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## Beef Production.

H. R. Smith

*University of Nebraska-Lincoln*

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THE UNIVERSITY OF NEBRASKA.

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BEEF PRODUCTION.

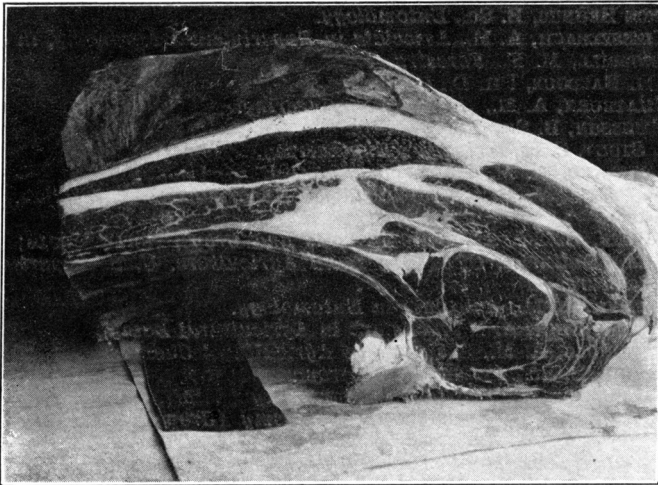
- Part I. Comparison of Rations.  
Part II. Comparison of Breeds and Types.
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By H. R. SMITH.

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DISTRIBUTED OCTOBER 21, 1912.

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Chuck—First prize two-year-old steer in carcass competition, International Live Stock Exposition, Chicago, 1911. Fed and exhibited by Department of Animal Husbandry, University of Nebraska.

LINCOLN, NEBRASKA  
U. S. A.

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\* Resigned January 31, 1912.

† Resigned August 31, 1912.

## TABLE OF CONTENTS.

	PAGE
Part I.—Comparison of Rations—	
Experiment I.—Beef Production in Summer with Corn Silage..	5
Plan of the Experiment.....	5
Character of the Rations Fed.....	6
Tables 1 to 6 inclusive .....	9-14
Experiment II.—The Relative Values of Prairie Hay and Corn- stover Fed with Alfalfa, and of Wheat Bran, Linseed-meal, Cottonseed-cake, and Alfalfa Fed with Prairie Hay.....	17
Tables 7 to 12 inclusive.....	18-23
Experiment III.—	
1.—Corn Silage vs. Stover.....	25
Tables 13 to 16 inclusive.....	27-30
2.—Heavy and Light Rations of Corn with Silage and Al- falfa for Calves.....	33
Plan of Experiment—	
Preliminary Feeding.....	34
Experimental Rations.....	34
Tables 17 to 20 inclusive.....	36-39
Part II.—Breeds and Types of Cattle as Factors in Economical Beef	
Production .....	41
Illustrations showing groups, with individual data.....	45-48
Summary .....	49
Acknowledgment .....	50

# **BEEF PRODUCTION.**

BY H. R. SMITH.

## **PART I.**

### **COMPARISON OF RATIONS.**

#### **EXPERIMENT I.—BEEF PRODUCTION IN SUMMER WITH CORN SILAGE.**

During the past few years a number of tests have been made at State Experiment Stations to determine whether or not corn silage can be used with economy for fattening cattle. In nearly all these trials it has been found that by converting the corn plant into silage a feed is produced that, when properly used in the ration, will reduce materially the cost of production. In the majority of the experiments reported it was found that the cost of gains was reduced about \$1.00 per hundred. In this method of preparing the corn plant for feeding purposes there is some expense involved in the construction of the silo and the purchase or rental of a machine for cutting the fodder into short lengths during the filling process, but this added expense seems to be more than offset by the superior quality of the food produced, its more complete utilization, and its greater convenience in feeding. This is of course assuming that the silo and ensilage cutter are serviceable for a number of years.

Practically all the experiments reported thus far deal with silage for winter feeding. Its value for beef production during the summer months is less well known. In a state like Nebraska, where blue-grass does not grow so luxuriantly for pasture purposes as in states farther east, but where there is a great abundance of corn and an immense tonnage of fodder, which is usually left to waste in the field, it would seem that the silo would be especially valuable as an agency whereby the winter surplus could be made to offset the summer shortage of grass, increasing immensely the capacity of each farm to produce beef. An experiment therefore which would give data as to the value of the silage for summer use, fed in different ways and without the use of grass pasture, seemed timely.

#### **PLAN OF THE EXPERIMENT.**

In making the test, 48 steers, each nine months old, were divided into six groups. Approximately half of these steers were

grade Shorthorns. There were also in the test some grade Herefords, Angus, Red Polls, Jerseys, Guernseys, and Holsteins. These were evenly distributed among the several groups to make the cattle of one group average well with another. The placing of different breeds and types in each group was also done to make it possible to compare individuals of different types and breeds in their capacity to make gains under like conditions. This comparison of types, which was made possible by keeping records on each individual, was a separate study from that of the rations and will be reported later. All the steers in the test were fed in a uniform manner during the first six months of their lives on skim-milk supplemented with grain and hay. One calf had as good a chance as another and any difference in condition noticeable when the silage experiment was begun was due to the individual and not to the previous feeding; but as the divisions were made so as to have one group average with another with respect to quality and condition, the relative efficiency of the rations tested as shown by the averages of each group are quite as reliable as when cattle in an experiment are uniform thruout.

In order to show the differences in the capacity of steers to make gains it was necessary to feed each animal separately. To do this, a barn containing individual stalls and feeding mangers for the entire number was provided. The steers were fastened during the day in stanchions and turned into the open yards for exercise during the night. They were of course allowed no feed while in the yard. Water tanks were provided in the several yards and salt was given at frequent intervals.

#### CHARACTER OF THE RATIONS FED.

The six groups of steers, eight in each, were started on their rations the first week in March, 1911. Group I was fed a ration consisting of corn, alfalfa, and shredded corn-stover (stalks); Group II, corn, alfalfa, and corn silage; Group III, corn, wheat bran, and silage; Group IV, corn, linseed-meal, and silage; Group V, corn, cold pressed cottonseed-cake, and silage; and Group VI, corn, cold pressed cottonseed-cake, and silage.

The first five groups were given about two-thirds of a full feed of grain. In Group VI each steer was given all the grain he would take. On March 25, when the experimental records were begun, each steer in the stover group was receiving 6 pounds of corn-meal per day, which was gradually increased until the close of the experiment, August 15, when each animal was taking 9 pounds per day. The average amount of corn consumed by

each steer in this group for the entire period was 7.5 pounds per day, as indicated in the table following. The silage-fed steers were kept on 6 pounds of corn-meal per day until late in the experiment, when 7 pounds were fed, the average for the entire period being 6.1 pounds. The stover-fed steers were each given 1.4 pounds more of corn-meal than the silage steers received because of the presence of that quantity of grain in the 15 pounds of silage.

The corn from which the silage was made was fully ripe when cut. The leaves, however, were more or less green, so that practically everything was consumed when the silage was fed. The stover came from shock corn cut at the same time. The two rations were practically identical, except that in one group the stalk was fed as silage, and in the other as field-cured stover.

Each steer in Group I, fed the stover, was started on 5 pounds of alfalfa per day, which was soon after reduced to 4 pounds. The silage steers were each given 4 pounds per day for the entire period. The waste hay was weighed back, and the tables show the amount actually consumed by each steer. In determining the cost of gains, the hay and stover fed, including that refused as waste, was charged to the steers. The alfalfa was only fair in quality, which may also be said of the stover and silage.

The rations fed Groups II, III, IV, and V make possible a comparison of wheat bran, linseed-meal, and cold pressed cottonseed-cake, with each other and with alfalfa, as sources of protein when fed with corn-meal and silage. Somewhat less bran than alfalfa was fed because of the higher protein content of the bran. Linseed and cottonseed-cake contain fully twice as much protein as bran, and about half the quantity was therefore fed. All the steers in Groups II, III, IV, and V received the same amount of grain per day, and those in Groups III, IV, and V were fed practically all the silage they would eat—an average of 18.6 pounds per day. The steers in Group II consumed but 15 pounds of silage each per day because of having received nearly 4 pounds of other roughage, in the form of alfalfa.

The steers in Group VI were given the same kind of a ration as those in Group V but were fed all the grain that each would consume to furnish a comparison of a full feed of grain with what would approximate two-thirds of a full feed. The composition of all rations was nearly the same, the nutritive ratio ranging from 1:7.2 to 1:7.5.

In computing the cost of 100 pounds of gain, all foodstuffs were figured at their market value on the average farm in eastern Nebraska at the time the experiment was made. Corn was

valued at 45 cents per bushel, bran \$22 per ton, cold pressed cottonseed-cake \$25, linseed-meal \$36, alfalfa \$8, corn silage \$3, and corn-stover \$3. The corn was ground to make it unnecessary to have pigs behind the cattle, thus eliminating the pork factor from the experiment. In commercial feeding it is usually more profitable to feed the corn unground, allowing pigs to pick up the waste corn. In this experiment where separate records were kept on each steer, it would have been difficult to determine exactly the pork produced from the waste corn from each steer. For this reason corn-meal was fed to the entire number.

In figuring the profits, each calf was assigned a value per hundred corresponding to market conditions at the beginning of the experiment. The actual cost per pound at birth was the same on all; but if they had been marketed at the age of nine months when the experimental records were begun, prices would have ranged from \$4 to \$4.50 per hundred on this class of cattle. Had they been sold at the close of the experiment the following August, all steers would have brought approximately 50 cents per hundred more than the estimated cost the preceding March, except the alfalfa-silage steers (Group II) and the heavy grain fed cottonseed-cake steers (Group VI), which were worth 75 cents to 90 cents per hundred more, due to a higher condition of flesh at the close.

The tables showing the record made by each steer in the six groups follow. The abbreviations used in the tables are: Sh. = Shorthorn; Jer. = Jersey; Ang. = Angus; R. P. = Red Poll; Her. = Hereford; D. B. = Dutch Belted.



TABLE 1.—*Record of each steer in Group I, March 25 to August 15, 1911 (20 weeks, 3 days).  
Ration,—corn, alfalfa, and stover.*

Number of each steer.....	24 Sh.	6 Jer.	34 Ang.	21 Sh.	69 Sh.	67 R. P.	38 Sh.	12 Sh.	Av.
Initial weight of each steer, lbs.....	455	455	385	525	400	490	495	475	460
Final weight of each steer, lbs.....	675	695	635	740	635	690	675	680	681
Av. daily gain of each steer, lbs..	1.54	1.68	1.75	1.50	1.64	1.39	1.26	1.43	1.52
Av. amt. of corn consumed daily by each steer, lbs....	7.52	7.49	7.49	7.52	7.52	7.52	7.52	7.52	7.51
Av. amt. of alfalfa consumed daily by each steer, lbs....	4.29	4.25	4.24	4.32	4.14	4.32	4.18	3.04	4.09
Av. amt. of stover fed daily to each steer, lbs.....	3.81	3.82	3.49	3.76	3.76	3.49	3.42	3.62	3.64
Grain consumed for one lb. of gain, lbs.....	4.88	4.46	4.28	4.99	4.57	5.38	5.97	5.24	4.97
Alfalfa consumed for one lb. of gain, lbs.....	2.78	2.53	2.42	2.87	2.52	3.09	3.32	2.12	2.71
Stover consumed for one lb. of gain, lbs.....	2.47	2.28	2.00	2.50	2.29	2.50	2.73	2.53	2.41
Total food consumed for one lb. of gain, lbs.....	10.13	9.27	8.70	10.36	9.38	10.97	12.02	9.89	10.09
Total dry matter consumed for one lb. of gain, lbs.....	8.97	8.22	7.71	9.19	8.32	9.73	10.64	8.78	8.94
Cost of food for 100 lbs. of gain.....	\$5.38	\$4.92	\$4.69	\$5.52	\$5.01	\$5.92	\$6.52	\$5.42	\$5.42
Market value of each steer per 100 lbs., March 25, 1911 ..	\$4.00	\$4.00	\$4.50	\$4.50	\$4.25	\$4.00	\$4.50	\$4.50	\$4.28
Market value of each steer per 100 lbs., August 15, 1911	\$4.50	\$4.50	\$5.00	\$5.00	\$4.75	\$4.50	\$5.25	\$5.00	\$4.81
Estimated profit on each steer during the period.....	\$1.24	\$1.17	\$2.69	\$1.50	\$1.39	\$0.39	\$1.42	\$1.51	\$1.31

TABLE 2.—*Record of each steer in Group II, March 25 to August 15, 1911 (20 weeks, 3 days).  
Ration,—corn, alfalfa, and silage.*

