MILK PRODUCTION AND COMPOSITION IN CHAROLAIS AND POLLED HEREFORD COWS ON DIFFERENT FORAGE SYSTEMS

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ABSTRACT
The objective of this study was to study the effect of different winter and summer forage systems on milk production and composition in beef cows. Charolais and Polled Hereford cows were assigned to receive either grass hay and supplemental feed or ryegrass pasture during the late winter/early spring period, and then allowed to either graze warm-season grass pasture on a continuous or rotational basis during the summer period. Representative cows were machine-milked on day 48 (hay/feed vs ryegrass), on days 117 and 175 (continuous vs rotational grazing) postpartum. Milk weights were recorded and converted to 24-hour yields. Samples were collected from each cow on each milk date for determination of butterfat, protein and lactose content in milk.

KEYWORDS
Beef cow, ryegrass, milk production, milk composition, weaning weight

INTRODUCTION
Most pastures in southern Arkansas consist of warm season perennial grasses such as bermudagrass (*Cynodon dactylon*), dallisgrass (*Paspalum dilatatum*), and bahiagrass (*Paspalum notatum*), which are well-suited for overseeding with winter annual grasses in the fall. Hoveland and Anthony (1979) reported that cool season annual grasses lengthened the grazing season by as much as three months when overseeded into perennial sods in Alabama. Many forage/beef producers could lessen hay needs by utilizing winter annuals in their forage program.

The impact of a beef dam's milk production on the growth of her calf is well documented (Bartle et al. 1984; Beal et al., 1990). In a study involving 279 Hereford calves, Rutledge et al. (1971) reported that approximately 60% of the variance in 205-day adjusted weaning weights was due to the independent effects of the dam's milk yield. Boggs et al. (1980) found that each additional kg of milk per day produced by Polled Hereford cows added 7.2 kg to the 205-day adjusted weaning weight of their calves.

Butson et al. (1980) reported that milk yield and composition are largely influenced by breed of dam. Valentine et al. (1993) studied milk yield and composition in dairy cows grazing perennial ryegrass. However, information is limited on the effect of various forage systems on milk production and composition in beef cows. The objectives of this study were to evaluate the effects of two winter (hay/commercial supplement vs annual ryegrass) and two summer (continuous vs rotational grazing) forage systems on milk production and composition in beef cows.

MATERIALS AND METHODS
Charolais and Polled Hereford cows were stratified by breed and age and assigned to one of four 20-cow replicate groups that were maintained over a three-year period. Representative cows (Year 1, n = 46; Year 2, n = 47; Year 3, n = 48) were milked to assess the effect of different winter and summer forage systems on milk production and composition.

Ryegrass pastures were established the previous September by lightly disking to allow for about 50% soil exposure. Marshall® ryegrass was broadcast at a rate of 30 kg pure live seed per hectare. Fertilizer rate recommendations were followed for high production.

Prior to the imposition of forage treatments during the winter phase of the study, all cows were allowed free-choice access to bermudagrass hay and were fed 2.27 kg/day of a corn-based commercial supplement (12% crude protein). Beginning in late winter of each year (Year 1, March 3, 1993; Year 2, March 4, 1994; Year 3, February 24, 1995), two replicate groups were each placed on 4-hectare pastures (20 cow-calf pairs / 4 hectares) of Marshall® annual ryegrass. The remaining two groups continued to receive hay and commercial supplement. Cows grazing ryegrass remained on these pastures until June 4, 1993, June 3, 1994, and June 5, 1995, during Years 1, 2 and 3, respectively.

At the beginning of the summer grazing phase (early June), each replicate group was placed on 8-hectare bermudagrass-dallisgrass pastures. Two of the groups were allowed to continuous graze, while the other two groups grazed rotationally on a 5-day grazing interval. Bermudagrass-dallisgrass pastures were fertilized at recommended rates for high production.

The calving season extended from mid-February to mid-April of each year. All calves were Brahman-sired and were weaned on September 28, 1993, October, 10, 1994, and September 11, 1995, in Years 1, 2 and 3, respectively. Calf weights were adjusted for age of dam and sex to 205-day weaning weights (ADJWW; Beef Improvement Federation, 1990)

Cows were milked on three different occasions in each year: once while on ryegrass or hay/supplement (day 48 ± 2 postpartum), and two times while either continuously or rotationally grazing bermudagrass-dallisgrass pasture (days 117 and 175 ± 2 postpartum). Calves were separated from cows at 4:00 p.m. the day before each milking. At 4:00 a.m. on the day of milking, calves were placed with cows, allowed to suckle for 30 minutes, and separated. Beginning at 8:30 a.m., cows were milked using a portable, single-unit milking machine. At approximately five minutes prior to milking, cows received (i.m.) approximately 15 mg of the tranquilizer acepromazine maleate (10 mg/mL). Immediately before milking, cows were administered (i.v.) oxytocin (20 IU; 1 mL) to induce milk letdown. After milking, each quarter was hand-stripped to ensure complete milkout. Milk was weighed and sampled for butterfat, protein, and lactose analyses. Milk production was adjusted for separation time and converted to 24-hour yields.

