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KANSAS STATE AGRICULTURAL COLLEGE
MANHATTAN, KANSAS

DEPARTMENT OF ANIMAL HUSBANDRY



THE STEERS IN LOT 8 READY FOR MARKET.

SILAGE FEEDING INVESTIGATIONS, 1922-'23¹

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PART I.

THE AMOUNT OF COTTONSEED CAKE NECESSARY TO SUPPLEMENT A FULL SILAGE RATION MOST ECONOMICALLY IN THE FATTENING OF BABY BEEF.

Investigations conducted by the Department of Animal Husbandry of the Kansas Agricultural Experiment Station during the last few years have demonstrated the practicability of feeding calves for the production of baby beef. They have also shown that

1. Contribution No. 71 from the Department of Animal Husbandry.

the cost of producing baby beef can be lowered materially by the use of silage in the ration.

Steers consuming a large amount of silage, which is a carbonaceous roughage, will not eat in addition a very large amount of a nitrogenous roughage. Since corn, or any of the other grains which are sometimes substituted for it in the fattening ration, is a carbonaceous concentrate, the ration produced by the use of all the silage and shelled corn steers will eat, supplemented with what alfalfa hay they will consume in addition, is rather low in nitrogenous constituents. To increase the proportion of these in the ration it is necessary to add a nitrogenous concentrate such as cottonseed cake. Since this forms a very expensive constituent, the feeder should not feed it in large amounts unless by so doing he can increase either the rate of gain, the finish, or both the gain and the finish enough to repay for the extra feed consumed.

A feeding experiment was conducted during the winter of 1922-'23 to determine the amount of cottonseed cake that the feeder can most economically add to a ration of shelled corn, cane silage, and alfalfa hay used in the fattening of baby beef. In connection with this experiment a group of heifers was fed to secure additional data regarding the production of baby beef from heifers.

FEEDING PLAN.

The calves used in this experiment were high-grade Herefords. They were raised at the Fort Hays branch of the Kansas Agricultural Experiment Station and were shipped to Manhattan, October 22, 1922. During the time which elapsed between this and November 3, when the experiment was started, the calves were fed on cane silage and alfalfa hay. The 50 steers were divided as carefully as possible with regard to size, type and quality into five lots. Ten heifers similar to the steers in size, type and quality were placed in the sixth lot:

Each group was kept in a lot approximately 30 by 40 feet, including a shed 15 feet deep and open on the south, located across the north end of the lot. They had access to salt and water at all times. The length of the feeding period was 231 days.

Each lot was fed exactly the same basal ration of shelled corn and cane silage, both full fed, and two pounds of alfalfa hay per

SILAGE FEEDING INVESTIGATIONS.

head per day. In addition to this the different lots were fed cottonseed cake in the following amounts per head per day:

- Lot 1—none.
- Lot 2—one-half pound.
- Lot 3—one pound.
- Lot 4—one and one-half pounds.
- Lot 5—two pounds.

The heifers in lot 6 were fed exactly the same as the steers in lot 5.

RESULTS.

Detailed results are given in Table I.

TABLE I.—The efficiency of varying amounts of cottonseed cake when fed as a supplement to a full corn and silage ration in fattening baby beef.

Lot No.....	1	2	3	4	5	6 (Heifers)
Average initial weight per calf at feed lot.....	Pounds. 355.42	Pounds. 344.80	Pounds. 342.87	Pounds. 339.48	Pounds. 349.00	Pounds. 357.37
Average selling weight per calf.....	780.00	803.00	819.00	816.07	837.78	828.00
Average total gain per calf.....	424.58	458.20	476.33	477.19	488.78	470.63
Average daily gain per calf.....	1.84	1.98	2.06	2.07	2.12	2.04
Average daily ration per calf:						
Cottonseed cake.....		0.50	0.98	1.45	1.92	1.91
Shelled corn.....	9.71	9.71	9.71	9.69	9.71	9.66
Cane silage.....	9.10	9.16	9.12	9.04	9.13	9.12
Feed required for 100 pounds gain:						
Cottonseed cake.....		24.99	47.55	70.41	90.63	93.59
Shelled corn.....	528.46	489.69	471.05	469.00	459.01	474.39
Alfalfa hay.....	108.81	100.83	96.99	96.82	94.48	98.00
Cane silage.....	494.90	461.92	442.06	437.83	431.62	447.44
Cost of feed per 100 pounds gain.....	\$8.66	\$8.66	\$8.91	\$9.44	\$9.79	\$10.12
Cost of calves per head.....	\$30.21	\$29.31	\$29.13	\$28.86	\$29.66	\$30.88
Interest per head on investment in cattle and feed at 8 per cent.....	3.39	3.49	3.62	3.74	3.92	3.95
Marketing cost per head.....	2.04	2.04	2.04	2.04	2.04	2.04
Total cost per head not including labor.....	73.81	75.41	78.13	80.60	84.88	84.91
Selling price per head.....	77.22	80.30	84.77	83.71	87.97	74.52
Labor income per steer based on cattle alone.....	3.91	4.89	6.94	3.11	3.69	-10.39
Labor income per steer including hog gains.....	7.10	7.79	9.17	6.62	6.28	-7.29
Cost of calves per cwt. in feed lot.....	\$8.50	\$8.50	\$8.50	\$8.50	\$8.50	\$8.50
Necessary selling price per cwt. to break even on cattle alone.....	9.40	9.39	9.54	9.87	10.07	10.25
Selling price per cwt.....	9.90	10.00	10.35	10.25	10.50	9.00
Margin per cwt. on cattle alone to cover labor.....	.50	.61	.81	.38	.43	-1.25
Value of hog gains on basis of each 100 pounds live weight of cattle.....	.41	.36	.31	.43	.32	.37
Total margin on each 100 pounds of cattle, including hog gains, to cover labor.....	.91	.97	1.12	.81	.75	-.88

