Supplemental Protein Levels for Calves and Yearlings Grazing On Winter Bluestem Pasture[1]

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Highlight

One lb/head daily of soybean oil meal pellets was adequate supplemental protein for yearling steers grazing winter bluestem pasture when followed by summer grazing that permitted the steers to compensate for low winter gains. Calves responded to additional supplemental feed, energy or protein with efficient gains.

Native bluestem pasture in Eastern Kansas is highest in nutritive value during the first two or three months of the growing season, May through July, and depending somewhat on environmental factors, steadily declines in nutritive value to a low in late winter, February and March. Traditionally, it has been used during the spring and summer when it is highest in nutritive value and has been used for winter grazing in only a limited way, but its winter use has steadily increased.

Cattle gains on bluestem pasture are much lower in winter than in the summer (Smith et al., 1960) and it is the usual winter custom to feed some type of supplemental feed to increase weight gains.

This investigation was to determine response to supplemental protein fed at different levels by young cattle grazing winter bluestem pasture.

Materials and Methods

The experiments were conducted from 1952 to 1964 at the Kansas Agricultural Experiment Station at Manhattan on native bluestem range six miles northwest of the campus. The vegetation is typical true tall grass prairie. Big bluestem *(Andropogon gerardi)*, little bluestem *(Andropogon scoparius)*, and indian grass *(Sorghastrum nutans)*, make up between 50 and 60% of the total vegetation on the ordinary upland and limestone break sites, as described by Anderson and Fly (1955). Each experiment is a summary of one or more trials and each trial included a winter supplemental feeding period and a summer grazing period when no supplement was fed. The winter period usually extended from November or December to April and the summer period, from April to August or September. During the winter when snow covered the grass, an average of 190 lb of grass hay was fed per animal per winter.

Experiment I — Forty-four Hereford heifer calves were divided into two treatment groups, one group was fed an average of 2 lb/head/day of soybean oil meal pellets (.92 lb of crude protein) during the winter grazing period; the other, 2 lb of ground sorghum grain (.23 lb crude protein). Each group received approximately the same amount of supplemental energy. Dicalcium phosphate was added to the supplements to equalize supplemental phosphorus intake at about 15 g/heifer/day; vitamin A, to supply 15,000 IU/heifer/day. Salt was always available.

Experiment II — Sixty-one Hereford heifer calves were used in three trials, two treatment groups per trial, with 10 to 11 heifers per group. During the winter grazing period one group got twice as much alfalfa as the other. Ground shelled corn was fed to the group receiving the smaller amount of hay to minimize the difference in energy intake. Crude protein intake for the doubled alfalfa hay was approximately 1.07/lb/head/day; from the corn and alfalfa combined, .76 lb. Salt and a mixture of equal parts by weight of salt and bonemeal were available during the winter period.

Experiment III — Three trials were conducted with three experimental treatment groups of steers per trial, 10 Hereford steer calves per group, or 30 steers per treatment. During each winter grazing period these supplements were compared (lb/head/day): 1 lb of soybean oil meal pellets (.46 lb crude protein), 1 lb soybean oil meal pellets and 1 lb ground shelled corn (.56 lb crude protein), 2 lb soybean oil meal pellets (.92 lb of crude protein). Salt and a mixture of salt and bonemeal (equal parts by weight) were available during the winter grazing period.

Experiment IV — Three trials were conducted with two experimental groups of yearling Hereford steers per trial, 10 steers per group, or 30 per treatment. During the winter grazing period in each trial one group of steers was fed 1 lb/head/day of oil seed meal pellets; the other, 2 lb (Soybean oil meal pellets were fed in trials 1 and 3 and cottonseed oil meal pellets in trial 2). Approximately .42 to .46 lb/head/day of crude protein was supplied to the group at the lower level of supplementation depending on whether cottonseed or soybean oil meal was fed, while the intake of supplemental crude protein for the other group was twice that much. The steers were rotated on pastures during the winter to minimize pasture differences. During the winter period a mixture of equal parts by weight of bonemeal and salt and also salt alone were available.

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Results

Experiment I — A highly significant ($P<.01$) increase in weight gain was obtained during the winter grazing period and for the combined winter and summer period ($P<.01$) by winter supplemental feeding of soybean oil meal pellets compared with ground sorghum grain (Table 1). Summer gains were higher for steers fed sorghum grain, but not significantly so.

