A SUMMARY OF THE RESULTS TO DATE OF USE OF CROSSBRED BULLS IN FLORIDA

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SUMMARY

Results of use of crossbred and Brahman-derivative breed bulls in Florida and other southeastern locations were examined. Some loss in growth potential of calves sired by crossbred bulls compared to those sired by purebred bulls has been found in several studies, when crossbred bulls were not as intensely selected as were purebreds. In a Georgia study where comparable selection procedures were used, weaning weights of calves sired by crossbred bulls were identical to those of calves sired by purebred bulls. The reproductive performance of daughters of F1 bulls, and weaning weights of their calves, did not differ from those of comparable daughters of purebred bulls at the Beef Research Unit (BRU), Gainesville, FL. Studies are underway at the BRU to evaluate productivity of progeny of bulls of different Brahman-derivative breeds and Brahman-crossbred cows with differing Bos taurus breeding.

INTRODUCTION

The use of crossbred bulls in Florida and throughout the U.S. has increased in the past 10 years as a result of several factors. The first was arrival in the U.S. of European breeds such as Simmental, Limousin, Gelbvieh, Chianina etc. The numbers of animals of these breeds were increased in the U.S. through upgrading programs and, as a result, F1 (half-blood) and three-quarter European breed bulls were produced and often sold and used in crossbreeding programs. A more significant factor in the increase in use of crossbred bulls in Florida has been the "dock" received by cattlemen in recent years for calves showing distinctive characteristics of Bos indicus breeding; that is, excess skin, large ears and a noticeable hump. Calves with gray coloration typical of U.S. Brahman cattle also suffer price discounts. Since the majority of commercial breed cows in Florida are from 1/4 to 3/4 Bos indicus (primarily American Brahman) breeding, purebred Bos indicus bulls can not be used extensively without producing a high proportion of calves with distinctive Bos indicus characteristics and coloration; calves which currently receive a substantial price discount. While use of bulls of Bos taurus breeding (Angus, Hereford, Simmental, etc.) on typical Florida crossbred cows will result in steer calves that are generally acceptable to calf buyers, heifer calves from such bulls may not have sufficient Bos indicus breeding to perform well under extensive production systems in central and south Florida. An alternative that is becoming increasingly popular in Florida is the use of Brahman x Bos taurus F1 crossbred or Brahman-derivative breed (Braford, Beefmaster, Brangus, etc.) bulls. The resulting heifer calves should have sufficient adaptation to perform well as replacements and steers will, for the most part, not show sufficient Bos indicus characteristics to be docked in price. The degree of heterosis or hybrid vigor retained in the progeny from such crossing has not been well documented to date.
Maximum heterosis or hybrid vigor (improvement of crossbreds over the average of the purebred breeds used in the cross) is found in the F₁ cross of a Bos indicus breed, such as the Brahman, with a Bos taurus breed, such as the Angus. This is the standard to which heterosis resulting from other crossbreeding systems will be compared in this paper. The typical, two-breed rotational crossbreeding system should maintain about two-thirds or 67% of the heterosis expressed by the F₁ cross. A rotational crossbreeding system involving two Brahman derivative breeds such as the Brangus and Braford breeds (3/8 Bos indicus: 5/8 Bos taurus), is expected, on a theoretical basis, to maintain about 56% of F₁ heterosis. This expectation is based on the system discussed by Koger (1980). This system predicts heterosis retention based on both heterozygosity and expected increases in performance (heterosis) due to Brahman x European versus European x European gene combinations. If we assume that the combined effect of maximal heterosis, in terms of both increased growth of crossbred calves and increased maternal ability of crossbred cows, is 100 pounds, then the two-breed rotational system will maintain 67 pounds of this increased productivity, while the composite rotation would be expected to retain about 56 pounds (11 pounds less).

