ECONOMIC EVALUATION OF TOTAL BEEF PRODUCTION FROM VARIOUS TWO-BREED CROSS COW GROUPS

D.M. Marshall[1] and R.R. Frahm[2]

Story in Brief

A systems approach was used to evaluate economic efficiency of calf production of various two-breed cross cow groups (Hereford X Angus reciprocal crosses, HAx; Simmental X Angus, SA; Simmental X Hereford, SH; Brown Swiss X Angus, BA; Brown Swiss X Hereford, BH; Jersey X Angus, JA and Jersey X Hereford, JH) in a terminal crossbreeding system. Crossbred cow group differences in reproductive performance, feed requirements, calf growth rate, calf survival, calf carcass merit and cow salvage weight were considered in the system. Land area for the breeding herd was held constant and supplemental feed was purchased as needed to meet requirements. Feedlot nutrients were purchased as needed to allow calves to attain a low choice carcass grade. The number of cow-calf units per herd for the specified land area was greatest for J cross cows and lowest for S cross cows. Herds using SH and BH cows required the most replacement heifers to maintain constant herd size (herds using J crosses required the fewest), but gross returns from the sale of cull cows were also greater for SH and BH cow groups. Gross returns from the sale of slaughter calves was greatest for herds using BA, J cross and HAx cows and lowest for herds using S cross cows. Total costs were greatest for herds using SH cows and lowest for herds using JA and SA cows. The relative advantages and disadvantages of the various cross- bred cow groups tended to largely offset one another, resulting in small differences among groups in relative profitability of slaughter calf production. Gross margin per herd, used to evaluate relative profit- ability among crossbred cow groups, was greatest for the BA group. Herds using J cross, HAx, BH and SH cows produced slightly lower gross margins, followed closely by herds using SA cows. However, rankings for gross margin changed when the cost of replacement heifers was varied. Rankings changed only slightly when the cost of feedlot TDN was varied. In a separate analysis in which calving rate was held constant across crossbred cow groups, gross margins for slaughter calf production were highest for herds using SH cows, followed in order by herds using B cross, HAx, SA and J cross cows.

(Key Words: Crossbreeding, Economic efficiency, Angus, Hereford, Simmental, Brown Swiss and Jersey)

Introduction

This study is a portion of a comprehensive research project evaluating lifetime productivity of various two-breed cross cow groups (Hereford X Angus reciprocal crosses, HAx; Simmental X Angus, SA; Simmental X Hereford, SH; Brown Swiss X Angus, BA; Brown Swiss X Hereford, BH; Jersey X Angus, JA and Jersey X Hereford, JH) when mated

[1]Graduate Assistant [2]Professor

to bulls of a third breed. To accurately determine the net worth of a crossbred type to the entire beef industry, it is necessary to evaluate crossbred types for a variety of important production traits, taking into consideration all production segments (i.e., cow-calf, stocker-feedlot and slaughter-packing). Important differences among the two-breed cross dam groups have been reported for milk production (Belcher et al., 1979), nutrient requirements (Marshall et al., 1982), cow productivity and calf performance to weaning (Frahm and Marshall, 1985), calf feed- lot performance (Marshall and Frahm, 1985) and calf carcass characteristics (Marshall et al., 1985). Crossbred cow group rankings were quite variable across the spectrum of traits evaluated, suggesting relative advantages and disadvantages of each crossbred type. The objective of this study was to evaluate economic differences among these two-breed cross cow groups, utilizing biological differences from experimental results and economic considerations under specified management situations.

Materials and Methods

Economic comparisons of crossbred cow groups were evaluated using a simulated beef production system that included the cow herd, feedlot and slaughter phases. A spring calving season was assumed and calves were weaned in the fall at 205 days of age. Replacement heifers were purchased in the spring at one year of age and exposed to bulls during the summer breeding season. Pregnant heifers entered the cow herd in the fall when calves were weaned from the existing cow herd.

Crossbred cow groups were compared under two alternative cow culling systems: CULL1, nonpregnant cows and heifers were culled at weaning time in the fall; CULL2, nonpregnant cows and heifers were culled in the fall and cows and heifers without a live calf in the spring were culled at the end of the calving season. In addition, 1 percent management culls (sold at weaning) and 2 percent annual cow death loss were assumed for each crossbred cow group.

