

# The Agricultural Experiment Station

OF THE

Colorado Agricultural College

---

---

PART I.

CARRYING RANGE STEERS THROUGH THE WINTER.

PART II.

SUGAR BEETS FOR FATTENING STEERS.

BY

W. L. CARLYLE

AND

G. E. MORTON.

---

# The Agricultural Experiment Station

FORT COLLINS, COLORADO

## THE STATE BOARD OF AGRICULTURE

TERMS  
EXPIRE

HON. B. F. ROCKAFELLOW, - - - - -	Canon City,	1911
HON. E. H. GRUBB, - - - - -	Carbondale,	1911
HON. R. W. CORWIN, - - - - -	Pueblo,	1913
HON. A. A. EDWARDS, <i>President</i> - - - - -	Fort Collins,	1913
HON. F. E. BROOKS, - - - - -	Colorado Springs,	1915
HON. J. L. BRUSH, - - - - -	Greeley,	1915
HON. J. C. BELL, - - - - -	Montrose,	1917
HON. E. M. AMMONS, - - - - -	Littleton,	1917

GOVERNOR JOHN F. SHAFROTH - - - } *Ex-Officio.*  
THE PRESIDENT OF THE COLLEGE - - - }

L. M. TAYLOR, SECRETARY,

G. A. WEBB, TREASURER

## EXECUTIVE COMMITTEE IN CHARGE

A. A. EDWARDS, *Chairman*

J. L. BRUSH

E. M. AMMONS

## STATION STAFF

L. G. CARPENTER, M. S., <i>Director</i> , - - - - -	IRRIGATION ENGINEER
C. P. GILLETTE, M. S., - - - - -	ENTOMOLOGIST
W. P. HEADDEN, A. M., Ph. D., - - - - -	CHEMIST
WENDELL PADDOCK, M. S., - - - - -	HORTICULTURIST
G. H. GLOVER, M. S., D. V. M., - - - - -	VETERINARIAN
ALVIN KEYSER, A. M., - - - - -	AGRONOMIST
J. O. WILLIAMS, B. S. A., <i>U. S. Expert in charge</i> -	HORSE BREEDING
W. G. SACKETT B. S., - - - - -	BACTERIOLOGIST
P. K. BLINN, B. S., FIELD AGENT, ARKANSAS VALLEY, ROCKY FORD	
R. E. TRIMBLE, B. S., - - - - -	ASSISTANT IRRIGATION ENGINEER
F. C. ALFORD, M. S., - - - - -	ASSISTANT CHEMIST
EARL DOUGLASS M. S., - - - - -	ASSISTANT CHEMIST
S. ARTHUR JOHNSON, M. S., - - - - -	ASSISTANT ENTOMOLOGIST
B. O. LONGYEAR, B. S., - - - - -	ASSISTANT HORTICULTURIST
E. R. BENNETT, B. S., - - - - -	POTATO INVESTIGATIONS
MIRIAM A. PALMER, - - - - -	ARTIST
L. C. BRAGG, - - - - -	ASSISTANT IN ENTOMOLOGY

## STATE FRUIT INVESTIGATIONS

O. B. WHIPPLE, B. S., GRAND JUNCTION, -	FIELD HORTICULTURIST
GEORGE P. WELDON, B. S., DELTA, -	FIELD ENTOMOLOGIST

PART I  
CARRYING RANGE STEERS THROUGH THE WINTER  
W. L. CARLYLE and G. E. MORTON

---

INTRODUCTION

Cattlemen are at variance in their opinions as to whether range steers should be winter fed as calves and as yearlings, when they are to be carried over for fattening as two-year-olds. And an equal divergence of opinion exists as to whether it is wise to carry steers to that age before finishing. The experiment detailed in PART I of this bulletin was outlined by Prof. W. L. Carlyle in 1905 and carried out under his direction until its completion in 1908. Professor J. A. McLean and the writer, who succeeded him, carried out the winter feeding work with the steers. The writer is the only one of these three at hand at the publication of the bulletin, and as he did not see the first two years of the experiments, he finds it difficult to make as thorough a write-up as he would like. The data presented is sufficient, however, to indicate the answers to one or two questions concerning winter feeding of store steers.

