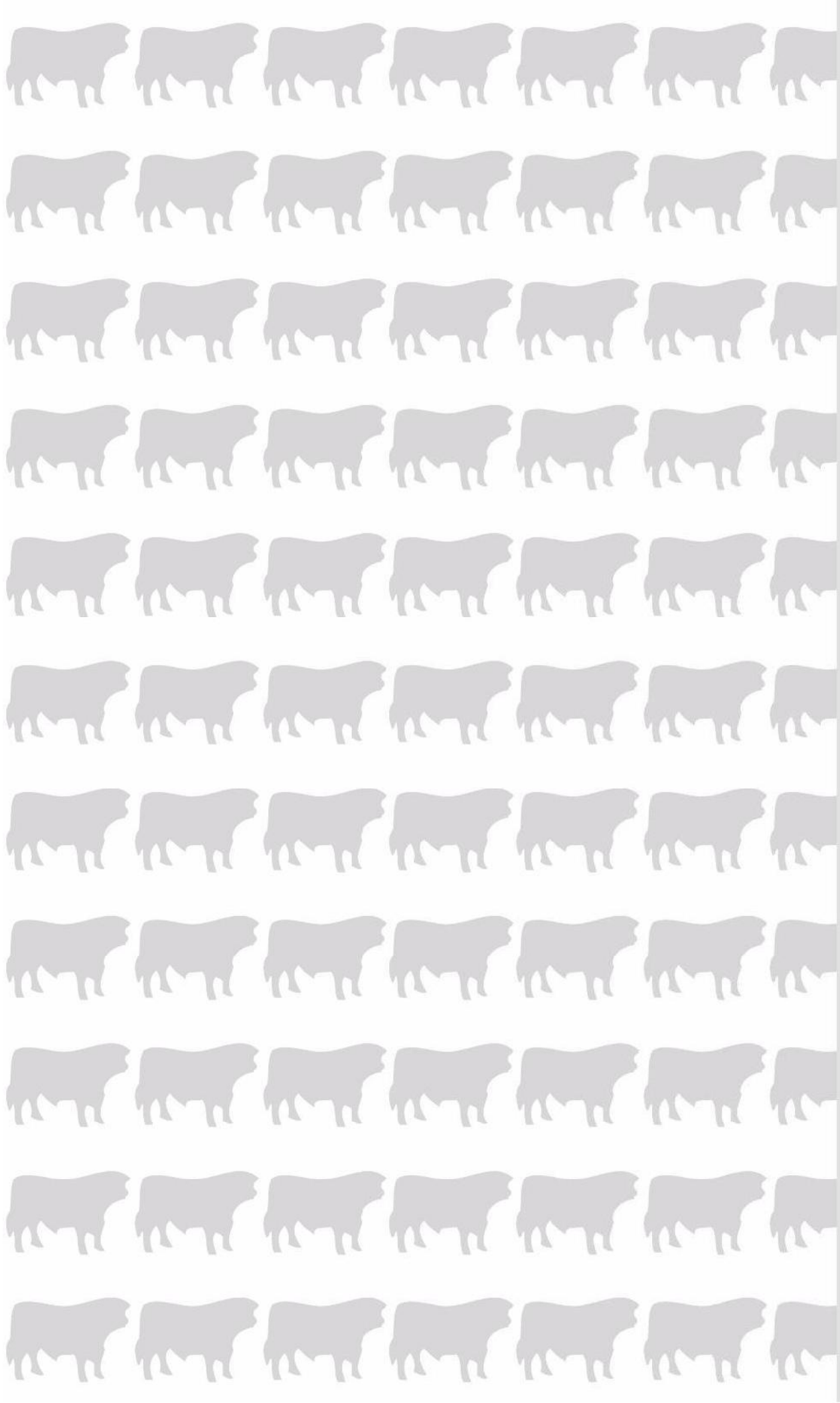


Beef Cattle (Bovine)



Black Angus



Hereford



Red Angus



Shorthorn



Charolais



Limousin



Maine Anjou



Simmental



Brahman



Black Brangus



Santa Gertrudis



Beefmaster



Beef Cattle Breeds:

BRITISH:

Angus (Scotland):

- Black, naturally polled, moderate size
- Excellent marbling, early compositional maturity
- Excellent maternal breed, easy fleshing, good milk production
- Early maturing sexually
- Largest number of annual registrations in United States (270,000 head)

Hereford (England):

- Red with white face, also white on underline, legs, switch, etc.
- Moderate size, adaptable to many environments, good disposition
- Low to moderate milk, relatively early maturing
- Poorest marbling of the British breeds, average to below average muscle
- US Registry Assn. of Hereford and Polled Hereford; merged in 1995
- 2nd largest annual registrations (110,000 head)

Polled Hereford (United States):

- Red with white face, also white on underline, legs, switch, etc.
- Moderate size, adaptable to many environments, good disposition
- Low to moderate milk, relatively early maturing
- Poorest marbling of the British breeds, average to below average muscle
- Naturally hornless, developed from Hereford cattle with mutated gene

Red Angus (United States):

- Red, naturally polled, moderate size
- Excellent marbling, early compositional maturity
- Excellent maternal breed, easy fleshing, good milk production
- Early maturing sexually
- Developed from a recessive gene found in black Angus cattle

Shorthorn (England):

- Three major colors--red, white, and roan
- Moderate size, good disposition, excellent milk production
- Has appendix registry program which allows outside genetics to be introduced (i.e. Maine Anjou)

CONTINENTAL or EUROPEAN (EXOTIC):

Chianina (Italy):

- Short, straight off-white hair coat with black skin pigmentation
- One of the world's oldest breeds
- Extremely large framed, late maturing breed that is fast growing
- Has had a tremendous impact on the "show steer" industry
- Produce lean, muscular carcasses, marbling is suspect
- Not considered a maternal breed

Charolais (France):

- White, off-white to cream coloration, some pigmentation of skin possible
- Extremely fast growing, muscular breed that is late maturing
- Large framed with relatively heavy birth weights and large mature size
- Produce lean, muscular carcasses, marbling can be a problem
- Below average maternally
- Fourth in annual registrations (45,000 head)

Gelbvieh (Germany):

- Reddish gold to russet colored hair
- Resulted from government controlled breeding program (W. Germany)

Continued on next page.

