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Wintering Calves with Alfalfa Hay or Prairie Hay

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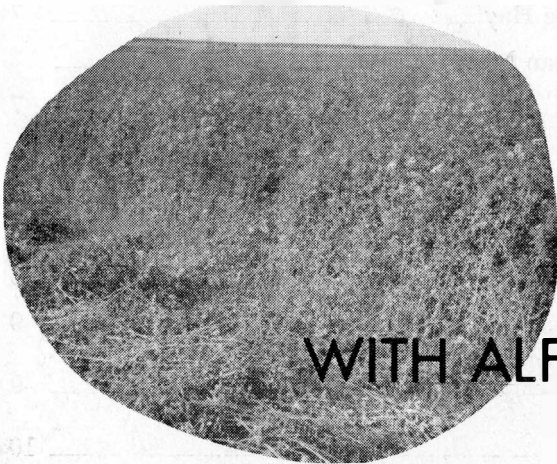
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ANIMAL HUSBANDRY AND BIOCHEMISTRY DEPARTMENTS

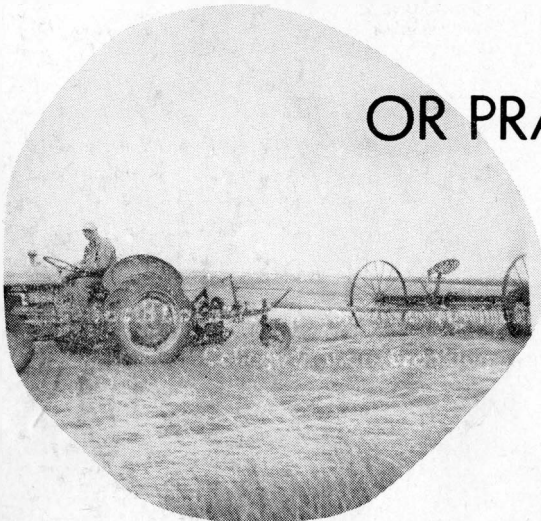
AGRICULTURAL EXPERIMENT STATION

SOUTH DAKOTA STATE COLLEGE, BROOKINGS

wintering calves



WITH ALFALFA HAY



OR PRAIRIE HAY

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Wintering Calves

with

Alfalfa Hay or Prairie Hay

By L. B. EMBRY, A. C. DITTMAN, and G. F. GASTLER¹

Alfalfa hay and prairie hay are among the important roughages available for winter feeding of cattle in South Dakota. One major difference between the two feeds is the protein content. Many samples of alfalfa hay analyzed at this station contained 16% or more protein, air-dry basis. Good quality prairie hay usually contains about 7 to 8% protein. When harvesting is delayed until late summer, the protein content may be much lower.

Calves can be wintered in a thrifty and healthy condition on roughages alone when they get enough protein, minerals, and vitamins. Prairie hay is generally too low in protein for satisfactory wintering of calves. On the other hand, alfalfa hay nearly always furnishes a surplus of protein when it is fed in liberal amounts. Since protein is often deficient in winter rations, many farmers and ranchers probably do not give due consideration to the production and use of alfalfa.

Alfalfa hay has been recognized for many years as being a high-

quality roughage for cattle. However, some cattle feeders in the state prefer prairie hay over alfalfa hay.

The experiment reported here was designed to compare the performance of calves wintered on (1) alfalfa hay alone, (2) a mixture of alfalfa hay and prairie hay, (3) prairie hay and soybean meal pellets, and (4) prairie hay alone. In addition to these comparisons, some studies were made on the effect of winter gains on summer performance of the calves when grazing native prairie pasture.

The primary objectives of the experiment were to compare the performance and determine the relative economy of wintering calves on alfalfa hay and prairie hay. Winter feed costs of calves may be considered on the basis of cost per unit of gain or on the basis of total cost per head during the winter.

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Cost per unit of gain is an important consideration for calves to be sold after the winter feeding period. Of course, the effect of the winter feeding system on condition of the calves and their market value will be important.

In the case of calves to be held over for further feeding, total feed cost per head, along with the effect of winter gain on subsequent pasture or dry-lot gains and when the cattle are to be ready for market, are important considerations. The feed costs for this experiment were calculated both on the basis of cost per 100 pounds of gain and cost of feed per head.

