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RATIONS FOR FATTENING BABY BEEVES AND SELECTION OF CALVES FOR BABY BEEF PRODUCTION

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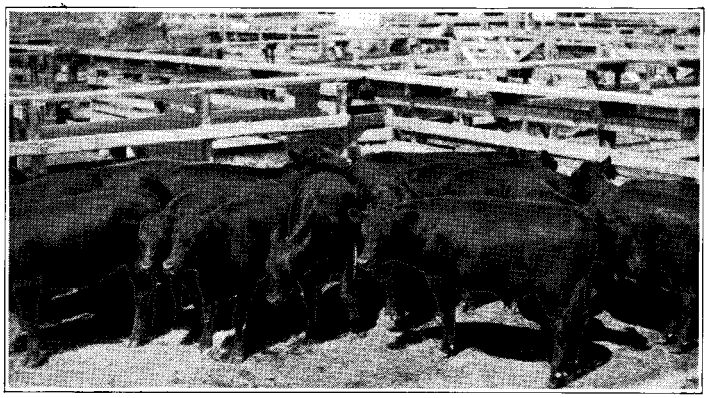

BABY BEEVES FROM UNIVERSITY OF MINNESOTA FEEDING TRIALS ON SOUTH ST. PAUL MARKET

UNIVERSITY FARM, ST. PAUL

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RATIONS FOR FATTENING BABY BEEVES AND SELECTION OF CALVES FOR BABY BEEF PRODUCTION

H. W. VAUGHAN

INTRODUCTION

For five years, investigations have been carried on by the Division of Animal Husbandry of the University of Minnesota in an attempt to determine the most profitable methods of fattening baby beeves in Minnesota. The investigations have also included a study of the adaptability of various kinds of calves to baby beef production.

The first experiment in fattening baby beeves at the University of Minnesota was conducted in 1921-22 by W. H. Peters and N. K. Carnes; the second in 1922-23 by W. H. Peters, N. K. Carnes, and A. L. Harvey; the third in 1923-24 by H. W. Vaughan and A. L. Harvey; the fourth in 1924-25 by H. W. Vaughan, A. L. Harvey, and Louis Vinke; the fifth in 1925-26 by H. W. Vaughan and A. L. Harvey.

METHOD OF PROCEDURE

Purchase and preparation of calves.—In each of the five years, 65 to 70 head of spring or early summer calves were purchased in October at weaning time, at 6 to 9 months of age, and were brought to University Farm, St. Paul, where they were dehorned, castrated, treated with blackleg vaccine, and tuberculin tested. Prior to the experiment the calves were given two or more weeks to recover from operations, attain good thrift, and become accustomed to eating the grain and other feeds which were to be used in the trial. (See Figs. 1 and 2.)

Allotment of calves.—Sixty calves were selected and divided into six lots of 10 head each. They were divided as evenly as possible with respect to size, form, quality, thrift, condition, color, and other points, so that each lot contained the same number of large and small calves, blocky and rangy calves, fleshy and thin calves, etc.

Quarters.—Each lot of calves occupied similar quarters, which consisted of an open and unpaved lot, 24 by 120 feet, and a shed 23 by 24 feet, opening on the south into the lot by means of a sliding door. A hay rack, feed bunk, salt box, and water tank were all inside the shed. The clay floor of the shed was bedded with straw as needed, and the sheds were cleaned at intervals of two or three weeks.

Weight.—Each calf was identified by a neck chain bearing an individual number. Each was weighed on three consecutive days at the beginning of the trial and the average of the three weights was taken as his initial weight. The same method was used to determine the final weight at the end of the trial. During the trial each calf was weighed individually at the end of each 28-day period.

Valuation of calves.—The values of the calves at the close of the trials were determined by a commission man and a packer buyer from the South St. Paul livestock market. These men inspected the calves in the feed lots and estimated their value, based on the South St. Paul market.[1]

Duration of trials.—The length of the feeding period in different years varied from 196 to 224 days. In each of the five years the trials terminated in June.

Methods of feeding.—For the first two years, if silage was fed, the concentrates were fed on the silage and the hay was fed separately.

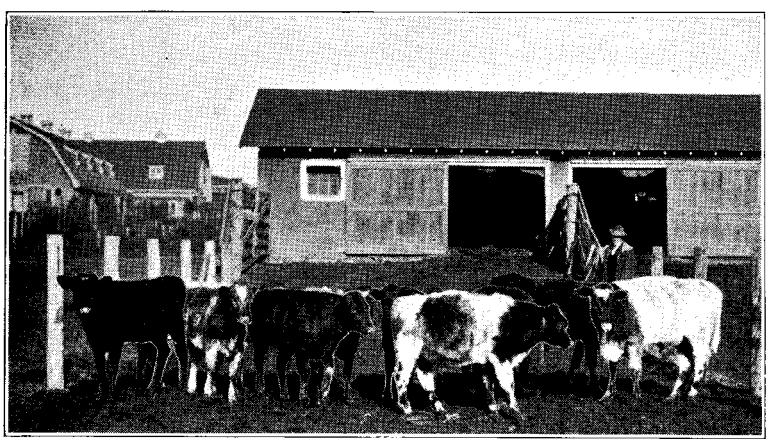

Fig. 1. Purebred Shorthorn steer calves at beginning of 1922-1923 trial. Average weight 483.50 pounds. Fig. 9 shows this lot at end of feeding period.

For the last three years the concentrates, silage, and hay were each fed separately, the concentrates being fed first, followed in about one hour by the roughages. All feeds were hand-fed twice daily except in one trial in which one lot was fed grain in a self-feeder. All lots had access at all times to water and salt, and for the last three years all lots also had access at all times to a box of raw bonemeal.

Getting calves on full feed.—A full feed of roughage was fed from the beginning of the trials, but a full allowance of grain was

[1] For this service we are indebted to L. E. Daubney of Swift & Co.; J. A. Pribyl and John Goff of Armour & Co.; O. A. Clark of the Central Co-operative Livestock Commission Association, and J. J. Keis and Anton Laustrap of Percy Vittum & Co., South St. Paul.

not fed until after the trials had been in progress from 30 to 40 days. During this period the allowance of grain was gradually increased from 2 pounds per head daily to the full allowance. About one month was also taken to bring the calves up to the full allowance of linseed meal, except in the trial of 1925-26, in which 2 pounds of linseed meal was fed each calf daily from the beginning of the trial, with no bad results whatever. As a sudden change from prairie hay to alfalfa hay results in scouring, if alfalfa hay was to be used in the trial 7 to 10 days were taken to make the change from prairie hay to alfalfa. Prairie hay was the only feed given when the calves first arrived at University Farm. Changes from prairie hay to silage and alfalfa were made gradually prior to the beginning of the trials.