Beef Cattle Breeds:

Developed as dual purpose breed, leaned toward beef production
Moderate sized, early maturing exotic, good dispositions, excellent fertility and milk production
Steers that finish at ~ 1200 pounds with high cutability carcasses

Limousin (France):

Reddish gold in color
Moderate sized continental breed that will finish at < 1200 pounds
Below average maternally--somewhat lacking in milk production
Produce extremely lean, muscular carcasses but difficult to grade choice
Fastest growing breed in the country (percentage increase in registrations)
Third in annual U.S. registrations (49,000 head)

Maine Anjou (France):

Deep red color with white underline and patches
Largest continental breed in terms of weight
Relatively high birth weights have been a problem
Produce extremely lean, muscular carcasses but difficult to grade choice
Popular breed in the production of show steers for youth

Simmental (Switzerland):

Range in color from straw colored through light red to dark red
Gentle disposition, heaviest milking continental breed, large framed with large mature size
Fast growing in the feedlot, produce muscular carcasses but marbling is below average
Early maturing sexually, very fertile with over 10% of European purebreds producing twins
Fifth in annual registrations (44,000 head)

Texas Longhorn (Texas, were of Spanish origin):

Long, distinctive horns, many colors including speckled and spotted
Lived as feral cattle for approximately 300 years from 1550 to 1850, then we began to drive cattle north for slaughter (See Lonesome Dove). In 1800s, began to improve Longhorns with British bulls (primarily Shorthorns and Herefords), by the early 1900s the Longhorn was diluted nearly to extinction. In 1927, the Department of Interior paid \$3000 to buy a pure herd of Longhorns to be maintained at the Wichita Mountains Wildlife Refuge at Cache, Oklahoma. Started with 20 cows, 4 calves and 3 bulls, natural selection determined the parents of each generation
Progeny from the Wichita Mountains herd were used to populate other wildlife preserves and private concerns where the cattle were maintained as hobby or curiosity herds until the 1970s
Relatively slow growing, light birth weight, light muscled cattle with excellent hardiness and known for longevity and ability to utilize browse

BOS INDICUS

Brahman (India):

The American Brahman is a cross of three Indian breeds
Both red and gray strains of Brahmans exist, both have black pigmentation, horned
Noted for heat tolerance, disease and insect resistance and crossing ability
Poor marbling ability and slow sexual maturity is offset by their ability to thrive in the hot, humid environments of the Southern US
Brahman composites (Brangus, Santa Gertrudis, Beefmaster, Braford, Simbrah, Brahmousin, Charbray)

Brangus (United States):

5/8 Angus and 3/8 Brahman, black and naturally polled
excellent mothering ability, moderate size, early sexual maturity, heat tolerance and foraging ability
result from the two parent breeds
intermediate in carcass merit between the parent breeds

Continued on next page.

Beef Cattle Breeds:

Simbrah (United States):

5/8 Simmental and 3/8 Brahman

Evolved in the late 1960s

Brahman influence contributes to heat and insect tolerance, hardiness, and excellent foraging ability, as well as maternal calving ease and longevity.

Simmental complements these characteristics with early sexual maturity, fertility, milking ability, rapid growth and good beef characteristics.

The Simbrah Registry is kept by the American Simmental Association.

Santa Gertrudis (United States):

5/8 Shorthorn and 3/8 Brahman, dark red, both horned and polled

Developed on the King ranch in Kingsville by founder Robert J. Kleberg

Breed traces back to a single sire

Noted for maternal ability of females, productivity under hot, adverse conditions and overall hardiness

Composite breed

Santa Cruz composite developed at King Ranch (50% Santa Gertrudis, 25% Gelbvieh, 25% Red Angus)

Beefmaster (United States):

Developed by Tom Lasater in the 1930s in Falfurias, Texas

About 50% Brahman, 25% Shorthorn and 25% Hereford

No set color pattern

Developed based on the "six essentials" as described by Lasater - weight, conformation, fertility, hardiness, disposition and milking ability

Noted for longevity, hardiness, rapid growth, and maternal ability

Composite breed

Largest registration of Bos Indicus breeds (40,000 head)

Terminology:

Bull: Sexually mature male. Bull calf used to denote males under a year of age.

Cow: Female that has produced a calf.

Heifer: Female that has not produced a calf.

Heiferette: Heifer that has calved once, dried up, and is then fed for slaughter.

Steer: Castrated male.

Calf: Young cattle (less than 1 year) of either sex.

Calve: Act of giving birth. Some dairymen will refer to "freshen" as a term denoting calving.

A.I.: Artificial insemination

Stocker: Weaned cattle that are run on grass or fed on high roughage diets. Generally weigh 350 to 550 pounds when started. Expected to gain 250 to 300 pounds during growing phase.

Cow-Calf Operation: Management unit that maintains a breeding herd of cows and produces weaned calves for sale.

Yearling: A cattle of either sex that is 1 to 2 years of age. Some cattlemen will refer to short and long yearlings.

Crossbred: An animal that is a product of the crossing of two or more breeds.

Feeder Cattle: Those requiring more growth and/or fattening before slaughter.

Feedlot: Beef cattle enterprise where cattle are placed in confinement, fed harvested feeds and fattened for slaughter.

Seedstock Producer: Enterprise that produces breeding animals for the commercial segment of the industry. The majority of purebred breeders fall into this category.

Introduction:

Beef cattle production is spread across the United States with Texas as the leading state in all segments of the industry including cow/calf production, stocker cattle production and feedlot production. Cow/calf production includes cattle raised on grassland and focuses on production of a live calf annually. Environmental adaptation is critical for success of cow herds so breed types vary across the country to acclimate to environmental stressors. Brahman-influenced or American breeds proliferate as the cow herd base in the south and southeastern parts of the country. British breeds originated in colder climates and are more adaptable to the cold. British breeds constitute the cowherd base in the Midwestern and western states. European breeds are also found in the Midwestern states and are typically used as sire breeds. Charolais or reddish-colored breeds also work well in the south or southwest as sire breeds. Stocker cattle production focuses on moderate growth on a forage based diet. Stocker cattle graze on wheat pastures of northern Texas and Texas Panhandle areas during the winter months. Feedlot production encompasses feeding of high concentrate, grain based diets to cattle to achieve rapid growth to attain market endpoint weights. Feedlot production is centered in the Texas Panhandle, Kansas and Nebraska. Most steers and heifers are marketed between 15-24 months of age weighing 1000-1400 pounds.

Beef Cattle Production in the United States and Globally:

Beef cattle production plays a highly significant role in United States agriculture. It creates the most jobs in agriculture-providing 1 million direct jobs and nearly 2 million related positions in thousands of American communities. Every dollar of cattle sales generates another \$5 to \$6 in increased economic activity in the community. The amount of beef consumed in the U.S. per capita was 57.2 pounds in 2018. One steer can provide 540 servings of beef, thus potentially impacting 540 consumers. There are 94.8 million cattle in the United States in 2019. Top five beef cattle states are Texas, Nebraska, Kansas, Oklahoma and California. Top beef producing countries in 2019 are United States, Brazil, European Union and China.

90% of cow herds have less than 100 cows (average 40 head).

Top Foreign Markets (2018) for U.S. Beef (value): Japan, South Korea, Mexico, Hong Kong and Canada
Global Leaders in Cattle Numbers: India (305m), Brazil (232m), China (97m), USA (94m), and European Union (88m).

Beef Cattle Production in Texas:

Texas ranks first in beef cow numbers (5.2 million) with followed by Oklahoma (2.15m), Missouri (2.06m), and Nebraska (1.94m), and South Dakota (1.82m) (2018). Gonzales County (57,341 cows) ranks 18th and Lavaco County (67,102 cows) ranks 13th nationally among counties (2019).

Nebraska and Texas both have 2.75 million head of cattle on feed to rank first, Kansas (2.43m), Iowa (1.32m), and Colorado (1.05m) round out the top 5.

