

The trend for drylot calves with higher milk intakes to consume less creep has also been noted previously. Results presented herein suggest that the same depression of non-milk feed intake at high levels of milk intake also holds true for calves grazing range forage. The lower proportion of non-milk:milk nutrients in the diet of dairy crossbred progeny may reduce the overall efficiency of heavier weaning weights produced by increased milk production on range. Previous Oklahoma research with Charolais crossbred calves of Hereford, Hereford x Holstein and Holstein dams in drylot showed that Hereford progeny was more efficient in converting digestible energy of milk and creep to weaning weight than Hereford x Holstein or Holstein progeny.

Effects of Two Milk Intake Levels on Performance of Two Calf Types

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Story in Brief

The effect of two levels of milk intake on the performance of calves of two growth potentials was determined. This was accomplished by breeding Hereford cows to Angus bulls and Holstein cows to Charolais bulls, followed by reciprocal cross-fostering of about one-half of the calves.

The high level of milk consumption (24 lb/day, produced by Holsteins) resulted an additional 105 and 126 lb of weaning weight in Angus x Hereford and Charolais x Holstein calves, respectively. Increasing the level of milk consumption from 10-12 to 24 lb/day resulted in a reduction in apparent efficiency of conversion of milk to calf gain of 63 and 72% in Angus x Hereford and Charolais x Holstein calves, respectively.

Relative forage intake was reduced 30 and 49% in Angus x Hereford and Charolais x Holstein calves, respectively, at high levels of milk

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intake in the early summer (May). Forage intake in older calves (August) was reduced 28% in Angus x Hereford calves at the high milk intake level, but forage intake was not affected by level of milk intake in Charolais x Holstein calves.

Introduction

Selection for increased calf weaning weight usually results in an automatic selection for higher milk production in cows due to the strong positive relationship between milk production level and calf weaning weight. In recent years, there has been considerable interest in the infusion of dairy breeding into beef herds as a means of increasing the milk yield of cows and intensifying the cow-calf enterprise.

Beginning in 1969, an intensive research effort at the Oklahoma Agricultural Experiment station was directed toward defining the relationships between milk production levels, resource (land and supplemental feed) requirements, reproduction of cows and calf performance of Hereford, Hereford x Holstein and Holstein cows managed under tallgrass range conditions.

Increasing the milk production level in cows resulted in distinct increases in calf weaning weights. However, the effects of increased milk intake on calf performance were not clear, since level of milk production was confounded by genetic differences for growth rate in dams of the calves.

Questions not answered in the first phase of this experiment include: Will the capacity of the calf limit the cow's milk production? Will additional milk be efficiently converted to calf gain? What effect will increasing milk intake have on forage intake by the calf? Will the pre-weaning milk consumption level affect subsequent feedlot performance and carcass composition of calves? The research reported here was designed to help answer some of these questions.

Materials and Methods

Using Hereford and Holstein cows employed in the earlier phase of the project, a system was devised whereby calves of similar genetic composition could be exposed to a low (Hereford) or high (Holstein) level of milk consumption. This was accomplished by breeding the Hereford cows to Angus bulls and the Holstein cows to Charolais bulls followed by reciprocal cross-fostering of about one-half of the calves at birth. Thus, within each calf breed (Angus x Hereford and Charolais x Holstein) one group was the recipient of a low level of milk (10 to 12 lb/day) while another group received a high level of milk (22 to 24 lb/day).

All cows were six-year-olds producing their fifth calves. Cows were maintained on tall grass native range and calved during December, January and February.

Cows received a post-calving winter supplement level considered adequate for their size and milk production level based on the results of earlier work at this station. Hereford and Holstein cows were fed 2.8 and 6.3 lb per day, respectively, of a 30% all-natural crude protein supplement.

Parturition was induced in cows by administration of 40 mg dexamethazone (Azium) within 10 days of the expected calving date to facilitate scheduling of the cross-fostering program.

Forage intake trials were conducted in May and August 1975 while calves were on lush native pasture. Relative forage intake by calves was estimated by use of an external indicator technique employing chromic oxide as the indicator.

Results and Discussion

Performance of cows is summarized in Table 1. Supplemental feed was fed at the rate of 2.8 and 6.3 lb per day to the Hereford and Holstein cows, respectively. Among Hereford cows the 20% body weight loss target was slightly exceeded indicating that a small increase in supplement allocation would have been justified. The 20% body weight loss target was not quite achieved in the Holstein cow groups.

Calf performance is summarized in Table 2. Angus x Hereford calves consumed 12.1 and 24.2 lb of milk daily at the low and high milk levels, respectively. Charolais x Holstein calves consumed 10.6 and 22.3 lb of milk daily at the low and high levels, respectively. At the high level of milk intake, Angus x Hereford and Charolais x Holstein calves consumed about the same amount of milk (24.2 and 22.3 lb/day, respectively). Thus, it appears that the potential growth rate of calves had

Table 1. Performance of Cows.

