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Texas Adapted Genetic Strategies for Beef Cattle

VI: Creating Breeds and Composites

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In recent years, considerable interest has developed in the formation of new breeds of cattle. The term *composite* is often used to describe these breeds because they are formed by combining existing breeds. However, *composite* has been defined to indicate a particular set of intents and procedures in creating new populations. In fact, the modern composites are probably not breeds.

What is a breed?

To discuss breeds, it is necessary to understand that term. There is no generally accepted definition—scientific or otherwise—of a breed. A 1940 dictionary defines breed as "a race of animals which have some distinctive qualities in common." A 1999 dictionary says "a stock of animals within a species having similar appearance, usually developed by deliberate selection."

There is no "official" recognition of cattle breeds. At one time, the U.S. Department of Agriculture periodically printed a bulletin, "Beef Cattle Breeds." Although inclusion in this publication was often considered official recognition, the 1975 edition of the publication clearly stated, "Inclusion of a breed should not be interpreted as official recognition by the U.S. Department of Agriculture."

There are organizations of breeds, such as the National Pedigreed Livestock Council, but not all breed associations are members. The National Association of Animal Breeders has 108 breed codes for identifying cattle semen. I. L. Mason's *World Dictionary of Livestock Breeds* lists more than 250 "numerically or historically important" breeds of cattle, along with many less important ones.

One definition of a breed might be animals recorded in an association registry. There are currently some 75 cattle breed registries in the United States. In some cases, there are more than one registry for essentially the same breed. The only actions needed to start a registry are to adopt specific requirements of eligibility and start recording ancestry. Although those requirements may vary considerably and may not be very stringent, an existing registry may be as good a definition of a breed as any other criteria. The distinguished animal breeder Dr. Jay Lush, in *The Genetics of Populations*, said, "A breed is a group of domestic animals, termed such by common consent of the breeders." In short, a "breed" is whatever you say it is.

Origin of breeds

Even before cattle were domesticated, distinctive populations developed in response to the prevailing influences of natural selection. After domestication, some cattle populations became even more distinctive because humans began to influence selection. This often involved aesthetic considerations, such as color or horns, for various cultural and religious purposes. Later, there was some selection to develop animals better suited for particular purposes, including milk, meat, and draft. But such selection generally involved little planning or direction.

At times, individuals with desired characteristics were brought into one area from another. These individuals, usually sires, were bred to local stock and a new population was formed. The new population was similar to the imported stock, but also had the influence of the local animals along with any natural and human-directed selection.

The development of what has been termed "pedigree breeds" began in England in the mid to late 1700s. In general, development proceeded as explained by Lush in *Animal Breeding Plans*:

1. A generally useful production type was identified.
2. The best individuals of that type were congregated into a breeding group (herd) or groups, often with little if any outside introduction of breeding stock.
3. Varying levels, sometimes intense, of inbreeding occurred, often through linebreeding to certain individuals.
4. These groups became distinctive in type and inheritance.
5. If the group was desirable in some way, it attracted notice and became popular with other breeders.
6. In response to its popularity, the group increased in numbers, leading to records of ancestry in a herdbook or registry to keep track of inheritance.
7. A breed society or association was formed to facilitate accurate recording of ancestry, maintain breed purity, and promote the breed. The first such registry for cattle began in England in 1822 for Shorthorns; the Hereford registry started in England in 1846 and the Angus, actually Aberdeen-Angus, began in Scotland in 1862.

European breeds in the United States

Mostly nondescript cattle as well as some distinctive types were brought to this country almost as soon as European colonists arrived. In the eastern part of what became the United States, the cattle came from northern Europe. In the southwest, the cattle, known as criollo, came from Spain.

Not long after the English breeds were formed, some individuals were imported into the United States. The first imports that could be called a breed were Shorthorns, even though the English breed registry had not yet started. A few head were brought in as early as 1783, and significant numbers started arriving around 1817. A few Herefords also entered the country in 1817, but the first meaningful numbers were brought in about 1840. Angus came later, a few in 1873, followed by the establishment of the first purebred herd in 1878.

Other breeds imported before 1900 from the British Isles included Ayrshire, Devon, Galloway, Highland, Kerry, Red Poll, and Sussex.

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Brown Swiss, Dutch Belted, Guernsey, Holstein-Friesian, and Jersey were brought in before 1900 from Continental Europe or the English Channel Islands.