Land size for the breeding herd was fixed at 1000 acres. Within each culling system, the given land area was assumed sufficient to provide pasture for 100 HAx cow-calf units (cows of approximately 1000 lb mature size), including replacements, under typical north central Oklahoma range conditions. Supplementary cottonseed meal and bermuda-grass hay were purchased to allow cows to meet protein and energy requirements. Nutrients required for the feedlot segment of production were purchased as needed. All calves entered the feedlot immediately after weaning and were fed a corn-milo finishing ration until attaining a low choice carcass grade.

The carrying capacity (or equivently, herd size) for a given cross-bred cow group was a function of the land requirements of the breeding herd, reproductive performance and culling alternative. A sufficient number of replacement heifers were purchased to maintain a constant herd size from year to year, even though herd size varied during the year. In addition, the proportion of yearling replacement heifers, first calf cows and older cows remained constant over years. Crossbred cow group comparisons were made over one production cycle and measured from weaning one year to weaning the next year. For greater precision in calculations, fractions of animals were allowed to exist. Hence, it is desirable to think in terms of numbers of animals per herd, where herd is the total conglomeration of cattle produced under the specified land area restriction.

The bioeconomic model considered crossbred cow group differences for reproductive performance, nutrient requirements, calf growth rate, calf survival, carcass composition and cow salvage weights. The performance data assumed in the analysis were based on actual research data from these crossbred cow groups and reported in three preceeding papers of this series. Crossbred cows were mated to Red Poll and Shorthorn bulls as two-year-olds and to Charolais, Brahman, Limousin and Gelbvieh bulls at subsequent ages. All three-breed calf performance data used in this analysis were the average of steer and heifer performance. Nutrient requirements of yearling replacement heifers and two-year-old cows were calculated from NRC (1974), based on weights and first lactation milk yields measured on these crossbred cow groups (Belcher et al., 1978). Nutrient requirements of older cows were based on individual feed intake data of drylotted cows (Marshall et al., 1982).

It is uncertain if existing environmental conditions allowed cows to reproduce at rates typical of the respective crossbred cow groups. Under the assumption that the levels of pasture and supplement provided were appropriate for cow size and lactation level, and should provide adequate nutrition for all crossbred cow groups to reproduce at the same level, an additional analysis was done in which a constant calving rate of 90 percent was assumed for all crossbred groups.

Since land area utilized by the breeding herd was the same for each crossbred dam group (within a given culling system), pasture costs were not considered. In addition, the cost of establishing existing herds was assumed to be the same for all crossbred cow groups and thus was ignored. Relative profitability of crossbred cow groups was estimated by substracting all costs for a given herd, except fixed herd costs, from total gross returns. Thus, crossbred cow groups were compared on gross margin per herd. Differences among crossbred cow groups in gross margin per herd would be equivalent to differences in net income per herd. Gross margin was calculated for selling calves at weaning and for selling calves at slaughter. Three different product end points were considered for slaughter calf production: live weight, carcass weight and boneless, closely trimmed retail cuts.

Economic coefficients assumed for cattle and feedstuffs were based on a six year (1977-1982) average of Oklahoma prices. The cost of cottonseed meal and bermudagrass hay were set at $.1221 and $.0200 per pound of dry matter, respectively. The cost of nutrients for feedlot calves was set at $.0790/lb TDN. To test the sensitivity of crossbred cow group rankings to the relative cost of nutrients for the breeding herd versus the feedlot, the cost of feedlot TDN was later varied.

Calf prices were averaged over steers and heifers. Prices assumed for weaned weight, live slaughter weight, carcass weight and retail cuts were $.65, $.61, $.95 and $1.91/lb, respectively. Yearling replacement heifers were purchased for $.65/lb, calculated as a $.05/lb premium over feeder heifer prices (variations in heifer costs were later examined). Nonpregnant heifers were sold for $.60/lb (the price of slaughter heifers) and cull cows were sold for $.39/lb.

A breeding cost of $15.60 was charged per cow exposed to breeding. This figure assumes that a bull was purchased at $1200, maintained at a cost of $300/year, serviced 30 females per year, and was sold for $700 after three years of service. A direct cost of $20 per difficult birth was assumed in this study. This figure was obtained by charging $4 per non-Caesarian difficult birth and $100 per Caesarian birth and assumes that 17 percent of all difficult births required Caesarian sections (unpublishd data). Effects of calving difficulty on subsequent calf mortality and fertility were assumed to be reflected in weaning rates.

Other operating costs were based on enterprise budgets supplied by the Oklahoma Cooperative Extension Service. Per head costs of $50 for cows remaining in the herd for the full annual production cycle, $30 for cows culled in the spring and $28 per yearling heifer were charged to cover veterinary supplies and services, utilities, labor, machinery and miscellaneous expenses of the breeding herd. Non-feed expenses for the feedlot segment included a charge for veterinary supplies and services of $5.50/head, a marketing cost of $13.25/head and a lot charge of $.05/head/day fed.

