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Evaluation of the Brahman Breed as Straightbred and Crossbred for Beef Production in South Central Florida [1]

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The American Brahman breed was developed in the southern part of the United States from various strains of humped cattle originating in India. Thus, Brahman had its beginning in areas where the specialized European breeds were not adapted and the indigenous cattle were not sufficiently productive. The Brahman is classified in the genus and species *Bos indicus* , whereas breeds originating in the British Isles and Continental Europe are *Bos taurus* .

The Brahman's unusual appearance sets it apart from all European breeds. Distinctive characteristics of the breed are the hump over the shoulders, long legs, large pendulous ears, abundance of loose folds of skin under the neck, and smooth hair coat.

Bonsma (*2*) stated that the thick, muscular hide of the Zebu aids in resisting attacks of external parasites, and the high vascularity of the hide (profuse blood flow) make it well adapted to high temperatures. Research in Missouri (*3*) showed that the European breeds were most comfortable at temperatures ranging between 30° and 60°F, whereas the Brahman were most comfortable at 50° to 80°F. The higher heat tolerance of the Brahman, compared with European breeds, is primarily because of its lower basal heat production (*3* , *6*).

The purpose of this bulletin is to present results from research on the Brahman breed conducted at the Agricultural Research Center, (ARC), Ona, Florida.

Review of Literature

Reproduction

Reproductive performance of Brahman cows at the ARC, Ona generally has been low, but higher than contemporary Shorthorn cows (*14*). Research in Louisiana (*19*) showed that Brahman cows compared favorably with Angus and Hereford cows, whereas Texas (*5*), Brooksville Beef Cattle Research Station (*4*), and AREC, Belle Glade, Florida (*7*) research showed that reproduction was lower in the Brahmans than in the British breeds.

A study (*17*) at the ARC, Ona, on reproductive behavior of Brahman females indicated that low pregnancy rates were due mainly to lack of sexual maturity of two-year-olds when put in the breeding

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herd and to a tendency for cows less than 5 years of age not to rebreed while nursing a calf.

Higher reproductive performance among crossbred Brahman x British cows than among their parental straightbreds has been generally observed throughout the Gulf Coast Region. Texas (*5*) reported advantages of 9.5% in calving, 10.4% in survival, and 20.3% in weaning for F_1 Brahman x Hereford cows over their parental breeds, while Louisiana (*19*) reported heterosis levels of 18.2% in calving for F_1 Brahman x Angus cows and 28.1% for F_1 Brahman x Hereford cows. Research in Florida (1 *5*) showed that levels increased with improvement in forage systems. Heterosis for weaning rate for all crossbreds increased linearly with improved pasture conditions, being 11.6% on native range; 15.8% on a combination of native and improved pasture; and 18.2% on a highly improved grass-clover pasture.

Weaning Traits

Weaning traits of calves are measures of production which reflect the genes inherited from both the sire and dam, plus an expression of the maternal influence of the dam. Weaning weights of Brahman calves at the ARC, Ona have been higher than weaning weights of Shorthorn calves (*16*). A report from Louisiana (*8*) clearly demonstrated the superior mothering ability of females possessing Brahman breeding. Research at Belle Glade, Florida, (*7*) showed that Brahman, Angus, and Brahman-Hereford rotational crosses weaned calves that weighed from 17.2% to 18.2% above the average of their parental breeds. Similar results (16%) have been reported from Texas (*5*) for production of the F_1 Hereford x Brahman cow.

Crossbreeding research (*16*) at the Ona Center showed heterosis levels for weaning weight of calves from Shorthorn-Brahman crossbreds to be 21% for the F_1 calves, 32% for reciprocal backcross calves from F_1 (SB) cows, 25% for second backcross calves (3/4-1/4 reciprocal cows), and 14%, for (7/8-1/8) calves from reciprocal 3/4-1/4 cows. The F_1 (BS) calves weighed 84 pounds more than straightbred Shorthorn, and F_1 (SB) calves were 63 pounds heavier than straightbred Brahman. Brahman sired calves from S_3B_1 cows weighed 55 pounds heavier that Shorthorn sired calves, and Shorthorn sired calves from B_3S_1 cows were 24 pounds heavier than Brahman sired calves. Heterosis levels for condition score of calves were 9% for F_1 calves, 14% for backcross calves from F_1 dams, 8% for second backcross calves from 3/4-1/4 dams, and 5% for 7/8-1/8 calves from 3/4-1/4 dams. Level of hybrid vigor observed in different mating groups for all production traits was approximately linear with breed heterozygosity (*11*).

