GENETICS—
ANIMAL BREEDING

Consumption and Utilization of Total Digestible Nutrients by Various Two-Breed Cross Cows Through a Production Cycle

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Story in Brief

Individual consumption of total digestible nutrients (TDN) was measured on 105 two-breed cross cows managed in drylot over a 3-yr period (35 per year). Records from Hereford-Angus reciprocal crosses, Simmental-Angus, Simmental-Hereford, Brown Swiss-Angus, Brown Swiss-Hereford, Jersey-Angus and Jersey-Hereford cows and their three-breed cross calves were included in the study. Cows were 4 to 6 years of age and mated to Charolais or Limousin bulls.

Cows were allowed ad libitum consumption of corn silage for about 4 hours each day supplemented with fixed amounts of protein and grain as needed. Intake of TDN varied among crossbred cow groups. For a production cycle (365-day period), Hereford-Angus, Simmental-Hereford and Brown Swiss cross cows had similar TDN consumption (averaged 4588 lb). Compared to these intermediate crossbred cow groups, Simmental-Angus cows consumed 503 lb (11 percent) more TDN and Jersey cross cows consumed 293 lb (6.4 percent) less TDN. Heavier cows tended to consume more TDN than cows of lighter weights although the smaller Jersey crosses consumed more TDN per unit of body weight than other crosses. Daily TDN intake per 100 lb cow weight was 1.48 lb/day for Jersey crosses, 1.34 lb/day for Simmental-Angus and Brown Swiss-Angus, 1.28 lb/day for Hereford-Angus and Brown Swiss-Hereford and 1.24 lb/day for Simmental-Hereford cows. On the average, Angus cross cows consumed 5.8 percent more TDN per 100 lb body weight than Hereford cross cows.

Efficiency of TDN conversion to calf weaning weight (lb TDN/lb calf weight) favored Jersey-Hereford, Brown Swiss-Hereford and Simmental-Hereford cows (averaged 10.0 lb), followed by Hereford-Angus and Brown Swiss-Angus cows (averaged 10.5 lb) and Jersey-Angus and Simmental-Angus cows (averaged 10.9 lb). Hereford cross cows consistently required less TDN to produce a pound of weaned calf than Angus cross cows (10.0 vs 10.8 lb).

Introduction

Due to increased production costs, many cattlemen have been seeking new methods of improving production efficiency of their breeding herds. Research has indicated that systematic crossbreeding can effectively increase production output of commercial beef cow herds. Studies have been conducted to identify specific breed combinations that are most desirable under given mating systems and particular environmental conditions.

An extensive research project is in progress at the Oklahoma Agricultural Experiment Station to evaluate lifetime productivity of various two-breed cross cows when mated to bulls of a third breed. It is important to consider feed requirements of the various crossbred groups to adequately measure efficiency of production since feed costs constitute a major portion of production expenses in a beef cow herd. Thus, the objectives of this study were to compare TDN requirements and efficiency of TDN conversion to calf weaning weight of various two-breed cross cows and their calves through a production cycle.

Experimental Procedure

The crossbred cows involved in this study were produced in 1973, 1974 and 1975 by Angus and Hereford cows mated to Angus, Hereford, Simmental, Brown Swiss and Jersey bulls. All heifer calves produced by these matings were introduced into the herd for subsequent evaluation as cows. Cows were maintained on native and bermudagrass pastures at the Lake Carl Blackwell Research Range west of Stillwater.

Five pregnant cows of each crossbred group (Hereford x Angus and Angus x Hereford crosses were combined into one group) were transported to a drylot at the Southwestern Livestock and Forage Research Station near El Reno in the fall of 1976, 1977 and 1979 to measure individual feed intake for one production cycle (approximately one year). Thus, a total of 105 cows were involved in the study (35 per year). Each cow had weaned a calf just prior to entering the drylot and remained in drylot until weaning her next calf. If a cow or her calf died in drylot, a replacement cow (or cow-calf pair) of the same age and breed group was brought into drylot from the cow herd on range. Cows entering the drylot in the fall of 1976, 1977 and 1979 were 4-, 5- and 6-yr-old, respectively, at calving time in the spring. Cows entering the drylot in 1976 were mated to Charolais bulls whereas those entering the drylot in 1977 and 1979 were mated to Charolais or Limousin bulls.

Cows were moved into individual feeding stalls each morning at about 8:00 a.m. and were allowed ad libitum consumption of corn silage (for about a 4-hr period) plus a specific amount of grain and (or) protein supplement as needed. Weights of cows in drylot and on range were analyzed monthly so that consumption of supplement could be adjusted to keep weight changes of drylot cows parallel to those of range cows. Creep feed was available to drylot calves during the later portion of lactation.

Composition of feedstuffs utilized by drylot cows and calves is presented in Table 1. Weekly silage samples were analyzed for content of dry matter and crude protein at the station research lab. In vitro dry matter digestibility (IVDMD) was estimated each month on a composite of weekly silage samples. Tabular values were used to estimate composition of grain, protein supplement and calf creep feed.

Twenty-four hour milk yield of drylot cows was estimated by the calf nursing method during the first 2 years of the study and by machine milkout during the last year of the study.

