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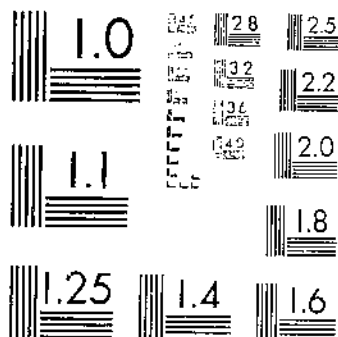
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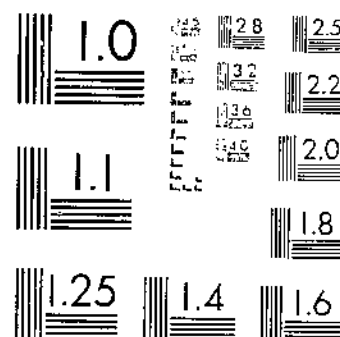
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EFFECT OF DIFFERENT METHODS OF WINTERING BEEF CALVES, IN THE NORTHERN  
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UNITED STATES DEPARTMENT OF AGRICULTURE  
WASHINGTON, D. C.

EFFECT OF DIFFERENT METHODS OF WINTERING  
BEEF CALVES, IN THE NORTHERN GREAT PLAINS,  
ON WINTER GAINS AND FEED COSTS AND ON  
SUBSEQUENT SUMMER GAINS<sup>1</sup>

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THE AREA AND ITS PROBLEMS

The northern Great Plains include approximately 130,000,000 acres of land in eastern Montana, northeastern Wyoming, and the western parts of North Dakota and South Dakota. This area lies generally in the Missouri River drainage system, is bounded on the north by Canada, and extends east and south from the base of the Rocky Mountains to the eastern boundaries of the Missouri Plateau. The average yearly precipitation varies from 13 inches at Assiniboine in north-central Montana to 17.6 inches at Dickinson in southwestern North Dakota. At Miles City, Mont., where these experiments were carried on, the precipitation was 13.4 inches. The average length of the growing season varies from 115 days at Dickinson to 136 days at Huntley in south-central Montana and at Ardmore in southwestern South Dakota.

Of this area, 2 percent is irrigated land, 12 percent farming, 12 percent farming-grazing, 13 percent grazing-forage, 54 percent grazing, and 7 percent national forests.<sup>2</sup> Predominating range-forage

<sup>1</sup>This work was carried on in cooperation with the Montana Agricultural Experiment Station. F. B. Linfield, dean and director, and C. N. Arnett,<sup>2</sup> vice dean and professor of animal husbandry, at the station, assisted in planning the experiment.

<sup>2</sup>Deceased.

<sup>3</sup>ALDOUS, A. E., and others. LAND CLASSIFICATION OF THE NORTHERN GREAT PLAINS: MONTANA, NORTH DAKOTA, SOUTH DAKOTA, AND WYOMING. U. S. Dept. Int. Geol. Survey, 136 pp., 1929. [ mimeographed.]

plants include wheatgrass (*Agropyron smithii* Rydb.), grama grass (*Bouteloua gracilis* (H. B. K.) Lag.), buffalo grass (*Bulbilia dactyloides*, Raf.) needlegrass (*Stipa comata* Trin. and Rupr.), junegrass (*Coeleria cristata* (L.) Pers.), niggerwool (*Carex filifolia* Nutt.), and sagebrush (*Artemisia tridentata* Nutt.). This immense area, with its different land types and low rainfall, can best be utilized through the production of livestock with controlled methods of grazing and sufficient forage-crop production to insure adequate supplies of winter feed.

The production of feeder and grass-fat cattle, therefore, constitutes one of the major enterprises in the northern Great Plains. Economic changes in recent years brought about through an increased demand for smaller cuts of beef have had a direct reaction on beef-cattle production in the area. Fewer mature steers are carried on the ranges for grass fattening, and more calves and yearlings are marketed as feeders for fattening purposes.