Texas ranks first in total cattle numbers (13 million) and beef production is the largest sector of the Texas agriculture industry.

Texas is number one in the Nation in:

Total Cattle

Ranches Beef

Cows

Feedlot Cattle (tied with Nebraska)



Beef Cattle Production Systems:

Cattle production in the U.S. encompasses many different types of operations and the predominant types are listed below.

A. Cow-Calf Production involves cows and heifers mated to bulls, either by natural service or artificial insemination, to produce a **calf crop**. Various breeding programs are utilized to achieve the desired result. The two types of cow-calf producers include **commercial** and **purebred** breeders.

1. **Commercial producers** raise steers and heifers that are generally sold at weaning and destined to become slaughter animals. However some operations retain ownership of cattle through the feedlot and merchandise them at market weight.
2. **Purebred breeders** specialize in **seedstock production** meaning that these calves are destined to become part of breeding herds or become bulls from which semen can be collected for artificial insemination purposes.

Top 5 U.S. Beef Cow/Calf Operations Number of Cows, 2018

1. Deseret Cattle & Citrus, FL
2. J.R. Simplot Co., ID
3. King Ranch, Inc., TX
4. Silver Spur Land and Cattle, WY
5. Lykes Bros., Inc., FL

Top 5 Seedstock Operations Calves Produced Per Year, 2018

1. Express Ranches, OK
2. Gardiner Angus Ranch, KS
3. 44 Farms, Cameron, TX
4. Leachman Cattle of Colorado, CO
5. Ludvigson Stock Farms, Billings, MT

Reproduction Summary for Breeding Operations:

Age at Puberty: Bulls - 10 (6-10 months) Heifers - 10 (4-14) months

Estrous Cycle: Length of Cycle - 21 (18-24) days

Length of estrus - 18 (10-26) hours

Time of ovulation - 12 (4-6) hours post-estrus

Signs of Estrus: Stands to be mounted / Nervous / Mucus secretion from vulva / Roughened hair over tail

Breeding Ratio: Pasture mating - 1:25-30 (Young bulls 1:15 / Mature bulls 1:30)

Time to breed in cycle: Mid to late estrus

Gestation length: 283 (275-290) days

Beef Cattle Production Systems:

B. Stocker Operations utilize available forages or roughages to grow cattle from weaning until weight- ready for entrance into the feedlot. In addition, replacement heifers for cow-calf operation are generally handled in a similar manner from weaning to yearling age.

C. Feedlot Production (30,320 feedlots in US) involves feeding high concentrate rations to cattle in a large confinement facility specifically designed for finishing cattle. When cattle are deemed market ready as determined by finish and weight, cattle are sold to a commercial meat processor for conversion to consumer product. The two types of feedlot operations include **commercial cattle feeding** operations and **farmer-feeder**.

Top 5 U.S. Feedlots One Time Capacities, 2015

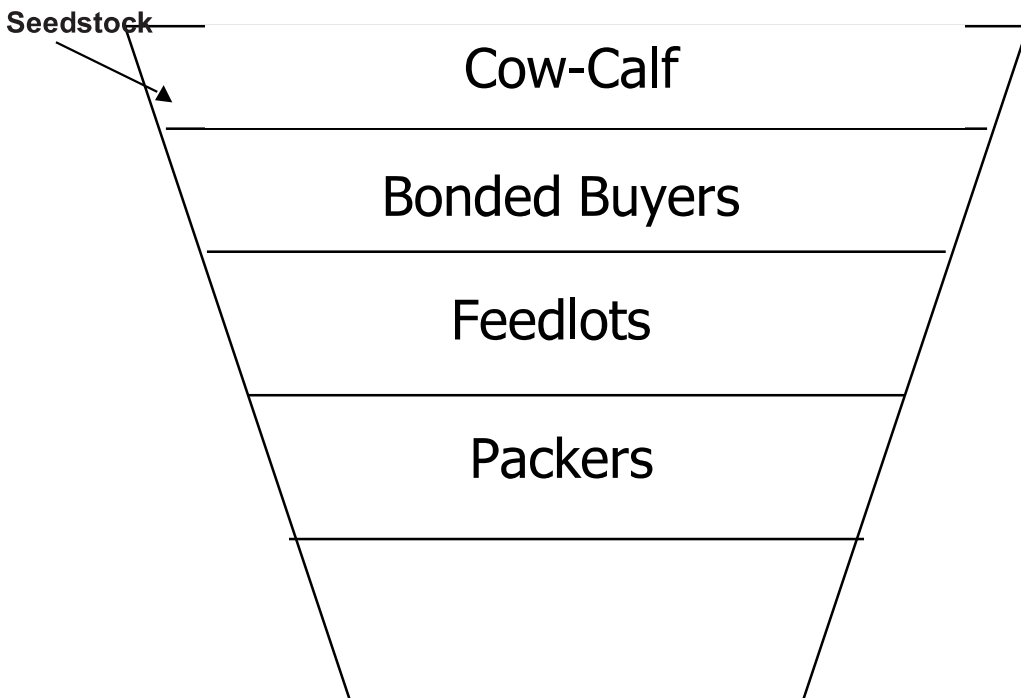
1. Five Rivers Cattle Feeding, LLC., KS, TX, CO, OK, ID, NM, AZ
2. Cactus Feeders, Inc., TX, KS
3. Friona Industries, L.P., TX
4. Irsik and Doll Services, Inc., KS
5. Green Plains Cattle Company, TX, KS, CO

1. **Commercial feeders** are generally quite large with capacities of up to 40,000 to 100,000 head. Corporations often own these operations (81% of all cattle on feed).
2. **Farmer-feeder** producers have capacities less than 1000 head and accounts for approximately 19% of the feedlot cattle in the U.S.

D. Check-off funding \$1/hd. each time sold – monies utilized for research, advertisement and marketing of beef products.

E. Feedyard cost of Gain: 80-85/pound

Beef Control Funnel:



Retailers

Top 20
Control
59.6%

Consumers

Common Management Practices:

IDENTIFICATION

There are various methods of identification for cattle. Cattle identification should provide individual, permanent identity, information about each animal, and should be easy to recognize.

Methods of Identification

Combination tattoo and ear tag: A tattoo is a permanent set of digits placed in the ear by using ink and tattooing pliers. An ear tag is generally made of plastic and is placed in the ears. It provides semi-permanent identification while the tattoo is permanent identification.

Hot or Fire Branding: Fire branding of the hide with hot irons is one of the oldest and most permanent methods of identification. This technique can be used to establish legal ownership and individual identification.

Freeze Branding: Freeze branding cattle with super-chilled irons has developed in recent years. The hair in the area of the freeze branding is discolored due to the extreme cold. This technique is particularly successful when utilized on black cattle.

Electronic Ear Tags: The use of electronic ear tags is increasing, especially in European countries. This is a newer technology that allows for identification of an individual animal or carcass to be traced to its point of origin. The advantage to electronic ear tags is that the means of identification are industry-wide and not recognizable only to individual producers. There is additional cost to electronic ear tags, but tags can be reused.

