The Influence of Winter Nutrition on Range Beef Cattle Production in Eastern Oregon*

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INTRODUCTION

Thousands of beef cattle depend upon sagebrush-bunchgrass type range for their only source of summer forage. This type of range provides forage of good nutritive value during May and June, but is of very poor quality during later summer months. Cattle grazed on the sagebrush-bunchgrass range are generally wintered on native meadows where varying amounts of hay and protein supplements are fed.

Stanley (1938) and Black, Quesenberry, and Baker (1938) reported that supplemental feeding of cottonseed cake to range cows during the winter would not increase beef production sufficiently to warrant the practice if enough forage was available for the maintenance of the health and thrifty condition of the breeding herd. The weaning weights of the calves from the unsupplemented groups indicate that the animals included in both studies were on a higher year-long plane of nutrition than cattle depending on sagebrush-bunchgrass range for their only summer feed.

The purpose of this study was to investigate the influence of 3 levels of winter nutrition on the production of Hereford cows depending upon sagebrush-bunchgrass type range for their summer feed and native meadow hay for the main winter feed.

THE EXPERIMENTAL AREA

The Squaw Butte-Harney Range and Livestock Experiment Station consists of 3 units all located near Burns, Oregon. Elevation over the station ranges from 4,000 to 5,500 feet.

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The average annual precipitation of the area is approximately 11 inches ranging from a low of approximately 4 inches to a high of approximately 16 inches over a period of 27 years. Over one-half of the precipitation falls in the form of snow during the winter months. The January temperature ranges from -45° to 50° above zero with a mean of 21°. The average July temperature is approximately 67° with a range of 25° to 105°.

The native hay meadows on the station are of the wet land type with over 50 percent of the forage produced consisting of rush (Juncus spp.), and sedge (Carex spp.). Mixed grasses and weeds complete the vegetative cover of the meadows. The hay harvested from these meadows was fed from the stack. When fed, the hay had an average crude protein content of 5 to 7 percent, on an air dry basis.

The range used for summer grazing was composed primarily of big sagebrush (Artemisia tridentata), and bunchgrasses. The grasses producing the major portion of the forage were bluebunch wheatgrass (Agropyron spicatum) and Idaho fescue (Festuca idahoensis). The dry matter of these grasses were found to contain approximately 12 to 14 percent crude protein during early May. The protein content gradually dropped from that level until the grasses matured near July 15. Near maturity the crude protein content leveled off between 2 to 5 percent. There was no green feed on the range from the time the grasses matured until growth began the following spring.

SOURCE OF DATA AND EXPERIMENTAL METHODS

Sixty-three cows were assigned to this study from the herd of grade Hereford cattle maintained by the Squaw Butte-Harney Range and Livestock Experiment Station. The cows ranged in age from 3 to 6 years when the study was initiated. Twenty-one cows were randomly assigned to each of three lots in such a manner that age, weight, condition, and previous calving date were evenly balanced between lots. The same animals were carried throughout the entire study in the lot to which they were first assigned. When it was necessary to cull a cow, a replacement was not made to the lot.

The study was initiated on December 9, 1946, and will be terminated when calving is completed in 1951. The treatments were applied during an approximate 130-day winter feeding period each year, and consisted of the following 3 levels of nutrition:

Lot 1 was to receive all of the meadow hay that would be cleaned up in a 24-hour period.

Lot 2 was to receive only enough meadow hay to maintain the animals in a healthy condition, but not enough to prevent a loss of approximately 100 pounds in body weight by each animal during the wintering period.

Lot 3 was to receive one pound of barley and one pound of cottonseed meal per day in addition to all of the meadow hay that would be cleaned up in a 24-hour period.

All animals had access to salt, disodium phosphate and bonemeal at all times.

The time of initiating the treatments each winter was determined by weather conditions, the amount of fall meadow regrowth, and meadow aftermath available for grazing. The beginning date of winter feeding varied from November 28th to January 3rd and was ended on April 17th, with the exception of 1947 when feeding was terminated on April 14th.

