Some Effects of Supplemental Grain Feeding on Performance of Cows and Calves on Range Forage

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Highlight: *This study was conducted to determine the effects of supplemental grain feeding on reproductive performance of lactating range beef cows. Results indicated that feeding 3.86 kg grain either before or during lactation, or before and during the breeding season, decreased the fall pregnancy rate in supplemented cows compared to cows on range forage only. The high level of grain feeding reduced grazing time and subsequent forage intake and served as a substitute for the range forage rather than a supplement.*

A major part of the diet of dams grazing during the early spring period was new growth on western wheatgrass. This forage was available in limited amounts during this early time period, and the moisture content ranged from 65.3 to 82.1%, resulting in a low dry matter intake. Lactating dams lost 1.23 kg daily during this time period, but daily calf gains at this time averaged 0.71 kilograms. Thus, a major part of the nutrients consumed by the dam was being used for production of milk, and at least a portion of the milk was being produced at the expense of body tissue stores of the dam.

This work indicates that the period from calving until adequate forage with a sufficient dry matter content is available to produce weight gains in the lactating dams should be considered a critical nutritional period. These findings indicate the need for studies to determine the most satisfactory methods of meeting the nutritional requirements of the lactating dam during this period.

Data from studies conducted in feedlots indicate that feed levels immediately after calving and during the prebreeding and breeding periods have marked effects on reproductive performance of beef cattle (Wiltbank et al., 1962; Bellows, 1966; Dunn et al., 1969; review by Thomas, 1973). Additional information is needed regarding the effects of supplemental grain feeding on reproductive performance of lactating beef cows grazing range forage during the spring.

This study was conducted to determine reproductive performance of lactating range beef cows fed a high level of grain supplement before and during the breeding season. In addition, weight gains of the calves suckling the cows were evaluated. Moisture content of western wheatgrass (*Agropyron smithii*) was determined and related to weight changes in the cow and calf.

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Methods

The study involved 57 Hereford cows. Twenty-nine were second calf 3-year-olds; 28 ranged in age from 4 to 10 years. All cows were wintered on range, and hay was fed in amounts ranging from 5.4 to 8.2 kg per head daily from December 15 until calving. Total winter weight losses from December 1 until the precalving weighing on March 9 averaged 14.5 kg per head for the 3-year-olds and 31.4 kg for the older cows. Cows were held in dry lots from March 9 until calving. The average calving date was April 15.

All cows were weighed within 12 hours after calving. Most of the dams had regained their appetite at this postcalving weighing, thus, this weight should not be considered a shrunk weight. All calves were weighed, branded, eartagged, and dehorned, and male calves were castrated with elastrator bands within 12 hours after birth.

Cows nursing calves were returned to range pasture 3 to 5 days after calving, and from then on their diet consisted of available range forage. Forage in this pasture consisted of new growth plus plant residue remaining from the previous year. The pasture had been grazed during the fall and winter immediately preceding this study, and estimates indicated that approximately 60% of the forage produced the previous year had been utilized.

On May 12, which was 35 days before the beginning of the breeding season, cows were randomly assigned within age group to a factorially designed feeding experiment. Feed groups were: (1) range forage with no grain supplement (May 12–July 29); (2) range forage plus grain supplement for 34 days immediately before the beginning of the breeding season (May 12–June 14) but range forage only during the 45-day breeding season (June 15–July 29); (3) range forage only before the breeding season (May 12–June 14) followed by range forage plus grain supplement during breeding (June 15–July 29); (4) range forage plus grain supplement for 34 days before and during the breeding season (May 12–July 29). Groups 1, 2, 3, and 4 contained 16, 14, 14, and 13 cow-calf pairs, respectively.

All cows were pastured together in the same range areas throughout the study. Cows assigned to a grain supplement treatment were gathered and held in a corral during the daily grain feeding period. Gathering was done by experienced herdsmen and created only minimal stress for the cows. This procedure resulted in supplemented cows being corralled for approximately 2 hours each day. Cows not receiving grain remained on pasture at all times. The pelleted grain supplement was group fed at the rate of 3.86 kg per head daily. Supplement composition was 75% barley, 20% wheat millrun, and 5% molasses. This level of supplement provided a calculated (Nat. Res. Counc., 1970) 3.25 kg of total digestible nutrients (TDN) per head daily. All animals had free access to fresh water and a bone meal-salt mix (0.33 to 0.67 ratio) throughout the study.