Number of each steer . . . . .	28 Her	45 Sh.	19 Hol.	41 Sh.	11 Sh.	23 Hol.	20 Sh.	56 Sh.	Av.
Initial weight of each steer, lbs. . . . .	495	518	520	485	515	505	475	510	502
Final weight of each steer, lbs. . . . .	775	775	835	740	770	800	700	740	766
Av. daily gain of each steer, lbs. . . . .	1.96	1.80	2.20	1.78	1.78	2.10	1.57	1.61	1.85
Av. amt. of corn consumed daily by each steer, lbs. . . . .	6.13	6.17	6.12	6.12	6.16	6.15	6.17	5.99	6.12
Av. amt. of alfalfa consumed daily by each steer, lbs. . . . .	3.56	3.52	3.58	3.12	3.60	3.76	2.85	3.54	3.44
Av. amt. of silage consumed daily by each steer, lbs. . . . .	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00
Grain consumed for one lb. of gain, lbs. . . . .	3.13	3.43	2.78	3.43	3.45	2.94	3.92	3.72	3.35
Alfalfa consumed for one lb. of gain, lbs. . . . .	1.82	1.93	1.62	1.76	2.03	1.73	1.81	2.20	1.86
Silage consumed for one lb. of gain, lbs. . . . .	7.66	8.37	6.81	8.41	8.41	7.26	9.53	9.32	8.21
Total food consumed for one lb. of gain, lbs. . . . .	12.61	13.73	11.21	13.60	13.99	11.93	15.25	15.24	13.42
Total dry matter consumed for one lb. of gain, lbs. . . . .	7.38	8.01	6.56	7.85	8.13	6.98	8.82	8.89	7.83
Cost of food for 100 lbs. of gain. . . . .	\$4.38	\$4.78	\$3.89	\$4.71	\$4.84	\$4.13	\$5.29	\$5.26	\$4.66
Market value of each steer per 100 lbs., March 25, 1911. . . . .	\$4.50	\$4.25	\$4.25	\$4.50	\$4.50	\$4.00	\$4.00	\$4.50	\$4.31
Market value of each steer per 100 lbs., August 15, 1911. . . . .	\$5.40	\$5.51	\$5.15	\$5.40	\$5.40	\$4.90	\$4.65	\$5.40	\$5.17
Estimated profit on each steer during the period. . . . .	\$7.31	\$5.63	\$8.65	\$6.12	\$6.07	\$6.82	\$1.55	\$4.91	\$5.88

TABLE 3.—*Record of each steer in Group III, March 25 to August 15, 1911 (20 weeks, 3 days).  
Ration,—corn, bran, and silage.*

Number of each steer .....	75 Hol.	61 Her.	64 Her.	70 Ang.	18 Sh.	37' Her.	33 Jer.	44 Sh.	Av.
Initial weight of each steer, lbs.....	578	585	604	575	595	552	555	576	577
Final weight of each steer, lbs.....	780	825	785	760	815	710	780	770	778
Av. daily gain of each steer, lbs.....	1.41	1.68	1.27	1.29	1.54	1.11	1.57	1.36	1.40
Av. amt. of corn consumed daily by each steer, lbs.....	3.65	3.64	3.65	3.64	3.64	3.64	3.65	3.63	3.64
Av. amt. of bran consumed daily by each steer, lbs.....	2.53	2.53	2.53	2.52	2.52	2.52	2.53	2.53	2.52
Av. amt. of silage consumed daily by each steer, lbs.....	18.76	18.70	18.71	18.70	18.52	18.55	18.77	18.69	18.67
Total grain consumed daily by each steer, lbs..	6.18	6.17	6.18	6.16	6.16	6.16	6.18	6.16	6.17
Grain consumed for one lb. of gain, lbs.....	4.38	3.67	4.88	4.77	4.01	5.58	3.92	4.55	4.46
Silage consumed for one lb. of gain, lbs.....	13.27	11.14	14.78	14.46	12.04	16.79	11.93	13.78	13.30
Total dry matter consumed for one lb. of gain, lbs.....	9.09	7.64	10.13	9.90	8.28	11.54	8.08	9.44	9.26
Total food consumed for one lb. of gain, lbs.....	17.65	14.81	19.66	19.23	16.05	22.37	15.85	18.33	17.99
Cost of food for 100 lbs. of gain .....	\$5.02	\$5.07	\$6.72	\$6.53	\$5.51	\$7.68	\$5.42	\$6.26	\$6.17
Market value of each steer per 100 lbs., March 25, 1911..	\$4.00	\$4.50	\$4.5	\$4.50	\$4.50	\$4.25	\$4.00	\$4.50	\$4.34
Market value of each steer per 100 lbs., August 15, 1911.	\$4.5	\$5.00	\$5.00	\$5.00	\$5.00	\$4.75	\$4.50	\$5.00	\$4.84
	Loss			Loss		Loss			
Estimated profit on each steer during the period .....	\$0.18	\$2.76	\$0.09	\$0.01	\$1.86	\$1.86	\$0.71	\$0.54	\$0.49

TABLE 4.—*Record of each steer in Group IV, March 25 to August 15, 1911 (20 weeks, 3 days).*  
*Ration,—corn, linseed-meal, and silage.*

Number of each steer .....	7 Sh.	32 R. P.	43 Sh.	47 Her.	1 Sh.	30 Guer.	40 Guer.	8 Sh.	Av.
Initial weight of each steer, lbs.....	505	495	518	500	515	500	515	509	507
Final weight of each steer, lbs.....	710	715	740	735	765	730	695	705	724
Av. daily gain of each steer, lbs.....	1.43	1.54	1.55	1.64	1.75	1.61	1.26	1.37	1.51
Av. amt. of corn consumed daily by each steer, lbs.....	4.96	4.98	4.91	4.97	4.96	4.97	4.90	4.98	4.95
Av. amt. of oil-meal consumed daily by each steer, lbs....	1.21	1.21	1.20	1.21	1.21	1.20	1.21	1.21	1.21
Av. amt. of silage consumed daily by each steer, lbs.....	18.60	18.67	18.99	18.59	18.66	18.55	18.36	18.68	18.63
Total grain consumed daily by each steer, lbs.....	6.17	6.19	6.11	6.18	6.17	6.17	6.10	6.19	6.16
Grain consumed for one lb. of gain, lbs.....	4.30	4.02	3.93	3.76	3.53	3.84	4.85	4.51	4.11
Silage consumed for one lb. of gain, lbs.....	12.98	12.14	12.23	11.31	10.67	11.51	14.59	13.63	12.38
Total food consumed for one lb. of gain, lbs.....	17.28	16.16	16.16	15.07	14.20	15.35	19.44	18.14	16.49
Total dry matter consumed for one lb. of gain, lbs.....	8.95	8.37	8.33	7.81	7.38	7.91	10.08	9.35	8.52
Cost of food for 100 lbs. of gain.....	\$6.22	\$5.82	\$5.76	\$5.44	\$5.11	\$5.55	\$7.01	\$6.40	\$5.91
Market value of each steer per 100 lbs., March 25, 1911..	\$4.25	\$4.25	\$4.25	\$4.50	\$4.50	\$4.50	\$4.25	\$4.50	\$4.38
Market value of each steer per 100 lbs., August 15, 1911..	\$4.75	\$4.75	\$4.75	\$5.00	\$5.00	\$5.00	\$4.75	\$5.00	\$4.88
Loss							Loss	Loss	
Estimated profit on each steer during the period .....	\$0.48	\$0.12	\$0.36	\$1.47	\$2.31	\$1.23	\$0.80	\$0.20	\$0.55

TABLE 5.—*Record of each steer in Group V, March 25 to August 15, 1911 (20 weeks, 3 days).  
Ration,—corn, cold-pressed cottonseed-cake, and silage.*

Number of each steer.....	10 R. P.	16 R. P.	2 Hol.	39 Sh.	9 Sh.	27 Sh.	50 Her.	13 Sh.	Av.
Initial weight of each steer, lbs.....	525	544	545	520	521	543	516	545	531
Final weight of each steer, lbs.....	740	705	755	730	780	770	725	745	743
Av. daily gain of each steer, lbs.....	1.50	1.13	1.54	1.47	1.81	1.59	1.46	1.40	1.45
Av. amt. of corn consumed daily by each steer, lbs.....	4.97	4.76	4.96	4.92	4.96	4.84	4.92	4.92	4.91
Av. amt. of cottonseed-cake consumed daily by each steer, lbs.....	1.21	1.19	1.20	1.20	1.20	1.19	1.19	1.20	1.20
Av. amt. of silage consumed daily by each steer, lbs.....	18.60	18.16	18.66	18.36	18.58	18.67	18.62	18.73	18.55
Total grain consumed daily by each steer, lbs.....	6.18	5.94	6.15	6.12	6.16	6.03	6.12	6.13	6.11
Grain consumed daily for one lb. of gain, lbs.....	4.11	5.28	4.00	4.17	3.41	3.79	4.19	4.38	4.17
Silage consumed for one lb. of gain, lbs.....	12.37	16.13	12.13	12.50	10.26	11.76	12.74	13.39	12.66
Total food consumed for one lb. of gain, lbs.....	16.43	21.41	16.13	16.67	13.66	15.55	16.93	17.77	16.90
Total dry matter consumed for one lb. of gain, lbs.....	8.55	11.08	8.35	8.65	7.08	7.99	8.77	9.19	8.71
Cost of food for 100 lbs. of gain.....	\$5.50	\$7.12	\$5.38	\$5.58	\$4.56	\$5.15	\$5.63	\$5.90	\$5.63
Market value of each steer per 100 lbs., March 25, 1911..	\$4.25	\$4.25	\$4.00	\$4.25	\$4.25	\$4.50	\$4.50	\$4.50	\$4.31
Market value of each steer per 100 lbs., August 15, 1911.	\$4.75	\$4.75	\$4.50	\$4.75	\$4.75	\$5.00	\$5.00	\$5.00	\$4.81
Estimated profit on each steer during the period.....	\$1.01	\$1.09	\$1.77	\$0.86	\$3.10	\$2.37	\$1.26	\$0.92	\$1.27

*Beef Production*

TABLE 6.—*Record of each steer in Group VI, March 25 to August 15, 1911 (20 weeks, 3 days).  
Ration,—corn, cold-pressed cottonseed-cake, and silage.*

Number of each steer .....	65 Sh.	17 Jer.	59 Sh.	49 Her.	53 Sh.	52 Her.	58 Sh.	48 Sh.	Av.
Initial weight of each steer, lbs.....	615	557	582	619	595	632	577	602	597
Final weight of each steer, lbs.....	820	785	765	835	790	845	810	845	812
Av. daily gain of each steer, lbs.....	1.42	1.59	1.29	1.51	1.39	1.49	1.62	1.71	1.50
Av. amt. of corn consumed daily by each steer, lbs.....	7.09	7.59	7.20	7.19	7.65	7.75	8.02	8.05	7.57
Av. amt. of cottonseed-cake consumed daily by each steer, lbs.....	1.26	1.29	1.27	1.25	1.26	1.26	1.28	1.28	1.27
Av. amt. of silage consumed by each steer daily, lbs.....	17.86	15.76	17.46	17.89	17.97	18.06	17.76	17.53	17.53
Total grain consumed daily by each steer, lbs.....	8.35	8.88	8.47	8.44	8.91	9.01	9.30	9.33	8.84
Grain consumed for one lb. of gain, lbs.....	5.82	5.57	6.61	5.59	6.54	6.05	5.70	5.49	5.92
Silage consumed for one lb. of gain, lbs.....	12.45	9.89	13.64	11.85	13.10	12.13	10.91	10.31	11.83
Total food consumed for one lb. of gain, lbs.....	18.28	15.45	20.25	17.43	19.64	18.23	16.61	15.80	17.75
Total dry matter consumed for one lb. of gain, lbs.....	11.13	8.86	11.23	9.66	11.03	10.21	9.39	8.92	10.05
Cost of food for 100 lbs. of gain.....	\$6.96	\$6.31	\$7.78	\$6.62	\$7.61	\$7.14	\$6.55	\$6.28	\$6.90
Market value of each steer per 100 lbs., March 25, 1911..	\$4.25	\$4.00	\$4.50	\$4.25	\$4.25	\$4.50	\$4.50	\$4.50	\$4.34
Market value of each steer per 100 lbs., August 15, 1911..	\$5.00	\$4.75	\$5.25	\$5.00	\$5.00	\$5.25	\$5.25	\$5.25	\$5.09
Estimated profit on each steer during the period.. ....	\$0 59	\$0.61	\$1.36	\$1.15	\$0 63	\$0.92	\$1 28	\$2.01	\$0.97

In comparing stover with silage, as shown in Tables 1 and 2, it will be observed that all the silage calves except numbers 20 and 56 made larger daily gains than the best gainer in the stover group, which was steer No. 34, and the average daily gain of all calves fed silage was 1.85 pounds, while the average for those fed stover was 1.52 pounds. The silage calves therefore made 20 per cent larger gains than the stover calves. Each of the eight calves fed silage required less grain for a pound of gain than the best gainer in the stover group. The average of the entire number in each group shows that 4.97 pounds of corn-meal were required for a pound of gain with stover, and 3.35 pounds with silage, which would be 33 per cent or one-third less meal with the silage. If, however, in computing the corn required for a pound of gain, we include the grain in the 8.2 pounds of silage consumed for each pound of gain, the silage steers required 14 per cent less total grain for a pound of gain than the stover steers required. There was a saving of alfalfa with the silage, but more total food was consumed for a pound of gain because of the high percentage of water in the silage. The actual amount of dry matter consumed for a pound of gain was 1.1 pounds less with the silage than with the stover. This is of real significance.

