at harvest, pounds	900-1400	1200-1275
Average daily gain	2.0 – 4.5	3.5
Dressing percent	60-64	62-63
Fat thickness (inches)	0.15-0.80	0.35-0.45
Ribeye area (inches ²)	12.0-17.0	14.0-16.0
Yield grade	Less than 3.5	2
Quality grade	Select or better	Choice
Feed efficiency (pounds of feed per pound of gain)	5-9	6

- How many days until the show
- Typical average daily gain for project animals

Talk Like a Cattle Feeder!

Dressing percent: Determined by dividing the carcass weight by the live weight, times 100. The average for steers is about 63%.

Yield grade: Classification of animals according to their estimated trimmed lean that their carcass provides (a.k.a. cutability).

Quality grade: Classification of animals based upon conformation and fatness. Estimates palatability and juiciness of the meat.

Feed efficiency: The efficiency at which an animal converts the feed it eats to gain. The average for steers is about 6-9 pounds of feed per pound of gain.

Use the feeder cattle grading system to estimate a final weight for the project. A good example would be for a steer, 1250 pounds is a good goal. For market heifers, 1100 pounds may be a good goal. You will determine how many days until the show. A special calendar, called a Julian Calendar (see Appendix 1) can easily help you determine the number of days until your show. In commercial production, most feedlot steers gain, on average, over 3.0 pounds per day. However, your animal may not gain quite as much as that since you will be working with your animal project a lot. You can expect your animal to average about 2.5 to 2.75 pounds of gain per day. Let's work through an example of how to estimate what weight you need to purchase your calf:

- Estimated final weight: 1250 pounds
- Days until show: 200 days
- Estimated average daily gain: 2.75 lbs per day

$$200 \text{ days} \times 2.75 \text{ pounds/day} = 550 \text{ pounds of gain for total period}$$

$$1250 - 550 = 700 \text{ pounds beginning weight}$$

Figure 3. Standards for grades of feeder cattle (adapted from USDA Agricultural Marketing Service publication AMS-586)

USDA Feeder Cattle Frame Scores

Weights shown are the minimum expected weights for grading choice



Large:
Steers - 1250 lbs +
Heifers - 1150 lbs +



Medium:
Steers - 1100-1250 lbs
Heifers - 1000-1150 lbs



Small:
Steers - less than 1100 lbs
Heifers - less than 1000 lbs

USDA Feeder Cattle Muscle Scores



No. 1:
Thrifty and moderately thick throughout.



No. 2:
Thrifty and slightly thick throughout.

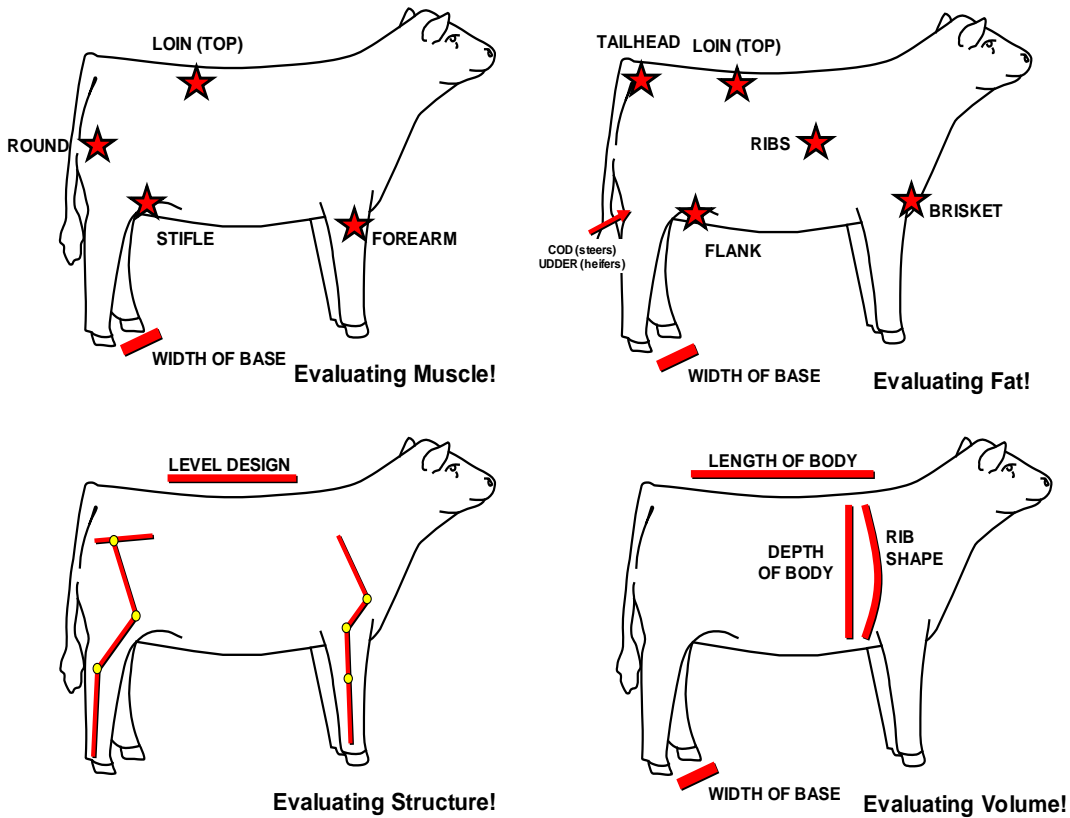


No. 3:
Thrifty and thin throughout



No. 4:
Thrifty and extremely thin throughout

Figure 4. Evaluating various traits in cattle



Nutrition Concepts

Your feeding program will be your largest cost of your project. Proper feeding of your animal will allow your beef animal to shine to the best of its ability! In order to properly feed your animal, a basic understanding of your animal's requirements is important.

There are six classes of nutrients that your animal requires. These nutrients are necessary for your beef animal to grow.

