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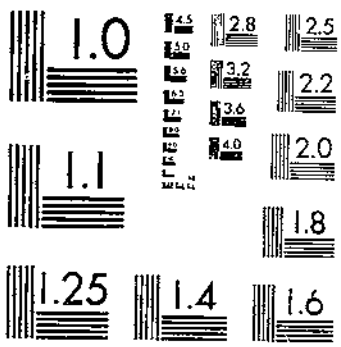

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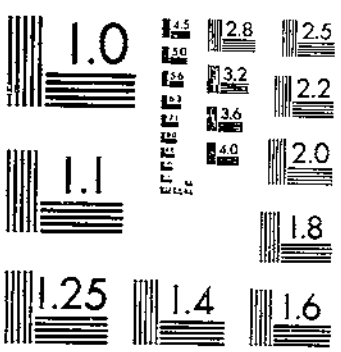

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TECHNICAL BULLETIN No. 628 August 1938

UNITED STATES DEPARTMENT OF AGRICULTURE
WASHINGTON, D. C.

EFFECT OF SUPPLEMENTING WINTER AND SUMMER RANGE ON GAINS OF STEERS IN THE NORTHERN GREAT PLAINS[1]

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CONTENTS

THE AREA AND ITS PROBLEMS

Beef-cattle production is the major industry in that part of the northern Great Plains, embraced by eastern Montana, eastern Wyoming, western North Dakota, western South Dakota, and northwestern Nebraska (fig. 1). In this area it is common practice to raise feeder cattle and to market them as yearlings or as 2-year-olds. Grass is the primary asset and is depended on for most of the steer gain which is put on during the growing season (May to September). In recent years more attention has been given to the use of native range for wintering cattle.

The area as a whole has comparatively low precipitation and rather extreme temperatures, making crop production very uncertain. Table 1 shows the monthly mean temperatures and precipitation during these experiments (1933–36) and the averages for 1912–36 at the Ardmore Field Station, Ardmore, S. Dak., where the experiments were conducted. Although the station is located in the southern part of the northern Great Plains, the results are generally applicable to the area as a whole, with the possible exception of the extreme northern and northwestern portions.

[1] Submitted for publication February 4, 1938.

[2] Acknowledgment is made to A. L. Baker, assistant animal husbandman, who was superintendent of the Ardmore Field Station, Ardmore, S. Dak., from November 1, 1932, to January 1, 1935, for his supervision of the first part of these experiments.

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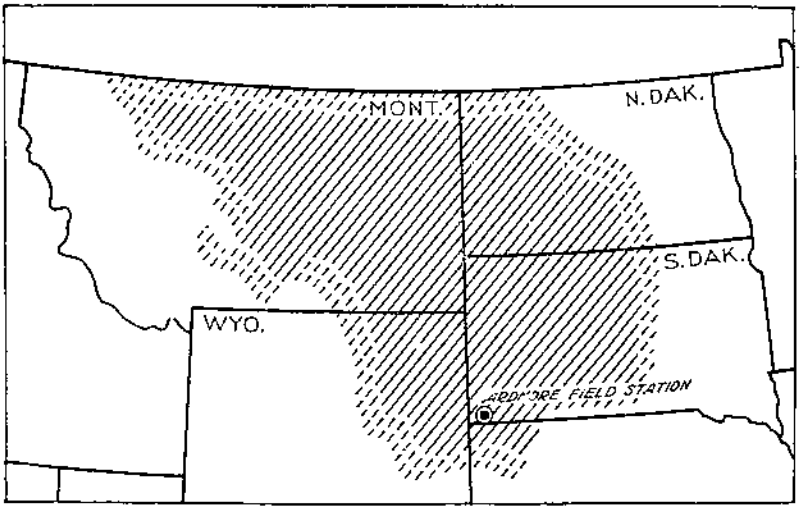

FIGURE 1.—Shaded area shows territory to which the results of this study apply.

TABLE 1.—*Monthly mean temperatures and precipitation during the 3 years of the experiments, and averages for 1912–36 at the Ardmore Field Station, Ardmore, S. Dak.*

Month	Mean temperature				Mean precipitation			
	1933–34	1934–35	1935–36	1912–36 (average)	1933–34	1934–35	1935–36	1912–36 (average)
	°F.	°F.	°F.	°F.	*Inches*	*Inches*	*Inches*	*Inches*
December	27.6	26	27	20	0.17	0.11	0.23	0.33
January	28.4	25	19	20	.30	.07	.61	.33
February	30.7	31	3	24	.33	.29	1.35	.38
March	33.5	37	35	33	.60	2.23	.95	.75
April	47.4	41	43	45	1.11	4.59	.70	2.12
May	65.7	49	62	53	.30	5.66	1.42	2.76
June	68.1	64	71	66	3.56	1.31	1.58	2.55
July	77.3	76	82	74	3.16	1.22	.79	2.13
August	71.9	73	75	71	2.47	1.42	1.71	1.65
September	55.3	62	64	61	1.37	.26	1.07	1.06
October	53.0	46	47	47	1.39	.36	.65	1.18
November	39.0	31	31	34	.20	.24	.92	.46

The monthly mean temperatures during these experiments corresponded rather closely to the averages for the long-time period of 1912–36. In the winter of 1935–36, however, the temperatures for February averaged considerably lower. In this winter also the average temperature for January was somewhat lower than for the same month of the previous experiments.

The precipitation during these experiments with few exceptions followed rather closely the averages for 1912–36. However, in December, January, and February of the first two experiments, and in September, October, and November of the second experiment, the precipitation was considerably less than the average for 1912–36. The rainfall for June, July, and August in the first experiment and for March, April, and May in the second experiment was considerably higher than the averages for the corresponding periods of 1912–36.

