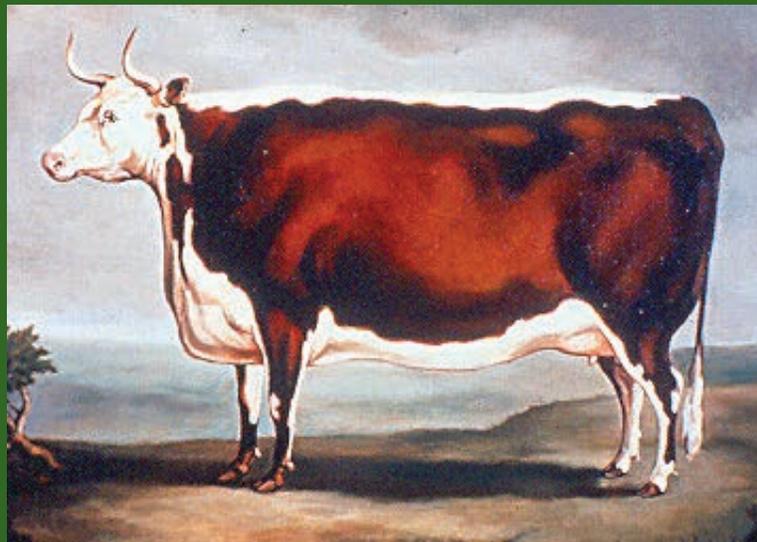


Texas Adapted Genetic Strategies for Beef Cattle V: Type and Breed Characteristics and Uses



A 1700s painting of the foundation cow of an early cattle breed. (Source: Michigan State University Animal Science Department)

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The subject of breeds intrigues most beef cattle producers. However, breeds are only part of a genetic strategy, which should include:

- Matching applicable performance or functional levels to environmental, management, and marketing conditions
- Choosing a breeding system, either continuous (in which replacement females are produced within the herd) or terminal (in which replacements are introduced externally)
- Selecting functional types, breeds within types, and individuals within breeds that are compatible with the performance levels needed and breeding system chosen

Genetic classifications and breeds

Cattle have been divided into two basic classifications, *Bos taurus* (non-humped) or *Bos indicus* (humped, also called Zebu). Because these two types readily interbreed,

some authorities now classify them as *Bos taurus*, subspecies *taurus*, and *Bos taurus*, subspecies *indicus*, or simply call them taurine and indicine.

Cattle are not native to the western hemisphere; the *Bos taurus* in the United States originally came from the British Isles and western continental Europe. Although the *Bos indicus* originated in south central Asia, most in the United States came by way of Brazil.

Although it has no strict biological definition, a breed can be described as a group of animals of common origin with certain distinguishing characteristics that are passed

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from parent to offspring. Breed characteristics result from both natural selection and from that imposed by people.

Most breeds have registry associations that record ancestry, define and document characteristics, and promote the breed. About 75 breeds have registry associations in the United States.

For a discussion of breed development, see another publication in this series by the Texas A&M AgriLife Extension Service, *Texas Adapted Genetic Strategies for Beef Cattle—VI: Creating Breeds*.

Functional traits or characteristics

The major functional traits that are important in beef production in Texas are body size and growth, milking potential, age at puberty, hot climate adaptability, fleshing ability, muscle expression, cutability, and marbling. The estimates of functional trait levels listed below are based on breed averages; individuals can vary considerably within breeds.

Body size and growth

Inherent body size is best evaluated as weight at the same level of body condition or fatness. However, growth or rate of gain is often evaluated over time-constant periods or to the same age; this type of comparison can produce differences in fatness among individuals of different functional types or breeds within types.

As a result, evaluations of rate of gain and feed efficiency over time- or age-constant periods often differ from evaluations of cattle at the same level of fatness. Genetically larger, later-maturing animals generally gain faster and more efficiently than do smaller, earlier maturing animals over time- or age-constant periods but often not when fed to the same level of fatness. Weight also correlates closely with nutritional requirements for body maintenance.

