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January 1997

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Deutscher, Gene H.; Adams, Don C.; Farthing, Duane; Lamb, Jim; Colburn, David; and Nielsen, Merlyn K., "Supplemental Protein on Performance of Lactating Beef Heifers" (1997). *Nebraska Beef Cattle Reports*. 431.
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Supplemental Protein on Performance of Lactating Beef Heifers

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Feeding supplement with meadow hay increased weights and rebreeding performance of lactating 2-year-old heifers. Exposing non-cycling heifers to bulls two weeks before normal breeding and flushing on green grass stimulated cycling.

Summary

A three-year study investigated effects of feeding a supplement (37.5% CP) with meadow hay (7.5% CP) after calving on hay intake and performance of two-year-old heifers (n = 243). Heifers were individually fed supplement from March 11 to May 15. Hay intake and digestibility were similar for supplemented and non-supplemented heifers, but lower than expected, resulting in energy and protein deficient diets. Heifers in supplement group and their calves were heavier on May 15 than those in non-supplement group. Only 6% of all heifers were cycling at beginning of breeding, but 87 percent became pregnant. Heifers in the supplement group calved nine days earlier with their second calf.

Introduction

A major challenge for beef producers is to obtain high rebreeding performance of two-year-old heifers after calving. Proper management is particularly important when heifers are raised under range conditions on low quality forage.

Nutritional status of first-calf heifers has a major impact on reproductive performance. Heifers deficient in protein intake after calving have longer postpartum intervals and decreased conception rates. Protein supplements may also influence energy consumption by increasing intake of low to medium quality hay.

In the Nebraska Sandhills, heifers are generally calved in late February-early March and fed subirrigated meadow hay until native range can be grazed in mid-May. Both protein and energy are potentially limiting, depending on hay quality and intake. Little information is available on intake and digestibility of subirrigated meadow hay by lactating heifers and its effect on performance.

This study was conducted to determine the effects of feeding a supplement (35 to 40% CP) with subirrigated meadow hay on hay intake, weight change, reproduction, and productivity of two-year-old heifers after calving.

Procedure

The study was conducted over three years using 243 MARC II (1/4 Angus, 1/4 Hereford, 1/4 Simmental, 1/4 Gelbvieh) two-year-old heifers and their calves. The heifers originated from the MARC II cow herd at the Gudmundsen Sandhills Laboratory (GSL) near Whitman, NE. They were developed and bred by AI as yearlings to black Angus bulls to calve beginning Feb. 15. In 1991, the study was conducted at GSL where the heifers (n = 80) were calved. In 1992 (n = 81) and 1993 (n = 82), the heifers were transported before calving to the West Central Research and Extension Center at North Platte to conduct the study.

After calving, all heifers with calves shared a common drylot and were fed ad libitum subirrigated meadow hay produced at GSL. Hay samples ranged from 7.0 to 8.0 percent CP each year. Heifers had free access to dical and salt. On March 11, heifers were randomly assigned by calving date to either a supplement (Supp) or a non-supplement control group (Non-supp). The heifers receiving the supplement were individually fed supplement twice weekly until May 15. The supplement consisted of 70% soybean meal (SBM) and 30% wheat in a pellet and was fed each year with the meadow hay to meet the NRC (1984) recommendations.

In 1992 and 1993, the heifers and calves were transported to GSL on May 15; in all three years, cows and calves were placed on native range for summer grazing on May 15. MARC II bulls were placed with the heifers on May 16 each year to begin the 75-day breeding season. Calves were weaned on September 11. Calving dates were obtained the following year.

Weights and body condition scores of heifers and weights of calves were taken in March at the beginning of the supplementation period, in mid-May at the end of supplementation, and in September at weaning. Milk production was estimated on 40 heifers (20 per treatment) in early May each year by the 12-hour weigh-suckle-weigh method. Blood samples were obtained

(Continued on next page)

before the breeding season in 1991 and 1992 to ascertain cyclicity of heifers.

Twenty-four heifers each year (12 per treatment) were randomly selected to measure hay intake in 1991 and 1992. Intake was determined from fecal output and forage indigestibility. Fecal output was determined using a continuous release chromium-oxide (Cr) bolus. Heifers were dosed with the bolus five days before fecal collection, and rectal fecal samples were taken on day 6 through 10.

Digestion trials were conducted using 1991 and 1992 meadow hay with eight steers (four/treatment each year) to validate digestibility of hay determined with indigestible NDF (INDF) used as a marker. Steers were given a continuous release Cr bolus which was checked and adjusted for release rate by measuring Cr in daily total fecal output. Steers were placed in individual pens and received either subirrigated meadow hay or hay and supplement.

Data were analyzed by analysis of variance using the GLM procedure of SAS with treatment, year, and treatment by year in the model. For heifer and calf weights and heifer body condition scores, beginning (March) weight and body condition score were used as covariates to standardize variation. Pregnancy and estrous cycling data were analyzed using Chi-Square procedures.

Table 1. Intake and digestibility of meadow hay by two-year-old heifers during 1991 and 1992

	Treatment		Year	
Trait	Supp	Non-supp	1991	1992
No. of heifers	23	22	21	24
Hay digestibility, %	44.6	44.5	48.9**	40.2
Hay intake, lb/day	18.5	17.6	20.5**	15.6
Hay intake, % body wt.	2.1	2.0	2.3**	1.8
Intake, hay + supplement, lb/day	19.6	17.6	20.9**	16.3
Intake, hay + supplement, % body wt.	2.3	2.0	2.4**	1.9

** Means within a category in same row are different (P<.01).

Results

Hay digestibility and hay intake by heifers are reported in Table 1. No differences were found between treatments for any of the traits. Year effects (P<.01) occurred for all traits measured. Hay digestibility averaged 48.9 percent and 40.2 percent for 1991 and 1992, respectively. The markers used for determination may have underestimated the digestibility in 1992 due to the lower CP in the hay. Forage intake was 2.3 and 1.8 percent of body weight for 1991 and 1992, respectively. Total intake (meadow hay + supplement) was 2.4 lb/100 lb body weight in 1991 and 1.9 lb/100 lb in 1992.