The reproductive organs of all cows were palpated rectally at 14-day intervals throughout the study. Cows and calves were weighed May 12, June 15, July 29, and August 30. The animals were corralled and held off feed and water for approximately 12 hours before weighing; thus, resulting in a shrunk weight. Data collection, except for pregnancy information, was terminated on August 30 since calves were weaned and placed on another study on that date.

The 45-day breeding season began June 15 and continued until July 29. Breeding was by artificial insemination utilizing frozen semen and routine procedures. Sterile bulls wearing marking harnesses were used to detect estrus throughout the study. Ovulation was confirmed after estrus by palpation of a corpus luteum in the ovary. Uterine involution was considered complete when both uterine horns were of equal size and of normal consistency.

Western wheatgrass samples were obtained at 14-day intervals throughout the study for moisture determinations from native range areas frequently grazed by the cows. Western wheatgrass was chosen because it was the predominant cool-season grass in these areas. Fresh samples were weighed and placed in an oven for drying. After drying and cooling, the samples were reweighed and the percentages of moisture and dry matter calculated.

Weight changes of the cows and calves, intervals from calving to attainment of the various reproductive criteria, services per conception, and forage moisture data were analyzed by Student's *t*-test or analyses of variance. The method of unweighted means was used for data with unequal subclass numbers. Chi-square procedures were used to analyze pregnancy percentage data. All statistical procedures were as outlined by Steel and Torrie (1960).

Results and Discussion

Data were analyzed to determine whether cow reproductive responses were affected by grain supplementation, age of cow, or sex of calf. The main effects of grain feeding, age of cow, and sex of calf were nonsignificant, as were all two- and three-way interactions. Calf weight gains were not significantly affected by age of cow, feed treatment of the dam or sex of calf, and all two- and three-way interactions were nonsignificant. The results of supplemental grain feeding are summarized in Tables 1 and 2. Since age-of-cow and sex-of-calf effects were nonsignificant, these variables were ignored in summarizing the results for entry into Tables 1 and 2.

The results indicate that daily feeding of 3.86 kg of grain to range cows before and during the breeding season did not significantly affect weight changes of the cow or calf growth (Table 1) or the interval from calving to uterine involution and first estrus (Table 2). The results further show that the reproductive performance of cows receiving range only was at or near optimum, as indicated by a pregnancy rate of 93.8%. A concurrent study[1] revealed that forage production from perennial grasses during the spring and summer growing period of the year of the present study exceeded that of all other years during a 10-year period. This high forage production met the nutrient requirements of the cows, resulting in a high pregnancy rate.

However, the high level of grain feeding reduced the October pregnancy percentage in the supplemented group (Table 2). Statistical analyses indicated this reduction was not significant ($P \cong 0.20$). However, factors causing reduction in pregnancy rates ranging from 15.2 to 32.3% (Group 1 vs Groups 2 and 4, respectively) are of major interest to cow-calf producers and indicate the need for additional work. The reduced pregnancy rate resulted from an increase in the number of cows failing to conceive when bred and from a trend toward an increase in services per conception in cows that did become pregnant (Table 2). A seemingly high incidence (13.0%) of estrous cycles 7 to 15 days in duration was observed during the

[1] Unpublished data, W. R. Houston, U.S. Range Livestock Experiment Station, Miles City, Mont. 59301.

Table 1. Summary of effects of feed treatment on cow and calf weights (kg) and gains (kg/day).