Feed records.—All feeds were weighed and a complete daily feed record was kept. Samples of all feeds were taken at intervals during the trials and were analyzed by the Division of Biochemistry. The analyses are reported in the appendix.

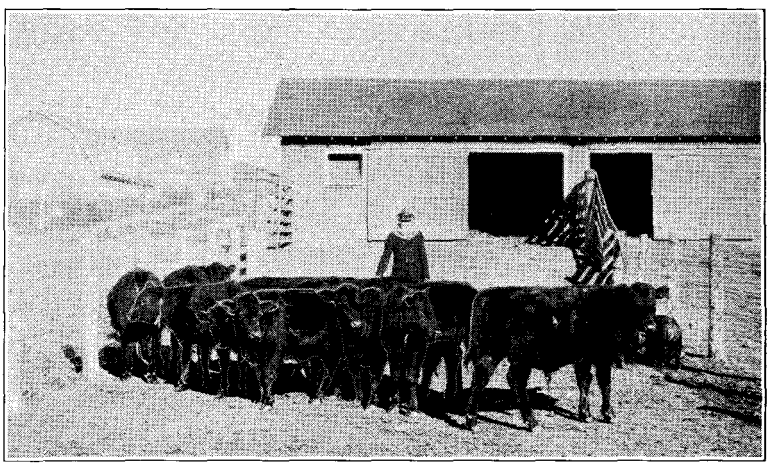

Fig. 2. Purebred and grade Aberdeen-Angus steer calves at beginning of 1923-1924 trial. Average weight 446.80 pounds. Fig. 15 shows this lot at end of feeding period.

Feed prices.—The prices charged for the various feeds in each trial were the averages of farm feed prices reported monthly by the United States Department of Agriculture for the State of Minnesota during the progress of the trial. The price charged for silage was the cost of production in Minnesota for the year, as determined by the department of farm management.

Hogs following the calves.—Each lot of calves was followed by the same number of shoats, the number of shoats varying at different times from 3 to 4 per lot. Twice daily the hogs were hand-fed enough shelled corn and tankage (1 part tankage to 10 parts corn

by weight) to enable all lots of hogs to make uniform and rapid gains in weight. Complete records were kept of all feeds fed to hogs and of all gains in weight. When the hogs reached an average weight of 200 to 225 pounds, they were replaced by new lots of feeder pigs weighing about 100 pounds per head. Two or three lots of hogs were fattened annually with each lot of calves.

Hog gains credited to calves.—Each lot of calves was credited with the pounds of pork produced by the pigs from wasted feed that passed through the calves undigested, or was thrown out of the feed bunks by the calves, or small amounts of feed thrown out of the bunks at times by the attendant when cleaning bunks prior to feeding. The amount of pork credited to each lot of calves was the difference between the total hog gains and the gains produced by the feeds fed to the hogs twice daily. The amount of this deduction from the total gain was determined from the records of a check lot of similar pigs full-fed on shelled corn and tankage.

COMPARISON OF PUREBRED, GRADE, AND COMMON STEER CALVES FOR FATTENING AS BABY BEEVES

Ten purebred Hereford steer calves, 10 grade Hereford steer calves, and 10 common or "scrub" steer calves were fed the same feeds for 196 days. (See Figs. 6, 7, and 8.) The ration consisted of shelled corn, ground oats, linseed meal, and alfalfa hay. The results are given in Table I.

At the beginning of the trial the purebreds averaged 487.6 pounds in weight, the grades 479.9 pounds, and the common calves 334 pounds. The purebreds and grades were both valued at $8.07 per hundredweight at the start, while the common calves were valued at $4.14 per hundredweight. On this basis the breeders of the purebred calves received $39.35 per head for them, the breeders of the grades $38.73, and the breeders of the common or "scrub" calves only $13.83. The common calves were probably as old as the purebreds and grades. Unquestionably the common calves were produced at considerable loss to the men who raised them and sold them as feeder calves.

The common calves were in much thinner flesh than the others at the beginning of the trial, and for this reason they made more rapid gains during the trial and required less feed per unit of gain than did the purebred or grade calves.

When finished, the purebred calves were valued at $9.00 per hundredweight, the grade calves at $8.70, and the common calves at $6.65. In spite of their low valuation, the common calves returned more margin over feed cost during the fattening period than did the grade calves. The common calves proved more profitable to the feeder

because someone raised and sold them as feeder calves at a price considerably below cost of production. The breeder's loss was the feeder's gain.

TABLE I

FATTENING PUREBRED, GRADE, AND COMMON CALVES FOR MARKET
December 15, 1921 to June 29, 1922—196 days

	Purebred calves	Grade calves	Common calves
Initial weight, lbs.	487.60	479.90	334.00
Final weight, lbs.	923.16	916.98	796.82
Average daily gain, lbs.	2.22	2.23	2.36
Average daily feed:			
Shelled corn, lbs.	8.46	8.50	7.74
Ground oats, lbs.	3.34	3.35	3.02
Linseed meal, lbs.	1.31	1.31	1.19
Alfalfa hay, lbs.	5.33	5.47	5.19
Cost of feeds, 100 lbs. gain*	$7.06	$7.09	$6.14
Initial cost per cwt.	$8.07	$8.07	$4.14
Initial cost per head	39.35	38.73	13.83
Total cost of feeds	30.75	30.99	28.44
Final cost per head	70.10	69.72	42.27
Selling price, South St. Paul	$9.40	$9.10	$7.05
Selling price, University Farm	9.00	8.70	6.65
Value per head, University Farm	83.08	79.78	52.99
Pork credit per calf, lbs.	31.70	26.00	28.10
Pork credit, @ $10 per cwt.	3.17	2.60	2.81
Margin per calf over feed cost	$16.15	$12.66	$13.53

* Feed prices charged: Shelled corn 42 cents per bushel, ground oats 28 cents, linseed meal $45 per ton, alfalfa hay $13.

Had the breeders kept the three lots of calves and fattened them, the cost of rearing and fattening the three lots would have been practically the same for each lot; yet, when finished, the common calves were worth only $52.99 per head, while the grades were worth $79.78, or 50 per cent more. The purebreds sold at $83.08 per head, or 57 per cent more than the common calves.

The general conclusions are these:

The cattle *feeder* frequently may purchase and feed the lower grades of feeder cattle to advantage. If he can buy such cattle cheap enough, they may equal or surpass in profit the higher grades of feeder cattle.