Breed of dam Breed of calf	Hereford		Holstein	
	Angus x Hereford	Charolais x Holstein	Angus x Hereford	Charolais x Holstein
Daily winter supplement post-calving, lb	2.8	2.8	6.3	6.3
Weight, fall 1974, lb	1065	1047	1335	1292
Weight, spring 1975, lb	823	784	1090	1089
Winter weight change, lb	-242	-263	-245	-203
Winter weight loss, %	22.7	25.1	18.5	15.7
Calving date	1-21-75	1-10-75	1-11-75	2-10-75

Table 2. Performance of Calves.

Breed of calf Milk intake level	Angus x Hereford		Charolais x Holstein	
	Low	High	Low	High
Daily milk consumption, lb	12.1	24.2	10.6	22.3
Birth weight, lb	67.3	66.9	87.6	103.9
Weaning weight, lb ¹	511	616	563	689
Daily gain, lb ²	1.85	2.29	1.98	2.44
Conformation grade ³	12.7	12.8	12.0	13.4
Condition score ⁴	5.6	6.9	4.5	4.9

¹ 240-day sex corrected weaning weight. Sex correction factor of 1.05 used to adjust heifers to a steer equivalent.

² Rate of daily gain adjusted for birth weight.

³ 12=low choice, 13=average choice, 14=high choice.

⁴ 1=very thin, 9=very fat.

little affect on milk intake in this study. The range in milk consumption employed here should include levels which would be encountered under most range beef cattle production situations.

At weaning, Angus x Hereford calves consuming the high levels of milk (24.2 lb) were 105 lb heavier than calves receiving the low milk level (12.1 lb). This represents a 20% increase in weaning weight or an additional 0.44 lb per day gain. This increased growth rate was reflected in condition scores of the calves. Condition scores for Angus x Hereford calves were 5.6 and 6.9 for the low and high milk levels, respectively. Charolais x Holstein calves receiving the high milk level (22.3 lb) were 126 lb heavier at weaning than calves at the low milk level (10.6 lb). This was a 22% increase in weaning weight or an additional 0.46 lb of gain per day. Among Charolais x Holstein calves, the level of milk intake had little effect upon condition score. It is interesting to note that at low levels of milk intake, the advantage in growth rate of the large Charolais x Holstein calves was not great (1.85 vs 1.98 lb/day). Charolais x Holstein calves weighed 563 lb at weaning, 52 lb more than the Angus x Hereford calves. About 20 lb of this difference was due to the difference in birth weight.

As milk consumed and rate of gain increased, the apparent efficiency with which milk was utilized for gain decreased. Angus x Hereford calves receiving the high milk level required 4.1 lb more milk per pound of gain (Table 3, 10.6 - 6.5 = 4.1). This represents a 63% decrease in the efficiency of milk utilization by calves at the high level of intake. An additional 27.6 lb of milk was required to produce an additional pound of gain above that of calves receiving the low milk level. Charolais x Holstein calves consuming the high milk level required 3.8 lb more milk per pound of gain compared to calves receiving the low milk level (Table 3). This represents a 72% decrease in efficiency of

Table 3. Milk Conversion Efficiency

Breed of calf Milk intake level	Angus x Hereford		Charolais x Holstein	
	Low	High	Low	High
Milk per lb gain, lb ¹	6.5	10.6	5.3	9.1
Additional milk per lb additional gain, lb	27.6		25.7	

¹Rate of gain adjusted for birth weight.

utilization compared to calves receiving the low milk level or an additional 25.7 lb of milk to produce an additional pound of weaning weight.

Increasing the level of milk consumption by calves of both breed types resulted in an apparent reduction in relative forage intake in May (Table 4). Angus x Hereford calves at the high milk intake levels consumed 30% less forage and Charolais x Holstein calves receiving the high milk level consumed 49% less forage than their counterparts on the low milk levels. In August Angus x Hereford calves on the high milk level consumed 28% less forage than those on the low milk level, while level of milk intake had little affect on forage intake of Charolais x Holstein calves. Apparently the growthier Charolais x Holstein calves were able to consume the higher milk level without decreasing forage intake as they approached weaning age.

Table 4. Relative Forage Intake¹

Breed of calf Milk intake level	Angus x Hereford		Charolais x Holstein	
	Low	High	Low	High
Trial 1 (May)	100	70	120	71
Trial 2 (August)	100	72	112	108

¹Expressed as percent of forage intake by Angus x Hereford calves at the low milk intake level.