Beef Production and the Brahman-Influenced Cow in the Southeast

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The importance of the brood cow to efficient beef production is often overlooked in reference to the importance of the bull to create genetic change. The emphasis on selection of growth traits and carcass traits measured in cattle at older ages clearly directs attention to sires for genetic change on a herd basis. However, beef herd productivity is obviously related to reproductive, maternal and growth traits expressed in the brood cow herd. Dickerson (1970) defined efficient beef production to involve:

- Reproductive aspects for the herd
- Maternal performance
- Growth of the progeny after weaning.

The first two aspects are fundamental female attributes that encompass herd conception, calving and survival, and maternal care to weaning. The industry has accepted the "best" herd productivity measure for the cow-calf enterprise to be pounds of weaned calf per cow exposed to breeding. This is average weaning weight, multiplied by the percentage of calves weaned from cows exposed. Weaning weight is both a direct genetic trait relative to growth and a maternal trait reflective of the cow in milking ability. The percentage of calf crop weaned is also a combination trait that reflects (percentage conception) x (percentage successful gestation and calving survival) x (percentage survival to weaning). To illustrate this point, consider a 93% conception rate in a breeding season, a 97% successful gestation and delivery, and a 97% survival to weaning. The combined product, (.93) x (.97) x (.97) = .875, indicates calves weaned from cows exposed.

The relative importance of environmental factors is estimated by the heritability of a trait. Classically, reproductive traits are lowly heritable (less than 20%) except for some indicator traits, such as scrotal circumference. Weaning weight is moderate in heritability between 20 to 30% in most breed EPD analyses. Therefore, the importance of environmental effects cannot be ignored when designing herd improvement programs or using selection both within and between breeds to improve herd productivity. This relates to cows matching the natural environment for ease of management and care, basically reflected in nutritional and weather stress factors. To define and measure adaptive merit is nearly impossible on an individual phenotypic basis. Clearly, herd production statistics are the most important variables that become descriptive in most herds. Controlled breed comparisons are essentially lacking due to the cost, time, and herd size required. The USDA Meat Animal Research Center Germ Plasm Project is the national effort; and cooperative studies pooled across regions are also helpful to define breed or breed type differences (Wyatt and Franke, 1986).

Brown and Thrift (1992), Brown and Johnson (1992) and Robison (1992) prepared excellent concept papers to relate to reproductive, growth and composition, and maternal and paternal effects in utilizing quantitative genetics in beef production in the South. The most important concepts directly impacting breeding policy involve the relatively large negative genetic correlation between growth direct genetic and maternal genetic effects. That is, selection for growth traits are negatively associated with maternal (milking) ability. Also, the magnitude of maternal effects in weaning weight are larger than the direct genetic effects. Robison (1992) concludes that maternal effects may contribute as much or more than direct genetic effects to crossbreeding programs. This says that the crossbred cow may best define expected herd productivity. Please refer to Table 1 for the summary of maternal and direct genetic effects documented.

The relative importance of heterosis in reproduction, maternal, and growth traits has been clearly and capably documented. Evidence indicates that the *Bos taurus* and *Bos indicus* crosses are capable of larger heterosis effects. The magnitude of the effects is relative to the parental breed performance in a defined environment. Larger heterosis effects are seen in stressful environments where purebred performance is restricted due to poor adaptation or largely negative environmental factors affecting performance.

Listed below are advantages considered important in recommending Brahman-influenced or crossbred cows with *Bos taurus* breeding:

- Intermediate parental breed genetics (average additive effects) for traits expressed later in life.
- Adaptation to stressful environments and utilization of reproductive heterosis (planned or recombination effects).
- Sufficient early puberty to support 2-year-old calving.
- Calving ease and maternal care advantages.
- Enhanced weaning weight due to both maternal and growth heterosis.
- Enhanced longevity in the cow herd.

The apparent *disadvantages* are identified as:

- Disposition and handling difficulties.
- Increased management problems due to poor teats and udders and uterine prolapse frequency.
- Lack of phenotypic uniformity in progeny due to intermediate parental breed base. Too much Brahman appearance clearly reduces marketability.
- Carcass merit aspects are seriously questioned in all Brahman-influenced cattle. Only 1/4 blood composition is considered acceptable.

At this point, it is important to identify that the carcass traits and beef attributes related to eating quality are highly heritable and under additive genetic influence. Little heterosis has been documented in carcass aspects, and crosses are the average of their breed composition. Stated differently, using 3/8 Brahman inheritance to predict carcass merit is essentially useless without knowledge of the other 5/8 composition inheritance.

Clearly, the most appropriate use of Brahman-influenced cattle is related to the maternal advantages manifest in heterosis in reproduction, maternal and growth traits, and additional breed merits relative to adaptive and environmental restrictions. The intermated composite cattle, American breeds, are comparable to controlled crossbreds due to additive breed composition and expected recombination that will recreate heterozygous genotypes and retain some heterotic advantages. As an example, a 5/8–3/8 composition breed will retain 30/64 heterozygous genotypes with random mating each generation. If selection favors heterotic effects in growth traits, then the effect of selection should be toward intermediate gene frequency and maximum frequency of heterozygous genotypes.

The beef industry most often forces attention and evaluation of breeds and crosses toward paternal or direct genetic effects in growth traits. This results in emphasis on breeding bulls. Economically, the breeds and crosses most productive are those with major reproductive and maternal merits. Reproduction should be maximized but maternal (milk) aspects should be optimum for early growth advantage and for adaptive benefit to support yearly reproduction. The convenience aspects of limited dystocia and ease of management are important in labor efficiency.

