PRELIMINARY REPORT ON GENOTYPE-ENVIRONMENT INTERACTIONS IN CROSSBRED CALVES WITH DIFFERENT PROPORTIONS OF BRAHMAN BREEDING BORN IN SPRING AND FALL

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Story in Brief

The effects of interaction between proportion of Brahman breeding and season of birth were evaluated on crossbred calves produced during the initial stage of a long-term project. This project was designed to evaluate the overall productivity of cows with different proportions of Brahman breeding under alternate management systems. Crossbred calves were classified as either 0, 1/4 or 1/2 Brahman according to the proportion of Brahman breeding. During the two-year period, 1981-82, 330 and 293 crossbred calves were produced in the spring and fall, respectively. Average weaning ages were 205 days for spring calves and 240 days for fall calves. Following weaning, heifers in both groups were managed to calve at two years of age.

The proportion of Brahman breeding by season of birth interaction was significant for 8 of 11 performance traits measured in this study. At birth, 1/4 Brahman and 1/2 Brahman calves were heavier ($P<.05$) than 0 Brahman calves by 2.5 and 8 lb, respectively. At weaning, the Brahman cross calves had a weight advantage in the spring calving group, but not in the fall group. However, Brahman crosses had a height advantage in both seasons. Fall-born heifers outgained spring-born heifers from weaning to a year of age with Brahman crosses having the most rapid gain. At a year of age, spring-born heifers still had a weight advantage, and 1/2 Brahman heifers were heavier ($P<.05$) than 1/4 Brahman and 0 Brahman heifers by 29 and 38 lb, respectively. Also, 1/4 Brahman and 1/2 Brahman heifers were taller ($P<.01$) at a year of age by .7 and 2.4 in, respectively.

These preliminary data indicate that calves with some proportion of Brahman breeding may perform better through a year of age and that in general spring-born calves have an advantage over fall-born calves. The interaction between proportion Brahman breeding and season of birth may be important in determining management systems for particular crossbred types.

Introduction

Genotype-environment interactions are generally assumed to exist in beef cattle and may be an important factor to consider in beef production. Different genetic types of cattle may require different production environments to maximize efficiency. Therefore, a project was initiated at the Oklahoma Agriculture Research Station to determine the nature and extent of interactions between genotypes (crossbred cow type) and environments (season of calving) in crossbred cows with different proportions of Brahman breeding managed under spring and fall calving systems. The objective of this particular study was to evaluate

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the effects of proportion Brahman breeding by season of birth interactions on growth of crossbred calves produced in the initial stage of this extensive project.

Materials and Methods

The data utilized in this study were collected in the foundation stage of a long term project designed to evaluate overall productivity of crossbred cows with different proportions of Brahman breeding when managed under spring vs fall calving programs. Angus, Hereford, Brahman, Brahman-Angus and Brahman-Hereford bulls were mated to Angus or Hereford cows to produce crossbred calves that were 0 Brahman (Angus-Hereford, Hereford-Angus), 1/4 Brahman (1/4 Brahman:1/4 Angus:1/2 Hereford, 1/4 Brahman:1/4 Hereford:1/2 Angus) and 1/2 Brahman (Brahman-Angus, Brahman-Hereford). During the two-year period, 1981-82, 330 and 293 crossbred calves were produced in the spring and fall calving seasons, respectively. The same set of three bulls of each sire breed were used in the spring and fall calving groups within the same year and a different set of bulls were used each year.

Cows in both calving groups were managed on native and Bermuda grass pastures at the Southwestern Livestock and Forage Research Station at El Reno. Spring calves were born from February through April, and fall calves were born from September through November each year. Birth weights were recorded on all calves within 24 hours after birth. Calves in both groups were allowed to run with their dams on pasture and neither group received creep feed. Calves were weaned at an average age of 205 and 240 days for the spring and fall calves, respectively. Average weaning dates were September 25 for the spring-born calves and May 25 for the fall-born calves. After weaning, steer calves were allotted to other experiments to evaluate basic biological differences between crossbred groups, while all heifers were developed to calve at two years of age. Postweaning, heifers were maintained on native and Bermuda grass pasture. In addition, they received a combination of silage and concentrate whenever necessary to maintain proper growth. Also, protein supplementation was provided to meet requirements.