Cumulative capital expenditures and returns were updated monthly and interest expense or interest income was computed at monthly intervals, assuming an annual interest rate of 13 percent. Interest was not charged on fixed herd costs, since the value of these were assumed to be the same for all crossbred cow groups.

Results and Discussion

All tabular results are presented by crossbred cow group and culling system. Comparisons among crossbred cow groups were made within culling system. Comparisons of culling systems were not generally made since the intent of including alternative culling systems was not to aid in making management decisions, but rather to determine whether or not crossbred cow group rankings differed over different culling systems. Except when noted otherwise, rankings among crossbred cow groups were consistent over culling alternatives.

Herd inventory for various classes of cattle are presented in Table 1. These results are quite useful in evaluating relationships between nutrient requirements, reproductive performance, culling system and replacement rate. The number of cows calving was fixed at 100 for the HAx group. Since land area available for the breeding herd were the same for each crossbred dam group, fewer animals were maintained for those groups with higher land requirements. Under culling system CULL1, for example, compared to the HAx group, the number of cows calving was greater for the J crosses by an average of seven cows per herd, while the B and S groups averaged nine and 13 cows less, respectively. Lower reproductive rates required that a higher proportion of nutrients be used for development of replacement heifers, leaving less land available for pregnant and lactating cows. The number of heifers purchased and the number of heifers and cows sold were greater under culling system CULL2 than under system CULL1, since most of the cows culled in the spring under system CULL2 would have become pregnant and retained in the herd under system CULL1.

Considerably more yearling heifers were purchased for herds using SH and BH cows than for herds using other crossbred cow groups because of the poor rebreeding performance of these cows under extensive range conditions and the lower reproductive rate of heifers during the limited breeding season. The latter factor affected the SH group in particular. For example, the number of yearling heifers needed for the SH group was greater than for the BH group, even though the number of cows culled (sold) was similar for those two groups. The fewest cows and nonpregnant heifers were sold and fewest replacements were needed in systems using J cross cows.

The number of calves weaned and slaughtered depended primarily on the number of cows calving, but also on calf survival. Under culling system CULL1 for example, HAx cows produced 7.9 more calves than BA cows

Table 1. Herd inventory for various classes of cattle.

Crossbred cow group[a]	No. cows calving		No. yearling heifers purchased		No. cows sold		No. nonpregnant heifers sold		No. calves weaned		No. calves slaughtered	
	CULL1[b]	CULL2[b]	CULL1	CULL2	CULL1	CULL2	CULL1	CULL2	CULL1	CULL2	CULL1	CULL2
HAx	100.0	100.0	17.1	21.5	12.8	17.1	2.3	2.9	88.9	88.7	87.7	87.4
SA	88.1	87.4	17.1	22.9	12.1	17.2	3.2	4.3	78.0	77.3	76.6	75.9
SH	83.9	82.5	34.0	40.2	18.0	20.8	14.4	17.0	76.5	75.2	76.2	74.9
BA	92.1	92.1	18.0	20.1	15.0	17.3	1.2	1.3	86.2	86.1	85.2	85.0
BH	87.8	87.3	26.6	29.4	19.0	20.6	5.9	6.5	81.9	81.4	79.4	78.9
JA	105.6	104.6	7.9	11.8	5.0	8.2	.8	1.2	97.3	96.6	96.0	95.3
JH	107.5	106.1	11.1	17.0	8.4	13.6	.6	.9	97.7	96.6	95.7	94.7

[a] H=Hereford, A=Angus, S=Simmental, B=Brown Swiss and J=Jersey.
[b] Culling systems: CULL1, open cows were culled at weaning in the fall; CULL2, open cows were culled in the fall and cows without a live calf at the end of the calving season were culled in the spring.

at birth, but the difference was reduced to 2.7 calves at weaning and 2.5 calves at slaughter. Compared to the SA group, there were 4.0 more BA calves at birth, but 8.2 and 8.6 more calves at weaning and slaughter, respectively. The consequences of these differences are discussed later in the paper. Even though the numbers of cows calving in herds using HAx cows were the same under both culling systems, the cow age distribution varied, resulting in slightly more calves weaned and slaughtered under culling system CULL1 than under CULL2.