PLAN OF THE EXPERIMENT

In the fall of 1905, 20 head of representative steer calves were secured from the herds of W. H. Gerdts, Cope, Colo.; E. M. Ammons, Littleton, Colo., and I. B. Griffith, New Castle, Colo. These calves were Hereford grades, and were brought to the College for winter feeding. A like number of representative steers of the same crop were brought to the College from these herds in the fall of 1906, and again a like number in the fall of 1907, with the exception that the five head from Mr. Griffith's herd were not secured in 1907, because of shipping difficulties.

Each summer the steers, which had been winter fed at the College, were turned out upon enclosed range, owned by the College and located on the foot hills west of Fort Collins.

In this way some of the steers were winter fed as calves, as yearlings, and as two-year-olds; some were fed as yearlings and as two-year-olds; and some fed only as two-year-olds.

Again, some of the steers fed as calves were finished off as yearlings, while others were not marketed until they were twos.

The following table shows the weights and gains made by the steers each season:

## AVERAGE WEIGHTS AND GAINS OF ALL STEERS FOR EACH SEASON

	Average Weight Fall of 1905	Average Weight Spring of 1906	Average Gain Winter 1905-06	Average Weight Fall of 1906	Average Gain Summer 1906	Average Weight Spring of 1907	Average Gain Winter 1906-07	Average Weight Fall of 1907	Average Gain Summer 1907	Average Weight Spring 1908	Average Gain Winter 1907-08
Steers Fed as Calves, 20 Head.....	404	663	259	804	141	1094	290	1145	x62	1368	223
Steers Fed as Yearlings, 20 head.....				664		984	320	1046	*95	1407	361
Steers Fed as Two-Year-Olds, 15 Head.....								911		1146	235

x The average weight of six head which were kept over, their average weight in the spring of 1907 being 1083 pounds. The other 14 head were sold in the spring of 1907, average weight 1099 pounds.

\* The average weight of the 14 head which were kept over, their average weight in the spring of 1907 being 951 pounds. The other six head were sold in the spring of 1907.

In discussing the table, we will first take up this question:

*If you expect to feed steers out at two years of age, does it pay to winter feed them either as calves or as yearlings?*

The steers fed during the third winter only—the winter during which they were fitted for market—gained 235 pounds per head and weighed 1146 pounds, while those fed the second and third winters, gained 361 pounds the third winter and weighed 1407 pounds. The latter not only weighed 261 pounds per head more because of their previous feeding, but were in better shape to put on good gains the winter they were finished out, putting on 126 pounds per head more weight than the steers fed the third winter only. Another point in their favor was that the extra weight was in fat rather than in frame, as they were valued at the close of the third winter, when ready for market, at \$6.20 per cwt, while the steers fed the third winter only, were valued at \$5.75 per cwt. These valuations were made by Mr. Henry Gebhardt, of Denver, without knowledge of what lots the steers were from.

Mr. Gebhardt, at the same time, placed a valuation of \$6.10 upon the steers brought in to the College in the fall of 1905 and fed all three winters. These steers made a gain of only 223 pounds per head the third winter,—less than either of the other lots; and they showed an average weight of 1368 pounds per head, or 39 pounds per head less than the steers that were not winter fed as calves, and 222 pounds per head more than the steers that were not winter fed either as calves or yearlings. These results plainly show that winter feeding the calves was not profitable when the steers were to be held over to be finished off as two-year-olds, for the lot that were not winter fed as calves, but were fed the two succeeding winters, not only made the largest gain during the last winter, but showed the heaviest average weight, and were in best market condition.