The tables also show that with stover and silage each quoted at \$3 per ton, corn 45 cents per bushel, and alfalfa \$8 per ton, the cost of 100 pounds of gain was \$5.42 on the stover ration and \$4.66 on the silage ration, which would be 14 per cent less with the silage. Had the silage been figured at \$4.80 per ton instead of \$3.00 or the stover \$1.90 instead of \$3.00, the cost of gains would have been the same in both groups.

The estimated profit on each of the silage steers was greater than the most profitable steer in the stover group. This was because the silage calves not only made more economical gains but their larger gains gave them a higher market value per hundred at the close, as condition of flesh seems to have a greater influence upon market value than any other one factor.

Referring to Tables 2, 3, 4, and 5, it will be observed that in the group where alfalfa was used as a source of protein all the steers except numbers 20 and 56 made larger gains than the steers in all other groups, except No. 9, fed cottonseed-cake. This gave the steers of the alfalfa group a much higher average than the other three groups. The slight difference in gains made by the use of bran, linseed-meal, and cottonseed-cake might easily be accounted for by individual differences in the capacity to make gains. The average of the 8 in each group shows linseed-meal is second to alfalfa, cottonseed-cake third, and wheat bran fourth.

Alfalfa shows its unquestioned superiority not only because all the steers fed alfalfa made large gains but also because less grain and less total dry matter was required for a pound of gain, lessening the cost of production and increasing the profits to a marked degree. It is difficult to explain why the alfalfa steers gained so much faster as the amount of protein fed the steers in each group was practically the same. It is quite probable that the use of some dry roughage with silage is better than to make the roughage to consist of silage alone fed in larger quantity.

The relative feeding value of the supplementary foods—bran, linseed-meal, and cold pressed cottonseed-cake—as shown in this experiment is a matter of interest. If the bran had cost \$17.20 per ton and the linseed-meal \$29.74, the cost of producing beef in these two groups would have been the same as with the cold pressed cottonseed-cake at \$25 per ton. In this experiment, therefore, the cold pressed cottonseed-cake proved to be worth about 50 per cent more than the bran, and linseed-meal 20 per cent more than the cottonseed-cake. The old process cottonseed-meal was not used in the experiment. As the meal contains much less crude fibre and a higher percentage of protein than the cold pressed cake it is reasonable to think that it possesses a higher feeding value. However, the cold pressed cake—the product left after removing the oil from cottonseed in the hull by means of pressure—is a much cheaper feed than the cottonseed-meal and it is likely to come into general use.

Groups V and VI furnish a comparison of a full feed of grain with what would approximate two-thirds of a full feed. Aside from this difference in the amount of grain fed and the fact that a little more roughage was supplied the calves given less grain, the rations were practically identical. There was so little difference in daily gains favoring those which were given all the grain they would clean up in two feeds per day that it seems inadvisable to crowd calves to the limit with grain unless they are to be marketed as baby beef. The larger use of corn-meal and the smaller use of silage increased the cost of gains from \$5.53 to \$6.90 per hundred. Were it not for the fact that the heavier fed calves showed a somewhat higher condition of flesh at the close of the experiment and were therefore appraised 25 cents per hundred higher, the difference in estimated profits in favor of the more moderate use of grain would have been still greater. With a spread of 75 cents per hundred in selling value over cost, the heavier grain fed calves showed an average profit of 97 cents each over and above the cost of food. The lighter fed calves showed a profit of \$1.27.



**EXPERIMENT II.—THE RELATIVE VALUES OF PRAIRIE HAY AND CORN-STOVER FED WITH ALFALFA, AND OF WHEAT BRAN, LINSEED-MEAL, COTTONSEED-CAKE, AND ALFALFA FED WITH PRAIRIE HAY.**

On August 15, 1911, the supply of silage fed the steers described in the previous experiment became exhausted and prairie hay was substituted for it in all groups. The steers previously fed stover were continued on the same ration to furnish a comparison of stover with prairie hay. Each steer in both groups received 9 pounds of corn-meal at the beginning of this experiment, which was gradually increased to 12 pounds toward the close—December 5. This made an average of 10.96 pounds each per day for the entire period as indicated in the tables following. Alfalfa was increased from 4 to 5 pounds, the average for the period being 4.5 pounds per day. Each steer in Group I was fed 4 pounds of stover per day during the entire period. Each steer in Group 2 was started on 2 pounds of prairie hay per day, which was soon after increased to 4 pounds, making the average for the period 3.3 pounds per day. The steers in Groups III, IV, and V were each started on 6 pounds of grain per day, which was later increased to 12, making the average for the period 10.9 pounds per day, the same as in Group II, fed alfalfa. The steers in Group VI were continued on the heavy feed to make a second comparison of a full grain ration with a two-thirds ration.

In computing the cost of gains in this experiment, corn was figured at 56 cents per bushel, bran \$22 per ton, cold pressed cottonseed-cake \$25, linseed-meal \$36, alfalfa \$10, prairie hay \$10, and corn-stover \$3. Corn was given a higher value because there was a considerable advance in market price during the summer. All these figures represent as nearly as possible the market price of the various foodstuffs on the average farm in eastern Nebraska at the time the experiment was made. The price of corn at the elevator would be a little higher than this figure because the average haul from the farm to the elevator in this state is between four and five miles. To get as accurate an estimate as possible of the profits made by each steer, expert buyers from the packing firms of Swift & Company and Armour & Company of South Omaha came to the Experiment Station and appraised each steer in the barn, which appraisal was based on current market values. The record made by each steer in this experiment follows.

TABLE 7.—*Record of each steer in Group I, August 15 to December 5, 1911 (16 weeks).*  
*Ration,—corn, alfalfa, and corn-stover.*

Number of each steer .....	24 Hol.- Sh.	6 Jer.	34 Ang.	21 Sh.	69 Sh.	67 R. P.	38 Sh.	12 Sh.	Av.
Initial weight of each steer, lbs. ....	675	695	635	740	635	690	675	680	680
Final weight of each steer, lbs. ....	875	878	848	955	855	867	858	865	863
Av. daily gain of each steer, lbs. ....	1.79	1.63	1.90	1.92	1.96	1.58	1.63	1.65	1.76
Av. amt. of corn consumed daily by each steer, lbs. ....	10.96	10.96	10.96	10.96	10.96	10.96	10.96	10.96	10.96
Av. amt. of alfalfa consumed daily by each steer, lbs. ....	4.54	4.51	4.52	4.53	4.50	4.51	4.51	4.52	4.51
Av. amt. of stover fed daily to each steer, lbs. ....	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
Grain consumed for one lb. of gain, lbs. ....	6.14	6.70	5.76	5.71	5.58	6.93	6.70	6.63	6.27
Alfalfa consumed for one lb. of gain, lbs. ....	2.54	2.77	2.38	2.36	2.30	2.86	2.77	2.74	2.58
Stover consumed for one lb. of gain, lbs. ....	2.24	2.45	2.10	2.08	2.04	2.53	2.45	2.42	2.29
Total food consumed for one lb. of gain, lbs. ....	10.92	11.92	10.24	10.15	9.92	12.32	11.92	11.79	11.15
Total dry matter consumed for one lb. of gain, lbs. ....	9.69	10.59	9.10	9.01	8.81	10.95	10.59	10.47	9.90
Cost of food for 100 lbs. of gain .....	\$7.77	\$8.49	\$7.29	\$7.22	\$7.06	\$8.77	\$8.49	\$8.39	\$7.94
Market value of each steer per 100 lbs., August 15, 1911.	\$4.50	\$4.50	\$5.00	\$5.00	\$4.75	\$4.50	\$5.25	\$5.00	\$4.81
Market value of each steer per 100 lbs., December 5, 1911	\$5.50	\$5.50	\$6.00	\$6.00	\$5.75	\$5.25	\$6.50	\$6.00	\$5.66
Estimated profit on each steer during the period. ....	\$2.20	\$1.48	\$3.60	\$4.78	\$3.44	Loss \$1.05	\$4.79	\$2.38	\$2.70

TABLE 8.—*Record of each steer in Group II, August 15 to December 5, 1911 (16 weeks).  
Ration,—corn, alfalfa, and prairie hay.*

Number of each steer .....	45 Sh.	41 Sh.	28 Her.	19 Hol.	20 Sh.	11 Sh.	23 Hol.	56 Sh.	Av.
Initial weight of each steer, lbs. ....	775	740	775	835	700	770	800	740	766
Final weight of each steer, lbs. ....	975	945	963	1082	870	968	1032	920	969
Av. daily gain of each steer, lbs. ....	1.79	1.82	1.68	2.21	1.52	1.77	2.07	1.61	1.81
Av. amt. of corn consumed daily by each steer, lbs. ....	10.96	10.96	10.96	10.96	10.96	10.96	10.96	10.96	10.96
Av. amt. of alfalfa consumed daily by each steer, lbs. ....	4.54	4.50	4.51	4.53	4.53	4.53	4.53	4.54	4.53
Av. amt. of prairie hay consumed daily by each steer, lbs. ....	3.30	3.30	3.30	3.30	3.30	3.30	3.30	3.30	3.30
Grain consumed for one lb. of gain, lbs. ....	6.14	5.99	6.53	4.97	7.22	6.20	5.21	6.82	6.15
Alfalfa consumed for one lb. of gain, lbs. ....	2.54	2.47	2.69	2.05	2.98	2.56	2.19	2.82	2.54
Prairie hay consumed for one lb. of gain, lbs. ....	1.85	1.80	1.97	1.50	2.12	1.87	1.59	2.06	1.85
Total food consumed for one lb. of gain, lbs. ....	10.53	10.26	11.19	8.52	12.32	10.63	9.07	11.70	10.53
Total dry matter consumed for one lb. of gain, lbs. ....	9.40	9.17	10.01	7.61	11.06	9.49	8.11	10.45	9.41
Cost of food for 100 lbs. of gain. ....	\$8.83	\$8.13	\$8.87	\$6.75	\$9.81	\$8.42	\$7.19	\$9.27	\$8.41
Market value of each steer per 100 lbs., August 15, 1911. ....	\$5.15	\$5.40	\$5.40	\$5.15	\$5.40	\$5.40	\$4.90	\$5.40	\$5.27
Market value of each steer per 100 lbs., December 5, 1911. ....	\$5.75	\$6.25	\$6.25	\$6.25	\$6.25	\$6.25	\$6.00	\$6.25	\$6.15
Estimated profit on each steer during the period. ....	Loss \$1.51	\$2.43	\$1.66	\$7.96	Loss \$0.10	\$2.25	\$6.04	\$0.85	\$2.44

TABLE 9.—*Record of each steer in Group III, August 15 to December 5, 1911 (16 weeks).*  
*Ration,—corn, bran, and prairie hay.*

Number of each steer.....	37 Her.	70 Ang.	18 Sh.	64 Her.	44 Sh.	61 Her.	75 Hol.	33 Jer.	Av.
Initial weight of each steer, lbs.....	710	760	815	785	770	825	780	780	778
Final weight of each steer, lbs.....	890	925	1030	970	932	955	975	940	952
Av. daily gain of each steer, lbs. ....	1.61	1.47	1.92	1.65	1.45	1.16	1.74	1.43	1.55
Av. amt. of corn consumed daily by each steer, lbs.....	6.31	6.34	6.34	6.34	6.34	6.34	6.34	6.34	6.34
Av. amt. of bran consumed daily by each steer, lbs.....	4.61	4.61	4.61	4.61	4.61	4.61	4.61	4.61	4.61
Total grain consumed daily by each steer, lbs.....	10.95	10.95	10.95	10.95	10.95	10.95	10.95	10.95	10.95
Prairie hay consumed daily by each steer, lbs.....	7.97	7.97	7.97	7.97	7.97	7.97	7.97	7.97	7.97
Grain consumed for one lb. of gain, lbs.....	6.82	7.44	5.70	6.63	7.57	9.44	6.29	7.67	7.19
Prairie hay consumed for one lb. of gain, lbs.....	4.87	5.32	4.08	4.74	5.41	6.74	4.49	5.48	5.14
Total food consumed for one lb. of gain, lbs.....	11.69	12.76	9.78	11.37	12.98	16.18	10.78	13.15	12.33
Total dry matter consumed for one lb. of gain, lbs.....	10.59	11.80	8.87	10.31	11.78	14.76	9.79	11.92	11.21
Cost of food for 100 lbs. of gain.....	\$9.54	\$10.41	\$7.99	\$9.31	\$10.61	\$13.22	\$8.81	\$10.65	\$10.07
Market value of each steer per 100 lbs., August 15, 1911..	\$4.75	\$5.00	\$5.00	\$5.00	\$5.00	\$5.00	\$4.50	\$4.50	\$4.84
Market value of each steer per 100 lbs., December 5, 1911.	\$5.50	\$5.75	\$6.00	\$6.00	\$5.75	\$5.75	\$5.25	\$5.25	\$5.66
	Loss	Loss			Loss	Loss		Loss	Loss
Estimated profit on each steer during the period.....	\$1.95	\$1.99	\$3.87	\$1.73	\$2.10	\$3.53	\$1.09	\$2.79	\$0.70

