

Texas Adapted Genetic Strategies for Beef Cattle VI: Creating Breeds



Figure 1. Robert Bakewell, circa 1775, English pioneer creator of breeds of livestock.

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There is often interest in creating new breeds of cattle. Why would we need any new breeds? What breeds do we already have? How are breeds created?

What is a breed?

There is no strict definition—scientific or otherwise—of a breed. A 1940 Webster's Unabridged Dictionary defines breed as "a race of animals which have some distinctive qualities in common." A 2000 Oxford Dictionary says "a stock of animals within a species having similar appearance, usually developed by deliberate selection." Dr. Jay Lush, in *The Genetics of Populations*, said "the members of a breed are more closely related by descent and more like each other phenotypically than are random members of their whole species."

In 1999, the Food and Agriculture Organization of the United Nations adopted the following broad definition of breed:

"Either 1) a subspecific group of domestic livestock with definable and identifiable external characteristics that enable it to be separated by visual appraisal from other similarly defined groups within the same species or 2) a group for which geographical and/or cultural separation from phenotypically similar groups has led to acceptance of its separate identity."

There is no "official" recognition of cattle breeds in the United States. In the past, the U.S. Department of Agriculture periodically printed a bulletin, *Beef Cattle Breeds*. Although inclusion in this publication was sometimes

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thought to be official recognition, the 1975 edition clearly stated, "Inclusion of a breed should not be interpreted as official recognition by the U.S. Department of Agriculture." The USDA does designate registry associations for purposes of brucellosis indemnity payments and importation.

How many breeds of cattle are there? The National Association of Animal Breeders has 113 breed codes for identifying cattle semen. The Breeds of Livestock Web site (<http://www.ansi.okstate.edu/breeds/cattle/>) maintained by Oklahoma State University lists 268 cattle breeds in the world, about the same number of "numerically or historically important" breeds listed in I. L. Mason's *World Dictionary of Livestock Breeds*.

One definition of a breed might be the existence of a breed registry, also called herdbook, as in the case of USDA above. The United States has 70 to 75 cattle breed registries. In some cases, more than one registry exists for essentially the same cattle. 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, having an existing registry could be considered to constitute a breed.

The definition of "breed" has been discussed for a long time. With perhaps as accurate, concise, and useful a definition as any, O. Lloyd-Jones, in a 1915 *Journal of Heredity* paper entitled "What is a Breed?" 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 distinct as people influenced selection. This selection often involved aesthetic considerations, such as color or horns, for various cultural and religious purposes. Later, some people selected breeding stock for particular production purposes, including milk, meat, and draft, but usually with 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 not only similar to the imported stock, but it also had the influence of the local animals along with that of any subsequent natural and human-directed selection.

The development of what has been termed "pedigree breeds" began in England in the mid to late 1700s, pioneered by Robert Bakewell. This was facilitated by the advent of fenced pastures, which allowed for selective rather than random mating. 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 of sometimes intense inbreeding occurred, but more often linebreeding to highly favored individuals was practiced to increase the relationship to such individuals while minimizing elevation of inbreeding.
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

Early European colonists brought with them mostly nondescript cattle as well as a few distinctive types. In the eastern part of what became the United States, most of the cattle came from the British Isles. In the Southwest the cattle, known generically as Criollo, came from Spain.

Not long after the British breeds were formed, some individuals were imported here. The most numerous of those that could be called a breed were Shorthorns, even though the English breed registry had not yet started. A few came as early as 1783, and significant numbers arrived around 1817. A few Herefords also entered the country in 1817, but the first meaningful numbers came in about 1840. The first few Angus came in 1873.

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



Figure 2. An 1811 painting of Comet, one of the foundation sires of Shorthorn. Image supplied courtesy of Beamish Museum Limited, copyright on image Beamish Museum Limited. www.beamishcollections.com/

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 required that foundation animals trace to ancestors recorded in the British registries. That is, no “upgrading” was allowed, which was not true of many breeds established or formed later in this country.