We can state then, so far as the gains made by these steers are concerned, that when the aim in view was to finish the steers as two-year-olds, the feed put into them as calves was wasted, but feeding them the winter they were yearlings put them in shape to make better gains the next winter and made better market steers of them. This result does not coincide with the view of those cattlemen, who believe that if only one winter's feed is to be given previous to the winter of finishing, that feed should be given the calves in order to retain upon them their baby flesh. But a study of the weights and gains of the steers brought in as calves will bring out the reason, I believe, for the poor showing made by these steers the third winter.

**WEIGHTS AND GAINS OF STEERS FED THREE WINTERS AND  
THOSE FED TWO WINTERS**

Weight	Steers Fed Each Winter		Steers Fed Two Winters	
	Weight	Gain	Weight	Gain
Fall of 1905 (Calves).....	404			
Spring of 1906.....	663	259		
Fall of 1906.....	804	141	664	
Spring of 1907.....	1094	290	984	320
Fall of 1907.....	1145	62	1046	95
Spring of 1908.....	1368	223	1407	361

You will note the heavy gain put on by the calves during the first winter's feeding—almost as much as they put on the next winter as yearlings. As a consequence, they weighed, the fall that they were yearlings, 140 pounds per head more than the steers of the same crop brought in from the range as yearlings. The next spring they were only 110 pounds heavier, the next fall 99 pounds heavier, and the spring they were marketed, 39 pounds lighter than the steers brought from the range as yearlings. This gradual decrease in the margin between the two sets of steers indicates that the winter feeding as calves hastened the steers to maturity and consequently lessened their power for gain each successive season at a rapid rate.

Another way to look at the question is to compare the gains made each year by the same lot of steers. The lot fed as calves made a gain of 400 pounds per head the first winter and succeeding summer; the next year they made 352 pounds gain per head—already starting down hill you notice—and the last winter they made a gain of only 223 pounds per head, or 36 pounds per head less than they made the winter they were calves.

Considering the year when they were one year old, they made a gain of 431 pounds as against a gain of 285 pounds when two-year-olds. And the steers that were not fed until they were yearlings made a gain of 456 pounds the year that they were twos.

**WEIGHTS AND GAINS OF STEERS OF THE DIFFERENT BRANDS**  
**All Steers are of the Same Age, Calved 1905. See Note**

	Fall 1905	Year 1905-06	Winter 1906-07 to April-2nd	Summer 1907		Winter 1907-08
				June 7thx	Oct. 26th*	
VI—1905.....				(3)		
Total (10).....	3527	7646	9930	3125	3320	4230
Average.....	353	765	993	1042	1107	1410
Average Gain.....		412	228		65	303
VI—1906.....				(6)		
Total (10).....		6857	9395	5790	6360	8390
Average.....			960	965	1060	1398
Average Gain.....		656	274		95	338
VI—1907.....						
Total (10).....					9265	11360
Average.....					927	1136
Average Gain.....						209
U—1905.....				(1)		
Total (5).....	1870	3999	5155	1210	1240	1240
Average.....	374	800	1031			
Average Gain.....		446	231		30	0
U—1906.....				(5)		
Total (5).....		2968	4218	4625	5090	7165
Average.....		594	844	925	1018	1433
Average Gain.....			250		93	415
U—1907.....						
Total (5).....					4400	5830
Average.....					880	1166
Average Gain.....						286
1—L 1905.....				(2)		
Total (5).....	2690	4398	5427	2165	2310	2740
Average.....	538	880	1085	1083	1155	1370
Average Gain.....		342	205		72	215
1—L 1906.....				(3)		
Total (5).....		3464	4455	2905	3200	4150
Average.....		693	891	968	1067	1383
Average Gain.....			198		99	316

NOTE—For convenience the steers are designated by the year during which they were brought from the range. For example U—1906 means the U—steers brought to the College from the range in the fall of 1906, the steers then being yearlings.

