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Utilization of Field Pea and Sunflower Meal as Dietary Supplements for Beef Cows

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ABSTRACT: The objectives of this study were to determine if field pea and sunflower meal can be used effectively as dietary supplements and whether energy or protein is a first-limiting nutrient for beef cows grazing stockpiled native forage in the late fall and early winter. Beef cows grazed a pasture of stockpiled predominately native range in western North Dakota from November through January in each of two years. At the end of the grazing portion of the experiment each year, all cows were combined into one group and managed similarly. Grazing treatments included a control (CON) and three supplemented groups. Supplemental treatments were chosen to supply additional energy and gradient levels of protein. Supplemental treatments were a barley-, field pea- and sunflower meal-based pellet. Dietary treatment did not affect BW change on day 14 of grazing (P>.7). Supplementation improved BW change compared to CON on days 42 (P≤.1) and 70 (P≤.05) in both years and on day 84 (P≤.01) in year 2. Overall, supplementation improved weight change during grazing by 29.6 and 27.2 kg in years 1 and 2, respectively. Body condition score (BCS) change was improved by supplementation on day 42 in year 1 (P=.08) and on day 84 in year 2 (P=.02). Under common management for 28 days post-grazing, overall BW change (P>.5) did not differ among treatments in year 1. However, in year 2 after 42 days post-grazing, supplemented cows were still 25 kg heavier than CON cows. Overall change in BCS with common post-grazing management (P=.8 and .18 in years 1 and 2, respectively) was not affected by dietary treatment. Supplemental treatment did not affect BW (P>.19) or BCS (P>.13) change in either year. Weight change in beef cows grazing stockpiled native forage from mid November to late January was improved by supplementation. Energy appeared to be a first limiting nutrient and source of supplemental energy (barley, field pea or sunflower meal) did not affect BW change.

Key Words: Stockpiled Native Forage, Supplementation, Winter Range

Introduction

Narrow profit margins in the cow/calf sector of the beef industry require careful attention to production costs and associated levels of output. Extended grazing periods have been shown to decrease winter feed costs (a major component of overall cow/calf expenses; Adams et al., 1994). Management of precalving cow weight and condition change can enhance overall reproductive efficiency (Dunn and Moss, 1992). Nutritional supplementation regimes may be necessary to manage cow weight and condition during extended fall/winter grazing periods. Dietary protein has been suggested to be the first-limiting nutrient in cattle grazing winter range. There are alternative crops and processing co-products that are higher in crude protein than typical feed grains that might be used effectively in protein supplements formulated for cattle grazing stockpiled perennial forage. Stockpiling refers to the practice of allowing forage to accumulate in the absence of grazing for use at a later time.

Objectives on this study were to (1) determine whether field pea (*Pisum sativum* L)and sunflower (*Helianthus annuus* L.) meal can be used effectively as dietary supplements for beef cows grazing stockpiled perennial forage in the late fall/early winter and (2) determine whether either energy or protein is the first-limiting nutrient for beef cows grazing stockpiled perennial forage in late fall/early winter.

Materials and Methods

Dry, pregnant beef cows grazed a pasture (116.6 ha) of stockpiled predominately native range in southwestern North Dakota from November through January in each of two years (Table 1). In each year (2001-2002 and 2002-2003), cows were randomly allotted into four groups and groups were then assigned one of four dietary treatments. Treatments included an unsupplemented control (CON) and three supplemented groups. Supplemental treatments were a barley (BAR)-, field pea (PEA)- and sunflower meal (SFM)-based pellet. Supplemental treatments were chosen to supply additional energy and gradient levels of rumen-degradable protein (Table 2). Supplements were provided to individual cows in the supplemental treatments three times a week. Supplemental intake was limited to 3.0 lb/hd per day or 7.0 lb/hd per feeding. To monitor carry-over effects, at the end of grazing in each year all cows were combined into one group and managed similarly. Cows were moved to a corn field that had been previously grazed by beef heifers and fed grass hay ad libitum. Cows remained at this facility until grazing commenced the following spring.

Cows were weighed (BW) and condition scored (BCS; Encinias and Lardy, 2000) at 14-day intervals throughout the course of the grazing period. Weight and BCS was also recorded either 28 or 42 days post-grazing in year 1 and 2, respectively.

Animal data were analyzed by year utilizing a completely random design with four treatments replicated across cows. Treatment represented a fixed effect and animal within treatment served as the experimental unit. Means were separated using a set of orthogonal contrasts. Specific contrasts included 1) CON vs supplemental treatments, 2) BAR vs PEA and SFM and 3) PEA vs SFM.

Results and Discussion

In general, cows were heavier and in better body condition in year 1 compared to year 2 (Table 1). The seasonal stocking rate (ha per animal unit month) was greater in year 2. This resulted from lighter cows and a longer grazing period in year 2. Initial forage available for grazing was not different between years (Poland et al., 2005).

Year 1. Dietary treatment ($P > .3$; Table 3) did not affect BW change on day 14. On this day, cows had lost an average of 64.5 kg. Supplementation reduced BW loss compared to CON on days 42 ($P = .10$) and 70 ($P < .01$). Overall, supplementation reduced BW loss during grazing by 28.6 kg. Loss of BCS ($P < .10$; Table 3) was reduced by supplementation on day 42. Supplemental treatments did not affect BW ($P>.4$) or BCS ($P>.1$) changes.

Under common management for 28 days post-grazing, overall BW and BCS change did not differ among dietary treatments ($P > .2$; Table 4). In general during late fall and early winter, BW increased 34.0 kg and BCS decreased .3 units with 70 days of grazing and 28 days of recovery.