Higher production was not restricted to crossbred cows of specific breeding but also included cows with Brahman breeding regardless of the other composition. Peacock et al. (*13*) showed that commercial cows with 1/2 Brahman breeding weaned calves that were heavier than calves from cows with either more or less than 1/2 Brahman.

Post Weaning Performance

Research at Belle Glade (*6*) on feedlot performance and carcass characteristics of Angus, Brahman, Hereford, and crisscrosses of the breeds showed the Angus to grade highest, Brahman lowest, and the crosses intermediate.

Research at the Ona Center with Brahman and Shorthorn-Brahman crosses (*13*) showed that feed efficiency for weight gain was positively related to percent Brahman breeding, while carcass grade was positively related with Shorthorn breeding. Results from a recent study (*18*) on the Shorthorn and Brahman breeds from a crossbreeding design that produced reciprocal F_1 calves, reciprocal backcross calves (S_3B_1 and B_3S_1), and reciprocal second backcross calves (B_5S_3 and S_5B_3), showed similar trends for both feed efficiency and carcass grade.

Materials and Methods

Breed groups including Angus, Brahman, Charolais, and reciprocal F_1 Brahman x Angus and Brahman x Charolais were evaluated for reproduction, production traits, and postweaning performance.

The Center is located at latitude 27°25' north, longitude 81°55' west on a low-fertility sandy soil.

Average rainfall is 54 inches with 75% falling from May to October. The climate is semi-tropical with temperate intrusions in the winter. These intrusions are characterized by repeated frosts with temperatures at 28° to 34°F with lower temperatures occurring at less frequent intervals.

Herds were maintained on improved grass pastures, mostly Pangola digitgrass (*Digitaria decumbens.*), moderately fertilized, and the cattle were supplemented with 5 pounds of either molasses or citrus pulp-cottonseed meal (4:1 ratio) per head per day for approximately 90 days during late winter and early spring.

The Angus and Brahman cows were purebreds, while the Charolais were high grades (three-fourths to purebred). Cows were culled from the herd annually for unsoundness or failure to raise a calf. The breeding season was restricted to 90 days (March 1 to June 1, 1967-1973).

The criteria for evaluating cow reproductive performance were pregnancy rate, calf survival, and weaning rate. Measurements used for evaluating weaning traits were condition score, 205-day weight, weaning weight, and annual production per cow. Sires of both parent breeds were backcrossed to F_1 cows to determine heterosis levels for maternal performance of F_1 dams.

Postweaning performance studies of breed groups were conducted for comparative feedlot performance and carcass characteristics. Weanling steer calves were fullfed in drylot for approximately 174 days.

Angus, Brahman, Charolais, and reciprocal BA and BC cross steer calves were randomized by breed across pens and fed rations averaging 15 parts of 41% cottonseed meal, 50 parts dried citrus pulp, 29 parts corn, 5 parts alfalfa, and 1 part of mineral, plus 3 pounds Pangolagrass hay daily per steer. Approximate protein and total digestible nutrient (TDN) content of rations were 13% and 72%, respectively.

The finished steers were slaughtered at the University of Florida Meats Laboratory, Gainesville, where slaughter and carcass data were collected. Cold carcass weights were obtained after chilling for 48 hours at 2° to 3°C. The estimated percent yield expresses the percent of boned and closely trimmed major cuts from the round, rump, loin, rib, and chuck; the components of percent kidney, fat over the eye, rib eye area, and cold carcass weight were used in estimating the formula. Carcass grade was based on grade standards prior to April 14, 1975.

Average daily gains for breed comparisons were computed from actual weight of calves when put on feed and final weight adjusted to a 60% chilled dressing percentage. This was obtained by dividing the chilled carcass weight by 60 and multiplying by 100 (*1*). Measurements for evaluating breed of steers were adjusted daily gain, federal carcass grade (old), fat over the eye, ribeye area, and estimated percent yield.

All data were analyzed by least squares methods for disproportionate subclass frequencies as outlined by Harvey (*9*). Reproduction and production traits were adjusted for years and age of dam, whereas postweaning traits were adjusted for years and age of steers.

Results and Discussion

Reproduction

Means for birth rate, survival and weaning rate, and the advantage of crossbreds over straightbreds in units and percentage increase are given in Table 1 .

Birth rate - Birth rates for the straightbred Angus (A), Brahman (B), and Charolais (C) were 75.3%, 89.9% and 79.7%, respectively. The B x A and B x C matings resulted in pregnancy rates of 92.4 and 82.5%, respectively. The advantage for the crossbred matings was 17.1 for Brahman bulls on Angus cows over the straightbred Angus matings and 2.8 for Brahman bulls on Charolais cows over the straightbred Charolais.