Table 1. Composition of feedstuffs utilized in drylot

			Dry matter basis	
	Ingredient	Dry matter (%)	TDN (%)	Crude protein (%)
	Corn silage	34.3	61.1	8.0
Year	Protein supplement	89.4	67.0	56.7
One	Whole shell corn	89.0	91.0	10.0
	Calf creep feed	89.5	81.1	15.4
Year	Corn silage	37.2	58.5	9.2
Two	Protein supplement	89.4	67.0	56.7
	Calf creep feed	89.5	81.1	15.4
	Corn silage	39.1	61.1	9.4
Year	Protein supplement	89.4	67.0	56.7
Three	Ground milo	89.0	80.0	12.4
	Calf creep feed	89.5	81.1	15.4

Results and Discussion

Total TDN consumption and TDN consumption per 100 lb cow weight are presented in Table 2. Feed intake was adjusted to 160 and 205 days for non-lactating and lactating periods, respectively, to account for variation among cows with regard to calving date. The 205-day lactating period corresponds to the average lactation length of the entire cow herd (drylot and range cows). Lactating intake includes calf creep feed consumption along with cow intake.

Overall, cows consumed an average of 1590, 2981 and 4576 lb TDN for the 160-day non-lactating, 205-day lactating and 365-day total periods, respectively. Relative differences in intake among crossbred cow groups were similar for the non-lactating and lactating periods. Simmental-Angus cows consumed 5091 lb TDN for the 365-day total period, which was significantly more than all other crossbred groups, and Jersey cross cows consumed 4295 lb TDN which was significantly less than all other crossbred cow groups. Hereford-Angus, Simmental-Hereford and Brown Swiss crosses consumed similar amounts of TDN (averaged 4588 lb) for the 365-day period. Compared to this intermediate group, Simmental-Angus cows consumed 503 lb (11.0 percent) more TDN whereas the Jersey cross cows consumed 293 lb (6.4 percent) less TDN.

Although heavier cows tended to consume more TDN than cows of lighter weights, the smaller Jersey crosses consumed the most TDN per unit of body weight. Daily TDN intake per 100 lb cow weight averaged 1.48 lb/day for Jersey

Table 2. TDN consumption by each crossbred cow group

Crossbred cow group	No. cows	TDN intake (lb)			Daily TDN intake per 100 lb cow weight (lb/day)		
		160-day non-lactating period	205-day lactating period	365-day total	160-day non-lactating period	205-day lactating period	365-day total
Hereford-Angus	15	1578^{bc}	2997^{b}	4576^{bc}	.998^{d}	1.487^{bc}	1.274^{bc}
Simmental-Angus	15	1775^{a}	3311^{a}	5091^{a}	1.056^{bcd}	1.552^{b}	1.336^{b}
Simmental-Hereford	15	1598^{bc}	3011^{b}	4575^{bc}	.989^{d}	1.449^{c}	1.239^{c}
Brown Swiss-Angus	15	1651^{b}	3000^{b}	4672^{b}	1.083^{bc}	1.540^{bc}	1.345^{b}
Brown Swiss-Hereford	15	1584^{bc}	2953^{bc}	4530^{bc}	1.031^{cd}	1.496^{bc}	1.289^{bc}
Jersey-Angus	15	1449^{d}	2770^{d}	4248^{d}	1.198^{a}	1.754^{a}	1.514^{a}
Jersey-Hereford	15	1497^{cd}	2822^{cd}	4342^{cd}	1.124^{ab}	1.677^{a}	1.439^{a}
Total or Average	105	1590	2981	4576	1.068	1.565	1.348

^{abcd}Means in the same column not sharing at least one superscript significantly differ ($P<.05$).

crosses, 1.34 lb/day for Simmental-Angus and Brown Swiss-Angus cows, 1.28 lb/day for Hereford-Angus and Brown Swiss-Hereford cows and 1.24 lb/day for Simmental-Hereford cows during the 365-day total period. Averaged over all crossbred groups, cows consumed 47 percent more daily TDN per 100 lb body weight during lactation than during non-lactation. Excluding the Hereford-Angus group, Angus crosses consumed, on the average, 6.1, 4.8 and 5.8 percent more daily TDN per 100 lb cow weight than Hereford crosses for the dry, lactating and 365-day total periods, respectively.

Various productivity and efficiency traits of the drylot cows and their three-breed cross calves are presented in Table 3. Productivity comparisons of these crossbred groups based on evaluation of the entire herd (range and drylot cows) have been previously reported by Belcher et al. (1978), Frahm et al. (1979), Frahm et al. (1981) and Marshall et al. (1981).

Birth weights were heaviest for calves from Brown Swiss-Hereford and Simmental-Angus cows (averaged 94.5 lb) followed by calves from Simmental-Hereford, Brown Swiss-Angus and Hereford-Angus cows (averaged 84.5 lb). The lightest calves at birth were produced by Jersey crosses (averaged 74.9 lb).

Twenty-four hour milk yield averaged 14.2 lb/day over all crossbred cow groups. Milk yields were 1.8 and 2.1 lb/day higher for Brown Swiss-Angus cows than for Hereford-Angus and Simmental-Hereford cows, respectively. No other differences between breed groups were statistically significant.

