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Texas Adapted Genetic Strategies for Beef Cattle

# I: An Overview

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To manage the genetics of beef cow herds, producers should consider several factors in a logical sequence. These factors are production conditions and markets, types of cattle, breeding systems, breeds, and selection of individual breeding animals.

## Production conditions and markets

The first factors to consider in a genetic strategy are not genetic. They are production conditions and markets. Genetic strategies for a beef cow herd should be based primarily on production conditions, including:

- **Climate**—In Texas, climatic conditions range from hot to cold and humid to arid. Cattle types vary in their ability to adapt to different climates.
- **Forage conditions**—Most beef cows are maintained on forage, which can vary within the state from abundant to sparse and nourishing to deficient. Cattle also differ in their ability to adapt to diverse forage conditions.
- **Available labor and management skill**—These can range from limited to plentiful and uninformed to knowledgeable. Some genetic strategies require more time and expertise than others.

Also consider market timing, methods, and specifications. If calves are sold at weaning, the producer is paid for weight and, in price per pound, for the buyer's estimate of value beyond weaning. However, if the producer retains ownership all the way through selling carcasses, then income is directly influenced by postweaning performance and carcass merit.

Fed beef is used primarily for three purposes: "white table cloth" restaurant; "lean" beef; and commodity/retail market. The first requires high carcass marbling, the second emphasizes low fat, and the last balances marbling and leanness. Different markets call for different genetic strategies.

Unlike most other animal enterprises, production conditions in beef cow herds usually cannot be controlled easily or economically. In cow/calf operations, it is more efficient and economical to adapt the operation to the production conditions.

## Types of cattle

The second step is to determine what types of cattle best fit the production conditions and markets. When cattle are not matched to production conditions and markets, performance is reduced and income drops. For hot, humid climates, cattle types that originated in such conditions are best adapted. Cattle native to more temperate regions fit better in cooler climates.

The choice of compatible types also depends on forage characteristics:

- **Sparse**—Cattle of moderate body size fit best.
- **Abundant**—Larger cows can be maintained, or smaller cows at higher stocking rates.
- **Low quality**—Lower milking cattle are best suited. Cows of high mlking ability can lose body condition and reproduction rates can drop.
- **High quality**—Cows can be higher milking; otherwise, forage potential may not be fully realized.
- **Inconsistent**—Easy fleshing types are best adapted.

Although forage deficiencies can be offset with supplemental feed, cost must be weighed against return.

When selling at weaning, the paramount factors in choice of types are production efficiency and calf value at that point. For retained ownership, efficiency and returns are directly influenced by postweaning and carcass traits.

## Breeding systems

Before considering breeds and selecting breeding stock, you should plan a breeding system. The two basic breeding systems are continuous and terminal. The difference in these systems is their source of replacement females.

In continuous systems, heifers are retained in the breeding herd. For these systems, consider not only calving ease, livability, rate and efficiency of gain, and marketability, but also the replacement heifers' environmental adaptability and maternal qualities.

In a terminal system, because no replacement heifers are retained, terminal sires can be selected without regard for how their heifer progeny would perform as brood cows. Replacement females in terminal systems must be either purchased or produced in another herd. Environmental adaptability and maternal characteristics are important in designing genetic programs to produce these replacements.

Although straightbreeding can be done for commercial production, it lacks the advantages of well-planned crossbreeding in heterosis (hybrid vigor), production, efficiency, and, in some cases, marketability. There are practical crossbreeding plans for herds maintained in one breeding group or several, and for one-bull herds or thousand-cow operations.

## Breeds

The fourth step is choosing breeds. There are about 75 breeds of cattle in the United States. Some (originally from Europe) perform best in temperate locales; others (such as the American Brahman, which was created from humped *Bos indicus* cattle native to India)

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are better adapted to tropical environments; and still others are intermediate in adaptability.

Breeds can be logically grouped according to their adaptability and key physical characteristics (Table 1). These groups include British Beef, Continental Beef, Continental Dual Purpose, Dairy, Bos indicus, and American. Specialty breeds, such as the Texas Longhorn, cannot be placed logically in one of these groups because of their unusual genetic features.

Breeds in the American group were formed from a crossbred base of established breeds of two types—tropical adapted (usually Brahman, at levels of 3/8 to 1/2) and temperate adapted (mostly British Beef). In addition to the American group, other combination breeds are being formed. Some of these new combination breeds have less tropical-adapted content than the established American breeds, while some have none. Also, some combinations of breeds are being developed, called composites, with the specific intent of retaining maximum levels of heterosis but not the formation of a breed. The suitability of combination breeds and composites depends primarily on the characteristics of the constituent breeds.

Although breeds should be chosen primarily on the basis of their adaptability to climatic and other production conditions, producers should also consider performance and marketability. In most parts of Texas, taking into account both production and marketing, calves can be produced most efficiently and without significant price discounts if they are at least 1/4 British, no more than 1/2 Continental, no more than 1/4 Bos indicus (which could come from sources such as a half-Brahman parent or an American parent), or, possibly, no more than 1/4 Dairy. For the high-quality market, higher percentages of British are applicable. For the lean-beef market, more Continental is more appropriate.