Although there are individual exceptions, cattle that are heavier at birth tend to be heavier throughout life. An important exception is in *Bos indicus*. Calves of *Bos indicus* **dams**, even by *Bos taurus* sires, tend to be relatively smaller at birth than later in life, usually resulting in fewer difficulties in calving. However, calves by *Bos indicus* **sires** out of *Bos taurus* dams often are relatively large at birth, so calving may be more difficult.

Size is discussed in *Texas Adapted Genetic Strategies for Beef Cattle—III: Body Size and Milking Level*. Frame score, an objective measure of skeletal dimension used to estimate current and future body size, is discussed in *Texas Adapted Genetic Strategies for Beef Cattle—X: Frame Score and Weight*.

Milking potential

Milking potential is the genetic capability to produce milk. It is not the actual volume of milk produced, which is also influenced by the cow's nutrition and the calf's nursing pressure.

Estimate milking potential in relation to body size. Higher-milking females need more nutrients for body maintenance and require higher-quality diets, even when not lactating. Again, see *Texas Adapted Genetic Strategies for Beef Cattle—III: Body Size and Milking Level*.

Age at puberty

Age at puberty relates to body size, milking potential, and genetic classification. Smaller individuals and higher milking types usually mature earlier; *Bos indicus* mature relatively late. Although higher milking females, even large ones, often reach puberty and conceive when relatively young, their subsequent reproductive performance can suffer because they may become thin after beginning lactation and therefore be slow to start cycling. While *Bos indicus* types reach puberty relatively late, their productive life is usually longer.

Heat tolerance

The cattle best adapted hot climates are those with *Bos indicus* inheritance. However, to a lesser degree, some *Bos taurus* animals do have heat tolerance, especially those with dark skin and lighter-colored short hair coats.

High humidity intensifies the effects of heat because it decreases the ability of respiration to reduce heat load. Also, hot, humid climates often add the stresses of parasites and low-quality forage. Heat with high humidity will stress cattle that fail to shed long, thick hair coats, particularly those that are dark colored.

As might be expected, animals tolerant to hot climates are relatively less adapted to cold.

Fleshing ability/fatness

Fleshing ability, or inherent fatness, is the body's capacity to fatten and retain fat. Fleshing ability tends to decrease with rises in maintenance requirements relative to body size, milking level, or muscularity. Also, larger animals may be unable to consume enough forage when it is sparse, thus reducing fatness. Animals poorly adapted to their environment generally are less able to maintain and increase flesh.

Compared to *Bos taurus*, *Bos indicus* often flesh more easily on low-quality forage and roughage. Easy-fleshing cattle may better tolerate periods of nutritional

energy deficiency and, therefore, may reproduce more consistently. However, they may also over-fatten more readily in the feedyard unless they are fed for a shorter period than is typical.

Muscle expression

Muscle expression is inherent muscularity relative to body size. Muscling is the second most important factor in cutability, or leanness. Some heavy-muscled types may also have less fleshing ability, which reduces their reproductive efficiency.

Cutability

Cutability is usually evaluated in beef carcasses as USDA Yield Grade. Cutability depends on the relative proportions of fat (which varies most), muscle, and bone (which varies least).

Cutability is most commonly evaluated over time-constant feeding periods; in this type of evaluation, the animals that grow faster and mature later tend to be higher in cutability. However, producers can manipulate fatness, and therefore cutability, by varying nutrition and length of feeding.

Marbling

Marbling, or intramuscular fat, is the primary factor determining USDA Quality Grade, an indicator of the palatability factors of tenderness, juiciness, and flavor. Marbling increases with age up to physiological maturity and generally is higher in earlier-maturing types.

Marbling can generally be increased by feeding high-energy rations for extended periods starting early in life.