U.S. breed registries for Shorthorn, Hereford, and Angus began in 1846, 1881, and 1883, respectively. All three associations required that foundation animals trace to ancestors recorded in the founding British herdbooks. That is, no "upgrading" was allowed. That was not true of many breeds established or formed later in this country.

Upgrading

One way to create purebreds (or almost "pure") is by the process called upgrading—successive "topcrosses" of purebreds (usually sires) on animals of other breeds, crosses, or unknown background. The first such topcross produces a 1/2-blood progeny. If that 1/2-blood is topcrossed with a purebred, the progeny is 3/4 "pure." A third topcross results in a 7/8 blood, which is generally the minimum for registry as purebred. Others require 15/16 or 31/32 to be registered as purebred. In a number of registries, one more topcross is required for males than females in order to be considered purebred. As with defining a breed, the definition of purebred is entirely arbitrary and is determined by the breed association.

Upgrading is generally the quickest and least expensive means of creating large numbers of purebreds. For this reason, most of the breeds imported into the United States beginning in the late 1960s (as well as the earlier introduced Charolais) used upgrading as the primary method of establishment. This group includes Braunvieh, Chianina, Gelbvieh, Limousin, Maine-Anjou, Salers, Simmental, and some less numerous breeds.

Some of these breeds distinguish between "Purebred"(with some arbitrary prescribed level of upgrading) and "Fullblood." If so, Fullbloods are usually considered to be animals that are registered in some officially recognized foreign breed association, often the single association considered to be the parent of the breed, and animals that trace exclusively to such ancestors. Specific criteria for Fullblood designation are established by the breed association.

Why combine breeds?

Crossbreeding of cattle was generally viewed unfavorably until the past 40 to 50 years, when the utility of heterosis (the phenomenon in which hybrids display greater size, vigor, resistance, etc. than their parents) and favorable breed combinations gradually came to be recognized. This recognition occurred earlier in plants and later in animals other than cattle. Until then, emphasis was on creating and maintaining breed purity or "racial constancy," increasing visible uniformity, and developing prepotent breeding stock capable of reliably transmitting their characteristics to their offspring.

Some inbreeding usually occurred in trying to achieve these ends. It was thought that purebred influence was necessary to improve "common" stock. At least some of these motivations may have been related to nationalism and societal structure. It is interesting to note that planned crossbreeding systems and the creation of combination breeds have been most prevalent in the United States, a more open and heterogenous society than those in Europe where most cattle breeds were first developed.

New combinations may be formed when there is a perceived need for some production type better suited to the prevailing conditions in a particular area. The U.S. Gulf Coast is characterized by a harsh climate of persistent heat and high humidity. The first combination breed of cattle created in the United States—the American Brahman—was developed from foundation breeds that were better suited to those conditions than the British breeds. The Brahman was formed, primarily beginning in the early 1900s, from humped cattle (*Bos indicus*, sometimes called Zebu) native to the Indian subcontinent, mostly from the Guzerat, Nelore, Gyr, and Krishna Valley breeds.

Shortly after development of the Brahman began, other breeders in the same locale saw a need for a type intermediate to European (*Bos taurus*) and *Bos indicus*. The quickest and most logical way to accomplish this was by combining those types. This was the motivation behind what have come to be known as "American" breeds. The first of these was the Santa Gertrudis, developed on the King Ranch in South Texas. Santa Gertrudis are usually characterized as being 5/8 Shorthorn and 3/8 Brahman. However, the group of 52 bulls initially used in 1918 were 3/4 and 7/8 *Bos indicus* (the name "Brahman" had not yet been adopted), so the exact breed makeup of Santa Gertrudis is not known.

Beginning in the early 1930s, Beefmaster were formed on the Lasater Ranch in South Texas. That breed is now thought to be a little less than 1/2 Brahman and a little more than 1/4 each of Shorthorn and Hereford. Starting in 1947, several breeders, most notably the Adams Ranch in Florida, created Braford from crosses of Brahman and Hereford. After several breeders had experimented with crossing Angus and Brahman for some years, a specific content of 5/8 Angus and 3/8 Brahman was established for Brangus in 1949. Other American breeds were created, some including heat-tolerant non-*Bos indicus* breeds in addition to or in place of Brahman.

