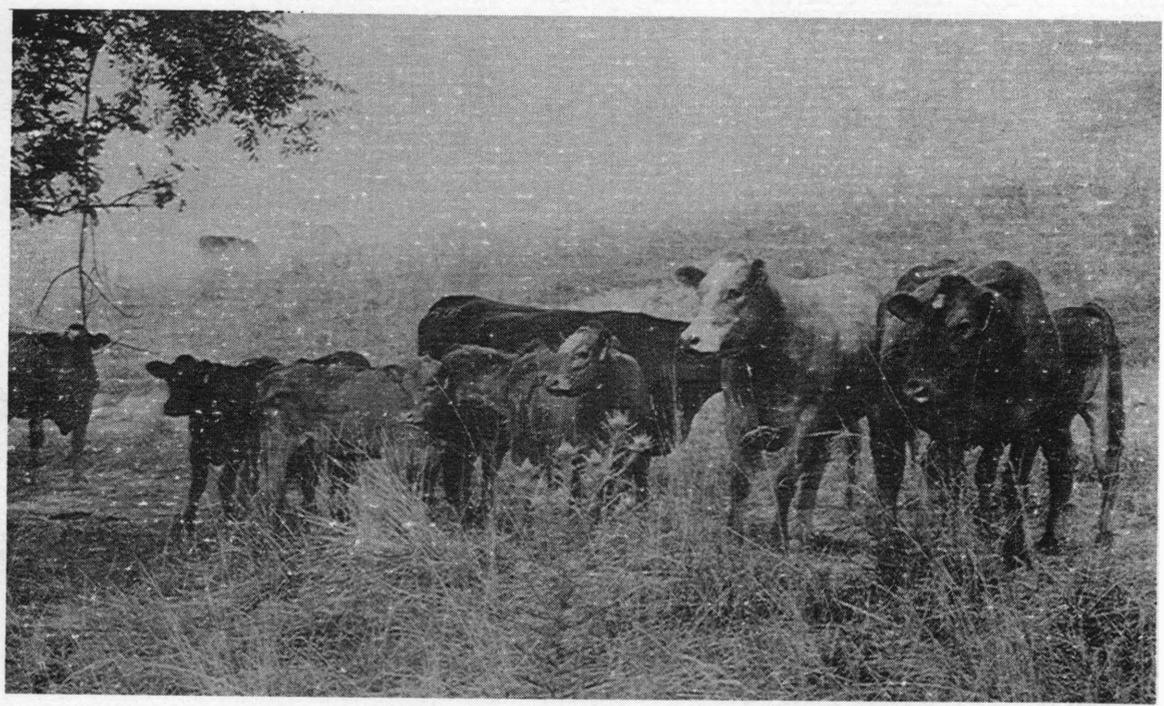


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# Virginia 4-H Beef Breeding Project Guide

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Virginia Cooperative Extension



Virginia Polytechnic Institute  
and State University

Publication 400-480  
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## INTRODUCTION

This 4-H Beef Breeding Project Guide is provided to 4-H'ers who are enrolled in the Beef Heifer or Cow-Calf projects. Basic information on selection, feeding, health care, facilities, record-keeping, and fitting/showing is provided. Additional information about specific beef cattle subjects is available in other Virginia Cooperative Extension Service (VCES) publications and in publications available from other sources; see the Sources of Additional Information section of this guide. A glossary is also included which contains word definitions that will help 4-H'ers understand this subject matter.

Any 4-H member is eligible for the beef heifer or cow-calf project. Members must own or care for at least one heifer or cow. However, since cattle are herd-type animals, at least 2 or 3 cattle kept together as a management group is more satisfactory. Ani-

mals used for this project may be either purebred or commercial, but the primary emphasis of this guide is heifer development and cow management from a commercial standpoint.

Records for the Beef Breeding Projects are to be kept in the 4-H Livestock Record Book (VCES publication 380-122) for first-year members or for members under 11 years of age. For more experienced 4-H'ers, records should be kept in the Advanced 4-H Livestock Record Book, (VCES publication 380-121).

Because beef cattle breeding is one of the most involved 4-H projects you can take, you should ask questions to help you understand and learn. Don't hesitate to ask your parents, volunteer leaders, or 4-H or Agricultural Extension Agents when you have a question or want to learn more.

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# WHY TAKE THIS PROJECT?

## What will be required in a 4-H beef breeding project?

1. Land area to support a beef heifer or beef cow is not great. For beginners, 1-2 acres of fenced pasture with water available will support one beef animal from May through November.
2. Buildings are nice to have. A 10X10 three-sided shed will provide winter weather protection, give you a place to catch and work with your heifer, and give her a place to calve when that time comes.
3. Some feed will have to be purchased. If you have the pasture area for each animal discussed in item 1 above, you will need hay and some grain during the winter. Approximately 2000 to 2500 pounds of hay will be needed for each animal (50 to 75 small square bales) during the winter. In addition, around 750 pounds of grain will be needed for each heifer in your project. Cows will require much less grain (100- 300 pounds each).
4. All of the above will take money. A good quality commercial heifer calf may cost \$300-400, while a bred heifer or cow may cost \$500-700. If you elect purebred rather than commercial animals, then heifer calves may cost \$500 and up, and older heifers or cows will cost \$700-\$1000 and up.
5. Time required for the project is minimal. Once sufficient facilities are constructed, the basic animal care (feeding, watering, checking to see everything is all right) will take only 30-45 minutes per day. During the summer, when animals are grazing, only 10-15 minutes each day are needed to check animals.
6. What's in it for me? Caring for animals, watching them grow and develop, and especially watching them raise their calves, is a very gratifying experience. Although you will be spending a fairly large amount of money, your project animals are also worth a lot of money. Over several years, you will watch your beginning project of 1 or 2 animals grow into a small herd that will be worth at least several thousand dollars. To accomplish this, though, will take many hours of time each month, in both good and bad weather, and there will be some disappointments. When you are working with animals, sometimes you won't get them all bred,

so they don't calve. Calves and sometimes even heifers or cows can die. You decide if the rewards of raising animals, and especially of raising cattle and being a part of the largest agricultural industry in Virginia, are worth your time and money. If the answer is yes, then this project guide will help you do every step of this project the right way.

## GETTING STARTED

The beef breeding project may be conducted in many ways, and may not require a lot of land. Most projects are started with one or two heifers. Your goal should be the development of productive brood cows and eventually a small cow-calf herd.

You must answer three questions before you acquire any animals. Do I want to raise purebred or commercial beef cattle? What breed? What age? Let's look at these questions in detail.

Purebred vs. commercial. Registered purebred cattle cost more than grade or commercial cattle. With purebreds, you can take part in more shows, because some county shows and most district, state, and regional shows do not allow commercial heifers. You can also become a seedstock producer if you have high quality purebred cattle.

Since a commercial animal will cost less than a purebred, you probably should buy a good crossbred rather than a poorer quality purebred. The cow-calf business is built on crossbred cows because they are efficient producers. A crossbred is often the best choice for a project.

Breed. Select a breed or cross that is adaptable to your area and is popular. When you are buying, be thinking about your market, because later you will want to sell calves from your cows. This is a reason to raise a popular breed. Also, select a breed that you like, but choose a breed on the basis of traits that are economically important. These include growth, milk, fertility, longevity, disposition, and carcass traits.

Age. Calves obviously cost less than older animals, but it will be a long time before they produce offspring to sell. When you buy a bred cow with a calf at side, this three-in-one package would involve a larger investment, but you will have a calf ready to sell in just a few months. Buying an open or bred yearling heifer is also a possibility. Purchasing a bred animal eliminates the need for you to get her bred, and removes the possibility that she is a non-breeder. If you will be showing the animal, check the show rules to see what age animal is eligible.

## *SELECTING A HEIFER*

Performance. Be sure any animal you select has as many good points as possible. Remember that you are choosing an animal to produce calves. Most traits, good and bad, are heritable (passed on from parent to offspring). Therefore, you want a heifer whose mother was a good cow. Ask to see performance or production records on any cattle you may want to buy. If the information is available, you should look at:

1. Adjusted 205-day weaning weight and ratio.
2. Adjusted 365-day yearling weight and ratio.
3. Production information on the mothers of heifers, including:
  - a. Number of calves raised (should be one or two less than the cow's age).
  - b. Weights and ratios of all her calves.

These records will help you be sure that the cattle you buy are not someone else's culls. Buy animals that were above average in the herds they were raised in (over 100 ratio). But expect to pay more than feeder price for this type animal. For more information on performance records, see the section on Record Keeping in this guide.

Health is very important. Buy your heifers from accredited and certified herds that are free of tuberculosis (TB) and brucellosis (Bang's). Heifers should be vaccinated for brucellosis (calfhood vaccination). Buy only from farms that have good herd health programs.

If you are buying a registered heifer, be sure she has a good pedigree. Ask someone who is familiar with bloodlines in that breed for some help in evaluating the pedigree.

Be sure any registered animal you buy is properly tattooed, with the tattoo matching the registration certificate. Be certain the registration is properly transferred to your name and that this is done before the deadlines set by any shows you may wish to compete in. The registration will be checked before you are allowed to compete in a show.

Selecting heifers from your family's cow herd. Carefully select heifers as replacements for your cow herd. Here are some guidelines for such selection:

1. Record birth dates and birth weights.
2. Record weaning weights and adjust to a 205-day basis. (See the Record Keeping section to learn how to do this yourself). Beef cattle improvement or breed associations will do this for members.
3. Rank heifers in order of 205-day weight or ratio.
4. Cull the bottom one-third and sell as feeders.
5. From the top two-thirds cull those that are structurally unsound, of poor type, small-framed and lacking in growthiness, or are over-fat at weaning.
6. Grow those remaining to breeding age, then make another selection based on adjusted yearling weight. Cull those that did not grow well.
7. Breed the rest to an easy-calving bull for 45 days.
8. Test for pregnancy 60 days after the breeding period ends.
9. Cull those that are not pregnant.
10. Allow those that were bred to calve, then make final selection on the performance of the first calf.

## *FACILITIES*

Beef cattle need few buildings. All a cow herd requires is a windbreak in winter and shade in summer. If buildings are used for beef breeding cattle, they should have open fronts that face south to allow for good ventilation. Cattle can get sick from the high humidity that builds up in a closed barn without good ventilation.

Cattle farms and ranches should have a catch-pen or corral and chute for confining cattle and working on them (treating sick animals, vaccinations, health tests, artificial insemination, pregnancy diagnosis, etc.). A chute should be no more than 26 inches wide, at least 50 inches high, and at least 20 feet long. All cattle handling and restraining structures should be ruggedly made out of sturdy materials, such as 8-inch-diameter posts and 1 1/4-inch hardwood boards.

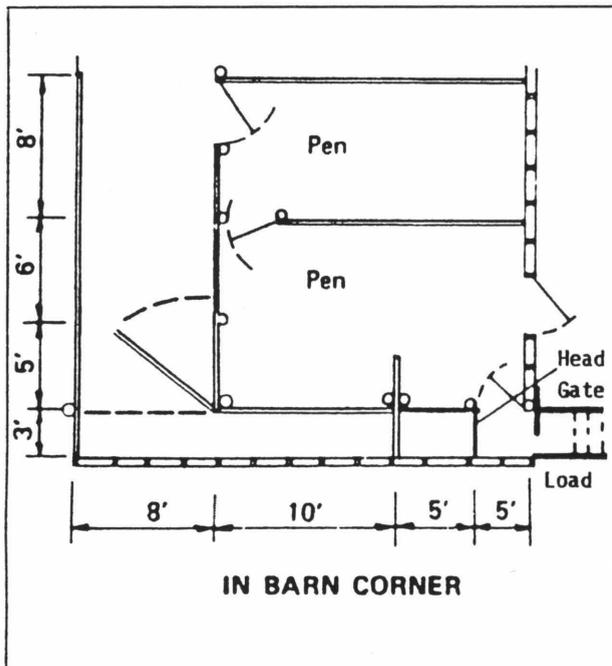


Figure 1. A well-designed corral and chute, constructed of appropriate materials, is necessary for any cattle operation but need not be large or elaborate.