The experiment was conducted at the North Central Substation, Eureka, during the winter feeding and summer pasture seasons of 1955-56 and 1956-57.

Procedure

Cattle. Forty steer calves of good to choice quality and of uniform breeding were purchased each year of the experiment. Angus calves averaging slightly over 450 pounds were used in the 1955-56 trial. Hereford calves whose average initial weight was slightly over 425 pounds were fed during the winter of 1956-57.

The feeding trials were not started until the calves had recovered from any effects of shipping and were all on feed. This took two or three weeks. They were vaccinated against blackleg shortly after arriving at the substation, and the Herefords were dehorned shortly after the beginning of the winter feeding trial.

Housing: The calves were confined to a shed open to the south with outside lots. Each lot contained an automatic, electric waterer connected to the municipal water system. Hay mangers and mineral feeding boxes were inside the shed. The inside pens were bedded with straw as needed.

Feeds: Prairie hay was full-fed from the time the calves arrived until they were started on the experiment. They also received soybean meal pellets and oats during this time. Whole oats were fed at first and soybean meal pellets were used to gradually replace the oats with the total amount being limited to 1 pound per head daily.

Alfalfa hay was harvested locally from the same field each year. The harvesting dates were June 12 and August 23 for 1955 and June 21 and August 3 for 1956. Both the first and second cuttings were fed each year and bales of the two cuttings were alternated at feeding. The first cuttings were about 90 to 95% alfalfa, but the second cuttings contained 20 to 25% annual weeds, principally foxtail and kochia. Average protein content, on a 12% moisture basis, for the alfalfa hay used in the 1955-56 and 1956-57 trials was 15.84 and 17.36%, respectively.

Prairie hay was also obtained locally. Harvesting was done as early as possible after the needles fell from the needleandthread. The harvesting dates were August 15 and July 26 for the 1955 and 1956 crops, respectively. Composition of the prairie hay was predomi-

nantly green needlegrass, western wheatgrass, needleandthread and blue grama; all are important native grasses of the mixed prairie in the Eureka area. Several other species, including big and little bluestem, sand reedgrass, tall dropseed, slender wheatgrass, bluegrass, and forbs, were present in small amounts. Minor species were more common in the 1956 hay. The average protein content of the prairie hay, on a 10% moisture basis, for the 2 years was 6.62 and 7.07%, respectively.

The protein content for the alfalfa hay was calculated on the basis of 12% moisture and that of the prairie hay on a 10% moisture basis. These moisture values appeared to be representative of the hay when fed.

Solvent-process soybean meal pellets containing 44% protein were fed to one lot of calves (lot 3). Trace-mineralized salt and a mineral mixture composed of equal parts bone meal and trace-mineralized salt were fed free-choice to all lots.

Experimental Treatments: Four lots of 10 steer calves were started on the experiment each year and fed as follows:

- Lot 1—Alfalfa hay alone.
- Lot 2—Alfalfa hay and prairie hay mixed to provide approximately 10% protein in the total ration.
- Lot 3—Prairie hay and soybean meal pellets in amounts to provide the same amount of protein fed to lot 2.
- Lot 4—Prairie hay alone.

Hay was fed once daily in mangers inside the shed. Soybean meal pellets (lot 3) were fed once daily in a feed bunk in the outside lot.

The calves were weighed at the beginning and end of the trials and at 28-day intervals during the course of the experiment. One additional weight was taken after the first 14 days to study the effect on the calves of sudden change from a full feed of prairie hay to a full feed of alfalfa hay.

All calves started in 1955-56 completed the trial. In the 1956-57 trial, one calf in lot 3 died during the first few days of the trial. The calf appeared to have difficulty swallowing and autopsy revealed a tumor growth in the neck. This calf was not considered in the results. One calf in each of lots 2, 3, and 4 developed urinary calculi, and they were removed from the experiment. This condition was not encountered in lot 1, fed alfalfa hay alone. The gains made by these calves up to the time they were removed from the experiment were credited to the lot.

Results of the Winter Feeding Trial

The rates of gain for calves on each ration were similar for the 2 years. An average has been calculated and is shown in table 1. Since the number of days and animals differed some for the 2 years, the averages have been calculated and weighted accordingly.

Alfalfa Hay Alone: The largest gain (1.03 pounds daily) was made by the calves in lot 1, fed only alfalfa hay. At the feed prices used,

the total feed cost per calf was the greatest for this lot. However, they required the least amount of feed and had the least cost per 100 pounds of gain.