Production problems resulting from this change in market demand have brought about the need for information on methods of wintering beef cattle, particularly calves, in order to obtain the maximum use from the area's most economical and abundant crop, range grass. Breeding cows and older steers can be wintered on the range at relatively low costs, provided adequate supplies of range grass and water are available and there is natural shelter from storms. Supplementary feeds, such as cottonseed cake or hay, are required only during periods of extremely severe weather and heavy snowfall. Calves, however, are not well adapted to this rigorous treatment and require regular feeding, shelter, and good care for normal growth and development. One of the principal problems in wintering calves is the economical use of winter feeds to obtain normal growth and development during this season and still obtain a maximum return from range grass before shipping time the following fall. Variations occur throughout different sections of the northern Great Plains with regard to available feed supplies, length of feeding period, summer-grazing conditions, and marketing facilities, and the stockman at all times must be able to select and follow the practices best suited to his own conditions.

#### SCOPE OF EXPERIMENTS

The experiments reported in this bulletin were made to determine the effects of feeding alfalfa hay alone, or in combination with cottonseed cake or corn silage, on winter gains and feed costs and on subsequent gains on grass. These experiments extended from the winter of 1926-27 through the summer-grazing season of 1929.

The studies were made at the United States Range Livestock Experiment Station, formerly the Fort Keogh Military Reservation, located near the center of the northern Great Plains, in Miles City, Mont. The station comprises 56,300 acres, 46,915 acres of which are in a triangle between the junction of the Tongue and Yellowstone Rivers and 9,385 acres on the north side of the Yellowstone River. Approximately 650 acres are devoted to the production of alfalfa under irrigation, 700 acres to the production of dry-land grain crops, and the remainder is utilized as winter and summer ranges for cattle, sheep, and horses.

## EXPERIMENTAL PROCEDURE

## CALVES USED AND METHODS OF HANDLING

The calves used in these experiments consisted of 114 heifers and 82 steers from a herd of purebred Herefords at the station. With only a few exceptions the calves were dropped between April 10 and June 1 on the range (fig. 1). They were weaned late in October and grazed at headquarters on third-growth alfalfa until winter feeding was begun early in December. All calves were vaccinated with blackleg aggressin before weaning time.

At the beginning of each winter-feeding period the calves were divided as uniformly as possible into three lots with respect to age, weight, sex, condition, and previous gains. Lot 1 received only

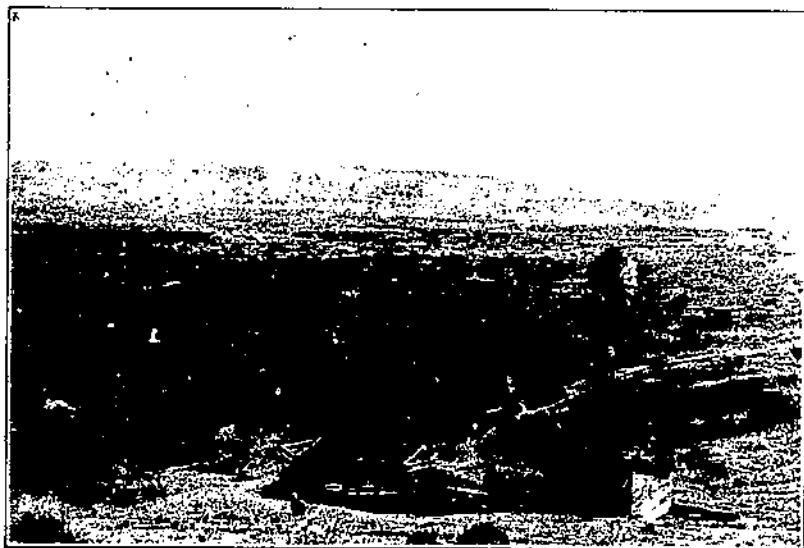


FIGURE 1.—Experimental calves with their dams on summer range at the United States Range Livestock Experiment Station, Miles City, Mont.