Non-feed expenses per herd for the cow-calf phase to weaning and the feedlot phase are presented in Table 2. Variation among crossbred cow groups in dollars spent purchasing yearling heifers contributed the most of any source to variation in total expenses. The expense of purchasing yearling heifers was greatest for the SH and BH groups and least for herds using J cross cows. Non-feed operating expenses for the breeding herd were generally higher for those groups with higher numbers of cows and heifers, but the magnitudes of differences were relatively small. Jersey cross cows produced the most milk, especially in proportion to body size, and thus supplement requirements per cow were similar to other groups even though the J cross cows were smaller. Total herd supplement costs were greatest for J cross cows and least for SH cows. Replacement heifers were purchased in the spring when pasture conditions required little supplementation. Thus, herds using SH cows had relatively low supplement costs, since this group had a relatively high proportion of heifers.

The gross returns per herd when calves were sold at weaning are presented in Table 3. The proportion of total gross returns, consisting of income from the sale of cull cows and nonpregnant heifers, was greater for culling system CULL2 than for CULL1. Both reproductive performance and salvage weight contributed to the amount of returns from these sources. Returns from the sale of cull cows was greatest for SH and BH cows, intermediate for BA, SA and HAx cows and lowest for J cross cows. However, rankings of S and B crosses differed over culling systems. Under system CULL1, cull cow returns wer $789/herd greater for BA than for SA cows, and $137/herd greater for BH than for SH cows. However, under system CULL2, cull cow returns were $227/herd greater for SA than for BA cows, and $302/herd greater for SH than for BH cows. These changes in rank occurred because a higher proportion of pregnant B cross cows produced a live calf at birth as compared with S cross cows. Rankings for gross returns from the sale of nonpregnant heifers were the same as rankings for number of nonpregnant heifers sold.

If calves were sold at weaning and calves from all crossbred cow groups were sold at the same price per unit weight, returns were greatest for calves from J cross cows, followed in order by calves from B cross, HAx and S cross cows. Total gross returns per herd were greatest for herds using SH and B cross cows, as a result of the large numbers of culled cows.

Even though feed costs comprised a large proportion of total non-fixed herd expenses (Table 2), differences in feed costs among crossbred cow groups were relatively small. This is largely due to crossbred groups with higher per calf feed requirements (i.e., S and B crosses) had fewer calves in the feedlot. The largest difference in feed costs under culling system CULL1 was the $3250 greater feed costs for calves from JH cows than for calves from SH cows. Although the lot charge depended on the number of calves fed and length of the feeding period, crossbred cow group differences in non-feed operating costs in the feedlot primarily reflected differences in number of calves fed. Total

Table 2. Non-fixed expenses per herd for calves sold at weaning or at slaughter.

Crossbred cow group[a]	Expenses to weaning ($/herd)								Feedlot expenses ($/herd)				Total herd expenses $/herd	
	Yearling heifer purchase		Non-feed operating costs		Supplement		Total		Feedlot TDN		Feedlot operating costs			
	CULL1[b]	CULL2[b]	CULL1	CULL2	CULL1	CULL2	CULL1	CULL2	CULL1	CULL2	CULL1	CULL2	CULL1	CULL2
HAx	5444	6834	8926	9110	7963	7807	22,333	23,751	22,588	22,291	3744	3647	48,665	49,689
SA	6125	8180	8252	8421	7938	7669	22,314	24,270	21,600	21,033	3371	3207	47,285	48,510
SH	11,250	13,289	8924	9159	7064	6811	27,237	29,259	20,639	19,962	3136	2966	51,012	52,187
BA	6209	6920	8406	8569	8036	7936	22,651	23,425	23,386	23,219	3582	3526	49,619	50,171
BH	8651	9554	8511	8687	7335	7207	24,497	25,448	21,453	21,139	3280	3194	49,230	49,781
JA	2401	3569	8673	8888	9093	8899	20,167	21,356	23,286	22,936	4036	3929	47,489	48,220
JH	3362	5170	9115	9267	8983	8683	21,460	23,120	23,889	23,293	4076	3893	49,425	50,306

[a] H=Hereford, A=Angus, S=Simmental, B=Brown Swiss and J=Jersey.
[b] Culling system: CULL1, open cows were culled at weaning in the fall; CULL2, open cows were culled in the fall and cows without a live calf at the end of the calving season were culled in the spring.

Table 3. Gross returns per herd when calves sold at weaning.