In some situations. producers may deviate from these guidelines. Depending on production conditions and markets, a variety of useful blends can be created within these approximate ranges.

## Individual selection

The final step in a sound genetic strategy is to select individual breeding stock. Regardless of breeding system, sires are the most crucial element in genetic selection. Although selection of females certainly affects the genetics of a herd, even in a terminal cross a sire has much more genetic influence than any female. A sire usually is the parent of at least 20 to 25 calves a year or, with artificial insemination, many more. Also, in a continuous system, the genetic composition of a cow herd is determined largely by the sires used over the past three generations.

Sires must be structurally sound, fertile, and active and capable breeders. Ease of calving also is important, especially in breeding heifers for their first calves. For both sires and dams, limit selection to traits that are economically important and reasonably heritable. Depending on breeding system and market, those traits may include such things as environmental adaptability, soundness, temperament, reproduction, livability, longevity, maternal qualities, body size, rate and efficiency of gain, and carcass merit.

Several methods can be used to select individuals. While some characteristics must be evaluated visually, such as anatomical soundness and visible physical traits that affect market price, many traits can be measured objectively. These traits include reproductive features, weight, and body composition or carcass characteristics. Objective methods include performance tests, breeding soundness evaluation, actual carcass measurement or ultrasound estimate, and breed-association programs for Expected Progeny Difference (EPD) of some traits. Of these methods, EPD is the most accurate tool for genetic selection.

Genomic techniques are being developed, particularly marker-assisted selection and DNA analysis. However, these methods are now limited to simply-inherited characteristics such as hair color, some genetic defects, and a few genes influencing carcass merit. For most production traits, this technology will not be used for genetic selection of beef cattle until further research and development are conducted.

**Genetics and economics.** Net income from a beef cattle herd is calculated using this formula:

Net income = (Number of head sold X Sale weight per head X Sale price per pound) – Total cost

Number of head is affected by reproductive efficiency and death loss. But numbers also vary depending on body size and management system. On fixed resources, producers can maintain more cows of smaller size, resulting in more calves to sell, but average sale weight is likely to be reduced. If weaned calves are retained for grazing, then fewer brood cows can be maintained, sale numbers will be lower, average sale weights will be higher, and price per pound will be lower.

Weight per head is influenced by available nutrition (including that provided through milk), environmental effects (such as climate, disease, and sickness), genetics for growth, environmental adaptability, and resistance to disease and sickness.

Price per pound is determined by the real or perceived value to a buyer at whatever stage of production the herd owner decides to market.

Cost of production should include every relevant item, not just out-of-pocket cash expenses.

The highest net income often comes not from the greatest numbers, the heaviest weights, the highest price, nor the lowest cost. The most successful producers develop adapted genetic strategies that optimize and balance these four elements to maximize returns.

## For further reading

To obtain other publications in this Texas Adapted Genetics Strategies for Beef Cattle series, contact your county Extension office or see the Extension Web site *http://tcebookstore.org* and the Texas A&M Animal Science Extension Web site *http://animalscience.tamu.edu*.

**Table 1. Cattle breeds grouped according to adaptability and key physical characteristics.[1]**

| Type of cattle | Gain and Mature Size | Sexual Maturity | Milking potential[2] | Fleshing ability | Lean-to-Fat Ratio | Marbling | Most Applicable As |
|---|---|---|---|---|---|---|---|
| British Beef (Examples: Angus, Hereford, Red Angus, Shorthorn) | Average to high | Early to average | Low to average | High | Low | Average to high | Crossbreds or straightbreds, in continuous systems and both sides of terminal crosses |
| Continental Beef (Examples: Charolais, Chianina, Limousin) | Average to very high | Late | Low | Low to average | High to very high | Low to average | Terminal sires, or possibly lower-milking crossbred terminal dams |
| Continental Dual Purpose (Examples: Braunvieh, Gelbvieh, Maine- Anjou, Salers, Simmental) | High to very high | Early to average | Average to high | Low to average | High | Average | Terminal sires, or possibly higher-milking crossbred terminal dams |
| Dairy (Examples: Holstein, Jersey) | Low (Jersey) or high (Holstein) | Very early to early | High to very high | Low to average | Very low to average | Average to very high | High-milking crossbred terminal dams |
| Bos indicus (Example: Brahman) | Average to high | Late to very late | Low to average | Average to high | Low to average | Low | Heat-tolerant crossbred terminal dams maximizing heterosis |
| American (Examples: Beefmaster, Braford, Brangus, Red Brangus, Santa Gertrudis, Simbrah) | Average to high | Average to late | Average to high | Average to high | Low to average | Low to average | Crossbreds or straight-breds, in continuous systems and both sides of terminal crosses, where some heat tolerance is needed |

[1]Example breeds are those most numerous in Texas. Characteristics are breed averages, realizing there is considerable variation within a breed.
[2]In relation to body size.

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