Upgrading

One way to create purebreds (or almost “pure”) is by a process called upgrading—successive “topcrosses” of purebred sires on other breeds, crosses, or of unknown background. The first topcross results in $\frac{1}{2}$ -“blood” progeny. If that $\frac{1}{2}$ -blood is topcrossed with a purebred, the progeny is $\frac{3}{4}$ “pure.” A third topcross results in a $\frac{7}{8}$ blood, generally the minimum in most associations for registry as officially defined Purebred. Some breed associations require $\frac{15}{16}$ or $\frac{31}{32}$ to be Purebred. In a number of registries, one more topcross is required for males than females in order to be Purebred. Upgrading results in some residual content of the base cattle, with the amount depending on how many topcrosses are involved. As with defining a breed, the definition of Purebred is arbitrary, as determined by the breed association.

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

Some associations distinguish between Purebred (with an arbitrary prescribed level of upgrading) and “Fullblood.” If so, Fullbloods are usually considered to be: 1) individuals recorded in a foreign breed registry officially recognized by the U.S. association (often the single registry considered to be the parent of the breed) and 2) individuals tracing exclusively to such ancestors. If there is a Fullblood designation, specific requirements are established by the particular breed association.

Why combine breeds?

Crossbreeding of cattle was often viewed unfavorably until the past 50 years or so, when the industry gradually recognized the utility of favorable breed combinations and heterosis, or hybrid vigor. This practice occurred earlier in plants and was followed by the crossbreeding of animals other than cattle. Until then, cattle breeders stressed creating and maintaining breed purity or “racial constancy,” increasing visible uniformity, and developing prepotent breeding stock that could reliably transmit their characteristics to offspring. Some inbreeding usually occurred in achieving these ends.

Purebred influence was thought necessary to improve “common” stock. This may have been at least partly a function of nationalism and societal structure. It is interesting to note that planned crossbreeding and creation of new breeds from crossbreds have been actively employed in the United States, a more open and heterogeneous society than those in Europe where the first breeds were developed.

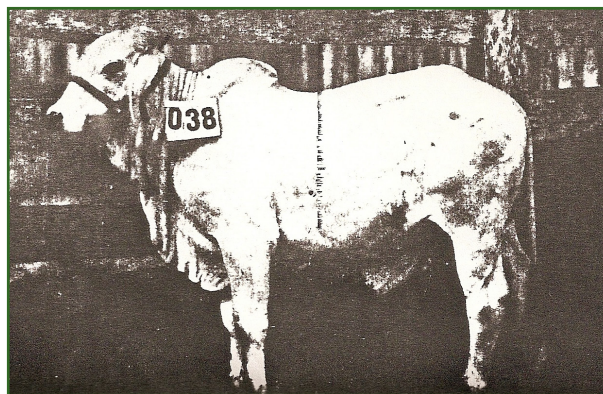


Figure 3. Photograph taken in 1924 upon importation of Aristocrata, sire of Manso who appears in the pedigrees of about 80 percent of today’s Grey Brahmans. Courtesy of J. D. Hudgins, Inc.

Breeders may make new breed combinations when there is a perceived need for a production type better suited to prevailing conditions. The U.S. Gulf Coast is characterized by a harsh climate

of generally persistent heat and high humidity. The first breed created in the United States by combining existing breeds—the American Brahman—was developed from a foundation better suited to those conditions than the British breeds. The Brahman was formed in the early 1900s from humped cattle (*Bos indicus*, also called Zebu) native to the Indian subcontinent. Some of the foundation cattle came directly from India but were largely from Brazil, mostly of the Guzerat, Gyr, Krishna Valley, and Nelore breeds.

Shortly after development of the Brahman began, other breeders in the same locale saw a need for a type intermediate to European cattle (*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 has come to be known as “American” breeds.

The first of these breeds created by combining different genetic types, not just different breeds of the same type, was the Santa Gertrudis, which was developed on the King Ranch in South Texas. These cattle are usually characterized as being $\frac{5}{8}$ Shorthorn and $\frac{3}{8}$ Brahman. However, the group of 52 bulls initially used in 1918 were $\frac{3}{4}$ and $\frac{1}{8}$ *Bos indicus* (the name “Brahman” was not officially adopted until 1924 when the American Brahman registry was started), so the precise breed content of Santa Gertrudis is not known.