TABLE 10.—*Record of each steer in Group IV, August 15 to December 5, 1911 (16 weeks).*  
*Ration,—corn, linseed-meal, and prairie hay.*

Number of each steer. ....	30 Guer.	43 Sh.	47 Her.	40 Guer.	7 Sh.	32 R. P.	1 Sh.	8 Sh.	Av.
Initial weight of each steer, lbs.....	730	740	735	695	710	715	765	705	724
Final weight of each steer, lbs.....	950	925	955	880	880	890	970	910	920
Av. daily gain of each steer, lbs.....	1.96	1.65	1.96	1.65	1.52	1.56	1.83	1.83	1.74
Av. amt. of corn consumed daily by each steer, lbs.....	9.03	9.03	9.03	9.03	9.03	9.03	9.03	9.03	9.03
Av. amt. of oil-meal consumed daily by each steer, lbs...	1.92	1.92	1.92	1.92	1.92	1.92	1.92	1.92	1.92
Total grain consumed daily by each steer, lbs.....	10.95	10.95	10.95	10.95	10.95	10.95	10.95	10.95	10.95
Prairie hay consumed daily by each steer, lbs.....	7.83	7.83	7.83	7.83	7.83	7.83	7.83	7.83	7.83
Grain consumed for one lb. of gain, lbs.....	5.58	6.63	5.58	6.63	7.22	7.07	5.99	5.99	6.34
Prairie hay consumed for one lb. of gain, lbs.....	3.53	4.74	3.53	4.74	5.16	5.01	4.28	4.28	4.41
Total food consumed for one lb. of gain, lbs.....	9.11	11.37	9.11	11.37	12.38	12.08	10.27	10.27	10.75
Total dry matter consumed for one lb. of gain, lbs.....	8.72	10.36	8.72	10.36	11.28	11.53	9.35	9.35	9.96
Cost of food for 100 lbs. of gain.....	\$8.31	\$9.88	\$8.31	\$9.88	\$10.75	\$10.50	\$8.91	\$8.91	\$9.43
Market value of each steer per 100 lbs., August 15, 1911..	\$5.00	\$4.75	\$5.00	\$4.75	\$4.75	\$4.75	\$5.00	\$5.00	\$4.87
Market value of each steer per 100 lbs., December 5, 1911	\$6.00	\$5.75	\$6.25	\$5.75	\$5.50	\$5.75	\$5.75	\$5.75	\$5.81
		Loss		Loss	Loss	Loss	Loss	Loss	Loss
Estimated profit on each steer during the period.....	\$2.22	\$0.24	\$4.65	\$0.66	\$3.59	\$1.16	\$0.74	\$1.19	\$0.10

TABLE 11.—*Record of each steer in Group V, August 15 to December 5, 1911 (16 weeks).*  
*Ration,—corn, cold-pressed cottonseed-cake, and prairie hay.*

Number of each steer.....	10 R. P.	16 R. P.	2 Hol.	39 Sh.	9 Sh.	27 Sh.	50 Her.	13 Sh.	Av.
Initial weight of each steer, lbs.....	740	705	755	730	780	770	725	745	743
Final weight of each steer, lbs.....	920	885	930	915	950	965	890	915	921
Av. daily gain of each steer, lbs.....	1.61	1.61	1.56	1.65	1.52	1.74	1.47	1.52	1.59
Av. amt. of corn consumed daily by each steer, lbs.....	9.04	9.04	9.04	9.04	9.04	9.04	9.04	9.04	9.04
Av. amt. of cot's'd-cake consumed daily by each steer, lbs.....	1.92	1.92	1.92	1.92	1.92	1.92	1.92	1.92	1.92
Total grain consumed daily by each steer, lbs.....	10.96	10.96	10.96	10.96	10.96	10.96	10.96	10.96	10.96
Prairie hay consumed daily by each steer, lbs.....	7.83	7.83	7.83	7.83	7.83	7.83	7.83	7.83	7.83
Grain consumed for one lb. of gain, lbs.....	6.82	6.82	7.01	6.63	7.22	6.29	7.44	7.22	6.93
Prairie hay consumed for one lb. of gain, lbs.....	4.87	4.87	5.01	4.63	5.16	4.49	5.32	5.16	4.94
Total food consumed for one lb. of gain, lbs.....	11.69	11.69	12.02	11.26	12.38	10.78	12.76	12.38	11.87
Total dry matter consumed for one lb. of gain, lbs.....	10.66	10.66	10.97	10.37	11.29	9.85	11.63	11.29	10.84
Cost of food for 100 lbs. of gain.....	\$9.56	\$9.56	\$9.83	\$9.29	\$10.12	\$8.82	\$10.42	\$10.12	\$9.72
Market value of each steer per 100 lbs., August 15, 1911..	\$4.75	\$4.75	\$4.50	\$4.75	\$4.75	\$5.00	\$5.00	\$5.00	\$4.81
Market value of each steer per 100 lbs., December 5, 1911	\$5.75	\$5.50	\$5.75	\$5.50	\$5.50	\$6.00	\$5.75	\$6.00	\$5.72
Estimated profit on each steer during the period.....	\$0.55	Loss \$2.01	\$2.30	Loss \$1.53	Loss \$2.00	\$2.21	Loss \$2.27	\$0.45	Loss \$0.28

TABLE 12.—*Record of each steer in Group VI, August 15 to December 5, 1911 (16 weeks)*  
*Ration,—corn, cold-pressed cottonseed-cake, and prairie hay.*

Number of each steer.....	59 Sh.	48 Sh.	58 Her.- Sh.	52 Her.	49 Her.	65 Sh.	53 Sh.	17 Jer.	Av.
Initial weight of each steer, lbs.....	765	845	810	845	835	820	790	785	811
Final weight of each steer, lbs.....	962	1032	1010	1040	1030	1005	965	945	998
Av. daily gain of each steer, lbs.....	1.76	1.67	1.78	1.74	1.74	1.65	1.56	1.43	1.67
Av. amt. of corn consumed daily by each steer, lbs.....	12.26	13.21	13.29	13.29	12.81	12.39	11.85	12.42	12.69
Av. amt. of cot's'd cake consumed daily by each steer, lbs.	1.92	1.92	1.92	1.92	1.92	1.92	1.92	1.92	1.92
Total grain consumed daily by each steer, lbs.....	14.18	15.13	15.21	15.21	14.73	14.31	13.77	14.34	14.61
Prairie hay consumed daily by each steer, lbs.....	5.75	5.75	5.75	5.75	5.75	5.75	5.75	5.75	5.75
Grain consumed for one lb. of gain, lbs.....	8.07	9.07	8.51	8.73	8.46	8.66	8.81	10.04	8.79
Prairie hay consumed for one lb. of gain, lbs.....	3.27	3.44	3.22	3.30	3.30	3.48	3.68	4.01	3.46
Total food consumed for one lb. of gain, lbs.....	11.43	12.51	11.73	12.03	11.76	12.14	12.49	14.05	12.26
Total dry matter consumed for one lb. of gain, lbs.....	10.26	11.32	10.61	10.89	10.65	10.99	11.32	12.73	11.10
Cost of food for 100 lbs. of gain.....	\$9.97	\$11.08	\$10.39	\$10.66	\$10.39	\$10.69	\$11.08	\$12.39	\$10.82
Market value of each steer per 100 lbs., August 15, 1911..	\$5.00	\$5.25	\$5.25	\$5.25	\$5.00	\$5.00	\$5.00	\$4.75	\$5.06
Market value of each steer per 100 lbs., December 5, 1911	\$6.00	\$6.50	\$6.00	\$6.50	\$6.00	\$6.25	\$6.25	\$5.50	\$6.12
Estimated profit on each steer during the period.....	Loss \$0.17	\$2.01	Loss \$2.70	\$2.46	Loss \$0.21	\$2.04	\$1.42	Loss \$5.13	Loss \$0.04

Referring to Tables 7 and 8 it will be observed that the two largest gainers of the entire 12 were fed prairie hay, but that the three next highest were in the stover group, and the lowest gainer in the prairie hay group. The average gain for the eight on prairie hay was 1.81 pounds, while the average for the eight on stover was 1.76 pounds. The daily gains therefore were practically as good on stover as on prairie hay, tho somewhat more stover was fed each day because of the presence of some coarse, woody material which is necessarily refused by the cattle—approximately 20 per cent of the amount fed. The part of the stover actually consumed proved to be just as valuable as prairie hay, pound for pound. In this experiment, therefore, shredded corn-stover as it came from the barn had a feeding value 80 per cent as great as prairie hay, which would make it worth \$8 per ton as compared with prairie hay at \$10. This corroborates the results of two experiments made in former years, which also showed that the portion of the cornstalk actually consumed has a feeding value which makes it the equal of prairie hay.

Figuring the stover at its market value, which in Nebraska could be but little more than the cost of gathering the crop and shredding the fodder, the cost of gains made on the stover ration was \$7.94 per hundred as compared with \$8.41 on the prairie hay ration. With unfavorable market conditions at the close of the experiment which gave the cattle a valuation not greatly in excess of their value at the beginning of the experiment, the estimated profits on each steer in the stover group was \$2.70 above the cost of foods, whereas with the prairie hay there was an average profit of \$2.44.

Comparing next the efficiency of alfalfa, wheat bran, linseed-meal, and cold pressed cottonseed-cake as shown in Tables 8, 9, 10, and 11, it is to be noted that there were two steers in the alfalfa group—numbers 19 and 23—which made larger gains than the best in the other three groups. The two smallest gainers were in the bran group. Taking each group as a whole the alfalfa steers show again the largest gains, with linseed-meal second, cottonseed-cake third, bran fourth, the same order as in the preceding experiment where corn and silage were used as the basis of each ration instead of corn and prairie hay. In both gains and cost of production the linseed-meal shows better in this experiment than cold-pressed-cake. With the exception of the alfalfa steers all groups show a somewhat larger average daily gain in the second experiment than in the first, which can perhaps be attributed to the fact that the cattle were older and of larger capacity. The cost of gains, however, in all groups was



higher in the second experiment. This is because the cost of gains always increases as cattle grow older and lay on fat. The cost of gains was further augmented in the second experiment by the increased price of corn and the substitution of prairie hay, which at \$10 per ton is a much more expensive feed than silage at \$3.

With corn costing 56c. per bushel, prairie hay \$10 per ton and cold pressed cottonseed-cake \$25 the cost of food for 100 pounds of gain was \$9.72—too high to make any profit during the four months period on a selling price of only 91c. per hundred above cost price. With bran costing \$22 and linseed-meal \$36 per ton, there was also a loss in these groups. The large gains made by the alfalfa steers were such as to give this hay plant a very high value in comparison with the protein concentrates. If the alfalfa had cost \$19.40 per ton, the bran \$20.50, and the linseed-meal \$32, the cost of producing gains would have been the same as on cold pressed cottonseed-cake at \$25 per ton. From the results of these two tests it would seem that bran and linseed-meal have a relatively higher value when fed with prairie hay than with silage, and *vice versa* with the cottonseed-cake. This might perhaps be explained by the fact that bran and linseed-meal are both somewhat laxative in effect, which would be a slight advantage with a constipating food like prairie hay and a disadvantage with a succulent food like silage. This, however, is only a conjecture.

Comparing the cost of gains in Groups V and VI, we find that the full grain ration is again more expensive,—in this case \$1.10 per hundred. The heavier grain fed steers made an advance of \$1.06 over their market value at the beginning as compared with 91c. per hundred on the lighter fed cattle. In a general way this experiment shows that with prairie hay used as a roughage and with corn costing \$1 per hundred, there is not likely to be a profit in cattle feeding. The two factors of greatest importance in economical feeding are alfalfa and silage, and the largest of these is apparently alfalfa. With this foodstuff forming a large part of the ration, corn can be purchased at a much higher price and fed with profit than when prairie hay at its usual cost is depended upon.

### EXPERIMENT III.

#### 1. CORN SILAGE VS. STOVER.

The results of the first experiment, in which corn silage was compared with stover, while favorable to the silage, were not conclusive, and it seemed wise to repeat the test with more mature cattle.

In the comparisons of alfalfa, wheat bran, linseed-meal, and cottonseed-cake, the profits have been so much greater with the alfalfa, not only when fed with silage but also when fed with dry roughage, as reported in the previous bulletins, that it seemed unnecessary to repeat the experiment.

From the result of all these tests covering a period of ten years, in which a large number of combinations have been tried, it is safe to conclude that in Nebraska beef can be produced at the least cost and with the greatest profit with the corn plant and alfalfa hay. Whether or not it pays best to convert the fodder into silage or to cure it in the field as shock corn is still open to some question. Whether the silage and alfalfa should be supplemented with a light, medium, or heavy feed of grain is also a question of importance to be determined.

To get further data on these questions, four of the groups of steers used in the preceding experiments reported in this bulletin were given rations as follows:

All the steers previously fed on corn, alfalfa, and stover (Group I), except No. 38, which was sold in December because of his finished condition, were started early in January on a ration consisting of corn-meal (light feed), alfalfa, and silage (heavy feed). Steer number 20, rather thin in condition, previously fed in Group II, was substituted for number 38. The eight steers in Group V, previously fed cold pressed cottonseed-cake, were started the same time on corn-meal (medium feed), alfalfa, and silage (medium feed). The eight previously fed bran were put on corn-meal (heavy feed), alfalfa, and silage (light feed). The eight previously fed linseed-meal were given a ration consisting of corn-meal (heavy feed), alfalfa, and corn-stover.

