# Virginia Cooperative Extension

# Beef Cattle Breeds and Biological Types

*Scott P. Greiner, Extension Animal Scientist, Virginia Tech*

Worldwide there are more than 250 breeds of beef cattle. Over 60 of these breeds are present in the United States. However, a relatively small number of breeds (less than 20) constitute the majority of the genetics utilized in the U.S. for commercial beef production. The breed, or combination of breeds, used in a defined breeding program have a significant impact on the efficiency and profitability of the beef enterprise. Breed influences the important parameters of growth rate, reproductive efficiency, maternal ability, and end-product specifications. Additionally, nutritional requirements and production costs are related to traits such as mature cow size and growth rate that are largely determined by breed. Therefore, selecting appropriate breeds to be used in a crossbreeding program is an important decision for beef cattle producers.

## Characterizing Breeds of Beef Cattle

### British Breeds

British breeds are breeds that were developed in the British Isles and were brought to the United States in the late 1700s through the late 1800s. Angus (Black and Red), Hereford (Horned and Polled), and Shorthorn are the primary British breeds. When compared to Continental European breeds, British breeds are generally smaller in mature size, reach mature size at an earlier age, have less growth potential, excel in fertility and calving ease, attain higher quality grades, and yield carcasses with a lower percentage of saleable product.

### Continental European Breeds

Continental European breeds are also commonly referred to as "exotic" breeds and include Charolais, Chianina, Gelbvieh, Limousin, Maine Anjou, Salers, and Simmental. The majority of these breeds are relatively new to the U.S., being imported in the late 1960's and early 1970's primarily to improve the growth rate and leanness of existing breeds. In comparison to British breeds, Continental European breeds are generally larger in mature size, later maturing (reach mature size at an older age), produce carcasses with less fat and a higher percentage of saleable product, have lower quality grades, and produce more calving difficulty when mated to cows of the British breeds.

In the past 25 years, considerable research has been conducted to characterize and compare the major beef breeds in the U.S. The most comprehensive studies have been conducted at the U.S. Meat Animal Research Center in Clay Center, NE. Since 1970, over 30 breeds have been evaluated in a common environment and management system for various performance traits. The data presented in the following tables summarize the results for sire breeds common to Virginia. Data on the breeds represented in this publication were collected from 1970 to 1990. Sires of the various breeds were mated to Angus, Hereford, or crossbred cows. Therefore, the data shown are for crossbred progeny sired by the various breeds and out of Angus, Hereford, or crossbred dams. Hereford-Angus cross calves were produced throughout the duration of the study and served as the control. Original Hereford-Angus data represent performance of progeny from Hereford (Horned and Polled) and Angus bulls born before 1970; current Hereford-Angus data are for bulls of these breeds born from 1982 to 1984. The situation is similar for Original and Current Charolais.

### Growth Traits:

Breed group means for birth and weaning weight, as well as feedlot average daily gain and final (slaughter) weights are shown in Table 1. Birth and weaning data are from both steers and heifers, whereas average daily

**Virginia Tech**
*Invent the Future*

VIRGINIA STATE UNIVERSITY

gain and final weight are averages of only steer progeny. Final weights are adjusted to a common age at slaughter. Significant differences among breeds for the various traits are evident. Breeds that sire calves that are heavy at birth also tend to be the heaviest at weaning, grow the fastest in the feedlot, and have the heaviest final weights (Charolais). The high-growth breeds with heavier birth weights also tended to cause more calving difficulty resulting in a lower percentage of unassisted births. Research studies confirm that heavy birth weights are the primary cause of calving difficulty. Calf survival to weaning tended to be higher in breeds that required less assistance at birth (Hereford-Angus, Shorthorn, Salers).

## Carcass Traits:

Means for steer progeny carcass data are presented in Table 2. Carcass weights are highly related to final weights presented in Table 1. This table demonstrates that breeds which excel in retail product yield (percentage of the carcass weight that is trimmed, saleable red meat) also have lower marbling scores and reduced percentage of USDA Choice quality grades (Chianina, Limousin). Marbling score is a measurement of the amount of intramuscular fat in the ribeye muscle and is an indicator of eating quality. High marbling breeds generally are lower in retail product yield. Fat thickness of the carcass has the largest impact on retail product yield. As fat thickness increases, a lower percentage