The cattle *breeder* should always aim to produce animals of top quality. Such cattle cost little, if any, more to produce than scrubs, but they bring a much larger return than scrub or inferior cattle when sold as feeders or as fat cattle. Breeders of beef cattle should use good purebred beef bulls and should strive continually to improve their cow herds by breeding and culling.

A COMPARISON OF STEER CALVES AND HEIFER CALVES

How do steer calves and heifer calves compare in rate of gain, cost of gain, time required to fatten, selling price, and profit? Does the feeding of baby beef steers and heifers together in the same lot decrease the rate of gain and increase the cost of gain, as compared with separating the steers and heifers and feeding them in different lots?

To answer these questions, a 217-day trial was carried out, with three lots of purebred and grade Hereford calves bred by Schermerhorn Farms, Mahnomen, Minn. The first lot contained 10 steer calves, the second 5 steers and 5 heifers, and the third 10 heifers. (See Figs. 28, 30, and 31.) All three lots were fed a ration of shelled corn, linseed meal, corn silage, and alfalfa hay. The results are given in Table II.

TABLE II

FATTENING STEER AND HEIFER CALVES FOR MARKET
November 13, 1925 to June 18, 1926—217 days

	Steer calves	Steers and heifers	Heifer calves
Initial weight, lbs.	451.00	449.20	449.03
Final weight, lbs.	960.85	940.00	941.70
Average daily gain, lbs.	2.35	2.26	2.27
Average daily feed:			
Shelled corn, lbs.	12.14	12.14	12.14
Linseed meal, lbs.	2.00	2.00	2.00
Corn silage, lbs.	7.57	7.30	8.87
Alfalfa hay, lbs.	1.61	1.59	2.10
Cost of feeds, 100 lbs. gain*	$8.98	$9.29	$9.58
Initial cost per cwt.	$8.00	$8.00	$8.00
Initial cost per head	36.08	35.94	35.92
Total cost of feeds	45.77	45.61	47.17
Final cost per head	81.85	81.55	83.09
Selling price, South St. Paul	$10.00	$9.95	$9.60
Selling price, University Farm	9.50	9.45	9.10
Value per head, University Farm	91.28	88.83	85.69
Pork credit per calf, lbs.	36.60	38.18	59.65
Pork credit, @ $11 per cwt.	4.03	4.20	6.56
Margin per calf over feed cost	$13.46	$11.48	$9.16
Return per bushel ear corn	0.89	0.84	0.79

* Feed prices charged: Ear corn 60 cents per bushel, shelled corn 62 cents, linseed meal $48 per ton, corn silage $4.50, alfalfa hay $14.25.

The 10 steer calves and 10 heifer calves were each fed an average of 12.14 pounds of shelled corn per head daily, 2 pounds of linseed meal, and all the corn silage and alfalfa hay they would clean up twice daily for 217 days. The cost of feeding the heifers was $1.40 per head higher because they ate more silage and alfalfa than the steers. Altho the heifers ate more feed, they made less gain. However, the

hogs following the heifers made larger gains from wasted feed than did the hogs following the steers.

Altho the heifers did not gain as fast as the steers, they were fatter at the finish. This is explained by the fact that the heifers did not make as much growth as the steers. The gains of the heifers were more in fat and less in growth than the gains of the steers.

In every respect the heifers indicated a greater degree of maturity and earlier maturity than the steers. This was shown in their greater feed consumption, slower gains, quicker finish, and larger pork credit. Some of the heifers became rather patchy at the tailhead and rather too heavy in the brisket.

Altho the heifers fattened earlier and in greater degree than the steers, and altho the heifers were somewhat patchy at the tailhead and heavy in the brisket at the end of 217 days, had the steers and heifers been sold at the end of 140 days or 168 days, the heifers would not have equaled the steers in price and profit. This is shown in Table III.

TABLE III

FATTENING STEER AND HEIFER CALVES FOR MARKET
November 13, 1925 to June 18, 1926—217 days

	Steer calves	Steers and heifers	Heifer calves
Selling price, University Farm:			
April 2—140 days	$8.30	$8.25	$8.15
April 30—168 days	8.85	8.85	8.65
June 18—217 days	9.50	9.45	9.10
Margin per head over feed cost:			
April 2—140 days	$4.48	$2.71	$2.80
April 30 168 days	7.64	6.73	5.98
June 18—217 days	13.46	11.48	9.16
Return per bushel ear corn:			
140 days	$0.76	$0.70	$0.70
168 days	0.82	0.80	0.77
217 days	0.89	0.84	0.79

The steer lot returned 10 cents more per bushel of corn than the heifer lot fed the same ration.

The lot containing 5 steers and 5 open heifers was fed exactly the same amount of shelled corn and linseed meal as the lot of steers and the lot of heifers. The mixed lot consumed about the same amount of silage and alfalfa as the steer lot, but made less gain. The pork credit was about the same as in the steer lot. The heifers in the mixed lot fattened to a greater degree than the steers in the same lot. At the finish the heifers in the mixed lot showed more smoothness and quality than those in the heifer lot, which explains why the value of the mixed lot was nearly as high as that of the steer lot.

The 5 steers in the mixed lot made an average daily gain of 2.34 pounds, and the 10 steers in the steer lot averaged 2.35 pounds, or practically the same. The 5 heifers in the mixed lot made an average daily gain of 2.18 pounds, as compared to 2.27 pounds for the ten heifers in the heifer lot. Therefore it appears that if the heat periods lessened the gains in the mixed lot, it was not caused by a lessening of the steers' gains, but by a lessening of the heifers' gains only. It is doubtful whether the slower gains of the heifers in the mixed lot can be accounted for by the presence of steers in the same lot. There is little or no evidence in this trial that the feeding of mixed lots of steers and open heifers is objectionable. All the calves in the mixed lot were well finished at the close of the trial.

The following conclusions may be drawn from this trial:

Steer calves make larger and more economical daily gains than heifer calves, but the heifers fatten in less time.

When steer calves and heifer calves of the same breeding are purchased for feeding at the same price per hundredweight, the steers sell at higher prices when finished and return a larger profit.

There was little or no evidence that the feeding of mixed lots of steers and open heifers is less profitable than feeding the steers and heifers in separate lots.

THE SELF-FEEDER FOR FEEDING GRAIN TO BABY BEEVES

To compare the self-feeding method of feeding grain with the hand-feeding method, two lots each containing 10 purebred and grade Aberdeen-Angus steer calves were fed shelled corn, linseed meal, corn silage, and alfalfa hay for 224 days. (See Figs. 17 and 18.) One lot twice daily was hand-fed as much shelled corn as they would clean up in about one hour's time. The other lot had access at all times to a self-feeder containing shelled corn. The other feeds were hand-fed twice daily in each lot. The results are presented in Table IV.