The average 205-day weaning weight for all drylot calves was 444 lb. Cows in drylot generally produced calves that were lighter at weaning than calves produced on range, especially during the last 2 years of the study. Drylot calves produced by Jersey-Angus cows averaged 50 lb lighter at 205-days than calves of the other crossbred groups. This surprisingly low weaning weight is atypical for this breed group based on weaning weights obtained from calves produced by cows on range and reflects the relatively low birth weights and cow weights of the Jersey-Angus group. Although the means varied from 436 to 464 lb among other breed groups, the differences were not statistically significant.

Cow weights ranged from 1048 lb for Simmental-Angus cows to 762 lb for Jersey-Angus cows. Weights were intermediate for Hereford-Angus cows (1002 lb), Simmental-Hereford cows and Brown Swiss crosses (averaged 959 lb) and Jersey-Hereford cows (827 lb). Relative to other crossbred cow groups, weights of Hereford-Angus cows in drylot were heavier than the average of Hereford-Angus cows in the entire herd while the reverse situation occurred for Jersey-Angus cows.

Efficient production of weaned calves is critical to maximize profit in a commercial beef cow enterprise. Larger cows have higher feed requirements for body maintenance and thus need to produce larger calves to be as efficient as smaller cows. Three measures of cow efficiency are presented in Table 3. The ratio of 365-day TDN intake (of cow and calf) to calf weaning weight is a more direct and probably more useful measure of efficiency than the other two ratios. Pounds of TDN required to produce a pound of 205-day calf weight ranged from 9.9 for Jersey-Hereford cows to 11.0 for Simmental-Angus cows. The most efficient groups were Jersey-Hereford, Brown Swiss-Hereford and Simmental-Hereford (averaged 10.0 lb/lb) followed by Hereford-Angus and Brown Swiss-Angus (averaged 10.5 lb/lb). The least efficient groups were Jersey-Angus and Simmental-Angus (averaged 10.9 lb/lb). The Hereford crosses were consistently more efficient than the Angus crosses (10.0 vs 10.8 lb/lb excluding the Hereford-Angus group). The unusually low weaning weights of calves produced by Jersey-Angus cows in drylot may have caused the ratio of TDN intake to calf weaning weight to be higher than it might have been with a different sample of Jersey-Angus cows.

Table 3. Herd productivity traits and measures of efficiency

Crossbred cow group	No. cow-calf pairs	Birth wt (lb)	24-hour milk yield (lb)	205-day weaning wt (lb)	Average cow wt (lb)[1]	365-day TDN intake (lb) / calf wn wt (lb)	Calf wn wt (lb) / cow wt (lb)	Calf wn wt (lb) / cow metabolic wt (lb)
Hereford-Angus	15	82.2^{cd}	13.8^{b}	436^{a}	1002^{ab}	10.5^{abc}	.440^{c}	2.47^{c}
Simmental-Angus	15	92.2^{ab}	14.0^{ab}	464^{a}	1048^{a}	11.0^{a}	.446^{bc}	2.53^{bc}
Simmental-Hereford	15	86.0^{bc}	13.5^{b}	445^{a}	961^{b}	10.1^{bc}	.465^{bc}	2.58^{abc}
Brown Swiss-Angus	15	85.2^{bc}	15.6^{a}	448^{a}	958^{b}	10.5^{abc}	.475^{bc}	2.63^{abc}
Brown Swiss-Hereford	15	96.8^{a}	14.1^{ab}	464^{a}	958^{b}	10.0^{bc}	.488^{ab}	2.70^{ab}
Jersey-Angus	15	73.3^{e}	14.2^{ab}	401^{b}	762^{d}	10.8^{ab}	.527^{a}	2.76^{a}
Jersey-Hereford	15	76.4^{de}	14.2^{ab}	447^{a}	827^{c}	9.9^{c}	.529^{a}	2.83^{a}
Total or average	105	85.6	14.2	444	931	10.4	.481	2.64

[1]Average of eight monthly weights (March through October).

[abcde]Means in the same column not sharing at least one common superscript are significantly different at the .05 probability level.

Another measure of cow efficiency is the ratio of calf weaning weight to cow weight. On this basis, Jersey crosses were most efficient, weaning 53 percent of their body weight, followed by Simmental crosses and Brown Swiss-Angus cows (averaged 46 percent) and Hereford-Angus cows (44 percent).

Feed requirements for maintenance of a cow are dependent upon the metabolic size of the animal, which can be estimated as the cow's weight taken to the 0.75 power. Differences in feed requirements should be estimated more accurately when based on metabolic cow weight. Thus, the ratio of calf weaning weight to cow metabolic weight was calculated as a third estimate of efficiency. On this basis, rankings of crossbred cow groups were the same as when calculated based on cow weight.

These data suggest important differences in feed requirements, herd productivity and efficiency of feed conversion to calf weaning weight among the various crossbred cow groups involved in this study. While the differences reported in this study are important, reproductive performance must also be considered to evaluate net efficiency of weaned calf production.

Literature Cited

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