Crossbred cow group[a]	Nonpregnant heifers		Cull cows		Weaned calves		Total	
	CULL1[b]	CULL2[b]	CULL1	CULL2	CULL1	CULL2	CULL1	CULL2
HAx	809	1016	4509	5843	26,583	26,290	31,902	33,149
SA	1265	1690	4622	6369	25,708	25,232	31,596	33,291
SH	5250	6202	6711	7669	24,541	23,887	36,502	37,758
BA	433	483	5411	6142	28,860	28,730	34,705	35,355
BH	2103	2323	6848	7367	27,087	26,758	36,039	36,448
JA	269	399	1577	2571	31,411	31,007	33,256	33,977
JH	187	287	2653	4264	31,480	30,845	34,320	35,396

[a] H=Hereford, A=Angus, S=Simmental, B=Brown Swiss and J=Jersey.
[b] Culling systems: CULL1, open cows were culled at weaning in the fall; CULL2, open cows were culled in the fall and cows without a live calf at the end of the calving season were culled in the spring.

non-fixed herd expenses for slaughter calf production were lowest for SA and JA groups and greatest for herds using SH cows.

Gross returns from the sale of slaughter calves was estimated at three product endpoints: live weight, carcass weight and retail cuts (Table 4). The use of carcass weight favored groups with relatively high dressing percentage and the use of retail cuts favored groups with high dressing percentage and high cutability. However, crossbred cow group rankings were quite similar for each product end point and culling system combination. Gross returns from the sale of slaughter calves was greatest for herds using J cross cows, followed by herds using BA and HAx cows. The relatively heavy weights of calves from S cross cows did not completely compensate for their smaller numbers of calves per herd,

Table 4. Gross returns per herd when calves sold at slaughter.

Crossbred cow group[a]	Gross returns at three end points, $/herd						Total returns at three end points, $/herd[c]					
	Live weight		Carcass weight		Retail cuts		Live weight		Carcass weight		Retail cuts	
	CULL1[b]	CULL2[b]	CULL1	CULL2	CULL1	CULL2	CULL1	CULL2	CULL1	CULL2	CULL1	CULL2
HAx	56,420	55,703	56,061	55,275	55,440	54,586	61,739	62,561	61,379	62,133	60,758	61,445
SA	53,346	52,142	53,088	51,776	53,031	51,623	59,234	60,201	58,976	59,835	58,919	59,682
SH	52,137	50,572	51,727	50,105	51,420	49,698	64,098	64,443	63,688	63,976	63,381	63,569
BA	57,894	57,532	57,362	56,966	56,919	56,487	63,738	64,157	63,207	63,592	62,764	63,112
BH	53,089	52,405	52,824	52,095	52,509	51,734	62,041	62,095	61,776	61,785	61,461	61,424
JA	59,633	58,764	58,850	57,922	58,976	57,976	61,478	61,734	60,695	60,892	60,812	60,947
JH	60,505	59,092	59,450	57,899	59,591	57,913	63,345	63,643	62,290	62,450	62,431	62,464

[a] H=Hereford, A=Angus, S=Simmental, B=Brown Swiss and J=Jersey.
[b] Culling systems: CULL1, open cows were culled at weaning in the fall; CULL2, open cows were culled in the fall and cows without a live calf at the end of the calving season were culled in the spring.
[c] Includes returns from the sale of culled females (Table 3) and slaughter calves.

Table 5. Gross margins ($/herd) for selling calves at weaning or slaughter.

Crossbred cow group[a]	Weaned calves		Slaughter calves - value based on three end points					
			Live weight		Carcass weight		Retail cuts	
	CULL1[b]	CULL2[b]	CULL1	CULL2	CULL1	CULL2	CULL1	CULL2
HAx	9,568	9,398	13,074	12,872	12,714	12,444	12,093	11,756
SA	9,282	9,021	11,949	11,691	11,691	11,326	11,634	11,172
SH	9,265	8,499	13,086	12,256	12,676	11,789	12,369	11,382
BA	12,054	11,930	14,119	13,987	13,588	13,421	13,145	12,941
BH	11,542	11,000	12,810	12,314	12,546	12,004	12,231	11,643
JA	13,088	12,621	13,989	13,514	13,206	12,672	13,323	12,727
JH	12,860	12,276	13,920	13,338	12,865	12,145	13,006	12,158

[a] H=Hereford, A=Angus, S=Simmental, B=Brown Swiss and J=Jersey.
[b] Culling systems: CULL1, open cows were culled at weaning in the fall; CULL2, open cows were culled in the fall and cows without a live calf at the end of the calving season were culled in the spring.

resulting in lower gross returns per herd. Herd total gross returns, including returns from the sale of slaughter calves and culled cows, were greatest for herds using SH and BA cows.