Cattle raising also requires feed bunks and hay or silage feeders. Cows that are wintered outside may be fed hay on the ground, but grain should not be fed on the ground. Dimensions for feed bunks are discussed in the section on feeding.

Fences are required for pastures, and several types are available. They differ widely in cost and ease of construction. You might want to use wood, steel, or fiberglass posts, and barbed, woven, or high-tensile smooth wire for permanent fences. Two- or three-strand electric fences are good for subdividing pastures for controlled grazing or for temporary use, such as around a field to graze a cover crop. Electric fence materials cost less but may need more maintenance. For a lower cost permanent fence, space posts farther apart. Such a "suspension fence" can be made with either barbed or high-tensile smooth wire.

Other items you might need include gates, cattle guards, loading chutes or ramps, mineral feeders, squeeze chutes, and headgates for chutes. Plans for

building them are available. See your Extension Agent for more information. See the list of references in the back of this manual for some available publications on facilities.



Figure 2. This 5-strand high tensile fence, which may be electrified, is a low cost design that works well for boundary fences of pastures.

## FEEDING

Pasture. Availability of quality pasture is important to the success of your cattle project. Grazing of growing, stockpiled, or residue forages is the least expensive way to feed your cattle.

Forages for your cattle to graze should be between 2 and 8 inches tall. Grasses over 8 inches tall are becoming mature and are losing feed quality. Grasses and legumes under 2 inches tall are in need of a rest period to grow and strengthen the root system for continued plant vigor. This can best be accomplished with a rotational or controlled grazing system to allow parts of the pasture to rest and re-grow while those that have been sufficiently rested are being grazed.



Figure 3. Rough land such as this can grow a fairly productive pasture which can be well-utilized by cows and calves.

Various forages and their availability for grazing are shown in Table 1.

**Table 1. SEASONAL AVAILABILITY OF VARIOUS FORAGE CROPS**

Forage Type	When Available
1. Cool Season Perennials <i>Legumes- Alfalfa, Red Clover, Ladino Clover, White Clover, Birdsfoot Trefoil</i> <i>Grasses - Tall Fescue, Kentucky Bluegrass, Timothy, Orchardgrass</i>	May 1 - November 2
2. Stockpiled Tall Fescue	October 15 - January 15
3. Small Grains Rye, Wheat, Barley	October 15 - January 15 March 15 - May 1
4. Warm Season Annuals Millet, Sudangrass, Sorghum-Sudan cross	June 15 - August 30
5. Crop Residues Corn Stover, Soybean Stover	October 15 - December 15

Grazing can be made available during all 12 months of the year if various types of forages are used.

The best perennial pastures are mixtures of grasses and legumes, such as bluegrass-white clover, orchardgrass-alfalfa, tall fescue-alfalfa, orchardgrass-ladino clover, and tall fescue-ladino clover. Such mixtures need no nitrogen fertilizer and thus are lower cost pastures to maintain.

Your forage production will determine the number of cattle your farm can carry. Although greater carrying capacity can come from subdividing a large pasture into many (more than ten) paddocks and utilizing controlled grazing, you will probably need 1 1/2 to 2 acres of pasture for each cow and her calf. As you gain experience as a pasture manager, you may be able to graze more cows per acre. Excellent information on pasture improvement, fencing, water, and grazing management is available from two organizations in your county, the Cooperative Extension Service and the Soil Conservation Service.

**Growing Replacement Heifers.** Your goal in feeding heifers is to develop them into productive cows at a reasonable cost. Heifers should be large enough to breed at 14 to 15 months of age. Table 2 gives target weights for heifers of various breeds and crosses. If heifers fail to reach these target weights by the time you want to breed them, they may not have reached puberty (exhibit their first heat) and cannot be bred. Do not allow heifers to get too fat because then they may be difficult to get bred and may have lower milk-producing ability.

**Table 2. TARGET WEIGHTS FOR HEIFERS OF VARIOUS BREEDS AT 14 MONTHS OF AGE**

Breed	Weight in Pounds
Angus	650
Brahman	750
Brangus	700
Charolais	775
Hereford	700
Santa Gertrudis	750
Shorthorn	600
Brahman X British	760
British X British	675
Charolais X British	775
Chianina X British	825
Limousin X British	775
Simmental X British	750

Most heifers should gain 1.25 to 1.5 pounds per day from weaning to breeding age to reach the target weights shown in Table 2. The gain should be 1.75 pounds per day for large breeds and their crosses. This may sound like a slow rate of gain, but remember that you do not want heifers to get fat. Gains above the recommended rates will cause the animals to put on excess fat. (For more details, see the section on Feeding Heifers for Show.)

In much of Virginia, pasture for beef cattle can supply most of the feed needs. In times of drought or during winter, however, a beef animal should receive hay or silage and up to 5 pounds of grain a day. Expect heifers to eat 2.5 pounds of hay for every 100 pounds of body weight. Legume or grass-legume hay will provide enough protein, but a heifer still needs added energy to grow at the proper rate. Therefore, you should feed 3 to 5 pounds of grain daily in addition to the self-fed hay. See Table 3 for some sample rations.

**Table 3. SAMPLE RATIONS FOR BREEDING CATTLE**

(A mixture of 1/2 trace-mineral salt + 1/2 dicalcium phosphate should be available at all times)

All rations are amount per animal per day.

**500 LB WEANED HEIFER CALVES**

(to gain 1.0 to 1.5 pounds/day)

1. High quality pasture + 5 lbs grain
2. 12 lbs hay (full-feed) + 5 lbs grain
3. 40 lbs corn silage (30% DM) + 1 lb soybean meal
4. 10 lbs hay + 20 lbs corn silage

**900 LB PREGNANT YEARLING HEIFERS**

(to gain 1.0 pounds per day for 4 months up to calving)

1. High quality pasture
2. 20 to 25 lbs hay (full-feed)
3. 45 lbs corn silage (30% DM) + 1 1/4 lbs soybean meal
4. 15 lbs hay + 15 lbs corn silage

**1100 LB MATURE COWS, MIDDLE 1/3 PREGNANCY**

1. Low to medium quality pasture
2. 17 to 25 lbs hay
3. 40 lbs corn silage
4. 1 to 2 acres corn stalks per cow + hay or supplement as needed
5. 10 lbs hay + 15 lbs straw

**1100 LB MATURE COWS, LAST 1/3 PREGNANCY**

1. Medium to high quality pasture
2. 25 to 30 lbs hay
3. 50 lbs corn silage
4. 10 lbs hay + 25 lbs corn silage

**1100 LB LACTATING COW-AVERAGE MILKING ABILITY**

(10 lbs milk/day)

1. High quality pasture
2. 25 to 35 lbs hay (full-feed)
3. 60 lbs corn silage + 1 lb soybean meal
4. 20 lbs hay + 20 lbs corn silage

**1100 LB LACTATING COW-SUPERIOR MILKING ABILITY**

(20 lbs milk/day)

1. High quality pasture (+ 5 lbs grain may be necessary)
2. 30 to 40 lbs hay (full-feed) (+ 5 lbs grain may be necessary)
3. 75 lbs corn silage (30% DM), full-feed + 2 1/4 lbs soybean meal

**Feeding Heifers For Show.** The rules for feeding replacement heifers also apply to show heifers. Judges, however, like to see somewhat more condition on show heifers, which should look filled out and "bloomy". Feed your heifers to gain 1 3/4 to 2 pounds per day for about the last six weeks before a show. Longer than six weeks usually results in show heifers getting too fat. The easiest way to put on more condition is to increase grain by 2 pounds a day above the level previously fed.

**Bred Heifers.** Bred heifers should continue to grow to calving without fattening. Fat heifers can have trouble calving. Heifers should continue to gain at 1 to 1.25 pounds a day from breeding to calving. Good pasture should keep them gaining at this rate. If good pasture is not available, however, use 20 to 25 pounds of good quality hay per day.

Begin giving the heifer more feed, especially energy, about 60 days before she is due to calve. This allows

her to continue to grow and to provide additional energy for the growing fetus. About 70 percent of the weight of the calf is gained during the last three months of pregnancy.

**Lactating Heifers.** After calving, heifers need large amounts of high quality feed. Save the best hay you have for this time. A heifer needs twice as many nutrients after calving as before. She is still growing and must produce milk to nurse her calf, repair her reproductive tract, and come in heat and get bred within 85 days to calve the following year. This is why a first-calf heifer needs more nutrients than a mature cow.

A heifer should gain weight between calving and re-breeding. If you plan the proper time of calving, pasture can be used for most of the nutrients. A heifer may need 5 to 8 pounds of alfalfa or other legume hay, or 5 pounds of grain, per day in addition to pasture. A full feed of corn or sorghum silage plus 1 pound of soybean meal per day is also a good ration for lactating heifers.

Lactating cows also have high nutrient needs and are fed similarly to first-calf heifers. A big difference is that mature cows are not growing, although they do need to gain some weight before breeding time. Try to have both cows and first-calf heifers come back into heat and get bred within 60 to 90 days after calving. They will thus be calving at about the same time each year.

**Feeding Your Cows.** After a female has been rebred and has weaned her first calf, she can be fed with the rest of the cows. Much forage should be available to cows. It may be of low quality at times but should be of good quality from calving through breeding.

A cow can be fed low quality forages after she has weaned her calf. Dry, bred cows can effectively use corn stalks, straw, other crop residues, and poor quality pastures. Cows fed on such low quality feeds longer than 30 days will need supplemental protein, minerals, and vitamin A. They also will need extra energy if they are within 60 days of calving.

The cow needs more nutrients when the fetus begins to grow at a more rapid rate, during the last 60 to 90 days before calving. Cows should gain 1/2 pound to 1 pound per day in late pregnancy. Cows in thin condition may need to gain more. However, do not let your cows get overly fat because this leads to calving difficulty.

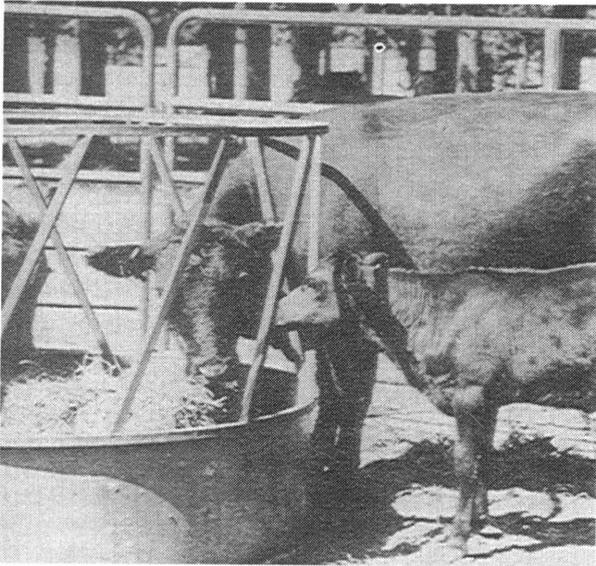


Figure 4. Some type of feeder for large round hay bales is necessary to reduce feeding losses.

Feeding lactating cows is much the same as feeding lactating heifers. Cows nursing calves must be fed well enough to produce adequate milk and to get rebred within 85 days after calving. High-quality pasture or a full-feed of high-quality hay will take care of the nutrient needs at this time. Feed quality is very important for cows and first-calf heifers that are nursing calves.

#### Guidelines for Feeding Beef Breeding Cattle.

1. Use grazing as much as possible. It is your cheapest feed source.
2. Feed according to requirements. Extra feed wastes money. Animal requirements are shown in Appendix Table A2. The sample rations in Table 3 are good guidelines.
3. If a feed bunk is used, the bottom should be 12 inches from the ground. A bunk should be 8 inches deep and 30 inches wide, and 2 feet of length should be provided for each animal.
4. Always keep feed fresh. Remove stale or moldy feed from feed bunks.
5. Feed at the same time each day. Don't skip feedings, especially if you are feeding grain.
6. Provide free access to salt and minerals. A good mixture is 1/2 trace mineral salt + selenium and 1/2 dicalcium phosphate or steamed bone meal. Provide this mixture in a

covered mineral feeder and have it available at all times.