alfalfa hay, which was full fed; lot 2 was likewise fed the alfalfa hay but received, in addition, cottonseed cake, which varied in quantity from year to year; lot 3 received limited quantities of alfalfa hay and all the corn silage that the animals would eat. Hay was fed in the morning and in the afternoon to lots 1 and 2 and in the morning only to lot 3. Cottonseed cake was fed in the morning and silage at noon. Feeding was begun at 7 a. m. Corn silage and cottonseed cake were fed in troughs separate from the hay. Refused hay was removed from the troughs, reweighed, and the weight deducted from the total quantity of hay fed. The calves were weighed at the beginning and close of the experiments and also at the conclusion of each 28-day feeding period. The initial and final weights were the average of 3 consecutive days' weights taken at the beginning and close of the experiments. The winter-feeding experiments were begun with the afternoon feeding on the second day of weighing and closed with the morning feeding on the second day of weighing. All weighings of the different lots were made in the

same order each time, beginning at or about 8:30 a. m. and ending before 12 m.

During the winter-feeding period the calves in each lot were quartered in similar corrals. Each lot had access to a sheltered pen inside the cattle barn, the barn being 30 by 40 feet in size with 66 lineal feet of bunk space. The outside corral for each lot was 30 by 120 feet. Wooden water tanks located inside the barn provided water for each lot of calves. During the first winter the calves drank water on which the ice had been broken, and during the remaining two winters they drank water warmed by tank heaters. Salt was available at all times. All calves were dehorned before the close of the last 28-day period of feeding.

The calves were turned on native-grass spring range at the conclusion of the winter-feeding experiments and grazed through the summer with other experimental cattle. Final feed-lot weights were used as initial range weights, and final range weights were taken at the close of the summer season, between October 20 and November 1. The average period on summer range for the three seasons was 195 days.

Water was obtained from the Yellowstone River while the yearlings were on the range used in 1927 and 1929 and from water holes and tanks while they were on the range used in 1928. Salt was available at all times. Salt boxes were located in good grass areas remote from water, in order to obtain the most satisfactory utilization of range.

#### WINTER FEEDS USED

Table 1 shows the chemical analyses of the feeds used, based on the average for the 3 years.

TABLE 1.—Average chemical analyses of winter feeds used from 1926-27 to 1928-29

Feed	Water	Ash	Crude protein	Crude fiber	Nitrogen-free extract	Fat
	Percent	Percent	Percent	Percent	Percent	Percent
Alfalfa hay.....	4.54	7.27	12.80	37.30	38.54	1.53
Corn silage <sup>1</sup> .....	71.7	1.61	2.61	5.96	17.65	.46
Cottonseed cake.....	3.25	6.98	43.88	11.16	28.92	6.73

<sup>1</sup> For 1926-27 only.

All the feeds except cottonseed cake were produced under irrigation on the station farm. The alfalfa hay fed during the first year was largely second cutting, whereas that fed during the 2 succeeding years was first cutting. The hay was well cured but contained foxtail and was somewhat stemmy. Federal grades were obtained on the hay fed during 1928-29, and most of it graded U. S. No. 3, with a small proportion of U. S. No. 2.

The corn silage used each year was of good quality, was produced from yellow dent corn under irrigation, and during the 3 years varied only about 3 percent in water content.

The cottonseed cake varied slightly more than 3 percent in protein content. Both nut- and pea-size cake were fed during the three winters.

## SUMMER RANGE

Important native-grass species available for summer grazing included wheatgrass (*Agropyron smithii*), junegrass (*Koeleria cristata*), blue grama grass (*Bouteloua gracilis*), buffalo grass (*Bulbilis dactyloides*), and needlegrass (*Stipa comata*).

The rate of stocking on spring and summer ranges varied from year to year with the numbers of available cattle, but in general all ranges were understocked, and grazing conditions, insofar as available feed was concerned, were satisfactory in character. The rate of stocking for the different years was as follows: One steer or heifer to 28 acres for 124 days in 1927, one steer or heifer to about 63 acres for 195 days in 1928, and one steer or heifer to about 15 acres for 201 days in 1929. There was considerable variation in grazing conditions through the three summer seasons. Grass growth was above normal in 1927, below normal in 1928, and nearly normal in 1929. For the use of the range through the period covered by this experiment an allowance of 1 cent per head per day was made. This allowance was based on the prevailing lease rate of native range land, which is a little less than 1 cent per head per day.