In dry-land farming crops which are not marketed direct as grain and roughage are used largely for wintering steers and breeding herds. Since feed supplies are rather limited, it is important to carry the cattle through the winter on locally produced feeds, fed in such quantities as will produce slight winter gains in younger steers and maintenance in 2-year-old or older steers. One of the foremost problems, therefore, is to winter steers satisfactorily, yet economically, and in such condition as will enable them to make the greatest use of grass the following summer. Another equally important problem is to determine the advisability of increasing the condition of steers during the grazing season, in order to produce slaughter steers by the use of grain supplements rather than feeder steers by the use of native range only.

Wintering experiments conducted at the Ardmore Field Station from 1923 to 1928 [3] and from 1928 to 1933 [4] showed that steers could be wintered in the feed lot very satisfactorily on such home-grown feeds as alfalfa when fed alone or in combination with oat straw and silage, on wheatgrass alone, on sorgo fodder alone, and on native range with very small quantities of supplemental feeds.

Summer grazing experiments [5] conducted at Ardmore from 1919 to 1933 showed that more than 7 acres of native range was required for steers 1 year old or more during the summer grazing season. These experiments also showed that the vegetation of the type in the pastures used cannot be injured by overgrazing without the steers suffering severe losses in weight toward the end of the grazing season. Alternate grazing was found to be more satisfactory than continuous grazing when the same rate of stocking was used.

To throw further light on the problems of wintering and summer grazing of steers in the area, the experiments reported in this bulletin were carried on from 1933 to 1936, inclusive.

EXPERIMENTAL PROCEDURE

METHODS OF FEEDING

In the wintering experiments, 1933–34 to 1935–36, groups of yearling steers were fed as follows:

Group 1. Cottonseed cake (43 percent protein) and straw (about 35 percent oat and 65 percent barley during the first year, and about 85 percent oat and 15 percent barley during the last 2 years) in the feed lot.

Group 2. Cottonseed cake (43 percent protein) on the range and small quantities of roughage when weather did not permit the use of range during the last 2 years.

Group 3. Chopped ear corn on the range except for a small quantity of shelled corn from March 3 to April 10 in 1933–34; roughage fed same as group 2.

Group 4. Range with no grain supplement; roughage fed same as in groups 2 and 3. (This group was added at the end of the first year.)

When it was necessary to supplement the range by the use of roughage, either in the form of straw or alfalfa hay, the same quantity per steer was fed to groups 2, 3, and 4.

[3] BLACK, W. H., and MATHEWS, O. R. WINTERING STEERS IN THE NORTH CENTRAL GREAT PLAINS SECTION. U. S. Dept. Agr. Tech. Bull. 102, 14 pp., illus. 1930.

[4] —— and MATHEWS, O. R. COMPARISON OF FEEDS FOR WINTERING STEERS IN THE NORTHERN GREAT PLAINS. U. S. Dept. Agr. Tech. Bull. 565, 16 pp., illus. 1937.

[5] —— BAKER, A. L., CLARK, V. I., and MATHEWS, O. R. EFFECT OF DIFFERENT METHODS OF GRAZING ON NATIVE VEGETATION AND GAINS OF STEERS IN NORTHERN GREAT PLAINS. U. S. Dept. Agr. Tech. Bull. 547, 104 pp., illus. 1937.

In the grazing experiments conducted during the summers of 1934, 1935, and 1936, the steers were fed as follows:

Group 1. On native range and fed grain supplement throughout the grazing season. (Ground barley fed first year and ground wheat last 2 years.)
Group 2. On native range and, after the first 56 days, fed same kinds of grain supplement as were fed to group 1.
Group 3. On native range, grazed intensively and continuously.
Group 4. On native range, grazed alternatively every 28 days.

The roughage and grain used in these experiments were of good quality and were produced locally, mostly on the station farm.

The native vegetation of the northern Great Plains includes a large number of species from widely separated families. It is dominated, however, by western wheatgrass (*Agropyron smithii*), buffalo grass (*Buchloe dactyloides*), and blue grama grass (*Bouteloua gracilis*).[6]

CATTLE USED AND METHODS OF HANDLING

During each of the 3 years that the experiments were conducted good grade Hereford yearling steers, approximately 18 months of age when placed on the wintering experiments, were used. The same steers, except for a few representative ones which were in excess of the number required for the various pastures, were used in the summer grazing experiments subsequent to the winter feeding experiments.

The steers were branded with individual numbers and were weighed individually on 3 consecutive days at the beginning and at the end of the experiments, and at 28-day intervals. The average of each of these consecutive 3-day weighings constituted the initial and final weights. The steers were divided into groups as nearly equal as possible for wintering and grazing experiments. For the summer grazing studies, the animals were so selected that approximately the same number from each of the winter groups were included in each group. Group 4, however, included twice as many steers as were used in each of the other groups because the area grazed was twice that used by groups 1, 2, and 3. The rate of stocking for each pasture was approximately one steer to 10 acres.

The wintering experiments were begun each year in the first half of December and ended about May 1. The summer grazing experiments were begun each year on May 15 and ended about the middle of September. Between the end of the wintering experiments and the beginning of the summer grazing experiments, the steers were handled on a reserve pasture without supplemental feeds. At the end of the summer grazing experiments, the steers in groups 1 and 2, fed supplements on the range, were graded as slaughter steers, and those in groups 3 and 4, handled on the native range without supplement, as feeders. The steers from all lots were marketed at Omaha, Nebr., during the first 2 years and at Denver, Colo., the third year.