At the end of the winter feeding period all animals were trailed 40 miles to the summer sagebrush-bunchgrass range. All of the cows were allowed 10 to 12 surface acres per month in 2,200 acre ranges for summer grazing. They were removed from the summer ranges during the latter part of September and were trailed back to the meadow unit of the station. Bunched meadow hay, meadow regrowth, and meadow aftermath provided the forage for all animals until the supply was exhausted.

All calves born, and cows were weighed when winter feeding was initiated; at the end of winter feeding; at the time weighed onto the summer range, after a 10 to 14 day fill on surplus ranges; at the end of summer grazing; and at the time the calves were weaned. Weights were taken after the animals were corralled for 12 hours off feed, but on water. The cows were also given a condition rating* at the end of winter feeding, and again at the end of the summer grazing period. All calf birth weights used in the analysis of birth weights were taken within 24 hours after the birth of the calf.

The cows from each lot were evenly distributed between the 2,200 acre ranges used so that the sire influence was evenly distributed between lots. One bull was supplied for approximately 20 cows during the breeding season. The breeding season of 1948 was delayed approximately one month because of an unsuccessful artificial insemination program. It is believed that the amount of error injected by this delay in breeding cannot be determined.

Where possible, analysis of variance as shown by Snedecor (1948) was used to determine where significant differences existed.

RESULTS AND DISCUSSION

Feed Consumption

The average daily feed consumption per cow is shown in table 1. The amount of forage picked up from the meadows on which they were fed cannot be determined.

*Condition rating is based on the amount of fat carried by the animal.

Table 1. Summary of average daily feed consumption per cow during the winter feeding periods of 1946-47, 1947-48, 1948-49, and 1949-50

Feed	1	2	3
	(lbs.)	(lbs.)	(lbs.)
1946-47			
Hay	14.3	5.7	19.1
Barley	-	-	1.0
Cottonseed meal	-	-	1.0
1947-48			
Hay	14.4	7.5	20.4
Barley	-	-	1.0
Cottonseed meal	-	-	1.0
1948-49			
Hay	18.9	11.8	20.2
Barley	-	-	1.2
Cottonseed meal	-	-	1.2
1949-50			
Hay	21.1	11.5	23.0
Barley	-	-	0.5
Cottonseed meal	-	-	1.4
Average			
Hay	16.8	8.7	21.0
Barley	-	-	0.9
Cottonseed meal	-	-	1.2

Although the feed consumption data could not be analyzed statistically, the consistently higher consumption of hay by lot 3 compared to lot 1 is considered important. Over the 4 wintering periods, the animals in lot 3 consumed an average of 4.2 pounds more meadow hay per day than lot 1 when both lots were being fed all of the hay that would be cleaned up in a 24-hour period. The only difference in the treatment of the two lots was the supplement of barley and cottonseed meal received by lot 3. Guilbert (1942) points out that a deficiency of dietary protein commonly decreases appetite.

Weight and Condition of Cows

When the 63 animals were assigned to the lots during the fall of 1946 the greatest average individual weight difference between lots was 7 pounds (table 2). No difference in average condition of the animals was observed to exist between the lots.

The average age of the animals when assigned to the lots was 4 years, ranging from 3 to 6 years. These cows were approximately 200 pounds lighter at an average age of 4 years than the Hereford range cows of the same age referred to by Knapp, Baker, Quesenberry, and Clark (1942). It is believed that the lighter weights of the cattle used in this study reflect the low plane of nutrition on which they normally exist.

The October weights of 1950 (table 2) showed that the animals on the low plane of nutrition were 114 pounds heavier than when weighed into the lots in 1946. The condition ratings of the animals indicated that there was little difference in condition of the animals when the weights were taken. The gain of the animals in lot 1 was found to be approximately the same as in lot 2, and the animals on the high plane of nutrition were found to be 190 pounds heavier than when put on the study.

It is believed that the gain in weight of lot 2, although they were on a very low plane of nutrition, reflects the slow rate at which they reach a relatively constant mature weight. Knapp, Baker, Quesenberry, and Clark (1942), referring to purebred Hereford cows raised at the U. S. Range Livestock Experiment Station, Miles City, Montana, states: "The mature weight of the animals is reached at approximately five years of age, although there is less than 50 lb. change in weight after three and one-half years of age." It is believed the data collected in this study indicates that range cows, depending upon the type of sagebrush-bunchgrass range found reach their mature weight at 5 years of age, when managed as the animals in this study.

