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Cattle Feeding Experiment. Roughness Supplementary to Corn for Fattening Two-Year-Old Range Steers.

H. R. Smith
University of Nebraska-Lincoln

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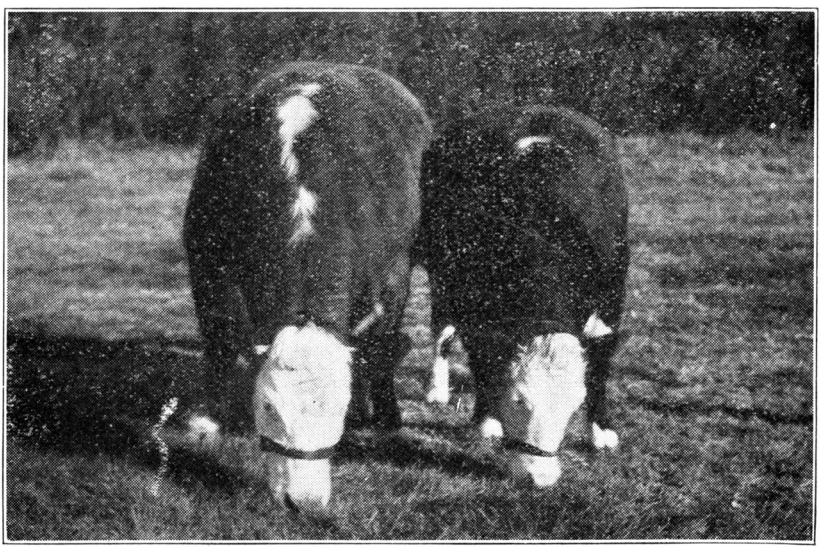

EXHIBITED BY THE UNIVERSITY OF NEBRASKA AT THE INTERNATIONAL LIVE STOCK EXPOSITION, CHICAGO, ILL., DECEMBER, 1904.

CHALLENGER II—
1st in Hereford Special for grades two years old.
2d in open class for grades two years old.

STANTON—
2d in Hereford Special for grades one year old.
5th in open class for grades one year old.

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CATTLE FEEDING EXPERIMENT.

ROUGHNESS SUPPLEMENTARY TO CORN FOR FATTENING TWO-YEAR-OLD RANGE STEERS.

By H R. Smith.

In the economical production of beef, the character of the roughness fed in connection with corn is a factor of greater importance than we have given it in the past. Heretofore, the inclination among cattle feeders has been to depend almost entirely upon corn for producing beef, supplying almost any sort of roughness that would satisfy the craving of the animal for something bulky. Some, in fact, have operated upon the theory that in producing beef for the market it is desirable to feed corn as heavily as possible, discouraging the consumption of rough feed by supplying an inferior quality of hay and not infrequently nothing more than a straw stack.

Under present market conditions, with a foreign and home demand for corn such as to make this grain continue high in price, and with beef selling at a figure hardly in keeping with modern corn values, we are forced to depend less upon grain and more upon the cheaper bulky foods. In other words, we are compelled to recognize the fact that the steer is an animal adapted for the conversion of roughage as well as grain into beef and that this part of the ration should be given as much consideration. It was the desire on the part of the Station to secure data on the relative value of rough feeds common in the West that led to a feeding test with yearling steers during the winter of 1904, the results of which were published in Bulletin 85. It seemed advisable to secure further proof along this line, and similar investiga-

tions were carried on the past winter with two-year-old steers. The only departure made in the two-year-old test was the use of alfalfa hay as a source of protein in the place of oil-meal for the steers fed corn-stover.

PLAN OF THE EXPERIMENT.

On December 28, 1904, fifty range two-year-old steers, mostly grade Shorthorns, were purchased in South Omaha. These steers came from what is known as the North Park country in Colorado, where they had all been handled in the same manner, none having received grain previous to their use in the experiment. When purchased they went under the stock yards nomenclature of "hay feds."

Upon arrival at the Experiment Station farm, the fifty steers were placed in five separate lots with ten in each lot. In making the division, the better steers were distributed in such a way as to make the several lots as even as possible in both quality and weight.

SHELTER.

At the north end of each feed lot was shed space with large open doors on the south to permit the steers to pass in and out at will. These sheds were kept bedded with straw and the steers were thus encouraged to lie down when not eating, a matter of importance in beef production. Within each shed was placed a box which always contained salt. Both hay and grain were fed in the lots, which were sufficiently large to permit the steers to move about freely without being unduly active. The yards were no drier than the average feed lots in the State. No doubt still larger gains would have been secured had the lots been better drained.