7. Clean, fresh water must be available at all times. Clean the waterers often in the summer. In the winter, remove ice whenever it forms.
8. Gradually change rations or increase grain slowly. Do not change rations abruptly.
9. For show heifers, limit the amount of forage 2 to 4 weeks before the show. This will firm the heifer's middle and make her appear trimmer.
10. Don't grind grain too finely. Whole grain is better than feed ground as finely as hog feed. Processed grain should be crimped or coarsely cracked.
11. Send samples of all forages to the Virginia Tech Forage Testing Lab to determine the nutrient content of these feeds. Check with your local Extension Agent for details.

## **HEALTH**

Buy only disease-free cattle from herds that have good health programs. Preventing health problems is much easier and cheaper than treating sick cattle. Get to know a veterinarian. Discuss with him a herd health program that includes vaccinations and parasite control. A good cattle health program is outlined below:

#### Breeding cattle (cows, bulls, replacement heifers).

1. Fertility test bulls before the breeding season.
2. Vaccinate for 5-way leptospirosis, IBR, BVD, PI-3, and vibrio (also called campylobacter) before the breeding season and while females are open (not pregnant).
3. Treat for internal parasites (worms). First-calf heifers should be dewormed at calving time. Older cows usually have sufficient resistance against parasites and treatment is, therefore, not recommended. Managers of problem herds should consult veterinarians.
4. Control external parasites. Treat for grubs and lice in the fall, before November 1. Follow label directions on all drugs and pesticides.
5. After the breeding season, examine all females for pregnancy and cull open cows.
6. Test all new additions to the herd for brucellosis, tuberculosis, and anaplasmosis. Isolate newly purchased cattle and retest them for brucellosis in 30 to 60 days.

## Calves.

1. Vaccinate all calves with a 7-way clostridial vaccine. Do this at two to four months of age and again at five to eight months.
2. Check with your veterinarian about using vaccines for other diseases and calf scours (rotavirus and coronavirus).
3. Vaccinate all replacement heifers between 4 and 12 months of age against brucellosis (Bang's).
4. Routinely vaccinate for IBR, BVD, PI-3 and Haemophilus somnus two to four weeks before weaning because of stress at that time. Revaccinate for Haemophilus somnus at weaning.
5. Treat for grubs and lice in the fall. Follow directions on product label.
6. Treat for internal parasites on a routine basis, usually before or at weaning and then subsequently through the first grazing season.

Parasite control is important to animal performance. External parasites (flies, lice, and grubs) and internal parasites (worms) may need to be controlled. The compounds used to control parasites are poisonous and should be used carefully. Always read the label and follow the directions exactly.



Figure 5. This young cattleman is deworming his heifer with a paste-type product.

External parasites can be controlled with dusts, sprays, dips, ear tags, back rubbers, and pour-on

chemicals. Ask your Extension Agent for recommendations about which materials to use.

Good management can minimize the problem of internal parasites. Keep the environment clean, do not overgraze pastures, and avoid using wet or marshy areas. Proper nutrition and rotation of pastures also will help reduce the problem of internal parasites. Dewormer medicine can be given as a bolus (large pill), drench (liquid), feed additive, or injection. Ask your Extension Agent for recommendations.

## CROSSBREEDING

Crossbreeding is the mating of animals of different breeds, which includes mating purebred sires to crossbred females or using crossbred bulls with purebred females. Crossbreeding has two main advantages: heterosis (hybrid vigor), and complementarity of breeds.

Heterosis causes crossbreds to have higher production levels than the average of their parents. Here is the formula:

$$\text{Percent hybrid vigor} = \frac{\text{Crossbred average} - \text{straightbred average}}{\text{Straightbred Average}} \times 100$$

For example, if calves from two straightbred parent breeds had weaning weights of 445 and 455 pounds, the average would be 450 pounds. If the calves from the cross between the two breeds weighed 470 pounds, then:

$$\frac{470 - 450}{450} \times 100 = 4.4 \text{ percent hybrid vigor}$$

Hybrid vigor will increase calf weaning weights by 4 to 5 percent. The calf crop produced by crossbred cows also should be about 5 percent heavier. This extra gain is free, so commercial cattle should be crossbred to take advantage of this added performance.

Any selected trait (such as weaning weight) is affected by both genetic factors (called heritability) and by the environment. A calf from an excellent cow bred to an outstanding sire will not grow to its potential if the cow is not fed properly to milk well. The calf is still capable, however, of passing on its good genes to its offspring. Excellent management, likewise, can make a herd of average cattle perform very well.

Complementarity of breeds. There is not one best breed of beef cattle. Each breed has good and bad points in any management system. The matching of breeds to make up for weaknesses and to bring together the best traits is called complementarity.

British breeds are usually thought of as maternal breeds, with traits that are important in a productive beef cow. (Such breeds can be used as sire breeds as well, however). These breeds mature and reach slaughter grade quickly, have smaller mature size, grow less rapidly, are less muscular, have a higher rate of reproductive performance or fertility, and tend to have less calving difficulty due to lighter calf birth weight. British breeds include Hereford, Angus, Shorthorn, Devon, Galloway, Red Poll, Red Angus, Scotch Highland, and Murray Grey.

Continental or European breeds are usually thought of as sire breeds. This is not to say that they cannot be used on the maternal side of a cross. Simmental cows, for example, milk very well and can add pounds to a calf crop. Continental breeds generally have larger mature sizes, are later maturing, grow faster, are heavier muscled, are leaner and thus have higher cutability, have less marbling in the meat and consequently have lower carcass quality grade, and tend to produce more calving difficulty because of higher birth weights. Continental breeds include Charolais, Simmental, Limousin, Chianina, Gelbvieh, Maine-Anjou, Blonde d'Aquitaine, Pinzgauer, and Salers.

Brahman and Brahman crosses tolerate heat and insects and produce well in the hot climate of the southern United States. But Brahmans are lower in fertility, post-weaning rate of gain, and marbling and palatability of the meat. Neither straight Brahman nor straight British cattle are as productive as Brahman-British crossbreds in a hot, humid environment. Brahman X British cattle show a large amount of hybrid vigor. This is seen in cow fertility, growth rate, and calf survival. Some Brahman-based synthetic or American breeds are Santa Gertrudis (5/8 Shorthorn, 3/8 Brahman), Brangus (5/8 Angus, 3/8 Brahman), Braford (5/8 Hereford, 3/8 Brahman), and Beefmaster (about 50 percent Brahman and the rest equal parts of Hereford and

Shorthorn). Good performing Brahman-Continental crosses are available also, such as the Simmental X Brahman called Simbrah, the Limousin X Brahman called Brahmousin, or Gelbvieh X Brahman called Gelbray.

Crossbreeding Systems. Many different crossbreeding systems are used. Some are simple, involving only two or three breeds. The more complex systems can best be accomplished with artificial insemination (AI). Here are several systems:

1. Two-breed or Two-way Terminal Cross. Uses straightbred cows and bulls of a second breed. Calves are half each breed.
2. Three-breed or Three-way Terminal cross. Crossbred cows (produced as in system number 1 above) are bred to a purebred bull of a third breed. Usually all crossbred replacements are purchased and all calves are sold.
3. Two-breed Crisscross or Backcross. Crossbred cows are used as shown in system 1. Daughters of one breed of bull are bred to a bull of the other breed. Therefore two sire breeds are used each breeding season. Replacements are kept from the calves produced.
4. Three-breed Rotational Cross. Three sire breeds are used. A cow is bred to a bull of the breed she is least related to. Cows usually will be 4/7 of their sire's breed, 2/7 of their dam's breed, and 1/7 of the third breed used. Replacements are kept from within the herd.

Crossbreeding must be done according to a system using breeds that are good combinations. See your Extension Agent or state beef cattle specialist for more information, or the list of references in the back of this publication. You are specifically referred to VCES Publication 400-781 "Crossbreeding of Beef Cattle".

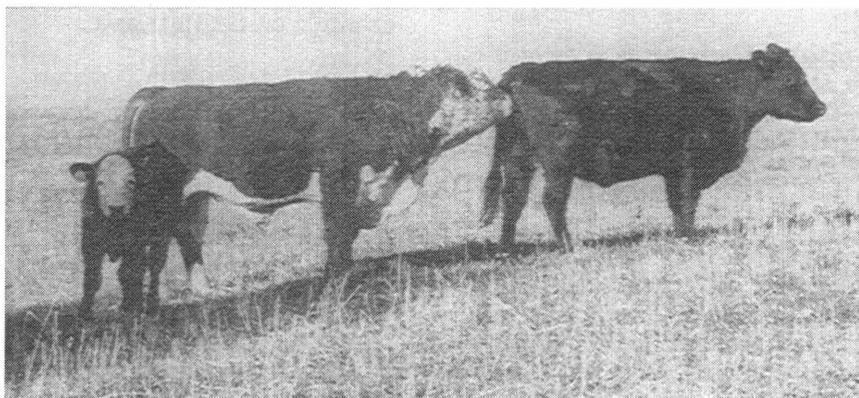


Figure 6. The Angus cow and Polled Hereford bull shown will produce "black-baldy" calves, which are crossbred cattle in high demand by cattle feeders.

# RECORD KEEPING

Records are absolutely necessary if you want to improve your herd as much as possible. Many organizations, such as breed associations, will process your records. The Virginia Beef Cattle Improvement Association (BCIA) also provides this service. Check with your Extension Agent about such services.

Records. The following records for your 4-H heifer or cow-calf project should be kept in either the Livestock Record Book (VCES publication 380-122) or preferably, in the Advanced Livestock Record Book (VCES publication 380-121).

## Information needed.

1. Identification of all cows, calves, and bulls. Use ear tags, tattoos, freeze brands, or fire brands.
2. Birth dates of calves.
3. Birth weights of calves. (This is optional in a commercial herd).
4. Sex of calf (bull, heifer, or steer).
5. Weaning weights of calves taken between 160 and 250 days old, but the closer to 205 days the better. Weigh before or at weaning.
6. Type scores or grades at weaning (optional).
7. Whether or not the calves were creep-fed.
8. Yearling weights taken between 330 and 440 days of age and adjusted to 365 days. These weights are needed to evaluate post-weaning growth.
9. Lifetime production records for each cow in the herd. The eight factors above are done for each calf each year and entered on the record for the mother of each calf.

Kinds of Records Available. Many kinds of records are available, and you need to understand the purposes of all of them. These records should be kept in your 4-H Livestock Record Book. Some of the more important records that you should keep are:

205-Day Adjusted (Adj) Weaning Weight. This indicates what a calf would weigh at 205 days of age. Weights of all calves are adjusted to the same calf age and to a mature-cow equivalent. They can also be adjusted to the same sex, which is usually either bulls or steers. These adjustments allow for more accurate comparisons of calves and of cow production.

The adjusted weaning weight is an indicator of the dam's milking ability and early growth rate of the

calf. This weight is useful only in the herd where it is obtained. You can not compare 205-day weights from different herds because of possible differences in feed, disease, weather, etc.

To calculate 205-day adjusted weaning weights, use the following procedure:

1. Take birth weights on all calves. See Table 4 for standards if birth weights are not taken.
2. Weigh calves between 160 and 250 day of age.
3. Calculate according to the formula (with example) on the next page.
4. Additive Age of Dam Factors are different for different breeds and are shown in Table 4.
5. If you wish to compare the production of weaning weight for your cows, you should also multiply the Adjusted 205-day Weight (Formula shown in item 3 above) by the following factors based on the sex of the calves. This adjusts all weights to a steer basis.