Time or date of weight	Feed group[1]: 1-Range only			2-Range + grain prebreeding			3-Range + grain during breeding			4-Range + grain pre- and during breeding		
	No.	Avg. weight	ADG[2]	No.	Avg. weight	ADG	No.	Avg. weight	ADG	No.	Avg. weight	ADG
Cow data:												
Postcalve	57	431.5	–	–	–	–	–	–	–	–	–	–
May 12	16	394.2	−1.24	14	391.1	−1.35	14	403.2	−0.94	13	389.6	−1.40
June 15	16	409.7	0.46	14	425.6	1.01	14	418.5	0.45	13	419.7	0.88
July 29	16	435.4	0.58	14	443.1	0.40	14	453.2	0.79	13	443.6	0.54
Aug. 30	16	452.2	0.52	14	456.2	0.41	14	462.3	0.28	13	455.1	0.35
Calf data:												
Birth	57	34.7	–	–	–	–	–	–	–	–	–	–
May 12	16	56.9	0.72	14	53.9	0.64	14	57.5	0.75	13	55.5	0.72
June 15	16	80.8	0.70	14	75.7	0.64	14	81.6	0.71	13	76.4	0.61
July 29	16	118.5	0.86	14	110.0	0.78	14	113.7	0.73	13	113.6	0.84
Aug. 30	16	145.3	0.84	14	141.2	0.98	14	141.5	0.87	13	140.3	0.83

[1] See text for description of treatments.
[2] Average daily gain.

Table 2. Summary of effects of feed treatment on cow reproductive performance.

	Feed group[1]							
	1-Range only		2-Range + grain prebreeding		3-Range + grain during breeding		4-Range + grain pre- and during breeding	
Cow reproduction data	No.	Avg.	No.	Avg.	No.	Avg.	No.	Avg.
Interval (days) calving to:								
Uterine involution	16	50.2	14	41.5	14	46.5	13	42.8
First estrus	15	62.5	14	66.6	13	66.5	12	63.9
Pregnancy data:								
No. cows bred[2]	15		14		13		12	
No. pregnant in October	15		11		10		8	
Percent pregnant in October[3]	93.8		78.6		71.4		61.5	
Avg. services per conception	1.27		1.36		1.30		1.62	

[1] See text for description of treatments.
[2] Difference in group numbers due to three cows not exhibiting estrus during breeding season.
[3] $X^2 = 4.6; P \cong 0.20$.

breeding season. The cause of these short cycles is unknown and the incidence did not appear to be related to feed treatment.

Rittenhouse et al. (1970) reported that high levels of energy supplementation significantly depressed forage intake in cattle grazing winter forage. Neither grazing time nor forage intakes were determined in the present study, but visual observations of cows after the daily grain feeding indicated that cows would not return to the pasture immediately. After being released from the corral, the cows would lie down for periods of up to 4 hours before starting to graze. This meant that the cows did not consume forage for periods of up to 6 hours duration, and this probably resulted in forage intake of the supplemented cows being lower than that of cows receiving range forage only. Cow weights and gains summarized in Table 1 show trends for increased weight gains in cows receiving grain during the supplement period; however, these increases were not statistically significant. These results indicate that the cows were using the grain as a substitute for the range forage rather than as a supplement. This is in agreement with the work reported by Rittenhouse et al. (1970).

Forage moisture data and weight changes of the cows on forage only during the various weigh periods are summarized in Table 3. The most striking figure is the −1.23 kg average daily weight loss in cows from calving until May 12. Houston and Woodward (1966) reported an average daily weight loss of −0.71 kg in lactating cows during the same time period. A part of the weight loss noted in the present study was due to shrink because of the weighing procedures described previously. However, the weight loss during the early pasture period in both studies represents a sizable loss in body condition. A factor contributing to this weight loss can be seen by studying the calf weight gains during the period from birth to May 12 (Table 1). The average calf gain during this period was 0.71 kg per day and would have been largely a result of intake of milk.[2] Thus, even though the cows were losing weight, milk production was not significantly reduced. This indicates that a major part of the nutrients consumed by the dam was being used for milk production, and the loss in body condition indicates that a portion of the milk was being produced at the expense of body tissue stores of the dam.

Table 3. Moisture content (%) of western wheatgrass related to weight changes (kg/day) of cows at different time periods.

Date grass sample obtained	Moisture content	Time period	No. cows[1]	Weight change per cow[3]
April 21	82.1c[2]	Postcalving to May 12	57	−1.23e
May 5	65.3c			
May 19	43.2d	May 12 to June 15	30	0.46f
June 16	49.2d			
July 22	45.3d	June 15 to July 29	16	0.58f

[1] Weight changes of cows on range forage only.
[2] Average moisture percentages with different superscripts (c, d) differ at $P < .05$.
[3] Average weight changes with different superscripts (e, f) differ at $P < .01$.