WATER.

Water was made accessible twice each day by giving each lot of cattle the run of a yard in which was stationed a tank fed by an elevated reservoir. The water came from a deep

well and was always pure. Small heaters were used in the tanks during extremely cold weather simply to prevent ice formation. The importance of having a plentiful supply of water cannot be given too much emphasis.

PRELIMINARY FEEDING.

Inasmuch as all the steers were accustomed to native prairie hay, it seemed best to continue with that feed for a time, making the change to the experimental rations gradual. Twenty-four days were occupied in making this change, so that it was not until January 21st that each lot was on its experimental ration entire and the records of the experiment proper were begun. During these three weeks of preliminary feeding, the steers were fed a grain ration, gradually increased from four pounds the first day to ten pounds January 21st.

INITIAL WEIGHTS OF STEERS.

The steers were weighed at the time of the division of the lots, December 28th, and each lot was again weighed four days in succession just preceding and immediately after January 21st, the average being taken for the initial weight of each lot January 21st, the opening day of the experiment. The average of four successive days' weighings was made in order to secure a more reliable record of weights and gains, a single weight being unsatisfactory because it may be on a fill either above or below normal.

RATIONS FED.

Each lot was fed for twenty-four weeks upon rations as follows:

Lot 1, shelled corn and prairie hay.

Lot 2, shelled corn 90 per cent, oil-meal 10 per cent, and prairie hay.

Lot 3, shelled corn and alfalfa hay.

Lot 4, shelled corn, alfalfa hay, and corn-stover.

Lot 5, shelled corn 90 per cent, oil-meal 10 per cent, and sorghum hay.

CHARACTER OF FOODS USED.

The shelled corn used was a good quality of yellow dent.

The oil-meal was oil-cake which had been ground coarsely, the particles being about the size of peas or kernels of corn. The pea size is less likely to be adulterated than finely ground meal and is not blown by the wind in open bunks.

Both the prairie hay and the alfalfa were of good quality, the latter being from an early cutting, therefore less laxative in its effects.

The corn-stover was from corn cut and put in the shock just after the husks about the ears had turned yellow, while most of the stalk leaves were yet green. The kernels were hard and well dented, so there was no injury whatever to the corn by cutting and shocking at that stage. The ears were all removed from the stalks several weeks later and the stover (stalks without ears) was left in shocks outdoors until late in winter, when it was stored under roof. It was fed in open racks unshredded.

The sorghum hay (cane) was grown by planting the seeds rather thickly. The stems varied from the size of a pencil to that of the finger on a man's hand. The fodder was kept in stacks until late spring, when some was put under cover for better preservation during rainy weather. The sorghum was also fed in open racks uncut.

METHOD OF FEEDING.

Each lot having been gradually increased from four pounds of grain per steer December 28th to ten pounds January 21st, the opening of the experiment proper, there remained considerable room for a further increase before a full feed of grain was reached. For the sake of economy in the larger use of roughage, it was not until the end of the eighth week

of the experiment proper that the cattle were receiving what would be considered a full grain feed.

During the first two months of the experiment, all lots were purposely fed the same weight of grain and all the hay that would be cleaned out of the racks reasonably well. After the second month, each lot was fed grain according to the appetites of the cattle, some taking more than others, the amount fed being just what would be consumed within about one hour after feeding. The steers were fed morning and night, at the same hours each day, and the feeding bunks were large enough to accommodate the ten head at one time.

Every feed of roughage was weighed, the waste being thrown out for bedding but charged to the steers as though all had been consumed. This amounted to several pounds each day in the case of the corn-stover, the butts being useless for feed.

MONTHLY RECORD OF GAINS.

An attempt was made to secure an accurate record of the gains by month. It was thought that by making an average of three weights on successive days at the end of each month, unevenness due to fill would be overcome, which was true in part, though the daily gains for each separate month as shown by the following table are so variable as to make one conclude that fill is a difficult matter to control, even when several weighings are made at the same hour each day and under the same conditions. The table is of especial interest in that it shows the average amount of both grain and hay fed daily during each period of four weeks, the increasing amount of feed required for a pound of gain as the cattle take on more fat, and the corresponding increase in cost of gains.