<u>Sex</u>	<u>Factor</u>
Bull	0.95
Steer	1.00 (no adjustment)
Heifer	1.05

365-Day Adjusted Yearling Weight. To get this figure, daily gain from weaning to about one year of age is calculated and multiplied by 160 (365 days minus 205 equals 160). The 205-day adjusted weight for age of dam only is added to this figure to arrive at the adjusted 365-day weight.

This crucial measure is a way of evaluating the combination of milking ability (weaning weight) and the ability of the calf to gain weight after it is weaned. It is fairly easy to improve yearling weight because it is moderately heritable and therefore can be improved by selection. See the formula and an example on the next page.

205-Day and 365-Day Weight Ratios. These are used to compare one animal with the average for all the animals in a group. It is computed by this formula:

$$\text{Ratio} = \frac{\text{Individual Adjusted Weight}}{\text{Average Adjusted Weight of Group}} \times 100$$

The average for the entire group is assigned a value of 100. The ratios of the individual animals in the group are expressed as percentages above or below the average. (A calf with a ratio of 106 is 6 percent heavier than the group's average.)

Because ratios indicate an animal's performance within a group, they can be used to compare animals

Calculate adjusted 205-day weaning weight according to this formula:

$$\text{Adj 205-Day Wt} = \left[ \frac{(\text{Actual Wt} - \text{Birth Wt})}{\text{Days of Age}} \times 205 \right] + \text{Birth Wt} + \text{Additive Age of Dam Factor}$$

Example

	Sex	Birth Wt	Birth Date	Breed of Cow	Age of Cow	Date Weighed	Weight	Days of Age
Calf A	Bull	85	March 3	Angus	4	Sept. 20	580	207
Calf B	Steer	78	March 18	P.Hierford	2	Sept. 20	525	186

$$\begin{aligned} \text{Calf A: Adj 205-Day Wt} &= \left[ \left( \frac{580 - 85}{207} \right) \times 205 \right] + 85 + 9 \\ &= \left[ \left( \frac{495}{207} \right) \times 205 \right] + 85 + 9 \\ &= [(2.39) \times 205] + 85 + 9 \\ &= (490) + 85 + 9 \\ &= 584 \text{ pounds} \end{aligned}$$

$$\begin{aligned} \text{Calf B: Adj 205-Day Wt} &= \left[ \left( \frac{525 - 78}{186} \right) \times 205 \right] + 78 + 60 \\ &= \left[ \left( \frac{447}{186} \right) \times 205 \right] + 78 + 60 \\ &= [(2.40) \times 205] + 78 + 60 \\ &= (492) + 78 + 60 \\ &= 630 \text{ pounds} \end{aligned}$$

To adjust to the same sex for the above calves, use the weights calculated above and multiply by the appropriate factor shown in item 5 on page 11.

$$\text{Calf A: } 584 \text{ pounds} \times 0.95 = 555 \text{ pounds}$$

$$\text{Calf B: } 630 \text{ pounds} \times 1.00 = 630 \text{ pounds}$$

Note that this is used to compare cows on their ability to produce pounds of weaned calf, by removing the effect sex has on rate of gain.

Adjusted 365-day weight is calculated by the following formula:

$$\text{Adj 365-Day Wt} = \left[ \frac{(\text{Actual Wt} - \text{Actual Weaning Wt})}{\text{No. of Days Between Wt}} \times 160 \right] + \text{Adj 205-Day Wt (age dam adj only)}$$

Example

	Sex	Actual Wn Wt	Date Weighed	Adj 205 Day Wt	Actual Yrling Wt	Date Weighed	Days Between
Calf A	Bull	580	Sept. 20	584	970	March 12	173
Calf B	Steer	525	Sept. 20	630	845	March 12	173

$$\begin{aligned} \text{Calf A: Adj 365-Day Wt} &= \left[ \left( \frac{970 - 580}{173} \right) \times 160 \right] + 584 \\ &= \left[ \left( \frac{390}{173} \right) \times 160 \right] + 584 \\ &= [(2.25) \times 160] + 584 \\ &= 360 + 584 \\ &= 944 \text{ pounds} \end{aligned}$$

$$\begin{aligned} \text{Calf B: Adj 365-Day Wt} &= \left[ \left( \frac{845 - 525}{173} \right) \times 160 \right] + 630 \\ &= \left[ \left( \frac{320}{173} \right) \times 160 \right] + 630 \\ &= [(1.85) \times 160] + 630 \\ &= 296 + 630 \\ &= 926 \text{ pounds} \end{aligned}$$

from different herds. Let's look at two calves from different herds:

	<u>Adj 205 Day Weight</u>	<u>Adj 205 Ratio</u>
Calf A	525	103
Calf B	490	116

Even though Calf A had a heavier weaning weight, it was only slightly better than the average for its herd. But Calf B was much heavier than the average for its herd. The calves in Herd A might have turned out heavier because of better management. Or the whole herd might be truly superior to Herd B, and Calf A might be superior to Calf B even though it has a lower ratio. In other words, an average calf out of a genetically superior herd may be better than a high-ratio calf from a mediocre herd. You must determine whether genetics or management is responsible for heavier weights. The ratio, however, identifies the best calves in each herd.

Herd Sire and Cow Records. Information about a calf crop from one year can be used to rank cows in a herd. But progeny records are a better way to evaluate cows.

Progeny records are records of all calves produced by a cow in her lifetime. The more calves a cow has had, the more accurate is her record of performance.

Sire records are much like cow records. They are averages of all calves produced by a bull. Both cow and sire records enable us to evaluate breeding value, or genetic ability to produce. These records help us make intelligent selections of both cows and bulls.

The goal of every cattle breeder is to bring about genetic improvement in the herd. Therefore, selection should be based on reliable, measurable information. Using performance data can create rapid progress in improving your herd.

Table 4. BREED STANDARDS AND ADDITIVE ADJUSTMENT FACTORS TO BE USED IN PERFORMANCE TESTING PROGRAMS

<u>Breed</u>	<u>Calf Sex</u>	<u>Birth Weight Breed Standard</u>	<u>205 Weaning Weight Age-of-Dam Adjustment</u>				
			<u>2</u>	<u>3</u>	<u>4</u>	<u>5-10</u>	<u>11+</u>
Angus	M	75	45	21	9	0	9
	F	70	37	18	7	0	9
Brahman	M	75	30	20	10	0	10
	F	70	27	18	9	0	9
Charolais	M	88	69	35	10	0	30
	F	83	59	30	11	0	30
Hereford	M	82	See Footnote <sup>a</sup>				
	F	77	See Footnote <sup>a</sup>				
Limousin	M	85	50	29	13	0	0
	F	80	41	23	10	0	0
Maine-Anjou	M	92	66	30	13	0	0
	F	84	57	33	6	0	0
Murray Grey <sup>b</sup>	M	65	1.15	1.1	1.05	1.0	1.05
	F	60					
Shorthorn	M	75	See Footnote <sup>a</sup>				
	F	70	See Footnote <sup>a</sup>				
Simmental	M	91	63	37	22	0	0
	F	83	53	32	16	0	0
All Other Breeds	M	75	60	40	20	0	20
	F	70	54	36	18	0	18

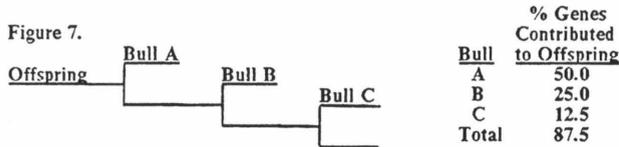
<sup>a</sup> Adjustment factors for weaning weight for both males and females are:

<u>Age of Dam</u>	<u>Additive Factor</u>
Up to 2 yr. 3 mo.	52
2 yr, 3 mo to 3 yr	35
3 yr to 3 yr, 11 mo	23
3 yr 11 mo to 4 yr, 11 mo	9
4 yr, 11 mo to 12 yr	0
Over 12 yr	12

<sup>b</sup> Under Weaning Weight, multiplicative factors rather than additive.

# SIRE SELECTION

**Importance of the Sire.** Sire selection must receive the greatest emphasis if the genetic improvement of a herd is to be maximized. Even though a bull contributes 50% of the genetic material to each calf, the magnitude of the bull's contribution is greater because he sires all of the calves. The genetic importance of successive bulls used in a herd is shown in Figure 7. Bulls used account for 87.5% of the genes over three generations.



Emphasis on bull selection does not diminish the importance of good beef females because genetically superior bulls typically do not have poor dams. However, most of the genetic superiority or inferiority of the cows will depend on their sire, grand sire, and great-grand sire.

**Genetic Superiority.** Select herd sires that are genetically superior in the traits that are economically important. The major traits of economic importance to beef cattle producers are:

1. **Calving Ease.** Birth weight is the most important factor in calving ease. Consider the birth weights of the sires or their offspring.
2. **Growth Rate.** This is a very important trait. It affects weaning weight, feedlot gain, and yearling or final feedlot weight. The related performance records of importance on bulls and their offspring are:
  - a. **Weaning Weight** (adjusted to 205 days and for the age of the mother) and weaning weight ratio, which ranks calves among their herd or test mates.
  - b. **Post-weaning Average Daily Gain** is calculated for the period from weaning to one year of age and is passed on to offspring at a moderate high rate.
  - c. **Yearling Weight.** This is usually expressed as adjusted 365-day weight. Adjusted yearling weight and ratio are probably the

best measures of growth to use for selection.

3. **Maternal Ability.** Milk production is a most important aspect. Herd sires genetically superior for maternal traits are a must, because milking ability is passed on to daughters. Select young bulls whose sires are positive for milk production and whose mothers are superior on weaning weights (ratios) of their calves. It is also helpful to consider maternal breeding values from performance pedigrees.

4. **Fertility.** This is a crucial factor in a young bull. He should be given a reproductive soundness exam by a veterinarian. This test should include checking internal sex organs and scrotal measurement. Scrotal circumference (the measure of both testicles and the scrotum at the largest point) should be at least 30 centimeters for bulls 12 months old. Bulls with larger testicles have greater spermatic counts and, consequently, greater breeding capacity, and they also sire daughters that reach puberty sooner.

**Performance records** must certainly be used in selecting prospective herd sires. A **bull's own performance record** is a very good estimate of his breeding value. Listed in the Sire Selection Using Individual Bull Performance Records table are the individual performance records of three bulls tested at a central station. One of these bulls should not be selected, and the other two have different strengths. Can you find them?

One can easily conclude that bull B is the earliest maturing, poorest performing among the three bulls. He is the smallest framed, highest conditioned bull that had the lowest test gain ratio and adjusted yearling weight ratio. On the other hand, bull C is the "growth bull", having the greatest weight per day of age. He is the largest framed, fastest growing bull with the largest scrotal circumference. Bull A has moderate growth and frame and is the most likely candidate to breed to virgin heifers (lowest birth weight).

**Estimated breeding values (EBV)** are calculated by national breed associations, are available on individual animals, and are often printed on performance pedigrees. The three-generation pedigrees are very useful. They use the animal's own record and records on relatives such as half-brothers and half-

Sire Selection Using Individual Bull Performance Records

Bull	Birth Date	Birth Wt	Adj 205 Day Wt	Wean Ratio	Post Adi	Gain Ratio	Adj 365 Day Wt	Year Ratio	365 Day Hip Ht	Frame Score	Back Fat Th	Scrotal Cir
A	Mar 3	70	567	110	3.23	107	1051	100	47.5	4	0.38	33
B	Feb 26	81	589	106	2.93	94	977	93	46.0	3	0.45	36
C	Feb 28	90	614	117	3.64	116	1157	111	51.5	6	0.3	37

sisters, sires, dams, and daughters, giving Estimated Breeding Values in ratio terms for important traits. EBV compares the individual bulls with breed averages. The accuracy (ACC) of each EBV is stated as a decimal portion of 1.00, which would be perfect.