WATER:

Water is the nutrient required in the largest amounts for your beef animal, but is often overlooked. Your animal's body is over 70% water. Water is important for digestion, nutrient transport, waste removal, and temperature regulation. Your animal requires 10 to 15 gallons of fresh, clean water, every day.

CARBOHYDRATES:

Carbohydrates will make up over 80% of your beef animal's diet and are the most important source of

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Nutrient: Chemical that supports your animal's growth and development.

Ruminant: Animal such as cattle that has a stomach with 4 compartments. The compartments are the rumen, reticulum, omasum, and abomasum. Ruminants are also known as "cud-chewers".

Crude Protein: Crude protein (CP) is an estimate of the amount of protein in a feed. It is required by law to be listed on the feed label.

TDN: Total Digestible Nutrients (TDN) is an estimate of how much of feed is digested by the animal to be used as an energy source. For example, if a feed is 80% TDN, that means that for every 10 lbs of feed, 8 lbs is used for energy for the animal.

Crude Fiber: Crude fiber is an estimate of the fibrous portion of the feed. This portion of the feed is generally considered to be of lower digestibility. Cellulose and lignin are the primary components of this portion of the feed.

energy for your animal. The primary sources of carbohydrates for your animal will be roughages (like hay) and concentrates (grains like corn). Beef cattle are ruminants and are able to convert feeds that humans can't use into food products like meat.

PROTEIN:

Protein is required for your animal to grow and develop. Protein is made up of individual "building blocks" called amino acids. Muscle in your animal is made up of protein and your beef animal will require a diet between 12-15 % crude protein.

MINERALS:

Minerals are inorganic elements required for good growth in animals. Minerals such as calcium, phosphorus, and sodium chloride (salt) are important elements for growing beef cattle.

VITAMINS:

Vitamins are very important for the maintenance of your animal. Vitamins can be divided into two classes, fat-soluble and water-soluble. The water-soluble vitamins (vitamin C, B-complex) are not essential for your animal. However, the fat-soluble vitamins (vitamins A, D, E, and K) may be needed.

Common Feeds for Cattle

Feeds for growing/finishing cattle can be divided into two major categories: concentrates and roughages. Concentrates are high energy feeds such as cereal grains and contain less than 18% crude fiber. Roughages are lower energy feeds such as hays and forages and will contain over 18% crude fiber. Both are needed for your market beef animal to perform to the best of it's ability! Appendix 2 summarizes the nutrient composition of some of the more common feedstuffs used in growing and finishing cattle diets.

CONCENTRATES:

Corn. Corn is the most common feed grain in the United States and the one most other grains are usually compared with. Shelled corn (no cobs, kernel only) is one of the highest feeds relative to energy value, usually containing over 85% TDN and only about 2% crude fiber. Since corn is high in energy, it will usually represent the primary ingredient in many cattle finishing rations. If your ration contains less than 20% roughage, corn can be fed whole. However, if fed with a high roughage diet (over 20% roughage), the corn must be processed to improve digestibility. Examples of different processing will be to crack, roll, or steam-flake the corn. Corn will also provide a small amount of protein as well (8-10% CP).

Milo or sorghum. Milo is more commonly fed in the southern half of the United States, where it is commonly raised. Milo is lower in energy (about 75-85% TDN), than corn, but is higher in protein (12-14% CP). Milo must be processed prior to feeding to cattle (do not feed it whole). Suggested processing methods are similar to corn.

Wheat. Wheat is normally too high priced to be used in commercial feeding rations, since it is needed for human food products such as bakery items. However, sometimes it can be priced comparably to corn and may be used in rations. Wheat contains about the same energy levels as corn, but is higher in protein (12-14% CP). Care must be given when feeding wheat to cattle, as too much, too soon, can cause digestive upset. The best

method is to blend wheat with another feed (such as corn or milo), and make sure the wheat is processed (for example, ground).

Oats. Oats are one of the safest grains to feed, as they have the least tendency to cause digestive problems. Oats are high in fiber, compared to other grains (10-12% CF), however oats are the lowest in TDN (70-75% TDN). Oats are generally used in a ration to maintain animals, due to the higher fiber and lower energy values.

Barley. Barley is an excellent grain that is commonly used in the northern United States, where it is grown. Barley contains about 75-85% TDN and 13-14% CP. If barley and alfalfa hay are fed together, there is a small risk of bloat. However, this problem can be reduced if some additional fiber is added to the ration, such as oats, beet pulp, or other higher fiber feeds.

Millet. Millet can be used as a substitute for other grains in beef cattle rations, if priced right. Millet can be valued at about 75-90% the value of corn.

Beet pulp. Dried beet pulp is a tasty feed that can help reduce bloat in cattle. If it makes up 5-15% of the ration, the feeding value is similar to corn.

Soybean meal and Cottonseed meal. When soybean meal or cottonseed meal is used in a ration, it is being used as a protein source. These meals contain similar energy (TDN) as corn, but will contain about 40 - 47% CP!

ROUGHAGES:

Legumes. Legumes are forages that are high in energy (50-60% TDN) and crude protein (15-22% CP). Alfalfa hay is the most common legume used and is an excellent feed. Legumes are also high in calcium (about 1.2%), but only moderate in phosphorus (0.2%), so supplementation may be needed. High quality legume hay can sometimes cause scouring (loose stools), but this can be fixed by decreasing the legume or adding in some grass hay.

Grasses. Grass hays (such as timothy, fescue, meadow) contain similar amounts of TDN as legumes, but only half the protein of the legumes. A good quality grass hay works well if the animal is having difficulty with bloat.

Silages. Silages are fermented forages that are preserved for later use. They are most commonly made from corn, sorghum, or legume plants. Silages are high moisture feeds, containing about 70% water and 30% dry matter. About 3 pounds of silage will contain the same amount of dry matter as 1 pound of hay.