**Table 1.** Sire Breed Group Averages for Birth, Weaning and Feedlot Performance Traits[1]

| Breed Group | % Unassisted Births | % Survival To Weaning | Birth Wt., lb. | 200 day Wn. Wt., lb. | Average Daily Gain, lb. | Final Weight, lb. |
|---|---|---|---|---|---|---|
| Orig. Hereford-Angus | 94.8 | 95.7 | 75.2 | 432 | 2.51 | 1068 |
| Curr. Hereford-Angus | 92.7 | 91.5 | 80.4 | 458 | 2.74 | 1152 |
| Orig. Charolais | 83.5 | 85.8 | 86.4 | 461 | 2.77 | 1160 |
| Curr. Charolais | 86.8 | 89.5 | 86.5 | 479 | 2.89 | 1219 |
| Chianina | 88.4 | 89.3 | 86.9 | 459 | 2.63 | 1124 |
| Gelbvieh | 94.1 | 91.0 | 83.8 | 456 | 2.66 | 1129 |
| Limousin | 91.8 | 90.8 | 80.6 | 443 | 2.49 | 1080 |
| Maine Anjou | 79.4 | 88.9 | 88.0 | 456 | 2.72 | 1147 |
| Salers | 95.2 | 91.7 | 80.9 | 464 | 2.70 | 1148 |
| Shorthorn | 97.6 | 91.9 | 82.4 | 460 | 2.73 | 1156 |
| Simmental | 89.2 | 88.8 | 84.9 | 458 | 2.73 | 1148 |

[1]Adapted from Cundiff et al., 1993.

**Table 2.** Sire Breed Group Averages for Carcass Traits[1]

| Breed Group | Carcass Weight, lb. | Fat thickness, in. | Ribeye Area, in2. | Retail Product Yield, % | Marbling Score[2] | % USDA Choice |
|---|---|---|---|---|---|---|
| Orig. Hereford-Angus | 654 | .62 | 10.9 | 67.1 | 551 | 74.5 |
| Curr. Hereford-Angus | 707 | .63 | 11.2 | 67.2 | 543 | 70.7 |
| Orig. Charolais | 710 | .37 | 12.4 | 71.1 | 528 | 64.7 |
| Curr. Charolais | 747 | .36 | 12.6 | 70.2 | 523 | 58.9 |
| Chianina | 692 | .32 | 12.4 | 71.9 | 448 | 27.5 |
| Gelbvieh | 686 | .39 | 12.0 | 70.2 | 507 | 45.2 |
| Limousin | 667 | .39 | 12.3 | 71.5 | 477 | 43.8 |
| Maine Anjou | 705 | .38 | 12.3 | 70.1 | 501 | 49.5 |
| Salers | 707 | .41 | 12.0 | 70.0 | 515 | 44.5 |
| Shorthorn | 707 | .49 | 11.1 | 67.0 | 566 | 74.7 |
| Simmental | 695 | .37 | 11.9 | 70.1 | 510 | 63.4 |

[1]Adapted from Cundiff et al., 1993.
[2]400 = Slight degree of marbling = Select Quality Grade,  500 = Small degree of marbling = Choice- Quality Grade

of the carcass is saleable retail product due to trimming loss. Consequently, lean breeds with minimal carcass fat thickness excel in retail product yield. Ribeye area is an indicator of total muscle mass in the carcass and has a positive influence on retail product yield. These breed differences verify the importance of using a combination of British and Continental genetics that complement each other in a breeding program to produce an end product that has both acceptable carcass quality and retail product yield.

## Yearling Heifer Traits:

Yearling heifer data for growth and reproductive traits are shown in Table 3. Heifers sired by breeds that were heaviest at 400 days of age tended to be the oldest at puberty. Conversely, heifers sired by breeds with smaller mature size tended to reach puberty at a younger age (Hereford-Angus). However, some large breeds that have been selected for milk production (Gelbvieh, Simmental, Salers) reach puberty at a relatively young age. Pregnancy rate in heifers was not consistently related to age at puberty or body weight at 400 days of age because most animals in these studies were managed to grow at rates that allowed them to express puberty well before the start of their first breeding season. Different results could occur in less intensively managed animals.