Figure 4. Monkey, considered to be the foundation sire of Santa Gertrudis. Used by permission of King Ranch.

Beginning in the early 1930s, Beefmasters were formed on the Lasater Ranch in South Texas. That breed is now thought to be a little less than $\frac{1}{2}$ Brahman and a little more than $\frac{1}{4}$ each of Shorthorn and Hereford. In the mid 1940s, several breeders, most notably the Adams Ranch in Florida, created the Braford breed from crosses of Brahman and Hereford. After several breeders had experimented with crossing Angus and Brahman for some years, a specific content of $\frac{5}{8}$ Angus and $\frac{3}{8}$ 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.

These first crossbred-base breeds were developed over periods of at least 20 to 30 years before a registry was established. Even after establishment, some breeds allowed registry without knowing parentage, at least in the closed herd of a foundation breeder. But in most breeds created recently a registry was established when breed formation began, with required documentation of parentage.

After quarantine and disease-testing facilities were established in North America, the importation of many new breeds began in the late 1960s, mostly from Continental Europe. This led to various combinations of British and Continental breeds in many commercial herds, particularly outside the South and Southwest. A few of these combinations have registries.

Breed combinations

Breeds may be combined in several ways for different purposes, including the creation of a new breed with a registry. Breed registries can be closed or open. In a closed registry, individuals must trace to ancestors recorded in the registry at the time of formation or closing. Open registries allow outside stock to be brought in at any point by upgrading or other means.

- **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 create specific percentages of the constituent breeds or to keep track of the percentages that result as the breed is developed. Some pool breeds establish a closed registry, and some allow upgrading once the breed is established, but 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 ranges of percentages. If a range is allowed, the exact breed percentage of individuals is usually noted on pedigrees. After individuals of the defined percentage or formula are created, the registry may either be closed or allow creation from the parent breeds, but upgrading is generally not allowed. If creation is allowed from the parent breeds, most associations arbitrarily define an individual whose composition is that of the prescribed formula to be Purebred, regardless of the path taken to reach that formula. However, some animal breeding authorities hold that it takes the first generation of progeny from intermating indi-

viduals of the prescribed formula to be logically called purebred. If creation is from parent breeds, the number of early generations of intermating is often indicated on pedigrees.

- **Composites** are populations formed by crossing two or more existing breeds in specific percentages, followed by intermating of the crosses to maintain the percentages as with formulas. However, a specific intent in creating composites is to maintain the maximum possible levels of heterosis in future generations without additional crossing. This differentiates composites from pool and formula breeds. Composites are more an alternative to crossbreeding systems than a means of creating a breed. Composite breed has often been used to mean those formed by combining existing breeds. In fact, the term composite breeds probably should not be used. Instead, designation as combination breeds (pools and formulas) would distinguish them from true 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 many examples in beef production, a common one being the Brahman-crossbred female such as the Brahman-Hereford or Brahman-Angus. Crossbred females are often bred to another breed in a terminal cross, in which case they must be re-created when replacement females are needed. However, crossbreds 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 systems, see another publication in this series, E-189, *Texas Adapted Genetic Strategies for Beef Cattle—IV: Breeding Systems*.

These four methods of combining breeds are often confused and misunderstood. Also, 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 combining breeds 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 combining breeds

Crossbreds have long been thought to be inherently more variable than purebreds. But, theoretically, the progeny from the first cross of two breeds should be rather uniform, at least in production characteristics if not in physical features such as color. In a study involving large numbers of several British and Continental breeds at the U.S. Meat Animal Research Center (MARC) it was reported that “increased genetic variation in composite populations was not observed relative to contributing purebreds.”

It has also been thought that continued crossing, as in developing combination breeds, would destroy heterosis. One of the purposes of the MARC work was to determine how much heterosis is lost when crossbreds are intermated. In theory, when first-generation (F_1) crosses are intermated, half of their heterosis is lost in the second-generation (F_2) progeny. But if those F_2 progeny are then intermated, there should be no additional reduction of heterosis.

The MARC research basically confirmed this theory of heterosis retention, at least in extended generations of intermating British and Continental crosses. 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, closed populations of breed combinations (including breeds formed from combinations) should be as numerous 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 breeds most influential in Texas are:

- **Angus**—The registry started in 1883 with base animals all recorded in the founding Scottish registry. It has been closed since inception, except to cattle recorded in approved foreign registries.