\*June 7th was the date upon which the steers kept over were put out to pasture.

xThe figures in brackets in this column are the number of head of steers not sold and put out on pasture June 7th.

Thus any way one wishes to look at the problem, the feeding of calves does not appear profitable if they are to be held over for finishing as two-year-olds. The amount of feed used is not considered in the discussion above, because the interpretation of results could in no way be affected by the cost of the feed, save for the general statement that the greater the cost of feed for calves, the greater would be the loss to the feeder.

## COLORADO EXPERIMENT STATION

## FEEDING TWO WINTERS OR ONE

In considering winter-feeding for two winters compared with feeding the third winter only, we must note first of all that the steers fed as yearlings weighed 261 pounds per head more at marketing than the steers fed the last winter only, and were worth 45 cents per cwt. more than the latter. They were both heavier and fatter. Whether this extra weight and fatness paid for the feed put into them as yearlings is problematic. The feed for the steers, brought to the College in different seasons was not kept separate, so that the feed per head as shown in the following table is an average for all the steers:

AVERAGE FEED AND GAIN PER HEAD  
2nd and 3rd Winters

Season Winter	Number Head	Average Weight at Close Winter	Average Gain During Winter	Feed Per Head in Pounds			Cost of Feed Per Head
				Corn	Alfalfa Hay	Sugar Beets	
1906-07...	20 (held over)	991		992	2644	1306	\$19.89
1906-07...	20 (sold)	1087		1203	2536	2270	24.04
1906-07...	40 (all)	1039	307	1138	2660	1921	22.83
1907-08...	35	1289	284	1252	2835	1998	24.60

NOTE—Price of corn, \$1.00 per hundred; price of alfalfa, \$5.00 per ton; price of beets, \$5.00 per ton.

## AVERAGE FEED AND GAIN PER HEAD 2ND AND 3RD WINTERS.

The steers denoted in the second column of this table as "held over," comprised six head of the steers fed as calves, and 14 head of those brought in as yearlings. The average feed per head for these during the second winter was 992 pounds of corn, 1306 pounds of sugar beets, and 2644 pounds of hay, or in round numbers  $\frac{1}{2}$  ton corn,  $2\frac{1}{4}$  tons of hay, and  $\frac{2}{3}$  of a ton of sugar beets. At the prices listed, this feed cost about \$20.00 per head (\$19.89). With alfalfa hay at \$10.00 per ton, the cost of feed would be raised to about \$26.00 per head.

Now for returns. Assuming that the feed during the third winter, for the two lots under discussion, was approximately equal, as assumption not out of the way, the extra income from the steers fed two winters may be credited against the first winter's feed. Referring again to Table A, we find the steers fed the second and third winters weighed 1407 pounds per head at the close. This weight at an advance of 45 cents per cwt. over the other steers, means \$6.33 credit. Then 261 pounds extra weight at \$6.20 gives \$16.18, or a total of \$22.51 to credit against the feed. And yet another item is to be taken into consideration, the College range is not good range late in the summer, which accounts for the low gains made each summer. Any range man would expect to secure larger gains than are shown by the spring and fall weights of these steers. So that with this evidence before us, I believe the winter



feeding as yearlings was a paying proposition. It is by no means proven, but the indications are strongly in that direction. With so many problems involved in this one experiment, it is difficult to make a clean cut conclusion on each issue. While we have convincing proof that the winter feeding of calves, destined to be fed each winter until sold as two-year-olds, was a losing proposition, all we can say concerning the question at issue is this: The winter feeding of yearlings destined to be fattened and sold as two-year-olds, resulted in heavier, fatter and more marketable steers; and besides producing good gains during the winter in which the feeding was done, produced residual feeding effects shown by very heavy gains the winter they were finished. And so far as we can tell from the results at hand, such feeding will ordinarily produce a profit if feeding stuffs are not too high priced.