Pasture. Pastures vary greatly in quality due to maturity, species, weathering, etc. It's best to visit with local producers or extension agents who may have experience with similar pasture to yours to estimate the quality of pasture.

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Dry Matter: Dry matter (DM) refers to the feed with the water removed. The DM is the fraction of the feed where all the nutrients such as protein are concentrated. It is important to compare feeds for cattle on a dry matter basis as some are high moisture (silage is 30% DM) and others are low moisture (hay is 90% DM)

FEED ADDITIVES:

Antibiotics. Antibiotics are medicine (like you take) that are fed at low levels in a ration to help reduce sickness, and therefore improve animal performance. Common antibiotics are Aureomycin and Terramycin.

Ionophores. Ionophores are feed additives that may improve feed efficiency by 5-10%. The most common examples of ionophores are Rumensin (chemical is monensin) and Bovatec (chemical is lasalocid).

Anabolic agents. Anabolic agents are implants that contain steroid hormones that promote growth in cattle. These hormones are similar to the ones that are naturally occurring in the animal's body. These agents stimulate gain (especially lean gain) and common examples are Ralgro and Synovex.

Beta agonists. This is a new class of compounds that have recently been approved to feed to cattle. The **only** beta agonist approved for cattle is ractopamine (trade name is Optaflexx). These additives alter how the animal's body uses nutrients. As a result, beta agonists promote lean growth.

Talk Like a Cattle Feeder!

Feed Additives: Feed additives are chemical components that are added to a ration in small amounts, to accomplish one or more of the following:

1. Increased intake (which would mean increased performance)
2. Increased gain
3. Increased feed efficiency

Feed additives are products that you will not buy as an individual product, but as part of a pre-mixed feed or supplement. Extreme care needs to be taken when feeding these products.

FOLLOW THE LABEL DIRECTIONS!!!

Extra-label Use: All feed products are required to have label directions on them. It is the law to follow these label directions. ***If you don't follow the label, it's called "extra-label use" and can only be done under the direction of a veterinarian.***

Starting Calves on Feed

There are a variety of successful methods to start calves on feed, here are some helpful hints to aid you in being successfully starting your calf on feed:

- Minimize any stress associated with the transition and adaptation from purchase or weaning to the calf's new environment. This should minimize potential respiratory problems.
- Start the calf on a palatable, good quality hay. A grass or a legume-grass mixture is usually preferred for starting calves.
- Feed them a bulky, palatable grain mixture. It should be limited initially to several pounds (not more than 1% of your calf's body weight) per day.
- Quantity of grain should be increased GRADUALLY (ex. over a week or two) to the desired intake. Bringing calves on feed too rapidly can cause digestive upset. Table 2 shows intake levels (pounds of grain) for starting cattle on feed.
- Early in the feeding program, full feed the roughage source (hay). This means letting the calf eat as much roughage as it wants. Gradually, you will begin limit feeding the roughage until the calf is receiving 3 to 5 pounds of roughage. You will not want to feed less roughage than this, as it may lead to digestive upset.
- Use only fresh, high quality feeds!

- Remove stale feeds from the feeder or bunk.
- Feed regularly – preferably 2 to 3x per day.
- Observe regularly for disorders.
- Provide clean, fresh water at all times.

Table 2. Grain intake levels for starting calves on feed.

Body Weight, lbs.	Grain feeding rate, % of body weight				
	0.5%	1.0%	1.5%	2.0%	2.5%
500	2.5	5	7.5	10	12.5
600	3	6	9	12	15
700	3.5	7	10.5	14	17.5
800	4	8	12	16	20
900	4.5	9	13.5	18	22.5

Rations for Cattle

It is possible to do a professional job of feeding cattle with a variety of feeding programs. Many producers have specific ideas of what works and what doesn't work when feeding show cattle. Take the time to visit with those who are successful with their feeding programs to determine what might work for your calf as well. Most of the commercially prepared show feeds can produce the desired results when fed according to the company recommendations. However, they can be expensive. Working with your project leader to develop a successful feeding program can make your project successful and cost-effective.

Your calf's feeding program can be divided into two phases. These phases are described below:

Growing Phase: Grower rations are usually designed to be lower in energy (TDN) to allow cattle to grow as opposed to finishing (fattening). Typical growing programs will support gains from 1.5 to 2.5 pounds per day, depending upon your goals. Grower rations are based upon large amounts of roughages (50 – 100%) and limited concentrates. Some feeders prefer to use bulkier concentrates such as oats during this period. Concentrates are generally fed at no more than 1% of body weight.

Finishing Phase: Finishing rations are higher in energy and designed to promote "finishing" or fat deposition on cattle, as well as more rapid gains (in excess of 2.5 pounds per day). Finishing rations are lower in roughages (20% or less) and mostly made of concentrates. The level of grain intake is much higher and will range from 2 to 2.5% of body weight.

If a ration is doing a good job for you, the best advice is to continue it! When cattle are being fed to show, they have specific nutrient requirements relative to gain and/or finish. You may find the need to regulate your animal's growth and this can be accomplished by either controlling the quantity of concentrate fed, or altering the concentrate mixture (energy content). Appendix 3 demonstrates the changing nutrient requirements of growing/finishing beef cattle.

It is generally well accepted that cattle which are finished at slower rates of gain will have a harder, firmer finish than those which are permitted to gain more rapidly (even though the amount of finish at the end may be the same). Also, excessive finish may be minimized.

Some desirable characteristics of fitting rations are as follows:

- Bulky rations, using whole oats or steam rolled grains (oats, corn, milo, barley) are preferred.
- A mixture of several grains is often desirable.
- Dustiness, powder, and excessive “fines” should be minimized.
- Some molasses (5 to 7%) is helpful in improving ration palatability, uniformity, and acceptance particularly during the first few weeks on feed. With high quality feeds, improved intakes from molasses are probably just temporary.
- Wheat bran (no more 10%), beet pulp (5 to 15%), or dehydrated alfalfa pellets (5 to 20%) are extremely palatable and can be beneficial additions.
- Rations should contain a minimum of 13 to 14% CP and contain soybean meal, cottonseed meal, or linseed meal as a protein source. Linseed meal can improve gloss and sheen of the hair coat.
- When not too expensive, oats (whole or rolled) can be included in the ration at levels ranging from 20 to 60% or more. Straight oats are fine for younger cattle.
- Corn can be fed in the whole kernel form when used in grain mixtures and with lower levels of roughage (no more than 0.5 to 0.75% of body weight in roughage).
- Feeds must be fresh and not musty or moldy.