Feed costs: Cottonseed cake, \$50 per ton; shelled corn, 70 cents per bushel; alfalfa hay, \$15 per ton; cane silage, \$5 per ton.
All calculations are based on selling weights at Kansas City.

OBSERVATIONS.

1. The steers in lot 2 receiving one-half pound of cottonseed cake per head per day made 0.14 of a pound greater gain per head per day than did the steers in lot 1 receiving no cottonseed cake. The one-half pound of cottonseed cake per head per day added enough finish to increase the selling price 10 cents per hundred and the profit 69 cents per head.

2. The steers in lot 3 receiving one pound of cottonseed cake per head per day made 0.22 of a pound greater gains per head per day than did the steers in lot 1 receiving no cottonseed cake and 0.08 of a pound greater gains per head per day than the steers in lot 2 receiving one-half pound of cottonseed cake per head per day. The one pound of cottonseed cake per head per day added enough finish to the steers in lot 3 to increase their selling price 45 cents per hundred over the selling price of the steers in lot 1 receiving no cottonseed cake and increased the profit \$2.07 per head. The addition of one pound of cottonseed cake per head per day also added enough finish to the steers in lot 3 to increase their selling price 35 cents per hundred over the selling price of the steers in lot 2 receiving one-half pound of cottonseed cake per head per day and increased the profits \$1.38 per head.

3. The addition of one and one-half pounds of cottonseed cake per head per day in lot 4 and two pounds per head per day in lot 5 increased both gains and selling price so slightly over the gains and selling price of lot 3 that the profits in both lots were less than the profits in lot 3 receiving one pound of cottonseed cake per head per day.

4. The profits in lot 4 receiving one and one-half pounds of cottonseed cake per head per day were 48 cents per head less than in lot 1 receiving no cottonseed cake; \$1.17 less per head than in lot 2 receiving one-half pound per head per day; \$2.55 per head less than in lot 3 receiving one pound per head per day; and 34 cents per head greater than in lot 5 receiving two pounds of cottonseed cake per head per day. The profits in lot 5 receiving two pounds of cottonseed cake per head per day were 82 cents per head less than in lot 1 receiving no cottonseed cake; \$1.51 per head less than in lot 2 receiving one-half pound of cottonseed cake per head per day; \$2.89 per head less than in lot 3 receiving one pound of cottonseed cake per head per day; and 34 cents per head less than in lot 4 receiving one and one-half pounds of cottonseed cake per head per day.

5. The heifers fattened more rapidly than the steers fed the same ration and were fatter at the close of the experiment, but their total gains were not quite as great. In spite of the fact that the heifers were a bit fatter, dressed as well, and looked as good on the hooks, they sold on the market for \$1.50 less per hundred pounds than did the steers. Due to these differences the steers returned a profit of \$14.57 per head more than the heifers.