The loss of condition by the animals of lot 2 during the wintering period, as compared to the relatively stable condition of the lot 3 animals, is believed as important as the total gain made by the animals. The animals in lot 2 lost an average of 84 pounds each

Table 2. Summary of average weight of cows at the beginning, and end of the winters of 1946-47, 1947-48, 1948-49, and 1949-50.

Lot	Years								
	1946-47		1947-48		1948-49		1949-50		1950
	Oct.	Apr.	Oct.	Apr.	Oct.	Apr.	Oct.	Apr.	Oct.
	(lbs.)	(lbs.)	(lbs.)	(lbs.)	(lbs.)	(lbs.)	(lbs.)	(lbs.)	(lbs.)
1	839	729	852	814	859	859	901	839	950
2	840	712	834	789	900	855	941	821	954
3	833	832	929	954	908	934	945	938	1023

winter as compared to the 43 pound gain by the lot 3 animals (table 2). The lot 2 animals then made an average summer gain of 113 pounds as compared to an average gain of 37 pounds by the animals of lot 3. To the authors' knowledge, no studies have been made on the forage consumption of cattle turned on low carrying capacity range after being wintered on planes of nutrition similar to those of this study. Assuming that forage consumption was similar between the two lots, it would seem that a greater amount of nutrients would be available for milk production by the lot 3 cows because of the smaller increase in body weight during the suckling period.

Production of Cows, and Calf Performance

The production of calf weaning weight per cow for 1947 could not be included in the analysis of this study because the conception rate during the 1946 breeding season was not influenced by the treatments.

The animals in lot 1 produced 70 pounds more calf weaning weight per cow than did the animals of lot 2 (significant*), and table 3 also shows that the lot 3 cows produced an average of 106 pounds more calf weaning weight per cow than lot 2 (highly significant**). The 36 pound difference in production per cow between lots 1 and 3 was not found to be significant.

Table 4 shows a summary of the percent of calves dropped by the cows in each lot. A difference of 15 percent was found between lots 1 and 2. The rate of conception data could not be statistically analyzed, but a great advantage for lot 1 was found throughout the period of the study. The difference in the number of calves dropped is the primary factor influencing the difference in production per cow as there were no significant differences in calf birth weights, daily gain from birth to weaning, age at weaning, or weaning weight.

The high plane of winter nutrition was found to result in a significant difference in the birth weights of both bull and heifer calves when compared with lot 2 (table 5). A difference of 6 pounds was found to exist between the calves of the two lots at birth. The addition of the cottonseed meal and barley supplements did not result in bull calves that were significantly heavier than those produced by the cows in lot 1; however, the difference of 5 pounds between the heifer calves was significant.

The calves produced by lot 3 gained at an average of 1.11 pounds per day from birth to weaning over the 4 year period as compared to

*A difference referred to in this paper as significant is statistically significant at the 5 percent level of probability.

**A difference referred to in this paper as highly significant is statistically significant at the 1 percent level of probability.

Table 3. Summary of total beef production per cow in the breeding herd during 1948, 1949, and 1950

Lot	Years			Average
	1948	1949	1950	
	(pounds per cow)	(pounds per cow)	(pounds per cow)	(pounds per cow)
1	277	229	249	253
2	203	147	196	183
3	324	270	264	289
Average	268	215	237	242

Differences between lots of less than the following are not considered to be significant:

at the 5 percent level of probability - 62 lb.
at the 1 percent level of probability - 81 lb.

Table 4. Summary of the percentage of cows carring a calf to term

	Years						Total	Average
	1948		1949		1950			
	number of cows	%	number of cows	%	number of cows	%	number of cows	%
1	21	90	19	90	17	76	57	84
2	19	58	16	75	14	64	49	69
3	20	95	16	94	16	75	52	88

Table 5. Summary of average birth weights during 1947, 1948, 1949, and 1950

	Years									
	1947		1948		1949		1950		Average	
	Bull	Heifer	Bull	Heifer	Bull	Heifer	Bull	Heifer	Bull	Heifer
	(lb.)	(lb.)	(lb.)	(lb.)	(lb.)	(lb.)	(lb.)	(lb.)	(lb.)	(lb.)
1	69	62	77	67	72	68	75	75	73	66
2	62	61	67	70	79	64	69	69	70	65
3	78	70	76	72	78	69	74	74	76	71
Average	71	64	74	69	75	68	72	70	73	68