As an example of the economics of this situation, let us compare total selling price of steer calves from a Brahman x Angus rotation to those of a Brangus x Braford rotation. Assume that we have 100 steer calves to sell in both systems, and that Brahman-Angus rotation calves have a sale weight of 500 pounds and the Brangus-Braford rotation calves have a sale weight of 489 or 11 pounds less. Half of the calves from the Brahman-Angus rotation will be Brahman-sired calves and might sell for as much as $10 less per pound than the Angus-sired calves and those resulting from Braford x Brangus matings. If we assume a selling price of $.52 for Brahman-sired calves and $.62 per pound for the others, total selling price of the calves from Brangus x Braford rotation would be $1818 greater than that of steer calves from the Brahman x Angus rotation (50 x 500 x .62 + 50 x 500 x .52 = $28,500 for calves from the Brahman x Angus rotation, and 100 x 489 x .62 = $30,318 for calves from the Brangus x Braford rotation).

The above calculations are based only on consideration of calf weaning weight and ignore possible effects of these types of crossbreeding programs on reproductive rate. Also ignored has been possible effects of epistatic recombination loss on both calf weaning weight and cow reproduction. In general what is meant by epistatic recombination loss is that favorable combinations of genes at different loci may be present in the current breeds and these, if present, are broken up as a result of the crossbreeding process. The problem is that we do not know the extent to which these favorable combinations exist in beef cattle. Several studies have shown that they may be important for some traits. It is because of these uncertainties, and because of the increasing use of crossbred sires in Florida that studies have been conducted and another has just begun in an attempt to clarify the subject.

**Conducting and Outcome of the Studies**

Studies utilizing crossbred or Brahman derivative bred bulls have been conducted at the Everglades Research and Education Center at
Belle Glade and the Ona AREC and at the Beef Research Unit near Gainesville. At Belle Glade Brangus, Angus and Hereford cows were mated to Beefmaster, Brahman, Brangus, Limousin, Simmental and Maine-Anjou bulls. Results of this study were summarized in Florida Agricultural Experiment Station Technical Bulletin 820, titled "Comparative Performance of Calves sired by Exotic, Brahman, and Brahman-Derivative bulls" (Crockett et al., 1984). While this study was not designed to specifically address the question at hand, some of the data are pertinent. Brangus cows bred to Beefmaster bulls produced calves which were 11 and 26 pounds lighter at 205 days of age than those sired by Brangus and Brahman bulls, respectively. However, the Beefmaster-sired calves were all late season calves and were reported to have been sired by an inferior sample of Beefmaster sires, bulls which were used as clean-up bulls following an AI program to other breeds in the study. The performance of Beefmaster x Brangus crossbred calves would have been expected to be somewhat better than that of the Brangus x Brangus calves due to the higher heterozygosity that would result from Hereford and Shorthorn breeding in the Beefmaster, but apparently this was overcome by greater genetic potential for growth of Brangus bulls that were used. The maternal ability of the various types of crossbred females was not reported but postweaning feedlot gains of Beefmaster and Brangus-sired steers were significantly lower than those of Brahman and exotic-sired steers. The results of this study are not overly encouraging regarding use of Brahman-derivative breed bulls but may reflect a problem in sire selection and not actual problems of the crossbreeding system.

Results from the Ona AREC in which F₁ and F₂ (F₁ x F₁) crossbred bulls were bred to purebred cows to produce backcross and three-breed crossbred calves indicated adequate performance to weaning of calves sired by crossbred bulls (Peacock et al., 1986). In this study, Brahman x Angus (BA), Brahman x Charolais (BC) and Charolais x Angus (CA) crossbred bulls were bred to Angus, Charolais and Brahman cows. In addition, the BA bulls were mated to BA cows, BC bulls were mated to BC cows and CA bulls were mated to CA cows to produce inter se crossbred calves. The heterosis levels resulting from use of BA and BC bulls on purebred cows to produce either three-breed crosses or backcrosses were somewhat less than would have been expected based on the heterozygosity retained. By this it is meant that performance of calves sired by these Brahman crossbred bulls and purebred Angus or Charolais cows was not what would have been expected based on matings involving purebred bulls. For example, heterosis resulting from mating Brahman x Charolais crossbred bulls to Angus cows was less than the average of heterosis resulting from mating Brahman bulls with Angus cow and that from mating Charolais bulls and Angus cows. This could have been due to effects of epistatic recombination loss but also may have been the result of crossbred bulls having been less intensely selected than purebred bulls which were used. Crossbred bulls used were selected from a small number of early-season crossbred calves. Heterosis levels for BA x BA and BC x BC inter se crossbred calves were 22.7 and 13.1% respectively, for 205-day weight. These heterosis levels were very similar to levels expressed by backcross progeny of the same F₁ cows. These latter results support use of Brahman-derivative breed
bulls or Brahman crossbred bulls on Brahman crossbred cows.