## WEATHER CONDITIONS DURING THE EXPERIMENTS

Table 2 shows the average temperature and the precipitation at Miles City, Mont., during the winter-feeding and summer-grazing experiments.

TABLE 2.—Meteorological data<sup>1</sup> during winter-feeding and summer-grazing experiments

WINTER-FEEDING EXPERIMENTS						
Month	Average temperature			Total precipitation		
	1926-27	1927-28	1928-29	1926-27	1927-28	1928-29
	<i>°F.</i>	<i>°F.</i>	<i>°F.</i>	<i>Inches</i>	<i>Inches</i>	<i>Inches</i>
December	16.4	2.8	23.5	0.63	1.33	0.40
January	16.2	20.6	3.0	.61	.44	.90
February	20.7	21.1	8.8	.22	.38	.38
March	33.2	38.0	36.7	.23	.54	1.72
Average or total	22.1	21.1	18.6	1.69	2.69	3.40
SUMMER-GRAZING EXPERIMENTS						
Month	1927	1928	1929	1927	1928	1929
	<i>°F.</i>	<i>°F.</i>	<i>°F.</i>	<i>Inches</i>	<i>Inches</i>	<i>Inches</i>
April	41.1	43.0	41.7	2.37	0.43	0.70
May	52.0	62.2	53.3	4.71	.37	2.24
June	61.0	60.7	61.4	1.72	2.83	2.01
July	71.6	71.8	76.0	1.32	4.78	.70
August	68.7	68.8	75.8	2.51	.14	.28
September	58.4	58.1	55.4	1.78	.31	1.86
October	50.9	46.4	50.2	.33	1.34	1.05
Average or total	58.6	58.8	60.0	11.80	10.33	9.77

<sup>1</sup> Data obtained from the station of the U. S. Weather Bureau situated at Miles City, Mont.



## RESULTS OF EXPERIMENTS

## EXPERIMENT 1, 1926-27

The calves were weighed and weaned on October 18 and turned out to fall pasture on frosted alfalfa aftermath. Winter feeding was begun on December 18 and concluded on April 12, at the end of a 115-day period. On April 12 the calves were turned on spring range and on May 7 were moved to summer range. Fall weights were taken on October 24, at the end of a 195-day grazing season. Spring- and summer-grazing conditions were generally satisfactory.

The results of the first winter-feeding and summer-grazing periods are given in table 3, which shows that the calves in lot 3, fed alfalfa and corn silage, made considerably greater winter gains than those in lot 1, fed alfalfa hay, or those in lot 2, fed alfalfa hay and cottonseed cake. However, the lot 3 calves did no better than the other two lots during the subsequent summer-grazing season, so that in total gains there were differences of only 26 pounds between the calves in lot 3 and in lot 1, and 22 pounds between those in lot 3 and in lot 2. Moreover, the winter-feed cost per calf for the animals in lot 3 was 84 cents more than for those in lot 1 and 34 cents more than for those in lot 2. The feed cost for 100 pounds of gain for the winter and summer seasons was practically the same for all lots. Consequently, no one of the three winter rations seemed to have any advantage over the others during the 1926-27 experiment.

TABLE 3.—Comparison of different methods of winter feeding calves, in their effect on winter gains and feed costs and on subsequent summer gains, 1926-27

Item	Lot 1 (fed alfalfa, 12.4 pounds)	Lot 2 (fed alfalfa, 11.5 pounds; cottonseed cake, 0.46 pound)	Lot 3 (fed alfalfa, 9.4 pounds; corn silage, 5.8 pounds)
Calves in lot 1.....	number	17	17
Winter period (115 days):			
Average initial weight per calf.....	pounds	413	411
Average gain per calf.....	do.	35	47
Average feed cost per calf <sup>2</sup> .....	dollars	7.11	7.61
Summer range period (195 days):			
Average gain per calf.....	pounds	292	284
Average feed cost per calf <sup>3</sup> .....	dollars	1.95	1.95
Winter and summer period (310 days):			
Average gain per calf.....	pounds	327	331
Average feed cost per calf <sup>4</sup> .....	dollars	9.06	9.56
Average cost per 100 pounds of gain.....	do.	2.77	2.88

<sup>1</sup> Steers: Lot 1, 7; lot 2, 6; lot 3, 7. Heifers: Lot 1, 10; lot 2, 11; lot 3, 10.