CASTRATING BULL CALVES

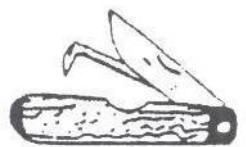
Castration is removing the testicles from bulls or in some manner rendering them nonfunctional. It is universally practiced by cattlemen in the United States.

Purposes for Castrating

Steers are more docile in temperament and less restless in the feedlot. Bulls tend to fight and ride each other more than steers. Steers produce a carcass with finer texture of lean and more marbling. The hormone secretions that produce the masculine characteristics of a bull are stopped by complete castration. The heavy shoulders and crest of bulls do not develop in a steer. Steers will usually finish in a little less time (fatten quicker). This should not be understood as meaning they have a higher rate of gain, for just the opposite is true. It is not uncommon to obtain gains of 3.0 to 4.0 pounds per day in the feedlot from bulls with steers gaining 2.5 to 3.5 pounds per day on the same ration.

Steers can be mixed with females in pasture or in lots without causing any management problems.

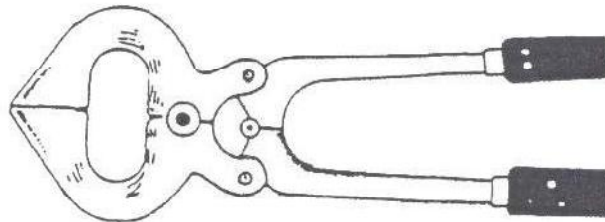
Castration eliminates the possibility of inferior bulls breeding the cows.



Two methods of cutting across the scrotum prior to removal of the testicles



Side slit next to the leg. Lower third of scrotum cut off.



Burdizzo:
The burdizzo is not used very often for castration purposes

DEHORNING CATTLE

Dehorning cattle is the process of removing horns from cattle. If calves are to be sold for slaughter at weaning time it may not be necessary that they be dehorned, but for the other calves it is highly desirable. Dehorning serves many purposes.

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Common Management Practices:

DEHORNING CATTLE

Purposes for Dehorning

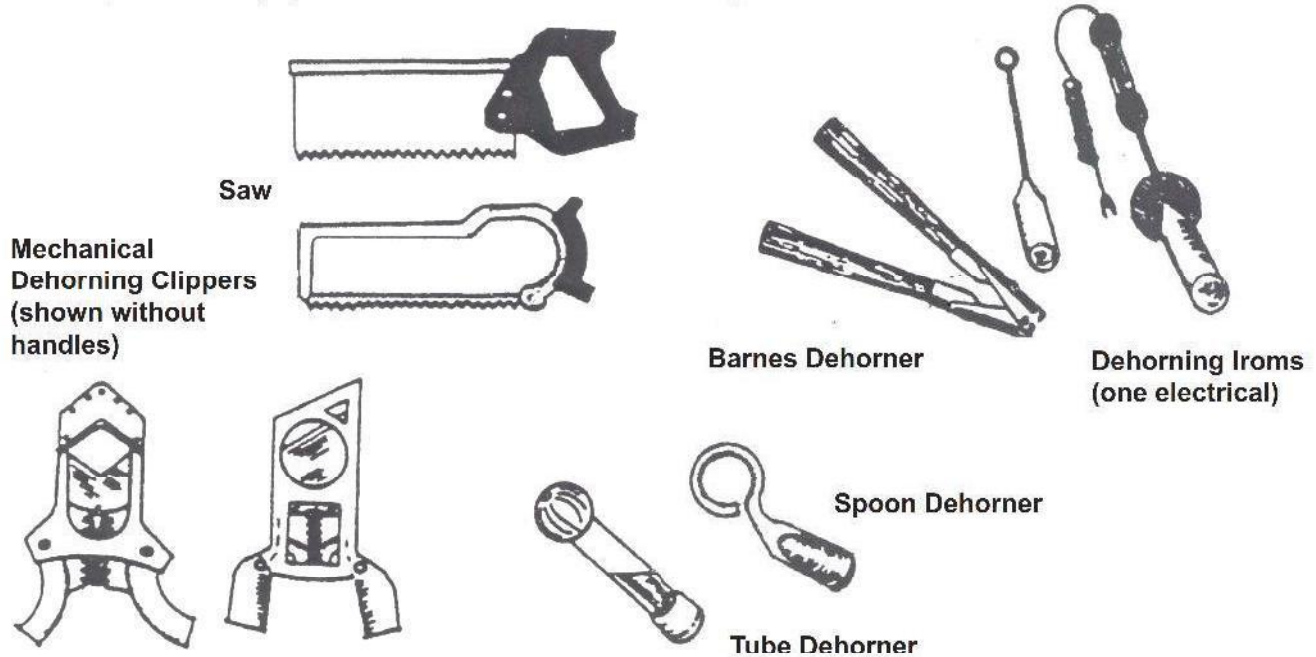
Dehorned cattle look more uniform in groups.

Less shed and feeding space are required for dehorned animals. One has only to observe one "bossy" horned cow run off several other cattle from a feed bunker and eat more than their fair share of the feed to appreciate the advantage of dehorned cattle.

Losses from horn bruises are eliminated at slaughter time or in marketing.

Cattle without horns sell for higher prices because the packer knows there will be less carcass trimming due to horn bruises.

Dehorning reduces injury to men and horses when working cattle



IMPLANTING CATTLE

Implanting cattle is the process of placing a pellet of steroid hormones into the ear of young calves at various time points to accentuate growth potential.

Purposes for Implanting

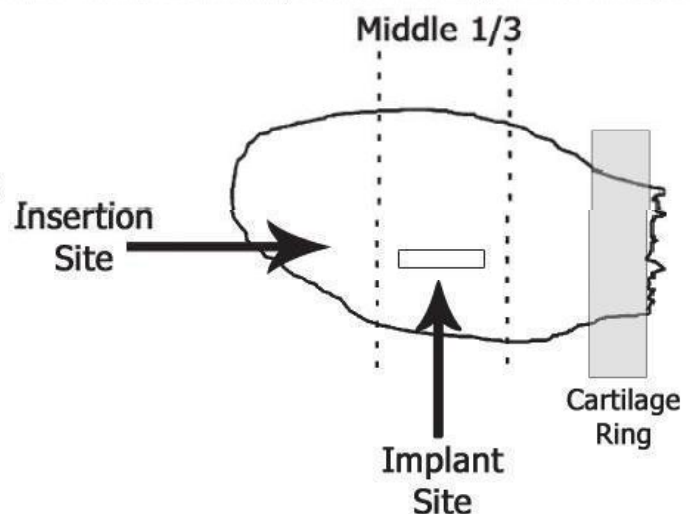
Weaning weight of implanted calves is generally increased 5 to 10% compared to non-implanted calves.

Implanted stocker cattle gain 10 to 15% more than non-implanted feeder cattle.

Implanted feeder cattle gain 10 to 15% more than non-implanted feeder cattle.

Implanted feeder cattle are 8 to 10% more efficient than non-implanted feeder cattle.

Caution should be exercised when implanting heifers that may be utilized as future breeding stock. Use only implants that have been approved for use in breeding beef heifers and follow label directions. The exact magnitude of implant response will depend upon the animal's genetic potential for gain, the animal's plane of nutrition, and environmental conditions.