AMOUNTS TO FEED:

- Finishing Steer:
 - Full-feed concentrate at 2 to 2.5 pounds per 100 pounds of body weight
 - Limit-feed dry roughage at 3 to 5 pounds per day
 - Example: 800 pound steer
 - Concentrate: 16 to 20 pounds per day
 - $8 \times 2 = 16$
 - $8 \times 2.5 = 20$
 - Roughage: 3 to 5 pounds per day
- Growing Steer:
 - Limit-feed concentrate at 1 to 1.5 pounds per 100 pounds of body weight
 - Full-feed roughage
 - Example: 500 pound steer
 - Concentrate: 5 to 7.5 pounds per day
 - $5 \times 1 = 5$
 - $5 \times 1.5 = 7.5$

- Roughage: full feed
- Growing Heifer:
 - Limit-feed concentrate at 0.5 to 1 pound per 100 pounds of body weight
 - Full-feed roughage
 - Example: 500 pound heifer
 - Concentrate: 2.5 to 5 pounds per day
 - $5 \times 0.5 = 2.5$
 - $5 \times 1 = 5$
 - Roughage: full feed

FORMULATING A RATION:

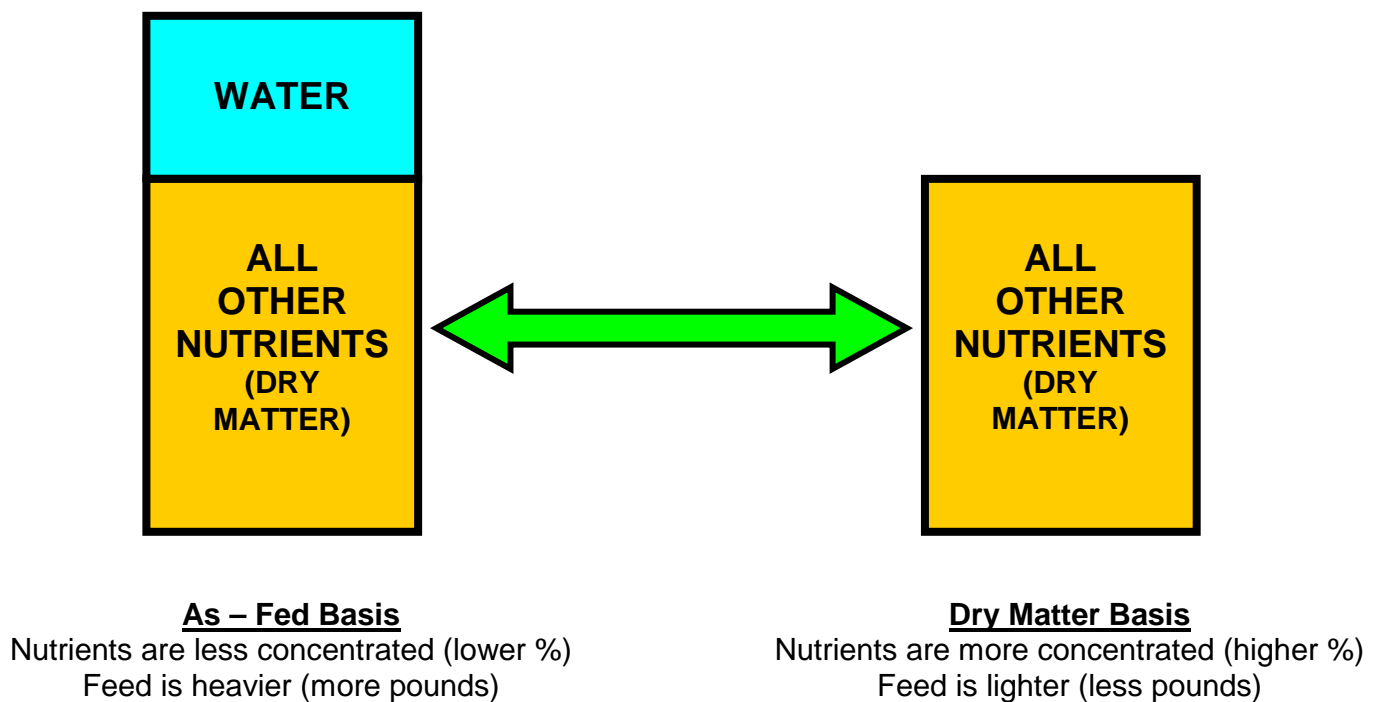
To formulate a ration for your animal you will need to know the following information:

1. Your animal's nutrient requirements (see Appendix 3)
2. The nutrient composition of the feeds (see Appendix 2)
3. Desired production level (ex. rate of gain).

Your goal as a producer is to best match the feed to your animal's requirements in order to achieve a specific goal. Balancing your animal's ration is a great way to practice your math skills!!!

It is important to be able to convert nutrients and pounds of feed between a dry matter and as-fed basis. Dry matter basis refers to the feed with the water removed, as-fed basis refers to the feed as it is fed to the animal (it includes the water). Figure 5 illustrates the difference between these two expressions of nutrients.

Figure 5. Comparison of methods of expressing nutritive value of feeds.



The following sets of equations can help you convert between these two forms.