The effects of proportion Brahman breeding, season of birth and the proportion Brahman breeding by season of birth interaction on preweaning growth of calves and weaning to yearling growth of heifers were evaluated using least squares procedures.

Results and Discussion

Significance levels for the effects of proportion Brahman breeding,, season of birth and the proportion Brahman breeding by season of birth interaction are presented in Table 1. The interaction between proportion Brahman breeding and season of birth was significant ($P<.05$) in 8 out of 11 performance traits measured in this study. A significant genotype by environment interaction such as this means that differences among genetic types (proportion of Brahman breeding) evaluated vary from one production environment (season of birth) to the next. Therefore, for most traits considered in this study, it is necessary to make comparisons among crossbred groups with different proportions of Brahman breeding separately for each season of birth.

Performance through weaning of calves with different proportions of Brahman breeding born in spring and fall is presented in Table 2. Birth

Table 1. **Significance levels for effects of proportion Brahman breeding, season of birth and proportion Brahman breeding by season of birth interaction.**

Trait	Proportion Brahman	Season of birth	Proportion Brahman x season of birth
	Effect		
Birth wt	**	N.S.	N.S.
Preweaning ADG	**	**	**
Weaning wt	**	**	**
Weaning hip ht	**	*	*
Weaning conf.	**	**	**
Weaning cond.	**	**	**
Weaning to yearling ADG	**	**	*
Yearling wt	**	**	N.S.
Yearling hip ht	**	**	N.S.
Yearling conf.	N.S.	*	**
Yearling cond.	**	N.S.	**

**Significant at .01 probability level.
*Significant at .05 probability level.

Table 2. Preweaning performance of calves with different proportions of Brahman breeding born in spring and fall.

Item	Spring: Proportion Brahman 0	Spring: 1/4	Spring: 1/2	Fall: Proportion Brahman 0	Fall: 1/4	Fall: 1/2
No. of calves	70	146	114	51	116	126
Birth wt (lb)	76	78	84	75	78	83
Preweaning ADG (lb/day)	1.85^{c}	1.93^{b}	2.01^{a}	1.38^{d}	1.36^{d}	1.37^{d}
Weaning wt (lb)	458^{c}	477^{b}	503^{a}	413^{d}	407^{d}	418^{d}
Weaning hip ht (in)	40.4^{e}	41.9^{c}	43.6^{a}	40.6^{e}	41.4^{d}	42.9^{b}
Weaning conf.[1]	13.1^{a}	13.0^{a}	13.2^{a}	13.1^{a}	12.8^{b}	12.5^{b}
Weaning cond.[2]	5.9^{a}	5.5^{b}	5.5^{b}	6.0^{a}	5.4^{b}	5.0^{c}

[abcde] Means in the same row not sharing at least one common superscript differ at at the .05 probability level.
[1] Conformation: 12 = low choice, 13 = average choice.
[2] Condition: 1 = thin to 9 = fat with 5 = average fat.

weights for the 0, 1/4 and 1/2 Brahman calves were similar in spring and fall calving seasons. Compared to 0 Brahman calves (75.5 lb), 1/4 Brahman and 1/2 Brahman calves were 2.5 and 8 lb heavier (P<.05) at birth, respectively. At weaning, spring-born calves were 67 lb heavier (P<.01) than fall-born calves even though fall-born calves were approximately 35 days older. Among the spring-born calves, 1/4 Brahman and 1/2 Brahman calves were 19 and 45 lb heavier (P<.05) at weaning, respectively, than 0 Brahman calves (458 lb). Weaning weights were similar for 0, 1/4 and 1/2 Brahman calves born in the fall.