In a study utilizing Angus (A), Santa Gertrudis (SG) and SG x A F₁ bulls in southeastern Georgia, Neville et al. (1985) reported that there was essentially no difference between weaning weights of calves from SG x A F₁ bulls and the average of calves from purebred Santa Gertrudis and Angus bulls. The dams of all calves were Polled Hereford cows. There also was no significant difference in postweaning gains of steer progeny of purebred and F₁ bulls. Reproductive rates of cows exposed to F₁ bulls were identical to those of the average of cows exposed to A and SG bulls, but calves of cows exposed to F₁ bulls were born about 8 days earlier. Since all bulls used were young, this effect could have been due to earlier sexual maturity in crossbred bulls as compared to SG bulls.

In an extensive study at Beef Research Unit in Gainesville, the Brown Swiss (BS) and Angus (A) breeds were crossed and F₁ BS x A crossbred bulls were mated to A, BS and BS x A F₁ cows. Calves from crossbred cows sired by F₁ crossbred bulls were about 10 pounds lighter at 205 days of age than the average of A and BS-sired calves from the same F₁ cows, but this could have been due to a lowered selection intensity (fewer bulls to select from) in the F₁ bulls.

Perhaps one of the most important evaluations of the progeny of crossbred and Brahman-derivative bulls would be productivity and fertility of daughters of such bulls. Only limited data are available from studies in Florida. A thorough study at the Beef Research Unit, however, compared maternal performance of F₁ and F₂ BS x A cows from the study described in the preceding paragraph.

Reproductive performance, calf weight data and one year's milk production of F₁ and F₂ cows are shown in Table 1.

The data presented in Table 1 are striking in that there are no traits for which the F₂ cows were significantly below the F₁ cows, and for two traits of great economic importance, pregnancy rate and calf survival rate, the F₂ cows actually surpassed performance of the F₁ cows. The F₁ and F₂ cows were bred to Brown Swiss x Angus crossbred bulls for their first calf and in some cases their second calf, with the remainder of calves sired by Brahman and Romana Red bulls. The Romana Red breed was discussed in another paper in this report. All calves in the 1985 calf crop were sired by Brahman bulls. These data clearly indicate that F₁ bulls from the cross of two Bos taurus breeds can sire daughters from crossbred cows, even of the same breed composition as that of the bulls, that will perform well as brood cows in Florida. Better performance would theoretically be expected if the crossbred bulls were mated to crossbred cows of a different breed composition.

Results of studies to date encourage, in general, the use of crossbred bulls, and certainly do not indicate that Florida cattlemen will be disappointed in productivity of progeny of properly selected crossbred and Brahman-derivative breed bulls. These bulls, however, must be selected for performance traits as rigorously as bulls of other breeds to give comparable results. Further studies are now underway with the goal of clarifying the utility of crossbred and Brahman-derivative breed bulls. These studies are at the Ona AREC and the Beef Research Unit in Gainesville.
In a recently completed, but as yet unanalyzed, study at the Everglades Research and Education Center, Brahman x Angus F1 and F2 cows were compared to similarly aged multi-generation Brangus (3/8 B: 5/8 A) cows. At the Ona AREC, F2 crossbred cows of Brahman x Angus, Brahman x Charolais and Angus x Charolais composition are being compared to purebred cows of each of the breeds for fertility and calf weaning traits. A preliminary summary of the data from these crossbred cows in comparison to purebred and other types of crossbred cows is reported in another report in this publication.