Brahman and the first American breeds were developed over periods of 20 to 30 years before a registry was established. Some of these breeds have allowed registry where exact parentage is not known, especially in the case of multiple-sire breeding groups or even with neither sire nor dam identified, at least in the closed herd of a foundation breeder. With most breeds created in recent times (American or not), an association registry was established when breed formation began.

With the establishment of quarantine and disease-testing facilities in North America, importation of numerous new breeds, mostly from Continental Europe, began in the late 1960s. Soon, many commercial herds, particularly outside the South and Southwest, were made up of various percentages of British and Continental breeds.

These combinations, often roughly half of each type, proved to be generally useful in those regions. However, perpetuation of such cattle was not possible without continuous crossing because there were no combination British-Continental breeds. Consequently, some interest developed in creating such combinations. In the late 1970s, the USDA Meat Animal Research Center (MARC) at Clay Center, Nebraska, started to form populations containing British and Continental breeds. These MARC populations are generally considered to be the first of the modern composites.

Creating breed combinations

Breeds maybe combined in several ways for different purposes:

- **Pool breeds** are formed by various paths of combining two or more existing breeds and, in some cases, upgrading, to create a new genetic pool. There is no particular intent to maintain any specific percentages or to keep track of percentages of the constituent breeds. Although some of these breeds implement a closed herdbook and some allow upgrading of outside stock to purebred status once the breed is established, they usually do not allow creation anew from parent breeds.
- **Formula breeds** are formed by combining two or more existing breeds to create specific breed percentages, or range of percentages, and intermating the crosses. If a range is allowed, the exact breed percentage of individuals is usually noted on registry records. After individuals of the defined formula are created, the registry may either be closed to outside genetics or creation may be allowed anew from the parent breeds, but

upgrading is generally not allowed. The number of early generations of intermating is often documented. If it is allowed to create the formula anew, at least the first generation should probably be considered hybrids, even though the registry association may define and register them as purebred.

- **Composites** are populations formed by combining two or more existing breeds, usually in specific percentages, followed by some intermating and possibly some re-creation, as with formulas. However, an additional intent in creating composites is to intentionally maintain maximum possible levels of heterosis in future generations without additional crossbreeding. This differentiates composites from pool breeds and formula breeds. As a result, composites are more an alternative to crossbreeding systems than a means of forming a breed.

  Composite breed has often been used to mean those formed by combining existing breeds, regardless of the process or intent. In fact, the term composite breeds probably should not be used. Instead, combination breeds (pools and formulas) would distinguish them from what has been defined as composites.
- **Crossbreds** are hybrid combinations that will not be used to form a breed or a composite. In much of agriculture, especially crops, "dead-end" or terminal crosses are the bases of commercial production. Such crosses must be constantly re-created. There are examples in beef production, a common one being the Brahman crossbred female such as the Brahman-Hereford or Brahman-Angus. These females are usually bred in a terminal cross, in which case they must be re-created whenever replacements are needed. Crosses can be used for breeding in continuous crossbreeding systems. But if this is done, outside genetic influence (usually sires) is introduced on a regular basis. (For more information on crossbreeding methods, see another publication in this series, E-189, "Texas Adapted Genetic Strategies for Beef Cattle—IV: Breeding Systems.")

Distinctions are often blurred between these four methods of combining breeds. And there is no best method of forming combinations, nor any best breed percentages. Some people think that pools allow selection over time to result in the most useful and adapted genetic structures. Others believe that adherence to a formula increases genetic uniformity. Some place major importance on maintaining heterosis without continual crossing. And still others merely implement a planned crossbreeding system.

Purposes and intents have as much to do with defining a breed combination as do the methods employed. The method used to form new combinations is less important than the choice of constituent breeds to fit prevailing production conditions and market specifications. (For more information on choosing breeds, see E-190, "Texas Adapted Genetic Strategies for Beef Cattle—V: Types and Breeds - Characteristics and Uses," and E-191, "Texas Adapted Genetic Strategies for Beef Cattle—VII: Sire Types for Commercial Herds.")

Consequences of creating combinations

A historical objection to crossbreeding has been that crossbreds are not as uniform as purebreds. Theoretically, however, the progeny from crossing two breeds should be rather uniform, at least in production characteristics if not in physical features such as color. And while this has been confirmed in research and field observation, there still was some question of the variation in progeny from intermating crossbreds. However, the MARC research in creating composites reported that "increased genetic variation in composite populations was not observed relative to contributing purebreds"and that "composite populations offer a procedure that is more effective than continuous crossbreeding for using genetic differences among breeds to achieve and maintain optimum performance levels for major bioeconomic traits on a continuing basis."