<sup>2</sup> At the following prices per ton: Alfalfa hay, \$10; cottonseed cake, \$37.50; corn silage, \$5.

<sup>3</sup> Estimated at 1 cent per head per day.

<sup>4</sup> The cost of salt was not included since it was difficult to determine its consumption because of unavoidable wastage, especially by rains. The quantity consumed per calf for the total winter and summer feeding was only a few cents.

## EXPERIMENT 2, 1927-28

The calves were weighed and weaned on October 27 and turned out to fall pasture on frosted alfalfa aftermath. As weather conditions were unfavorable for fall pasture by the end of November, winter feeding was begun on December 2 and concluded on April 17, at the end of a 137-day feeding period. The calves were turned on spring range on April 18 and were moved to summer range on

May 26. Fall weights were taken on October 19 at the close of a 185-day grazing period. Spring- and summer-grazing conditions were generally satisfactory.

The results of the second winter-feeding and summer-grazing periods are given in table 4. These results were somewhat similar to those of the first year. The total gains for the second year, however, were less than those of the first. The calves in lot 1, fed alfalfa hay alone, made the smallest winter gain, the greatest summer gain, and essentially the same combined winter and summer gains as the calves in lot 3, fed alfalfa hay and corn silage. The total gains of the calves in lot 2, fed alfalfa hay and cottonseed cake, were not significantly lower than those of lots 1 and 3. In 1927-28 the winter-feed cost per calf in lot 2 was a little over \$2 more than for the calves in each of the other two lots. This was due primarily to the use of a greater quantity of higher priced cottonseed cake than was used during the first year. The feed cost per 100 pounds of gain for lot 2 through the winter and summer seasons, including the estimated value of feed on the range, was \$0.73 more than for lot 1 and \$0.70 more than for lot 3. Alfalfa hay and corn silage and alfalfa hay alone, therefore, had a significant advantage over alfalfa hay and cottonseed cake during the second experiment.

TABLE 5.—Comparison of different methods of winter feeding calves, in their effect on winter gains and feed costs and on subsequent summer gains, 1927-28

Item		Lot 1 (fed alfalfa 13.1 pounds)	Lot 2 (fed alfalfa, 12.1 pounds; cottonseed cake, 0.82 pounds)	Lot 3 (fed alfalfa, 9.6 pounds; corn silage, 8.1 pounds)
Calves in lot 1	number	24	24	24
Winter period (137 days):				
Average initial weight per calf	pounds	345	356	385
Average gain per calf	do.	41	87	80
Average feed cost per calf <sup>1</sup>	dollars	10.74	12.82	10.62
Summer range period (185 days):				
Average gain per calf	pounds	250	231	212
Average feed cost per calf <sup>1</sup>	dollars	1.85	1.85	1.85
Winter and summer period (322 days):				
Average gain per calf	pounds	323	317	322
Average feed cost per calf <sup>2</sup>	dollars	12.59	14.67	12.47
Average feed cost per 100 pounds of gain	do.	3.90	4.63	3.87

<sup>1</sup> Steers: Lot 1, 9; lot 2, 10; lot 3, 11. Heifers: Lot 1, 15; lot 2, 13; lot 3, 13.

<sup>2</sup> 1 heifer died of blackleg while on summer range.

<sup>3</sup> At the following prices per ton: Alfalfa hay, \$12; cottonseed cake, \$50.50; corn silage, \$5.

<sup>4</sup> Estimated at 1 cent per head per day.

<sup>5</sup> See footnote 1, table 3.