- *Converting nutrients on an as-fed basis to a dry matter basis:*

% nutrient (DM basis) = % nutrient as-fed \div % DM (make sure to put this value on a decimal basis, ex. 50% = 0.50)

Ex. A commercial steer feed contains 12% CP on an as-fed basis and is 90% DM. What is the percent CP on a dry matter basis?

$$\begin{aligned}\% \text{ nutrient (DM basis)} &= 12\% \text{ CP as-fed} \div 0.90 && \text{(remember, divide DM by 100)} \\ &= 12 \div 0.90 \\ &= 13.3\% \text{ CP on a dry matter basis}\end{aligned}$$

- *Converting nutrients on a DM basis to an as-fed basis:*

% nutrient (as-fed basis) = % nutrient as-fed \times % DM (make sure to put this value on a decimal basis, ex. 50% = 0.50)

Ex. A commercial steer feed contains 16% CP on a dry matter basis and is 85% DM. What is the percent CP on an as-fed basis?

$$\begin{aligned}\% \text{ nutrient (as-fed basis)} &= 16\% \text{ CP} \times 0.85 && \text{(remember, divide DM by 100)} \\ &= 16 \times 0.85 \\ &= 13.6\% \text{ CP on an as-fed basis}\end{aligned}$$

- *Converting amount of feed on an as-fed basis to a DM basis:*

Pounds of feed DM = Pounds feed as-fed \times % DM (make sure to put this value on a decimal basis, ex. 50% = 0.50)

Ex. You have 2000 pounds of corn silage which is 35% DM. How many pounds of corn silage on a DM do you have?

$$\begin{aligned}\text{Pounds of feed DM} &= 2000 \times 0.35 && \text{(remember, divide DM by 100)} \\ &= 700 \text{ pounds of DM}\end{aligned}$$

- *Converting amount of feed on a DM basis to an as-fed basis:*

Pounds of feed as-fed = Pounds feed DM \div % DM (make sure to put this value on a decimal basis, ex. 50% = 0.50)

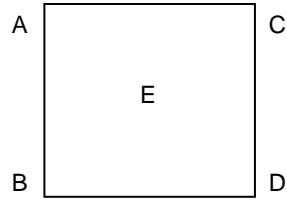
Ex. A beef animal requires 15 lbs of DM per day. If the ration is 75% DM, how many pounds of feed do you need to feed this animal?

$$\begin{aligned}\text{Pounds of feed as-fed} &= 15 \div 0.75 && \text{(remember, divide DM by 100)} \\ &= 20 \text{ pounds as-fed}\end{aligned}$$

It is best to balance beef cattle rations on a dry matter basis and then convert the ration to an as-fed basis, due to the moisture differences found in feeds.

One of the simplest methods for balancing rations is the Pearson Square. This method allows you balance for a single nutrient using two feeds. Here are the steps:

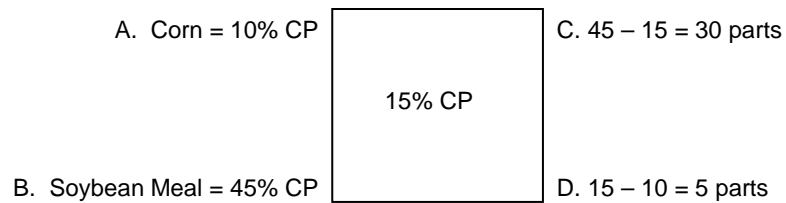
1. Draw a square:



2. Place the concentration of the nutrient you want at “E” (example: balance for 15% CP, DM basis)

3. Place the concentration of the nutrient in each of the two feeds at “A” and “B”

4. Subtract diagonally ($B - E = C$ and $A - E = D$) and don't worry if you have a negative sign



5. “C” represents the part of the ration that is from Feed A (corn) and “D” represents the part of the ration that is from Feed B (soybean meal).

6. Sum “C” and “D” ($30 + 5 = 35$ total parts)

7. Now you can calculate the appropriate proportions of each ingredient! To do this you divide the “part” by the “total”, and multiply by 100, to express as a percentage.

$$\begin{aligned} \text{Corn} &= (30 \div 35) \times 100 \\ &= 0.856 \times 100 \\ &= 85.6\% \text{ corn} \end{aligned}$$

$$\begin{aligned} \text{Soybean meal} &= (5 \div 35) \times 100 \\ &= 0.143 \times 100 \\ &= 14.3\% \text{ soybean meal} \end{aligned}$$

$$\text{Check} = 85.6 + 14.3 = 100\%$$

Appendix 4 has some sample cases that may help you with your project.

Pen Requirements

- Your beef animal requires about 150 to 175 square feet of space. If you are use a feed bunk for multiple animals, each animal requires about 2 feet of space at the bunk.
- Have the pen located so that it drains well. Not only are muddy pens messy, but mud is hard to clean off the animals. For healthy animals, they need a clean, dry place to lie and rest. Bedding (such as straw or shavings) is generally used, especially in cold weather.
- If no shed is available, you will need to at least try to provide a windbreak for your calf during the winter, and shade during the summer.
- Keep the pen clean and free from manure. This will assist you in keeping parasites like flies, lice, and ticks under control. Additionally, you may need to use a commercial insecticide to prevent parasites. Use only as directed on the label.
- Examine the boards of the pen and/or shed where your calf will be kept. Make sure that there is nothing sticking out that can hurt the calf, such as nails, wire, or pieces of metal or wood.
- Quietness, kindness, and patience are the key to working with your calf. You are raising a product for human consumption, so it is important to treat your calf with care.

Common Diseases of Cattle

A few of the more common ailments that you may encounter in your market beef project are listed below. Remember, it is important that you establish a relationship with a veterinarian in your area. If you have any questions about your animal's health, you need to consult with your veterinarian. Your calf should be vaccinated against the clostridial diseases and IBR/PI₃. Optional vaccinations that may be required (ask your veterinarian) may include BVD, leptospirosis, hemophilus somnus, and pasteurilla. For a complete vaccination program, ask your veterinarian.