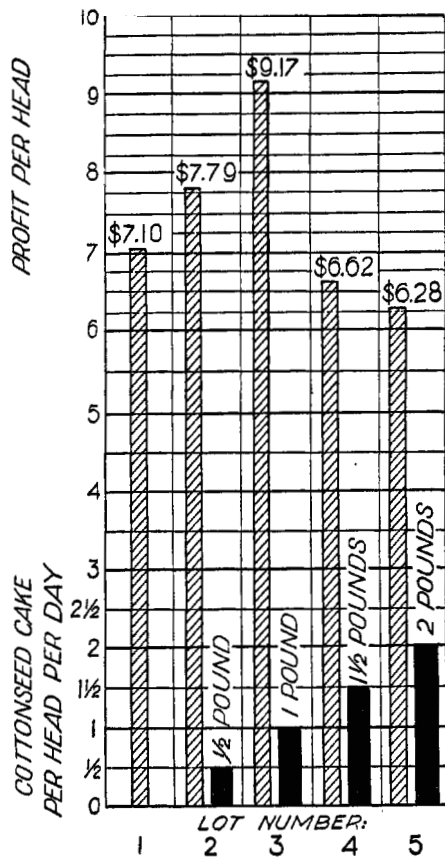


FIG. 1.—Graphs showing the average profit per head on the steers in each lot, also the amount of cottonseed cake per head fed daily.

CONCLUSIONS.

1. These results indicate the value of adding up to one pound of cottonseed cake per head per day to a ration consisting of corn, silage, and alfalfa hay when fed in fattening baby beef; also the impracticability of adding more than one pound per head per day when feed values and cattle prices maintain approximately the same ratios as prevailed during this experiment.

2. It is not always the cattle that make the most rapid gains nor the cattle whose ration is the least costly that make the most profit. It is important to know how to combine feeds in such a manner that they will produce the most rapid gains and the highest degree of finish at the least possible cost.

3. Cottonseed cake acts as a stimulant to the appetite of cattle.

4. A very decided discrimination against heifer beef exists on the market at the present time.

5. As long as the packer insists upon paying less for heifers than steers the feeder must also pay less for heifer calves than for steer calves for feeding purposes.

6. Heifer calves will gain almost as rapidly as steer calves in the feed lot and will be fatter at the end of any given feeding period.

The influence of feeding different amounts of cottonseed cake, under the conditions of this experiment, is shown graphically in figure 1.

PART II.

**THE INFLUENCE OF WINTER RATIONS UPON SUMMER GAINS
ON PASTURE ALONE.**

The opinion has been expressed often that cattle wintered on silage would not do well on grass the following season. In the fall of 1919 a test was begun by the Kansas Agricultural Experiment Station for the purpose of securing data relative to this matter. A group of steers calved during the spring of 1919 purchased from Alex Philip, of Hays, Kan., was used. They were divided into two lots. One lot was fed silage and approximately one pound of cottonseed cake per head per day during the winter months. The other lot received alfalfa hay only. Both lots were pastured together on bluestem grass during the summer. The test continued through three winters and three summers. Results in detail are given in Table II.

SILAGE FEEDING INVESTIGATIONS.

TABLE II.—Influence of a winter ration of silage supplemented with cottonseed cake compared with a winter ration of alfalfa hay alone upon summer pasture gains.

Lot No.	1 Silage (a).	2 Alfalfa hay.
Winter ration.....		
	<i>Pounds.</i>	<i>Pounds.</i>
Average weight per steer December 17, 1919.....	437.34	443.40
Average weight per steer April 29, 1920.....	525.20	504.60
Average gain per steer, winter, 1919-'20.....	87.86	61.20
Average weight per steer November 25, 1920.....	806.20	799.80
Average gain per steer on pasture, summer, 1920.....	281.00	295.20
Average monthly gain per steer on pasture, summer, 1920:		
May.....	47.20	46.00
June.....	101.00	105.80
July.....	33.80	35.00
August.....	30.80	42.60
September.....	47.40	41.60
October.....	24.80	34.20
November.....	-4.00	-10.00
Average weight per steer May 5, 1921.....	981.20	875.73
Average gain per steer, winter, 1920-'21.....	155.00	75.93
Average weight per steer December 1, 1921.....	1,101.13	1,117.27
Average gain per steer on pasture, summer, 1921.....	139.93	241.54
Monthly gains per steer on pasture, summer, 1921:		
May.....	31.60	79.07
June.....	46.40	35.80
July.....	40.20	43.20
August.....	43.20	55.40
September.....	25.00	40.80
October.....	-17.40	-7.40
November.....	-29.07	-4.33
Average weight per steer April 30, 1922.....	1,113.27	1,156.00
Average gain per steer, winter, 1921-'22.....	12.14	38.73
Average weight per steer September 30, 1922.....	1,366.53	1,395.93
Average gain per steer on pasture, summer, 1922.....	253.26	239.93
Average monthly gains per steer on pasture, summer, 1922:		
May.....	81.53	62.20
June.....	81.80	64.60
July.....	32.00	47.20
August.....	50.20	56.00
September.....	7.73	9.93

Average daily winter ration per steer—

WINTER OF 1919-'20: Lot 1—silage, 25 pounds; cottonseed cake, 1 pound.
Lot 2—alfalfa hay, 10.29 pounds.