Common Management Practices:

VALUE ADDED CALF (VAC): Vaccination Management Program

The purpose of a vaccination program is to raise the level of resistance to viruses and other pathogens before a disease challenge occurs. It is critical that the proper vaccines be administered and that adequate time be allowed to develop immunity in an environment where stress is reduced for optimal response. The following vaccination regimes to produce protection against the major viral pathogens are based upon results observed in the Texas A&M Ranch to Rail Program. These regimes resulted in calves with more consistent, predictable, favorable health results. The VAC programs are designed to get the calves ready to enter the various marketing and production channels after they leave the ranch. Other problems that exist at the ranch level are unique to each operation. Consult with your local veterinarian to assess what other health assurance measures are indicated. The following programs are listed below:

Value Added Calf-PreWean (VAC-PreWean)

This program is designed for producers who have the resources to be able to background calves for at least 45 days prior to shipment. This program has been shown to maximize the calf's preparedness to enter various marketing and production channels. There are two vaccination options in this program. One is based upon a pre-weaning vaccination followed by re-vaccination at weaning. The other is based upon vaccination at weaning followed by re-vaccination 14-21 days later. The type of vaccines used depends upon whether or not the calves are nursed or weaned at vaccination. In both options, the cattle are backgrounded at least 45 days after weaning.

Pre-Weaning Option:

Administer CattleMaster 4 vaccine 4-6 weeks prior to weaning. When the calves are weaned, re-vaccinate with one of the Modified Live Virus (MLV) vaccines listed in Table A. Do not re-vaccinate with CattleMaster 4.

Weaning Option:

If the calves did not receive a pre-weaning vaccination, administer one of the MLV vaccines in Table A at weaning and booster it 14-21 days later.

Value Added Calf-PreWean Plus (VAC-PreWean Plus)

Some producers don't have the resources to be able to background calves or vaccinate their calves 4-6 weeks prior to weaning. VAC-PreWean Plus is a vaccination management program designed to increase the level of resistance prior to weaning so that calves have more immunity as they enter various market channels. This program is based upon a pre-weaning vaccination at branding with the calves being shipped at weaning.

Vaccinate with CattleMaster 4 when the calves are worked at 2-4 months of age. Also, administer one of the intranasal vaccines shown in Table B.

Value Added Calf-PreCon (VAC-PreCon)

Producers that purchase weaned calves and background them on pasture or in a drylot situation are a major source of stocker/feeder cattle. VAC-PreCon is a vaccination management program designed to help ensure healthy stocker/feeders. This program is based upon cattle "put together" from various sources that are preconditioned or backgrounded for at least 45 days. VAC-PreCon is exactly like the VAC-45 Weaning Option except it denotes "put together" cattle versus calves of a common ranch origin.

Upon arrival, administer one of the intranasal vaccines listed in Table B and one of the injectable vaccines shown in Table A. Booster the injectable vaccine 14-21 days later.

Value Added Calf-PreWean Plus (VAC-PreWean Plus)

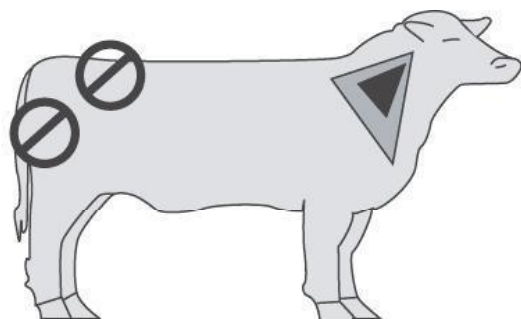
Some producers have the resources to be able to gather their calves prior to weaning, vaccinate them and place them back with the cows for a period of time prior to weaning. This allows time to develop immunity in an environment that is generally less stressful and where exposure to pathogens is minimal. Better immunity is generally established in older calves due to less maternal antibody interference and more functional immune system.

VAC-PreWean Plus is based upon administration of CattleMaster 4 and one of the intranasal vaccines in Table B at 4-6 weeks prior to weaning with the calves being shipped at weaning.

*Information and chart provided by Texas AgriLife Extension
If interested in the VAC programs please ask your TA or professor for the full sheets with Tables included.

Common Management Practices:

Proper Beef Cattle Injection Sites:



Do Not Inject



Subcutaneous (SQ)



Intramuscular (IM)

Beef Cattle Diseases:

Disease	Common Name	Cause	Treatment
Blackleg	-----	Clostridium chauvoci	Penicillin and sulfa drugs
Hemorrhagic Septicemia	Shipping fever	Stress, virus, infection, bacteria	Antibiotics, sulfonamides
Brucellosis	Bangs Disease	Bacteria (Brucella abortus)	N/A
Keratoconjunctivitis	Pink Eye	Moraxella bovis	Antibiotics, sulfonamides
Foot rot	Sore Foot	Bacteria, hooves don't dry out	Dry areas, bluestone solution
Cancer Eye	-----	Excessive gas in the rumen	Must be removed
Bloat	-----	Bacteria (Mycobacterium bovis)	Drench/Puncture rumen
Tuberculosis	TB	Virus	-----
Bovine Papillomatosis	Warts	-----	Toothpaste, pinch, twist off
Urinary Calculi	-----	Improper calcium and phosphorus ratio, genetics	Surgery

Disease	Type of Cattle Affected	Vaccine	Symptoms
Blackleg	4 months to 2 years	7-way vaccine	Swelling of muscles muscular depression
Hemorrhagic Septicemia	Young Calves	Pasturella	Prostration, rapid breathing, high temperature with chills
Brucellosis	-----	Strain 19	Infertility, retained placentas, abortion after 4 months
Keratoconjunctivitis	Common in White-faced cattle	Vaccines containing pink eye	Swollen eyelid, center of cornea appears white
Foot rot	-----	-----	Lameness, swelling of the foot, spreading of the toes
Cancer Eye	-----	-----	Tumor of they eye
Bloat	-----	-----	Left side of abdomen balloons up
Tuberculosis	-----	-----	Internal lesions
Bovine Papillomatosis	-----	vaccines	-----
Urinary Calculi	Primarily in male cattle	-----	Restlessness, unsuccessful attempts to urinate, loss of appetite

Common Management Practices:

Beef Cattle Parasites:

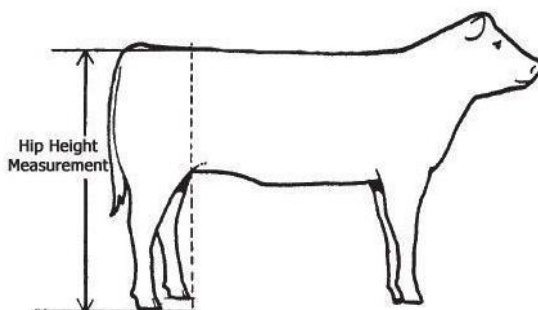
Disease	Common Name	Cause	Treatment
Hornfly	External	Insecticides by spraying or dusting	Devalue hide
Lice	External	Ivomec and insecticide sprays	Devalue hide, Premature shedding, Anemia
Grubs	Internal	Ivomec (Ivermectin)	Affect circulatory system, Affect central nervous system, Devalue hide
Screwworm	External	-----	Flies deposit eggs on open wounds that hatch into maggots and feed on exposed flesh
Stomach worms	Internal	Finbendazole, Levamisole, Thiabendazole, and Ivermectin	May cause cattle to have rough hair coat, Anemia Cattle may appear to be lethargic
Liver flukes	Internal	Curatrem (clorsulon), Albendazole	Decreased performance
Anaplasmosis	Internal	Commercial vaccine	High fever, Anemia, Loss of appetite
Leptospirosis	Internal	Vaccination should occur before breeding season	High Fever, Poor appetite, Abortion at anytime, Bloody urine, Anemia

Beef Cattle Evaluation:

Selection of breeding cattle should be based on visual appraisal and performance records. Important areas to be visually evaluated include size and scale, muscularity, structural correctness, condition, capacity and sex character. Performance records or genetic evaluation such as Expected Progeny Differences (EPDs) provide the best means to achieve goals of breeding programs. Trait selection should focus on those traits that are economically important, easily and accurately measured, and responsive to selection with some degree of heritability. When choosing a replacement heifer, it is important to remember that she is expected to calve at 2 years of age and thereafter maintain a yearly calving interval. Additionally, the years at which the female remains in the herd should be optimized; therefore, special attention should be paid to overall soundness and reproductive potential.

VISUAL EVALUATION

Size and Scale: Size and scale are important traits to evaluate in terms of functional efficiency and growth rate of cattle. Selection emphasis on increased frame size has resulted in faster growing and later maturing cattle physiologically. However, single trait selection for frame size reaches a point of diminishing returns as delayed attainment of puberty and higher feed maintenance requirements can offset growth advantages. Moderation of frame size within the cow herd provides a more efficient production unit, which can be mated to larger framed bulls to achieve advantages in growth rate in terminally marketed offspring.



Beef Cattle Evaluation:

Bull Hip Height Frame Score

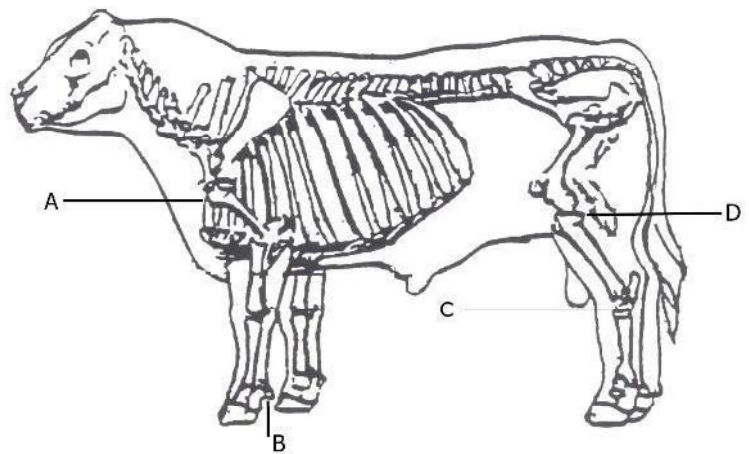
Ages in Months	1	2	3	4	5	6	7	8	9
6	34.8	36.8	38.8	40.8	42.9	44.9	46.9	48.9	51
12	41.0	43.0	45.0	47.0	49.0	51.0	53.0	55.0	57.0
18	44.5	46.5	48.5	50.5	52.4	54.5	56.4	58.4	60.3

Heifer Hip Height Frame Score

Ages in Months	1	2	3	4	5	6	7	8	9
6	34.1	36.2	38.2	40.3	42.3	44.4	46.5	48.5	50.6
12	39.0	41.0	43.0	45.0	47.0	49.0	51.0	53.0	55.0
18	41.7	43.6	45.6	47.5	49.5	51.4	53.4	55.3	57.3

Structural Correctness: Longevity in the beef herd rests with the structural soundness. Soundness basically encompasses skeletal design, especially feet and leg placement.

The shoulder should possess some slope and blend smoothly. Excessive muscularity of the shoulder coupled with heavier birth weights can result in dystocia, so shape of calf is critical at parturition. Evaluation of structural correctness encompasses the following:



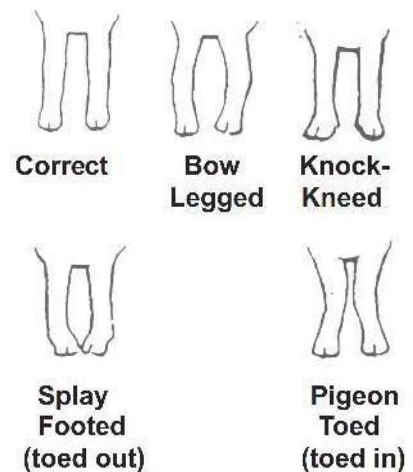
- A. Humerus to Scapula ~ 90°
- B. Pastern Angle ~ 54°
- C. Fibula to Metatarsus ~ 140°
- D. Femur to Tibia ~ 160°

The front legs should be straight, pastern sloped at an approximately 54° angle and possess adequate foot size.

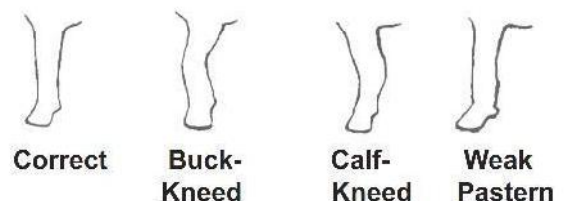
Faults of the forelimb include straightness in shoulder and buck or calf kneed. Calf kneed refers to condition where animal is back at knees and buck kneed is when animal is over at knees. The rear legs should be equally wide at hocks and pasterns from rear view when standing. The angle between the tibia and cannon bone (metatarsus) should approach 160°.

Structural incorrectness of the rear leg include cow hocked, sickle hocked and post legged. Cow hocked refers to condition where hocks turn in when viewed from the rear. Sickle hocked describes condition where too much set exists in hock so animal stands too far underneath body and walks in a similar manner. The highly discriminated fault of the hind leg is post-leggedness, which is described as extreme straightness of the rear leg. There is little or no set associated with the hock of post-legged animals and they travel with short, choppy strides.

Front View:

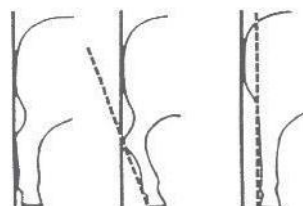


Side View Front Legs:



Side View Rear Legs:

- (A) Correct
- (B) Sickle Hocked
- (C) Post-Legged



Beef Cattle Evaluation:

Condition: The body condition or fleshing ability of cows and heifers significantly influences productive abilities in certain environments. Breeding cattle should be able to maintain their body weight under available feed resources. Increased size often leads to increased leanness and unless additional feed resources are available, it is often difficult for these cattle to maintain their body flesh, produce milk for the calf and rebreed readily.