- **Beefmaster**—This breed was formed from a pool of Brahman, Hereford, and Shorthorn. The registry started in 1961. Base purebreds are all from or trace to the founding Lasater herd. Registry is open, allowing upgrading with three topcrosses on visually inspected base cattle and inspected topcrosses to arrive at Purebred ($\frac{7}{8}$).
- **Braford**—The registry started in 1979 with approved foundation cattle formed from pools of Brahman and Hereford. It later accepted documented $\frac{5}{8}$ Hereford- $\frac{3}{8}$ Brahman individuals. Now the registry is open, where Purebred (defined as $\frac{5}{8}$ Hereford- $\frac{3}{8}$ Brahman, plus or minus 5 percent) can be created by any process, including upgrading.
- **Brahman**—This breed was formed from pools of several *Bos indicus* breeds and some upgrading. The registry started in 1924 and closed in 1939. It opened thereafter for a small number of 1946 imports and later to a few individuals of *Bos indicus* breeds recorded in other countries' approved registries. Former separate registries for American Gray and American Red have been combined.
- **Brangus**—These cattle are created using a specific formula. The registry started in 1949 with foundation individuals of $\frac{5}{8}$ Angus- $\frac{3}{8}$ Brahman content. The open registry allows for the creation of Purebreds from registered Angus and Brahman parents. There is no upgrading program. This breed was formerly limited to black color but now allows reds. The former International Red Brangus registry has been merged with Brangus.
- **Braunvieh**—The 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 allows upgrading to Purebred ($\frac{7}{8}$ female, $\frac{15}{16}$ male). The fullblood designation is called Original Braunvieh. It has a separate registry for Beef Builder.
- **Charolais**—This breed was formed from Mexican imports from France beginning in the 1930s. Registry started in 1957. Registry is open, with upgrading to Purebred ($\frac{3}{32}$). It also designates Full French (French imports or from French parents imported after 1961) and American French (minimum $\frac{15}{16}$ Full French). It has a separate registry (Red Factor Division) for Purebred individuals of colors other than white, light straw, or light cream. It also has a separate registry for Charbray.
- **Chianina**—The registry started in 1972 with imports from Italy. Any percentage may be registered, which is designated on pedigree. It has a Fullblood designation. It has separate registries for Chiangus, Chiford, Chimaine, and Red Chiangus.
- **Gelbvieh**—The registry started in 1971 with imports from Germany. Registry is open with upgrading to Purebred ($\frac{7}{8}$ for female, $\frac{15}{16}$ for male). It has a Fullblood designation and a separate registry for Balancer.
- **Hereford**—The registry began in 1881 with the base animals all recorded in the English registry. It has been closed since inception, except to cattle recorded in approved foreign registries. Formerly separate registries for horned and polled have been combined.
- **Holstein**—The registry started in 1872 with cattle from Holland. Cattle of any percentage Holstein can be registered, with four designations based on source (and breed percentage) as follows: North American registry ancestry (100 percent); North American (up to 99 percent); approved foreign registry ancestry (100 percent); foreign (up to 99 percent).
- **Jersey**—The registry started in 1868 with cattle imported from the Jersey Isles and England. It includes cattle descended from original herdbook and from parents recorded in approved foreign registries. It has an upgrading program to Purebred ($\frac{3}{32}$).
- **Limousin**—The registry started in 1968 with imports from France. It is open, with upgrading to Purebred ($\frac{7}{8}$ for female, $\frac{15}{16}$ for male) and for lower percentages. It has a Fullblood designation (100 percent). It has a separate registry for Lim-Flex.
- **Maine-Anjou**—The registry started in 1969 with imports from France. It is open, with upgrading to Purebred ($\frac{7}{8}$). It has a Fullblood designation and a separate registry for MaineTainers.
- **Red Angus**—The registry started in 1954, recording red animals out of parents registered in Angus association. It has four categories: 1A—100 percent Red Angus; 1B—87 to less than 100 percent Red Angus; II—also 87 to less than 100 percent Red Angus, but 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 visual

inspection, so the formula varies. It does not allow upgrading but does allow creation from the two parent breeds. The former International Red Brangus registry requiring $\frac{5}{8}$ Angus- $\frac{3}{8}$ Brahman has been merged with Brangus.