The two groups which showed the most finish at the close of the second experiment—Group II, fed corn, alfalfa, and silage, and Group VI, fed the heavier ration of corn, cottonseed-cake, and silage—were sold in December. The remaining four groups used in this experiment were fairly even in condition so that one group had no material advantage over the other with respect to condition at the beginning. By this time each steer had reached the age of nineteen months and the average weight of all was 940 pounds. The record of each steer for the period of 100 days follows.

TABLE 13.—*Record of each steer in Group I, January 25 to May 5, 1912 (100 days). Ration,—  
corn (light feed), corn silage (heavy feed), and alfalfa.*

Number of each steer.....	69 Sh.	12 Sh.	34 Jer.- Ang.	20 Sh.	17 R.P.	6 Jer.	21 Sh.	24 Hol.	Av.
Initial weight of each steer, lbs.....	900	870	860	865	835	900	1000	895	890
Final weight of each steer, lbs.....	1027	1055	1002	1002	940	1058	1165	1067	1039
Av. daily gain of each steer, lbs.....	1.27	1.85	1.42	1.37	1.05	1.58	1.65	1.72	1.49
Av. amt. of corn consumed daily by each steer, lbs.....	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00
Av. amt. of alfalfa consumed daily by each steer, lbs....	7.66	7.62	7.64	7.65	7.57	7.63	7.71	7.68	7.64
Av. amt. of silage consumed daily by each steer, lbs....	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00
Grain consumed for one lb. of gain, lbs.....	4.73	3.24	4.23	4.38	5.71	3.80	3.64	3.58	4.16
Alfalfa consumed for one lb. of gain, lbs.....	6.04	4.12	5.39	5.58	7.21	4.83	4.67	4.48	5.29
Silage consumed for one lb. of gain, lbs.....	23.51	16.52	21.19	21.76	28.57	18.72	18.19	17.98	20.80
Total food consumed for one lb. of gain, lbs.....	34.28	23.88	30.81	31.72	41.49	27.35	26.50	24.94	30.25
Total dry matter consumed for one lb. of gain, lbs.....	17.59	12.18	15.78	16.28	21.23	14.06	13.43	13.30	15.47
Cost of food for 100 lbs. of gain.....	\$12.17	\$8.35	\$10.88	\$11.28	\$14.72	\$9.78	\$9.37	\$8.99	\$10.69
Market value of each steer per 100 lbs., Dec. 5, 1911....	\$5.75	\$6.00	\$6.00	\$6.25	\$5.25	\$5.50	\$6.00	\$5.50	\$5.78
Market value of each steer per 100 lbs., May 11, 1912....	\$7.30	\$7.40	\$7.65	\$7.15	\$6.90	\$7.00	\$7.65	\$7.25	\$7.29
Estimated profit on each steer during the period.....	\$7.79	\$10.42	\$9.60	\$2.22	\$4.65	\$9.11	\$13.67	\$12.68	\$7.61

Beef Production

TABLE 14.—*Record of each steer in Group II, January 25 to May 5, 1912 (100 days). Ration,—corn (medium feed), corn silage (medium feed), and alfalfa.*

Number of each steer. ....	10 R. P.	9 Sh.	16 R. P.	39 Sh.	2 Hol.	27 Sh.	50 Her.	13 Sh.	Av.
Initial weight of each steer, lbs..	960	1002	903	955	952	1010	923	967	959
Final weight of each steer, lbs.....	1130	1190	1068	1110	1137	1228	1061	1120	1118
Av. daily gain of each steer, lbs.....	1.70	1.88	1.65	1.55	1.85	2.18	1.38	1.53	1.72
Av. amt. of corn consumed daily by each steer, lbs.....	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00
Av. amt. of alfalfa consumed daily by each steer, lbs....	7.80	7.77	7.70	7.70	7.69	7.69	7.67	7.78	7.73
Av. amt. of silage consumed daily by each steer, lbs.....	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00
Grain consumed for one lb. of gain, lbs.....	5.29	4.79	5.46	5.80	4.88	4.12	6.53	5.88	5.34
Alfalfa consumed for one lb. of gain, lbs.....	4.59	4.13	4.67	4.96	4.16	3.54	5.56	5.09	4.59
Silage consumed for one lb. of gain, lbs.....	11.89	10.63	12.12	12.90	10.83	9.16	14.79	13.07	11.92
Total food consumed for one lb. of gain, lbs.....	21.77	19.55	22.25	19.17	19.87	16.82	26.88	24.04	21.85
Total dry matter consumed for one lb. of gain, lbs.....	12.79	11.51	13.07	13.91	11.69	9.89	15.75	11.67	12.53
Cost of food for 100 lbs. of gain.....	\$10.25	\$9.27	\$10.57	\$11.25	\$9.42	\$8.00	\$12.63	\$11.39	\$10.35
Market value of each steer per 100 lbs., December 5, 1911	\$5.75	\$5.50	\$5.50	\$5.50	\$5.75	\$6.00	\$5.75	\$6.00	\$5.72
Market value of each steer per 100 lbs., May 11, 1912....	\$7.55	\$7.55	\$7.40	\$7.55	\$7.40	\$7.90	\$7.65	\$7.80	\$7.60
Estimated profit on each steer during the period.....	\$12.68	\$17.30	\$11.92	\$13.85	\$11.96	\$18.98	\$10.65	\$11.91	\$13.65

TABLE 15.—*Record of each steer in Group III, January 25 to May 5, 1912 (100 days). Ration,—corn (heavy feed), corn silage (light feed), and alfalfa.*

Number of each steer.....	18 Sh.	64 Her.	57 Her.	70 Ang.	44 Sh.	61 Her.	33 Jer.	75 Hol.	Av.
Initial weight of each steer, lbs.....	1070	992	917	957	977	1007	960	1025	988.12
Final weight of each steer, lbs.....	1295	1229	1104	1150	1198	1218	1180	1218	1199.0
Av. daily gain of each steer, lbs.....	2.25	2.37	1.87	1.93	2.21	2.11	2.20	1.93	2.11
Av. amt. of corn consumed daily by each steer, lbs.....	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
Av. amt. of alfalfa consumed daily by each steer, lbs.....	7.82	7.83	7.81	7.83	7.82	7.80	7.83	7.81	7.82
Av. amt. of silage consumed daily by each steer, lbs.....	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00
Grain consumed for one lb. of gain, lbs.....	5.32	5.06	6.41	6.20	5.46	5.67	5.44	6.22	5.72
Alfalfa consumed for one lb. of gain, lbs.....	3.47	3.31	4.18	4.05	3.54	3.69	3.56	4.05	3.73
Silage consumed for one lb. of gain, lbs.....	4.44	4.23	5.35	5.18	4.55	4.73	4.55	5.27	4.78
Total food consumed for one lb. of gain, lbs.....	13.23	12.60	15.94	15.43	13.55	14.09	13.55	15.54	14.25
Total dry matter consumed for one lb. of gain, lbs.....	9.26	8.82	11.16	10.79	9.48	9.86	9.48	10.85	9.96
Cost of food for 100 lbs. of gain.....	\$8.62	\$8.20	\$10.37	\$10.05	\$8.78	\$9.19	\$8.82	\$10.05	\$9.27
Market value of each steer per 100 lbs., December 5, 1911.....	\$6.00	\$6.00	\$5.50	\$5.75	\$5.75	\$5.75	\$5.25	\$5.25	\$5.66
Market value of each steer per 100 lbs., May 11, 1912....	\$7.90	\$7.90	\$7.55	\$7.75	\$7.55	\$7.80	\$7.50	\$6.65	\$7.57
Estimated profit on each steer during the period.....	\$18.70	\$18.17	\$13.52	\$15.75	\$14.87	\$17.70	\$18.70	\$7.79	\$15.65

Beef Production

TABLE 16.—*Record of each steer in Group IV, January 25 to May 5, 1912 (100 days). Ration,—corn (heavy feed), corn-stover (light feed), and alfalfa.*

Number of each steer.....	43 Sh.	40 Guer.	7 Sh.	47 Her.	32 R. P.	30 Guer.	1 Sh.	8 Sh.	Av.
Initial weight of each steer, lbs.....	924	875	875	925	923	967	985	922	924.5
Final weight of each steer, lbs.....	1083	1013	1065	1147	1098	1183	1173	1145	1113
Average daily gain of each steer, lbs. ....	1.59	1.38	1.90	2.22	1.75	2.13	1.88	2.23	1.89
Av. amt. of corn consumed daily by each steer, lbs. ....	14.00	14.00	14.00	14.00	14.00	14.00	14.00	14.00	14.00
Av. amt. of alfalfa consumed daily by each steer, lbs. ....	7.78	7.76	7.75	7.75	7.73	7.80	7.80	7.72	7.76
Av. amt. of stover consumed daily by each steer, lbs. ....	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
Grain consumed for one lb. of gain, lbs.....	8.79	10.13	7.36	6.30	7.99	6.56	7.44	6.27	7.61
Alfalfa consumed for one lb. of gain, lbs. ....	4.89	5.62	4.08	3.50	4.42	3.66	4.15	3.46	4.22
Stover consumed for one lb. of gain, lbs.....	1.89	2.17	1.58	1.35	1.71	1.41	1.60	1.35	1.63
Total food consumed for one lb. of gain, lbs.....	15.57	17.92	13.02	11.15	14.12	11.63	13.19	11.08	13.46
Total dry matter consumed for one lb. of gain, lbs.....	13.59	15.60	11.41	9.76	12.38	10.08	11.55	9.71	11.76
Cost of food for 100 lbs. of gain. ....	\$13.00	\$14.97	\$10.87	\$9.31	\$11.81	\$9.70	\$10.99	\$9.27	\$11.24
Market value of each steer per 100 lbs., December 5, 1911	\$5.75	\$5.75	\$5.50	\$6.25	\$5.75	\$6.00	\$5.75	\$5.75	\$5.81
Market value of each steer per 100 lbs., May 11, 1912 ....	\$7.50	\$7.90	\$7.30	\$8.15	\$7.65	\$8.00	\$7.75	\$7.80	\$7.75
Estimated profit on each steer during the period. ....	\$7.42	\$9.06	\$8.97	\$15.02	\$10.27	\$15.73	\$13.6	\$15.65	\$11.97

Referring first to Tables 15 and 16, which give a comparison of a ration consisting of corn, alfalfa, and stover, and corn, alfalfa, and silage, it will be observed that there were two steers fed silage that made larger gains than any fed stover. The three smallest gainers of the entire 16 were also in the stover group. Aside from these few extremes, there was practically no difference in gains, tho the average for each group shows a gain of 2.11 pounds per day on silage and 1.89 pounds on stover. This difference in the gain made on the two rations is not great and it is apparent that the inherent gaining capacity of the steers might be made to account for this small difference in gains. For example, if steer No. 40 had gained as much as No. 8 on the same ration, the average for the stover group would have been 2 pounds per day. Again, if steer No. 64, fed silage, had gained no more than No. 37, the smallest gainer of that group, the average of the silage fed steers would have been 2.02 pounds per day. Still the steers of the two groups averaged about the same in quality, when they were placed in the experiment, and the difference in gains would seem to furnish further reliable evidence as to the superiority of silage over stover.

The fourth line of the tables shows that the stover steers received 12 pounds of corn-meal per day, whereas the silage steers received but 10 pounds. There was, however, 1.1 pounds of grain in the 10 pounds of silage, so the silage steers received but .9 pound per day less than the stover steers. It was intended that all steers should have the same amount of alfalfa, and the amounts actually consumed by the steers as shown by the tables are so nearly alike that the results could not be affected by the alfalfa.

In this connection it should be stated that the alfalfa fed all the steers in this experiment was very inferior in quality. It was rather coarse and many of the leaves had been shaken off in curing and baling. The hay was also very dusty, indicating that it had not been well cured.

The silage was of excellent quality, having been made from corn that was ripe, and yet the stalks were in a fairly green condition when the silo was filled. The fact that it was consumed with practically no waste is proof of its superior quality.

The shredded stover had been stored in the barn and was in fairly good condition. This came from corn that was cut and put in the shock just after it had ripened in the field.

It will also be noted from the tables that more grain was consumed with stover than with silage. Were we to add the corn in the silage, there would have been required for 1 pound of

gain 6.3 pounds of grain instead of 5.7 pounds. This would be 1.3 pounds more grain per pound of gain with stover than with silage, which would represent a saving of 17 per cent of the grain on the stalk by feeding it in the form of silage rather than as husked corn and shredded stover. There was also less total dry matter consumed per pound of gain with the silage and a considerable saving in cost of production with foodstuffs figured at current market values, namely, corn 66c. per bushel, alfalfa \$10.00 per ton, corn silage \$3.00 per ton, and corn stover \$3.00. At these prices, it cost 17 per cent less to make a pound of gain with silage than with stover. The financial statement shows a handsome profit on all steers but a larger average profit on the silage steers. This large profit during a short period (100 days) is due to the fact that when the steers were marketed in South Omaha, at the close of the experiment, prices on beef were very high. It will be noticed that the advance in actual selling price over the estimated cost price at the beginning of the experiment was nearly \$2.00 per hundred.