At the Beef Research Unit, Brahman and Romana Red x Bos taurus F1 cows are currently being bred to Braford, Simbrah, Senepol and Simmental sires to further investigate the utility of Brahman derivative breed bulls in crosses with Bos indicus x Bos taurus crossbred cows. Senepol and Simmental bulls were also included in the study because each appears to possess genetic traits of importance to Florida cattlemen. Brahman x Angus F1 crossbred calves are being produced from Angus cows to serve as controls. The B x A F1 females should be particularly useful as controls for the other crosses being investigated, as this type of cow has long been considered by the industry as a superior brood cow and has been a part of many earlier crossbreeding studies.

The Senepol breed was selected to be included in this study as we believe that it provides an additional option to Brahman-derivative or Brahman crossbred bulls for use on Brahman crossbred cows to produce adapted progeny without distinctive Bos indicus characteristics. The Senepol is itself a highly tropically adopted breed without Bos indicus germ plasm. As a breed Senepol cattle express good maternal performance, have slick hair coats without Zebu characteristics and have docile temperaments. An equivalent degree of adaptation is expected in progeny of the Senepol as in progeny of the Brahman-derivative breeds. The final breed in the comparison is the Simmental, whose progeny from Bos indicus crossbred cows should be large productive animals, but with less tropical adaptation than progeny of the other three sire groups. The progeny of the Simmental sires will have 1/4 Bos indicus breeding as opposed to about 7/16 Bos indicus in progeny of the Braford and Simbrah bulls.

The first calf crop from this study was weaned in 1986. The study is designed to produce three additional calf crops. The steers will be fed a high concentrate diet and slaughtered at an estimated .4 inch outside fat thickness. Complete carcass evaluation will follow. The heifer calves produced will be fed postweaning to gain about 1 1/4 pound per day (a total of about 200 pounds) prior to being exposed to Polled Hereford bulls as yearlings. Reproductive and maternal performance will be evaluated.
Table 1. Maternal Performance of Brown Swiss (BS) x Angus (A) F₁ Crossbreds and Reciprocals in Comparison to Contemporary F₂ Crossbreds.

<table>
<thead>
<tr>
<th>Trait measured</th>
<th>Type of dam</th>
<th>Pregnancy rate (%)</th>
<th>Calf survival rate (%)</th>
<th>Calf age at weaning (days)</th>
<th>Calf birth weight (lb)</th>
<th>205-day calf weaning weight (lb)</th>
<th>Calf weaning condition score (units)</th>
<th>Estimated milk yield (lb)</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>A x BS F₁</td>
<td>89 ± 3</td>
<td>96 ± 3</td>
<td>211 ± 3</td>
<td>79 ± 2</td>
<td>540 ± 9</td>
<td>9.5 ± .2</td>
<td>3629 ± 198</td>
</tr>
<tr>
<td></td>
<td>BS x A F₁</td>
<td>87 ± 3</td>
<td>88 ± 4</td>
<td>220 ± 4</td>
<td>73 ± 2</td>
<td>515 ± 14</td>
<td>10.0 ± .3</td>
<td>3860 ± 214</td>
</tr>
<tr>
<td></td>
<td>F₂</td>
<td>92 ± 2</td>
<td>97 ± 3</td>
<td>213 ± 2</td>
<td>76 ± 1</td>
<td>524 ± 6</td>
<td>9.5 ± .1</td>
<td>3483 ± 165</td>
</tr>
<tr>
<td></td>
<td>F₂ - F₁</td>
<td>4 ± 3</td>
<td>6 ± 4</td>
<td>-2 ± 3</td>
<td>.1 ± 2</td>
<td>-4 ± 10</td>
<td>-.3 ± .2</td>
<td>-260 ± 190</td>
</tr>
</tbody>
</table>

*Lactation total, estimated only in 1984

The difference between the performance of F₂ cows and the average of F₁ cows

**LITERATURE CITED**