TABLE I.—*Average monthly record of each steer by lot.* (*1 mo.=28 days.*)

Lot.	No. of month.	Average weight per steer.	Daily gain per steer.	Grain per day per steer.	Hay per day per steer.	Grain consumed per pound of gain.	Hay consumed per pound of gain.	Total food per pound of gain.	Cost of 1 pound of gain.
		Pounds.							
		January 21, 926	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Cents.*
	1st	February 18, 999	2.60	12.2	17.6	4.69	6.77	11.46	5.31
	2d	March 18, 1056	1.99	15.3	11.3	7.67	5.67	13.34	7.07
1.	3d	April 15, 1104	1.96	19.3	7.9	10.96	4.48	15.44	9.02
Corn and prairie hay.	4th	May 13, 1159	1.98	20.9	7.1	10.55	3.58	14.13	8.46
	5th	June 10, 1202	1.54	18.7	7.1	12.29	4.58	16.87	9.84
	6th	July 8, 1241	1.38	20.7	7.6	14.98	5.50	20.48	12.18
	Average for 6 months		1.87	17.9	9.7	9.52	5.19	14.71	8.23
		January 21, 934							
	1st	February 18, 1008	2.80	12.2	17.9	4.36	6.39	10.75	5.28
	2d	March 18, 1074	2.25	15.3	11.6	6.80	5.18	11.98	6.95
2.	3d	April 15, 1141	2.39	20.8	7.8	8.76	3.29	12.05	7.74
Corn 90%, oil-meal 10%, prairie hay.	4th	May 13, 1203	2.22	23.4	7.1	10.58	3.20	13.78	9.11
	5th	June 10, 1257	1.95	21.5	6.0	11.97	3.07	15.04	10.15
	6th	July 8, 1293	1.29	19.5	4.9	16.57	3.80	20.37	13.98
	Average for 6 months		2.14	19.4	9.5	9.06	4.30	13.36	8.27
		January 21, 937							
	1st	February 18, 1014	2.90	12.2	19.2	4.20	6.62	10.82	4.86
	2d	March 18, 1089	2.41	15.3	12.3	6.37	5.16	11.53	5.85
3.	3d	April 15, 1150	2.20	20.4	7.1	9.27	3.22	12.49	7.47
Corn and alfalfa hay.	4th	May 13, 1217	2.39	21.9	5.9	9.16	2.46	11.62	7.17
	5th	June 10, 1282	2.32	21.4	6.0	9.22	2.58	11.80	7.22
	6th	July 8, 1324	1.50	20.7	4.7	13.81	3.13	16.94	10.66
	Average for 6 months		2.30	18.6	9.2	8.14	4.02	12.16	6.89

TABLE I (*Continued*).— *Average monthly record of each steer by lot.* (*1 mo.=28 days.*)

Lot.	No. of month.	Average weight per steer.	Daily gain per steer.	Grain per day per steer.	Hay per day per steer.	Grain consumed per pound of gain.	Hay consumed per pound of gain.	Total food per pound of gain.	Cost of 1 pound of gain.
		Pounds.							
		January 21, 941	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Cents.*
	1st	February 18, 1038	3.36	12.2	19.2	3.63	5.71	9.34	3.76
	2d	March 18, 1099	2.18	15.3	9.8	6.88	4.54	11.42	5.77
	3d	April 15, 1165	2.46	20.8	8.0	8.45	3.25	11.70	6.67
4.	4th	May 13, 1226	2.43	21.4	7.9	8.80	3.35	12.15	6.33
Corn, alfalfa hay 50%, corn-stover, 50%.	5th	June 10, 1288	2.46	22.1	7.2	8.98	3.65	12.63	10.48
	6th	July 8, 1324	1.42	20.0	7.4	14.05	5.21	19.26	13.81
	Average for 6 months		2.39	18.4	9.9	7.89	4.56	12.45	6.49
		January 21, 926							
	1st	February 18, 1001	2.68	12.2	17.1	4.55	6.38	10.93	4.62
	2d	March 18, 1060	2.09	15.3	12.1	7.32	5.79	13.11	6.64
	3d	April 15, 1132	2.58	22.3	8.6	8.64	3.33	11.97	7.24
	4th	May 13, 1199	2.38	26.6	6.2	11.17	2.60	13.77	9.04
5.	5th	June 10, 1277	2.80	26.2	4.8	9.35	1.71	11.06	7.49
Corn 90%, oil-meal 10%, sorghum hay.	6th	July 8, 1312	1.24	26.4	3.9	21.25	3.17	24.42	16.88
	Average for 6 months		2.30	21.5	8.8	9.36	3.82	13.18	7.87

COMMENTS ON THE EXPERIMENT.