Bos indicus and most heavy-muscled, later-maturing types tend to have relatively low marbling. Because marbling tends to increase with overall body fatness, comparing types or breeds usually involves a trade-off between Yield Grade and Quality Grade. As one improves, the other tends to decline. Also, as with cutability, marbling can be affected by nutrition and length of feeding.

For a discussion of carcass genetic considerations, see *Texas Adapted Genetic Strategies for Beef Cattle—IX: Selection for Carcass Merit*.

Functional types and their best uses

U.S. cattle can be categorized into six primary functional types based on their genetic classification and levels of functional traits. The trait rankings in Table 1 are based on breed-comparison research conducted for over 40 years at the U.S. Meat Animal Research Center (MARC) at Clay Center, Nebraska, as reported in 2012.

For yearly updates of breed genetic trends calculated each July by MARC, see the *Beef Improvement Federation Proceedings* at beefimprovement.org. Use the proportions of the constituent breeds to estimate the characteristics of multi-breed cattle.

Differences in some functional levels among breeds have changed over the years. This is particularly true when comparing Continental breeds to other types. Compared to the existing breeds, most of the Continental breeds that came to the United States in the late 1960s and 1970s were considerably larger and, in some cases, notably higher in milk production. Since then, some of these differences have diminished or even disappeared as increased weight and milk have been emphasized in selection of breeding stock within existing breeds.

There is no “best” type or breed for beef production because of extensive variation in climates, production conditions, and market preferences. These factors often cause differences in optimal functional levels of all traits.

For more information, see *Texas Adapted Genetic Strategies for Beef Cattle—II: Genetic-Environmental Interaction*.

Following is a list of the types and most numerous breeds in Texas, presented alphabetically within type, and their best uses based on functional characteristics. Keep in mind that individual animals within a breed can vary considerably.

- **British Beef**

The British Beef type consists of British-originated breeds that were developed and used for beef production only: Angus, Hereford, Red Angus, and Shorthorn. British Beef are widely applicable, with some limits in subtropical and, especially, tropical climates. These breeds are the most numerous in the U.S. beef herd.

Producers who use only one breed, i.e., for straightbreeding, often choose a British breed. To take advantage of hybrid vigor, cross them with other breeds of this type or with any other type.

British breeds are suitable for general-purpose production as well as for both the dam and sire sides of a terminal cross, depending on the target market.

- **Continental Beef**

These are Continental European breeds and derivatives developed exclusively for beef production where they originated and used in the United States for the same purpose: Charolais, Limousin, and Maine-Anjou. These breeds are part of what were once sometimes called “exotics.”

The most effective use of Continental Beef has been as terminal sires. When selecting sires for this group, pay attention to birth weight and calving ease, especially for use on smaller dams. If desired, Continental Beef increases muscling and leanness in females without elevating milk production.

In general, do not straightbreed this type or cross it with other Continentals. These breeds vary in adaptability to hot climates.

- **Continental Dual Purpose**

These breeds were developed and selected for both beef and dairy production in their native areas: Braunvieh, Gelbvieh, Salers, and Simmental. U.S. producers use these breeds only for beef. They are the other part of “exotics.”

As with Continental Beef, these breeds are often used as terminal sires. Maternal use of this type can create females that are leaner, more muscular, and possibly higher milking.

Use the same cautions as with the Continental Beef type in birth weight, straightbreeding, and crossing with other Continentals.

- **Dairy**

These breeds originated in western Continental Europe or the British Isles and are used in the United States for dairy purposes only: Holstein and Jersey. Beef is produced secondarily from these breeds. Though uncommon, the dairy type could be used to create crossbred early-maturing, high-milking, moderate-muscled females for beef production. Smaller cattle of this group may also

Table 1. Rankings of functional levels of the most numerous cattle breeds in Texas.¹