Salt and water were available to the steers at all times. The animals wintered on the range had access to shelter, a portion of the shed occupied by the group 1 steers, kept in the feed lot, being used.

[6] BLACK, W. H., BAKER, A. L., CLARK, V. I., and MATHEWS, O. R. See footnote 5.

EXPERIMENTAL RESULTS

1933-34 EXPERIMENTS

WINTER RATIONS AND GAINS

The results of the first year's experiment comparing wintering of steers on the range with supplements of cottonseed cake (group 2) and of chopped ear corn (group 3) with wintering in the dry lot on oat and barley straw and cottonseed cake (group 1) are summarized in table 2. The average winter steer weights by 28-day periods, shown graphically in figure 2, varied considerably in each group. The weights of group 1 fluctuated less, however, than those of the steers in the other two groups.

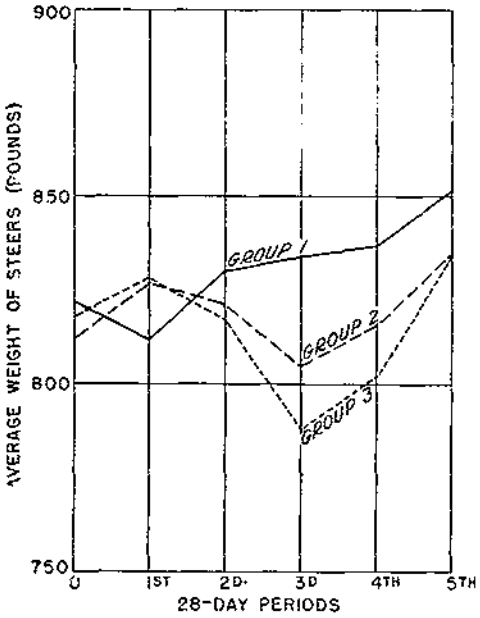

FIGURE 2.—Average weights of steers by 28-day periods, winter of 1933–34. (Group 1, fed cottonseed cake and straw in dry lot; group 2, fed cottonseed cake on range; group 3, fed chopped ear corn on range.)

In the two groups of steers on range, a daily supplement of 0.70 pound of cottonseed cake per steer was equally as satisfactory as nearly twice that quantity of chopped ear corn so far as gains and feed costs were concerned.

TABLE 2.—*Winter gains, feed consumption, and cost of feed for steers, Dec. 12, 1933, to May 1, 1934 (140 days)*

Item	Group 1, fed 13.86 pounds daily of straw and 0.98 pound of cottonseed cake in feed lot	Group 2, fed 0.70 pound daily of cottonseed cake on range [1]	Group 3, fed 1.33 pounds daily of chopped ear corn on range [2]
Steers.....number	14	14	15
Average initial weight.....pounds	822	812	818
Average final weight.....do	852	835	834
Average gain.....do	30	23	16
Average quantity of feeds per steer:			
Straw.....do	1,870		
Cottonseed cake.....do	137	83	
Corn.....do			157
Salt.....do	11	9	[3]
Value of feed per steer.....dollars	10.45	1.25	1.48
Value of range per steer.....do		4.62	4.62
Total value of feed (range and supplement) [3] dollars	10.45	5.87	6.10

[1] Supplement fed 118 days.
[2] Supplement fed 118 days. Quantity of corn reported on shelled basis; small quantity of shelled corn fed from Mar. 3 to Apr. 10.
[3] At the following prices: Range, $0.033 per head daily; corn, $0.893 per 100 pounds; straw, $9 per ton; cottonseed cake, $28 per ton; and salt, $20 per ton.

Although neither of the range groups made as large winter gains per steer as did group 1, fed nearly 14 pounds of straw and about 1 pound of cottonseed cake in dry lot, yet the average gains per steer in all groups were sufficient. There was no significant difference [7] in cost of feed between the two range groups, but between the range groups and the group handled in the dry lot there was a very marked difference in the winter feed bill—$4.46 per steer—in favor of wintering on the range.

SUMMER RATIONS AND GAINS

The results of the first year's experiment comparing various methods of summer grazing of steers on the range are summarized in table 3. The average summer steer weights by 28-day periods are presented graphically in figure 3. The figure shows that for the first 56 days the three groups on grass alone (groups 2, 3, and 4) made practically the same gains. After this period, however, groups 3 and 4 either lost weight or made small gains, whereas group 2, which was then given a barley supplement, continued to make good gains. Group 1, receiving barley supplement throughout the experiment, gained more consistently than the other groups in spite of the decrease in weight during the fourth period.

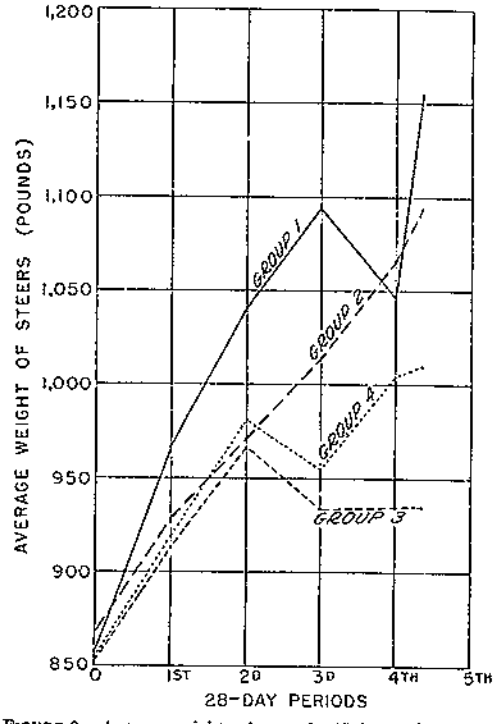

FIGURE 3.—Average weights of steers by 28-day periods, summer of 1934. (Group 1, on range and fed grain during experiment; group 2, on range and fed grain after first 56 days on grass; group 3, on range only, continuously grazed; group 4, on range only, alternately grazed.)