At the end of the second month one of the largest steers in Lot 4 contracted pneumonia from the effects of dipping and was withdrawn. His weight was credited to that lot, and the average thereafter was made on nine steers, which in no wise affected the results, though the withdrawal of such a heavy steer lowered the average of later weights in that lot.

After the second month's feeding, while each lot was fed all the grain that would be cleaned up reasonably soon, it will be noted that Lot 1 consumed the least grain of all. This lack of appetite was no doubt due to the fact that insufficient protein was furnished by corn and prairie hay, the steers in this lot being the only ones which were given a poorly balanced ration. This is exactly what occurred with yearling steers the previous winter, and it is probable that the smaller consumption of food partially accounts for the smaller gains on corn and prairie hay both winters. A large utilization of food is always more economical than a smaller one, because it is the surplus over and above maintenance requirements which goes to produce increase in weight.

The steers receiving sorghum hay were the heaviest consumers of grain, which was also true with yearlings the previous winter, though there was less difference with the latter. The steers when on a full grain feed consumed but a relatively small quantity of roughage, the amount being regulated in each lot by the inclination of the cattle.

The light gain for food consumed during the last month was due to the fact that the steers were then in good flesh, though the hot weather in June, together with the annoyance caused by flies, no doubt contributed to make the gain an unsatisfactory one.

With salt before the cattle at all times, each steer in Lot 1 consumed an average of .21 pound per week; in Lot 2, .21 pound; in Lot 3, .19 pound; in Lot 4, .15 pound; and in Lot 5, .31 pound.

The cost of producing one pound of gain is based upon the following average market values current in Lincoln, Nebr., during the progress of the experiment:

Corn, 70 cents per hundred (39 cents per bushel).

Oil-meal, $1.40 per hundred ($28 per ton).

Alfalfa hay, $6 per ton.

Prairie hay, $6 per ton.

Sorghum hay, $3.50 per ton.

Corn-stover, $2.50 per ton.

Following is a condensed table showing the average record of each steer by lot for the entire period of twenty-four weeks from January 21 to July 8, 1905:

TABLE II.—*Averages per steer for the entire period.*

	Lot 1.	Lot 2.	Lot 3.	Lot 4.	Lot 5.
	Corn and prairie hay.	Corn 90%, oil-meal 10%, prairie hay.	Corn, alfalfa hay.	Corn, alfalfa hay, corn-stover.	Corn 90%, oil-meal 10%, sorghum hay.
Average weight per steer January 21, pounds	926	934	937	941	926
Average gain per steer for six months, pounds	314.8	360.6	385.4	401.5	385.7
Average gain per steer per day, pounds	1.9	2.1	2.3	2.4	2.3
Average grain per steer per day, pounds	17.9	19.4	18.6	18.4	21.5
Average roughage per steer per day, pounds	9.7	9.5	9.2	9.9	8.8
Average grain consumed for each pound of gain, pounds	9.52	9.06	8.14	7.89	9.3¢
Average roughage consumed for each pound of gain, pounds	5.19	4.30	4.02	4.56	3.82
Average cost of one pound of gain, cents	8.23	8.27	6.89	6.49	7.87
Nutritive ratio by lot	1:10 2	1:8	1:7.4	1:8.4	1:8.2

The following table, showing the record for yearling steers as determined in 1904 and published in Bulletin 85, is introduced here to show the relative efficiency of similar rations with younger cattle. The yearlings were in better flesh at the beginning so that a comparison of the cattle at different ages should not be made:

TABLE III.—*Averages for yearling steers, December 26, 1903, to June 26, 1904.*

	Lot 1.	Lot 2.	Lot 3.	Lot 4.	Lot 5.
	Corn, prairie hay.	Corn 90%, oil-meal 10%, prairie hay.	Corn, alfalfa hay.	Corn 90%, oil-meal 10%, corn-stover.	Corn 90%, oil-meal 10%, sorghum hay.
Average weight per steer December 26, 1903, pounds	801	799	8.8	777	788
Average gain per steer for six months, pounds	246	347	359	356	324
Average gain per steer per day for six months, pounds	1 35	1.91	1.97	1.96	1.78
Average grain per steer per day, pounds	14 3	15 4	15.3	15.6	15.6
Average roughage per steer per day, pounds	8.7	8.8	9.2	11.2	11.3
Grain consumed per pound of gain, pounds	10.5	8.1	7.7	8.0	8.7
Roughage consumed per pound of gain, pounds	6.5	4.6	4.7	5.7	6 4
Cost of one pound of gain, cents	8.27	6.82	6.04	6.09	7.0
Nutritive ratio by lot	1:10.4	1:8	1:7	1:8 3	1:9

Prices, 1904.—Corn, 60 cents per hundred; oil-meal, $25 per ton; prairie hay, $6 per ton; alfalfa, $6 per ton; sorghum, $3.50 per ton; corn-stover, $2.50 per ton.