The calves fed only alfalfa hay were noticeably growthier than the calves in the other lots. However, they did not appear to have as much condition as the calves fed a mixture of alfalfa and prairie hay

(lot 2) or those fed prairie hay and soybean meal (lot 3).

The calves were full-fed prairie hay and about 1 pound per head daily of soybean meal pellets before being put on the experimental rations. This lot was changed to a full feed of alfalfa hay the day the experiment was begun. They scoured at first and had lost weight at the 14-day weighing. Calves in

Table 1. Winter Gain and Feed Efficiency of Steer Calves Fed Alfalfa Hay and Prairie Hay (Weighted Averages for 1955-56 and 1956-57 Trials)

	Lot 1 Alfalfa Hay Alone	Lot 2 Alfalfa Hay, Prairie Hay	Lot 3 Prairie Hay, Soybean Meal Pellets	Lot 4 Prairie Hay Alone
Number of Calves*	20	19.4	18.4	19.4
Number Days Fed†	152.5	152.5	152.5	152.5
Av. Initial Wt., lbs.	442	442	445	442
Av. Winter Gain, lbs.	157	111	113	47
Av. Daily Gain, lbs.	1.03	0.73	0.74	0.31
Av. Daily Ration Fed, lbs.				
Alfalfa Hay	14.2	4.1		
Prairie Hay		9.5	12.7	13.2
Soybean Meal Pellets			1.1	
Salt-bone Meal Mix	0.033	0.030	0.041	0.037
Trace-Mineralized Salt	0.027	0.029	0.031	0.031
Feed Per 100 lbs. Gain, lbs.				
Alfalfa Hay	1383	563		
Prairie Hay		1301	1721	4247
Soybean Meal Pellets			149.3	
Salt-bone Meal Mix	3.22	4.17	5.55	11.74
Trace-Mineralized Salt	2.62	3.98	4.15	9.78
Percent Protein in Ration‡	16.60	9.77	9.80	6.84
Feed Cost Per 100 lbs. Gain, \$\$	17.47	20.29	22.73	43.12
Winter Feed Cost Per Head, \$	27.36	22.58	25.62	20.44

*No losses occurred in 1955-56 trial. In 1956-57, one calf in lot 3 died a few days after starting the trial and was not considered in the results. One calf in each of lots 2, 3, and 4 developed urinary calculi in the 1956-57 trial and were removed from the experiment. The gains made by these calves up to the time they were removed were credited to the lots. This accounts for the fractional number of calves.

†Dates of trials: November 16, 1955 to April 19, 1956, and November 30, 1956, to April 29, 1957.

‡Air-dry basis.

§Feed prices per ton: alfalfa hay, \$25; prairie hay, \$20; soybean meal pellets, \$70; trace-mineralized salt, \$50; and bone meal, \$90.

the other lots made some gain during this time. No change was made in the feeding system, and the calves fed only alfalfa hay showed a gain at all other weigh periods. Their feces were considerably looser than those of the other lots throughout the trials and more bedding was used for them. No trouble from bloat was encountered in either year from feeding alfalfa hay.

Alfalfa Hay and Prairie Hay:

The calves in this lot were full fed hay but allowed a maximum of 10% refused feed. This seemed advisable since complete consumption could not be obtained without severely restricting the amount offered. These calves were offered nearly as much hay as those in lot 1, but those in lot 1 refused very little hay.

The average daily gain for this lot of calves for the two trials was 0.73 pound. They looked thrifty and had a desirable amount of condition for turning to pasture. These calves were fed an average of 4.1 pounds of alfalfa hay and 9.5 pounds of prairie hay daily. Feeding the limited amount of alfalfa hay resulted in a lower rate of gain and a more expensive gain than for calves fed alfalfa hay alone. However, using more of the cheaper prairie hay gave a lower winter feed cost per head than did alfalfa hay in lot 1.

Prairie Hay and Soybean Meal:

The rate of gain for the calves fed prairie hay and soybean meal pellets was about the same as for those fed a mixture of alfalfa and prairie

hay. They were also allowed a 10% refusal on hay. The pounds of hay plus pellets fed during the two trials were about the same as the pounds of hay fed in lot 2. These calves were similar in condition and appearance to those fed a mixture of alfalfa and prairie hay. With the feed prices used in table 1, feeding prairie hay and soybean meal pellets resulted in more expensive gains, both in cost per 100 pounds of gain and winter feed cost per head, than feeding alfalfa hay and prairie hay at the same protein level.