Shipping Fever. Shipping fever is an infectious disease affecting the lungs. Its primary cause is unknown. While it can occur any time, it most often occurs in cattle that are stressed. Examples of stress include excitement, shipping, changes in feed and water, and exposure to other animals that may have the disease. The first signs are a tired appearance, loss of appetite, chilling and a high temperature (105°F or higher), increased breathing rate, a soft cough may develop, and there may be a watery discharge from the nose and eyes. Treatment is usually by the use of antibiotics.

Acidosis. Acidosis is a common problem in commercial feedlots. Acidosis results from the ingestion of excessive amounts of easily digested carbohydrates. When an animal eats too much carbohydrate, too fast, the pH of their rumen drops considerably. If it drops too low, the animal could die. Acidosis is easily recognized by a grayish, loose stool that has a distinct odor. Treatment involves removing the source of easily digested carbohydrates and providing hay to the animal. In severe cases, it is best to contact your veterinarian.

Pinkeye. Pinkeye is commonly found in calves. The eyelids swell; a watery discharge from the eyes will often stain the face. Eyes are kept partially closed, the eyeball becomes cloudy, and a small ulcer may form on the front of the eye near the pupil. In severe cases, the animal may become temporarily or permanently blind. Treatment is with antibiotic ointments and keeping the animals out of direct sunlight.

Founder. Founder (laminitis) is a disturbance in the tissue of the foot resulting from too much feed at one time. It is seen most often when cattle are put on full feed before becoming fully accustomed to high concentrate diets. Sometimes cattle may accidentally find an open bag of feed and overeat. It also occurs in beef cattle that are overfed while being finished for a stock show or fair. Substances are formed in the body that cause damage to the inside of the hoof. One of the earlier signs of grain overload or founder will be the animal will go off feed followed by a very loose, watery diarrhea. A few days following the grain overload, lameness will be observed and damage to the hoof-producing tissue results in the growth of misshapen hooves. A stilted, halting gait may be seen after which corrugated and elongated hooves may be produced. The indigestion should be treated first. Cold applications to the feet and anti-inflammatory drugs are used to reduce the foot inflammation. After the acute symptoms have passed, repeated trimming of the hoof may restore something of the normal hoof-producing tissue.

Bloat. Bloat is frequently a cause of worry to club members feeding calves. An animal may bloat and die very suddenly. It results from the inability of an animal to belch up the gas that is formed in the rumen. Some feeds such as fine alfalfa hay and barley have more of a tendency to cause bloat than others. Also, some animals tend to bloat more easily than others. In most cases, there is a very noticeable distention or swelling on the left side of the animal, just in front of the hip bone. In mild cases, walking the animal around can help alleviate the problem. Additionally, in these mild cases, a dose of 3 to 4 ounces of mineral oil or cooking oil is effective in overcoming the trouble. In severe cases emergency procedures may be necessary to let the gas escape before the animal dies. However, when this point is reached, seek expert assistance from your veterinarian!

Warts. Warts are commonly seen on young cattle. They are infectious. Hence, if one calf in a pen has them, you can expect to find them on the other calves. A vaccine is used for prevention and treatment of animals with warts. You can obtain this vaccine from your local veterinarian.

Foot Rot. Foot rot is caused many times by animals being forced to stay in wet lots or muddy pens. Swelling and redness appear around the top of the hoof. It becomes very sensitive and sore. The animal will become lame in many instances. Sulfa preparations are used or antibiotics may be given to cure the condition.

Good nutrition, management, and animal health program will prevent most problems. When a problem arises, early and adequate treatment is necessary to assure recovery.

Importance of Good Record Keeping

Whether you are feeding a 4-H project animal, managing a ranch, or running a restaurant, keeping accurate, complete records is a necessity and a fact of life in our country.

Your record book may appear complicated and confusing at first glance. But don't let it overwhelm you!!! Spend a little time studying it and you will find it not as difficult as you might have first thought. If you do not understand some portions of the record book, ask your local leader or county extension agent for some help. Here are some suggestions for keeping a successful record book:

- Keep your record book up to date. For some people, it is easiest to keep a file of records (time and expenses or income) and update the record book once a month. For others, it is easiest to keep it up more regularly. Find a system that works for you. Just remember, small amounts of time spent on the record book periodically throughout the project will save you a lot of time at the very end!
- Be neat. Write carefully so it can be easily read.
- Be accurate.
- Keep a barn sheet where you store your animal's feed. On this sheet record how much and how often you feed your animal. Also make notes regarding your animal's health.
- Weigh and record your animal's weights regularly so that you can monitor your animals performance.

It is becoming increasingly important to maintain good records. National programs such as Country of Origin Labeling will require proof of ownership in case of an audit. The logical place to store this information is your project book. You will need to keep this information for 2 to 3 years after your project is completed! By keeping a great record book, you will understand all aspects of your project and be able to let anyone interested in your project know how your animal is doing. This is especially handy during showmanship competitions!

Worksheet 1. Determining how much principle you need to borrow (how much will your project cost).

Determining cost of animal:

- A. Beginning weight of animal: A.
- B. Cost per pound for animal: B.
- C. Total cost (A x B) or enter total price here: C.

Determining feed costs:

- D. Final weight of animal (estimate show weight): D.
- E. Total pounds of gain needed (D – A): E.
- F. Estimated feed efficiency (pounds of feed per pound of gain): F.
- G. Total pounds of feed needed (E x F) G.
- H. Total feed as concentrates (ex. grains, average about 2/3 of total feed for a market beef animal): H.
- I. Total feed as roughages (ex. hays, average about 1/3 of total feed for a market beef animal): I.
- J. Cost per pound for concentrates (check with your local feed store for current prices): J.
- K. Cost per pound for roughages (check with your local feed store for current prices): K.
- L. Total cost for concentrate (H x J): L.
- M. Total cost for roughages (I x K): M.
- N. Total feed cost (L + M): N.
- O. Estimated miscellaneous costs (it is good to plan for emergency expenditures): O.