The group 1 steers averaged more than 70 pounds greater gains per steer than did those of group 2. However, the cost of feed and grazing for the former group was only about two-thirds that of the latter.

The two groups on range with no supplement made decidedly less gain than the barley-fed groups. However, the group on the alternately grazed range made nearly twice as much gain per steer as did the group on the continuously grazed range and at practically the same cost. The cost of carrying groups 3 and 4 through the summer was less than one-third that of group 1.

[7] The statistical analyses of the data in this bulletin were made according to the following: FISHER, R. A. STATISTICAL METHODS FOR RESEARCH WORKERS. Ed. 5, rev. and enl., 319 pp., illus. Edinburgh and London, 1934.

TABLE 3.—*Results of summer grazing experiments, May 15 to Sept. 14, 1934 (122 days)*

Item	Group 1, on range and fed 9.57 pounds daily of barley for 122 days	Group 2, on range 122 days and fed 9.80 pounds daily of barley after first 50 days	Group 3, on range continuously grazed for 122 days	Group 4, on range alternately grazed for 122 days
Steers.....number	7	[1] 6	8	16
Average initial weight.....pounds	858	868	852	853
Average final weight.....do	1,115	1,094	935	1,010
Average gain.....do	257	226	83	157
Average quantity of feed per steer (exclusive of pasture):				
Barley.....do	1,168	940		
Salt.....do	9.6	11.7	6.8	5.3
Value of feed (exclusive of range) per steer.....dollars	11.08	6.13	0.07	0.05
Value of range per steer.....do	4.03	4.03	4.03	4.03
Total value [2].....do	15.16	10.20	4.10	4.08
Sales weight per steer.....pounds	1,037	1,040	871	918
Sales price per 100 pounds.....dollars	6.00	6.00	5.00	5.33
Sales value per steer.....do	62.22	60.00	43.55	48.92
Shrinkage per steer.....percent	10.2	7.7	6.8	9.0
Dressing percentage (hot and sales weight)	60.5	59.9		
Grade scores at close of experiment: [3]				
Feeder			67.08	72.08
Slaughter	79.29	70.55		
Carcass	67.38	63.89		

[1] 1 steer died on June 2; data not used.
[2] At the following prices: Range, $0.033 per head daily; barley, $0.94 per 100 pounds; and salt, $20 per ton.
[3] 90.00–80.01=Choice grade; 80.00–70.01=Good grade; 70.00–60.01=Medium grade.

1934–35 EXPERIMENTS

WINTER RATIONS AND GAINS

The results of the second year's experiment comparing the wintering of steers on the range with supplements of cottonseed cake (group 2) and chopped ear corn (group 3) and no grain supplement (group 4) with wintering in the dry lot on straw and cottonseed cake (group 1) are summarized in table 4. The average winter steer weights by 28-day periods are shown graphically in figure 4. All groups made slight gains during the winter period, and although the steers in dry lot made the greatest gain, it was not significantly greater than the gains of the other groups. Steers wintered in dry lot made more consistent increases than did the range-wintered steers.

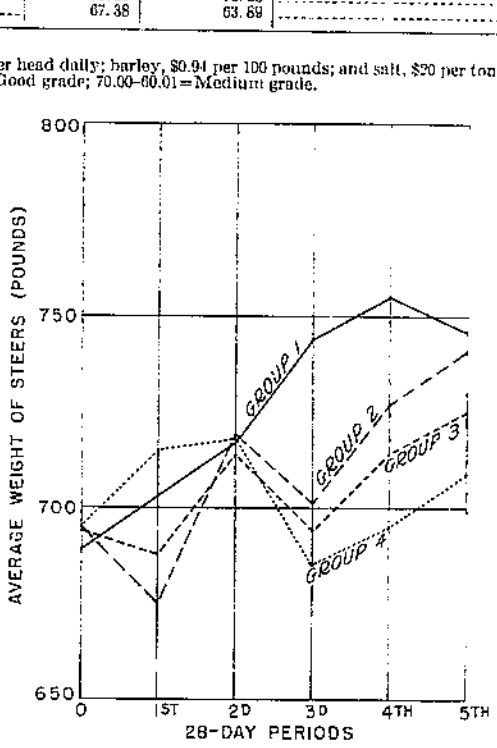

FIGURE 4.—Average steer weights by 28-day periods, winter of 1934–35. (Group 1, fed cottonseed cake and straw in dry lot; group 2, fed cottonseed cake on range; group 3, fed chopped ear corn on range; group 4, fed no grain supplement on range.)

TABLE 4.—*Winter gains, feed consumption, and cost of feed for steers, Dec. 11, 1934, to Apr. 30, 1935 (140 days)*

Item	Group 1, fed 13.46 pounds daily of straw and 0.96 pound of cottonseed cake in feed lot	Group 2, fed 0.83 pound daily of cottonseed cake on range	Group 3, fed 1.75 pounds daily of chopped ear corn on range	Group 4, on range with no grain supplement
Steers.....number	14	15	16	15
Average initial weight.....pounds	689	695	694	695
Average final weight.....do	746	741	725	709
Average gain.....do	57	46	31	14
Average quantity of feeds per steer:				
Straw.....do	1,884	[1] 10		
Cottonseed cake.....do	135	117		
Corn.....do			245	
Salt.....do	11.0	2.9	2.9	2.9
Alfalfa hay.....do		10.7	10.7	10.7
Value of feed per steer.....dollars	10.48	1.73	2.28	.00
Value of range per steer.....do		4.62	4.62	4.62
Total value of feed (range and supplement) [2].....dollars	10.48	6.35	6.90	4.71

[1] See text for explanation of the inclusion of this feed.
[2] At the following prices: Range, $0.033 per head daily; cottonseed cake, $28 per ton; corn, $0.893 per 100 pounds; straw, $0 per ton; alfalfa hay, $12 per ton; and salt, $20 per ton.