Prairie Hay Alone: Calves fed only prairie hay with 6.62% protein in 1955-56 and 7.07% protein in 1956-57 made an average daily gain of 0.31 pound each year. The amount of feed offered was only slightly less than for the other lots, and the calves were limited to the same amount of refused hay as the other calves.

The calves in this lot were noticeably smaller than calves in the other lots, but they appeared to be carrying as much condition as the calves fed only alfalfa hay in lot 1. The feed required per 100 pounds of gain was considerably higher in this lot than for the other calves. This gave a rather expensive gain, but the cheaper hay resulted in the lowest winter feed cost per head.

Performance on Pasture

Native pasture was available at the North Central Substation to graze cattle each year of the experiment. In order to get more information on the effect of winter gains

on summer gains, the high (alfalfa hay alone) and the low (prairie hay alone) gaining lots during the winter were used each summer.

The winter trials were terminated about mid- to late April so two lots of the steers could be used in other experiments at Brookings. Pastures at Eureka had not made sufficient growth to begin grazing until the middle or latter part of May. The two lots of steers were fed alike in dry lot between the end of the winter trials and the beginning of the pasture season. They were full-fed a mixture of alfalfa and prairie hay and about 1 pound of soybean meal pellets per head daily during this period. Hay feeding was rather liberal and there was considerable waste, but in this way damaged and poor-quality hay not suitable for experimental purposes was utilized. Only rough estimates were made on the amount of hay fed. Therefore, feed requirements are not reported for

this period. The gains are included with the pasture results.

The steers were pastured as a group. Water was supplied in a tank and they had free access to bone meal and salt. About 70 acres of pasture were grazed until September when another pasture of about equal size was used. In 1956 the steers were allowed free access to a stack of prairie hay in the pasture. An estimated 8 tons of this hay was consumed by the 19 steers.

Results of the Pasture Trials

Results of the pasture trials are presented in table 2. Some results of the winter trials are included in the table for ease in comparing the effects of winter gains on pasture performance.

Winter Alfalfa Hay Lot: The calves fed alfalfa hay during the winter made an average daily gain of 1.41 pounds for the two summers. Their average total winter and summer gain was 378 pounds

Table 2. Gains on Native Pasture by Steers Wintered on Alfalfa Hay or Prairie Hay Alone (Weighted Averages for 1956 and 1957 Trials)

	Winter Treatment	
	Lot 1 Alfalfa Hay Alone	Lot 2 Prairie Hay Alone
Total Number of Steers.....	20	19
Summer Treatment Days*.....	157	157
Av. Winter Gain, lbs.	157	47
Av. Final Winter Wt., lbs.....	598	489
Av. Final Summer Wt., lbs.....	820	760
Av. Summer Gain, lbs.....	221	272
Av. Daily Summer Gain, lbs.....	1.41	1.73
Total Winter and Summer Gain, lbs.....	378	319

*Both lots were taken off winter trial April 19 and put on pasture May 22 in 1956. They were taken off winter trial April 29 and put on pasture May 16 in 1957.

with an average weight off pasture of 820 pounds.

Winter Prairie Hay Lot: This lot gained an average of only 0.31 pound daily during the winter, but they made an average daily summer gain of 1.73 pounds for the two summers. Their average summer gain was 272 pounds, or 51 pounds more than the alfalfa hay lot.

The calves fed alfalfa hay gained an average of 110 pounds more per calf during the winter trials than those fed prairie hay. However, the more rapid gains made by the winter prairie hay lot during the pasture season reduced the difference in the total winter and summer gains to 59 pounds. This is still a large difference in favor of the alfalfa hay.

Discussion of the Results

The calves fed only alfalfa hay consumed the most feed and made the greatest and most efficient gains. There was very little hay refused by these calves in comparison to about 10% refusal by the calves in the other lots. Greater total consumption of hay no doubt influenced the gains. The alfalfa hay lot also received a ration with the highest level of protein. The protein level in the rations composed of alfalfa and prairie hay or prairie hay and soybean meal pellets may not have been high enough for maximum gains. Other experiments are in progress to determine optimum protein requirements for wintering calves.