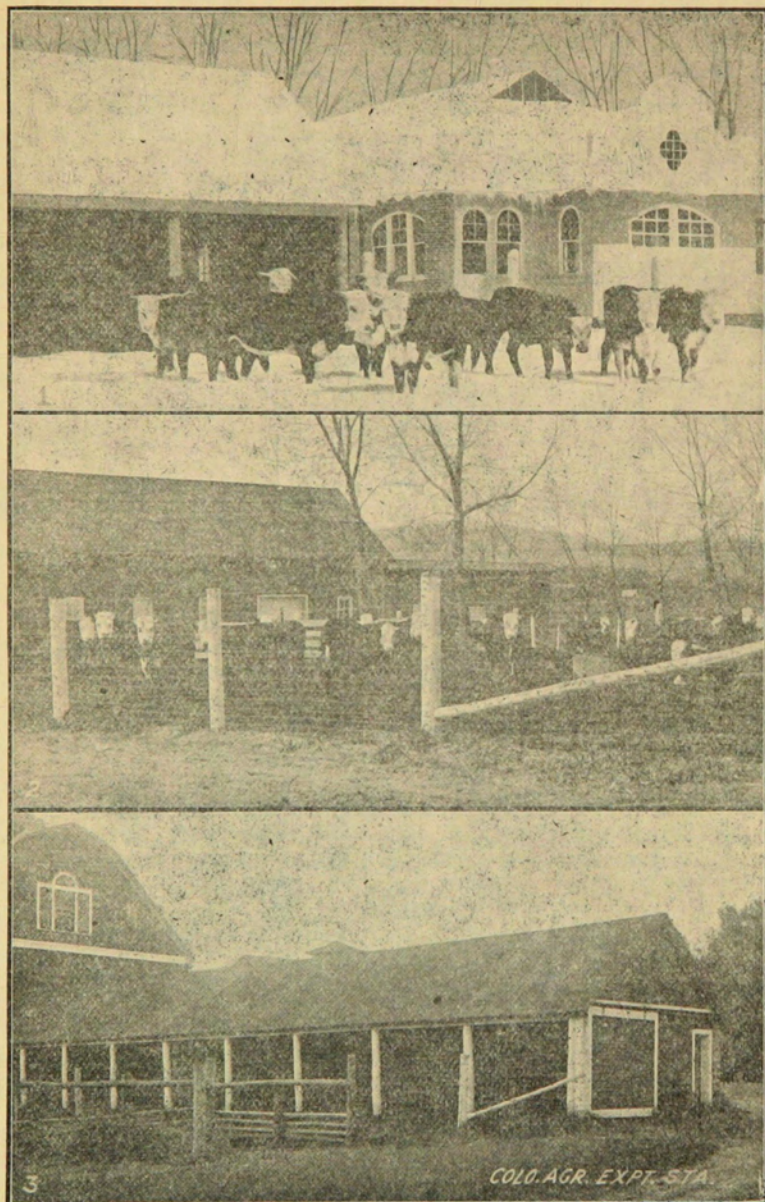
#### FATTEN YEARLINGS OR TWO-YEAR-OLDS?

But another question arises: *Does it pay better to winter feed as calves and finish as yearlings, or winter feed as yearlings and finish as twos?*

This question involves many more points than those taken up in this feeding experiment, so that it cannot be answered fully here. But we can furnish some data of use to the cattleman in figuring the problem for himself. The problem as it lies before the cattleman is this: If he fattens his steers as yearlings, he must charge all loss of cows and calves and depreciation of value in the young cows against this one year's running of the steers; while if he carries the steers two years he may distribute this charge over two years. On the other hand if he feeds as yearlings he gets cheaper gains on his steers, as one will on all young animals, and he releases his capital so that it is turned over every year instead of every other year. He does not need to make so large a profit on the yearlings, because he will make that profit twice as often.