From the results of this experiment and the previous one, it would seem that somewhat larger gains can be made by the use of silage than field cured shredded stover with additional corn. The question of whether grain should be fed liberally with silage and alfalfa or in more moderate quantity is yet to be considered.

Referring to Tables 13, 14, and 15, we have a comparison of the light, medium, and heavy feed of grain with correspondingly less silage. It will be noticed that in Group I, where the light grain and heavy silage ration was fed, but one steer, No. 12, made gains above the average in Group V, with the medium ration. The three best gainers, however, in the group fed the light ration of corn were ahead of the three lowest gainers on the medium ration. In the heavy grain and light silage group, there were four steers which made larger daily gains than the best gainers on the medium ration, and all made larger gains than the best gainers on the light grain ration. The average daily gain of each group as shown by the tables was 1.49 pounds on the light grain ration, 1.72 pounds on the medium ration, and 2.11 pounds on the heavy grain ration. A part of this difference was probably due to the fact that where 30 pounds of silage were fed per day the steers did not seem to care for much more than 6 pounds of corn-meal. As this silage was 30 per cent dry matter and 11 per cent was grain, there were in the 30 pounds of silage 3.3 pounds of grain, which, added to the 6 pounds of corn-meal, made a total of 9.3 pounds of grain. Those fed 20 pounds of silage containing 2.2 pounds of grain had a total of 11.2



pounds of grain per day, and those in Group III, which received 10 pounds of silage containing 1.1 pounds of grain, had a total of 13.1 pounds of grain per day.

The grain consumed for one pound of gain, as shown in the tables, does not include the corn in the silage. Even were this included, it would show less grain for a pound of gain on the heavy grain fed steers. The largest amount of total dry matter was consumed for a pound of gain on the light grain and heavy silage steers.

The average cost of gains on the light grain and heavy silage ration was \$10.69 per hundred, on the medium ration \$10.35, and on the heavy grain and light silage ration \$9.27. The cost of gains was much lower, therefore, with the liberal use of corn and the light ration of silage.

In this experiment the corn with the light grain fed cattle proved to be worth but 47 cents per bushel, and with the medium fed cattle 54 cents, in comparison with corn at 66 cents per bushel for the heavy fed cattle. The cost of gains in all groups was higher than in the previous experiment for the reason that, as cattle approach maturity and take on more flesh, more feed is required for maintenance, and less is therefore available for making gains. While the cost of gains in all groups is rather high, not only because of the condition of the cattle at the beginning of the experiment but also because of high-priced feed, the profits for the period were very satisfactory—thanks to the favorable market in May, 1912.

While the results of a single experiment are not at all conclusive, the indications are that it is easily possible to give too much silage to fattening cattle if large and economical gains are desired during the finishing process. The excessive bulk of this material, no doubt, makes it impossible to get into the animal all the nutriment that is required for the largest gains. Furthermore, too much bulky material in the form of silage may be a hindrance when steers are being finished for market. For yearlings weighing about 1,000 pounds which are being fattened for market, it would seem from these results that 10 to 15 pounds of silage each, per day, is more satisfactory than a larger quantity.

## **2. HEAVY AND LIGHT RATIONS OF CORN WITH SILAGE AND ALFALFA FOR CALVES.**

While the results of the preceding experiment would indicate that the liberal use of grain and moderate use of silage is best for fattening cattle, it would not be safe to conclude that such feeding is capable of giving the cheapest gains on calves. The

manner of feeding during the earlier stage may influence the profits quite as much as later feeding, and it seemed advisable to secure data on the quantity of corn which can be most economically fed with silage and alfalfa to calves.

#### PLAN OF EXPERIMENT.

**PRELIMINARY FEEDING.**—Thirty-two calves were purchased when but a few days old, during the month of June, 1911, from farmers in the vicinity of the Experiment Station as had been done the previous year. Approximately half of these calves were grade Shorthorns. Of the remainder, a few were grade Herefords, Angus, Red Polls, and there were also some specimens of the dairy breeds—Jerseys, Guernseys, and Holsteins. All were reared on skim-milk with some whole milk added—relatively more while the calves were young. The milk was supplemented with a small quantity of linseed-meal and soluble blood flour. Later, corn, oats, alfalfa, and a small quantity of prairie hay were fed. While the calves were all born during the month of June, 1911, some came earlier in the month and were larger than the others. The Jersey and Guernsey calves were smaller than the calves of other breeds. All the calves were put in two groups, the larger in one and the smaller calves in the other. Each of the individuals of a certain group were given the same feed, so that one had as good an opportunity to make gains as another. The calves in the second group, which were smaller, were fed alike but were given a little less feed than the larger calves in the first group. The aim was to raise all calves in as uniform a manner as possible. When weaned from the milk ration at the age of six months, they were an even bunch of calves with respect to condition of flesh, tho, of course, some were larger in size than others.

**EXPERIMENTAL RATIONS.**—After being weaned from milk the calves were removed to the feeding barn to be started on the experiment in question. They were divided into four groups of eight each. In each group were placed three good beef types, three dairy, and two with no particular breeding and of mediocre quality. The distribution was made with much care to have one group average with another so that the results of the rations would not be influenced by the fact that one group averaged better in quality than another. The mingling of different types in each group was also done to secure further data on the relative capacity of individuals to make gains under like conditions. This will be discussed in detail in a later bulletin.

The calves were started on their respective rations January

1, 1912, and the experimental records were begun January 25 and closed May 20, making a period of 114 days. Each calf was fed 6 pounds of alfalfa per day and consumed nearly all of it. The average for the entire period ranged from 5.74 to 5.87 pounds per day.

The steers in Group I were given no corn except what was in the 18 pounds of silage fed. The average amount of silage consumed daily by the steers of this group was 16.6 pounds for the period. Those in Group II each consumed 3 pounds of corn and 12 pounds of silage; those in Group III consumed 6 pounds of corn and 9 pounds of silage, and those in Group IV consumed 9 pounds of corn and 6 pounds of silage. The corn was fed in the form of meal, not because it is more economical to grind corn, but to make it unnecessary to keep pigs behind the cattle, eliminating in this way the item of pork. The silage was made from corn that was cut just as soon as it became ripe, while the leaves were yet fairly green. This corn would have yielded about 40 bushels of grain to the acre. It made a silage of most excellent quality. The alfalfa was not good. The fact that it was exceedingly dusty and very stemmy would indicate that it was not well cured when put up. These calves were stall fed in order to get individual records. They were given the run of small yards during the day and were watered night and morning. The following tables give the record of each steer in the four groups:

TABLE 17.—*Record of each steer in Group I, January 25 to May 19, 1912 (16 weeks, 2 days).  
Ration,—corn silage (heavy feed) and alfalfa.*

Number of each steer.....	80 Sh.	340 Sh.	95 R. P.	77 Sh.	343 Ang.	326 Sh.	355 Hol.	90 Jer.	Av.
Initial weight of each steer, lbs.....	405	382	395	390	325	400	400	340	380
Final weight of each steer, lbs.....	575	527	515	533	463	593	586	465	532
Av. daily gain of each steer, lbs.....	1.52	1.29	1.07	1.28	1.23	1.72	1.66	1.12	1.36
Av. amt. of alfalfa hay consumed daily per steer, lbs.....	5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87
Av. amt. of silage consumed daily per steer, lbs.....	16.64	16.64	16.64	16.64	16.64	16.64	16.64	16.64	16.64
Alfalfa hay consumed for one lb. of gain, lbs.....	3.86	4.53	5.48	4.59	4.76	3.40	3.53	5.26	4.42
Silage consumed for one lb. of gain, lbs.....	10.96	12.86	15.53	13.03	13.51	9.66	10.02	14.90	12.56
Total food consumed for one lb. of gain, lbs.....	14.82	17.39	21.01	17.62	18.27	13.06	13.55	20.16	16.98
Total dry matter consumed for one lb. of gain, lbs.....	7.12	8.35	10.10	8.46	8.78	6.27	6.51	9.69	8.16
Cost of food for 100 lbs. of gain.....	\$3.57	\$4.20	\$5.07	\$4.25	\$4.41	\$3.15	\$3.25	\$4.87	\$4.10

TABLE 18.—*Record of each steer in Group II, January 25 to May 19, 1912 (16 weeks, 2 days).  
Ration,—corn (light feed), silage (heavy feed), and alfalfa.*

Number of each steer.....	353 Her.	335 Sh.	83 Sh.	334 Sh.	356 Her.	345 Ang.	85 Hol.	91 Jer.	Av.
Initial weight of each steer, lbs.....	480	435	345	330	325	395	425	360	387
Final weight of each steer, lbs.....	678	650	568	590	503	463	640	538	578
Av. daily gain of each steer, lbs.....	1.77	1.92	1.99	2.32	1.59	0.61	1.92	1.59	1.71
Av. amt. of corn consumed daily per steer, lbs.....	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
Av. amt. of alfalfa hay consumed daily per steer, lbs....	5.79	5.77	5.79	5.78	5.78	5.79	5.79	5.78	5.78
Av. amt. of silage consumed daily per steer, lbs.....	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
Corn consumed for one lb. of gain, lbs.....	1.69	1.56	1.51	1.29	1.89	4.92	1.56	1.89	2.04
Alfalfa hay consumed for one lb. of gain, lbs.....	3.27	3.01	2.91	2.49	3.64	9.49	3.15	3.64	3.95
Silage consumed for one lb. of gain, lbs.....	6.78	6.25	6.03	5.17	7.55	19.72	6.25	7.55	8.16
Total dry matter consumed for one lb. of gain, lbs..	11.74	10.82	10.45	8.95	13.08	34.13	10.96	13.08	14.15
Total dry matter consumed for one lb. of gain, lbs.....	6.69	2.19	5.93	5.07	7.42	19.37	6.26	7.42	7.54
Cost of food for 100 lbs. of gain.....	\$4.52	\$4.17	\$4.02	\$3.44	\$5.02	\$13.12	\$4.24	\$5.02	\$5.44

TABLE 19.—*Record of each steer in Group III, January 25 to May 19, 1912 (16 weeks, 2 days).  
Ration,—corn (medium feed), silage (medium feed), and alfalfa.*

Number of each steer.....	84 Sh.	346 Ang.	357 Her.	92 Sh.	82 Sh.	339 Sh.	354 D. B.	331 Hol.- Jer.	Av.
Initial weight of each steer, lbs.....	420	425	405	380	390	360	410	315	388
Final weight of each steer, lbs.....	670	630	623	608	593	588	603	502	602
Av. daily gain of each steer, lbs.....	2.23	1.83	1.95	2.04	1.81	2.04	1.72	1.67	1.91
Av. amt. of corn consumed daily per steer, lbs.....	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00
Av. amt. of alfalfa hay consumed daily per steer, lbs.....	5.75	5.76	5.79	5.77	5.79	5.76	5.75	5.73	5.76
Av. amt. of silage consumed daily per steer, lbs.....	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00
Corn consumed for one lb. gain, lbs.....	2.69	3.28	3.08	2.94	3.31	2.94	3.49	3.59	3.17
Alfalfa hay consumed for one lb. of gain, lbs.....	2.58	3.15	2.97	2.83	3.20	2.83	3.34	3.43	3.04
Silage consumed for one lb. of gain, lbs.....	4.03	4.91	4.62	4.41	4.97	4.41	5.23	5.39	4.75
Total food consumed for one lb. of gain, lbs.....	9.30	11.34	10.67	10.18	11.48	10.18	12.06	12.41	10.95
Total dry matter consumed for one lb. of gain, lbs.....	6.00	7.33	6.89	6.58	7.42	6.58	7.79	8.02	7.08
Cost of food for 100 lbs. of gain.....	\$4.85	\$5.93	\$5.47	\$5.31	\$5.99	\$5.31	\$6.29	\$6.48	\$5.70

TABLE 20.—*Record of each steer in Group IV, January 25 to May 19, 1912 (16 weeks, 2 days).  
Ration,—corn (heavy feed), silage (light feed), and alfalfa.*

Number of each steer.....	94 Ayr.	360 Gal.	89 Sh.	88 Sh.	87 Sh.	341 Hol.	337 Hol.- Jer.	93 Jer.	Av.
Initial weight of each steer, lbs.....	415	440	385	430	330	380	320	380	385
Final weight of each steer, lbs.....	670	710	662	693	543	663	529	630	638
Av. daily gain of each steer, lbs.....	2.28	2.41	2.47	2.35	1.90	2.53	1.87	2.23	2.26
Av. amt. of corn consumed daily per steer, lbs.....	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00
Av. amt. of alfalfa hay consumed daily per steer, lbs....	5.79	5.78	5.78	5.75	5.74	5.77	5.75	5.75	5.76
Av. amt. of silage consumed daily per steer, lbs.....	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00
Corn consumed for one lb. of gain, lbs.....	3.95	3.73	3.64	3.83	4.74	3.56	4.81	4.04	4.04
Alfalfa hay consumed for one lb. of gain, lbs.....	2.54	2.40	2.34	2.45	3.02	2.28	3.07	2.58	2.59
Silage consumed for one lb. of gain, lbs.....	2.63	2.49	2.43	2.55	3.16	2.37	3.21	2.69	2.69
Total food consumed for one lb. of gain, lbs.....	9.12	8.62	8.41	8.83	10.92	8.21	11.09	9.31	9.31
Total dry matter consumed for one lb. of gain, lbs.....	6.60	6.24	6.09	6.39	7.92	5.95	8.03	6.74	6.75
Cost of food for 100 lbs. of gain.....	\$6.06	\$5.67	\$5.53	\$5.81	\$7.19	\$5.40	\$7.31	\$6.13	\$6.14

The tables show that the average weight of the four groups at the beginning of the experiment was 380 to 388 pounds each—practically the same average weight. The weights of each steer were taken on three consecutive days, and the weights given represent the average of these as in previous experiments. Referring to Group I, Table 17, it will be observed that three of the calves made very large gains for having received no grain, the average of the group being 1.36 pounds per day. The average daily gains for all groups seemed to be in proportion to the grain fed, the heaviest fed calves gaining on the average 2.26 pounds,—a very large daily gain for cattle of that age and weight. Less total dry matter was consumed where more grain was fed. On the other hand, the cost of producing gains increased in proportion to the amount of grain fed. This was directly opposite to the results in the previous experiment with cattle one year old.