Average pregnancy rates for the BA and BC F_1 cows were 92.9% and 93.0%, respectively. The advantage for F_1 cows over the average of their parental breeds was 10.3 for BA cows and 8.2 for BC cows.

Survival rate - Calving rate and survival are the two factors which determine net reproductive performance. Calf survival incorporates genotype of the calf, which partially determines its vigor, as well as the cow's ability to give birth normally and raise a calf. Calf survival rates of the straightbred were 89.2%, 90.8%, and 95.0%, respectively, for the Angus, Brahman and Charolais. Survival rate of B x A calves was 84.1% compared to 96.8% for B x C calves. The relatively low survival rate of straightbred Brahman calves (90.8%) may indicate a slight lack of vigor, while the low survival rate of F_1 Brahman x Angus calves was due possibly to heterosis in size of calf. Montana research (*12*) showed survival rate of calves to be influenced by size or birth weight of calves relative to cow size.

Survival rate of calves produced by F_1 BA cows was 96.2%, which was an increase of 6.2% units over the straightbred average, or a heterosis level of 6.9%. The low 90.5% calf survival rate of F_1 BC cows cannot be explained. Peacock et al. (*15*) reported a 96.0% survival rate of straightbred Brahman calves compared to 95.0% for Shorthorn calves. Calf survival rates of reciprocal crosses of the Brahman and Shorthorn as well as survival rate of calves of F_1 BS cows were similar to the average of the straightbreds.

Weaning rate - Weaning rates for straightbreds were 67.2, 81.6, and 75.7%, respectively, for the Angus, Brahman, and Charolais. For the crossbred matings, weaning rates were 77.7 and 79.9% for B x A and B x C matings and 89.4% and 84.1% for F_1 BA and BC cows. Brahman cows were the highest of the straightbreds. However, F_1 BA cows were highest and F_1 BC were next in order of all matings.

The advantage in units for crossbred matings over the average of straightbred parents was 3.3% for B x A, 1.2% for B x C, 15.0% for F_1 BA cows, and 5.4% for F_1 BC cows. Heterosis estimates for weaning rates were 20.2% for F_1 BA cows and 6.9% for BC cows.

Production Traits

Means for condition score, 205 day weight, weaning weight, and annual production per cow are presented in Table 2 .

Condition score - Condition score is a subjective evaluation of the degree of fatness and is the result of both genotype and environment and their interaction. The genotype of a calf is a combination of the genotype of both sire and dam and for full expression is dependent upon optimum environment. The preweaning environment of a calf is furnished primarily by the cow, expressed as mothering ability, and largely determines the condition score. However, a calf with a high growth potential could have a comparatively low condition score even though the cow is a high producer, because it utilizes the available nutrients for growth rather than for fattening.

Condition scores at weaning were 9.2 for the Angus and Charolais calves and 8.8 for Brahman calves, lowest of the straightbred. The 9.6 for F_1 BA calves nursing Angus cows compared to 9.2 for straightbred Angus calves indicates genetic adaptability of the hybrid calf to the environment. The low condition score for F_1 BC (7.4) calves indicates a high growth rate in the calf with the cow's milk production not sufficient to compensate for the calf's growth potential.

The F_1 BA cows produced calves averaging 10.6 in condition score. This shows the superior mothering ability in this cross as well as the genetic adaptability of the calf to its environment and heterosis for condition score. The 9.7 condition score of calves from F_1 BC cows showed milk production to be sufficient for growth in the calf but not sufficient to permit expression of the high growth potential in the calf and still have an energy surplus to allow the calf to deposit much fat. Percent advantage of crossbred calves over straightbreds for condition score was 6.7 for B x A, -17.8 for B x C, 17.8 for BA cows, and 7.8 for BC cows.

Weaning weights - Weaning weight of calves is a measure of production and reflects the genotype of both sire and dam, plus the maternal influence of dam.

The 205-day weaning weight is a measure of growth rate, while weaning weight reflects a combination of growth rate and age at weaning. Since the two factors were similar in this study, only weaning weight will be discussed.

Average weaning weights were 404, 399, and 492 pounds, respectively, for the straightbred Angus, Brahman, and Charolais calves. The heavier weaning weight of the Charolais as compared to the Angus and Brahman reflects primarily the large additive effects of the Charolais breed for growth.

Average weaning weights of F_1 B x A and B x C calves were 428 and 464 pounds, respectively. The 428 pound weaning weight of the F_1 B x A calf not only was higher than the average of the parental breeds but was higher than the better of the two breeds. This is a prime example of the level of heterosis derived from crossing the *Bos taurus* and *Bos indicus* , especially when the *Bos taurus* breed used is the Angus. The 464-pound weaning weight of calves from B x C matings expressed heterosis, being 4.0% above the average of the parental breeds, and also reflected the additive breed effects for size in the Charolais.