Successive intermatings of crossbred populations are sometimes referred to by generations. A first cross of two breeds would be a "first-generation halfblood" (called F_1 in classic genetic terminology). Intermating those would produce a second-generation halfblood (F_2) and so on. Just as there is no generally accepted definition of the number of topcrosses necessary to result in a purebred, there is no accepted number of intermatings to be a purebred. Perhaps the most commonly accepted minimum level to be considered purebred is the second intermating (third-generation, F_3), but that is strictly arbitrary.

One of the purposes of the MARC work was to determine how much heterosis is lost when crossbreds are intermated. In theory, when such crossbreds are first intermated, some of their heterosis is lost in the progeny. But if those progeny are then intermated, there should be no additional reduction of heterosis in their offspring.

Loss of heterosis from intermating crosses is theoretically related to the number of breeds included and their percentages. If two breeds are crossed and these half-and-half crosses then intermated, their progeny should retain an average of 50 percent of the heterosis exhibited by the first-cross parents. If the base parents are $^3/_4$ of one breed and $^1/_4$ of the other, only an average of 37.5 percent heterosis should be retained. For a four-breed base of equal parts, an average of 75 percent heterosis should be retained. But if the four-breed base is $^1/_2$ of one breed, $^1/_4$ of another, and $^1/_8$ of the other two, an average of about 66 percent should be retained.

The MARC research with several British and Continental breeds basically confirmed this theory of heterosis retention, at least in those types. When crosses were intermated, heterosis was reduced in progeny on the average about as predicted. And when the progeny were then intermated, their offspring averaged no additional loss of heterosis. In practice then, after the initial reduction of heterosis from the first intermating, the only additional loss in subsequent generations would be caused by whatever inbreeding might occur. For this reason, to maximize retention of heterosis in combining and perpetuating new breed combinations, the closed population should be as large as possible. (Heterosis is more fully covered in E-189, "Texas Adapted Genetic Strategies for Beef Cattle—IV: Breeding Systems.")

Breeds in Texas

The background and U.S. registry requirements of the breeds that are most influential in Texas include:

- **Angus**—registry started in 1883 with base animals all recorded in founding Scottish registry. Closed since inception, except to cattle recorded in approved foreign registries.
- **Beefmaster**—formed from a pool of Brahman, Hereford, and Shorthorn. Registry started in 1961. Base purebreds all from or trace to the founding Lasater herd. Open registry allowing upgrading with three topcrosses on inspected base cattle and inspected topcrosses to arrive at Purebred ($^7/_8$).
- **Braford**—registry started in 1979 with approved foundation cattle formed from pools of Brahman and Hereford. Later accepted documented $^5/_8$ Hereford -$^3/_8$ Brahman individuals. Now have open registry where Purebred (defined as $^5/_8$ Hereford - $^3/_8$ Brahman, plus or minus 5 percent) can be created by any process, including upgrading.
- **Brahman**—formed from pools of several *Bos indicus* breeds and some upgrading. Registry started in 1924 and closed in 1939. Opened thereafter for a few 1946 imports and later on individual animal basis to some *Bos indicus* breeds recorded in other countries approved registries. Have separate registry for American Gray and American Red.