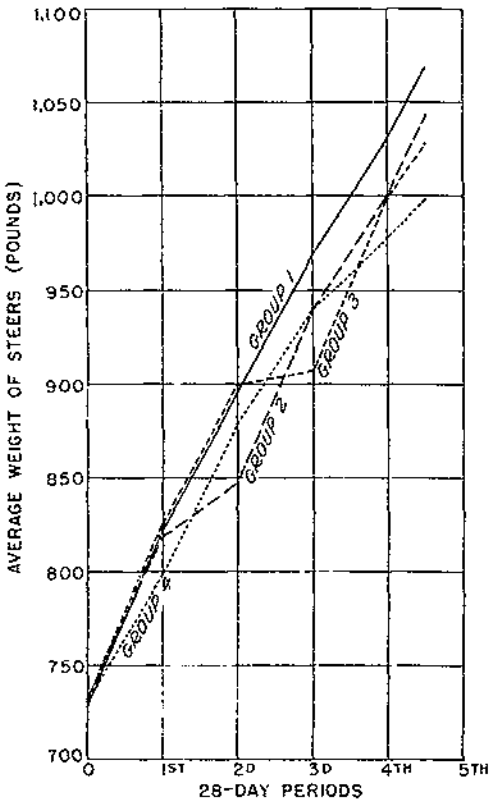

FIGURE 5.—Average steer weights by 28-day periods, summer of 1935. (For description of groups, see legend of figure 3.)

The table shows that the feeding of a daily supplement of 0.83 pound of cottonseed cake resulted in greater gain and lower feed cost per steer for the 140 days of feeding than did more than twice as much chopped ear corn. At the beginning of this experiment, some trouble was experienced in getting the steers of group 2 to eat the cottonseed cake. After the animals were kept in a pen for 3 or 4 days and fed only a small quantity of straw and the cottonseed cake, they became sufficiently hungry to consume the cottonseed cake ration, and no further trouble was experienced.

Both groups 2 and 3 made greater gains than group 4, fed no grain supplement, but the gains of the last-mentioned group were satisfactory. However, the cost of wintering this group was considerably less than that of the other two groups. As in the previous year, the steers in dry lot made the greatest gains but at a decidedly greater cost than the remaining three groups.

SUMMER RATIONS AND GAINS

The results obtained from the second year of summer grazing are given in table 5. The average steer weights by 28-day periods are shown graphically in figure 5. During the second summer, all groups made consistent gains. The grain-fed groups did not make appreciably greater gains than those on range only, owing probably to the better grazing conditions during the summer of 1935. As shown by table 1, during the preceding spring months the rainfall had been higher than average.

TABLE 5.—*Results of summer grazing experiments, May 15 to Sept. 18, 1935 (126 days)*

Item	Group 1, on range and fed 0.96 pounds daily of wheat for 126 days	Group 2, on range and fed 9.20 pounds daily of wheat after first 56 days	Group 3, on range continuously grazed 126 days	Group 4, on range alternately grazed 126 days
Steers.....number	17	8	8	16
Average initial weight.....pounds	728	732	730	730
Average final weight.....do	1,069	1,043	1,028	999
Average gain.....do	341	311	298	269
Average quantity of feeds per steer (exclusive of pasture):				
Wheat.....pounds	1,253	644	.....	.....
Salt.....do	7.6	5.0	1.9	1.4
Value of feed (exclusive of pasture) per steer.....dollars	15.74	8.05	.02	.01
Value of range per steer.....do	4.16	4.16	4.16	4.16
Total value [2].....do	19.90	12.21	4.18	4.17
Sales weight per steer.....pounds	1,009	970	900	883
Sales price per 100 pounds.....dollars	8.50	8.50	7.18	6.84
Sales value per steer.....do	85.76	82.45	64.62	60.39
Shrinkage per steer.....percent	5.61	7.0	12.45	11.61
Dressing percentage (hot and sales weight)	56.03	57.18	.....	.....
Grade scores at close of experiment: [3]				
Feeder.....percent	.....	.....	75.83	75.21
Slaughter.....do	72.14	75.06	.....	.....
Carcass.....do	76.43	75.42	.....	.....

[1] 1 steer died; data not used.
[2] At the following prices: Range, $0.033 per head daily; wheat, $1.25 per 100 pounds; salt, $20 per ton.
[3] See footnote 3, table 3.

There was decidedly less difference in total gains among the four groups than in the previous year. As in the first year, group 1, fed the grain supplement for the entire period on range, made the greatest gains but at a cost exceeding half again that of group 2, fed the supplement only during the latter part of the period on range. Most significant were the gains of the cattle on range with no supplement. Their gains closely approached those of the cattle receiving grain supplements. Unlike the results of the former year, the cattle on the continuously grazed range made larger gains than those on the alternately grazed range. The costs of gains in these two groups were

practically the same and were little more than one-fifth as much as that of group 1. However, the replacing of wheat for barley resulted in an additional cost of 31 cents per 100 pounds of grain fed, and this fact partially explains the high cost of summering group 1.