Functional type breed	Growth and size ²	Milking potential	Age of puberty ³	Heat tolerance	Fleshing ability	Muscling	Cutability ⁴	Marbling ⁴
British Beef								
Angus	5	3–4	4	1	3	3	2	5
Hereford ⁵	4	2	3	1	3	3	2	3
Red Angus	4	3	4	1	3	3	2	4
Shorthorn	4	3–4	4	1	3	3	2	4
Continental Beef								
Charolais	5	2	2	1	2	4	5	2
Limousin	4	1	2	1	2	5	5	1
Maine-Anjou	4	2	3	1	2	4	4	2
Continental Dual Purpose								
Braunvieh	3	3	3	2	2	4	4	2
Gelbvieh	4	4	4	1	2	4	4	2
Salers	4	3–4	3	1	2	3	4	3
Simmental	5	3–4	3	1	2	4	4	2
Dairy								
Holstein	5	6	4	1	1	2	4	3
Jersey	1	5	5	2	2	1	1	5
Bos indicus								
Brahman	4	4	1	4	3	3	3	1
American								
Beefmaster	4	3	3	3	3	3	3	2
Brangus	4	3	3	3	3	3	3	3
Santa Gertrudis	4	3	3	3	3	3	3	2
Specialty								
Texas Longhorn	1	2	3	2	3	1	3	2

¹ Breeds most numerous in Texas that have been evaluated by U.S. Meat Animal Research Center (MARC). Rankings are estimates of purebred breed-wide averages reported by MARC IN 2012. See text for explanation of productive functions. Higher numbers = greater expression of the trait. Range exists within these levels, so breeds with the same numerical designation do not necessarily average exactly the same level. Also, considerable individual variation exists within breeds. Levels for cattle of multi-breed background can be estimated from proportions of the constituent breeds.

² Rate of gain and mature weight.

³ Higher numbers=earlier expression of puberty

⁴ On time-constant feeding. See text for explanation.

⁵ Horned and polled.

maintain or possibly increase fertility if body condition is maintained.

However, it may be difficult to keep dairy crosses in good flesh on typical rangeland or coarse pasture, especially those of large body size. Significant price discounts are common for stocker and feeder animals of visible dairy breeding.

- **Bos indicus**

This group contains straight *Bos indicus* and are used only for beef production: American Brahman. They are used primarily to create crossbred females that are adapted to hot climates and have the most longevity, hybrid vigor, and calving ease.

Generally, these females are best used in terminal crossing systems. Do not straightbreed or cross them with other cattle containing *Bos indicus*, unless persistently hot and humid climatic conditions preclude any other logical choice.

- **American**

This type includes beef breeds that were created in the United States from combinations of about 3/8 to 1/2 Brahman, with the remainder usually consisting of a British Beef breed or breeds, or a Continental breed: Beefmaster, Braford, Brangus, Red Brangus, Santa Gertrudis, and Simbrah.

American breeds are widely applicable, especially for but not limited to hot climates.

They can be straightbred, crossed with other American breeds, or crossed with other types except for purebred or high-percentage *Bos indicus*. American breeds can be used effectively in general-purpose production and in terminal systems. They often can be the most logical choice for sires used in natural service in hot climates.

- **Specialty**

These breeds cannot be placed logically in any of the types above. They are often characterized by strong emphasis on certain traits: Texas Longhorn.

Specialty breeds vary considerably in level of functional traits. They may be used where their particular combinations of unusual traits are needed or desired.

- **“New” intermediate types**

Just as *Bos indicus* and *Bos taurus* were combined years ago to form intermediates now known as American breeds, newer intermediates have been formed. One involves combining Continental and British breeds. The more nu-

merous of those combinations (and their registry associations) include Beef Builder (Braunvieh), ChiAngus (Chianina), Balancer (Gelbvieh), LimFlex (Limousin), MaineTainer (Maine Anjou), Optimizer (Salers), and SimAngus (Simmental). Also, some American or *Bos indicus* have been combined with British or Continental to reduce the proportion of *Bos indicus* to 1/4 or less. The more numerous of these breeds are Angus Plus (Red Angus), Advancer (Beefmaster), UltraBlack and UltraRed (Brangus), Southern Balancer (Gelbvieh), and SimAngus HT (Simmental).