Below Optimal



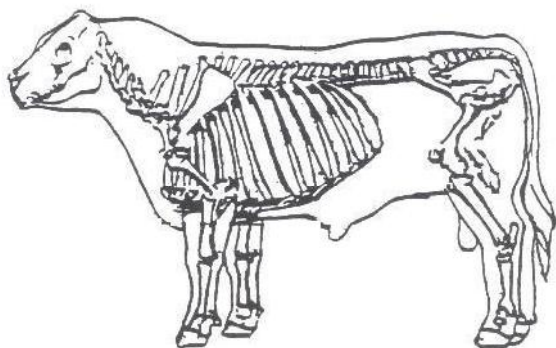
Optimal



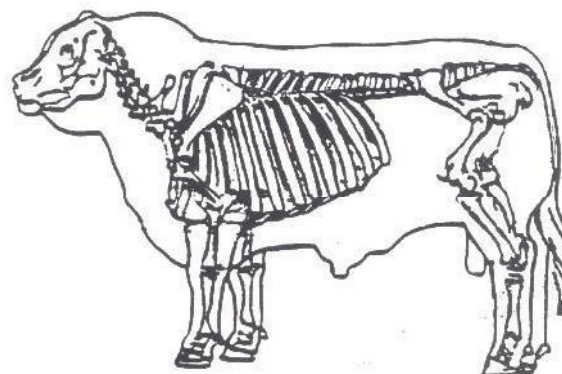
Above Optimal

Fat: Excessive fattening of heifers can result in fat deposition within mammary tissue and decrease subsequent milk production.

Capacity: Capacity refers to the shape of the ribcage and width of the chest floor. Performance oriented cattle generally have greater body capacity and are easier fleshing. Shallow bodied cattle lacking capacity are generally slower growing and harder to maintain in an acceptable condition score.



Wider through ribs and sternum, which portrays its true body capacity











Appears to have more depth of body due to fat thickness; however, it is shallower through the ribs and sternum

Sex Character: Sex character relates to hormone production within the particular animal and, to an extent, can be related to reproductive potential.

Bulls: Testosterone produced by bulls increases muscle development and delays fattening. Bulls are generally more expressive in their muscularity and possess a more pronounced crest on neck. Testicular development in bulls is critical as scrotal circumference is correlated with sperm production and fertility. A scrotal circumference of greater than 30 cm for yearling bulls is generally considered acceptable. Data has also shown heifers sired by bulls with above average scrotal circumference reach puberty earlier.

Heifers/Cows: Estrogen produced by females influences shape with females exhibiting a smoother, more feminine appearance and greater refinement about the head, neck and shoulder. The adequate development of the vulva and udder are also important in heifers, as these are external signs of reproductive tract development.

Guide to Determining the Age of Cattle by the Teeth:

Drawing	Age of Animal	Description of Teeth
	At birth to 1 month	Two or more of the temporary incisor teeth present. Within first month, entire 8 temporary incisors appear.
	2 years	As a long-yearling, the central pair of temporary incisor teeth or pinchers is replaced by the permanent pinchers. At 2 years, the central permanent incisors attain full development.
	2½ years	Permanent first intermediates, one on each side of the pinchers, are cut. Usually these are fully developed at 3 years.
	3½ years	The second intermediates or laterals are cut. They are on a level with the first intermediates and begin to wear at 4 years.
	4½ years	The corner teeth are replaced. At 5 years the animal usually has the full complement of incisors with the corners fully developed.
	5 or 6 years	The permanent pinchers are leveled, both pairs of intermediates are partially leveled, and the corner incisors show wear.
	7 to 10 years	At 7 or 8 years, the pinchers show noticeable wear; at 8 or 9 years, the middle pairs show noticeable wear; and at 10 years, the corner teeth show noticeable wear.
	12 years	After the animal passes the 6th year, the arch gradually loses its rounded contour and becomes nearly straight by the 12th year. In the meantime, the teeth gradually become triangular in shape, distinctly separated, and show progressive wearing to stubs. These conditions become more marked with increasing age.

Evaluation of Performance Data:

The Beef Improvement Federation establishes recommendations for producers to use for evaluation of beef cattle performance. The formulas and adjustment factors listed in the following section are from the federation's "Guidelines for Uniform Beef Improvement Programs".

REPRODUCTIVE PERFORMANCE

The production of a live calf from each cow on a yearly basis is the primary objective of any breeding program. Two measurements of this include conception rate and percentage calf crop weaned.

Conception rate = $\frac{\text{number of cows pregnant at end of breeding season}}{\text{number of cows exposed to bull or A.I.}} \times 100$

Percentage calf crop weaned = $\frac{\text{number of calves weaned}}{\text{number of cows exposed to bull or A.I.}} \times 100$

Beef Cattle Evaluation:

MATERNAL PERFORMANCE

Weaning Weight: The weaning weight of the calf reflects both the milking ability of the dam and the calf's genetic ability for growth. To accurately assess weaning weight, several known sources of variation should be considered and adjustments made accordingly.

Adjustments should be made for the following:

- 1. Weaning age of calf:** The standard age is 205 days and Beef Improvement Federation recommends weaning calves from 160 to 250 days of age and adjusting to 205-day standard.
- 2. Age of dam:** It is well documented in research by data that mature cows, age 5-10 years, produce more milk than both their younger and older herd mates. An adjustment factor from the following table is included in 205 day adjusted weaning weights to make fair comparisons.
- 3. Sex of calf:** It is well documented that male calves grow faster than their female counterparts. An adjustment factor for sex of calf is incorporated into the age of dam adjustment factor.

**Age of Dam & Sex of Calf
Adjustment Factors (lbs.)**

<u>Age of Dam (yrs.)</u>	<u>Male Calf</u>	<u>Female Calf</u>
2	60	54
3	40	36
4	20	18
5-10	0	0
11 +	20	18

With these adjustments considered, the calculation for weaning weight is:

$$\text{Adjusted 205 day (Weaning Wt.)} = \frac{[(\text{Actual weaning wt.} - \text{birth wt.}) \times 205]}{\text{Age in days at weaning}} + \text{Birth wt.} + \frac{(\text{Age of Dam and sex of calf Adjustment factor})}{\text{Age in days at weaning}}$$

Cow Efficiency: The adjusted weaning weight of the calf as a percentage of the cow weight at 205 days reflects the producing ability of the dam and allows for accurate comparisons of cows varying in frame size. Since larger framed cows require greater maintenance feed requirements, this efficiency indicator allows producer to determine functional efficiency of individual cows. The goal is for a cow to wean 50-60% of her body weight in calf weight.

$$\text{Cow Efficiency} = \frac{\text{Adjusted weaning weight of calf}}{\text{weight of cow at calf's weaning}} \times 100$$

Growth Performance: The most accurate measure of a calf's genetic ability for growth is yearling weight. Yearling weight or 365-day weight reflects maternal influence and growth to weaning coupled with calf's growth performance from weaning to a year of age.

$$\text{Adjusted 365-d Weight} = (\text{ADGPW} \times 160) + \text{Adj. Weaning Wt.}$$

$$\text{where, ADGPW} = \frac{\text{Actual Yearling Wt.} - \text{Actual Weaning Wt.}}{\text{number of days between weights}}$$

Efficiency in growth performance is related to the quantity of feed required per unit of gain.

$$\text{Feed Efficiency} = \frac{\text{Lbs. of feed consumed}}{\text{weight gain in lbs.}}$$

Genetic Evaluation:

The age of computers and methodology developed by C.R. Henderson (1972) has given rise to methods of genetic evaluation (expected progeny difference) that utilizes performance data accumulated from an individual and performance values from ancestors, parents, relatives and offspring to predict genetic merit. The major cattle breed associations have adopted the program and are currently using such genetic evaluations as a basis for selection decisions. The important terms associated with the program are listed below:

Expected Progeny Difference (EPD): Predicts the difference in performance of future offspring of a parent, as compared to progeny from other parents, when each are bred to mates of equal value.