Hay digestibility and hay intake of heifers were lower than expected. This resulted in both energy and protein deficiencies. NRC recommendations were 2.2 lb CP and 12.1 Mcal NE_m per day. In 1991, Non-supp and Supp heifers were deficient in daily NE_m by 3.8 and 2.3 Mcal NE_m, respectively. The Non-supp heifers in 1991 were .35 lb deficient for CP, but Supp heifers were not deficient. In 1992, Non-supp heifers were deficient .84 lb CP and 7.7 Mcal NE_m per day; and Supp heifers were deficient .29 lb CP and 5.7 Mcal NE_m.

Low forage digestibility probably reduced passage of forage through the animal and resulted in reduced forage intake. Supplemental protein did not increase forage digestibility in this study. The protein supplement was high (78%) in rumen degradable protein and low (22%) in escape protein (NRC, 1996). Previous Nebraska results showed rumen degradable protein enhanced digestibility and intake of native range hay (<6% CP). However, other research has shown no increase in forage digestibility and intake due to protein supplementation when forages contained 8 to 10 percent CP. The hay in our study ranged from 7.0 to 8.0 percent CP.

Hay digestibility and hay intake data by steers indicated that marker estimated and actual hay digestibility were less than 10 percent different. Therefore, INDF was used as an internal marker to determine digestibility for the heifers.

Heifer weights and body condition scores are reported in Table 2. Year effects were statistically removed to compare treatment effects. The Supp heifers were 18 lb heavier (P<.05) in mid-May (prebreeding) than the Non-supp heifers. No difference was found in body condition scores. Heifers in both treatments gained weight and condition from mid-May to weaning in September but no treatment differences were observed.

Table 2. Two-year-old heifer weights, condition scores and calf weights by treatment groups over three years.

	Groups	
Traits	Supp	Non-supp
No. of animals	123	120
Heifers		
March wt[a], lb	869	869
March body condition[a]	5.4	5.4
Mid-May wt, lb	876*	858
Mid-May body condition	4.8	4.7
September wt, lb	968	955
September body condition	5.3	5.3
Calves		
March wt[a], lb	117	117
Mid-May wt, lb	182*	172
September wt, lb	436	427

[a] March means were adjusted and used in covariate analyses of subsequent data.
* Means differ between treatments (P<.05).

Weight change during the feeding period (March to mid-May) was positive for the Supp and negative for the Non-supp heifers. Body condition decreased for both groups during this period indicating a nutritional deficiency.

Calves of the Supp heifers were heavier (P<.05) in mid-May than those of the Non-supp heifers. At weaning, calves of the Supp heifers were nine pounds heavier, but were not statistically different from those of the Non-supp heifers. The difference of calf weights in mid-May suggested that milk production was increased in the Supp

Table 3. Heifer milk production and reproduction by treatment groups over three years

Traits	Groups	
	Supp	Non-supp
No. of heifers	123	120
12-hour milk production[a], lb	7.0	6.9
Cycling before breeding[b], %	8.6†	2.5
Pregnant in 75 days breeding, %	88.6	86.7
Birth date of second calf, day	Mar. 22*	Mar. 31

[a] Data collected on only half of heifers each year.
[b] Data available for only first 2 years.
* Means differ between treatments (P<.05).
† Means differ between treatments (P<.10).

heifers. However, no difference (P>.10) in estimates of milk production was detected (Table 3). The weigh-suckle-weigh procedure may not have been sensitive enough to detect small differences.

Only 5.6 percent of all heifers cycled before the breeding season began (Table 3). Although a greater percentage (P<.10) of Supp heifers cycled (8.6%) compared to Non-supp heifers (2.5%). These very low percentages are indicative of a nutritional deficiency which is predicted by the intake data.

Pregnancy rates were similar between the treatment groups. Heifers were expected to have lower pregnancy rates due to both protein and energy deficiencies. The 75-day breeding season was longer than normal (60 days) which helped increase pregnancy rates. It is believed that starting the breeding season two weeks earlier than normal allowed the bulls to stimulate earlier estrous cycles in the heifers. Only a small percentage of heifers conceived during the first two weeks of the breeding season, but the average conception date was within the first 35 days of breeding. The Supp heifers calved 9 days earlier (P<.05) than the Non-supp heifers.

Nebraska research has shown that exposure to bulls will shorten postpartum anestrous intervals in cows and heifers. Bull exposure appears to have more pronounced effects on thin cows similar to the heifers in this study. The management practice of placing bulls with thin two-year-old cows about two weeks before the normal breeding season to stimulate estrous cycles may be quite beneficial. Also, cows in this study were placed on range with abundant green grass at the beginning of the breeding season which provided a flush of nutrients that would help induce cycling.

In conclusion, supplemental protein did not affect intake and digestibility of subirrigated meadow hay in lactating two-year-old heifers. However, supplementation did increase heifer and calf weights before the breeding season, and the supplemented heifers conceived and calved earlier for the second calf than the non-supplemented heifers. Diets for both treatments were deficient in protein and energy, but pregnancy rates were only slightly below normal, probably because of early bull exposure, lush green pastures, and a longer breeding season.

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