DEDUCTIONS FROM THE TWO EXPERIMENTS SUMMARIZED IN TABLES II AND III.

(1) By adding one pound of oil-meal to every nine pounds of corn to furnish protein lacking in a ration consisting of corn and prairie hay, 5 per cent less grain was required for each pound of gain on two-year-old steers and 23 per cent less on yearlings.

(2) By feeding alfalfa hay, which is a protein-rich roughness extremely palatable and readily masticated, in place of prairie hay with corn alone, 14 per cent less grain was required for each pound of gain on two-year-olds and 27 per cent less on yearlings.

(3) Alfalfa hay, fed once per day in connection with corn and well-cured cornstalks, furnished sufficient protein for two-year-olds to make the three foods a combination producing heavy and very economical gains—more economical than any other ration in the experiment.

(4) Corn and oil-meal mixed at the rate of one pound of oil-meal to nine of corn, fed with cured cornstalks for roughage, made an efficient combination for yearlings, and one quite as economical as corn and alfalfa, oil-meal at that time being worth $25 per ton.

(5) Sorghum hay fed with corn 90 per cent and oil-meal 10 per cent, the latter to supply needed protein, made a good fattening ration for both two-year-olds and yearlings, though less economical than cornstalks, the latter being cheaper because a by-product in corn production.

(6) Though less profitable in the end, the cost of producing one pound of gain on two-year-olds was approximately the same without the use of oil-meal as when the oil-meal formed 10 per cent of the grain ration in connection with corn and prairie hay and cost $28 per ton. On yearlings the cost of producing one pound of gain was 17 per cent less with 10 per cent of oil-meal than without oil-meal when the latter was worth $25 per ton.

(7) The use of cornstalks, worth $2.50 per ton, in Lot 4, as a substitute for one-half the alfalfa, worth $6 per ton, as fed in Lot 3, reduced the cost of gains on two-year-olds 6 per cent.

(8) Thin two-year-olds from the range made practically as large gains for food consumed as did yearling steers in good grass flesh at the beginning of the experiment.

SHIPMENT.

All lots of cattle in this experiment with two-year-old steers were reduced to one-half their usual allowance of grain and fed prairie hay immediately after the close of the experiment, preparatory to shipment two days later.

SALE.

They were sold in South Omaha, July 11, 1905, to the Omaha Packing Company, at the following prices:

Lot 1, corn and prairie hay	$5 10	per hundred
Lot 2, corn, oil-meal, and prairie hay	5 25	per hundred
Lot 3, corn and alfalfa hay	5 25	per hundred
Lot 4, corn, alfalfa and corn-stover	5 30	per hundred
Lot 5, corn, oil-meal and sorghum	5 30	per hundred

Lots 4 and 5 sold at the top price for the day, at which time there was a heavy run of beef cattle. The writer does not believe that the ration fed Lot 3 caused them to undersell Lots 4 and 5, as a small difference in quality, rather than fat, could easily have been made six months previous when the cattle were divided. In Lot 1, however, there was a pronounced lack of finish, apparently about one month's feeding, which was unquestionably the cause of their being sold 15 and 20 cents below the other lots. The previous winter the corn and prairie hay fed yearlings sold from 20 to 35 cents per hundred below all other lots, and the alfalfa and corn lot in that experiment was one of the number which sold 35 cents higher. The following statement of the dressing of each lot, as furnished by the Omaha Packing Company, shows the lack of finish on the steers fed corn and prairie hay, as steers lacking flesh dress a lower percentage:

DRESSING BY LOT.

	CARCASS.	INTESTINAL FAT.
Lot 1.....	60.20 per cent	2.66 per cent
Lot 2.....	60.87 per cent	2.69 per cent
Lot 3.....	61.40 per cent	3.30 per cent
Lot 4.....	61.62 per cent	3.33 per cent
Lot 5.....	60.73 per cent	3.26 per cent

FINANCIAL STATEMENT.