TOTAL ESTIMATED COST FOR PROJECT
(C + N + O) \$ _____

Appendix 1. Julian Calendar. An example: assume your show is on Aug. 15 and the current date is May 1. Since you are in the same calendar year, you would only use the left side. August 15 is number 227 and the current date is May 1 = 121. So $227 - 121 = 106$ days until the show!

DAY	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC
1	1	32	60	91	121	152	182	213	244	274	305	335	366	397	425	456	486	517	547	578	609	639	670	700
2	2	33	61	92	122	153	183	214	245	275	306	336	367	398	426	457	487	518	548	579	610	640	671	701
3	3	34	62	93	123	154	184	215	246	276	307	337	368	399	427	458	488	519	549	580	611	641	672	702
4	4	35	63	94	124	155	185	216	247	277	308	338	369	400	428	459	489	520	550	581	612	642	673	703
5	5	36	64	95	125	156	186	217	248	278	309	339	370	401	429	460	490	521	551	582	613	643	674	704
6	6	37	65	96	126	157	187	218	249	279	310	340	371	402	430	461	491	522	552	583	614	644	675	705
7	7	38	66	97	127	158	188	219	250	280	311	341	372	403	431	462	492	523	553	584	615	645	676	706
8	8	39	67	98	128	159	189	220	251	281	312	342	373	404	432	463	493	524	554	585	616	646	677	707
9	9	40	68	99	129	160	190	221	252	282	313	343	374	405	433	464	494	525	555	586	617	647	678	708
10	10	41	69	100	130	161	191	222	253	283	314	344	375	406	434	465	495	526	556	587	618	648	679	709
11	11	42	70	101	131	162	192	223	254	284	315	345	376	407	435	466	496	527	557	588	619	649	680	710
12	12	43	71	102	132	163	193	224	255	285	316	346	377	408	436	467	497	528	558	589	620	650	681	711
13	13	44	72	103	133	164	194	225	256	286	317	347	378	409	437	468	498	529	559	590	621	651	682	712
14	14	45	73	104	134	165	195	226	257	287	318	348	379	410	438	469	499	530	560	591	622	652	683	713
15	15	46	74	105	135	166	196	227	258	288	319	349	380	411	439	470	500	531	561	592	623	653	684	714
16	16	47	75	106	136	167	197	228	259	289	320	350	381	412	440	471	501	532	562	593	624	654	685	715
17	17	48	76	107	137	168	198	229	260	290	321	351	382	413	441	472	502	533	563	594	625	655	686	716
18	18	49	77	108	138	169	199	230	261	291	322	352	383	414	442	473	503	534	564	595	626	656	687	717
19	19	50	78	109	139	170	200	231	262	292	323	353	384	415	443	474	504	535	565	596	627	657	688	718
20	20	51	79	110	140	171	201	232	263	293	324	354	385	416	444	475	505	536	566	597	628	658	689	719
21	21	52	80	111	141	172	202	233	264	294	325	355	386	417	445	476	506	537	567	598	629	659	690	720
22	22	53	81	112	142	173	203	234	265	295	326	356	387	418	446	477	507	538	568	599	630	660	691	721
23	23	54	82	113	143	174	204	235	266	296	327	357	388	419	447	478	508	539	569	600	631	661	692	722
24	24	55	83	114	144	175	205	236	267	297	328	358	389	420	448	479	509	540	570	601	632	662	693	723
25	25	56	84	115	145	176	206	237	268	298	329	359	390	421	449	480	510	541	571	602	633	663	694	724
26	26	57	85	116	146	177	207	238	269	299	330	360	391	422	450	481	511	542	572	603	634	664	695	725
27	27	58	86	117	147	178	208	239	270	300	331	361	392	423	451	482	512	543	573	604	635	665	696	726
28	28	59	87	118	148	179	209	240	271	301	332	362	393	424	452	483	513	544	574	605	636	666	697	727
29	29	--	88	119	149	180	210	241	272	302	333	363	394	--	453	484	514	545	575	606	637	667	698	728
30	30	--	89	120	150	181	211	242	273	303	334	364	395	--	454	485	515	546	576	607	638	668	699	729
31	31	--	90	--	151	--	212	243	--	304	--	365	396	--	455	--	516	--	577	608	--	669	--	730

Appendix 2. Feed Table. A summary of nutrient composition of feeds commonly used to grow and finish beef cattle. All nutrients (except dry matter) are expressed on a DM basis.

Talk Like a Cattle Feeder!

DM: Dry matter (DM) refers to the feed with the water removed. The DM is the fraction of the feed where all the nutrients such as protein are concentrated. It is important to compare feeds for cattle on a dry matter basis as some are high moisture (silage is 30% DM) and others are low moisture (hay is 90% DM)

TDN: Total Digestible Nutrients (TDN) is an estimate of how much of feed is digested by the animal to be used as an energy source. For example, if a feed is 80% TDN, that means that for each 10 lbs of feed, 0.8 lbs is used for energy for the animal.

CP: Crude protein (CP) is an estimate of the amount of protein in a feed. It is required by law to be listed on the feed label.

NDF: Stands for Neutral Detergent Fiber, which is a measure of the fiber component of a feed. Ruminants require a small amount of fiber to prevent digestive upset. However, feeds really high in NDF are very bulky and can limit intake.

Calcium and Phosphorus: These two minerals are important for proper bone growth and health of your animal. It is important to have the ratio of Calcium to Phosphorus equal to about 1.5 to 1 or 2 to 1.