## Cow Production Traits:

The reproductive and maternal trait means of cows sired by the breeds of primary interest in Virginia are presented in Table 4. Cows were mated to similar bulls,

**Table 3.** Sire Breed Group Averages for Yearling Heifer Traits[1]

| Breed Group | 400-day weight, lb. | Puberty Expressed, % | Age at Puberty, days | Pregnancy Rate, % |
|---|---|---|---|---|
| Orig. Hereford-Angus | 706 | 92.2 | 365 | 87.9 |
| Curr. Hereford-Angus | 747 | 97.3 | 366 | 80.1 |
| Orig. Charolais | 744 | 87.0 | 393 | 81.0 |
| Curr. Charolais | 781 | 96.3 | 361 | 79.0 |
| Chianina | 734 | 83.8 | 400 | 84.0 |
| Gelbvieh | 725 | 87.1 | 341 | 87.4 |
| Limousin | 717 | 88.0 | 391 | 83.7 |
| Maine Anjou | 753 | 90.6 | 370 | 92.8 |
| Salers | 763 | 101.0 | 365 | 89.0 |
| Shorthorn | 769 | 95.8 | 359 | 89.0 |
| Simmental | 749 | 94.4 | 360 | 86.4 |

[1]Adapted from Cundiff et al., 1993.

**Table 4.** Breed Group Averages for Production Traits of Crossbred Cows[1]

| Breed Group | Calves Born Alive, % | Calves Weaned, % | Calves Born Unassisted, % | Calf Birth Wt., lb. | Calf 200-day Wt.: Per calf weaned, lb. | Calf 200-day Wt.: Per cow exposed, lb. |
|---|---|---|---|---|---|---|
| Orig. Hereford-Angus | 91 | 84 | 87 | 86 | 475 | 401 |
| Curr. Hereford-Angus | 88 | 79 | 87 | 88 | 504 | 399 |
| Orig. Charolais | 88 | 80 | 85 | 93 | 503 | 403 |
| Curr. Charolais | 89 | 80 | 91 | 91 | 507 | 404 |
| Chianina | 93 | 86 | 92 | 95 | 523 | 454 |
| Gelbvieh | 95 | 87 | 89 | 90 | 533 | 464 |
| Limousin | 89 | 82 | 88 | 88 | 484 | 397 |
| Maine Anjou | 94 | 86 | 89 | 96 | 522 | 449 |
| Salers | 92 | 86 | 92 | 90 | 527 | 453 |
| Shorthorn | 93 | 87 | 90 | 94 | 529 | 460 |
| Simmental | 89 | 83 | 83 | 91 | 521 | 433 |

[1]Adapted from Cundiff et al., 1993.

and performance information was recorded on the calves to measure the maternal characteristics of the crossbred cows. Cows sired by bulls with large mature size gave birth to heavier calves. However, these heavier calves at birth did not result in an increase in calving difficulty measured in percentage of calves born unassisted. This is different from the results shown in Table 1, where calves that were heavy at birth required more assistance at calving. For Table 4, maternal calving ease is the trait of interest, i.e. how the daughters of a particular breed of sire calve as cows. Table 4 suggests that cows that have increased mature size are able to give birth to heavier calves without increases in calving difficulty. The 200-day weaning weights are reflective of both the milking ability of the cow and the growth potential of the calf. Cows with high milk production and growth (Gelbvieh) had higher calf weaning weights than cows with low milk production (Limousin). Conception rates, calving difficulty, and calf livability also contribute to calf weaning weights when calf weaning weights are expressed on a per cow exposed basis. Breeds that sire cows that excel in this combination of traits will have heavier weaning weights per cow exposed (Gelbvieh, Shorthorn).

### General Characterization of Breeds:

Table 5 characterizes the breeds for relative differences in growth rate/mature size, lean to fat ratio (retail product yield), age at puberty, and milk production. Generally, the Hereford-Angus and Shorthorn crossbreds are moderate in growth and mature size, relatively low in lean to fat ratio, reach puberty at a young age, and are moderate in milk production. In comparison, calves sired by Gelbvieh, Maine Anjou, Salers, and Simmental bulls were moderate to high in growth rate and mature size, high in lean to fat ratio, moderate in age at

puberty, and moderate to high in milk production. The Charolais, Chianina, and Limousin breed types tended to be high in growth rate/mature size, high in lean to fat ratio, older at puberty, and low in milk production.