In a series of experiments made several years ago, the writer found that with alfalfa hay without silage a small grain ration is more economical than either no grain or a heavy grain ration. The results of this experiment would seem to indicate that a good quality of corn silage contains enough grain to make calves grow fairly well, and at a lower cost than tho they received grain in addition to the silage. The fact that calves can be grown at a cost of \$4.10 per hundred on silage valued at \$3.00 per ton and alfalfa at \$10.00 per ton is a strong argument in favor of using bulky feeds of this character in large quantity. That calves can make gains at a much lower cost than cattle one year older is also strongly brought out by comparing the cost of the gains of the heaviest fed calves, and that of the yearlings fed the same kind of a ration in the preceding experiment.

The calves which received no grain were of course in lower flesh at the close of the experiment, but they were in an excellent condition to go on spring pasture. In former experiments it was found that the calves which were in lower condition because of having received no grain during the winter always made much larger gains on grass alone the succeeding summer than the heavy grain fed calves. The liberal feeding of grain would only seem to be practical when calves are to be marketed early as "baby beef." Whether or not the calves in this experiment which received the heavy grain ration will prove more profitable as "baby beef" remains to be seen. All have since been put on a heavy grain ration to be marketed next fall.



## **PART II.**

### **BREEDS AND TYPES OF CATTLE AS FACTORS IN ECONOMICAL BEEF PRODUCTION.**

In comparisons of rations as described in this bulletin and in a large number of other Experiment Station reports, it is apparent that one combination of foods is capable of giving much larger and more economical gains than another. This difference in the feeding value of rations is generally attributed to the composition of the foods in the ration, the relative proportion of concentrates to roughage, and the palatability of the material. A great deal of investigational work has been done to determine the value of foods in various combinations, but very little has been done to show why one animal uses his food to much better advantage than another and therefore produces meat with greater economy. That there is a wide difference in the capacity of individuals to make gains is shown by referring to the tables published on previous pages of this report.

It was for the purpose of securing data on the relative capacity of individuals to make gains that separate records on the feed consumed and gains made by each steer were kept. Referring first to Table 1, page 9, it will be seen that the eight calves in Group I of the first experiment made daily gains in the following order: the Angus 1.75 pounds, the Jersey 1.68 pounds, the Holstein 1.54 pounds, the four Shorthorns 1.26 to 1.64 pounds (average 1.46), and the Red Poll 1.39 pounds. In Group II the two Holsteins made daily gains of 2.10 pounds and 2.20 pounds (average 2.15), the Hereford 1.96 pounds, and the five Shorthorns 1.57 to 1.80 pounds (average 1.71). In Group III the Jersey made a daily gain of 1.57 pounds, the two Shorthorns 1.36 to 1.54 pounds (average 1.45), the three Herefords 1.11 to 1.68 pounds (average 1.35), and the Angus 1.29 pounds. Attention is here called to the fact that an Angus was the largest gainer in Group I and another Angus steer the smallest gainer in Group III. In Group IV the Hereford gained 1.64 pounds, the Red Poll 1.54 pounds, the two Guernseys 1.26 and 1.61 pounds (average 1.43), and the four Shorthorns 1.37 to 1.75 pounds (average 1.52). In Group V the four Shorthorns gained 1.40 to 1.81 pounds (average 1.57), the Holstein 1.54 pounds, the Hereford 1.46 pounds and the two Red Polls 1.13 and 1.50 (average 1.31). In Group VI the Jersey gained 1.59 pounds, the two

Herefords 1.49 and 1.51 pounds (average 1.50), and the four Shorthorns 1.29 and 1.71 pounds (average 1.49).

Referring next to Table 7, page 18, it will be observed that the same Angus steer, No. 34, as in the first experiment, was again the largest gainer. The four Shorthorns averaged 1.79 and the Holstein 1.79, the Jersey 1.63, and the Red Poll 1.58. In Table 8 it will be seen that the two Holsteins, Nos. 19 and 23, were again the largest gainers in this experiment, averaging 2.14 pounds. The five Shorthorns averaged 1.70 pounds and the Hereford 1.68 pounds. In Group III of this experiment, the Holstein gained 1.74 pounds, the two Shorthorns 1.45 pounds and 1.92 pounds (average 1.68), the three Herefords 1.16 to 1.61 pounds (average 1.47), the Angus 1.47 pounds, and the Jersey 1.43 pounds.

In all these data there is nothing to indicate that the individuals of one breed make larger gains than those of another breed. In one group a steer of a certain breed may show the largest gain, while in another group a specimen of the same breed may show the smallest gain. These figures show that there is as wide a range in daily gains within a given breed as between animals representing different breeds.

Combining the gains in both experiments, from March 25 to December 5, 1910, the daily gains made by the five Holsteins range from 1.51 (2) to 2.59 (19), the average for the five being 1.86 pounds. The two Angus for the entire period made daily gains of 1.37 (70) and 1.82 (34), averaging 1.59 pounds. The two Guernseys for the entire period made daily gains of 1.43 to 1.76, averaging 1.59 pounds. The twenty-four Shorthorns made daily gains for the entire period ranging from 1.01 to 1.79, averaging 1.58 pounds; the eight Herefords 1.33 to 1.84, averaging 1.56 pounds; the three Jerseys 1.51 to 1.66, averaging 1.56 pounds; and the four Red Polls 1.34 to 1.55, averaging 1.48 pounds.

The profits made by each steer over and above the cost of feeds depend, of course, upon the gains made and the selling price of the steers at the close of the experiment, which is determined almost wholly by the condition of flesh and the quality of the animal with reference to the proportion of high-priced meat. Combining the profits made by each individual during the first two experiments, it is to be seen by referring to Tables 1 to 12, inclusive, that the Shorthorn steer No. 21 made the largest profit in Group I, with the Angus steer No. 34 second. The poorest showing made by any steer in this group was a loss of \$1.44 by steer No. 67, a Red Poll. The next lowest was No. 6, a Jersey, which made a profit in both experiments of \$2.65. In Group II the largest profit was made by a Shorthorn-Holstein steer, No. 19 (\$16.61). The next largest profit was made by a

grade Holstein, and the lowest profit by a Shorthorn of inferior type. In Group III the largest profit, amounting to \$6.29, was made by No. 61, a Hereford, with No. 18, a Shorthorn, second (\$5.73). The poorest showing in this group was made by No. 37, a Hereford, which lost \$3.81. Next to him was No. 33, a Jersey, which lost \$2.01. In Group IV the most profitable steer was a Hereford, and the next most profitable a Guernsey, while the least profitable was a Shorthorn. In Group V the most profitable steer was a Shorthorn and the next most profitable a Holstein, while a mongrel steer, No. 39, containing some Shorthorn blood, was least profitable. In Group VI a high grade Shorthorn, No. 48, was most profitable and a Jersey, No. 17, was least profitable.

Of the entire forty-eight steers, the largest profit made during the first two experiments was \$16.61 by the Shorthorn-Holstein steer No. 19. A part of this profit was, of course, due to the fact that this steer was in the group which received the best ration.

The poorest showing made by any steer of the entire number was that of the Jersey steer No. 17, which lost, during both experiments, \$4.52.

Combining the profits made during the three experiments, from March 25, 1910, to May 5, 1911, it was found that the largest total profit was made by the Shorthorn steer No. 18, amounting in all to \$24.43; the next largest profit was made by the Hereford No. 61, amounting to \$23.99; the third largest was the Shorthorn steer No. 27, amounting to \$23.56; the fourth largest by the Hereford steer No. 47, amounting to \$21.14. The poorest showing was made by the Red Poll steer No. 67, which lost, during the three experiments, \$6.09. The next poorest showing was made by the Shorthorn steer No. 7, which made a total profit of \$4.90; and the third poorest showing by the Holstein steer No. 75, which made a total profit of \$6.42.

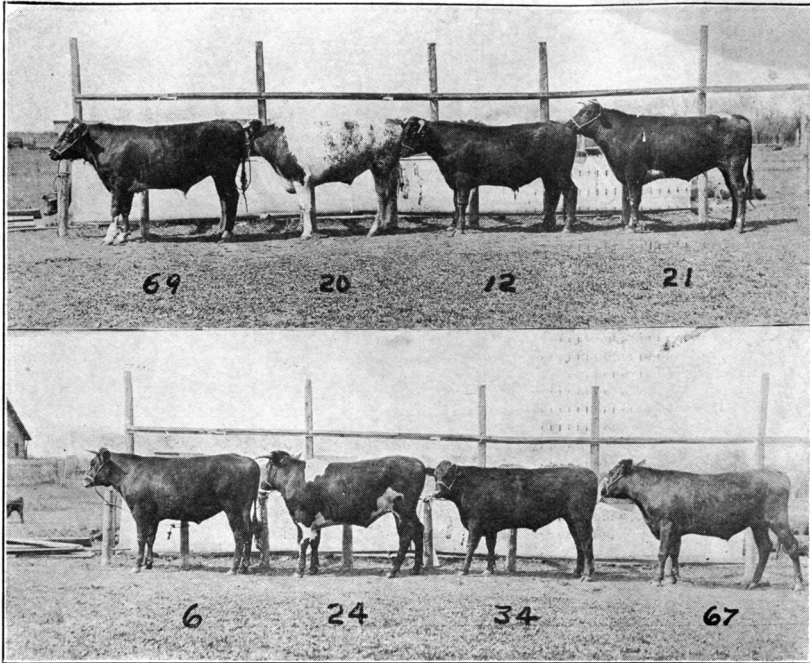
It was observed in these tests that while the representatives of the beef breeds did not make larger gains than the representatives of the dairy breeds during the first 18 months, the profits made by the better bred beef cattle were in the main considerably larger than on the dairy bred steers. Two of the grade Holstein steers made gains sufficiently large to offset their lower selling price. Judging from the records made by the few Holsteins in this experiment, it may be said that their gains are very satisfactory and these steers can be fed with profit especially when crossed with one of the beef breeds. The principal objection to Holsteins for the production of beef is the fact that they are very slow to fatten and must be kept in the feed lots for a longer time than is ordinarily needed by the beef breeds.

From the results of this test, in which it is shown that there is a wide variation in gains made by steers regardless of breed,—1.01 to 1.79 pounds per day with the twenty-four Shorthorns in this experiment,—it is apparent that there must be some other influencing factors. The real purpose of this comparison of individuals was to determine to what extent gains are influenced by the type of the animal. In other words, are there external qualities as shown by the animal conformation that indicate gaining capacity? In order to secure data on this question, each of the forty-eight steers was carefully measured at intervals to determine the size of the heart girth, middle girth, rear girth, width and depth of chest, height from the ground, length of body, length of neck, width and length of head, size of bone, pliability of skin, etc.

With the measurements on fifty-four two-year-old steers fed individually in earlier experiments and those on the 48 yearlings and 32 calves described in this bulletin, data on the correlation of conformation of body with gains for 134 steers will be published in bulletin form as soon as the young cattle now on feed are marketed.

Enough data have already accumulated to show that there are two things relating to conformation of cattle that are especially important for the feeder to know: (1) that the lower-set, more blocky types of cattle which usually have short, wide heads and short necks, with few exceptions fatten earlier than rangy cattle fed under like conditions, and bring a higher price per pound when sold, because they are thicker in flesh and usually show a larger proportion of the higher priced cuts of beef. In the majority of instances these lower-set cattle were also somewhat better gainers up to the age when most of these were marketed, namely, 23 months. (2) The data already accumulated also show that cattle which have plenty of body capacity—those that are large in barrel as indicated by the depth of body and size of the middle girth—make the largest gains. It would seem that there must be plenty of room for the organs of digestion. Slender bodies have not been associated with large gains in these experiments, whereas the correlation of middle girth with gains has been marked (.61+). This will be shown in the form of what are known as "Correlation Tables," to be published later in bulletin form.