The light which this experiment throws on that problem, consists in a definite knowledge of the gains made by steers during the different seasons as is shown in Table A.

The steers winter fed as calves made a gain during that winter and the following summer of 400 pounds; while the steers not fed until the winter they were yearlings made a gain during that winter and the following summer of 415 pounds. With practically equal gains, the calves undoubtedly put on their gain much more cheaply than the yearlings. By referring to PART II of this Bulletin it will be seen that yearlings put on their gain at about two-thirds the cost of the gain put on by two-year-olds. The second winter's feeding shows two-year-old steers weighing 1046 pounds per head in the fall, making a gain of 361 pounds per head during the winter; while yearling steers weighing 804 pounds per head made a gain of 290 pounds. The two-year-olds gained 34.6 per cent. of their live weight, while the yearlings gained 37.3 per cent. of their live weight. This again is in favor of the younger steers.



Upper picture—Steers when calves.

Centre picture—Steers coming two-year-olds.

Lower picture—Open shed in which steers slept and were fed grain.  
Hay racks in foreground.

During the winter of 1905-06 the calves were fed upon beet tops until the 15th of February, running in the fields with stock cattle. When taken from the beet fields ten head were fed a ration of four pounds daily of ground corn with alfalfa hay; while the other ten head were fed a ration of twenty pounds per head of sugar beets. Both lots made approximately the same gains, the only difference being that the lot fed beets ate somewhat less hay. For the purposes of this discussion, it is sufficient to say that the amount of feed consumed by the younger animal is less than that consumed by the older. And from this standpoint of feeding alone, it seems more economical to winter feed as calves and finish as yearlings than to winter feed as yearlings and finish as two-year-olds.

#### FINISHING YEARLINGS

*If you intend to finish steers as yearlings, is it profitable to feed them hay and grain the winter that they are calves?*

The steers winter fed as calves gained 30 pounds per head less during the winter they were yearlings, than the steers gained that were not winter fed as calves; but they averaged 110 pounds per head more in weight than the latter and sold for 25 cents per cwt. more. This offers no satisfactory conclusion without a knowledge of the cost of feed. However, the calves fed during their first winter gained 259 pounds per head that winter, and yet were only 140 pounds heavier the next fall than those not winter fed. This indicates a poor summer gain, which their gain of 141 pounds per head undoubtedly was. The steers in this experiment lost a great deal of flesh when first turned on the range and did not thrive at any time during the summer as range cattle wintered on hay would have done. The only conclusion that one can come to with the insufficient data at hand, is that whether or not there be profit in winter feeding of calves destined to be sold as yearlings, depends upon the condition of the range upon which they were run. It is more a question of grass and storms than one that can be settled definitely for all conditions.

#### MARKET VALUE OF THE STEERS

The last spring of the experiment when all of the steers were coming three-year-old, Mr. Henry Gebhardt, of Denver, put a market valuation on the three lots of steers, without knowledge as to how each lot had been handled. He valued the steers that had been fed every winter at \$6.10 per cwt.; those fed two winters at \$6.20 per cwt., and those fed one winter at \$5.75 per cwt. These prices indicate the comparative condition of flesh of the various lots, and the valuation given corresponds to the final weights of the three lots.

These market prices mean that the steers which were not fed as calves, but were fed the winter that they were yearlings, then put back on the range, and finished out as two-year-olds, not only made the most rapid gains and were heaviest when put upon the market, but were fattest, having put on a large proportion of their gains in flesh and fat.

## FAT, BONE AND LEAN MEAT IN A RIB CUT

Rib roasts, comprising the 8th and 9th ribs and measuring 5 inches in width, were taken from the carcasses of the two steers.

One steer, A, which had been fed both the winter he was a yearling and the succeeding winter, was killed in April, weighing 1440 pounds. The other steer, B, which was fed only as a two-year-old, was held until August after steer A had been killed, when he reached the 1400 pound weight.

