EFFICIENCY OF FEED UTILIZATION OF DIVERSE BIOLOGICAL TYPES OF CATTLE

T.G. Jenkins and C.L. Ferrell

U.S. Meat Animal Research Center, PO Box 166 Clay Center, NE, 68933-0166 USA

INTRODUCTION

Diverse breed resources provide cow/calf producers an opportunity to utilize breed combinations to enhance productivity for specific markets within defined production environments. Previous research documents the role of *Bos indicus* breeds of cattle for use in the cowherd in hot-humid production environments (Olson *et al*., 1991 ; Brown *et al*., 2001). Green *et al.* (1991) reported more weight of calf weaned from F_1 *Bos indicus* cows per unit of feed consumed by the cows from calving until weaning. Phillips *et a*l. (2001) reported calves whose dams were 50 % *Bos indicus* exhibited greater weight gains on native prairie pastures during the stocking period than straightbred calves. These positive contributions to beef production from *Bos indicus* breeds are offset by older ages at puberty (Gregory *et al*., 1979) and reduced meat tenderness with increasing percentage of *Bos indicus* breeding (Crouse *et al.*, 1989). Reproductive (Cundiff *et. al*., 2000) and meat palatability potentials (Wheeler *et al*., 2001) of tropically adapted *Bos taurus* breeds of cattle may provide alternative breed resources for southern beef producers. Ferrell and Jenkins (1998) reported significant variation in energy utilization during the postweaning period for steers representing tropically and non-tropically adapted breeds of cattle. These results document the need to characterize production characteristics of mature cows representing these diverse breeds of cattle. The objective is to compare production characteristics of tropically adapted *Bos taurus* (TBT)*, Bos indicus* (TBI) and non-adapted *Bos taurus* (NBT) cows from calving through weaning to identify an alternative to *Bos indicus* for use as a maternal breed cross in tropical or subtropical production environments.

MATERIALS AND METHODS

Animals and management. Mature pregnant F_1 (born from 1992 through 1994) dams were sampled from Cycle 5 of the Germ Plasm Evaluation project. Angus and Hereford (NBT), Brahman and Boran (TBI), and Tuli (TBT) bulls were mated by AI or natural service to Angus and Hereford cows. Cows (mated to Charolais bulls) determined pregnant by rectal palpation from each sire breed of cow group were identified for use in the study were sampled. Within each sire of cow breeding group, cows were randomly assigned to a diet at one of three feeding rates, 140, 180 or 240-kcal ME/weight$^{.75}$ (12-cows/feeding rate group). Individual cow weights, recorded upon entry into the testing area were used to assign a cow's daily ration. Cows were housed in pens (four cows/pen, nine pens per sire breed of cow) in an open front barn with concrete flooring with approximately 18.2 m^2 of space per cow. Each pen was equipped with four electronic head gates. Breed cross and feeding rate were confounded with pen to minimize the possible effect of cross nursing. Cows failing to learn to use the electronic head gate were replaced.

During the study, cows received a corn silage plus soybean meal diet (260 Mcal ME per kg DM, CP 13 %) fed once daily with delivered amounts recorded. Feed refusals were collected, weighed, and recorded weekly. Male calves were castrated at birth. During the testing period, calves were limited to a weekly presentation of 2-3 kg per week per calf of a creep feed composed of corn silage and ground alfalfa hay beginning when the oldest calf within a pen was 110 days of age. Other than this creep, dam's milk production was the sole source of nutrients for the calves. All calves were weaned with weights recorded at an approximate mean age of 210 d.

Calving began approximately the second week in March and continued through the third week in May. At approximately 14, 28, 56, 84, 112, 140, 168, and 192 days post-partum, milk production measurements were recorded using a weigh-suckle-weigh technique for each cow/calf pair. Calves were separated from their dam for an 18-hr period preceding the measurement. Differences between pre-and post-suckle calf weights were recorded as milk production measurement for that day. Individual cow measurements were used to estimate lactation curve parameters to predict time of peak lactation, yield at time of peak lactation, and total milk yield of lactation (Jenkins and Ferrell, 1992).

Statistical analyses. Analyses of covariance (Steele and Torrie, 1960) were used to partition variation associated with the fixed effect of sire breed of cow (SBC) and the covariate daily ME intake using the GLM procedure in SAS (SAS Institute, 1999). Where appropriate, sex of calf was included as a fixed effect. Initial models included linear and quadratic terms for daily metabolizable energy intake. Differences in performance between *Bos taurus vs. Bos indicus,* tropically adapted *vs.* non-adapted, and *Bos taurus* non-adapted *vs. Bos taurus* adapted were determined using linear contrast. Response variables include the lactation traits of time and yield at peak lactation (PY) and total yield (TY), calf traits include birthweight (BWT), weaning weight adjusted to 212 d (AWW), and preweaning daily gain ((AWW-BWT)/212, DG), and feed efficiency (gm DG/Mcal ME, FE). Initial models included SBC, pooled linear and quadratic terms for daily ME intake, these effects interacted with SBC, and calf gender.