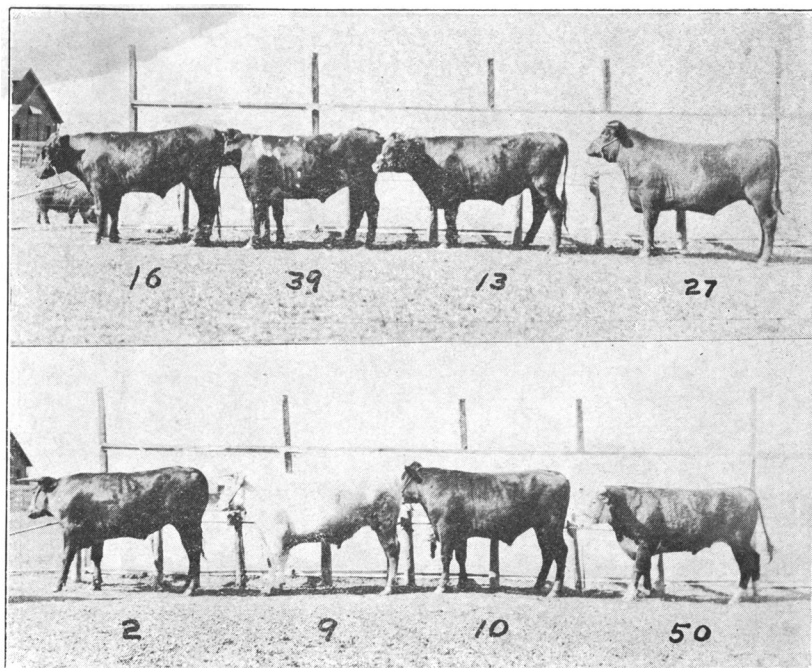
The accompanying illustrations show the four groups of steers fed in the last experiment (III). The number of the steer, the gains per day on the rations fed, and the size of the middle girth when each steer weighed 1,000 pounds appear below each picture.



GROUP I, EXPERIMENT III.

Ration,—corn (light feed), silage (heavy feed), and alfalfa.

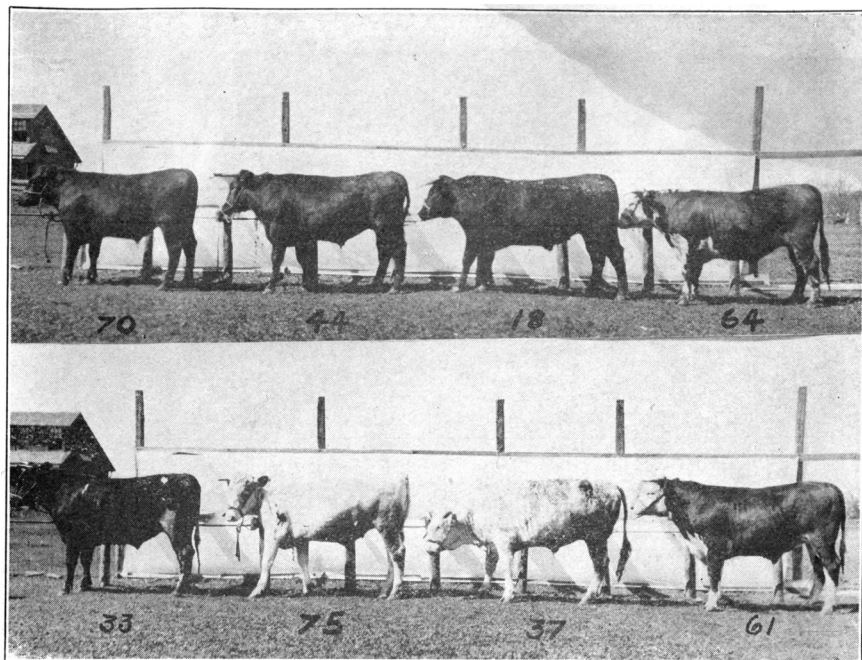
Steer No.	Daily gain	Middle girth at 1,000 pounds weight
	<i>Pounds</i>	<i>Inches</i>
12 (Shorthorn).....	1.85	84.4
24 (Shorthorn).....	1.72	83.9
21 (Shorthorn).....	1.65	83.5
6 (Jersey).....	1.58	84.0
34 (Angus).....	1.42	80.5
20 (Shorthorn).....	1.37	82.5
69 (Shorthorn).....	1.27	82.7
67 (Red Poll).....	1.05	81.0



## GROUP II, EXPERIMENT III.

Ration,—corn (medium feed), silage (medium feed), and alfalfa.

Steer No.	Daily gain		Middle girth at 1,000 pounds weight
	Pounds	Inches	
27 (Shorthorn).....	2.18	84.5	
9 (Shorthorn).....	1.88	83.0	
2 (Holstein).....	1.85	81.0	
10 (Red Poll).....	1.70	81.5	
16 (Red Poll).....	1.65	80.0	
39 (Shorthorn).....	1.55	82.1	
13 (Shorthorn).....	1.53	81.8	
50 (Hereford).....	1.38	81.5	

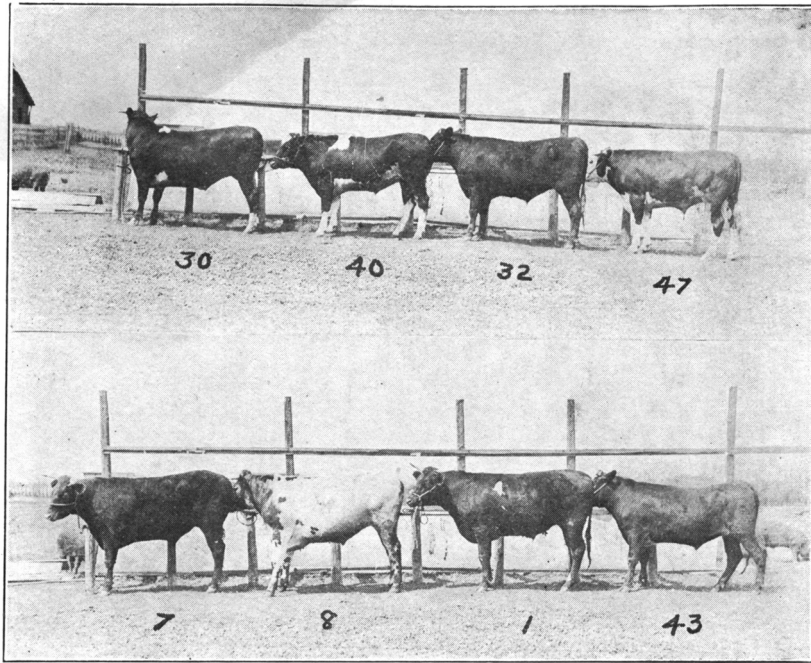


GROUP III, EXPERIMENT III.

Ration,—corn (heavy feed), silage (light feed), and alfalfa.

Steer No.	Daily gain	Middle girth at 1,000 pounds weight
	<i>Pounds</i>	<i>Inches</i>
64 (Hereford) .....	2.37	85.9
18 (Shorthorn) .....	2.25	84.5
44 (Shorthorn) .....	2.21	83.5
33 (Jersey) .....	2.20	83.1
61 (Hereford) .....	2.11	80.5
75 (Holstein) .....	1.93	82.2
70 (Angus) .....	1.93	80.2
37 (Hereford) .....	1.87	81.4





## GROUP IV, EXPERIMENT III.

Ration,—corn (heavy feed), stover (light feed), and alfalfa.

Steer No.	Daily gain	Middle girth at 1,000 pounds weight
	<i>Pounds</i>	<i>Inches</i>
8 (Shorthorn).....	2.23	85.5
47 (Hereford).....	2.22	83.0
30 (Guernsey).....	2.13	84.4
1 (Shorthorn).....	1.90	82.4
32 (Red Poll).....	1.75	80.6
43 (Shorthorn).....	1.59	80.3
40 (Guernsey).....	1 38	79.8



**SUMMARY.**

(1) In comparing bran, linseed-meal, and cold pressed cottonseed-cake, each as a source of protein supplementing corn-meal and silage, the cold pressed cake proved to be worth 50 per cent more per ton than wheat bran, and linseed-meal 18 per cent more per ton than cold pressed cottonseed-cake.

In the use of each of these supplementary protein feeds with corn-meal and prairie hay, the cold pressed cottonseed-cake showed a value per ton 22 per cent greater than wheat bran, and the linseed-meal 28 per cent more than the cottonseed-cake.

(2) Where alfalfa was used in connection with corn-meal and silage, or corn-meal and prairie hay, large gains were made without the use of a concentrated protein food. The gains in both experiments where alfalfa was fed were larger, less costly, and much more profitable. These experiments, supplementing what had previously been found, show that beef can be produced in Nebraska at a lower cost and with greater profit on a combination of the corn plant and alfalfa hay than on any other combination of foods available in the state.

(3) These experiments show that corn silage gives larger gains than shredded corn stover when each is fed with corn-meal and alfalfa, and for beef production is worth 60 per cent more per ton.

(4) Corn-stover has a value 80 per cent as great as prairie hay, and the portion consumed is fully as valuable. Prairie hay at its usual market price is not profitable for fattening cattle.

(5) In comparing a ration consisting of a heavy feed of corn-meal, alfalfa, and a light feed of silage, with a ration consisting of a medium quantity of each feed and a ration consisting of a light feed of corn, alfalfa, and a heavy feed of silage, yearling steers being fattened for market made cheaper and more profitable gains on the larger feed of corn and smaller feed of corn silage.

(6) In growing calves to be fattened later for market, the cheapest gains were made on a liberal ration of corn silage and alfalfa without grain, the cost of gains increasing in proportion to the amount of corn-meal fed.

(7) These experiments show that there is a great variation in the capacity of individual steers to make gains under like conditions. The data do not show that the individuals of one breed

make larger gains than those of another breed. The variation in gain seems to be fully as great within a breed as between representatives of different breeds.

(8) Type or conformation seems to be a controlling factor, the low-set, more compact types having something of an advantage in gains and much in early maturity over the rangy types.

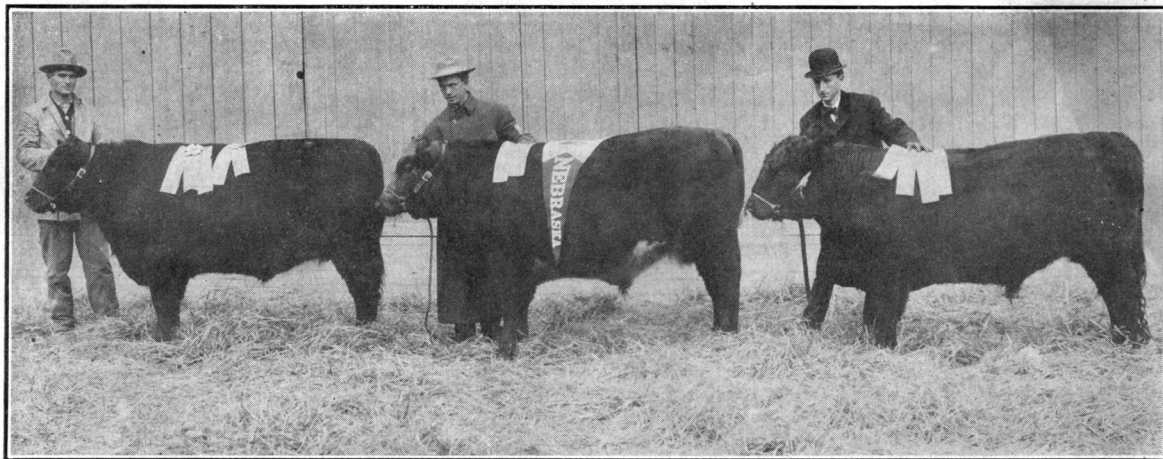
(9) Gains seem to correlate to a considerable degree with body capacity as indicated by the size of the middle girth, the largest gainers having relatively larger middle girths at the same weight in most instances.

(10) While the average gains made by all dairy bred steers are nearly the same as those made by the beef bred steers up to the age of twenty-three months, the latter showed in most instances a higher condition of flesh, a larger proportion of high-priced meat, and sold for a higher price per hundred, returning larger profits to the feeder on the basis of the same initial cost per hundred.

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#### ACKNOWLEDGMENT.

The writer wishes to express his appreciation for the careful and painstaking work of Walter Douglas, who fed the cattle in these experiments, and to Ellis Rail, C. B. Lee, W. J. Rupert, F. A. Hays, and K. F. Warner for assistance in compiling tables and checking figures.



"Prince of Viewpoint 2d," first prize Angus calf and champion of the breed, December, 1910; first prize Angus yearling, champion of breed and reserve grand champion, December, 1911.

"Bluebeard," first prize grade calf, December, 1910, and first prize yearling, December, 1911.

"Bobbie Burns," first prize Galloway calf and champion of the breed, December, 1910; first prize Galloway yearling, December, 1911.

Prize-winning steers at the International Live Stock Exposition, Chicago, fed and exhibited by the Department of Animal Husbandry, University of Nebraska.