1935–36 EXPERIMENTS

WINTER RATIONS AND GAINS

The results of the third year of the winter feeding experiment are summarized in table 6. The average steer weights by 28-day periods are shown in figure 6. Temperatures during January and February of this experiment were considerably lower than during the same months of previous experiments (table 1). In spite of the fact that the animals received extra feed, all groups lost weight during the latter part of the period. The steers wintered in dry lot showed a slight loss for the entire winter period. In the two previous experiments this group had gained in weight.

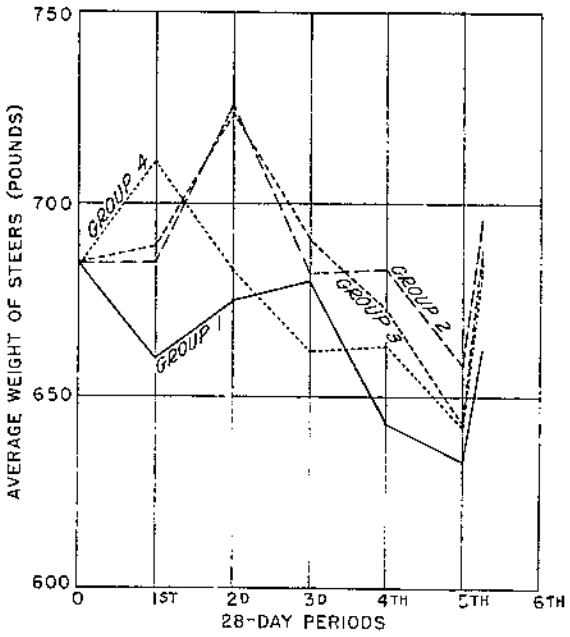

FIGURE 6.—Average steer weights by 28-day periods, winter of 1935–36. (For description of groups, see legend of figure 4.)

The differences in average gains per steer between groups 2 and 3, fed cottonseed cake and chopped ear corn, respectively, on the range were essentially the same as during the 2 previous years. The steers receiving the cottonseed cake consistently gained slightly more, ranging from 7 to 15 pounds per head, through the three experiments. Costs of wintering were consistently greater in the case of the steers fed corn; however, for the last year the costs were essentially the same.

As in the 1934–35 experiment, group 4, fed no grain supplement on the range, made less gain in weight and had a significantly smaller wintering cost than the groups fed either cottonseed cake or ear corn as supplements.

In spite of the fact that the steers fed in dry lot lost weight during the third winter, their feed cost was as high as in previous winters. The other groups, which made slight gains, were wintered at considerably less cost.

TABLE 6.—*Winter gains, feed consumption, and cost of feed for steers, Dec. 3, 1935, to Apr. 28, 1936 (147 days)*

Item	Group 1, fed 12.45 pounds daily of straw and 0.95 pound of cottonseed cake in feed lot	Group 2, fed 0.96 pound daily of cottonseed cake on range	Group 3, fed 1.73 pounds daily of chopped ear corn on range	Group 4, on range with no grain supplement
Steers.....number	12	11	11	11
Average initial weight.....pounds	685	685	685	684
Average final weight.....do	662	696	688	685
Average gain or loss.....do	−23	11	3	1
Average quantity of feed per steer:				
Straw.....do	1,830	35	35	35
Cottonseed cake.....do	141	141		
Corn.....do			254	
Salt.....do	5.9	1.5	1.5	1.5
Alfalfa hay.....do		99	99	99
Value of feed per steer.....dollars	10.55	3.02	3.04	.77
Value of range per steer.....do		4.85	4.85	4.85
Total value of feed (range and supplement)[1].....dollars	10.55	7.87	7.89	5.62

[1] At the following prices: Range, $0.033 per head daily; straw, $9 per ton; cottonseed cake, $32 per ton; corn, $0.893 per 100 pounds; alfalfa hay, $12 per ton; and salt, $20 per ton.

SUMMER RATIONS AND GAINS

The results of the third year of the summer grazing experiment are summarized in table 7. The average summer steer weights by 28-day periods are shown graphically in figure 7.

The gains made by the various groups more nearly approached those of the first year than of the second year. Again the group 1 steers made the greatest gains, followed by group 2, which gained almost 75 pounds less but which had a decidedly smaller feed cost. Similar to the results of the first year, the group on the alternately grazed range made slightly larger gains than the group on the continuously grazed range, and the cost of grazing was the same.

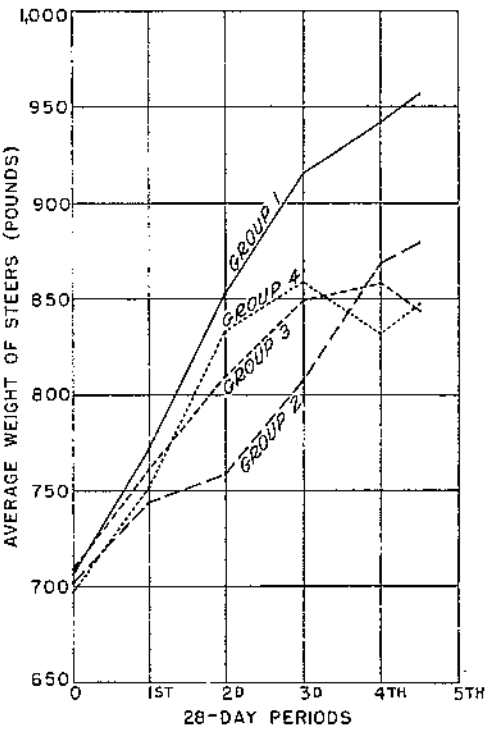

FIGURE 7.—Average steer weights by 28-day periods, summer of 1936. (For description of groups, see legend of figure 3.)