Average weaning weights of calves produced by F_1 BA cows were 492 pounds and by F_1 BC cows were 504 pounds. The F_1 BA cows produced calves 64 pounds heavier than the F_1 BA calf, expressing maternal heterosis of the dam as well as heterosis in the calf. Weaning weights of calves from BA cows were 90 pounds heavier than the average of the parental breeds, with a combined level (both calf and dam) of 22.5%.

The 504-pound weaning weight of calves produced by BC cows was 58 pounds (13.1%) heavier than the average of the parental breeds and was also 12 pounds heavier than the straightbred Charolais calves.

Annual production per cow - Production per cow is the product of weaning rate and weaning weight. Annual production per cow averages were 271, 326, and 372 pounds, respectively for the Angus, Brahman and Charolais. Net production was lowest for the Angus and highest for the Charolais.

Crossing Brahman bulls on Angus cows resulted in an annual production per cow of 332 pounds, 61 pounds more than the straightbred Angus and six pounds more than the straightbred Brahman. Mating Brahman bulls to Charolais cows resulted in an annual production per cow of 371 pounds, essentially the same as the straightbred Charolais, but 45 pounds more than the straightbred Brahman.

Annual production per cow for the F_1 BA was highest for all matings (440 pounds), with the BC cow being next (423 pounds).

The average percentage increases in annual production per cow of crossbreds over the straightbred parental averages were: Brahman x Angus, 11.4%; Brahman x Charolais, 6.3%; F_1 BA cows, 47.4%; F_1 BC cows, 21.2%.

Post weaning performance - The Charolais steers made the highest daily gain of the straightbreds, averaging 2.33 pounds daily compared to 1.88 and 1.81 pounds, respectively, for Angus and Brahman steers (Table 3). These results express the comparatively high additive breed effects for growth of the Charolais. Both crossbred groups (BA and BC) averaged 2.26 pounds daily. Observed heterosis for daily gains of the crossbreds was 22.5% for BA and 9.2% for BC steers.

The Angus graded highest of all breed groups (15.7), with the BA next (14.9). Brahman, Charolais, and BC steers graded lowest at 13.8, 13.5 and 14.0 respectively. These results show that breed effects for carcass grade were additive with no apparent heterosis present.

Fat over the eye for the Angus and BA carcasses was 0.39 inches; Brahman, 0.25 inches; BC, 0.23 inches; Charolais, 0.16 inches. The BA carcasses had 21.9% and BC carcasses 12.2% more fat over the eye than the average of their parental breeds, emphasizing the contribution of the Angus for fattening ability.

Ribeye areas in descending order were 11.11, 10.72, 9.98, 9.07, and 8.84 square inches for the Charolais, BC, BA, Angus, and Brahman, respectively. Ribeye area for the BA was 11% and BC 7% above the parental breed average.

Estimated percent yield was 52.35, 50.79 and 50.27 for the Charolais, Brahman and Angus, respectively. The BC carcasses yielded 51.34% and BA carcasses 49.99%. Crossbreds were average of their parental breeds, indicating no heterosis for that trait.

Summary and Conclusions

Research data have been presented on reproduction, production, and postweaning performance traits of Brahman, Angus, Charolais, and reciprocal Brahman x Angus and Brahman x Charolais cattle. This research has shown the Brahman to compare favorably with the other straightbreds in reproduction. Heterosis for weaning percent exhibited by F_1 females was 20.2% for BA and 6.9% for BC crosses.

Condition scores of calves were 9.2, 8.8, 9.2, 9.6, 7.4, 10.6, and 9.7 for Angus, Brahman, Charolais, B x A, B x C, F_1 AB cows, and F_1 BC cows, respectively. The B x C calves were 17.8% below and calves from F_1 BA cows 17.8% above their straightbred parental average. Weaning weights were similar for the straightbred Angus (404 pounds) and Brahman (399 pounds), with the Charolais calves being highest of the straightbreds (492 pounds). Crossing Brahman bulls on Angus cows resulted in heterosis for weaning weight of 6.5%, and Brahman on Charolais, 4.0%. Heterosis values for F_1 BA cows was 22.5%, and for BC cows, 13.1%. Heterosis for average calf production was 11.4% for Angus cows mated to Brahman bulls, 6.3% for Charolais cows bred to Brahman bulls, 47.4% for F_1 BA cows, and 21.2% for F_1 BC cows.