Feed Name	% DM	% TDN	% CP	% NDF	% Calcium	% Phosphorus
<i>Roughages</i>						
Alfalfa hay, excellent	91	66	25	37	1.5	0.33
Alfalfa hay, average	91	60	20	47	1.4	0.22
Alfalfa hay, mature	91	55	17	53	1.19	0.24
Meadow hay	90	60	13.4	67.6	0.26	0.15
Prairie hay	91	48	5.3	72.7	0.35	0.14
Cottonseed hulls	91	45	4.1	90	0.15	0.09
Corn silage	33	66	9.2	45	0.31	0.27
<i>Protein Concentrates</i>						
Soybean meal	89	77	49.9	14.9	0.29	0.71
Cottonseed meal	92	75	48.9	28.0	0.16	0.76
Sunflower meal	90	65	25.9	40.0	0.45	1.02
Corn gluten meal	91	84	46.8	37.0	0.16	0.51
Distillers grains	91	88	30.4	46.0	0.32	1.40
Brewers grains, dried	92	66	29.2	48.7	0.29	0.70

Appendix 2, continued. Feed Table. A summary of nutrient composition of feeds commonly used to grow and finish beef cattle.

Feed Name	% DM	% TDN	% CP	% NDF	% Calcium	% Phosphorus
Energy Concentrates						
Corn	88	90	9.8	10.8	0.03	0.35
Milo (sorghum)	90	82	12.6	23	0.05	0.34
Wheat	89	88	14.2	11.8	0.05	0.44
Barley	88	80	13.5	20	0.05	0.37
Oats	89	77	13.6	29.3	0.03	0.41
Wheat middlings	89	83	18.4	35	0.15	1.00
Soybean hulls	91	80	12.2	66.3	0.53	0.18
Molasses	75	73	6	0	0.20	0.05
Beet pulp	91	74	9.8	44.6	0.68	0.10
Tallow	99	177	0	0	0.57	0.06
Mineral Supplements						
Dicalcium phosphate	97	0	0	0	22	19.3
Limestone	100	0	0	0	34	0.02
Oystershells	99	0	0	0	38	0.07

Appendix 3. Nutrient Requirements. A summary of nutrient requirements for growing and finishing beef cattle. Please note that these are estimates, your animal's actual requirements may differ due to the amount of stress and exercise your animal is going through.

Body Weight, pounds	Desired ADG, pounds per day	Feed DM Intake, pounds per day	CP, % DM	TDN, % DM
300	1.0	8.3	11.5	58
300	1.5	8.6	13.7	63
300	2.0	8.6	16.2	68
300	2.5	8.6	18.7	73
300	3.0	8.3	22.0	80
400	1.0	10.3	10.4	58
400	1.5	10.6	13.3	63
400	2.0	10.7	14.1	68
400	2.5	10.7	16.1	73
400	3.0	10.4	18.7	80
500	1.0	12.2	9.8	58
500	1.5	12.6	11.2	63
500	2.0	12.6	12.9	68
500	2.5	12.6	14.6	73
500	3.0	12.2	16.8	80
600	1.0	14.0	9.3	58
600	1.5	14.4	10.6	63
600	2.0	14.4	12.1	68
600	2.5	14.4	13.5	73
600	3.0	14.0	15.4	80
700	1.0	15.7	9.0	58
700	1.5	16.2	10.1	63
700	2.0	16.3	11.3	68
700	2.5	16.2	12.7	73
700	3.0	15.8	14.4	80
840	2.0	22.1	8.8	60
840	3.0	21.6	10.8	70
840	3.8	20.4	12.8	80
840	4.3	18.8	14.7	90
900	2.0	23.3	8.4	60
900	3.0	22.7	10.2	70
900	3.8	21.5	12.0	80
900	4.3	19.8	13.8	90
960	2.0	24.4	8.1	60
960	3.0	23.9	9.7	70
960	3.8	22.5	11.3	80
960	4.3	20.8	13.0	90

Appendix 4. Sample Case. The following is an example of a scenario that may arise during the time you own your animal. The information is coming from Appendix 2 and Appendix 3. The solutions are shown.

1. Balance a ration for a 600 lb steer that you want to gain 3 pounds per day. Use average quality alfalfa hay and a commercial grain mix. You ask your local feed store for the TDN and CP of the mix and they tell you that it is 85% TDN and 14% CP (and 85% DM). Balance first for energy (TDN) and then check for protein.

First step – what does the steer require?

TDN required: 80 CP required: 15.4

Second step – what does the feed supply?

	Alfalfa hay	
TDN supply:	<u>60%</u>	CP supply: <u>20%</u>
	Grain mix (see below)	
TDN supply:	<u>85%</u>	CP supply: <u>14%</u>

Third step – balance for TDN.

A. Alfalfa hay = 60% TDN	80% TDN	C. 85 – 80 = 5 parts
B. Grain mix = 85% TDN		D. 80 – 60 = 20 parts

Total ration parts = 25

Alfalfa hay	=	5 parts ÷ 25 parts	=	0.25 × 100	=	25% of ration
Grain mix	=	20 parts ÷ 25 parts	=	0.75 × 100	=	75% of ration

Fourth step – check for CP.

Alfalfa hay	=	25 (% of ration) × 0.20 (% CP from the hay)	=	5.0
Grain mix	=	75 (% of ration) × 0.14 (% CP from the grain)	=	10.5

Sum the two ingredients (5 + 10.5 = 15.5% CP of the ration) – it meets the needs of the steer.

Final step – determine how much you need to feed.

Recall, that the nutrients and requirements are expressed on a DM basis, so the ration will need to be converted to an as-fed basis as well. First, the DM proportions of the ration must be determined. According to Appendix 3, this steer requires about 14 pounds of DM per day. Therefore...

14 × 0.25 (proportion of alfalfa hay)	=	3.5 lbs hay DM
14 × 0.75 (proportion of grain mix)	=	<u>10.5 lbs grain DM</u>
		Check: 14 lbs feed DM

3.5 lbs hay ÷ 0.90 (amount of DM in hay)	=	3.9 lbs hay as-fed
10.5 lbs grain ÷ 0.85 (amount of DM in grain)	=	12.4 lbs grain as-fed

So, this steer would need almost 4 lbs of hay per day and about 12.5 lbs of grain per day!