WINTER OF 1920-'21: Lot 1—silage, 35.76 pounds; cottonseed cake, 0.97 pounds.
Lot 2—alfalfa hay, 20.16 pounds.

WINTER OF 1921-'22: Lot 1—silage, 35.83 pounds; cottonseed cake, 1.4 pounds.
Lot 2—alfalfa hay, 24.58 pounds.

(a) Silage supplemented by approximately one pound of cottonseed cake per head per day.

OBSERVATIONS.

1. During the first winter the silage-fed steers gained 26.66 pounds per head more than the alfalfa-hay-fed steers, but they gained 14.2 pounds less while on grass during the following summer. The silage-fed steers, however, made a gain of 12.46 pounds more per head than the alfalfa-hay-fed steers for the combined winter and summer period of the first year.

2. During the second winter the silage-fed steers were fed liberally on silage and made a gain of 79.07 pounds per head more than the alfalfa-hay-fed steers, but they gained 101.61 pounds less on grass during the following summer. The silage-fed steers made a

gain of 22.54 pounds per head less than the alfalfa-hay-fed steers for the combined winter and summer period of the second year.

3. During the third winter the silage-fed steers were fed only a limited amount of silage, just enough to keep their total winter gains less than those fed alfalfa, and they made 26.59 pounds per head less than the alfalfa-fed steers, but 13.33 pounds more while on grass the following summer, or 13.26 pounds less for the combined winter and summer period of the third year.

4. The steers fed silage during the winter months made a total gain during the three years of 255 pounds per head, while the steers fed alfalfa gained only 175.86 pounds per head during the same period.

5. The steers fed silage during the winter months made a total pasture gain during the three year of 674.19 pounds per head and the steers fed alfalfa during the winter months, 776.28 pounds.

6. The steers fed silage during the winter months made a total summer and winter gain during the three years of 929.19 pounds per head, an average of 309.73 pounds per year from the time they were weaned. The steers fed alfalfa hay during the winter months made a total three-year gain of 952.53 pounds per head, or an average of 317.51 pounds per year from the time they were weaned.

7. These cattle were marketed in Kansas City, September 30, 1922. They brought \$9 a hundred, the top price for the year for grass-fat cattle that had never eaten grain.

CONCLUSIONS.

1. Silage and one pound of cottonseed cake per head per day is a satisfactory winter ration for stock cattle. Alfalfa hay alone is also a satisfactory winter ration for stock cattle. The choice of the two, will depend upon their availability and cost in a given locality.

2. The amount of gain a steer makes on pasture during the summer depends upon the amount of fat he carries when he goes to grass rather than upon the kind of feed he consumed during the preceding winter months.

3. Thin steers make nearly as much gain on bluestem pasture during the months of May and June as they do during the remainder of the grazing season.

PART III.

FINISHING GRASS-FAT CATTLE ON GRAIN.

Another group of steers of the same age, breeding, and quality were handled in exactly the same manner up to September 4, 1922, as those discussed in Part II. On that date they were started on ground corn. The behavior of this group of steers up to September 4, 1922, was practically identical with those discussed in Part II as is shown in Table III.

TABLE III.—Influence of a winter ration of silage supplemented with cottonseed cake compared with a winter ration of alfalfa hay alone upon summer pasture gains.