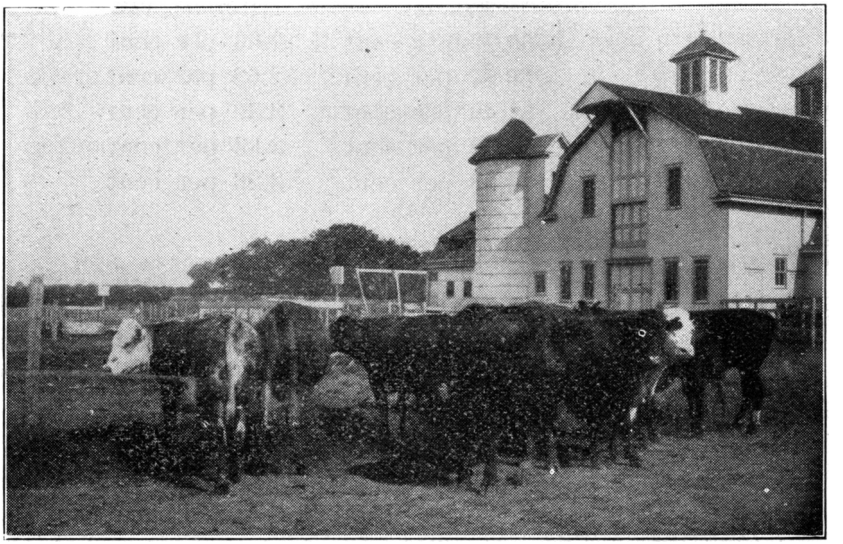
In the following statement, the original cost of the steers ($3.90 per hundredweight in South Omaha, 30 cents per hundred below top prices for feeders) including freight from South Omaha to Lincoln and food consumed during the preliminary period of feeding, makes the net cost on the opening day of the experiment proper exactly four cents per pound on experiment weights. The selling price is also net on final weights in the experiment. The cost of labor is not included since it is customary to figure the manure worth the labor.

Lot 1.

1905		Dr.	Cr.
Jan. 21	To 10 steers, weight 9,260 lbs., at 4 cents net, Lincoln.	$370 40	
	To 29,988 lbs. corn at 70 cents per cwt. (39 cents per bu.)	209 91	
	To 16,348 lbs. prairie hay at $6.00 per ton	49 04	
	To interest on investment ($370.40) for 6 mo. at 6 per cent	11 11	
1905			
July 8	By 10 steers, 12,410 lbs., at $4.78 net, Lincoln		$592 58
	By 732 lbs. of pork, from droppings, at 5 cents net.		36 60
	By loss on ten steers (pork produced from droppings included).		11 28
		$640 46	$640 46

(Loss per steer, $1.13.)

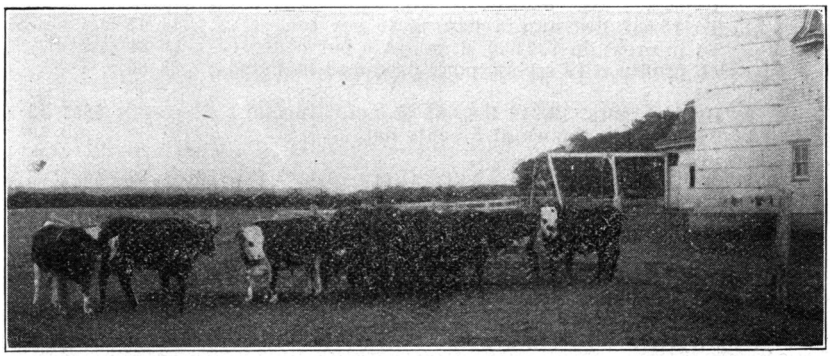
THE FIVE LOTS AS THEY APPEARED AT THE CLOSE OF THE EXPERIMENT.



Lot 1. Corn and prairie hay.

Lot 2. Corn 90%, oil-meal 10%, and prairie hay.

Lot 3. Corn and alfalfa hay.



Lot 4. Corn, alfalfa, and corn-stover.

Lot 5. Corn 90%, oil-meal 10%, and sorghum hay.

Lot 2.

1905				
Jan. 21	To 10 steers, weight 9,340 lbs., at 4 cents net, Lincoln.	$373 60		
	To 29,273 lbs. corn at 70 cents per cwt.	204 91		
	To 3,252 lbs. oil-meal at $28 per ton.	45 53		
	To 15,437 lbs. prairie hay at $6 per ton.	46 31		
	To interest on $373.60, 6 mo. at 6 per cent.	11 20		
	To profit on 10 steers, pork produced included.	10 92		
1905				
July 8	By 10 steers, 12,930 lbs., at $4.98 net, Lincoln.		$643 12	
	By 987 lbs. of pork at 5 cents net.		49 35	
		$692 47	$692 47	

(Profit per steer, $1.09.)