Gross margin for selling calves at weaning or slaughter are presented in Table 5. For production systems in which calves were sold at weaning, gross margin per herd was greatest for J cross cows, followed in order by B cross, HAx and S cross cows. Gross margins for slaughter calf production was greatest for the BA group at all 3 product end points. Herds using J cross, HAx, BH and SH cows produced slightly lower gross margins, followed closely by herds using SA cows. Crossbred cow group rankings for gross margin for slaughter calf production were similar across product end point and culling system with the only rank changes being between groups for which pair-wise differences were very small.

Rankings for J crosses reflect their advantage in reproductive performance and moderate preweaning growth rate, but relatively poor postweaning calf feedlot performance. Brown Swiss crosses had moderate reproductive performance, produced the heaviest calves at weaning and had relatively good postweaning performance. Hereford X Angus reciprocal cross cows had moderate reproductive performance, produced the lightest calves at weaning, but their calves were the most efficient in the feedlot. The S crosses ranked last in gross margin, despite relatively high weaning weights and good feedlot performance. The low ranking of the SH group was largely because of poor reproductive performance under the extensive range conditions. The relatively high energy requirements for SA cows contributed to their low rankings. Another important factor in the ranking of S crosses, especially for the SH group, was preweaning calf losses. As mentioned previously, the number of calves alive at 24 hours after birth and the number weaned, in proportion to the number of cows calving, was lowest for S crosses. Females which went into the pregnant herd in the fall, but failed to wean a calf, had to be maintained for much or all of the year (depending on when the calf died and the culling system assumed). This was less desirable than a cow failing to become pregnant.

Differences among crossbred cow groups for gross margin when calves were sold at slaughter were quite small, reflecting the trade-offs among the relative merits and disadvantages of the various crossbred groups. The relative economic advantage of BA and J cross cows over HAx, S cross and BH cows was considerably less when calves were sold at slaughter than when calves were sold at weaning. The better feedlot performance for calves from HAx, S cross and BH cows indicates that feedlot operators should pay less per unit weight for calves from J cross and BA cows at weaning. It is interesting to note that crossbred cow groups which produced the highest average milk yields (i.e., BA and J crosses) also produced calves which were less efficient (in terms of feed conversion) in the feedlot. Unfortunately, had a reasonable land charge for the breeding herd been included in expenses, all crossbred cow groups would likely have been operating at a loss. This would seem consistent with the economic situation many cattlemen have experienced in recent years.

In experimental data collected previously for this project, A cross cows have consistently had better reproductive performance than H crosses. On the other hand, H crosses have consistently had superior feed conversion, among drylotted cows producing weaned calves and among feedlot calves. Results from these economic analyses indicate that the relative advantages and disadvantages of A and H crosses were apparently offsetting when all segments of production were considered, resulting in similar gross margins for A and H cross cows.

The extent to which environmental conditions allowed cows to reproduce at rates typical for these crossbred cow groups is uncertain. However, the extensive range conditions apparently failed to provide sufficient energy for desirable reproductive performance for the larger S and B cross cows, in particular. Presented in Table 6 are gross margins for herds producing weaned calves or slaughter calves, when a constant birth rate of 90 percent was assumed for all crossbred cow groups. If calves were sold at weaning, B cross cows produced the highest gross margins, followed in order by J cross, SH, HAx and SA cows. If calves were sold at slaughter, herds using SH cows produced the highest gross margins, followed closely by B cross cows. Herds using HAx cows produced slightly lower gross margins, followed closely by herds using SA and J cross cows. The SH and BH cows had the lowest

Table 6. Gross margin ($/herd) for selling calves at weaning or slaughter, assuming a constant birth rate of 90 percent.

Crossbred cow group[a]	Weaned calf production		Slaughter calves - value based on three end points					
			Live weight		Carcass weight		Retail cuts	
	CULL1[b]	CULL2[b]	CULL1	CULL2	CULL1	CULL2	CULL1	CULL2
HAx	9,822	9,664	13,344	13,154	13,020	12,761	12,435	12,107
SA	9,728	9,503	12,412	12,195	12,212	11,881	12,208	11,775
SH	11,633	11,123	15,846	15,295	15,556	14,927	15,484	14,722
BA	12,803	12,638	14,926	14,746	14,475	14,260	14,123	13,869
BH	13,518	13,083	14,635	14,257	14,561	14,127	14,435	13,944
JA	11,954	11,447	12,814	12,301	11,953	11,387	11,957	11,336
JH	12,141	11,530	13,175	12,565	12,072	11,334	12,141	11,284

[a] H=Hereford, A=Angus, S=Simmental, B=Brown Swiss and J=Jersey.
[b] Culling systems: CULL1, open cows were culled at weaning in the fall; CULL2, open cows were culled in the fall and cows without a live calf at the end of the calving season were culled in the spring.

reproductive rates among the crossbred cow groups evaluated, and thus their relative profitability improved the most by assuming a constant birth rate. These calculations (Table 6) ignore potential increased feed costs associated with increased reproductive performance.