The rib cuts taken were dissected with the following results:

	Lean Meat	Fat	Bone
Steer A.....	8 lbs. 13 oz.	8 lbs. 12 oz.	2 lbs. 4 oz.
Steer B.....	9 lbs. 2 oz.	7 lbs. 5 oz.	3 lbs.

These figures show little difference between the steer which had been fed two winters, and the one fed only one winter. What difference there is shows more bone and lean meat in the animal fattened rapidly at a later stage of life. There was practically no difference in the appearance of the rib cuts from the two steers.

## PART II.

### SUGAR BEETS FOR FATTENING STEERS.

The steers used in the experiment, described in Part I, were fed during each winter with a view to finding the value of sugar beets in replacing part of the corn used with the customary corn and alfalfa ration in Colorado. European and Canadian feeders regard roots highly as an aid in finishing cattle, but in America it has been difficult to popularize their use. Many inquiries have come to this Station, however, as to the value of sugar beets for stock feed, and in conversation with feeders, I find that many are firmly convinced that sugar beets possess a feeding value of from \$5.00 to \$10.00 per ton. Results of experiments conducted in other states indicate a much lower value than this for feeding, and the following experiments were conducted with a view of ascertaining the true value of sugar beets for feeding under Colorado conditions. The results obtained throw considerable light upon this question.

#### EXPERIMENT I

In this trial of 16 weeks, Lot 1 was fed six pounds of corn and 30 pounds of sugar beets per head each day, while Lot 2 was fed 12 pounds of corn. This meant replacing half the corn with sugar beets in the proportion of 5 pounds of sugar beets to one pound of corn. The steers were yearlings.

#### FEED, GAIN, AND COST OF GAIN

Lot	No. in Lot	Total Gain in Weight	Total Feed Pounds			Average Gain Per Head	Pounds Feed Required For 100 lbs. Gain			Cost of Feed 100 lbs. Gain
			Corn	Sugar Beets	Alfalfa Hay		Corn	Sugar Beets	Alfalfa Hay	
1....	*	4714	9245	52234	30194	239	196	1108	641	\$6.33
2....	**	4256	18851		30640	216	443		720	6.23

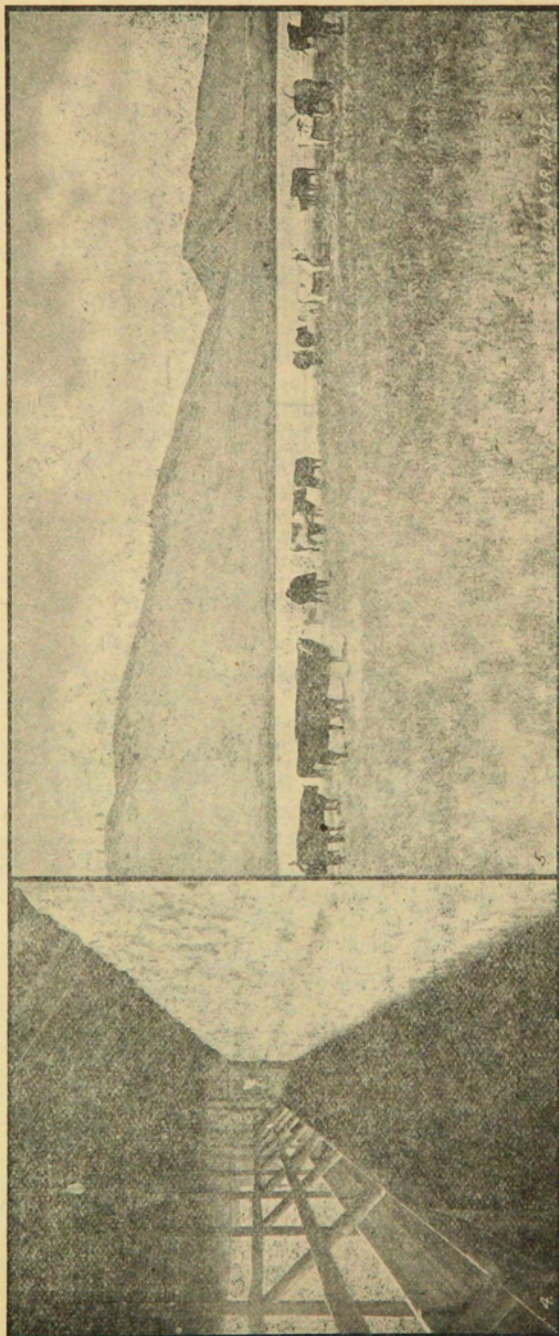
\* At first 18 head, after 3rd week, 20 head.