Lot 3.

1905				
Jan. 21	To 10 steers, weight 9,370 lbs., at 4 cents net, Lincoln.	$374 80		
	To 31,502 lbs. corn, at 70 cents per cwt.	220 51		
	To 15,557 lbs. alfalfa hay at $6 per ton.	46 67		
	To interest on $374.80, 6 mo. at 6 per cent.	11 24		
	To profit on 10 steers, pork produced included.	28 60		
1905				
July 8	By 10 steers, 13,240 lbs., at $5 net, Lincoln.		$661 42	
	By 408 lbs. of pork at 5 cents net.		20 40	
		$681 82	$681 82	

(Profit per steer, $2.86.)

Lot 4.

1905				
Jan. 21	To 10 steers, weight 9,410 lbs., at 4 cents net, Lincoln.	$376 40		
	To 31,678 lbs. of corn at 70 cents per cwt.	221 74		
	To 9,154 lbs. of alfalfa at $6 per ton.	27 46		
	To 9,154 lbs. of corn-stover at $2.50 per ton.	11 44		
	To interest on $376.40, 6 mo. at 6 per cent.	11 29		
	To profit on 10 steers, pork produced included.	33 18		
1905				
Mar. 18	By one steer withdrawn, weight 1,140 lbs., at $4.70.		$53 58	
July 8	By 9 steers, 11,916 lbs., at $5.04 net, Lincoln.		600 68	
	By 545 lbs. of pork at 5 cents.		27 25	
		$681 51	$681 51	

(Profit per steer, $3.32.)

Lot 5.

1905				
Jan. 21	To 10 steers, 9,260 lbs., at 4 cents net, Lincoln.	$370	40	
	To 33,427 lbs. corn at 70 cents per cwt.	227	62	
	To 3,603 lbs. oil-meal at $28 per ton.	50	44	
	To 14,745 lbs. sorghum hay at $3.50 per ton.	25	80	
	To interest on $370.40, 6 mo. at 6 per cent.	11	11	
	To profit on 10 steers, pork produced included.	19	22	
1905				
July 8	By 10 steers, 13,120 lbs., at $5.03			$660 24
	By 887 lbs. pork at 5 cents			44 35
		$704	59	$704 59

(Profit per steer, $1 92.)

CONCLUSIONS FROM THIS EXPERIMENT.

1. When the ration consisted of corn and prairie hay, the amount of grain required for each pound of gain was lessened five per cent by adding oil-meal to the grain ration.

The cost of producing a pound of gain was not lessened by the addition of oil-meal, but a better finish was secured, which caused the cattle to sell for 15 cents more per hundred, making a profit of $1.09 per head where a loss of $1.13 resulted from feeding corn and prairie hay only.

The cattle returned a value of $35 per ton for the oil-meal fed, with corn worth 39 cents per bushel.

2. Alfalfa is much superior to prairie hay when the grain consists of corn alone. It also proved to be a cheaper source of protein than oil-meal. The returns on the cattle fed alfalfa hay, were the alfalfa figured at $11.14 per ton, would have been as great as the returns on prairie hay at $6 per ton, with corn as the grain ration at 39 cents per bushel. In comparison with prairie hay at $6 when oil-meal worth $28 per ton was a part of the grain ration, the alfalfa returned a value of $8.28 per ton.

3. Bright, well-cured corn-stover fed with an equal weight of alfalfa, the grain consisting of corn alone, gave slightly larger gains than corn and alfalfa, and proved the most economical ration in the experiment. The addition of corn-stover may have improved to some extent the corn and alfalfa

ration by furnishing greater variety and by its tendency to check scours sometimes caused by alfalfa. The stover fed with alfalfa returned a value of $4.57 per ton in comparison with alfalfa at $6 per ton as the sole roughness.

4. Sorghum hay returned a value of $4.63 per ton in comparison with prairie hay at $6, each being fed with corn 90 per cent and oil-meal 10 per cent.

5. The ration given Lot 1, corn and prairie hay, with a nutritive ratio of 1:10.2, was too low in protein for large gains. However, the fact that corn, alfalfa, and stover, with a nutritive ratio of 1:8.4, gave a little larger gain for food consumed than corn and alfalfa (1:7.4), is additional proof of the correctness of the "American idea" that the old and accepted German standards call for more protein than is needed for the best gains, and that a nutritive ratio of 1:8 may be just as satisfactory for fairly mature cattle as one more narrow. For Western conditions it is certainly more profitable.