Let's compare the EBV's on two bulls:

TRAIT	BULL A		BULL B	
	EBV	ACC*	EBV	ACC
Birth	102	0.88	92	0.91
Weaning	105	0.96	105	0.90
Maternal	106	0.95	102	0.47
Yearling	110	0.96	103	0.91

\*ACC = accuracy (1.00 = 100%)

Bull A is superior to Bull B. The EBV of 102 for birth weights of Bull A indicates slightly larger calves, while the EBV of 92 for birth weights of Bull B indicates smaller calves. Bull A is strongly favored in both growth and maternal. Note the high accuracy for maternal on Bull A, meaning that he has many daughters in production.

Sire evaluation (progeny performance) records from breed association sire summaries are the most reliable and accurate evaluation of a bull's breeding value. These summaries allow ranking of bulls compared to other bulls in the breed, based on progeny records. The traits compared are birth weight, weaning weight, yearling weight, and maternal. The Expected Progeny Difference (EPD) for the growth traits tells us what the bull should transmit to his offspring, in pounds. The EPD for maternal is presented as a) milk and b) total indicating the change in weaning weight of daughter's calves due to milk production and to combined milk and growth. Study sire summaries to pick sires for AI use.

Let's look at sire summary data from a breed association sire summary on four bulls.

Sire A would be the calving ease sire. He would be a good risk to breed to first-calf heifers. Sire B is the growth sire of the group, but he should only be bred to mature cows because of his large birth weight EPD. Sires C and D could be selected because of their combination of reasonable birth weight, good growth, and fine maternal traits on their daughters. C should be favored for heavy use in a herd because of high accuracies compared to the younger sire D.

Pedigree. Bloodlines are important to the breeder of registered cattle, because of marketability, but

they are of little concern to the commercial producer except as they are related to performance, which is very important. Linebred or inbred bulls that are superior performers may be preferred.

This table shows percentages of inbreeding for various matings:

Half-brother-sister mating	12.5 percent
Full-brother-sister mating	25.0 percent
Sire-daughter mating	25.0 percent
Dam-son mating	25.0 percent

It is best to select on performance and progeny records as a primary consideration, with pedigree being secondary. Performance pedigrees and sire summary data are now available and should be consulted. The surest way to make progress through sire selection is to use superior progeny-proven sires through artificial insemination. The next best method is to use performance tested sons of superior progeny-proven bulls through natural service. By knowing sire summary data on a young bull's sire and his dam's sire (maternal grandsire), you can quickly calculate a pedigree index (PI) for any trait. Remember that the young bull is 50% related to his sire and 25% related to his maternal grandsire.

Example: If yearling weight EPD of the sire is +80 lbs and of the maternal grand sire is +60 lbs, the PI on the young sire for yearling weight may be calculated as follows:

$$1/2 (80) + 1/4 (60) = +55 \text{ lbs}$$

This young sire should himself have a yearling weight EPD of +55 lbs even if his performance record indicates he is an average bull (100 ratio) for the yearling weight trait. For example, if his yearling ratio is 110, we can add another 10 lbs giving him a PI for yearling weight EPD of = 65.

Breed associations are now calculating EPD's for traits of importance on young bulls with no offspring. The above method of calculating pedigree index is a quick method to estimate EPD if that information is not available.

Type and soundness. Genetically superior bulls come in many different sizes and shapes. You should use three primary criteria in selecting a herd bull after you have made sure he has a superior performance record and is out of a high-producing cow.

### Sire Evaluation

Sire	Birth Wt.		Weaning Wt.		Yearling Wt.		Maternal		
	EPD	ACC	EPD	ACC	EPD	ACC	Milk EPD	Total EPD	ACC
A	+0.2	0.96	+18.0	0.95	+32.0	0.90	+3.0	+12.0	0.82
B	+7.6	0.90	+44.3	0.91	+82.9	0.87	-2.0	+20.1	0.88
C	+2.0	0.90	+39.1	0.91	+70.0	0.83	+10.0	+29.5	0.85
D	+0.4	0.60	+30.2	0.65	+64.8	0.64	+9.0	+24.1	0.50



Figure 8. All major breed associations produce a sire summary, which is an excellent source of information on bulls you may want to use in your herd.

Those criteria are:

1. Frame Size. Cattle that have larger frames mature more slowly and will weigh more at slaughter or at maturity than smaller-framed cattle. Large-framed bulls are more apt to sire

medium- or large-framed feeder cattle, which are more valuable than small-framed calves. Bulls may be measured for height at the hip. This height can be converted to frame score on a 1 to 9 scale by using the frame score chart.

Frame Score Chart  
Bull Height (inches)  
Frame Score

Age Month	1	2	3	4	5	6	7	8	9	
Weaning	5	33.5	35.5	37.5	39.5	41.6	43.6	45.6	47.7	49.7
	6	34.8	36.8	38.8	40.8	42.9	44.9	46.9	48.9	51.0
	7	36.0	38.0	40.0	42.1	44.1	46.1	48.1	50.1	52.2
	8	37.2	39.2	41.2	43.2	45.2	47.2	49.3	51.3	53.3
	9	38.2	40.2	42.3	44.3	46.3	48.3	50.3	52.3	54.3
Yearling	10	39.2	41.2	43.3	45.3	47.3	49.3	51.3	53.3	55.3
	11	40.2	42.2	44.2	46.2	48.2	50.2	52.2	54.2	56.2
	12	41.0	43.0	45.0	47.0	49.0	51.0	53.0	55.0	57.0
	13	41.8	43.8	45.8	47.8	49.8	51.8	53.8	55.8	57.7
	14	42.5	44.5	46.5	48.5	50.4	52.4	54.4	56.4	58.4
	15	43.1	45.1	47.1	49.1	51.1	53.0	55.0	57.0	59.0
	16	43.6	45.6	47.6	49.6	51.6	53.6	55.6	57.5	59.5
	17	44.1	46.1	48.1	50.1	52.0	54.0	56.0	58.0	60.0
	18	44.5	46.5	48.5	50.5	52.4	54.4	56.4	58.4	60.3
	19	44.9	46.8	48.8	50.8	52.7	54.7	56.7	58.7	60.6
	20	45.1	47.1	49.1	51.0	53.0	55.0	56.9	58.9	60.9
	21	45.3	47.3	49.2	51.2	53.2	55.1	57.1	59.1	61.0

Here are expected slaughter weights for steers of each frame score:

Frame Score	Weight Range	Corresponding Feeder Grade
1	750-850	Small
2	851-950	Small
3	951-1050	Small/Medium
4	1051-1150	Medium
5	1151-1250	Medium/Large
6	1251-1350	Large
7,8,9	1351 & above	Large

2. Muscling. You should not normally select for extremely heavy muscling. Adequate muscling in the sire does affect the muscling (cutability) of the offspring. Judge muscling by standing squarely behind the bull. Also look at the stifle and forearm areas.
3. Soundness. This factor is most important. Be sure the bull is sound reproductively (adequate testicles, normal penis, etc.). Structural soundness is a must. Watch the bull walk. Is the stride free? Are the feet straight? Check to see that the hooves are deep, well-formed, and have deep heels. Are shoulders laid in smoothly? Hind legs should not be too straight. Soundness is very important because the bull must mount and serve cows and continue to do so for several years.

CONCLUSION. Herd sire selection is vital to any cow/calf operation. One must analyze the herd and establish goals and set priorities. Feed resources, marketing opportunities, and management abilities must be evaluated. Performance records and pedigrees, sire summaries, and visual appraisals should be used collectively in selecting your prospective herd sire, whether you are using either natural or artificial breeding.

## **BREEDING & CALVING MANAGEMENT**

Time to Breed. The time of year that you breed your cows and replacement heifers is based on when you want your calving season to begin. Your busiest time of the year will be calving season, so pick a time that is best for your farm and feed supply. Fall, winter, or early spring are better calving times. Calves born in the heat of summer do poorly. Determine when you want your calves to be born, and count back 9 1/2 months (283 days is the cow gestation length) to determine the time to breed your cows. See Appendix Table A1 for expected calving dates.

A cow needs the most feed when she is nursing a calf. Spring calving (February to April) means she can be on pasture during most of her lactation, and pasture is less expensive than hay or silage. Also,

calves are healthier on pasture than in smaller areas. Calving in the fall means more stored winter feed is required. Most herds in the U.S. are on a late winter or spring calving schedule.

Replacement heifers should be bred at 14-15 months of age, so they calve as two-year-olds. Heifers should reach the weights shown in Table 2 by 14 months of age. If they do not reach those weights, they may not be cycling and, therefore, will not become pregnant. Heifers should be bred 20 to 30 days before the cow herd, because heifers take longer to recover from calving, and they need to be ready for rebreeding at the same time as the mature cows the following year. The breeding season should not be longer than 45 to 60 days for replacement heifers and 60 to 80 days for the cow herd.

Heifers and cows will not rebreed for a period of time after calving. Improper feeding will lengthen this period time. After she begins to cycle again, a cow is in heat about every 21 days. The heat period is the only time the female will let the bull breed her. She is in heat for only 14 to 18 hours and if she is not bred at that time, she will not be ready to breed for another 21 days.

Methods of Breeding. There are three methods: pasture breeding and handmating (the two types of natural service), and artificial insemination (AI).

Pasture breeding is the most commonly used method. The bull is allowed to run with the breeding herd for the entire breeding season. More than one bull is needed for a large herd. A bull two years old or older can service about 35 cows. Yearling bulls should be given only 15 to 20 females to breed. Be careful about putting old and young bulls in the same herd, because an older, heavier bull will usually be dominant, possibly preventing the breeding of all the cows.

Less labor is required with pasture breeding than with AI, and pregnancy rates may be higher because the bull is better than the herdsman at finding cows in heat. Pasture breeding must be strictly controlled in purebred operations, because the registration of calves requires knowing what sire bred each cow.

Handmating, used only by purebred breeders, involves bringing the females in heat into a pen for breeding with a bull that is allowed to service the female once. This system allows the breeder to mate specific cows to a specific bull while using natural service. The bull only services a female once, whereas in the pasture he might serve a female in heat several times.

Artificial insemination requires the producer to determine when a cow is in heat and then to restrain her so she can be bred. Accurate heat detection is a must. Signs of heat include a swollen vulva, mucous discharge from the vulva, bellowing,

nervousness, loss of appetite, and riding or bulling. The best sign of a female in heat is her standing still when other cows mount her. This is called a standing heat.

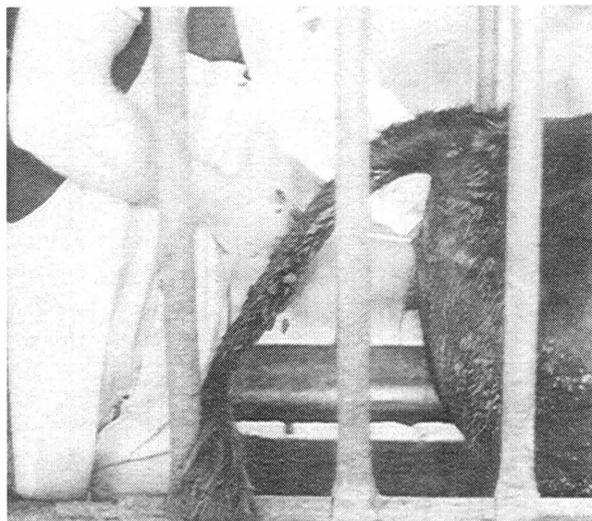


Figure 9. This farmer is using artificial insemination (AI), an excellent way to utilize the best bulls in the country as the sire of your calves.

The AI industry is based on the collection and freezing of semen from superior sires. Semen from outstanding sires can be bought for use in your herd at a relatively low cost. This is a great advantage for purebred breeders. A small amount of semen is frozen in a plastic straw. The semen is thawed and put into the cow's reproductive tract with an inseminating gun. A cow observed in standing heat in the morning should be bred that evening. If she is observed in heat in the afternoon or evening, she should be bred the next morning. This timing enables the sperm cells in the semen to come into contact with the egg at the best time.