Self-feeding the shelled corn in a ration of shelled corn, linseed meal, corn silage, and alfalfa hay resulted in slightly less daily gain and higher cost of gain, but the pigs following the self-fed calves made more pork from waste. The self-fed calves sold at a slightly higher price and returned a little more profit than the calves in the lot where all feeds were hand-fed.

This trial indicates that the labor-saving self-feeder may be used to advantage if a full feed of grain is to be fed.

TABLE IV

SELF-FEEDING VS. HAND-FEEDING GRAIN TO BABY BEEVES
November 2, 1923 to June 13, 1924—224 days

	All feeds hand-fed	Corn self-fed
Initial weight, lbs.	447.37	447.27
Final weight, lbs.	966.60	954.42
Average daily gain, lbs.	2.32	2.26
Average daily feeds:		
Shelled corn, lbs.	13.45	13.55
Linseed meal, lbs.	1.85	1.85
Corn silage, lbs.	4.34	4.48
Alfalfa hay, lbs.	1.33	1.34
Cost of feeds, 100 lbs. gain*	$9.61	$9.91
Initial cost per cwt.	$7.00	$7.00
Initial cost per head	31.32	31.31
Total cost of feeds	49.88	50.24
Final cost per head	81.20	81.55
Selling price, South St. Paul	$10.10	$10.30
Selling price, University Farm	9.60	9.80
Value per head, University Farm	92.79	93.53
Pork credit per calf, lbs.	28.14	45.77
Pork credit, at $6.30 per cwt.	1.77	2.88
Margin per calf over feed cost	$13.36	$14.86

* Feed prices charged: Shelled corn 65 cents per bushel, linseed meal $48 per ton, corn silage $5, alfalfa hay $17.

IS SILAGE NECESSARY IN THE RATION OF BABY BEEVES?

Three lots, each containing 10 head of purebred Hereford steer calves, were used for this 196-day trial. All lots received the same grain mixture, hand-fed. For the first 136 days the grain mixture consisted of 60 per cent shelled corn, 30 per cent ground oats, and 10 per cent linseed meal, by weight. For the remaining 60 days, a mixture of 75 per cent shelled corn, 15 per cent ground oats, and 10 per cent linseed meal was used. All lots were fed as much alfalfa hay as they would eat. One lot was given a full feed of corn silage, one lot a half feed of corn silage, and one lot received no silage. (See Figs. 3, 4, and 6.) The results are given in Table V.

The addition of silage to the ration caused the calves to remain on feed a little more regularly. The silage-fed calves ate a little less grain, gained faster, made their gains at a little less cost, sold only 10 cents per hundredweight lower, and made a slightly higher profit than the lot in which no silage was fed.

Had the cost of silage been increased from $3 to $4.50, other factors remaining the same, the lots fed silage would have shown no greater margin of profit than the no-silage lot.

TABLE V

FATTENING BABY BEEVES WITH AND WITHOUT CORN SILAGE IN THE RATION
December 15, 1921 to June 29, 1922—196 days

	Full feed silage	Half feed silage	No silage
Initial weight, lbs.	493.40	481.50	487.60
Final weight, lbs.	955.30	938.76	923.16
Average daily gain, lbs.	2.36	2.33	2.22
Average daily feed:			
Shelled corn, lbs.	7.78	8.35	8.46
Ground oats, lbs.	3.09	3.23	3.34
Linseed meal, lbs.	1.21	1.27	1.31
Corn silage, lbs.	11.98	6.02	....
Alfalfa hay, lbs.	4.25	4.86	5.33
Cost of feeds, 100 lbs. gain*	$6.72	$6.85	$7.06
Initial cost per cwt.	$8.07	$8.07	$8.07
Initial cost per head	39.81	38.86	39.35
Total cost of feeds	31.02	31.34	30.75
Final cost per head	70.83	70.20	70.10
Selling price, South St. Paul	$9.30	$9.30	$9.40
Selling price, University Farm	8.90	8.90	9.00
Value per head, University Farm	85.02	83.55	83.08
Pork credit per calf, lbs.	37.10	34.30	31.70
Pork credit, at $10 per cwt.	3.71	3.43	3.17
Margin per calf over feed cost	$17.90	$16.78	$16.15

* Feed prices charged: Shelled corn 42 cents per bushel, ground oats 28 cents, linseed meal $45 per ton, alfalfa hay $13.

SHALL SILAGE BE ADDED TO A RATION OF CORN AND ALFALFA HAY?

When baby beeves are fattened on a full feed of corn and a full feed of legume hay of good quality, the ration is fairly well balanced and the results are usually satisfactory. When corn silage is added to such a ration, however, the calves do not eat enough of the high-protein legume hay, and the result is an unbalanced ration, lacking sufficient protein for satisfactory results. This is shown in Table VI, which gives the results of feeding two lots (Figs. 19 and 20), each containing 10 head of purebred and grade Aberdeen-Angus steer calves, for 224 days.

The addition of corn silage to the ration of shelled corn and alfalfa hay lessened the rate of gain, increased the cost of gain, lessened the degree of finish and the selling price, and decreased the profits to the amount of $3.14 per head.

TABLE VI

ADDING CORN SILAGE TO A SHELLED CORN-ALFALFA HAY RATION
November 2, 1923 to June 13, 1924—224 days

	Silage	No silage
Initial weight, lbs.	445.03	446.64
Final weight, lbs.	898.43	915.63
Average daily gain, lbs.	2.02	2.09
Average daily feed:		
Shelled corn, lbs.	13.34	13.25
Corn silage. lbs.	4.34	.....
Alfalfa hay, lbs.	1.83	3.45
Cost of feeds, 100 lbs. gain*	$8.95	$8.75
Initial cost per cwt.	$7.00	$7.00
Initial cost per head	31.15	31.26
Total cost of feeds	40.59	41.02
Final cost per head	71.74	72.28
Selling price, South St. Paul	$9.45	$9.70
Selling price, University Farm	8.95	9.20
Value per head, University Farm	80.41	84.24
Pork credit per calf, lbs.	32.51	30.18
Pork credit, at $6.30 per cwt.	2.05	1.90
Margin per calf over feed cost	$10.72	$13.86

* Feed prices charged: Shelled corn 65 cents per bushel, corn silage $5 per ton, alfalfa hay $17.