TABLE 7.—*Results of summer grazing experiments, May 15 to Sept. 18, 1936 (126 days)*

Item	Group 1, on range and fed 11.72 pounds daily of wheat for 126 days	Group 2, on range and fed 10.50 pounds daily of wheat after first 56 days	Group 3, on range continuously grazed 126 days	Group 4, on range alternately grazed 126 days
Steers.....number	[1] 7	8	8	16
Average initial weight.....pounds	707	702	709	697
Average final weight.....do	957	879	844	847
Average gain.....do	250	177	135	150
Average quantity of feeds per steer (exclusive of pasture):				
Wheat.....pounds	1,477	735	----------	----------
Salt.....do	5	4	1	2
Value of feed (exclusive of pasture) per steer.....dollars	18.51	9.22	0.01	0.02
Value of range per steer.....do	4.16	4.16	4.16	4.16
Total value [2].....do	22.67	13.38	4.17	4.18
Sales weight per steer.....pounds	915	845	799	797
Sales price per 100 pounds.....dollars	7.50	6.50	5.72	5.84
Sales value per steer.....do	68.62	54.92	45.70	46.54
Shrinkage per steer.....percent	4.4	3.9	5.3	5.9
Dressing percentage (hot and sales weight)	55.61	58.43	----------	----------
Grade scores at close of experiment: [3]				
Feeder	----------	----------	77.50	76.04
Slaughter	78.81	76.25	----------	----------
Carcass	79.28	74.17	----------	----------

[1] 1 steer died; data not used.
[2] At the following prices: Range, $0.033 per head daily; wheat, $1.25 per 100 pounds; salt, $20 per ton.
[3] See footnote 3, table 3.

The cost of summering group 1 was the largest of any of the 3 years and more than five times that of either group 3 or 4. For this year the feed costs of all the groups more nearly approached those of the second year than of the first year.

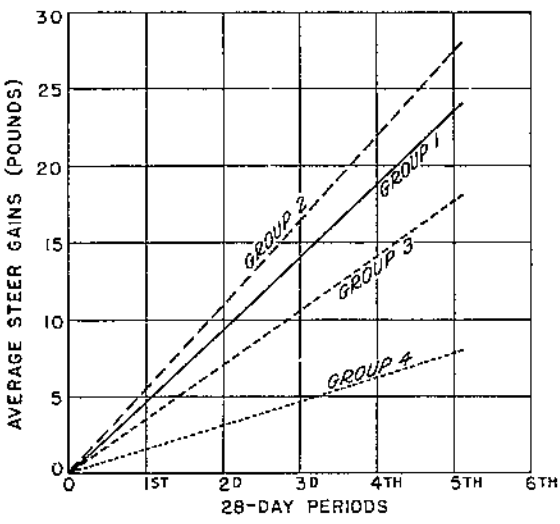

FIGURE 8.—Average steer gains for three experiments, winters of 1933–34 to 1935–36. (For description of groups, see legend of figure 4.)

AVERAGE RESULTS

WINTER EXPERIMENTS

The average results of the winter feeding experiments are presented in table 8 and figure 8. They show that steers wintered on the range and fed a supplement of 0.78 pound of cottonseed cake per head daily made significantly greater winter gains than similar steers win-

tered on the range and fed no grain supplement. Steers fed slightly more than 13 pounds of straw and approximately 1 pound of cottonseed cake per head daily, in the dry lot, gained only slightly less than the steers on the range fed cottonseed cake, and about one-third more than steers on the range fed a supplement of slightly more than 1½ pounds of chopped ear corn. However, this difference was not statistically significant.

TABLE 8.—*Summary of three winter feeding experiments, 1933–34 to 1935–36 (142.3 days)* [1]

Item	Group 1, fed 13.11 pounds daily of straw and 0.97 pound of cottonseed cake in feed lot	Group 2, fed 0.78 pound daily of cottonseed cake on range	Group 3, fed 1.51 pounds daily of corn on range	Group 4, on range and fed no grain supplement [2]
Steers.....number	40	40	41	26
Average initial weight.....pounds	734	733	737	690
Average final weight.....do	758	761	755	698
Average gain.....do	24	28	18	8
Average quantity of feed per steer:				
Straw.....do	1,863	13.4	9.3	14.6
Cottonseed cake.....do	138	112		
Corn.....do			215	
Salt.....do	9.5	4.7	4.3	2.3
Alfalfa hay.....dollars		31.3	30.5	48.1
Value of feed per steer.....dollars	10.49	1.92	2.19	0.38
Value of range per steer.....do		4.70	4.70	4.74
Total value of feed (range and supplement).....dollars	10.49	6.62	6.89	5.12

[1] Straw and hay were fed, when needed, to all groups in equal quantities; variations were due to length of time of feeding.
[2] Results obtained only from 1934–35 and 1935–36.

All groups kept on the range averaged $4.28 per head lower in wintering costs than the group kept in the dry lot. This difference is significant.

There was essentially no difference in wintering costs between the groups fed supplements of cottonseed cake and corn. The wintering cost of the group fed no grain supplement on the range was $1.50 and $1.77 lower, respectively, than the wintering costs of the groups fed the supplements of cottonseed cake and corn, but the differences were not statistically significant.

SUMMER GRAZING EXPERIMENTS

The average results of the three summer grazing experiments are shown in table 9. The average rate of steer gain throughout the summer grazing season is shown graphically in figure 9.