#### EXPERIMENT 3, 1928-29

The calves were weighed and weaned on October 19 and turned on native-grass range along the Yellowstone River on October 23. They were moved to the frosted alfalfa pastures on November 19 and grazed until the beginning of weighing on December 19. The winter-feeding experiment was begun on December 20 and concluded on April 11 at the end of a 112-day feeding period. Sarcocytic mange broke out in the bull herd during the winter season and the calves, although free from this disease, were quarantined and dipped. All lots were dipped on April 4, redipped on April 12, and lot 1 was kept off pasture and dipped a third time on April 22.

The calves in lots 2 and 3 were turned onto spring and summer range on April 15; lot 1 was turned onto the range on April 23. Late in August all calves were affected with pinkeye to a greater or lesser degree. There were 7 severe cases in lot 1, 9 in lot 2, and 10 in lot 3. The summer-grazing season was closed on November 2 at the end of a 205-day period. Grazing conditions were generally satisfactory through the 1929 season, and average gains were higher than those made in 1928 in spite of the quarantine against sarcoptic mange and the pinkeye outbreak during experiment 3.

The results of the third winter-feeding and summer-grazing period are given in table 5. In this experiment, calves in lot 3, fed hay and corn silage, made the greatest winter gain, the smallest summer gain, and the greatest total gain for the year. Steers in lot 1, fed alfalfa hay alone, produced the smallest winter gain, essentially the same summer gain as those fed alfalfa hay and cottonseed cake, and the smallest total gain for the year. The winter-feed cost per calf in lot 2 was \$2.06 more than that in lot 1 and \$1.54 more than that in lot 3. This increased winter-feed cost was not compensated for by either the winter or summer gains, as the calves in lot 2 made a total winter and summer gain of 11 pounds less than those in lot 3 and only 18 pounds more than those in lot 1. The feed cost per 100 pounds of gain for lot 2 was \$0.45 more than for lot 1 and \$0.54 more than for lot 3. Alfalfa hay alone and alfalfa hay and corn silage, therefore, had a significant advantage over alfalfa hay and cottonseed cake.

TABLE 5.—*Comparison of different methods of winter feeding calves, in their effect on winter gains and feed costs and on subsequent summer gains, 1928-29*

Item		Lot		
		1 (fed alfalfa, 13.4 pounds)	2 (fed alfalfa, 13.7 pounds; cottonseed cake, 0.72 pound)	3 (fed alfalfa, 9.3 pounds; corn silage, 10.2 pounds)
Calves in lot <sup>1</sup>	number	25	24	25
Winter period (112 days):				
Average initial weight per calf	pounds	410	413	410
Average gain per calf	do	57	76	92
Average feed cost per calf <sup>2</sup>	dollars	7.51	9.57	6.3
Summer range period (205 days):				
Average gain per calf	pounds	279	289	261
Average feed cost per calf <sup>3</sup>	dollars	2.05	2.05	2.05
Winter and summer period (317 days):				
Average gain per calf	pounds	327	313	350
Average feed cost per calf <sup>4</sup>	dollars	9.56	11.62	10.08
Average feed cost per 100 pounds of gain	do	2.92	3.37	2.83

<sup>1</sup> Steers: Lot 1, 11; lot 2, 10; lot 3, 11. Heifers: Lot 1, 14; lot 2, 11; lot 3, 14.

<sup>2</sup> 1 yearling steer went astray on summer range.

<sup>3</sup> At the following prices per ton: Alfalfa hay, \$10; cottonseed cake, \$50.50; corn silage, \$5.

<sup>4</sup> Estimated at 1 cent per head per day.

<sup>5</sup> See footnote 4, table 3.

#### SUMMARY OF EXPERIMENTS 1, 2, AND 3, 1926-27 TO 1928-29

The results of the three experiments are summarized in table 6, which shows that calves wintered on alfalfa hay and corn silage made the greatest gains at the end of the winter period. Calves wintered on alfalfa hay alone produced the smallest winter gains, the largest summer gains, only 7 pounds less total gain than calves

fed alfalfa hay and cottonseed cake, and 18 pounds less total gain than calves fed alfalfa hay and corn silage.