Daily feedlot gains were similar for Angus (1.88 pounds) and Brahman (1.81 pounds) steers, with Charolais (2.33 pounds) having the highest gain among the straightbreds. The BA and BC steers made the same daily gains (2.26 pounds), resulting in heterosis levels of 22.2% for BA steers and 9.2% for BC steers.

Carcass grades in descending order were 15.7, 14.9, 14.0, 13.8, and 13.5 for Angus, BA, BC, Brahman, and Charolais, respectively, with no heterosis effects for this trait.

Fat over the eye in descending order was 0.39 inches for the Angus and BA carcasses, 0.25 inches for the Brahman, 0.23 inches for BC crosses, and 0.16 inches for Charolais carcasses. Heterosis for external fat was 21.9% for BA and for BC carcasses, 12.2%.

Ribeye area in descending order was 11.11, 10.72, 9.98, 9.07, and 8.84 square inches for Charolais, BC, BA, Angus, and Brahman carcasses, respectively. The BA carcasses were 11% above and BC 7% above the parental breed average.

Estimated percent yield was 52.35, 51.34, 50.79, 50.27, and 49.99 for Charolais, BC, Brahman, Angus, and BA carcasses, respectively. Crossbreds were intermediate between the parent breeds.

The Brahman compared favorably with the Angus and Charolais for reproduction. The major advantage from combining the Brahman and Charolais was for production of the F_1 Charolais x Brahman cow. Combining the Brahman with the Angus resulted in improved production from the first cross with maximum production obtained from the F_1 cow. The Brahman and Angus combination resulted in cattle that gained well in feedlot with the ability to obtain a desirable grade.

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Table 1.

Table 1. Reproduction traits of Angus (A), Brahman (B), Charolais (C), and F_1 BA and BC cows.							
Breed of Sire	A	B	C	B	B	A, B	C, B
Breed of Dam	A	B	C	A	C	BA	BC
Number	81	84	95	71	73	140	117
Birth Rate %	75.3	89.9	79.7	92.4	82.5	92.9	93.0
Survival Rate %	89.2	90.8	95.0	84.1	96.8	96.2	90.5
Weaning Rate %	67.2	81.6	75.7	77.7	79.9	89.4	84.1
Advantage of crossbreds over straightbred average-units and %.							
Weaning %, units				3.3	1.2	15.0	5.4
	%			4.4%	1.5%	20.2%	6.9%

Table 2.

Table 2. Production of Angus (A), Brahman (B), Charolais (C) and F_1 BA and CB cows.							
Breed of Sire	A	B	C	B	B	A, B	C, B
Breed of Dam	A	B	C	A	C	BA	BC
Number	56	69	73	54	60	127	98

Table 2.

Condition Score	9.2	8.8	9.2	9.6	7.4	10.6	9.7
205 day wt., lbs.	367	385	465	413	455	453	469
Wean wt., lbs.	404	399	492	428	464	492	504
Prod/cow., lbs.	271	326	372	332	371	440	423
Advantage crossbreds over straightbred average-units and %.							
Cond. score, units				.6	-1.6	1.6	.7
	%			6.7%	-17.8%	17.8%	7.8%
205 day wt., units				43	30	83	44
	%			11.6%	7.1%	22.4%	10.4%
Wean wt., units				26	18	90	58
	%			6.5%	4.0%	22.5%	13.1%
Prod/cow, units				34	22	142	74
	%			11.4%	6.3%	47.4%	21.2%

Table 3.

Table 3. Means for components related to feedlot performance and carcass characteristics of Angus (A), Brahman (B), Charolais (C), and F_1 Brahman crosses.

	A	B	C	AB	BC

Table 3.

Number	16	30	27	53	62
Adjusted final wt.[1] (lbs)	728	757	918	884	928
Chilled carcass wt. (lbs)	437	454	551	530	556
Adjusted Daily Gain (lbs)	1.88	1.81	2.33	2.26	2.26
Carcass Grade[2]	15.7	13.8	13.5	14.9	14.0
Fat Over Eye (in.)	.39	.25	.16	.39	.23
Ribeye Area	9.07	8.84	11.11	9.98	10.72
Estimated Yield (%)[3]	50.27	50.79	52.35	49.99	51.34
[1] (Chilled Carcass Weight ÷ 60) x 100 = Adjusted final weight.					
[2] 13, Low Good; 14, Good; 15, High Good; 16, Low Choice.					
[3] Estimated % Yield and Corresponding Yield Grade: 52.35, 2.0; 51.34, 2.4; 50.79, 2.7; 50.27, 2.9; 49.99, 3.0.					