Analysis of variance shows that there was a statistically significant difference in average steer gains among all groups with the exception of groups 3 and 4, handled on the range without supplement. However, the steers in group 4, under the alternate system of grazing, averaged 20 pounds more gain per steer than those in group 3, on the contin-

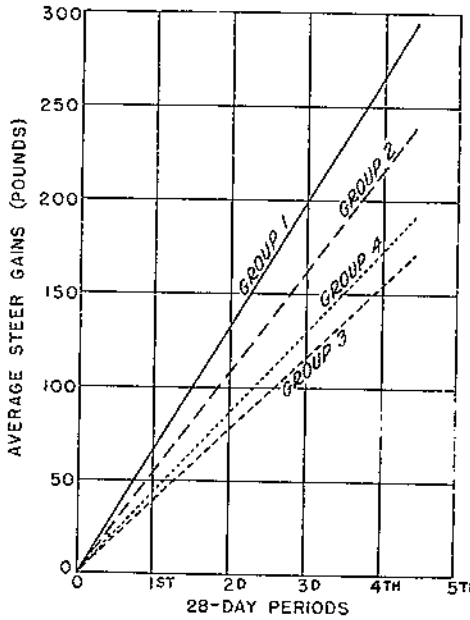

FIGURE 9.—Average steer gains for three experiments, summers of 1934 to 1936. (For description of groups, see legend of figure 3.)

uously grazed range, but the variations in gain within these groups were great enough to prevent this difference from being significant.

Although the feed costs were materially higher for groups 1 and 2, receiving grain in addition to grass, yet the sales prices for these groups were increased $1.21 per 100 pounds of live weight over the prices for the strictly grass-fed cattle. There were no significant differences among any of the groups in shrinkage in transit, nor in slaughter and carcass grades and dressing percentage between the supplement-fed groups, nor in feeder grades between the two strictly range groups.

TABLE 9.—*Summary of summer grazing experiments, 1934 to 1936 (124.7 days)*

Item	Group 1, on range and fed 10.42 pounds of grain per day for 124.7 days	Group 2, on range and fed 9.66 pounds of grain per day after first 56 days	Group 3, on range continuously grazed 124.7 days	Group 4, on range alternately grazed 124.7 days
Steers—number	21	22	24	48
Average initial weight—pounds	764	758	764	760
Average final weight—do	1,060	996	936	952
Average gain—do	296	238	172	192
Average quantity of feeds per steer (exclusive of pasture):				
Grain—pounds	1,299	976		
Salt—do	7.4	6.5	3.2	2.0
Value of feed (exclusive of range) per steer—dollars	15.11	7.95	.03	.03
Value of range per steer—do	4.11	4.11	4.11	4.11
Total value—do	19.22	12.06	4.14	4.14
Sales weight per steer—pounds	987	935	857	866
Sales price per 100 pounds—dollars	7.38	7.09	6.01	6.02
Sales value per steer—do	72.84	66.29	51.50	52.04
Shrinkage per steer—percent	6.9	6.1	8.4	9.0
Dressing percentage (hot and sales weight)	57.6	58.5		
Grade scores at close of experiment: [1]				
Feeder			73.47	74.44
Slaughter	76.75	74.21		
Carcass	74.38	71.82		

[1] See footnote 3, table 3.

SUMMARY AND CONCLUSIONS

Experiments were carried on at the Ardmore Field Station, Ardmore, S. Dak., to compare results obtained from wintering steers on the range with supplements and in the dry lot, and to determine also the comparative results from handling steers during the summer on native range with and without a grain supplement. These experiments began with the winter of 1933–34 and extended through 3 successive years, ending with the summer grazing season in September 1936. Good grade Hereford steers, approximately 1½ years of age at the beginning of the wintering experiments, were used each year.

In the wintering experiments, one group was fed cottonseed cake and straw in the dry lot for each of the 3 years. One group was carried on the range supplemented with cottonseed cake and another with chopped ear corn, for the three experiments. During the last 2 years, an additional group was handled on the range and fed no grain supplement.

The average winter feed cost for the three groups handled on the range was 40 percent less than that for the group wintered in dry lot.

Within the range groups there was little difference in winter gains and feed costs between groups 2 and 3, fed cottonseed cake and corn, respectively, but the feed cost per steer for group 4, kept on the range and fed no grain supplement, was $1.63 less than the average for the other two range-wintered groups.

It may, therefore, be concluded that under such conditions as were experienced at the Ardmore Field Station during these experiments and with the prices of feeds and range used herein, cattle may be wintered on the range satisfactorily with comparatively small quantities of grain or roughage and significantly more economically than in the feed lot on a moderate ration of native roughage and cottonseed meal. In years of normal rainfall and vegetation, if range such as is found at the station is reserved for winter use, the feeding of supplements to steers during the winter may be limited to the days of extremely cold weather or when the vegetation is snow-covered.

The groups of steers used in the wintering experiments were used the following summer in grazing experiments. Grain was fed to two groups—throughout the grazing season to one, and after the first 56 days of the grazing season to the other. The other two groups were carried on the range without supplement, one group using the range continuously, and the other grazing each half alternately every 28 days.

Under the range conditions prevailing during the years of these experiments and with uniform rate of stocking the summer grazing studies showed rather conclusively that the gains of steers on native range such as is found at the Ardmore Field Station can be materially increased by the feeding of a grain supplement. They also showed that under the conditions of these experiments and with the prices of feed and range used, the increased cost of gains due to the use of supplemental feed can be more than offset by the increased sales value of the steers as a result of more finish. Feeding grain to steers on grass made it possible to develop feeders into acceptable slaughter cattle, whereas the steers on range only were suitable for sale as feeders.

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U. S. GOVERNMENT PRINTING OFFICE: 1938

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