Table 1. Protein and energy winter supplements (2 lb/head/day)[1] for heifer calves on winter bluestem pasture.

Item	Ground sorghum grain	Soybean oil meal
No. of heifers	22	22
Initial wt, lb	429	432
Daily gain, lb		
Winter (146 day)	.06	.45**
Summer (147 day)	1.54	1.33
Total (293 day)	.80	.89**

[1]Dicalcium phosphate was added to equalize phosphorus intake at 15 gms. per head daily; 15000 I.U. vitamin A per heifer daily was included; salt was always available.
**=$P<.01$

Experiment II — Differences in weight gain between heifers fed an average of 7.3 lb/head/day of alfalfa hay and those fed 3.7 lb of alfalfa hay and 2.2 lb of ground shelled corn were not significant, although those fed the combination tended to perform slightly better (Table 2). The .76 lb of supplemental crude protein supplied by the grain and alfalfa combination was adequate protein for the calves.

Experiment III — During both the winter supplemental feeding period and the combined winter and summer grazing period, steer calves receiving 1 lb of soybean oil meal pellets gained significantly ($P<.05$) less than either steers receiving twice that quantity of soybean pellets or those receiving a combination of pellets and corn (Table 3). The .56 lb of crude protein supplied per steer daily by the combination of soybean pellets and corn provided adequate protein supplementation to the winter grass.

Table 2. Results from feeding two levels of alfalfa hay (in lb/head/day) to heifer calves on winter bluestem pasture (summary of three trials).[1]

Item	3.7 lb alfalfa hay 2.2 lb gr. shelled corn	7.3 lb alfalfa hay
No. of heifers	30	31
Initial wt, lb	488	492
Daily gain, lb		
Winter (127 day)	.54	.34
Summer (108 day)	1.80	1.82
Total (235 day)	1.12	1.02

[1]A mixture of equal parts by weight of salt and bonemeal was available during the winter. Salt was always available.

Experiment IV — The weight gains of yearling steers fed two levels of winter supplemental feed while grazing bluestem pasture are presented in Table 4. For the winter feeding period the steers fed 2 lb of oil seed meal pellets gained significantly ($P<.05$) more than those fed 1 lb. There was no significant difference in weight gain during the summer grazing period although the steers fed at the lower level gained more. For the combined winter and summer period the two treatments gave no significant difference in weight gain. Each steer was graded at the close of the test, using U.S.D.A. Feeder Cattle Grades, with no significant difference in grades between the two treatment groups.

Discussion

The larger quantities of protein fed, as the 2 lb/head/day of soybean oil meal (.92 lb of crude protein) and the 7.3 lb of alfalfa hay (1.07 lb of crude protein) seemed excessive since calves receiving lower quantities of protein with about the same amount of energy gained just as well.

Results were measured on the basis of weight gain only; higher

Table 3. Results from indicated levels of protein and energy (in lb/head/day) for steer calves grazing winter bluestem pasture (summary of three trials).[1]

	1 lb soybean meal	1 lb soybean meal and 1 lb corn	2 lb soybean meal
No. of steers	30	30	30
Initial wt, lb	505	507	508
Daily gain, lb			
Winter (126 day)	.35*	.51	.60
Summer (109 day)	1.88	1.89	1.87
Total (235 day)	1.07*	1.16	1.19

[1]A mixture of salt and bonemeal (equal parts by weight) was available during the winter and salt was always available.
*=$P<.05$

Table 4. Results from indicated levels of supplementation for yearling steers on winter bluestem pasture (summary of three trials).[1]

	Oil seed meal pellets head/day[2]	
	1 lb	2 lb
No. of steers	30	30
Initial wt, lb	689	687
Daily gain, lb		
Winter (143 day)	.45	.71*
Summer (110 day)	2.16	1.95
Total (253 day)	1.20	1.25

[1]A mixture of salt and bonemeal (equal parts by weight) was available during the winter, salt was always available.
[2]Oil seed meal pellets were soybean in two trials and cottonseed in one.
*=$P<.05$

Table 5. Composition of feeds in percent.[1]