The calves in lot 2, fed alfalfa hay and prairie hay, and in lot 3, fed prairie hay and soybean meal,

gained at about the same rate on nearly the same amount of total feed over the 2-year period. The results indicate little difference between these two rations, and the choice should depend on the availability and cost of the feeds. On the basis of feed required per 100 pounds of gain, 100 pounds of alfalfa hay was equal to 75 pounds of prairie hay plus 26 pounds of soybean meal pellets. In other words, 4 pounds of alfalfa hay in the ration replaced approximately 3 pounds of prairie hay and 1 pound of soybean meal pellets. Based on the above feed replacement equation, the alfalfa hay had a value of \$33.20 per ton when prairie hay costs \$20 and soybean meal \$70 per ton.

A comparison of results between lots 2 and 3 indicates that neither alfalfa hay nor soybean meal had any special nutritional value over the other as supplement to prairie hay. Both were excellent protein supplements and resulted in a considerable increase in rate of gain over prairie hay alone (lot 4).

Normally a high-protein feed has its greatest feeding and economic value when fed at a level to meet the protein needs of livestock. In this experiment, alfalfa hay alone resulted in the highest rate of gain. The protein furnished by this ration was considerably in excess of that generally recommended for wintering calves for gains of about 0.75 to 1.0 pound daily. The protein level fed in the rations for lots 2 and 3 may not have been high enough for maximum gains at the

level of feeding used. Alfalfa hay furnishes more energy than prairie hay which, along with the greater consumption of the alfalfa, also may account for the better gains. In this experiment, based on the prices of \$70 per ton for soybean meal and \$20 per ton for prairie hay, alfalfa hay had about as high a value when used as the only feed (lot 1) as when used as a protein supplement with prairie hay (lot 2).

Winter gains and feed costs are most important from the standpoint of their influence on total cost and the time it takes to produce cattle for slaughter. Cattle that have been subjected to restricted feeding and low rates of gains have been shown to make more rapid and more economical gains than non-restricted animals when placed on a liberal ration. The two winter lots of steers, alfalfa hay alone and prairie hay alone, grazed on native pasture at the North Central Substation during the summer provided some additional information on this problem.

During the winter months, the calves fed alfalfa consumed an average of 2,165 pounds of hay each year and made an average gain of 157 pounds. The calves fed prairie hay consumed an average of 2,013 pounds of hay and made an average gain of 47 pounds. The gain per ton of hay was 145 and 47 pounds, respectively, or a difference of 98 pounds per ton in favor of the alfalfa hay.

Since the calves wintered on prairie hay gained faster during the summer, the difference in total

winter and summer gain was reduced to 59 pounds at the end of the pasture season. The difference in total winter and summer gain per ton of hay fed during the winter was only 32 pounds in favor of the alfalfa hay lot. Thus the value of alfalfa hay compared to prairie hay was considerably lower after the grazing season than after the winter feeding period. However, the difference in the summer feed consumption between the two groups was not determined.

If less alfalfa hay were fed, a rate of gain similar to full feeding prairie hay could be obtained. This would be a means of conserving feed in time of shortage, yet calves could be wintered in a thrifty and healthy condition. Experiments are in progress to study the effects of restricting gains during the winter months by limiting the protein intake and limiting the total feed consumption on a ration adequate in protein. The effects on subsequent performance and total feed requirements to produce slaughter cattle are being studied.

Summary

Four lots of steer calves were wintered at the North Central Substation at Eureka in 1955-56 and 1956-57. The following rations were fed: (1) alfalfa hay alone, (2) alfalfa hay and prairie hay mixed to provide approximately 10% total protein in the ration, (3) prairie hay and soybean meal in amounts to provide approximately 10% protein in the ration, and (4) prairie hay alone. The protein con-

tent of the alfalfa hay on an air-dry basis for the 2 years of the experiment was 15.84 and 17.36%. Prairie hay used in the two trials contained 6.62 and 7.07% protein, air-dry basis.

Average daily winter gains for the four rations in the order listed above were 1.03, 0.73, 0.74, and 0.31 pounds in the two trials. Average daily rations were alfalfa hay alone, 14.2 pounds; alfalfa hay, 4.1 pounds, and prairie hay, 9.5 pounds; prairie hay, 12.7 pounds, and soybean meal pellets, 1.1 pounds; and prairie hay alone, 13.2 pounds. The calves were fed all the hay they would consume, allowing about 10% refusal. However, there was only a small percentage of refused feed in the alfalfa hay lot.