It has been assumed in this analysis that economic coefficients are known with certainty. If the assumed coefficients were to change, the results of this analysis would likely change as well, unless all economic coefficients changed proportionally. One concern in this study was the cost of replacement heifers. It was assumed that the cost of producing yearling replacement heifers from these two-breed crosses was the same per unit weight for all crosses. In a fully integrated system, the efficiency of purebred herds producing the crossbred replacements would be considered. Since the cost of producing replacement heifers

was not known, the sensitivity of crossbred cow group ranking to cost of replacement heifers was examined by calculating gross margin at alternative replacement costs.

Figure 1 shows gross margins for calves sold at weaning, under culling system CULL1, at low, moderate and high costs of purchasing replacement heifers. The moderate cost represents the cost previously assumed, while low- and high-cost heifers, respectively, were purchased at $50/head below the $50/head above the cost of moderate-cost heifers. Results indicate that crossbred cow group rankings were fairly stable over the range of heifer costs evaluated, although magnitudes of differences in gross margins increased as heifer costs increased. The SH group was most affected by varying heifer replacement costs because of the larger number of yearling heifers required for this group. For example, the gross margin of the HAx cows was $608 less than that for SH cows at the low heifer cost, but $1,215 greater at the high heifer cost.

Figure 2 shows gross margins for slaughter calf production under culling system CULL1 at high, moderate and low heifer costs, assuming retail cuts as the product endpoint. The SH group ranked second in gross margin at low heifer costs, but ranked next to last at high heifer costs. However, the magnitudes of differences were relatively small. At low and moderate heifer costs, the largest difference between pairs of crossbred dam groups was between BA and SA (difference was $1,945 and $1897 for low and moderate, respectively). At high heifer costs, the largest difference was between JA and SA groups ($2,011).

Figure 3 shows gross margins for production of retail cuts under culling system CULL1 when the cost of feedlot TDN was set at levels 25 percent below (low) and 25 percent above (high) the originally assumed price (moderate). Crossbred dam group rankings were quite stable over the range of feedlot TDN costs evaluated, with the only changes in rank occurring between groups for which gross margins were similar.

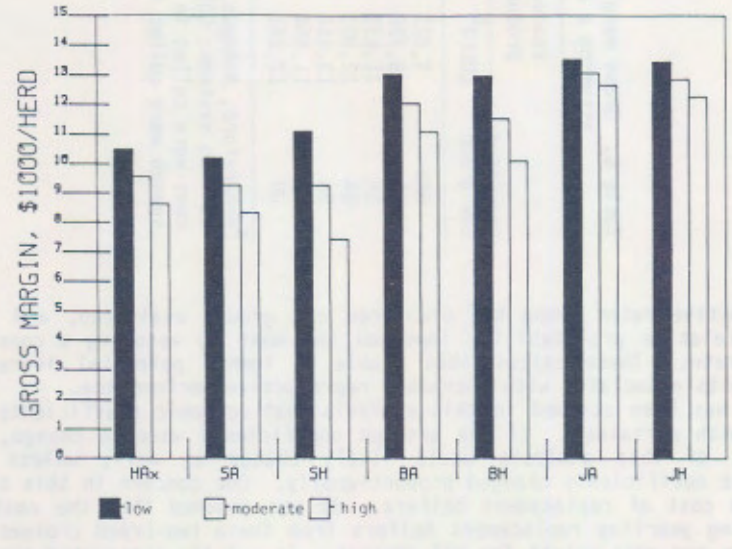

Figure 1. Gross margins at low, moderate and high replacement heifer costs under culling system CULL1 when calves are sold at weaning.