6. The margin between cost and average selling price (net) for all steers in this experiment was a little less than $1 per hundred. While the profit was small, the steers returned a good price for the rough feeds at the market values quoted—high enough to make them profitable crops to grow on the farm. Had the feeds been sold, these values for roughage would not have been secured on the average Nebraska farm, nor would the manure have been left to make the next crop larger. The results furnish a strong argument in favor of judicious feeding.

Note. The writer's experience in fattening cattle on corn in the stalk prompts the conjecture that if a part of the corn in Lot 4 had been fed as shock corn (bundle corn), still more economical gains would have been secured, as with that system there is no expense for husking and shelling the corn, the cob is kept fresh and soft within the husk, thus easily masticated, and the mixture is more readily penetrated by digestive juices in the stomach than is shelled corn.

In this experiment it seemed necessary to feed the corn separately to secure an accurate record of grain consumed. It is expected that data along the line noted will be forthcoming one year hence.

ACKNOWLEDGMENT.

The feeding in this experiment was done by Mr. Joseph F. Lamb whose watchfulness, and accuracy in making weights and keeping records are worthy of the highest commendation.

FOUR PERTINENT FACTS.

Disclosed by Two Experiments (1903–1905).

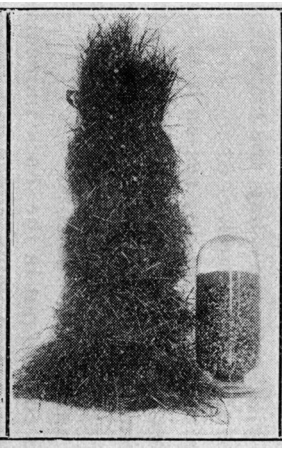
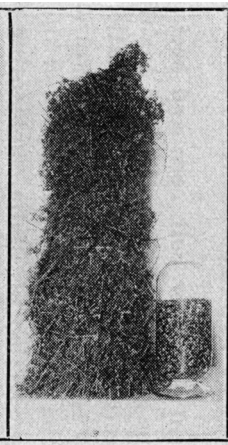
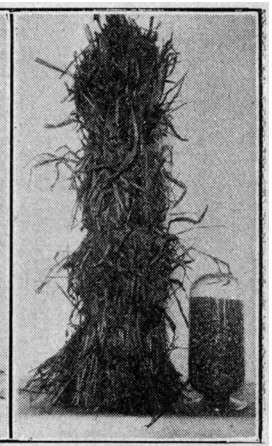
(1) With present prices for both corn and beef, greater consideration must be given to the character and quantity of roughness fed in connection with corn to fattening cattle.

(2) Alfalfa hay is pronouncedly superior to prairie hay for beef production, and the more rapid the extension of the area of land devoted to the production of alfalfa, supplanting the less valuable and lower yielding native hay, the more rapid will be the production of wealth from our soil.

(3) Native prairie hay, if for any reason it is most available for feeding purposes, should not be fed with corn alone, but rather with corn supplemented with a small quantity of some protein food, such as oil-meal, to give more nearly a balance of nutrients in keeping with animal requirements.

(4) Cornstalks cut and put in the shock immediately after the ears ripen possess a food value which can not consistently be ignored by the farmer, and existing land values warrant the larger utilization of this roughness by the adoption of methods of harvesting that will make such material more valuable for feeding purposes.

FOOD CONSUMED FOR ONE POUND OF GAIN ON EACH RATION.

LOT 1.	LOT 2.	LOT 3.	LOT 4.	LOT 5.
				
Corn, 9.5 lbs. Prairie hay, 5.2 lbs. Cost, 8.23 cents. Loss per steer, $1.13	Corn, 8.2 lbs. Oil-meal, .9 lb. Prairie hay, 4.3 lbs. Cost, 8.27 cents. Profit per steer, $1.09.	Corn, 8.1 lbs Alfalfa hay, 4 lbs. Cost, 6.89 cents. Profit per steer, $2.86.	Corn, 7.9 lbs. Alfalfa hay, 2.2 lbs. Corn-stover, 2.2 lbs. Cost, 6.49 cents. Profit per steer, $3.32.	Corn, 8.4 lbs. Oil-meal, 9 lbs. Sorghum hay, 3.8 lbs. Cost, 7.87 cents. Profit per steer, $1.92.