Data were analyzed using the GLM procedure (SAS, 1985). Milk production and the percentages of butterfat, protein and lactose were analyzed using a model consisting of forage treatment, year, breed and the appropriate interactions. The mean square for pasture replicate within treatment x year was used as the error term to test the effect of forage treatment, year and forage treatment x year. Days postpartum was used as a covariate for the analyses, and when not contributing to variation ($P > 0.05$), was deleted from subsequent analyses. Multivariate analysis of variance under the GLM procedure (SAS, 1985) was used to evaluate the relationship between milk production of the dam and ADJWW of the calf. This allowed for comparisons between these variables after accounting for differences that were due to forage treatment and breed. Data for milk production and composition, and ADJWW are reported as least-squares means.

RESULTS AND DISCUSSION
This study compared milk production and composition in cows that were exposed to different forage regimes at various time periods from parturition to weaning for three consecutive calf crops. On day 48 ± 2 postpartum, milk production in cows grazing ryegrass was higher than that in cows being fed bermudagrass hay and commercial supplement (Table 1). A forage treatment x breed interaction was detected, as ryegrass pasture increased milk production by a greater magnitude in Charolais than in Polled Hereford cows (Table 1). Neither a year effect nor a forage treatment x year interaction was detected for milk production on day 48 postpartum.

Grazing management (continuous vs rotational) did not impact milk production on days 117 or 175 ± 2 postpartum (Table 1). As expected, milk production was notably lower by day 175 postpartum.

Charolais cows produced more milk than Polled Hereford cows on each of the three observation days. Melton et al. (1967) reported that average daily milk production of Charolais cows exceeded that of Angus and Hereford cows. The breed effect on milk production observed in the present study was consistent as no year x breed interaction was detected.

Percentage of milk protein on day 48 ± 2 postpartum was significantly higher, and percentage of milk butterfat was numerically higher, in cows grazing ryegrass than in cows consuming hay and commercial supplement (Table 2). In view of the higher volume of milk produced by ryegrass cows, the higher percentage of protein was somewhat surprising. In dairy cows, protein concentrations usually decrease with increased milk yield, due to a simple dilution factor.

On days 117 and 175 ± 2 postpartum, respectively, cows grazing continuously did not differ ($P > .10$) from those grazing rotationally in milk butterfat (6.09 vs 5.80 ± .31 % and 6.30 vs 6.14 ± .32 %), protein (3.36 vs 3.29 ± .04 % and 3.79 vs 3.80 ± .07 %) or lactose (4.70 vs 4.75 ± .06 % and 4.37 vs 4.35 ± .05 %).

The only breed differences in milk composition that were observed in the entire study were on the last two milk days, as Charolais had a higher percentage of butterfat than Polled Hereford cows (6.25 vs 5.63 ± .12 % and 6.60 vs 5.83 ± .14%; $P < .01$) on days 117 and 175 postpartum, respectively. It is unclear why a breed difference in butterfat was noted on days 117 and 175 but not on day 48 postpartum. The higher milk production in early lactation may have masked any such difference.

Although calves were weaned approximately four months after the termination of ryegrass grazing, the higher milk production in cows grazing ryegrass during early lactation seemingly had a extended effect on calf weight, as calves from ryegrass cows tended to have higher ADJWW than calves from hay/commercial supplement cows (237 vs 215 ± 9 kg; $P < .12$). Calf ADJWW did not differ between calves grazing continuously and rotationally during the summer (230 vs 222 ± 10 kg; $P > .10$). Charolais had higher ADJWW than Polled Hereford calves (243 vs 209 ± 4 kg; $P < .01$).

Multivariate analysis of variance revealed a positive correlation between mean milk production and calf ADJWW ($r = .57$; $P < .01$). Regression analysis revealed that for every 1 kg increase in 24-hour milk production, there was a 7.8 kg increase in calf ADJWW.

In conclusion, the impact of ryegrass pastures on milk production and milk protein during early lactation (day 48 ± 2 postpartum) was very evident. Grazing management during the summer had no effect on milk production or composition. In this study, Charolais were superior to Polled Hereford cows in terms of milk production and calf weaning weight.

Table 1
Effect of forage treatment and breed on milk production (kg/24 hr)
in Charolais and Polled Hereford cows (n = 141) during winter and usmmer phases.

Breed	Days PP†	Hay	Ryegrass	SE‡	TRT	BRD	TxB
		Winter Phase			Probability		
Charolais	48±2	8.02	12.17	0.57	<0.02	<0.01	<0/03
Polled Hereford		7.30	8.95				
		Summer Phase					
		Continuous		Rotational			
Charolais	117±2	8.96	8.42	0.44	0.53	<0.01	0.94
Polled Hereford		6.43	5.83				
Charolais	175±2	5.07	5.76	0.32	0.33	<0.01	0.87
Polled Hereford		3.24	3.83				

† Days PP = days postpartum
‡ Standard error of the mean

Table 2
Effect of late winter forage treatment on mulk composition on day 48± postpartum in Charolais and Polled Hereford cows.

	Milk Composition during Winter Phase			
	Hay	Ryegrass	SE	Probability
Butterfat, %	5.97	6.88	0.45	0.20
Protein, %	2.97	3.37	0.07	<0.01
Lactose, %	4.73	4.62	0.07	0.32

Day 48±2 PP;n=139

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