\*\* At first 17 head, after 3rd week, 20 head

Note—Corn at \$1.00 per cwt., Beets at \$5.00 per ton, Alfalfa Hay at \$5.00 per ton.

The steers fed the sugar beets made somewhat better gains than the others, averaging 23 pounds heavier at the close. By inspection of the columns showing feed required for 100 pounds gain, we find that 1108 pounds of sugar beets replaced 247 pounds of corn and 79 pounds of alfalfa hay; or 4.5 pounds of sugar beets replaced 1 pound of corn and .32 pounds of hay in the production of 100 pounds gain in live weight.

Figuring corn at 1 cent per pound, sugar beets at \$5.00 per ton, and hay at \$5.00 per ton, the sugar beet ration cost \$6.33 for every hundred pounds gain produced, while the corn ration cost \$6.23. These results indicate that if corn costs more, or sugar beets less than these prices, it will pay to substitute sugar beets for half of the corn ration.



Range on Which the Steers Were Run in Summer

Interior of Steer Shed, Showing Grain Trough

## SECOND TRIAL 1907-1908

This trial lasted 22 weeks. The steers were two-year-olds. Lot 1 was fed 12 pounds of corn per head each day, while Lot 2 was fed 6 pounds of corn and 30 pounds of sugar beets.

## FEED, GAIN, AND COST OF GAIN

Lot	No. in Lot	Total Gain in Weight	Total Feed Lbs.			Average Gain Per Head	Pounds Feed Required for 100 Pounds of Gain			Cost of Feed For 100 lbs. Gain
			Corn	Sugar Beets	Alfalfa Hay		Corn	Sugar Beets	Alfalfa Hay	
1....	17	4425	28154		52653	260	643	1190	\$9.41	
2....	17	4655	15275	62931	46560	150	330	1502	9.55	

Note—Corn at \$1.00 per cwt., Beets at \$5.00 per ton, Alfalfa Hay at \$5.00 per ton.

The two lots of steers made equal gains. 1502 pounds of sugar beets replaced 313 pounds of corn and 190 pounds of hay in the production of 100 pounds gain, or 4 $\frac{3}{4}$  pounds of sugar beets replaced one pound of corn and  $\frac{1}{4}$  pound of hay. Figuring prices of feeds the same as in the previous trial, the sugar beet ration cost \$9.55 for every hundred pounds of gain produced, while the corn ration cost \$9.41. The greater cost in comparison with the former trial is undoubtedly due to the greater age of the steers.

This trial is so closely in accord with the previous trial with regard to the amount of beets necessary to replace half the corn ration, that we may state with reasonable certainty, that sugar beets when fed with a half ration of corn, have a feeding value of about one-fifth that of corn; it will take from 4 $\frac{1}{2}$  to 5 pounds of sugar beets to give the results produced by one pound of corn.

The steers used in the second experiment were priced by Mr. Henry Gebhardt, of Denver, without a knowledge as to the manner in which they had been fed. He valued the steers fed on sugar beets and corn at 10 cents per hundred weight less than the steers fed corn, so that the finish of the steers in one lot was not much different from that in the other.