Dams grazing the pasture from calving to May 12 showed a definite preference for the new growth from western wheatgrass which was the predominant cool-season grass in these areas. The total amount of this forage available during this time period was limited and the moisture content averaged 73.7% (range 65.3 to 82.1%; Table 3). This resulted in a low dry matter intake and was another factor contributing to the −1.23 kg weight loss. As the study continued, the cows began to gain weight and continued to do so throughout the rest of the study. This continued weight gain was due mainly to an increase in available forage containing a higher percentage of dry matter (Table 3).

Data reported by Wiltbank et al. (1962) and Dunn et al. (1969) indicate that weight loss in lactating dams after calving has a depressing effect on reproductive performance. Postcalving weight losses observed in this and cited studies involving lactating cows on range forage can be traced to a low level of available nutrients, partially due to the high moisture content of the forage consumed during the early spring growing period and the nutrient demand created by milk production. Since this study was conducted during

[2] Unpublished data, W. L. Reynolds, Iberia Livestock Experiment Station, Jeanerette, La. 70544.

a year of high forage production, the cow weight loss from calving until May 12 did not have a detrimental effect on reproduction in cows on range forage only. However, the period following calving could become a critical nutritional period in years when subsequent forage production was not ample to produce weight gains prior to and during breeding. These findings indicate the need for studies to determine the most satisfactory and economical methods of meeting the nutrient requirements of the lactating range cow during the early postpartum period.

This work gives further justification for development of management systems involving improved ranges or development of improved pastures containing introduced, cool-season forages for use as supplemental grazing sources during this critical nutritional period (Lang and Landers, 1960; Smoliak, 1968; Moore, 1970; Houston and Urick, 1972).

Literature Cited

Bellows, R. A. 1966. Improving reproductive performance in beef cattle. Vet. Scope 11:2-16.

Dunn, T. G., J. E. Ingalls, D. R. Zimmerman, and J. N. Wiltbank. 1969. Reproductive performance of 2-year-old Hereford and Angus heifers as influenced by pre- and post-calving energy intake. J. Anim. Sci. 29:719-726.

Houston, W. R., and J. J. Urick. 1972. Improved spring pastures, cow-calf production and stocking rate carryover in the Northern Great Plains. U.S. Dep. Agr. Tech. Bull. 1451. 21 p.

Houston, W. R., and R. R. Woodward. 1966. Effects of stocking rates on range vegetation and beef cattle production in the Northern Great Plains. U.S. Dep. Agr. Bull. 1357. 58 p.

Lang, R., and L. Landers. 1960. Beef production and grazing capacity from a combination of seeded pastures versus native range. Wyo. Agr. Exp. Sta. Bull. 370. 12 p.

Moore, R. A. 1970. Symposium on pasture methods for maximum production in beef cattle: Pasture systems for a cow-calf operation. J. Anim. Sci. 30:133-137.

National Research Council. 1970. Nutrient requirements of domestic animals. No. 4. Nutrient requirements of beef cattle. Nat. Res. Counc., Washington, D.C.

Rittenhouse, L. R., D. C. Clanton, and C. L. Streeter. 1970. Intake and digestibility of winter range forage by cattle with and without supplements. J. Anim. Sci. 31:1215-1221.

Smoliak, S. 1968. Grazing studies on native range, crested wheatgrass and Russian wildrye pastures. J. Range Manage. 21:47-50.

Steel, R. G. D., and J. H. Torrie. 1960. Principles and procedures of statistics. McGraw-Hill Book Co., New York. 481 p.

Thomas, O. O. 1973. Providing nutrition for calf production from Great Plains resources. Great Plains Beef Symp., Great Plains Agr. Counc. Pub. No. 63:E1-E16.

Wiltbank, J. N., W. W. Rowden, J. E. Ingalls, K. E. Gregory, and R. M. Koch. 1962. Effect of energy level on reproductive phenomena of mature Hereford cows. J. Anim. Sci. 21:219-225.