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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. These factors include the following:

- 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. Also, climate affects forage types and, therefore, appropriate levels of cattle production.
- Forage conditions. Most beef cows are maintained on forage, which can vary from abundant to sparse and nourishing to deficient. Cattle also differ in applicability 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.

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Texas Adapted Genetic Strategies

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. On the other end of the production chain, returns of those retaining ownership to the rail are directly influenced by post-weaning 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 leanness; and the last balances marbling and leanness. Different markets call for different genetic strategies.

Unlike most other livestock and poultry 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 next 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 these forage characteristics:

- **Sparse:** Cattle of small to moderate body size fit best.
- **Abundant:** Larger cows can be maintained, or smaller cows can be maintained at higher stocking rates.
- **Low quality:** Lower milking cattle are best suited. Cows of high milking ability can lose body condition, and reproduction rates can drop.
- **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 milk are best adapted.

Although forage deficiencies can be offset with supplemental feed, cost must be weighed against return. The Texas Cooperative Extension (TCE) Bookstore website (*http://tcebookstore.org*) provides more information on the relationship between genetics and production conditions in "Texas Adapted Genetic Strategies II: Genetic-Environmental Interaction," E-187. On the importance of size and milk, see "Texas Adapted Genetic Strategies III: Body Size and Milking Level," E-188. You will also find more about the relationship between body weight and skeletal size in, "Texas Adapted Genetic Strategies X: Frame Score and Weight," E-192.

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 post-weaning performance and carcass merit.

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 in these systems is their source of replacement females.

In continuous systems, heifers are retained to return to the breeding herd. So, in addition to traits important in market progeny, you should also consider the potential replacement heifers' environmental adaptability and maternal qualities.

Because no replacement heifers are retained in a terminal system, terminal sires can be selected regardless of how their heifer progeny would perform as brood cows. Since 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.

While straight breeding 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 or several breeding groups and for one-bull herds or thousand-cow operations.

For more information on systems, see "Texas Adapted Genetic Strategies IV: Breeding Systems," E-189, at the TCE Bookstore site.

Breeds

The fourth step is to choose 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) 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. These groups include British Beef, Continental Beef, Continental Dual Purpose, Dairy, Bos indicus and American. Specialty breeds cannot be placed logically in one of these groups because of their unusual genetic features. These groups, and breeds within them, are discussed in these Bookstore publications: "Texas Adapted Genetic Strategies V: Type and Breeds Characteristics and Uses," E-190; and "Texas Adapted Genetic Strategies VII: Sire Types for Commercial Herds," E-191.

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 ½) and temperate adapted (mostly British Beef). In addition to the American group, other combination breeds and composites are being formed. The applicability of combination breeds and composites rests largely on the characteristics of the constituent breeds. The Bookstore publication, "Texas Adapted Genetic Strategies VI: Creating Breeds and Composites," E-180, addresses the development of breeds and composites.

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. Considering production and marketing in most parts of Texas, calves can be produced most efficiently and without significant price discounts if they are at least ¼ British, no more than ½ Continental, no more than ¼ Bos indicus (which could come from sources such as a half-Brahman parent or an American parent), or possibly no more than ¼ Dairy. For the high quality market, higher percentages of British are applicable. For the lean-beef market, less British 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. Selection of females certainly affects the genetics of a herd. However, even in a terminal cross, a sire has much more genetic influence than any female. This is because a sire usually is the parent of at least 20 to 25 calves a year, or possibly of many more calves due to artificial insemination. Also, in a continuous system, the genetic composition of a cow herd is determined largely by the sires used over the last three generations. Regardless of the breeding system, sires are the most crucial element in genetic selection.

Sires must be structurally sound, fertile, and active and capable breeders. Ease of calving also is important – especially to breed heifers for their first calves. For sires and dams, limit selection to traits that are economically important and reasonably heritable. Depending on breeding system and market, these traits may include 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. Some characteristics must be evaluated visually, such as anatomical soundness and visible physical traits affecting market price. However, many traits can be measured objectively, including 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 effective tool for genetic selection. For more information on EPD, go to the Bookstore website for "Texas Adapted Genetic Strategies VIII: Expected Progeny Difference (EPD)," E-164, and "Texas Adapted Genetic Strategies IX: Selection for Carcass Merit," E-165.

Genomic techniques – particularly, marker assisted selection and DNA analysis – are being developed. 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. These techniques are most effective when combined with EPD, which is discussed in "Texas Adapted Genetic Strategies XI: Marker Assisted Selection for Beef Improvement," E-352, at the Bookstore.

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. However, 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 must be maintained; sale numbers and price per pound will be lower; and average sale weights will be higher.

Weight per head is influenced by available nutrition (including what comes from milk); environmental effects (such as climate, disease, and sickness); and 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 does not come from the greatest numbers, the heaviest weights, the highest price, or the lowest cost. The most successful producers develop adapted genetic strategies that optimize and balance these four elements to maximize returns.

For More Information

Refer to the Texas Adapted Genetic Strategies for Beef Cattle series, which you can obtained from county Extension offices. You can also access them through one of the following sites:

- Extension at *http://texaserc.tamu.edu*
- Extension Animal Science at *http://animalscience-extension.tamu.edu/*
- Extension Beef Cattle at *http://beef.tamu.edu/*.

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