- **Salers**—The registry started in 1974 with imports from France. It is open, with upgrading to Purebred ($\frac{15}{16}$). It has a Fullblood designation.
- **Santa Gertrudis**—This breed was formed on the King Ranch from a pool of approximately $\frac{5}{8}$ Shorthorn- $\frac{3}{8}$ Brahman. The registry started in 1951 with King Ranch cattle and officially designated Foundation Herds (tracing to King Ranch). The registry is open and allows upgrading with $\frac{1}{2}$ and $\frac{3}{4}$ bloods referred to as Star 5 and $\frac{7}{8}$ being Purebred.
- **Shorthorn**—The registry started in 1846 with the base animals all registered in the English herdbook. It was closed except to the English herdbook and other herdbooks tracing exclusively to the English. It was opened in 1973 to other approved foreign registries not necessarily tracing exclusively to English registry. It has an appendix upgrading program to $\frac{15}{16}$, called Fullblood, which is considered to be 100 percent Shorthorn. Base Appendix individuals enter as $\frac{3}{8}$ to $\frac{7}{8}$ blood, depending on the fraction of Shorthorn ancestry as defined by the association. American Milking Shorthorns tracing to the original English registry can enter as 100 percent Shorthorn. It has a separate registry for Durham Reds.
- **Simbrah**—This breed is registered in the Simmental association as Purebred (specific formula of $\frac{5}{8}$ Simmental- $\frac{3}{8}$ Brahman) or Percentage (combinations of not less than $\frac{3}{8}$ Simmental, not less than $\frac{1}{4}$ Brahman, and not more $\frac{3}{8}$ other breeds). There is no upgrading program, except of Simmental parentage.
- **Simmental**—The registry started in 1968 with imports from Continental Europe. It has an open registry, with upgrading to Purebred ($\frac{7}{8}$ female, $\frac{15}{16}$ male). It has a Fullblood designation. Accepted individuals may be recorded in any registry in the World Simmental Federation. It also has a registry for SimAngus.
- **Texas Longhorn**—The registry started in 1964 with a pool of Southwestern U.S. Criollo-type cattle (from seven long-time breeders of this type) approved by inspection for prescribed visible characteristics. Inspection ceased and the registry was closed in 1975.

Imported breeds of lesser numerical influence in Texas with current U.S. registries or that may be registered by current U.S. registries are:

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

Combination breeds of lesser numerical influence in Texas with current U.S. registries or that may be registered by current U.S. registries are:

- **American Breed**— $\frac{1}{2}$ Brahman, $\frac{1}{4}$ Charolais, $\frac{1}{8}$ bison, $\frac{1}{16}$ Hereford, $\frac{1}{16}$ Shorthorn
- **Amerifax**— $\frac{5}{8}$ Angus, $\frac{3}{8}$ Beef Friesian
- **Balancer**— $\frac{1}{4}$ to $\frac{3}{4}$ Gelbvieh, $\frac{1}{4}$ to $\frac{3}{4}$ Angus or Red Angus, possibly $\frac{1}{8}$ other breed
- **Beefmaster Advancer**— $\frac{1}{2}$ or more Registered Beefmaster and $\frac{1}{2}$ or less other registered breed
- **Barzona**—pool with about $\frac{1}{4}$ each Africander, Angus, Hereford, Santa Gertrudis
- **Beef Builder**— $\frac{1}{4}$ and higher Braunvieh
- **Brahmousin**— $\frac{5}{8}$ Limousin, $\frac{3}{8}$ Brahman
- **Bralers**— $\frac{5}{8}$ Salers, $\frac{3}{8}$ Brahman
- **BraunAngus**—at least $\frac{1}{4}$ and no more than $\frac{15}{16}$ (males) or $\frac{7}{8}$ (females) Braunvieh with remainder registered Angus or Red Angus
- **Braunbray**—at least $\frac{1}{4}$ and no more than $\frac{15}{16}$ (males) or $\frac{7}{8}$ (females) Braunvieh with remainder from animals registered in a U. S. Zebu breed association
- **BueLingo**—pool of Angus, Chianina, Dutch Belted, Shorthorn
- **Charbray**— $\frac{5}{8}$ to $\frac{13}{16}$ Charolais, $\frac{3}{16}$ to $\frac{3}{8}$ Brahman
- **Chiangus**—any percentages of Chianina and Angus
- **Chiford**—any percentages of Chianina and Hereford
- **Chimaine**—any percentages of Chianina and Maine-Anjou
- **Corriente**—pool of Criollo-type Mexican cattle