TABLE 6.—*Comparison of different methods of winter feeding calves in their effect on winter gains and feed costs and on subsequent summer gains*

[Summary of the 3 experiments, 1926-27 to 1928-29]

Item		Lot 1 (fed alfalfa, 13 pounds)	Lot 2 (fed alfalfa, 12 pounds; cottonseed cake, 0.7 pound)	Lot 3 (fed alfalfa, 9.1 pounds; corn silage, 9 pounds)
Calves in lot <sup>1</sup>	number	66	61	66
Winter period (121 days):				
Average initial weight per calf	pounds	401	402	401
Average gain per calf	do	51	72	82
Average feed cost per calf <sup>2</sup>	dollars	8.58	10.22	8.95
Summer range period (195 days):				
Average gain per calf	pounds	271	200	281
Average feed cost per calf <sup>3</sup>	dollars	1.95	1.95	1.95
Winter and summer period (316 days):				
Average gain per calf	pounds	323	332	343
Average feed cost per calf <sup>4</sup>	dollars	10.53	12.17	10.90
Average feed cost per 100 pounds gain	do	3.24	3.67	3.19

<sup>1</sup> Steers: Lot 1, 27; lot 2, 24; lot 3, 29. Heifers: Lot 1, 39; lot 2, 38; lot 3, 37.

<sup>2</sup> 1 of the animals in this lot died of blackleg on summer range, and another went astray on the range.

<sup>3</sup> At the following prices per ton: Alfalfa hay, \$10.82; cottonseed cake, \$18.31; corn silage, \$5.

<sup>4</sup> Estimated at 1 cent per head per day.

<sup>5</sup> See footnote 4, table 3.

The winter feed cost per calf on alfalfa hay alone was \$1.64 less than on alfalfa hay and cottonseed cake and \$0.37 less than on alfalfa hay and corn silage. The feed and range cost for 100 pounds of gain was lowest for the group wintered on alfalfa hay and corn silage, being \$0.06 less than for calves wintered on alfalfa hay alone and \$0.49 less than for calves wintered on alfalfa hay and cottonseed cake.

The addition of cottonseed cake to a ration of alfalfa hay increased the winter gain, but during the following summer calves which had received this winter ration made smaller gains than the calves which had received alfalfa hay alone. Therefore, the use of cottonseed cake as a supplement to good-quality alfalfa hay is not considered essential from a nutrition standpoint nor economical from a feed-cost standpoint for winter feeding of calves.

The replacement of 3.6 pounds of alfalfa hay by 9 pounds of corn silage in the average daily ration increased the winter gain 51.9 percent, but at the end of the summer-grazing season the calves fed alfalfa hay and corn silage were only 18 pounds, or 5.5 percent, heavier than calves fed hay alone. This comparatively small difference indicates no material advantage in replacing approximately one-fourth of a ration of alfalfa hay with corn silage. The greater gain made by the cattle is essentially offset by the higher cost of the winter ration.

#### SUMMARY AND CONCLUSIONS

Experiments were carried on with beef calves to determine the effects of feeding alfalfa hay alone, and in combination with (1) cottonseed cake and (2) corn silage, on winter gains and feed costs and subsequent gains on grass. These experiments were con-

ducted at Miles City, Mont., from the winter of 1926 through the summer-grazing season of 1929; both heifer and steer calves were used.

The results indicate that alfalfa hay of good quality when fed alone is a satisfactory winter feed for calves to be turned onto native range early in April. The cost of wintering is lower than when high-priced supplements are fed, and the results attained are generally more economical.

The use of silage with alfalfa hay is a decided advantage for wintering purposes when maximum gains are desired and an early sale of the animals from the feed lot is anticipated. Calves wintered on silage and alfalfa hay carried more condition or fleshing than was desired for maximum utilization of range grass but the gains were economical. The feeding of both alfalfa hay and corn silage is to be recommended only when corn silage can be produced economically.

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