

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 marketing, types of cattle, breeding systems, breeds, and selection of individual breeding animals.

PRODUCTION CONDITIONS

The initial considerations in a genetic strategy are not genetic. Beef cattle breeding programs should be based primarily on production conditions. These include the following:

- ▶ **Climate** – Texas climatic conditions range from hot to cold, humid to arid, and from sea level to almost 5,000 feet above. Cattle vary in their ability to adapt to different climates, and different types of cattle often respond in relatively different ways in different environments (i.e., genotype-environment interaction). 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.
- ▶ **Forage Conditions** – Most beef cows are maintained on forage, either native range, introduced types, or both. Geographic location and climate influence forage type and potential for growth. Beef cows can efficiently upcycle relatively poor-quality forages to high-quality animal protein. Forage diets can vary in quantity, from abundant to sparse, and in quality from nourishing to deficient. Cattle differ in grazing behavior and ability to efficiently utilize different types of forage.
- ▶ **Available Labor and Management Skill** – The complexity of a breeding program must not exceed the knowledge and capability of those asked to manage the herd. Some programs require more time and expertise than others.



Unlike swine and poultry enterprises, conditions under which beef cattle herds are maintained cannot easily be controlled. Therefore, in cow/calf production systems, it is most efficient and economical to select cattle that fit production conditions, rather than attempting to modify conditions to meet requirements of cattle.

MARKETING

It is important to consider market timing, methods, and specifications. If calves are sold at weaning, producers are paid for weight, and in price per pound, for the buyer's estimate of value beyond weaning. Price can be affected by such things as condition, health, frame size, and thickness/muscling. On the other end of the production chain are financial returns for those retaining ownership to carcass. Some entrepreneurial producers even sell retail products directly to consumers, usually under their personal brand. Regardless, with retained ownership beyond weaning, revenue to producers is directly influenced by post-weaning gain and efficiency, carcass merit, and, possibly, direct consumer appeal.

Beef is marketed through wholesale, retail, Hotel, Restaurant, and Institute (HRI), and direct-to-consumer outlets.

- ▶ Some retailers market United States Department of Agriculture (USDA) Select grade. But a minimum

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of Low Choice grade is becoming a requirement for much of retail sale.

- ▶ HRI uses a wide variety of beef quality. Fast-food hamburger marketers can use products below USDA Choice grade. Higher-end “white-table-cloth” restaurants generally require at least USDA mid-Choice or, in some cases, USDA Prime grade, often from products of unique brand names.
- ▶ Direct-to-consumer markets require attention to actual eating quality (e.g., tenderness, juiciness, and flavor), and perhaps the story behind how product is produced.

Markets have unique specifications met most effectively by different types of cattle from different production systems. Consequently, one breeding strategy cannot adequately satisfy the variety of needs of all markets.

TYPES OF CATTLE

When cattle are not matched to production conditions and markets, production is reduced and income drops. The choice of compatible types of cattle depends on these forage characteristics:

- ▶ **Sparse:** Small to moderate body size, earlier maturing cattle generally fit best.
- ▶ **Abundant:** Larger cows can be maintained. Or, smaller cows can be maintained at higher stocking rates, often resulting in greater overall herd performance and net returns.
- ▶ **Low-quality:** Cattle with lower milking production are best suited. Cows of high milking ability can lose body condition, and rates of reproduction can decline.
- ▶ **High-quality:** Cows can be of higher milking ability. Otherwise, forage potential may not be fully realized.
- ▶ **Inconsistent:** Easy-fleshing types with low to moderate milking potential are best adapted.

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

BREEDING SYSTEMS

The next step is to plan a breeding system before considering breeds and selecting breeding stock. The two basic breeding systems are called continuous and terminal. The difference lies in their source of replacement females.

In continuous systems, heifers are retained and returned to the breeding herd. Therefore, in addition to traits important in calves marketed, consideration

also must be given to mature size, environmental adaptability, and maternal attributes of potential replacement heifers.

Because no replacement heifers are retained in a terminal system, terminal sires can be selected without regard for how their heifer progeny would perform as brood cows. Replacement females in terminal systems must either be purchased or produced in another herd. Regardless of source, replacements should be adapted to the environment and possess maternal characteristics that are appropriate for the conditions under which they will be maintained. In both terminal and continuous systems, producing (i.e., versus purchasing) replacements allows more control of their genetics.

Commercial production can be done using only one breed (i.e., straight-breeding). It has the advantage of being simple and easy to manage, especially for smaller herds. However, straight-breeding sacrifices advantages of hybrid vigor/heterosis (except for some retention of hybrid vigor in recently-created breeds developed by combining existing breeds) realized in well-planned cross-breeding systems. Hybrid vigor typically improves reproductive performance, growth rate, production efficiency, and net return. Useful cross-breeding plans can be developed for single-sire herds, those involving several breeding groups, and for large, multi-thousand-cow operations.