- **Durham Reds**— $\frac{1}{4}$ to $\frac{3}{4}$ Shorthorn, remainder Red Angus
- **Florida Cracker/Pineywoods**—pool of Criollo-type Florida cattle
- **Gelbray**— $\frac{5}{8}$ Gelbvieh, $\frac{3}{8}$ Brahman
- **Lim-Flex**— $\frac{1}{4}$ to $\frac{3}{4}$ Limousin, $\frac{1}{4}$ to $\frac{3}{4}$ Angus or Red Angus, possibly $\frac{1}{8}$ other breed
- **MaineTainer**— $\frac{1}{4}$ to $\frac{5}{8}$ Maine Anjou
- **Murray Grey**—pool of Angus and Shorthorn
- **Red Chiangus**—any percentages of Chianina and Red Angus
- **RX³**— $\frac{1}{2}$ Red Angus, $\frac{1}{4}$ Hereford, $\frac{1}{4}$ Red Holstein
- **Salorn**— $\frac{5}{8}$ Salers, $\frac{3}{8}$ Texas Longhorn
- **Senepol**—pool of Red Poll and N'Dama (a humpless west African heat-tolerant breed)
- **SimAngus**— $\frac{1}{4}$ to $\frac{3}{4}$ Simmental, $\frac{1}{4}$ to $\frac{3}{4}$ Angus or Red Angus, possibly no more than $\frac{1}{4}$ other breed(s)
- **Simbravieh**—minimum $\frac{1}{4}$ Braunvieh, $\frac{1}{8}$ Simmental, and $\frac{1}{8}$ Brahman with no more than $\frac{1}{4}$ from any other breeds
- **South Poll**— $\frac{1}{4}$ Red Angus, $\frac{1}{4}$ Hereford, $\frac{1}{4}$ Barzona, $\frac{1}{4}$ Senepol
- **Southern Balancer**—at least $\frac{1}{4}$ Gelbvieh and $\frac{1}{16}$ to $\frac{1}{2}$ tropical-adapted breed or combination of tropical-adapted breed(s)
- **Texon**—pool of Devon and Texas Longhorn
- **MARC II**— $\frac{1}{4}$ Angus, $\frac{1}{4}$ Gelbvieh, $\frac{1}{4}$ Hereford, $\frac{1}{4}$ Simmental
- **MARC III**— $\frac{1}{4}$ Angus, $\frac{1}{4}$ Hereford, $\frac{1}{4}$ Pinzgauer, $\frac{1}{4}$ Red Poll

A number of what might be called new Southern combinations have been developed; these contain $\frac{1}{4}$ or less *Bos indicus* (and, in some instances, a portion of other heat-tolerant breeds) instead of $\frac{3}{8}$ to $\frac{1}{2}$ *Bos indicus* in the established American breeds. Some of these include Angus or Red Angus and generally $\frac{1}{4}$ or less Brahman. Also being developed are other new Southern combinations, all of which have better heat tolerance than 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 may simply want to form their own unique population. Regardless of the motivation, many combinations have been made and more are sure to come. Whether a particular combination is a “breed” is open to discussion.

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://AgriLifeBookstore.org> and the Texas A&M Animal Science Extension Web site <http://beef.tamu.edu>.

Other breed combinations

Beginning in the late 1970s, MARC created the following British-Continental combinations maintained as true composites:

- **MARC I**— $\frac{1}{4}$ Braunvieh, $\frac{1}{4}$ Charolais, $\frac{1}{4}$ Limousin, $\frac{1}{8}$ Angus, $\frac{1}{8}$ Hereford

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