The calves scoured when first put on a full feed of alfalfa hay and lost some weight by the end of 2 weeks. However, they showed gains in weight at all other weighings. The feces of calves in this lot were looser than for calves in the other lots throughout the trials and they required more bedding. No trouble was encountered from bloat by feeding alfalfa hay.

Calves fed a mixture of alfalfa hay and prairie hay or prairie hay and soybean meal pellets (protein level of both rations about equal) consumed approximately the same amount of total feed and made nearly the same rate of gain. Alfalfa hay and soybean meal were equally

effective protein supplements to prairie hay. Four pounds of alfalfa hay had a feed replacement value of about 1 pound of soybean meal and 3 pounds of prairie hay.

Calves fed prairie hay alone gained at a slow rate but appeared in a thrifty and healthy condition after the winter feeding period. This ration resulted in the most expensive feed cost per 100 pounds of gain but the cheapest winter feed cost per head.

The average summer pasture gain for 2 years was 1.73 pounds daily for the prairie hay lots and 1.41 for the alfalfa hay lots. A difference of 110 pounds in average winter gain between these two lots was reduced to 59 pounds at the end of the summer grazing season. The difference in gain per ton of alfalfa hay and prairie hay was 98 pounds at the end of the winter feeding period but only 32 pounds at the end of the pasture season.

Results show alfalfa hay is an excellent feed and protein supplement for wintering calves. The results also indicated calves wintered to gain about 0.3 pound daily during the winter remained in a thrifty and healthy condition, and they made rapid and efficient gains when put on pasture the following summer. However, the total winter and pasture gain was 59 pounds less than for calves which gained about 1 pound daily when fed only alfalfa hay during the winter.

TWO WINTER FEEDING TRIALS WITH STEER CALVES GAVE THE FOLLOWING RESULTS:

Alfalfa hay alone

1. An average daily gain of 1.03 pounds when fed at rate of 14.2 pounds.
2. A gain of 145 pounds per ton of hay fed.
3. A feed cost of \$17.47 per 100 pounds of gain and of \$27.36 per calf for the winter feeding period.

Alfalfa hay and prairie hay

1. An average daily gain of 0.73 pound when fed at the rate of 4.1 pounds of alfalfa hay and 9.5 pounds of prairie hay.
2. A gain of 107 pounds per ton of hay fed (603 pounds of alfalfa and 1,397 pounds of prairie hay).
3. A feed cost of \$20.29 per 100 pounds of gain and of \$22.58 per calf for the winter feeding period.
4. A feed replacement value for alfalfa hay of 4 pounds of alfalfa hay equal to 3 pounds prairie hay and 1 pound of soybean meal when compared to calves fed prairie hay and soybean meal pellets (both rations about 10% protein).

Prairie hay and soybean meal pellets

1. An average daily gain of 0.74 pound when fed at the rate of 12.7 pounds of prairie hay and 1.10 pounds soybean meal pellets.
2. A gain of 117 pounds per ton of hay when 173 pounds of soybean meal pellets were fed with each ton of hay.
3. A feed cost of \$22.73 per 100 pounds gain and of \$25.62 per calf for the winter feeding period.

Prairie hay alone

1. An average daily gain of 0.31 pound when fed at the rate of 13.2 pounds.
2. A gain of 47 pounds per ton of hay fed.
3. A feed cost of \$43.12 per 100 pounds of gain and of \$20.44 per calf for the winter feeding period.

Summer pasture phase

1. Calves wintered on alfalfa hay alone and which gained 1.03 pounds daily made an average daily gain of 1.41 pounds during the summer on native pasture.
2. Calves wintered on prairie hay alone which gained 0.31 pound daily made an average daily gain of 1.73 pounds during the summer on native prairie pasture.
3. Total winter and summer gain was 59 pounds more per calf for those fed alfalfa hay than for those fed prairie hay during the winter.

All the rations used in this experiment may have a place in winter feeding of calves. The supply of feeds on the farm or ranch, market value of feeds and cattle, subsequent feeding systems that will be followed, and when the cattle will be sold are some factors affecting the choice of ration. The results of this experiment give the amount of feeds needed and the gains that may be obtained with the various rations.