EPDs IMPORTANT IN BREEDING BEEF CATTLE SELECTION

(Examples taken from the North American Limousin Foundation)

Dystocia - Factors influencing:

Birth weight of calf / Sex of calf / Pelvic size of heifer/cow

Birth Weight EPD: Birth weight is an important factor contributing to calving difficulty. Birth weight EPD of sires has been shown to be the most accurate genetic predictor of calf birth weight.

Consider the following bulls:

	Birth Wt. EPD
Bull A	-2.5 lbs
Bull B	+2.5 lbs
Difference	5.0 lbs

*If bulls A & B were bred to similar heifers, we would expect calves from bull A to have birth weights that average 5 lbs less than calves from bull B. Should mean less potential for calving difficulty

Weaning and Yearling Weight EPDs: Expressed as the expected added pounds of weaning and yearling weight of offspring due to growth genes from the parent. Consider the following bulls:

	Weaning Wt. EPD	Yearling Wt. EPD
Bull A	+15 lbs	+30 lbs
Bull B	+5 lbs	+10 lbs
Difference	10 lbs	20 lbs

*Bull A, compared to Bull B, is expected to pass on genes that will result in calves that average 10 and 20 lbs more at weaning and a year of age, respectively.

Milking Ability EPD: Expressed as the additional lbs. of weaning weight of calves from daughters due to genes for milk passed on from the sire (or dam) to the daughters.

	Milk EPD
Bull A	+5 lbs
Bull B	-5 lbs
Difference	10 lbs

*Daughters of bull A are expected to wean calves that average 10 lbs more than the calves of the daughters of bull B, due to genes for milking ability the daughters inherited from their sires.

Total Maternal EPD: This EPD combines weaning and milk EPDs to predict the total weaning weight difference of calves from daughters. These are calculated by adding an animal's milk EPD to 1/2 of the animal's weaning weight EPD. This reflects the fact that a calf's weaning weight is affected by genes affecting its dam's lactation and 1/2 of its dam's genes for growth that were passed to the calf.

	Weaning Wt. EPD	Milk EPD	Total Maternal EPD
Bull A	+15 lbs	+5 lbs	+12.5 lbs
Bull B	+5 lbs	-5 lbs	-2.5 lbs
Difference	10 lbs	10 lbs	15 lbs

Genetic Evaluation:

Daughters of bull A would be expected to produce offspring that average 15 lbs more than offspring produced by daughters of bull B. The average 15 lb advantage is due to genes for milk that the sire passed to his daughter and genes for weaning growth that the daughter's calves inherited from their maternal grandsire.

Accuracy: The degree of confidence or amount of variation associated with an EPD. Ranges from 0 to 1.0 with larger values indicative of more certainty in a sire's value for a trait. Therefore, there is less variation observed in his progeny for a particular trait.

Possible Change Values for EPDs of Various Traits (possible change + or -)

BIF Accuracy	Birth Weight	Weaning Weight	Yearling Weight	Milking Ability
.10	2.8	15.0	22.0	13.7
.50	1.6	8.1	11.5	7.4
.90	0.4	1.5	2.1	1.4

	Birth Weight	Accuracy	
Bull A	+2.5	.50	*The birth weight EPD of Bull A ranges from 0.9 to 4.1.
Bull B	-2.5	.90	*The birth weight EPD of Bull B ranges from -2.9 to -2.1 lbs.
Difference	5.0	.40	

ANSC 108 Cattle Performance Records Example:

(Scenario)

You have been hired as a consultant to work with the performance records of a cow-calf operation. The herd consisted of 100 cows for the breeding season. The veterinarian palpated the cows at conclusion of the 60-day breeding season and determined that 95 were pregnant. Open or nonpregnant cows were sold at that time. Following the gestation period, 88 cows had live calves during the calving season and 85 actually weaned calves. The average adjusted 205-day weight for all bull calves was 500 pounds. The top three bulls calves for weaning weight were placed in a bull test station immediately following weaning. The pen of three bulls (9110, 9116, 9125) consumed 11,800 pounds of feed over the 165-day postweaning test period. The remainder of the bull calves were castrated at weaning and placed in a feedlot. All heifer calves were raised to a year of age and the adjusted yearling weight for the group was 900 pounds. The record of the highest performing heifer is listed below.

Calf No.	Sex	Birth Wt.	Age at Weaning	Weaning Wt.	Age of Dam	Dam's Wt.	Age Wt. Yearling Wt. (Yearling)
9110	Bull	95	220	750	3	1250	385 1300
9116	Bull	90	210	685	4	1280	375 1265
9125	Bull	85	195	705	5	1140	360 1280
9142	Heifer	80	195	675	2	1050	355 1170

1. Determine the conception rate of the herd.

$$95/100 = 95\%$$

2. Calculate the calf crop percent weaned.

$$85/100 = 85\%$$

3. Calculate the fully-adjusted weaning weight of bull calf no. 9110.

$$ADJ. 205 WW [(750-95/220) \times 205] + 95 + 40 = 74$$

ANSC 108 Cattle Performance Records Example:

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Continued from previous page:

4. Determine the weaning weight ratio of bull calf no. 9110.

$$745/500 \times 100 = 149$$

5. Determine the cow efficiency at weaning for the dam of bull calf no. 9110.

$$745/1250 \times 100 = 59.6$$

6. Calculate the fully-adjusted weaning weight of heifer no. 9142.

$$\text{ADJ. 205 WW} [(675-80/195) \times 205] + 80 + 54 = 759.51 \quad (760)$$

7. Calculate the fully-adjusted yearling weight of heifer no. 9142.

$$\text{ADJ. YW} [(1170 - 675/160) \times 160] + 760 = 1255$$

8. Calculate the yearling weight ratio of heifer no. 9142.

$$1255/900 \times 100 = 139.4$$

9. Calculate average daily gain of bull calf no. 9125 for postweaning test period.

$$(1280 - 705)/(360 - 195) = 3.48$$

10. Determine feed conversion of pen of three bulls for postweaning test period.

$$11,800/1705 = 6.92 \text{ LBS FEED PER POUND GAIN}$$

$$1300 - 750 = 550$$

$$1265 - 685 = 580$$

$$\underline{1280 - 705 = 575}$$

$$550 + 580 + 575 = 1705$$