BREEDS

After considering production conditions, marketing plan, cattle types, and breeding systems, the next decision concerns functional types and breed(s) within those types. Depending on the definition of “breed,” there are some 65 to 70 breeds of cattle in the U.S. (or even 85 to 90 if new combination breeds are included). *Bos taurus* cattle now found in the U.S. originated mostly in the British Isles, but also in recent times from the European continent. *Bos taurus* breeds perform best in temperate locales. *Bos indicus* (zebu or humped) cattle originated in India. They are best adapted to tropical and sub-tropical locales. The American Brahman breed was formed in South Texas and in the upper Texas Gulf Coast by combining four *Bos indicus* breeds.

Breeds logically can be grouped according to their environmental adaptability and key functional characteristics. These groups include: British Beef, Continental Beef, Continental Dual Purpose, (the latter two now commonly combined as Continental), Dairy, *Bos Indicus* (e.g., largely Brahman), and American. Specialty breeds cannot reasonably be placed in one of these groups because of their unusual genetic features.

Breeds in the American group were formed from a 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, but also more recently some Continental). In addition to the American group, other composite breeds have been formed, some of which incorporate British and Continental breeds, with or without inclusion of American breeds or Brahman (the latter two generally incorporate less than one-fourth Brahman). Applicability of composite breeds rests largely on characteristics and percentages of constituent breeds.

Breeds should be chosen primarily on adaptability to climatic and other production conditions, but producers also should consider production and marketability. Considering both of these factors, in most parts of Texas calves can be produced most efficiently and without significant price discounts if they are one-half or more British, no more than one-half Continental, and no more than three-eighths *Bos indicus*, which could come from half-Brahman or American background. For high-quality markets, higher percentages of British are more applicable. For lean beef markets, less British and more Continental is more useful. Some operations primarily produce replacement females, so breeds incorporated should complement demand for replacements. In some situations, producers justly may deviate from these guidelines for content of functional types. But, depending on production conditions and markets, a variety of useful blends generally can be created within these approximate ranges.

INDIVIDUAL SELECTION

The final step in a sound genetic strategy is to select individual breeding stock. Selection of females certainly affects genetic potential of a herd. However, even in a terminal cross-system, 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 possibly of more, especially via multiple breeding seasons or, in particular, artificial insemination. Also, in a continuous system, genetic composition of a cow herd is determined largely by sires used over the last three generations. Regardless of breeding system, sires are the most impactful element in genetic selection.

For both sires and dams, selection should be limited to economically important traits. Natural-service sires must be structurally sound, fertile, active and capable breeders, and of manageable temperament. Ease of calving also is important, especially to breed heifers for their first calves. In addition to these traits, and depending on breeding system and market, important traits for selection may include: environmental

adaptability, reproduction, livability, longevity, maternal qualities, mature size, rate and efficiency of gain, and carcass merit.

Some characteristics for selection must be evaluated visually, such as anatomical soundness and any visible physical traits that might affect market price. However, many traits can best be measured objectively, including reproduction traits (such as age at puberty, age at first calving, reproductive tract score, scrotal circumference, semen quality), weight, and body composition or carcass characteristics. Objective methods include performance tests, Breeding Soundness Evaluation (BSE), actual carcass or ultrasound measurement, and breed association programs for Expected Progeny Difference (EPD). Of these methods, EPD is the most effective tool for genetic selection.

Genomic/DNA techniques have been developed. The first mostly were limited to simply-inherited characteristics, such as hair color and a few genetic defects. Genomics is now primarily useful for incorporating into EPD to improve estimation and, especially, accuracy of EPD for young, unproven individuals. Most breed associations that have breed-wide genetic evaluation now calculate genomically-enhanced EPD (GE-EPD).

GENETICS AND ECONOMICS

Net income from a beef cattle herd is calculated as:

$$(\text{Number of Head Sold} \times \text{Sale Weight per Head} \times \text{Sale Price per Pound}) \text{ minus Total Cost}$$

Any net income from sale of cull breeding stock also should be included.

Number of head is affected by reproductive efficiency and death loss. Numbers also vary depending on body size and management system. More cows of smaller size can be maintained, resulting in more calves to sell, but average sale weight is likely to be reduced. Yet, on the same fixed forage resource, if weaned calves are retained for grazing or replacements, then fewer brood cows can be maintained, sale numbers and price per pound will be lower, but average sale weight will be higher.

Weight per head is influenced by available nutrition (including from milk), environmental effects (such as climate, disease, and sickness), age at weaning, and potential for growth.

Price is determined by real or perceived value to a buyer. Health status also impacts price. Lighter-weight calves generally bring a higher price per pound, so the relative effects of weight and price on total value should be evaluated.

Accurate determination of total cost must include fixed, variable, as well as any appropriate opportunity costs. Approximately two-thirds of total often is due to fixed costs.

Highest net income almost never comes from greatest numbers, heaviest weights, highest price, or lowest cost. The most successful producers develop adapted breeding programs that **optimize** and balance these four elements to **maximize** net returns.

FOR MORE INFORMATION

To obtain publications in the *Texas Adapted Genetics Strategies for Beef Cattle* series, and on other considerations for breeding programs and other subjects, visit the Texas A&M Animal Science Extension website: <http://beef.tamu.edu>, under Publications; or the Texas A&M AgriLife Extension website: <http://AgriLifeBookstore.org>.