AI is more widely used by dairymen than by beef producers because beef cattle are often kept on pasture year-round, and it is difficult to detect cows in heat when they are out in a large pasture. An AI system requires quality personnel who are able to detect heat and who have the facilities to easily work the animals. Cows have to be separated and restrained in a chute so an AI technician can inseminate them. Clean-up bulls are usually put in with the herd for pasture after one artificial breeding to guarantee the highest possible conception rate.

Estrus synchronization, or heat synchronization, is a technique that works well with AI. It causes cattle to come in heat at the same time, therefore makes heat detection much easier. Prostaglandin, a naturally occurring chemical in the female reproductive tract, is available commercially under the trade

names Lutalyse and Estrumate. It is available only from a veterinarian. Either one-or two-shot systems may be used. Most cows are in heat 3 to 5 days after the injection, and the breeder can get many females bred in a short period of time. Cows can be bred at the normal time after they are observed in heat, or 80 hours after the second injection. Syncro-Mate B is another product involving an injection and an ear implant. The implant is removed 10 days after implanting, and cows are normally in heat 80 hours thereafter. Check with your veterinarian if you are interested in using heat synchronization with AI.

Pregnancy Testing. Throughout the U.S., an average of only 72-74 percent of the cows exposed to breeding will actually wean a calf. The biggest factor in this relatively low weaning percentage is cows that remain open (do not become pregnant). They have calved before but for some reason fail to become pregnant this time. The second most important reason is calf losses at birth.

A cow or heifer that does not become pregnant represents an economic loss. She has been fed all year, but she does not produce a calf. Do not feed her for another year. If she is open, she should be sold. To prevent the wintering of open cows, you should conduct a pregnancy check and sell the cows that are not pregnant. Pregnancy can be determined as soon as 45 to 60 days after the end of the breeding season, but should be done no later than 4 months following the end of the breeding season.

It takes only a few seconds for an experienced examiner (normally a veterinarian) to determine pregnancy. The job can be done quicker if you have good facilities for working and restraining the cattle, and a door in the chute at the rear of the cow. Pregnancy checking can be combined with other jobs, such as vaccinating, weaning and implanting calves, etc. The cost of pregnancy checking is small compared to the cost of keeping an open cow through the year.

## ***MANAGEMENT AT CALVING TIME***

Calving season is the most important time of the year for the cattle breeder. Most calf death losses occur at birth or during the first three days thereafter. Calving difficulty is the reason for most of these losses. Losses can be greatly reduced by sound management, an understanding of what is happening, and knowing how to deal with any problem.

Types of problems. Heifers that are calving for the first time have higher incidences of calving difficulty. Many heifers need assistance in calving. Cows having their second calves normally have less difficulty than first-calf heifers, but more than cows having

their third calves. The amount of calving difficulty levels off after cows reach four years of age and are at their mature size.

The breed of sire is a factor in the birth weight, shape, and conformation of the calf, which affects calving ease or problems. But individual bulls vary, so that using a small-breed bull may not necessarily eliminate calving problems. Information on calving ease for individual bulls is available from many breed associations through their sire summaries and from AI companies on their bulls. As a guideline, do not mate heifers to bulls with over an 85-pound birth weight.

**Observation.** You should keep a closer watch on heifers at calving time, because they are more likely to have trouble. If AI has been used, you will know approximate calving dates. See Appendix Table A1 for determining the date of calving for different breeding dates. All heifers bred naturally should be brought together for observation. Follow these rules:

1. Move heifers to a clean, dry lot or pasture before calving starts.
2. The lot should be close to your house or at least easy to get to.
3. Check the heifers at least three times a day. Close surveillance during the night is a must.
4. Be ready to provide assistance at all times.

**Equipment.** Have the following equipment and materials available.

1. Obstetrical (calf-pulling) chains and handles. (Never use a truck or tractor to pull a calf).
2. Lubricants. These can help to slide a calf out.
3. Soap and water. Wash the manure off the rump area before assisting the cow and wash your own hands.
4. Sterile plastic gloves. These prevent you from transferring infectious agents into the uterus of the cow.
5. 7% iodine. After it has been cut, dip the calf's navel cord into it.
6. Maternity stalls. For use in case of very bad weather.
7. Antibiotics. These may need to be given to the cow to prevent infection.

### Calving Process (Parturition)

Calving has three stages: dilation, calving, and expulsion of the placenta (afterbirth). Each stage is outlined in detail below:

#### Stage 1 -- Dilation

1. The calf moves up into the birth canal.
2. Uterus contracts at 10-to 15-minute intervals.
3. The cervix (the area that closes off the uterus to prevent infection from the outside) begins to dilate or open wide.
4. The cow will come restless, may try to find a secluded spot, and alternately lie down and stand up.

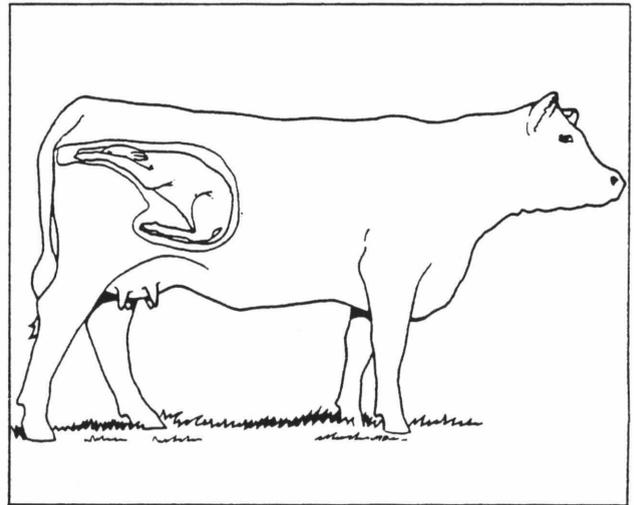


Figure 10. Position of the calf in the uterus after it has been oriented for normal delivery.

#### Stage 2 -- Calving

1. The first water bag may appear or break. You usually do not see the second water bag.
2. The calf's front feet should appear first. You can tell by the toes pointing up.
3. The cow has hard abdominal contractions.
4. The external genital region (vulva) dilates. Muscles around the tailhead relax.
5. The uterus contracts at two-minute intervals.
6. The calf should be delivered within two hours after the water bag appears or breaks.

The calf can live for 8 to 10 hours in the uterus if the calving process has not gone beyond early Stage 2. If the calf gets too far up into the birth canal, the umbilical cord could be compressed, which would shut off oxygen to the calf and result in stillbirth.



Figure 11. This newborn calf, being cleaned off by his mother, is the result of a normal, unassisted birth.

### Stage 3 -- Expulsion of the placenta

1. The afterbirth usually comes out immediately after calving, but if it does not it is not a problem unless the cow retains it more than 12 hours. If this occurs, she should be given antibiotics.
2. Do not pull on or attempt to pull out the retained placenta.
3. Call in a veterinarian if you do not have experience with a retained placenta.

### Providing assistance

Assist the cow if she has been in labor two to three hours and is not making progress, or if it has been two hours since early Stage 2, or if the calf is not coming front-feet-first. Keep conditions as sanitary as possible. If you cause a uterine infection, the cow may not be able to rebreed on time. Follow these rules in assisting the cow: (Caution: Do not put a cow in a chute to pull a calf. There may not be enough room when she lies down.)

1. Check to see if the calf is alive by pinching it. It should move by reflex if it is alive.
2. Check the positioning of the calf, which could be frontwards, backwards, upside down, or have one or two legs folded back. Correct the alignment of the calf if necessary. (It can be born back-legs-first).

3. Attach the calf-pulling chains with one loop on each leg, 2 to 3 inches above the dew claws.
4. Pull back and down, with an even pressure on both legs, when the cow pushes. When she rests, stop pulling.

### Helping the calf

When the calf is on the ground, help it to breathe. Follow this procedure:

1. Clear the mouth and nose of mucous.
2. Rub or shake the calf.
3. Scratch the inside of the nose with a straw to make it sneeze and thus begin breathing.
4. When the calf is breathing satisfactorily, untie the mother and make sure she accepts the calf.
5. The calf must nurse within 30 minutes after it is born, to get colostrum from the mother's milk. Colostrum contains antibodies that the calf needs to fight off infections. The calf can best utilize colostrum soon after birth and is unable to after it is 12 hours old. For weak calves that cannot nurse, you should have a supply of frozen colostrum. It can be warmed up and given to the calf through a stomach tube. Colostrum usually can be gotten from a dairy farm.

Several tasks should be done before you turn the cow and calf out: Tattoo and ear-tag the calf. Write down its birth date, birth weight, and tag and tattoo numbers in your record book. Vaccinate the calf if certain diseases, such as calf scours, are a problem. Some managers give all newborn calves vitamin shots. A selenium shot can be given to a new calf to prevent white muscle disease. In a commercial herd, castrate bull calves; the knife method works best. When you castrate, implant the calf with one of the recommended growth-promoting products.

## ***WEANING BEEF CALVES***

Weaning is the process of removing the calf from the cow and replacing the cow's milk with other feeds as the calf's source of nutrition.

Beef calves are typically born in the spring and weaned in the fall. Ages at weaning usually vary between 6 to 10 months of age. The weaning date is determined largely by necessary changes in herd management. Spring-born calves are frequently weaned about the first of October, and fall-born calves are weaned in the spring or summer. Producers often allow fall-born calves to nurse until midsummer because cows increase their milk pro-

duction when changed from winter feeding to pasture for their nutrition.

Weaning weights will vary from under 300 lbs to more than 600 lbs; the seven-month weight (no creep) average is between 425 and 475 lbs. Weight of the calf at weaning is a function of 1) the growth potential of the calf, 2) milk production of the cow, 3) adequate nutrition-forage quality and availability, and 4) environment and general health of the calf. It is estimated that approximately 60 to 70% of the weaning weight is accounted for by milk production of the cow. The remaining 30 to 40% comes from grass and other forage that the calf consumes directly. Therefore, available forage to both cows and calves will significantly affect the weights of the calves at weaning time.

The question whether to move the cows or the calves from a pasture at weaning time is much argued. In either case, it is necessary to separate the cows and the calves and to prevent them from getting back together. Each cow/calf producer must, by experience, work out a system that seems best. Small weaning pastures with tight fences for either the cows or calves will save much labor in keeping the pairs separated and under control. It works best to place the cows and calves beyond earshot of each other at the time of weaning.

Prewaning vaccination of calves, usually initiated 2 to 4 weeks prior to weaning, is highly recommended because weaning is a most stressful period for the young calf. Such treatment is effective in reducing the incidence of respiratory disease and enables calves to build immunities against certain viruses and bacterial agents.

Once the calves are separated from the cows, there must be adequate water and feed space, and overcrowding must be avoided. The ration offered should be one that the calves are accustomed to--usually high quality grass or grass-legume hay. The objective at weaning time is not to get the calves on a high level of grain but to get energy and protein into them as quickly as possible to reduce stress and obtain optimum gains. Particular attention must be given to digestive disorders and to maintaining feed quality and palatability when starting calves on feed. Feed allowance should be gradually increased until they are on full feed or until they are on a level of grain to promote maximum growth without fattening. Ten to 14 days are usually required to get newly-weaned calves on full feed.

## MARKETING YOUR CALVES

The goal of your project should be to produce a high quality calf from every one of your breeding-

age females. A good marketing program begins when you purchase your first heifer or cow, or when you make replacement heifer selections from within your herd, and when you select a bull to sire your calves. Produce the kind that are in demand and the marketing problem is half solved.

Marketing purebred cattle involves production of growthy, productive, high-performance cattle with pedigrees that are in demand. These cattle must be registered with a National Breed Association and transferred to the buyer promptly. Market outlets for purebred cattle include:

1. Shows. Presenting cattle at shows is a good form of advertising and lets people see the good ones that you are producing.
2. Breed Association Consignment Sales. Most state breed associations sponsor auction sales once or twice a year. Fees of 3 to 10% are deducted from the sale price to pay advertising and auctioneer costs.
3. Virginia BCIA Bull Tests. Bulls from breeder farms are consigned and undergo a 140-day gain test. The top 2/3 of the bulls in each breed are sold at auction after the test is completed. Fees similar to association consignment sales are deducted from sale price. In addition, testing costs to cover feed during the gain test are also charged to the consignor.
4. Private Treaty Sales. Most purebred cattle are sold privately. Potential buyers find out about cattle for sale through word-of-mouth, printed advertising in cattle publications, and promotion at shows. Sale price is negotiated between buyer and seller.