Use the proportions of their constituent breeds to estimate the functional characteristics of these new intermediate types and therefore their best uses in commercial herds.

Matching functional levels to production criteria

Climate and nutrition are key variables affecting where differing groups and breeds can be used efficiently. Production suffers when cattle are not adapted to climatic conditions. In hot, humid climates, cattle benefit from some *Bos indicus* or other tropical-adapted genetics.

Table 2, from the Beef Improvement Federation, shows the effects of nutrition on the optimum levels of the three primary production functions in cow herds. In general, as nutrition declines, the smaller, lower-milking, easier-fleshing cattle are better adapted and more efficient. This is discussed in detail in *Texas Adapted Genetic Strategies for Beef Cattle—III: Body Size and Milking Level*.

Appropriate functional levels can differ depending on the breeding system implemented.

Cattle for general-purpose, continuous systems should contain a blend of important production traits in both sires and dams.

Conversely, dissimilar types may be more effectively used in terminal systems. To reduce cow herd nutritional needs or increase stocking rate, use rela-

Table 2. Matching cowherd functional levels to nutrition (Source: Beef Improvement Federation).

Nutritional availability ¹	Mature size	Milking potential	Fleshing ability
Low	Low to Medium	Low to Medium	High
Medium	Medium	Medium	Medium to High
High	Medium to High	Medium to High	Medium

¹ Quantity, quality, and consistency of nutrition whether from grazing, harvested forage, or supplemental concentrates

tively small terminal dams complemented by high-growth sires. Maternal ability is unimportant in terminal sires because their heifers are not kept for replacements.

For more discussion on breeding systems, see *Texas Adapted Genetic Strategies for Beef Cattle—IV: Breeding Systems*.

Summary

Genetics vary widely within functional types and breeds. However, in creating specific production levels, it is usually more effective to exploit breed averages of applicable functional types than to look for genetic outliers in other types.

A fundamental challenge in commercial beef production is to match genetic capability with climatic,

nutritional, management, and market conditions. Knowing the functional levels of types and breeds can help you optimize animal performance to achieve the highest profit.

For further reading

Sire choice is greatly influenced by types represented in a cow herd. This subject is discussed in Extension publication *Texas Adapted Genetic Strategies for Beef Cattle—VII: Sire Types for Commercial Herds*.

To obtain other publications in this Texas Adapted Genetics Strategies for Beef Cattle series, contact your AgriLife Extension county office or see the website of the AgriLife Extension Bookstore at <http://AgriLife-Bookstore.org> and the Texas A&M Animal Science Extension at <http://animalscience.tamu.edu>.

Appendix A. Additional cattle breeds, less numerous in Texas, with registry associations.

British Beef	Continental Beef	Dual Purpose	Dairy	Bos indicus	American	Specialty
Belted Galloway	Belgian Blue	Amerifax	Ayrshire	Boran	American	Akaushi
Black Hereford	Blonde d'Aquitaine	Beef Friesian	Brown	Gyr	Barzona	Ankole/Watusi
British White	Marchigiana	Devon	Swiss	Indu-Brazil	Bonsmara	Beefalo
BueLingo	Parthenais	Dutch Belted	Guernsey	Nelore	Brahmousin	Corriente
Galloway	Piedmontese	Kerry	Milking	Sahiwal	Bralers	Dexter
Highland	Romagnola	Normande	Shorthorn		Braunbray	Florida Cracker
Irish Black		Norwegian Red			Charbray	Geltex
Irish Red		Pinzgauer			Gelbray	Salorn
Lincoln Red		Red Poll			Mashona	Texas Longhorn
Murray Grey		South Devon			Romosinuano	Texon
RX ³		Sussex			Santa Cruz	Wagyu
Welsh Black		Tarentaise			Senepol	
White Park					South Poll	
					Tuli	

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