Differences between lots of less than the following are not considered significant:
at the 5 percent level of probability 5 pounds
at the 1 percent level of probability 7 pounds

Differences between sex of less than the following are not considered significant:
at the 5 percent level of probability 3 pounds
at the 1 percent level of probability 4 pounds

1.03 pounds per day for both lot 1 and lot 2 (table 6). This significant difference in calf response indicates that the winter nutrition of a range cow, depending upon a limited late summer diet, has an influence on her milk production during the following summer.

Age at weaning did not differ significantly between lots. A trend toward earlier conception by the cows in the high plane of nutrition lot was apparent, however. The delay in the breeding season of 1948 probably had an adverse effect on the trend of early or late breeding of any of the lots in this study. It was believed that any difference in age of calves at weaning would be a result of the treatments so no analysis was made of weaning weights corrected for age. The calves averaged approximately 230 days of age at weaning.

The calves of lot 3 were found to be 36 pounds heavier than those of lot 2 (highly significant), and 26 pounds heavier than the lot 1 calves (significant) at weaning (table 7). No significant difference in weight between sex was found to exist at weaning. Knapp and Black (1941) and Koger and Knox (1945) reported that sex had a significant influence on weaning weights. It is believed that the lack of a significant difference in this study is due to a nutrient intake so low that any difference in the stimulus for growth between sex cannot be expressed. The heaviest weaning weights of 360 pounds were obtained during 1947 and again during 1948. Even with the influence of the high plane of winter nutrition, the weaning weights of the calves in this study are lower than expected under good management in other areas.

SUMMARY

A study was made on the influence of 3 planes of winter nutrition on the production of 62 Hereford cows. The treatments were applied during 4 wintering periods of approximately 130 days each. The rations fed were:

Lot 1 received an average of 16.8 pounds of meadow hay per day.

Lot 2 received an average of 8.7 pounds of meadow hay per day.

Lot 3 received an average of 21.0 pounds of meadow hay, 0.9 pounds of barley, and 1.2 pounds of cottonseed meal per day.

This study indicates that range cattle depending upon a nutritive level similar to that of the animals of this study will not reach a mature weight at 5 years.

An average production of 253, 183, and 289 pounds of calf weaning weight per cow was produced by lots 1, 2, and 3 respectively. The difference between the production of lots 1 and 2 was significant; between lots 2 and 3 was highly significant. The difference in number of calves dropped by each lot is the primary factor influencing differences in production per cow between lots.

Table 6. Summary of average daily gains made by calves from birth until weaning

Lot	Years				
	1947	1948	1949	1950	Average
	(lb.)	(lb.)	(lb.)	(lb.)	(lb.)
1	1.12	1.08	0.86	1.08	1.03
2	1.08	1.02	0.88	1.09	1.03
3	1.19	1.15	0.98	1.09	1.11
Average	1.13	1.09	0.91	1.09	1.06

Difference in average daily gain between lots of less than the following are not considered significant:
at the 5 percent level of probability 0.07 lb. per day
at the 1 percent level of probability 0.10 lb. per day

Table 7. Summary of weaning weights of calves during 1947, 1948, 1949, and 1950

Lot	Year				
	1947	1948	1949	1950	Average
	(lb.)	(lb.)	(lb.)	(lb.)	(lb.)
1	337	342	256	325	314
2	322	312	241	327	304
3	360	360	288	352	340
Average	339	341	264	335	321

Differences in weaning weights between lots of less than the following are not considered significant:
at the 5 percent level of probability 22 lb.
at the 1 percent level of probability 30 lb.

An average difference of 15 percent in the percent of calves dropped by the cows in each lot was found between lots 1 and 2. An average difference of 4 percent was found between lots 1 and 3.

An average daily gain from birth to weaning ot 1.03, 1.03, and 1.11 pounds was found for lots 1, 2, and 3 respectively. This significant difference in calf response is believed to indicate that the winter nutrition of a range cow, depending upon a limited summer diet, has an influence on her milk production.

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