Marketing commercial cattle almost always involves selling steers and heifers by the pound. In most instances, these are graded according to the following standards:

<u>Grade</u>	<u>Expected Weight at Low Choice Grade</u>
<u>Steers</u>	
Small (S)	Under 1000 pounds
Medium (M)	1000-1200 pounds
Large (L)	Over 1200 pounds
<u>Heifers</u>	
Small (S)	Under 850 pounds
Medium (M)	850-1000 pounds
Large (L)	Over 1000 pounds

1. Special Virginia Cattlemen's Association Sales. These are held in all parts of Virginia during March, April, September, and October each year. Both weaned calves and yearling feeder cattle are sold. Cattle are nominated ahead of the sale, and at sale time are graded and weighed, and put together with other owners' cattle of a similar breed, weight, and grade.

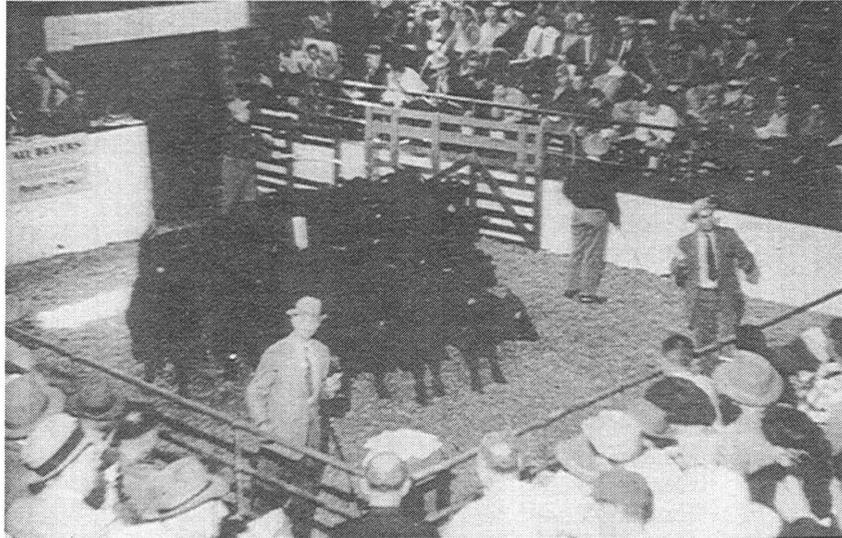


Figure 12. This pen of feeder cattle is getting active bidding from the buyers in the crowd.

These comingled pens are sold as a group to buyers from Virginia and neighboring states. Because of large numbers of cattle being sold, these sales frequently result in prices above those received at weekly auction markets. Contact your local Extension Agent for more information.

2. Weekly auction sales are held in most parts of the state. These sales occur during all months of the year, and are very convenient for sellers. Because lower numbers of cattle are sold, however, there are fewer volume buyers and prices are often somewhat lower than those received at special sales.
3. Tel-O-Auction sales of cattle are held for sellers who have at least a half of a trailer load of cattle to sell (20,000 pounds or more). The Virginia Cattlemen's Association handles these sales. Cattle are sold "in the field" over the telephone, and are weighed and picked up by the buyer shortly after the actual sale.

4. Private treaty sales of commercial steers and heifers are done less frequently than the types of sale described above, primarily because the advertising needed to get buyers to look at the cattle can be quite costly. Sales of calves to other youths for 4-H steer and heifer projects are often private, however.
5. Cull cows and bulls can be a significant source of income for cow herd owners. Although some packers may purchase these cattle directly, most sellers merchandise culls through one of the weekly auction markets.

To be a successful cattle marketer, you must produce the breed or breed cross most in demand, and these cattle must be healthy and at the desired weights. You must also know the value of cattle. Many of the larger newspapers, plus several specialty livestock publications, publish market reports. You should keep up with the market prices to know what your cattle are worth.

TABLE A1. COW GESTATION CALENDAR

Date of Service	Calving Date	Date of Service	Calving Date
January 1	October 11	July 2	April 11
January 8	October 18	July 9	April 18
January 15	October 25	July 16	April 25
January 22	November 1	July 23	May 2
January 29	November 8	July 30	May 9
February 5	November 15	August 6	May 16
February 12	November 22	August 13	May 23
February 19	November 29	August 20	May 30
February 26	December 6	August 27	June 6
March 5	December 13	September 3	June 13
March 12	December 20	September 10	June 20
March 19	December 27	September 17	June 27
March 26	January 3	September 24	July 4
April 2	January 10	October 1	July 11
April 9	January 17	October 8	July 18
April 16	January 24	October 15	July 25
April 23	January 31	October 22	August 1
April 30	February 7	October 29	August 8
May 7	February 14	November 5	August 15
May 14	February 21	November 12	August 22
May 21	February 28	November 19	August 29
May 28	March 7	November 26	September 5
June 4	March 14	December 3	September 12
June 11	March 21	December 10	September 19
June 18	March 28	December 17	September 26
June 25	April 4	December 24	October 3
		December 31	October 10

TABLE A2. DAILY NUTRIENT REQUIREMENTS OF BEEF CATTLE  
DAILY NUTRIENTS PER ANIMAL\*

Body Wt LBS	Av Daily Gain LBS	Min Dry Matter LBS	Total Protein LBS	%	TDN LBS	%	Ca g	P g	Vit A 1000 IU
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Medium Frame Heifer Calves and Yearlings  
(Add 7% to these amounts for Large Frame heifers)

500	1.0	11.8	1.11	9.4	7.3	62.0	16	11	12
	1.5	12.1	1.25	10.3	8.3	68.5	21	12	12
	2.0	11.8	1.35	11.4	9.1	77.0	24	13	12
600	1.0	13.5	1.19	8.8	8.37	62.0	17	12	14
	1.5	13.8	1.32	9.5	9.4	68.5	20	13	14
	2.0	13.5	1.41	10.4	10.4	77.0	23	14	14
700	1.0	15.1	1.28	8.4	9.4	62.0	17	13	15
	1.5	15.5	1.39	9.0	10.6	68.5	20	14	16
	2.0	15.2	1.46	9.6	11.7	77.0	22	15	15
800	1.0	16.7	1.36	8.1	10.4	62.0	17	14	17
	1.5	17.2	1.46	8.5	11.8	68.5	19	14	17
	2.0	16.8	1.51	9.0	12.9	77.0	21	15	17

Body Wt LBS	Av Daily Gain LBS	Min Dry Matter LBS	Total Protein		TDN		Ca g	P g	Vit A 1000 IU
			LBS	%	LBS	%			

Pregnant Yearling Heifers, Last 3 Months of Pregnancy

750	0.9	16.1	1.3	8.3	8.9	55.1	20	14	20
	1.4	16.6	1.5	8.9	10.0	59.9	24	16	21
	1.9	16.6	1.6	9.5	11.1	66.5	28	17	21
800	0.9	16.8	1.4	8.2	9.2	54.8	21	15	21
	1.4	17.4	1.5	8.8	10.4	59.6	25	16	22
	1.9	17.5	1.6	9.3	11.6	66.1	28	17	22
850	0.9	17.6	1.4	8.2	9.6	54.5	21	16	22
	1.4	18.2	1.6	8.6	10.8	59.3	25	17	23
	1.9	18.3	1.7	9.1	12.1	65.7	28	18	23
900	0.9	18.3	1.5	8.1	9.9	54.3	22	17	23
	1.4	19.0	1.6	8.5	11.3	59.1	26	18	24
	1.9	19.2	1.7	9.0	12.5	65.4	28	19	24

Dry Pregnant Cows, Middle Third of Pregnancy

900	0.0	16.7	1.2	7.0	8.2	48.8	14	14	21
1000	0.0	18.1	1.3	7.0	8.8	48.8	15	15	23
1100	0.0	19.5	1.4	7.0	9.5	48.8	17	17	25
1200	0.0	20.8	1.4	6.9	10.1	48.8	18	18	26
1300	0.0	22.0	1.5	6.9	10.8	48.8	20	20	28

Dry Pregnant Mature Cows, Last Third of Pregnancy

900	0.9	18.2	1.5	8.0	9.8	54.0	22	17	23
1000	0.9	19.6	1.6	7.9	10.5	53.6	23	18	25
1100	0.9	21.0	1.6	7.8	11.2	53.2	25	20	26
1200	0.9	22.3	1.7	7.8	11.8	52.9	26	21	28
1300	0.9	23.6	1.8	7.7	12.5	52.7	28	23	30

Two-year-old Heifers Nursing Calves  
(First 3-4 Months After Calving)

700	0.5	15.9	1.8	11.3	10.3	65.1	26	17	28
800	0.5	17.6	1.9	10.8	11.2	63.8	27	19	31
900	0.5	19.2	2.0	10.4	21.0	62.7	28	20	34
1000	0.5	20.8	2.1	10.0	12.9	61.9	29	22	37

Cows Nursing Calves (Average Milking Ability)  
(First 3-4 Months After Calving)

900	0.0	18.8	1.9	9.9	10.8	57.3	24	19	33
1000	0.0	20.2	2.0	9.6	11.5	56.6	25	20	36
1100	0.0	21.6	2.0	9.4	12.1	56.0	27	22	38
1200	0.0	23.0	2.1	9.3	12.8	55.5	28	23	41
1300	0.0	24.3	2.2	9.1	13.4	55.1	30	25	43

Cows Nursing Calves (Superior Milking Ability)  
(First 3-4 Months After Calving)

900	0.0	18.7	2.4	12.9	13.1	69.8	35	24	33
1000	0.0	20.6	2.5	12.3	13.8	67.0	36	25	37
1100	0.0	22.3	2.6	11.9	14.5	65.2	38	27	40
1200	0.0	23.8	2.7	11.5	15.2	63.7	39	28	42
1300	0.0	25.3	2.8	11.2	15.9	62.6	41	30	45

\*National Research Council, 1984.

# GLOSSARY

- Adjusted Weaning Weight (WW)** - Weight adjusted to 205 days of age and for age of dam.
- Adjusted Yearling Weight (YW)** - Weight adjusted to either 365, 452, or 550 days of age and for age of dam.
- Artificial Insemination (AI)** - The technique of placing semen from the male in the reproductive tract of the female by means other than natural service.
- Average Daily Gain** - Measurement of daily change in body weight when animals are fed for tests.
- Birth Weight (BW)** - The weight of a calf taken within 24 hours after birth. Heavy birth weights tend to be correlated with calving problems, but the conformation of the calf and the cow are contributing factors.
- Bred** - Applies to the pregnant female definitely safe in calf or pregnant; also used to refer to the mating process.
- Breed** - Cattle having a common origin and characteristics which distinguish them from other groups of cattle.
- Breeder** - In most beef breed associations, the owner of the dam of a calf at the time she was mated or bred to produce that calf.
- Breeding Value** - Value of an animal as a parent. It indicates the ability of bulls and cows to pass on good traits to their calves.
- British Breeds** - Breeds of cattle that are native to Great Britain such as Angus, Hereford, and Shorthorn.
- Bull** - An uncastrated male bovine.
- Calf** - Young cattle of either sex less than one year of age.
- Calf Crop** - The number or percentage of calves produced within a herd in a given year relative to the number of cows and heifers exposed to breeding.
- Calving (Parturition)** - The act of giving birth.
- Calving Difficulty (Dystocia)** - Abnormal or difficult labor, which causes difficulty in delivering the fetus and placenta.
- Calving Season** - The season(s) of the year when the calves are born. Limiting calving seasons is the first step to performance testing the whole herd.
- Carcass Evaluation** - Technique of measuring quality and quantity of carcasses.
- Castrate** - Remove the testes of male cattle.
- Colostrum** - The first milk produced at the beginning of each lactation. Highly nutritious and fortified with antibodies helpful in disease control in newborn calves.
- Conception** - The fertilization of the ovum or egg. The act of conceiving or becoming pregnant.
- Cow** - A mature female bovine.
- Crossbred** - An animal that has parents of different breeds.
- Crossbreeding** - The mating of animals of different breeds (or species). Crossbreeding takes advantage of hybrid vigor or heterosis.
- Cryptorchid** - Male cattle with undescended testes.
- Culling** - The process of eliminating less productive or less desirable cattle from a herd.
- Environment** - All nongenetic conditions which influence the reproduction, production, and carcass merit of cattle.
- Embryo** - A fertilized ovum (egg) in the earlier stages of pregnancy up to development of body parts.
- Embryo Transfer** - Removing the fertilized ovum (egg) from one cow (donor dam) and placing it into another cow (recipient cow). More calves can be obtained from cows of superior breeding value by this technique. Only proven producers should become donor dams.
- Estrus (Heat)** - The period when cows and heifers may be successfully bred. Nonpregnant cows and heifers usually come into heat every 18-21 days.
- F1** - Offspring resulting from the mating of a purebred (straightbred) bull to females of another purebred (straightbred) breed.
- Feed Conversion (Feed Efficiency)** - Pounds of feed consumed per pound of weight gain. Also, the production (meat, milk) per unit of feed consumed.
- Fetus** - The unborn young of cattle after the body parts are formed.