Item	Moist.	Protein (N X 6.25)	Crude fiber	N-free extr.	Ca.	P.
Soybean oil meal pellets	8.63	45.93	5.01	29.90	0.33	0.59
Cottonseed oil meal pellets	7.95	41.63	11.80	28.49	0.16	1.14
Ground shelled corn	12.04	10.08	1.93	70.72	0.01	0.33
Alfalfa hay	8.61	14.71	33.03	35.65	1.20	0.39
Ground sorghum grain	11.39	11.75	2.81	69.49	0.03	0.36
Bluestem pasture[2]						
June		9.37	32.67	47.40	.38	.14
August		8.00	32.12	49.57	.45	.09
October		4.79	32.62	51.99	.53	.06
December		4.10	35.67	49.62	.46	.05
February		3.10	34.58	51.12	.46	.08
April		2.98	33.60	50.00	.51	.07

[1] Analyzed according to A.O.A.C. methods. (1955).

[2] Bluestem pasture grasses, composite, moisture free basis.

protein levels may not be excessive for such functions as reproduction, stress, or longevity. Turman et al. (1964) pointed out that feeding low supplemental levels may be false economy for developing females. Where 2 lb/calf/day of sorghum grain was fed, supplying only .23 lb of protein, no winter gain was obtained. However, the summer gain was large and compensated partially for the lack of winter gain. The combination of 1 lb of soybean meal and 1 lb of corn, supplying a total of .56 lb of crude protein, and the combination of 3.7 lb of alfalfa hay and 2 lb of corn, supplying a total of .76 lb of crude protein gave results as good as did higher levels of protein. McIlvain et al. (1955) has recommended 1 lb/head/day of cottonseed meal for calves on winter range in western Oklahoma. Bohman et al. (1961) reported that energy and protein supplements increased gains of beef calves on a semi-desert range and that the protein supplement (1 lb/head/day of soybean meal or the equivalent) increased gains more than did energy (1 lb of barley). Yearling steers in Experiment IV gained just as well on 1 lb of soybean oil meal as 2 lb where performance was measured by combined winter and summer gain.

Chemical analyses of the grass (Table 5) indicate that additional feed may be used to advantage as the winter progresses and nutritive value of grass declines markedly. Extremes in weather as well as grass quality, condition of the animals, and future animal use suggest varying the level of protein to fit local conditions.

Summary

Four experiments were conducted with young growing beef animals to determine response to various protein levels in winter supplement feeds. All experimental animals were on native bluestem pasture for a winter and summer season, but supplements were fed only during the winter period.

Heifer calves gained more during the winter supplemental period and for the year when fed 2 lb/head/day of soybean oil meal pellets than when fed ground sorghum grain. They gained as well on 3.7 lb of alfalfa hay and 2.2 lb of ground shelled corn as when fed 7.3 lb of alfalfa hay. Steer calves gained less when fed 1 lb of soybean pellets than when fed 2 lb, however 1 lb of corn and 1 lb of soybean pellets were just as effective as 2 lb of soybean pellets.

Yearling steers gained just as well when fed 1 lb/head/day of such protein supplement as soybean oil meal pellets as when fed 2 lb when the winter grazing period was followed by a summer grazing period that permitted low winter gains to be offset.

LITERATURE CITED

ANDERSON, K. L., AND C. L. FLY. 1955. Vegetation-soil relationships in Flint Hills bluestem pastures. J. Range Manage. 8:163-169.

BOHMAN, V. R., H. MELENDY, AND M. A. WADE. 1961. Influence of dietary supplements on growth of beef calves on semi-desert range. J. Animal Sci. 20:553.

MCILVAIN, E. H., A. L. BAKER, W. R. KNEEBONE, AND D. H. GATES. 1955. Nineteen year summary of range improvement studies. U.S. Southern Great Plains Field Station Progress Report 5506.

SMITH, E. F., V. D. STEVENS, R. F. COX, D. L. MACKINTOSH, A. G. PICKETT, AND F. H. BAKER. 1960. Effect of plane of winter nutrition on the performance of heifer calves in a wintering, grazing and fattening program. Kansas Agr. Exp. Sta. Bull. 418.

TURMAN, E. J., L. SMITHSON, L. S. POPE, R. E. RENBARGER, AND D. F. STEPHENS. 1964. Effect of feed level before and after calving on the performance of two-year old heifers. Oklahoma Agr. Exp. Sta. MP-74:10.