Lot No.	1	2
Winter ration.....	Silage (a).	Alfalfa hay.
	<i>Pounds.</i>	<i>Pounds.</i>
Average weight per steer December 17, 1919	439.75	437.33
Average weight per steer April 29, 1920.....	543.87	496.80
Average gain per steer, winter, 1919-'20.....	103.92	59.47
Average weight per steer November 25, 1920.....	828.42	806.60
Average gain per steer on pasture, summer, 1920.....	282.75	309.80
Average monthly gain per steer on pasture, summer, 1920:		
May.....	55.08	39.30
June.....	86.00	103.10
July.....	42.25	36.40
August.....	43.00	48.40
September.....	38.50	49.80
October.....	29.00	22.80
November.....	-11.08	-10.00
Average weight per steer May 5, 1921.....	979.42	882.14
Average gain per steer, winter, 1920-'21.....	153.00	75.54
Average weight per steer December 1, 1921.....	1,134.33	1,119.53
Average gain per steer on pasture, summer, 1921.....	154.91	237.39
Average monthly gains per steer on pasture, summer, 1921:		
May.....	41.08	74.46
June.....	36.50	46.00
July.....	40.00	43.20
August.....	39.75	48.00
September.....	67.00	48.60
October.....	-35.50	-4.60
November.....	-33.92	-18.27
Average weight per steer April 30, 1922.....	1,154.75	1,160.07
Average gain per steer, winter, 1921-'22.....	20.42	40.54
Average weight per steer September 4, 1922.....	1,418.75	1,407.00
Average gain per steer, summer, 1922, to September 4.....	264.00	246.93
Average monthly gains per steer on pasture, summer, 1922:		
May.....	108.25	67.13
June.....	65.25	69.80
July.....	45.25	44.80
August.....	45.25	65.20
Average daily winter ration per steer—		
WINTER OF 1919-'20:	Lot 1—silage, 25 pounds; cottonseed cake, 1 pound.	
	Lot 2—alfalfa hay, 10.29 pounds.	
WINTER OF 1920-'21:	Lot 1—silage, 35.76 pounds; cottonseed cake, 0.97 pounds.	
	Lot 2—alfalfa hay, 20.16 pounds.	
WINTER OF 1921-'22:	Lot 1—silage, 35.83 pounds; cottonseed cake, 1.4 pounds.	
	Lot 2—alfalfa hay, 24.58 pounds.	

(a) Silage supplemented by approximately one pound of cottonseed cake per head per day.

These steers were gotten up to a full feed of corn as rapidly as possible and were left on the grass for 60 days, receiving only blue-stem grass and corn from September 4 to November 4, 1922. On this date they were moved to a dry lot and fed silage and alfalfa hay in addition to the ground corn for 23 days. Detailed results are shown in Table IV.

TABLE IV.—Value of corn in finishing grass-fat steers for market.

	<i>Pounds.</i>
Average initial weight per steer.....	1,412.22
Average final weight per steer based on market weights.....	1,477.22
Average total gain per steer based on market weights.....	65.00
Average daily gain per steer based on market weights.....	.78
Average final weight per steer based on home weights.....	1,534.72
Average total gain per steer based on home weights.....	122.50
Average daily gain per steer based on home weights.....	1.48
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Average weight per steer at end of 60 days feeding on grass.....	1,506.00
Average gain per steer at end of 60 days feeding on grass.....	93.78
Average daily gain per steer at end of 60 days feeding on grass.....	1.56
Average daily gain per steer for previous 120 days (May 7 to September 4, 1922) on grass alone.....	2.12
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Average daily ration per steer:	
Ground corn.....	15.28
Alfalfa hay (a).....	7.10
Cane silage (a).....	11.41
Feed required for 100 pounds gain based on market weights:	
Ground corn.....	1,951.11
Alfalfa hay (a).....	251.87
Cane silage (a).....	408.59
Cost of feed for 100 pounds gain based on market weights.....	\$21.78
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Average value per steer September 4, 1922.....	\$127.10
Average feed cost per steer.....	74.12
Int. per steer on investment in steers and feed at 8 per cent.....	2.49
Shipping expense per steer.....	4.05
Total cost per steer when sold on Kansas City market.....	147.80
Selling price per steer at Kansas City based on market weights.....	162.49
Labor income per steer.....	14.69
Valuation per cwt. in Kansas City.....	11.00
Value per cwt. September 4, 1922.....	9.00
Necessary selling price per cwt. at Kansas City to break even.....	10.00
Necessary margin to break even on all expenses.....	1.00

(a) Fed in dry lot for last 23 days only.

Cost of feeds: Ground corn, 56 cents per bushel; alfalfa hay, \$10 per ton; cane silage, \$5 per ton.

OBSERVATIONS AND CONCLUSIONS.

1. The gains made based upon selling weights were very small, being only 0.78 of a pound per day. This is partly due to the fact that these cattle received a very poor ship and did not arrive at the market until 10:30 a. m. They then refused to eat or drink, and this resulted in a shrink of 57.5 pounds per head on a 120-mile ship.

2. These cattle, valued at \$9 per hundred at the beginning of the test, sold for \$11 per hundred at the end of the 83-day feeding period.

3. The additional finish made during this 83-day feeding on corn was sufficient to increase the value of these cattle at least \$2 per hundred, and in spite of a very high cost of gains (\$21.78 per hundred), and a very poor ship, they made a net return of \$14.16 per head more than the same kind of cattle marketed off grass without a grain finish.