Most commercial cattlemen should basically match their brood cows environmentally and use heterosis in reproductive, maternal, and growth traits. Herd management plans are most often lacking, and controlled crossbreeding schemes are difficult to manage and accept due to the maternal changes over generations. This affords a major advantage to composite breeds that are managed as a single herd with a uniform female each generation. The herd management system in Figure 1 is recommended to commercial cattlemen.

This scheme can be altered by decreasing the crossbred matings to allow for herd expansion but this also increases the straightbred Breed B males. It obviously allows a Breed B purebred breeder to participate as a commercial producer with crossbred heifers that will be 100% heterozygous. Another important management advantage is the ability to change to another breed of bull for crossbred calves in any year with a uniform single breed (B) cow herd. By using American breeds as the maternal breed in this scheme, some natural heterozygous merits are realized in the straightbred cow herd. This scheme also allows for full use of selection in purebred bulls to direct genetic change. Lastly, many producers will feel it is easy to use because a simple phenotypic sort of calves is possible, based upon the breeds selected for the scheme.

The obvious merits in utility of Brahman-influenced breeds strongly favors a maternal use. American breed bulls are recommended to sustain the needed replacements, which indicates that growth emphasis should be optimized in selection. More moderate frame should be emphasized, but requirements differ due to the environment. Smaller cattle are suited to more restrictive nutritional and climatic stresses (heat and cold).

American breed bulls can be effectively used with other breeds of straightbred cows for controlled heterosis and an additive breed composition to create intermediate genotypes for a specific utility. However, the two-breed composite breeds of Brahman-influence are certainly recommended as the base cow herd for commercial beef herds.

References

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Table 1. Heritability, genetic correlation, and ratio values of maternal (M) and direct (D) effects, and maternal and direct heterosis in preweaning traits.[a]				
Trait	h^2(%)	$r_{gD.M}$	Effect Ratio M/D	Heterosis Ratio M/D
Birthweight	34	-.42	1.00	.98
Preweaning daily gain	17	-.45	1.51	.52
Weaning weight	25	-.72	1.73	.91
Postweaning daily gain	-[c]	-[b]	.83	1.30
Ribeye area	-[c]	-[d]	.27	.56
Fat thickness	-[c]	-[d]	.32	.67
Marbling	-[c]	-[d]	.20	1.00

[a] Adapted from Robison (1992).
[b] Negative covariance between direct and maternal effects for postweaning average daily gain and yearling weight.
[c] h^2 estimates are moderate to highly heritable with maternal effects assumed relatively unimportant. Yearling weight is influenced by maternal effects.
[d] Genetic correlation of direct and maternal effects is not available for carcass traits.

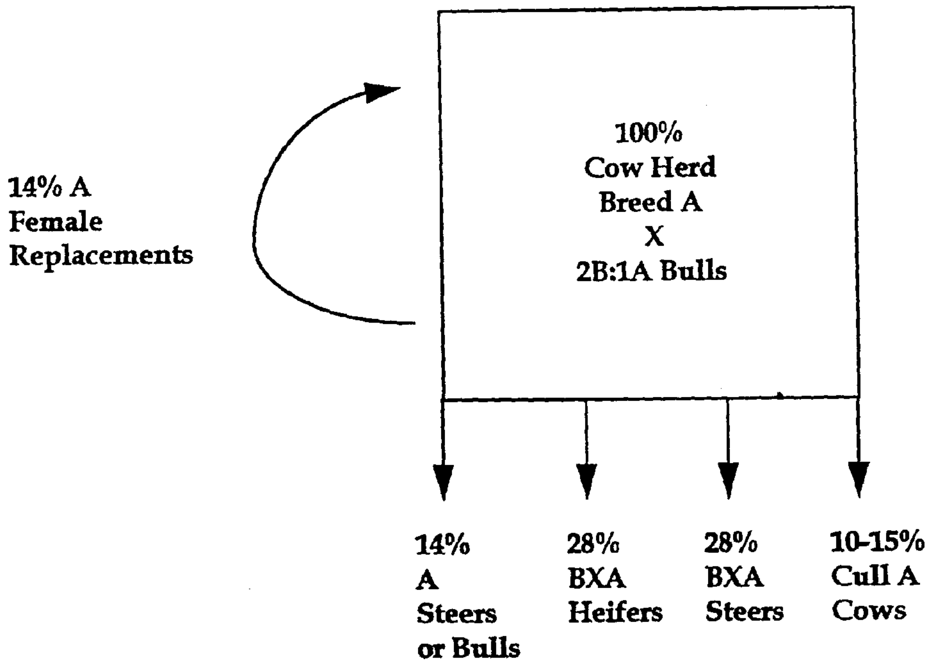

Figure 1. Terminal F-1 Crossbred Production

Advantages: (Assume 85% weaning rate)

1. 14% replacement heifer rate requires use of all Breed B heifers produced.
2. 3 bulls per 100 cow herd—can use Multiple Sire, but not advised due to possible disproportionate breeding rate among bulls.
3. Single breed cow herd and easy-to-change breeding program.
4. Certified F-1 calf system.
5. Could incorporate purebred herd of Breed B.

Disadvantages:

1. Does not fully utilize heterosis in cow aspects.
2. Three types of calves to sell. Must be sorted and sold differently.
3. Cannot "build up" herd—only maintain with minimum replacement numbers. Limited or no selection possible among Breed B females and replacements.