WHEN SILAGE IS FED, A PROTEIN SUPPLEMENT SHOULD ALSO BE FED

As pointed out in the preceding discussion, a ration composed of corn, corn silage, and legume hay is not a satisfactory ration for fattening baby beeves because the calves do not eat enough hay to satisfy their protein requirements. This deficiency of protein may be corrected by adding linseed meal to the ration.

Table VII shows the results of two trials in which linseed meal was added to a ration of grain, corn silage, and legume hay. In the first trial the grain was a mixture of ground corn and ground oats and the hay was red clover. In the second trial shelled corn and alfalfa hay were fed. Purebred Shorthorn steer calves (Figs. 10 and 13) were used in the first trial and purebred and grade Aberdeen-Angus steer calves (Figs. 17 and 19) were used in the second trial. There were 10 calves in each lot.

In both trials, the addition of linseed meal to a ration of grain, corn silage, and legume hay increased the daily feed consumption and cost of gains, but it also increased the rate of gain and gave a better finish and a higher selling price. The lots fed linseed meal returned the most profit. In the first trial $63.06 per ton could have been paid for the linseed meal and in the second trial $60.79, and still the calves fed linseed meal would have equaled the other calves in profit. A profit of $14.06 per ton was made by feeding linseed meal in the first

trial, and a profit of $12.79 in the second trial. More valuable manure was also produced where linseed meal was fed.

TABLE VII

EFFECT OF ADDING LINSEED MEAL TO A RATION OF GRAIN, SILAGE, AND LEGUME HAY
First trial—November 21, 1922 to June 26, 1923—217 days
Second trial—November 2, 1923 to June 13, 1924—224 days

	First trial		Second trial	
	Linseed	No linseed	Linseed	No linseed
Initial weight, lbs.	485.30	496.70	447.37	445.03
Final weight, lbs.	986.02	956.50	966.60	898.43
Average daily gain, lbs.	2.31	2.12	2.32	2.02
Average daily feed:				
Grain, lbs.	13.92	14.52	13.45	13.34
Linseed meal. lbs.	1.55	.....	1.85	.....
Corn silage, lbs.	12.29	10.88	4.34	4.34
Legume hay, lbs.	2.17	2.50	1.33	1.83
Cost of feeds, 100 lbs. gain*	$10.20	$9.59	$9.61	$8.95
Initial cost per cwt.	$7.17	$7.17	$7.00	$7.00
Initial cost per head	34.80	35.61	31.32	31.15
Total cost of feeds	51.07	44.11	49.88	40.59
Final cost per head	85.87	79.72	81.20	71.74
Selling price, South St. Paul	$10.50	$10.00	$10.10	$ 9.45
Selling price, University Farm	10.00	9.50	9.60	8.95
Value per head, University Farm	98.60	90.87	92.79	80.41
Pork credit per calf, lbs.	51.48	39.01	28.14	32.51
Pork credit, at $6.30 per cwt.	3.24	2.46	1.77	2.05
Margin per calf over feed cost	$15.97	$13.61	$13.36	$10.72

* **Feed prices** charged: (First trial) Shelled corn 59 cents per bushel, oats 34 cents, linseed meal $49 per ton, corn silage $4.25, clover hay $12.11. (Second trial) Shelled corn 65 cents, linseed meal $48, corn silage $5, alfalfa hay $17.

From Tables V, VI, and VII, the following general conclusions may be drawn: There is a slight advantage in the use of silage for fattening beef calves, provided the silage is a part of a well-balanced ration. In order to provide the necessary balance, a protein supplement such as linseed meal must be included in the ration with the silage. The addition of corn silage to a ration of grain and legume hay is ordinarily not advisable unless a protein supplement is also added to the ration.

SHALL CORN SILAGE AND A PROTEIN SUPPLEMENT BE ADDED TO A RATION OF GRAIN AND LEGUME HAY?

In two of our trials one lot of baby beeves was fed a ration of grain and legume hay, and another similar lot was fed the same ration with corn silage and linseed meal added. In the first trial the grain was a mixture of ground shelled corn and ground oats and the hay was red clover. In the second trial shelled corn and alfalfa hay were used. Purebred Shorthorn steer calves (Figs. 10 and 14) were fed

in the first trial and purebred and grade Aberdeen-Angus steer calves (Figs. 17 and 20) were fed in the second. There were 10 calves in each lot. The results are given in Table VIII.

TABLE VIII

ADDING CORN SILAGE AND LINSEED MEAL TO A GRAIN-LEGUME HAY RATION
First trial—November 21, 1922 to June 26, 1923—217 days
Second trial—November 2, 1923 to June 13, 1924—224 days

	First trial		Second trial		Average of two trials	
	Complete ration	Grain and hay	Complete ration	Grain and hay	Complete ration	Grain and hay
Initial weight, lbs.	485.30	497.70	447.37	446.64	466.34	472.17
Final weight, lbs	986.02	978.10	966.60	915.63	976.31	946.87
Average daily gain, lbs.	2.31	2.21	2.32	2.09	2.32	2.15
Average daily feed:						
Grain, lbs.	13.92	15.83	13.45	13.25	13.69	14.54
Linseed meal, lbs.	1.55	.....	1.85	.....	1.70	.....
Corn silage, lbs.	12.29	.....	4.34	.....	8.32	.....
Legume hay, lbs.	2.17	5.42	1.33	3.45	1.75	4.44
Cost of feeds, 100 lbs. gain*	$10.20	$9.61	$9.61	$8.75	$9.91	$9.18
Initial cost per cwt.	$7.17	$7.17	$7.00	$7.00	$7.09	$7.09
Initial cost per head	34.80	35.69	31.32	31.26	33.06	33.48
Total cost of feeds	51.07	46.15	49.88	41.02	50.48	43.59
Final cost per head	85.87	81.84	81.20	72.28	83.54	77.06
Selling price, South St. Paul	$10.50	$10.00	$10.10	$9.70	$10.30	$9.85
Selling price, University Farm	10.00	9.50	9.60	9.20	9.80	9.35
Value per head, University Farm	98.60	92.92	92.79	84.24	95.70	88.58
Pork credit per calf, lbs.	51.48	32.11	28.14	30.18	39.81	31.15
Pork credit, at $6.30 per cwt.	3.24	2.02	1.77	1.90	2.51	1.96
Margin per calf over feed cost.	$15.97	$13.10	$13.36	$13.86	$14.67	$13.48

* Feed prices charged: (First trial) Shelled corn 59 cents per bushel, oats 34 cents, linseed meal $49 per ton, corn silage $4.25, clover hay $12.11. Cost of grinding grain, 8 cents per hundredweight. (Second trial) Shelled corn 65 cents, linseed meal $48, corn silage $5, alfalfa hay $17.