- Fitted** - Fed, trained, and groomed for show or sale.
- Frame Score** - A score based on measurement of hip height. This score is related to slaughter weights at which cattle will grade choice or have half an inch of fat cover over the loin eye at the 12th-13th rib.
- Freemartin** - Female born twin to a bull calf (approximately 99 out of 100 will not conceive).
- Generation Interval** - Average age of the parents when the calves destined to replace them are born. A generation represents the average rate of turnover of a herd.
- Genes** - The basic units of heredity that occur in pairs and have their effect in pairs in the individual but which are transmitted singly (one or the other gene at random of each pair) from each parent to offspring.
- Genetics** - The science (study) of how characteristics are inherited from the parents.
- Gestation** - The period of time between successful mating (conception) of a cow and birth of the calf. Same as pregnancy.
- Heat Synchronization** - Causing a group of cows or heifers to exhibit heat together at one time by artificial manipulation of the estrus cycle.
- Heifer** - A female of the cattle species less than 3 years of age that has not borne a calf.
- Herd** - A group of cattle (or other animals) considered as a unit.
- Heredity** - The passing on of genetic or physical traits of parents to their offspring.
- Heritability** - The amount of the difference among cattle, measured or observed, that are transmitted to the offspring. Heritability varies from zero to one. The higher the heritability of a trait, the more accurately does individual performance predict breeding value and the more rapid should be the response due to selection for that trait.
- Heterosis (hybrid vigor)** - Amount by which the crossbreds exceed the average of the two purebreds that are crossed to produce the crossbreds.
- Inbreeding** - Production of offspring from parents that are closely related. Inbreeding increases prepotency and uncovering of undesirable recessive genes.
- Lactation** - The period of time that a cow gives milk following each birth of a calf.
- Legume** - Forage species with the ability to fix and use nitrogen from the air. Clovers, alfalfa, soybeans, and cowpeas are familiar legumes used as forage crops. These feedstuffs are commonly used in rations that require high protein content.
- Open** - A term commonly used to indicate a nonpregnant female.
- Outcrossing** - Mating of individuals that are less closely related than the average of the breed. Commercial breeders and some purebred breeders should be outcrossing by periodically adding new sires that are unrelated to their cowherd. This outcrossing should reduce the possibility of loss of vigor due to inbreeding.
- Pedigree** - A tabulation of names of ancestors, usually only those of the three to five closest generations.
- Performance Data** - The record of the individual animal for specific traits such as birth weight, weaning weight, postweaning gain, yearling weight, etc.
- Performance Testing** - The systematic collection of comparative production information for use in decision making to improve efficiency and profitability of beef production. Differences in performance among cattle must be utilized in decisionmaking for performance testing to be beneficial. The most useful performance records for management, selection, and promotion decisions will vary among purebred breeders and commercial cattle producers.
- Placenta** - The membrane or sac in which the fetus (calf) develops and through which it receives nourishment in the cow's uterus; afterbirth.
- Polled** - Naturally hornless cattle.
- Progeny** - The offspring of animals.
- Progeny Records** - The average, comparative performance of all the calves of a bull or a cow.
- Progeny Testing** - Evaluating the genetic excellence of an individual by a study of its progeny records.

**Protein** - An essential nutrient composed of amino acids that are components of every living cell. Required in animal diets. Crude protein refers to the total protein in a feed. Digestible protein refers to that portion that can be utilized by the animal.

**Puberty** - The age at which the reproductive organs become active and secondary sex characteristics develop.

**Purebred** - An animal of known parents within a recognized breed that is eligible for registry in the official herdbook of that breed.

**Ratio** - See Trait Ratio.

**Registered** - An animal whose name and assigned number, along with the name and number of its sire (father) and dam (mother) has been recorded in the record books of its breed association.

**Rotational Crossbreeding** - Systems of crossing two or more breeds where the crossbred females are bred to bulls of the breed to which the cow is least related. Rotation systems maintain relatively high levels of heterosis and produce replacement heifers from within the system. Opportunity to select replacement heifers is greater for rotation systems than for other crossbreeding systems.

**Scurs** - Horny tissue or rudimentary horns that are attached to the skin rather than the bony parts of the head.

**Selection** - Allowing certain cattle in a herd to produce calves in the next generation. The animals not selected are culled.

**Service** - The act of having a bull impregnate a cow.

**Steer** - A male bovine castrated before the development of secondary sex characteristics.

**TDN** - Total digestible nutrients, a commonly used estimate of the energy requirements of beef cattle. Used in the formulation of balanced rations and expressing the feeding values of feedstuffs.

**Terminal Sires** - Sires used in a crossbreeding system where all their calves, both male and female, are marketed. For example, F1 crossbred dams could be bred to sires of a third breed and all calves marketed. Although this system allows maximum heterosis and complementarity of breeds.

replacement females must come from other herds.

**Trait Ratio** - An expression of an animal's performance for a particular trait relative to the herd or contemporary group average. It is usually calculated for most traits as:

$$\frac{\text{Individual record}}{\text{Average of animals in group}} \times 100$$

**Vaccinate** - To inoculate healthy cattle with specific antigens that are capable of creating an immunity against disease. To perform or practice vaccination.

**Virgin** - A bovine, male or female, that has not been exposed to breeding.

## **SOURCES OF ADDITIONAL INFORMATION**

### *Books*

**The Merck Veterinary Manual.** Published by Merck and Co., Inc., Professional Handbooks Dept., P.O. Box 229, Norwood, NJ 07648.

**Nutrient Requirements of Beef Cattle.** Published by National Academy Press, 2101 Constitution Avenue, NW, Washington, DC 20418.

**Beef Housing and Equipment Handbook (MWPS-6).** Midwest Plan Service, Iowa State University, Ames, IA 50011.

**Handbook of Livestock Management Techniques.** Battaglia and Mayrose. Burgess Publishing Co., CEPCO Division, 7108 Ohms Lane, Minneapolis, MN 55435

## **VIRGINIA COOPERATIVE EXTENSION PUBLICATIONS**

**Virginia Beef Management Handbook.** Ask Extension Agriculture Agents for details. Cost \$30.00. (Many of the publications shown below are in this handbook).

**400-001** Creep Grazing for Calves  
**400-005** Beef Sire Selection  
**400-026** Understanding Performance Pedigrees

400-027 Understanding and Using Sire Summaries  
 400-028 Utilizing Performance Records in Commercial Beef Herds  
 400-030 Calving Difficulty in Beef Cattle  
 400-032 Culling the Commercial Cow Herd  
 400-033 Modern Commercial Beef Sire Selection  
 400-089 Individual Cow Production Record  
 400-461 Implants to Stimulate the Growth of Beef Cattle and Lambs  
 400-462 Beef Cattle Fitting and Showing  
 400-465 Forages for the Cow-Calf Herd  
 400-581 Protein Supplements for Beef Cows  
 400-589 Grass Tetany and Its Control  
 400-745 Control of Internal Parasites of Beef Cattle  
 400-746 Control of Parasites in Grazing Cattle  
 400-754 Feeding Broiler Litter to Cattle and Sheep  
 400-755 Feeding for Wintering Beef Cows  
 400-757 Beef Cattle Identification  
 400-766 Crop Residue Feeds for Beef Cattle  
 400-770 Beef Cow-Calf Management Guide  
 400-781 Crossbreeding of Beef Cattle  
 400-782 Beef Herd Health Program  
 400-801 Virginia Beef Cattle Improvement Guide  
 400-857 Estrus Synchronization of Beef Cattle  
 418-009 Stockpiled Tall Fescue for Winter Grazing  
 424-192 What to Look for in Hay Quality  
 424-724 Legumes and Grasses for High Quality  
 442-725 Reduce Hay Feeding Losses

## ***BEEF BREED ASSOCIATIONS***

**American Angus Association\***, 3201 Frederick Boulevard, St. Joseph, Missouri 64501

**American Brahman Breeders Association\***, 1313 LaConcha Lane, Houston, Texas 77054

**American Chianina Association**, P.O. Box 159, Blue Springs, Missouri 64015

**American Galloway Breeders Association**, 302 Livestock Exchange Building, Denver, Colorado 80216

**American Gelbvieh Association**, 313 Livestock Exchange, Denver, Colorado 80216

**American Hereford Association\***, 715 Hereford Drive, Kansas City, Missouri 64105

**American International Charolais Association\***, P.O. Box 20247 Kansas City, Missouri 64195

**American Maine-Anjou Association**, 564 Livestock Exchange Building, Kansas City, Missouri 64102

**American Murray-Grey Association**, 1222 N. 27th Street, Billings, Montana 59107

**American Pinzgauer Association**, P.O. Box 1003 Norman, Oklahoma 73070

**American Polled Hereford Association\***, 4700 East 63rd Street, Kansas City, Missouri 64130

**American Red Brangus Association**, 404 Colorado, Austin, Texas 78701

**American Salers Association**, Suite 101, Livestock Exchange Building, Denver, Colorado 80216

**American Scotch Highland Breeders Association**, P.O. Box 81, Remer, Minnesota 56672

**American Shorthorn Association\***, 8288 Hascall Street, Omaha, Nebraska 68124

**American Simmental Association**, 1 Simmental Way, Bozeman, Montana 59715

**American Tarentaise Association**, 123 Airport Road, Ames, Iowa 50010

**Beefmaster Breeders Universal**, Suite 350, GPM South Tower, 800 North West Loop 410, San Antonio, Texas 78216

**Foundation Beefmaster Association**, 200 Livestock Exchange Building, Denver, Colorado 80216

**International Brangus Breeders Association, Inc.**, 9500 Tioga Drive, San Antonio, Texas 78230

**National Beefmaster Association**, 817 Sinclair, Ft. Worth, Texas 76102

**North American Limousin Breeders Foundation**, 309 Livestock Exchange Building, Denver, CO 80216

**North American South Devon Association**, P.O. Box 68, Lynnville, Iowa 50153

**Red Angus Association of America**, P.O. Box 776, Denton, Texas 76201

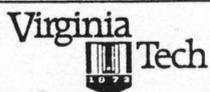
**Santa Gertrudis Breeders International**, Box 1257, Kingsville, Texas 78363

**Texas Longhorn Breeders Association**, 3701 Airport Freeway, Ft. Worth, Texas 76111

\*These breed associations have special booklets prepared for juniors. Almost all of these associations have journals or magazines.







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