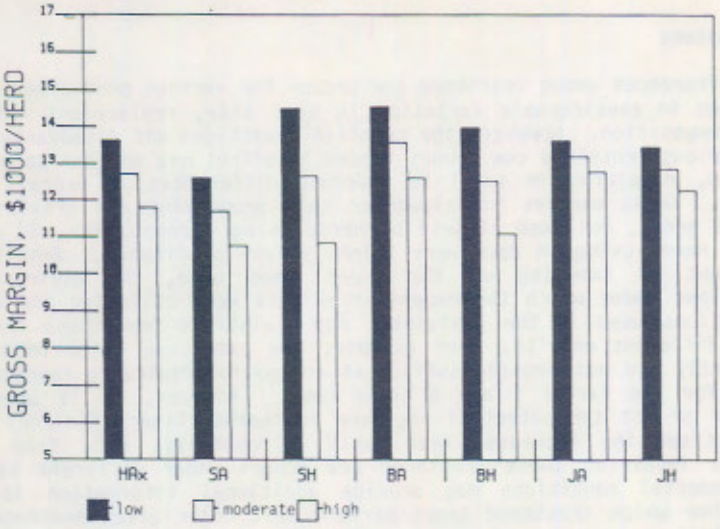

Figure 2. Gross margins at low, moderate and high replacement heifer costs under culling system CULL1 when calves are sold at slaughter.

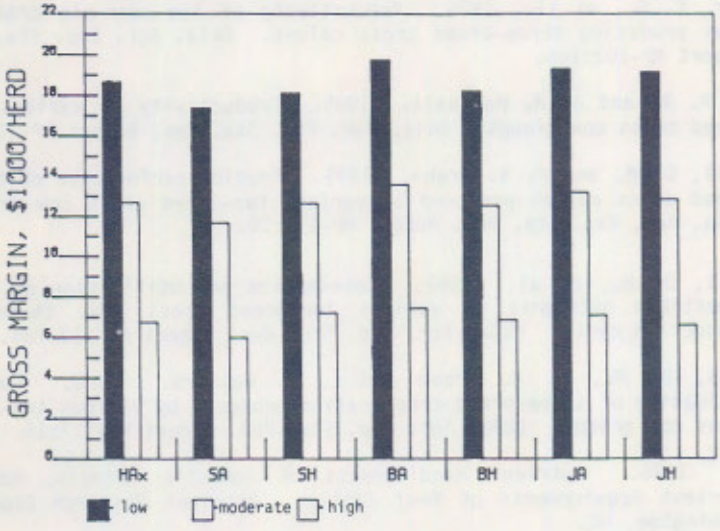

Figure 3. Gross margins at low, moderate and high costs of feedlot TDN under culling system CULL1 when calves are sold at slaughter.

Conclusions

Differences among crossbred cow groups for various production traits resulted in considerable variation in herd size, replacement rate and herd composition. However, the relative advantages and disadvantages of the various crossbred cow groups tended to offset one another to varying degrees, resulting in small to moderate differences in overall gross margin. Gross margins for slaughter calf production was greatest for the BA group, followed closely by herds using J cross, HAx, BH and SH cows. Herds using SA cows were slightly less profitable. Results are dependent on sampling of the breed types used, the environmental conditions under which the experimental data were collected and on the assumptions used in the analysis. Any deviations from these may have given different results. For example, the extensive range conditions apparently did not provide sufficient energy for desirable reproductive rates for the larger S and B cross cows. However, it is uncertain whether or not the potential increase in reproductive efficiency would have offset the increased feed costs. Hopefully, data from other studies involving these crossbred cow groups under different sets of environmental conditions may provide additional information to help determine which crossbred types perform best under given environmental conditions.

Literature Cited

Belcher, C. G., et al. 1979. Comparison of lactational performance among various four-year-old crossbred cow groups. Okla. Agr. Exp. Sta. Res. Report MP-104:132.

Belcher, C. G., et al. 1978. Productivity of two-year-old crossbred cows producing three-breed cross calves. Okla. Agr. Exp. Sta. Res. Report MP-103:105.

Frahm, R. R. and D. M. Marshall. 1985. Productivity of various two-breed cross cow groups. Okla. Agr. Exp. Sta. Res. Report MP-117:1 .

Marshall, D. M. and R. R. Frahm. 1985. Feedlot performance of three-breed cross calves produced by various two-breed cross cow groups. Okla. Agr. Exp. Sta. Res. Report MP-117:10.

Marshall, D. M., et al. 1982. Consumption and utilization of total digestible nutrients by various two-breed cross cows through a production cycle. Okla. Agr. Exp. Sta. Res. Report MP-112:284.

Marshall, D. M., R. R. Frahm and L. E. Walters. 1985. Carcass evaluation of three-breed cross calves produced by various two-breed cross cow groups. Okla. Agr. Exp. Sta. Res. Report MP-117:15.

N.R.C. 1976. Nutrient Requirements of Domestic Animals, No. 4. Nutrient Requirements of Beef Cattle. Nutrient Research Council, Washington, DC.