Year 2. Dietary treatment ($P>.7$; Table 4) did not affect BW change on day 14 (average gain was 34.9 kg). Supplemental treatments improved BW change on days 42 ($P<.05$), 70 ($P<.01$) and 84 ($<.01$). Overall, supplementation increased BW gain during grazing by 27.2 kg. Supplementation improved BCS change ($P<.05$) on day 84. Supplemental treatments did not affect BW ($P>.15$) or BCS ($P>.1$) changes.

Under common management for 42 day post-grazing, overall BCS change ($P>.1$; Table 4) was not affected by dietary treatment. However, previous supplementation improved BW change ($P<.01$) 25.0 kg. There were no difference among supplemental treatments in overall BW ($P>.5$) and BCS ($P>.1$) change. In general, BW increased 70.4 kg and BCS increased .9 units with 85 days of grazing and 42 days of recovery.

Despite cows starting from very different BW and BCS between the two years, BW change in beef cows grazing stockpiled perennial forages in southwestern North Dakota from mid November to late January was improved with dietary supplementation. Energy appeared to be the first limiting nutrient and source of supplemental energy (barley, field pea or sunflower meal) did not affect body weight change. Field pea and sunflower meal appear to be suitable feed ingredients in the formulation of supplements for beef cows grazing stockpiled perennial forage.

Implications

Beef cows can be managed in the late fall and early winter on stockpiled perennial forages in southwestern North Dakota and weight change during grazing can be improved with supplementation. Supplemental energy appears to be the first limiting nutrient for beef cows grazing this type of forage. Field pea and sunflower meal appear to be suitable feed ingredients in the formulation of supplements for beef cows grazing stockpiled perennial forage.

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Table 1. Initial animal and grazing information.

	Year 1	Year 2
Total number of cows[a]	21	24
Initial		
Body weight, lb	629.1 ± 64.5	509.3 ± 39.0
Body condition score[b]	6.8 ± .64	4.5 ± 1.1
Grazing dates		
Beginning	November 14	November 6
End	January 23	January 29
Total grazing days	70	85
Cow grazing days/ac[c]	5.1	7.1
Acres/cow/month[d]	6.0	4.3

[a] In year 1, there were 6 cows in the control treatment and 5 cows in each of the supplemental treatments. In year 2, all treatments had 6 cows.
[b] Estimate of body fatness (1 to 9 scale; Encinias and Lardy, 2000).
[c] Total pasture area was 288 acres
[d] One month equals 30 days.

Table 2. Composition of total digestible nutrients (TDN), crude protein (CP) and ruminally degraded crude protein (DIP) in stockpiled perennial forage, barley, field pea and sunflower meal[a].

	Forage	Barley	Field Pea	Sunflower Meal
TDN (%DM)	53	84	87	74
CP (%DM)	4.9	13	25	45
DIP (%DM)	-	10.3	19.5	34.2
DIP (%CP)	-	79	78	76

[a] Sources: NRC, 1984, 1985, 1996; Hickling, 1994; and Transtrom, et al., 2003.

Table 3. Effect of supplementation on body weight and body condition score changes in year 1.

Day of Trial	Treatment[a] CON	BAR	PEA	SFM	SE	Probability[b] 1	2	3
Body weight change, lb								
14	-58.1	-59.9	-63.5	-46.3	13.34	.90	.76	.37
42	-82.6	-46.3	-61.2	-48.1	16.28	.10	.68	.57
70	-74.4	-49.9	-44.0	-43.1	10.89	.03	.63	.96
Hay28	29.5	29.0	43.1	34.5	10.02	.59	.44	.55
Body condition score[c] change								
14	-.3	-.4	-.6	-.4	.24	.62	.74	.56
42	-1.2	-.6	-1.0	-.4	.25	.08	.74	.11
70	-1.0	-.4	-1.0	-.8	.27	.37	.14	.60
Hay28	-.3	0.0	-.4	-.4	.26	.81	.23	1.00

[a] Treatments include an unsupplemented control (CON) and three supplements. Supplemental treatments were a barley (BAR)-, field pea (PEA)- and sunflower meal (SFM)-based pellet.
[b] Probability of a significant orthogonal contrast. Specific contrasts were (1) CON vs supplemental treatments, (2) BAR vs PEA and SFM, and (3) PEA vs SFM.
[c] Estimate of body fatness (1 to 9 scale; Encinias and Lardy, 2000).

Table 4. Effect of supplementation on body weight and body condition score changes in year 2.

Day of Trial	Treatment[a] CON	BAR	PEA	SFM	SE	Probability[b] 1	2	3
Body weight change, lb								
14	33.6	38.1	29.9	37.2	5.03	.77	.47	.32
42	12.2	23.1	27.2	24.5	4.76	.03	.67	.69
70	20.4	41.3	42.6	43.5	4.45	.003	.72	.89
84	-14.5	11.3	18.1	8.6	5.03	.001	.73	.19
Hay42	51.7	78.9	78.5	73.0	6.94	.005	.70	.58
Body condition score[c] change								
14	.2	.3	.2	.2	.18	.79	.46	1.00
42	.5	.8	.7	.8	.30	.43	.82	.69
70	.5	1.2	1.2	.7	.32	.19	.53	.29
84	-.3	.5	.8	.2	.30	.02	1.00	.13
Hay42	.5	1.5	1.0	.7	.35	.18	.13	.50

[a] Treatments include an unsupplemented control (CON) and three supplements. Supplemental treatments were a barley (BAR)-, field pea (PEA)- and sunflower meal (SFM)-based pellet.
[b] Probability of a significant orthogonal contrast. Specific contrasts were (1) CON vs supplemental treatments, (2) BAR vs PEA and SFM, and (3) PEA vs SFM.
[c] Estimate of body fatness (1 to 9 scale; Encinias and Lardy, 2000).