## Selecting Breeds of Beef Cattle

There are several criteria that must be taken into consideration when making breed selection decisions:

- Production system
- Market demands
- Quantity and quality of feedstuffs available
- Climate
- Breed complementarity
- Cost and availability of purebred seedstock

Breeds need to be selected that fit into a designed production system. The production system for cow-calf producers should include a crossbreeding program that utilizes two or more breeds. The breeds chosen need to produce calves that are appropriate for their end use. As an example, choice of a sire breed may be different for a producer who is selling crossbred replacement heifers than for a producer who sells all his calves at weaning. For the producer marketing replacement heifers, maternal and reproductive performance along with growth rate and calving ease would be important considerations for the sire breed. If all calves are sold at weaning, growth rate and calving ease are of primary importance. If ownership of the calf crop is retained through the feedlot phase, carcass characteristics become increasingly important. USDA grade, conformation, and coat color of resulting progeny influence market prices received and should be considered when selecting breeds. Breeds utilized in a crossbreeding

**Table 5.** Characterization of Sire Breeds for Four Production Traits[1]

| Breed Group | Growth Rate and Mature Size | Lean to Fat Ratio | Age at Puberty | Milk Production |
|---|---|---|---|---|
| Hereford-Angus | XXX | XX | XXX | XX |
| Charolais | XXXXX | XXXXX | XXXX | X |
| Chianina | XXXXX | XXXXX | XXXX | X |
| Gelbvieh | XXXX | XXXX | XX | XXXX |
| Limousin | XXX | XXXXX | XXXX | X |
| Maine Anjou | XXXXX | XXXX | XXX | XXX |
| Salers | XXXXX | XXXX | XXX | XXX |
| Shorthorn | XXX | XX | XXX | XXX |
| Simmental | XXXXX | XXXX | XXX | XXXX |

[1]Adapted from Cundiff et al., 1993.
X = lowest, XXXXXX = highest

program also influence the mature size of the cowherd. Breeds need to be selected that have mature sizes that are appropriate for the operation's feed resources and environment. Cows that are too large for the available feed resources may have lower reproductive efficiencies and require more supplemental feed. Finally, the availability of high quality purebred seedstock for a desired breed needs to be considered.

# Breeds Common in Virginia

Tables 1 through 5 presented data for breeds that are frequently used on commercial cow-calf operations in Virginia. The majority of the commercial cow herd in Virginia consists of Angus and Angus-cross females. Traits important for dam breeds in crossbreeding programs include:

- early puberty
- moderate mature size
- high fertility
- moderate to high milking ability (appropriate for feed resources)
- calving ease
- longevity
- acceptable growth and carcass characteristics

The Angus female has been popular in Virginia as a result of her ability to combine these traits. Additionally, Angus genetics are available in abundant supply in Virginia. In crossbreeding programs, Angus also contributes black coat color and carcass quality (marbling). For these reasons, black Angus-influenced feeder cattle traditionally are in high demand by cattle feeders in the Eastern Corn Belt.

Traits important in selecting a sire breed for use in crossbreeding programs include:

- high growth rate with moderate mature size
- acceptable calving ease
- adequate carcass quality grades (marbling)
- high retail product yield

Breeds that excel in these traits are commonly referred to as "terminal sires" (all calves will be sold for slaughter, replacement heifers not retained in the herd) and include Charolais and Limousin. These breeds are commonly crossed with British breed cows to produce a fast growing calf that has acceptable carcass quality grade and retail product yield. In doing so, the strengths of the British breeds (carcass quality grades) and Continental European breeds (growth rate and retail product yield) complement each other.

Other breeds that are common to Virginia may be referred to as both sire and dam breeds, including Gelbvieh, Salers, and Simmental. These breeds are frequently used in rotational crossbreeding programs in which some of the heifers are retained as replacements and the remainder of the calf crop (steers and cull heifers) is sold as feeder calves or placed in a feedlot. The higher level of growth and milk production in these breeds results in females that will wean heavier calves. Commercial cows that are 1/2 to 3/4 British (Angus, Hereford, Shorthorn) and 1/4 to 1/2 Continental (Gelbvieh, Salers, Simmental) are well adapted to Virginia.

# Summary

No single breed is superior for all traits that are important for beef production. Compromises in certain traits are inevitable when selecting breeds to be used in a crossbreeding program. Additionally, there is tremendous variation within a breed for traits of importance. In some cases, this variation within a breed may be larger than the difference between two breeds for a particular trait. Therefore, selection within a breed through the use of Expected Progeny Differences (EPDs) is critical for any breeding program.

# References

Cundiff, L.V., F. Szabo, K.E. Gregory, R.M. Koch, M.E. Dikeman, and J.D. Crouse. 1993. Breed comparisons in the Germplasm Evaluation Program at MARC. Proc. Beef Improv. Fed. Ann. Res. Sym. and Ann. Mtg. pp. 124-136.