The calves fed the complete ration, including silage and linseed meal, made larger gains in both trials than those fed grain and hay only. In both trials the calves fed the complete ration acquired a higher finish and sold at a higher price per hundredweight. However, the cost of feed was higher when the more complete ration was fed. In the first trial the complete ration gave $2.87 more profit per head than the grain-hay ration. In the second trial the grain-hay ration gave 50 cents more profit per head than the more complete ration. The average of the two trials shows an added profit of only $1.19 per head in favor of the more complete ration.

We may conclude from these results that a ration of grain and legume hay is almost as profitable for fattening beef calves as a ration of grain, linseed meal, corn silage, and legume hay. The cattle feeder who does not have silage can fatten baby beeves successfully and profitably on a ration of shelled corn and alfalfa or clover hay provided the hay is of at least fair quality.

A COMPARISON OF BARLEY AND CORN

How does barley compare with corn for fattening baby beeves?

One lot of 10 purebred Hereford steer calves was fed a mixture of 60 per cent ground barley, 30 per cent ground oats, and 10 per cent linseed meal, together with as much alfalfa hay as they would clean up, for 136 days. For the remaining 60 days of this 196-day trial, the concentrate mixture was changed to ground barley 75 per cent, ground oats 15 per cent, and linseed meal 10 per cent. Another lot of similar calves was fed the same ration except for the substitution of shelled corn for the ground barley. (See Figs. 5 and 6.) The results are given in Table IX.

TABLE IX

BARLEY VS. CORN FOR FATTENING BABY BEEVES
December 15, 1921 to June 29, 1922—196 days

	Barley lot	Corn lot
Initial weight, lbs.	494.30	487.60
Final weight, lbs.	907.92	923.16
Average daily gain, lbs.	2.11	2.22
Average daily feed:		
Shelled corn, lbs.	....	8.46
Ground barley, lbs.	8.40	....
Ground oats, lbs.	3.34	3.34
Linseed meal, lbs.	1.30	1.31
Alfalfa hay, lbs.	5.82	5.33
Cost of feeds, 100 lbs. gain*	$8.13	$7.06
Initial cost per cwt.	$8.07	$8.07
Initial cost per head	39.89	39.35
Total cost of feeds	33.64	30.75
Final cost per head	73.53	70.10
Selling price, South St. Paul	$9.10	$9.40
Selling price, University Farm	8.70	9.00
Value per head, University Farm	78.99	83.08
Pork credit per calf, lbs.	14.50	31.70
Pork credit, at $10 per cwt.	1.45	3.17
Margin per calf over feed cost	$6.91	$16.15

* Feed prices charged: Shelled corn 42 cents per bushel, ground barley 43 cents, ground oats 28 cents, linseed meal $45 per ton, alfalfa hay $13.

The corn-fed calves made somewhat more rapid gains; their gains cost $1.07 per hundredweight less than those of the barley-fed calves; the pigs following the corn-fed lot made twice as much gain from waste, and the corn-fed calves sold at a higher price when finished. For the barley-fed calves the margin of profit over feed cost was $6.91 per head, whereas the margin on the corn-fed calves was $16.15 per head, or $9.24 per head more.

The barley would have had to be reduced in price per bushel from 43 cents to 16 cents in order to have made the feeding of barley as profitable as the feeding of corn in this trial. If the profits made in this trial are applied to the corn and barley consumed, then the barley

lot returned 63 cents per bushel of barley and the corn lot returned 96 cents per bushel of corn.

DOES IT PAY TO GRIND SHELLED CORN AND OATS?

One lot of 10 purebred Shorthorn steer calves was fed a mixture of shelled corn 60 per cent, whole oats 30 per cent, and linseed meal 10 per cent for 168 days. For the remaining 49 days of this 217-day trial, the mixture was changed to shelled corn 75 per cent, whole oats 15 per cent, and linseed meal 10 per cent. During the entire time the calves were fed all of the corn silage and alfalfa hay they would eat. A second lot of 10 similar calves was fed in the same manner, except that the corn and oats were ground. (See Figs. 9 and 10.) The results are given in Table X.

TABLE X

GRINDING SHELLED CORN AND OATS FOR FATTENING BABY BEEVES
November 21, 1922 to June 26, 1923—217 days

	Whole grain	Ground grain
Initial weight, lbs.	483.50	485.30
Final weight, lbs.	958.58	986.02
Average daily gain, lbs.	2.19	2.31
Average daily feed:		
Shelled corn, lbs.	9.37	9.97
Oats, lbs.	3.81	3.95
Linseed meal, lbs.	1.47	1.55
Corn silage, lbs.	10.44	12.29
Clover hay, lbs.	2.26	2.17
Cost of feeds, 100 lbs. gain*	$9.64	$10.20
Initial cost per cwt.	$7.17	$7.17
Initial cost per head	34.67	34.80
Total cost of feeds	45.79	51.07
Final cost per head	80.46	85.87
Selling price, South St. Paul	$10.50	$10.50
Selling price, University Farm	10.00	10.00
Value per head, University Farm	95.86	98.60
Pork credit per calf, lbs.	55.92	51.48
Pork credit, at $6.30 per cwt.	3.52	3.24
Margin per calf over feed cost	$18.92	$15.97

* Feed prices charged: Shelled corn 59 cents per bushel, oats 34 cents, linseed meal $49 per ton, corn silage $4.25, clover hay $12.11, cost of grinding grain 8 cents per hundredweight.

The calves fed ground grain consumed more feed and made somewhat larger gains. The two lots sold at the same price per hundredweight. The calves fed whole grain made somewhat cheaper gains and the pigs following them made slightly more pork from wasted feed, so that the calves fed the whole grain made a profit of $2.95 more per head than the calves fed ground grain. Grinding the grain proved to be unprofitable.

CORN COMPARED WITH CORN AND OATS

Does it pay to add oats to a ration of shelled corn, linseed meal, corn silage, and alfalfa hay?

One lot of 10 purebred and grade Aberdeen-Angus steer calves was fed the ration without oats, and a second and similar lot was fed the ration plus oats, 1 part oats by weight being fed with every 4 parts of shelled corn. (See Figs. 15 and 17.) The trial continued for 224 days. Table XI gives the results.