- **Brangus**—are a specific formula. Registry started in 1949 with foundation individuals of 5/8 Angus - 3/8 Brahman content. Open registry allows creation of Purebreds from registered Angus and Brahman parents. No upgrading program.
- **Braunvieh**—registry started in 1984 with foundation cattle recorded by the Swiss Braunvieh Federation as Swiss Original Braunvieh (containing no American Brown Swiss influence). Open registry allowing upgrading to Purebred (7/8 female, 15/16 male). Have Fullblood designation called Original Braunvieh.
- **Charolais**—formed from Mexican imports from France beginning in the 1930s. Registry started in 1957. Open registry, with upgrading to Purebred (31/32). Also designate Full French (French imports or from French parents imported after 1961) and American French (minimum 15/16 Full French).
- **Chianina**—registry started in 1972 with imports from Italy. Register any percentage that is designated on pedigree. Have separate categories for cattle with influence of Angus, Hereford, or Maine-Anjou (ChiAngus, Chiford, ChiMaine). Have a Fullblood designation.
- **Gelbvieh**—registry started in 1971 with imports from Germany. Open registry with upgrading to Purebred (7/8 for female, 15/16 for male). Have a Fullblood designation.
- H**ereford**—registry started in 1881 with base animals all recorded in English registry. Closed since inception, except to cattle recorded in approved foreign registries. Formerly separate registries for horned and polled have been combined.
- **Holstein**—registry started in 1872 with cattle from Holland. Register cattle of any percentage Holstein with four designations based on source (and breed percentage) as follows: North American registry ancestry (100 percent); North American (0 to 99 percent); approved foreign registry ancestry (100 percent); foreign (0 to 99 percent).
- **Jersey**—registry started in 1868 with cattle imported from the Jersey Isles and England. Register cattle descended from original herdbook and from parents recorded in approved foreign registries. Upgrading program to Purebred (31/32).
- **Limousin**—registry started in 1968 with imports from France. Open registry with upgrading to Purebred (7/8 for female, 15/16 for male). Have a Fullblood designation.
- **Maine-Anjou**—registry started in 1969 with imports from France. Open registry with upgrading to Purebred (7/8). Have a Fullblood designation.
- **Red Angus**—registry started in 1954, recording red animals out of parents registered in Angus association. Currently has four categories: 1A - 100 percent Red Angus; 1B - 87 to less than 100 percent Red Angus; II -87 to less than 100 percent Red Angus (with one or more disqualifying phenotypic features); III - less than 87 percent Red Angus.
- **Red Brangus**—the American Red Brangus registry started in 1956, recording red animals of purebred Angus and Brahman breeding. It registers animals of any percentage of the two breeds, contingent upon approved phenotypic inspection, so the formula for them ranges widely. The International Red Brangus registry requires 5/8 Angus - 3/8 Brahman to be purebred, so they are a specific formula. Neither association allows upgrading to purebred, but both allow creation anew from the two parent breeds.
- **Salers**—registry started in 1974 with imports from France. Open registry with upgrading to Purebred (15/16). Have a Fullblood designation.
- **Santa Gertrudi**s—formed on the King Ranch from a pool of approximately 5/8 Shorthorn - 3/8 Brahman. Registry started in 1951 with King Ranch cattle and officially designated Foundation Herds (tracing to King Ranch). Open registry with upgrading to Purebred (15/16).
- **Shorthorn**—registry started in 1846 with base animals all registered in English herdbook. Closed except to English herdbook and others tracing exclusively to that registry. Opened in 1973 to other approved foreign registries not necessarily tracing exclusively to English registry. Appendix upgrading program to purebred status (15/16 and higher), defined as Fullblood and considered to be 100 percent Shorthorn. Base Appendix individuals are entered as being from 3/8 to 7/8 blood, depending on the fraction of Shorthorn ancestry as defined by the association. American Milking Shorthorns tracing to original English registry can be recorded as 100 percent Shorthorn.
- **Simbrah**—registered in Simmental association in two categories of Purebred (specific formula of 5/8 Simmental- 3/8 Brahman) and Percentage (combinations of not less than 3/8 Simmental, not less than 1/4 Brahman, and not more 3/8 other breeds). No upgrading program, except of Simmental parentage.
- **Simmental**—registry started in 1968 with imports from Continental Europe. Accept animals recorded in any registry in World Simmental Federation. Open registry with upgrading to Purebred (7/8 female, 15/16 male). Have Fullblood designation.
- **Texas Longhorn**—registry started in 1964 with pool of cattle (exact breed makeup unknown) approved by official inspection for prescribed visible characteristics. Registry closed in 1975.

Imported breeds, with current U. S. registries, that are of lesser influence in Texas are:

Ankole Watusi	Guernsey	Red Poll
Ayrshire	Gyr	Romagnola
Beef Friesian	Highland	South Devon
Belgian Blue	Indu-Brazil	Sussex
Belted Galloway	Marchigiana	Tarentaise
Blonde d'Aquitaine	Milking Shorthorn	Tuli
British White	Nelore	Wagyu
Brown Swiss	Normande	Welsh Black
Devon	Parthenais	White Park
Dexter	Piedmontese	
Galloway	Pinzgauer	

Combination breeds, with current U.S. registries, that are of lesser influence in Texas are:

- **American Breed**—1/2 Brahman, 1/4 Charolais, 1/8 bison, 1/16 Hereford, 1/16 Shorthorn
- **Amerifax**—5/8 Angus, 3/8 Beef Friesian
- **Barzona**—pool with about 1/4 each Africander, Angus, Hereford, Santa Gertrudis
- **Brahmousin**—5/8 Limousin, 3/8 Brahman
- **Bralers**—5/8 Salers, 3/8 Brahman
- **BueLingo**—pool of Dutch Belted, Chianina, Shorthorn, Angus
- **Charbray**—5/8 to 13/16 Charolais, 13/16 to 3/8 Brahman
- **Corriente**—pool of criollo-type Mexican cattle
- **Gelbray**—5/8 Gelbvieh, 3/8 Brahman
- **Geltex**—5/8 Gelbvieh, 3/8 Texas Longhorn
- **Murray Grey**—pool of Angus and Shorthorn
- **RX3**—1/2 Red Angus, 1/4 Hereford, 1/4 Red Holstein
- **Salorn**—5/8 Salers, 3/8 Texas Longhorn
- **Senepol**—pool of Red Poll and N'Dama (a humpless west African heat-tolerant breed)
- **Texon**—pool of Devon and Texas Longhorn

Recent breed combinations without registries

Beginning in the late 1970s, MARC created the following combinations, which are being maintained as true composites:

- **MARC I**—1/4 Braunvieh, 1/4 Charolais, 1/4 Limousin, 1/8 Angus, 1/8 Hereford
- **MARC II**—1/4 Angus, 1/4 Gelbvieh, 1/4 Hereford, 1/4 Simmental
- **MARC III**—1/4 Angus, 1/4 Hereford, 1/4 Pinzgauer, 1/4 Red Poll

Using the MARC concept, the Leachman Ranch in Montana has been active in recent years in creating and merchandising new combinations including:

- **Stabilizers**—basically half Continental breeds and half British breeds. The first Stabilizers were 1/4 each Hereford, Red Angus, Gelbvieh, and Simmental. Later individuals called Stabilizers have sometimes varied slightly from half Continental and half British.
- **RangeMakers**—mostly 3/4 British breeds and 1/4 Continental breeds. At one time, the Leachman Ranch called Purebred RangeMaker a 1/2 Angus, 1/4 South Devon, 1/4 Tarentaise. But other individuals have later been called RangeMaker that included various percentages of the above and also in some cases Red Angus, Salers, or Simmental.
- **RangeCalvers**—mostly 1/4 to 1/2 Jersey along with Angus, South Devon, and Tarentaise.

The Leachman operation also produces several purebreds and various crosses they call hybrids. It is unclear which of the Leachman combinations meet the strict definition of composite. Probably the specific four-breed Stabilizer noted above would qualify as well as some others. Other breeders are forming combinations consisting of various mixtures of British and Continental breeds.

A number of what might be called new Southern combinations have been developed, containing 1/4 or less *Bos indicus* (and, in some instances, a portion of other heat-tolerant breeds) instead of 3/8 to 1/2 Bos indicus in the established American breeds. The King Ranch created a combination called Santa Cruz with 1/2 Santa Gertrudis, 1/4 Red Angus, and 1/4 Gelbvieh. The R. A. Brown Ranch created Hotlander, with 1/2 Simbrah, 1/4 Angus or Red Angus, and 1/4 Senepol, as well as some hybrids using various combinations of those breeds. The Theeck Ranch created Brazos, containing 1/2 Santa Gertrudis, 1/4 Gelbvich, 1/4 Hereford. The Adams Ranch in Florida created several combinations, all of which include their Brafords: ARRAB (Braford - Red Angus); ARGEL (Braford - Gelbvieh); and ABEEF (Braford- Red Angus - Gelbvieh).

Several combinations have been developed recently that include Angus or Red Angus and generally 1/4 or less Brahman, called by such names as Angus Plus, Red Angus Plus, Texas Reds, and Heat-Tolerant Reds. Other new Southern combinations are being developed, all of which have better heat tolerance than the Northern combinations of British and Continental breeds.

Summary

Breeds of cattle may be combined in several ways for various purposes. Combinations may be made to realize the many benefits of heterosis. A new combination may be better suited to prevailing conditions. Some producers, however, may simply want to form their own unique population. Regardless of the motivation, many combinations have been made, and many more are sure to come. Whether a particular combination is a “breed” is open to discussion.

For further reading

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