RESULTS AND DISCUSSION

Table 1 presents the mean squares for the sources of variation and significance levels for the measures of lactation, calf growth, and efficiency. Preliminary analyses of the data indicated no significant differences in performance between cows produced by Angus or Hereford sires.

Table 1. Mean squares from analyses of covariance for production traits [A]

SV	DoF	PY	TY	BWT	DG	AWW	FE
Sire breed of cow	3	8.4[C]	374351[C]	197[D]	372700[C]	11641[D]	447[D]
Daily ME intake							
Linear	1	10.1[B]	504735[D]		51544	17383[D]	478[D]
Quadratic	1				82585[C]		342[D]
Sex	1			157[D]			
Error	121	3.2	114509	29	20891	869	23

[A] See text for definition of abbreviations.
[B,C,D] = (P<0.10), (P<0.05), (P<0.01) ; respectively.

These two SBC were pooled in the remaining analyses. Time of peak lactation was not affected ($P > 0.10$) by identified sources of variation, therefore will not be discussed. Peak yield and total yield were significantly affected by SBC. The effect of SBC on measures of calf weight and efficiency were highly significant. The linear effect of daily ME intake on PY approached significance ($P < 0.10$) and significantly affected TY. A significant effect of the quadratic term of daily ME intake was observed for DG. Both the linear and quadratic terms for daily ME intake were highly significant for efficiency.

Least squares means and standard errors for traits of interest and results from planned linear contrasts are reported in table 2. *Bos indicus* sired cows tended to have higher PY at time of peak lactation and had greater TY ($P < 0.01$) than *Bos taurus* sired cows. The DG and AWW for calves of *Bos indicus* sired cows were greater ($P < 0.01$) than the same traits for *Bos taurus* sired cows, however ; BWT was heavier for *Bos taurus* sired cows than for *Bos indicus* sired cows. *Bos indicus* sired cows were more efficient ($P < 0.01$) in converting feed energy to calf weight during the preweaning period than *Bos taurus* sired cows. No differences ($P > 0.10$) were observed for the comparison of tropically adapted *vs.* non-adapted SBC for lactation traits. Calves from cows produced by tropically adapted sire breeds had significantly lighter BW and had greater DG. Efficiency for feed energy use by cows of tropically adapted sire breeds was greater than cows from non-adapted sire breeds. Cundiff *et al*. (2000) provided information from a larger sample, reporting minor differences in BWT among SBC, and a ranking of Brahman (211 kg), Boron (201 kg), Angus/Hereford (194 kg) and Tuli (187 kg) for weaning weights at 200 d. Direct comparison of production traits for tropically adapted (Tuli) and non-adapted *Bos taurus* (Angus/Hereford*)* sired cows indicate that the adapted cows had lower PY, lighter BWT but greater DG, and higher EF than non-tropically adapted cows.

Table 2. Least squares means, standard errors and linear contrast for preweaning production characteristics of mature F_1 cows

Sire breed of dam[A]	PY (kg)	TY (kg)	BWT (kg)	AWW[B] (kg)	DG (gm)	FE (gm/Mcal)
Hereford/Angus	10.0 ±0.3[C,D]	1676 ±58[C,D]	44±0.9[D]	167± 5.2[C]	574±26[C]	20±0.8[C]
Brahman	10.3 ±0.36[C]	1810±68[C]	39±1.1[C]	212±5.9[D]	830±29[D]	29±1.0[D]
Boran	9.9 ±0.31[C,D]	1723±58[C,D]	39±0.9[C]	202±5.1[D]	773±25[D]	27±0.8[D]
Tuli	9.0 ±0.31[D]	1531±59[D]	41±0.9[C,D]	177±5.1[C]	649±25[C]	23±0.8[E]
Linear contrast			Means squares			
Bos taurus vs. Bos indicus	674318[H]	440[H]	1047667[G]	33983[H]		1270[H]
Tropic adapted *vs.* non-adapted	NS	496[H]	680870[H]	17736[H]		785[H]
Bos taurus non-adapted *vs. Bos taurus* adapted	377748[G]	115[G]	87939[G]	NS		89[F]

[A] Produced by mating of bulls from each sire breed mated to either Angus or Hereford cows.
[B] Adjusted to 212 d weaning age.
[C,D,E] Means within columns with different superscripts differ ($P<0.05$).
[F,G,H] ($P < 0.10$), ($P < 0.05$), ($P < 0.01$) ; respectively.

CONCLUSION

Production characteristics associated with weaned calf enterprises were compared for mature cows produced by mating Angus or Hereford cow to Angus, Hereford, Brahman, Boron, and Tuli sires. The performance of Tuli sired cows in the present were equal to or more favorable than Angus/Hereford sired females. These results suggest the Tuli breed represents a viable alternative to *Bos indicus* breeds for use as a maternal breed cross in production environments characterized as tropical or subtropical.

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