TABLE XI

CORN VS. CORN AND OATS FOR FATTENING BABY BEEVES
November 2, 1923 to June 13, 1924—224 days

	No oats	Oats
Initial weight, lbs.	447.37	446.80
Final weight, lbs.	966.60	936.77
Average daily gain, lbs.	2.32	2.19
Average daily feed:		
Shelled corn, lbs.	13.45	10.55
Whole oats, lbs.	....	2.64
Linseed meal, lbs.	1.85	1.85
Corn silage, lbs.	4.34	4.40
Alfalfa hay, lbs.	1.33	1.33
Cost of feeds, 100 lbs. gain*	$9.61	$10.01
Initial cost per cwt.	$7.00	$7.00
Initial cost per head	31.32	31.28
Total cost of feeds	49.88	49.05
Final cost per head	81.20	80.33
Selling price, South St. Paul	$10.10	$9.90
Selling price, University Farm	9.60	9.40
Value per head, University Farm	92.79	88.06
Pork credit per calf, lbs.	28.14	33.75
Pork credit, at $6.30 per cwt.	1.77	2.13
Margin per calf over feed cost	$13.36	$9.86

* Feed prices charged: Shelled corn 65 cents per bushel, oats 36 cents, linseed meal $48 per ton, corn silage $5, alfalfa hay $17.

The addition of oats to the ration of shelled corn, linseed meal, corn silage, and alfalfa hay lessened the rate of gain, increased the cost of gain, gave less finish, and resulted in a slightly lower selling price per hundredweight. When oats were omitted from the ration the margin of profit per calf was $3.50 higher than when oats were fed. The oats fed in this trial would have to be reduced in price from 36 to 17 cents per bushel, a reduction of more than 50 per cent, in order to make the oats-fed calves as profitable as the calves fed no oats.

CORN-AND-COB MEAL VS. CORN AND OATS

Two trials in which corn-and-cob meal was fed in competition with a mixture of shelled corn and whole oats were conducted to determine which is the better grain ration for fattening beef calves. In addition to the grain, the calves were fed linseed meal, corn silage, and a legume hay. There were 10 steer calves in each lot. Purebred Shorthorns were used in the first trial (Figs. 9 and 12), and purebred

and high-grade Aberdeen-Angus calves (Figs. 15 and 16) in the second trial. The results are given in Table XII.

TABLE XII

CORN-AND-COB MEAL VS. SHELLED CORN AND WHOLE OATS FOR BABY BEEVES
First trial—November 21, 1922 to June 26, 1923—217 days
Second trial—November 2, 1923 to June 13, 1924—224 days

	First trial		Second trial		Average of two trials	
	Corn-and-cob meal	Corn and oats	Corn-and-cob meal	Corn and oats	Corn-and-cob meal	Corn and oats
Initial weight, lbs.	485.60	483.50	445.07	446.80	465.34	465.15
Final weight, lbs.	993.28	958.58	951.00	936.77	972.14	947.68
Average daily gain, lbs.	2.34	2.19	2.26	2.19	2.30	2.19
Average daily feed:						
Corn-and-cob meal, lbs.	13.97	....	15.08	....	14.53	....
Shelled corn, lbs.	....	9.37	....	10.55	....	9.96
Whole oats, lbs.	....	3.81	....	2.64	....	3.23
Linseed meal, lbs.	1.55	1.47	1.85	1.85	1.70	1.66
Corn silage, lbs.	12.06	10.44	4.14	4.40	8.10	7.42
Clover hay, lbs.	2.23	2.26	....	....	1.12	1.13
Alfalfa hay, lbs.	....	....	1.33	1.33	0.67	0.67
Cost of feeds, 100 lbs. gain*	$8.63	$9.64	$9.47	$10.01	$9.05	$9.83
Initial cost per cwt.	$7.17	$7.17	$7.00	$7.00	$7.09	$7.09
Initial cost per head	34.82	34.67	31.15	31.28	32.99	32.98
Total cost of feeds	43.84	45.79	47.91	49.05	45.88	47.42
Final cost per head	78.66	80.46	79.06	80.33	78.86	80.40
Selling price, South St. Paul	$10.00	$10.50	$10.40	$9.90	$10.20	$10.20
Selling price, University Farm	9.50	10.00	9.90	9.40	9.70	9.70
Value per head, University Farm	94.36	95.86	94.15	88.06	94.26	91.96
Pork credit per calf, lbs.	41.21	55.92	30.70	33.75	35.96	44.84
Pork credit, at $6.30 per cwt.	2.60	3.52	1.93	2.13	2.27	2.83
Margin per calf over feed cost.	$18.30	$18.92	$17.02	$9.86	$17.66	$14.39

* Feed prices charged: (First trial) Ear corn 57 cents per bushel, shelled corn 59 cents, oats 34 cents, linseed meal $49 per ton, corn silage $4.25, clover hay $12.11. Cost of grinding ear corn 8 cents per hundredweight. (Second trial) Ear corn 63 cents, shelled corn 65 cents, oats 36 cents, linseed meal $48, corn silage $5, alfalfa hay $17. Cost of grinding ear corn, 8 cents per hundredweight.

In each of the two trials the calves fed corn-and-cob meal made larger daily gains at less cost per pound of gain than did those fed shelled corn and whole oats. In both trials the calves fed corn-and-cob meal became somewhat the fatter, and this explains their higher selling price in the second trial. In the first trial the corn-and-cob meal calves received a lower valuation than the calves fattened on corn and oats. This was due in part to the fact that one or two calves fed corn-and-cob meal failed to shape up in desirable form as they developed; and in part to slightly more paunchiness in the corn-and-cob meal lot.

There was little difference in profit between the two lots in the first trial, but in the second trial the feeding of corn-and-cob meal resulted in much the larger profit. The average of the two trials shows an added profit of $3.28 per head in favor of corn-and-cob meal as compared with shelled corn and whole oats.

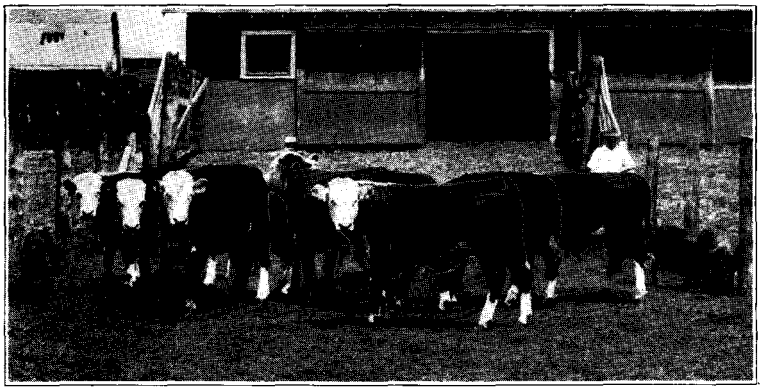

Fig. 3. Purebred Hereford steer calves at close of 1921-1922 trial, after 196 days on shelled corn, ground oats, linseed meal. corn silage, and alfalfa hay. Average weight 955.30 pounds.