Compared to 0 Brahman calves, 1/4 Brahman and 1/2 Brahman calves were 1.5 and 3.2 in. taller ($P<.05$), respectively, in the spring and .8 and 2.3 in. taller ($P<.05$), respectively, in the fall. Spring-born Brahman cross calves were .34 in. taller ($P<.05$) than fall born Brahman cross calves; however, hip heights of the black baldy calves were similar in both calving groups. Conformation scores at weaning were similar for 0, 1/4 and 1/2 Brahman spring-born calves; however, among the fall-born calves 1/4 Brahman and 1/2 Brahman calves had conformation scores .3 and .6 units lower ($P<.05$) than 0 Brahman calves (13.1). With respect to condition score, spring-born Brahman cross calves had scores .4 units lower ($P<.05$) than the 0 Brahman calves while in the fall-born group 1/4 Brahman and 1/2 Brahman calves had scores .6 and 1.0 units lower ($P<.05$) than 0 Brahman calves (6.0). Condition scores of 0 Brahman calves were similar in both calving groups.

Heifer yearling traits are presented in Table 3. Fall-born heifers outgained spring-born heifers from weaning to a year of age. Compared to 0 Brahman heifers, 1/4 Brahman and 1/2 Brahman heifers gained .14 and .21 lb/day faster ($P<.05$), respectively, in the spring group and .10 and .30 lb/day faster ($P<.05$), respectively, in the fall group. Even though the fall-born heifers appeared to have a period of compensatory growth,

Table 3. Yearling performance of heifers with different proportions of Brahman breeding born in spring and fall.

	Season of birth					
	Spring			Fall		
	Proportion Brahman			Proportion Brahman		
Item	0	1/4	1/2	0	1/4	1/2
No. of heifers	31	68	52	31	47	55
Weaning to yearling ADG (lb/day)	.75[e]	.89[d]	.96[d]	1.12[c]	1.22[b]	1.42[a]
Yearling wt (lb)	598	614	636	543	545	581
Yearling hip ht (in)	44.1	44.7	46.1	42.2	43.0	45.0
Yearling conf.[1]	13.3[a]	13.2[a]	13.0[b]	12.9[b]	13.0[b]	13.2[a]
Yearling cond.[2]	5.7[a]	5.4[b]	5.0[c]	5.5[ab]	5.3[b]	5.4[b]

[abcde] Means in the same row not sharing at least one common superscript differ at at the .05 probability level.
[1] Conformation: 12 = low choice, 13 = average choice.
[2] Condition: 1 = thin to 9 = fat with 5 = average fat.

at a year of age spring born heifers were still heavier than fall born heifers (616 vs 556 lb; $P<.01$). Also, 1/2 Brahman heifers (609 lb) were heavier ($P<.05$) than 1/4 and 0 Brahman heifers by 29and 38 lb, respectively.

The same response pattern was observed for yearling hip height with 1/4 Brahman and 1/2 Brahman heifers .7 and 2.4 in. taller ($P<.01$), respectively, than 0 Brahman heifers (43.2 in.). With respect to yearling conformation scores, there was a complete reversal in rank for the 0, 1/4 and 1/2 Brahman heifers in the spring and fall groups. Finally, at a year of age 1/4 Brahman and 1/2 Brahman heifers had condition scores .3 and .7 units lower ($P<.05$), respectively, than 0 Brahman heifers in the spring group. Among the fall born heifers, condition scores were similar for the 0, 1/4 and 1/2 Brahman heifers.

In summary, based on these preliminary results, it appears that Brahman cross calves may have an advantage for growth through a year of age whether born in spring or fall with the advantage being greater for spring-born calves. In general, spring-born calves tended to perform better than fall-born calves. However, interactions between proportion Brahman breeding and season of birth do appear to exist and may determine which crossbred types are most suitable for alternate management systems. Evaluation of future crossbred calf crops is necessary before further conclusions can be made with regard to genotype-environment interactions.