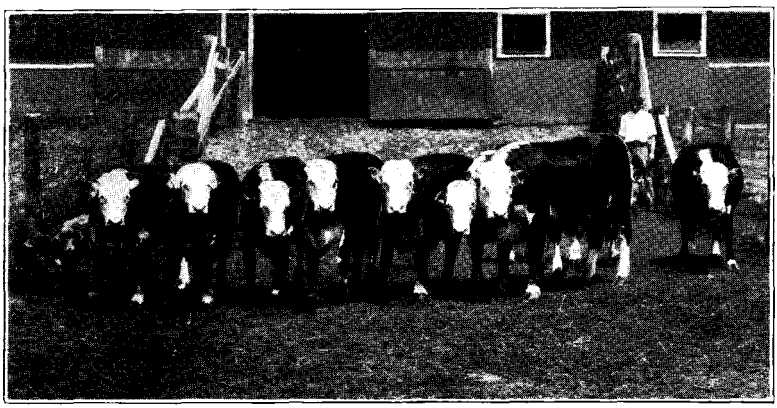

Fig. 4. Purebred Hereford steer calves at close of 1921-1922 trial, after 196 days on shelled corn, ground oats, linseed meal, corn silage half feed, and alfalfa hay. Average weight 938.76 pounds.

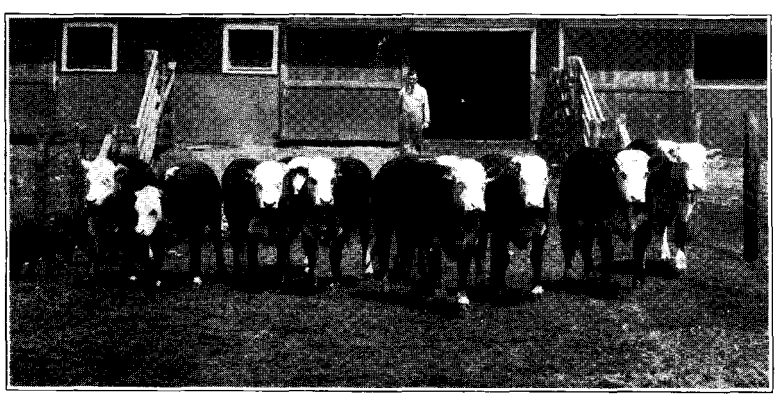

Fig. 5. Purebred Hereford steer calves at close of 1921-1922 trial, after 196 days on ground barley, ground oats, linseed meal, and alfalfa hay. Average weight 907.92 pounds.

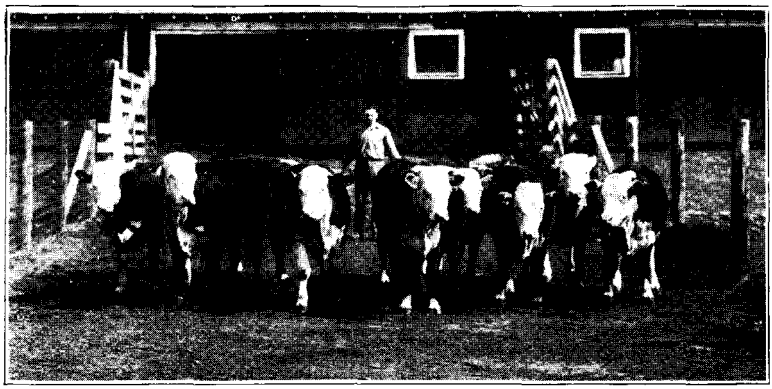

Fig. 6. Purebred Hereford steer calves at close of 1921-1922 trial, after 196 days on shelled corn, ground oats, linseed meal, and alfalfa hay. Average weight 923.16 pounds.

Fig. 7. Grade Hereford steer calves at close of 1921-1922 trial, after 196 days on shelled corn, ground oats, linseed meal, and alfalfa hay. Average weight 916.98 pounds.

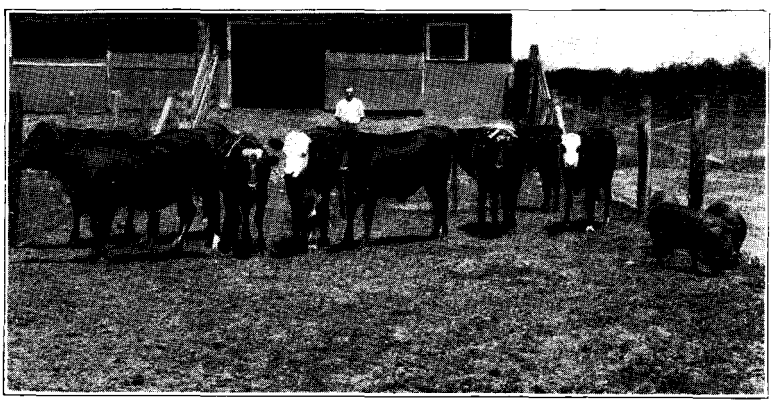

Fig. 8. Common steer calves at close of 1921-1922 trial, after 196 days on shelled corn, ground oats, linseed meal, and alfalfa hay. Average weight 796.82 pounds.

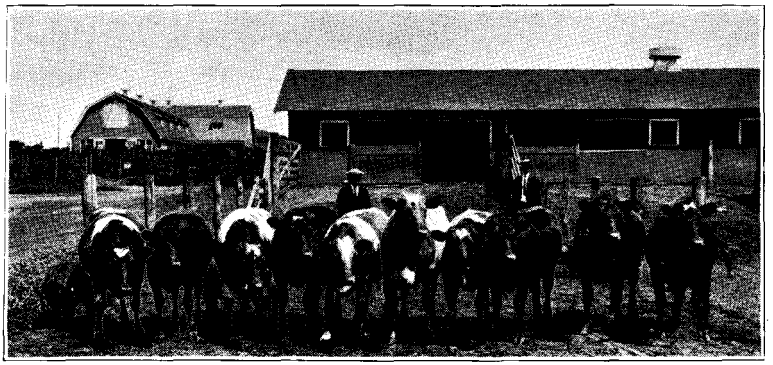

Fig. 9. Purebred Shorthorn steer calves at close of 1922-1923 trial, after 217 days on shelled corn, whole oats, linseed meal, corn silage, and clover hay. Average weight 958.58 pounds.

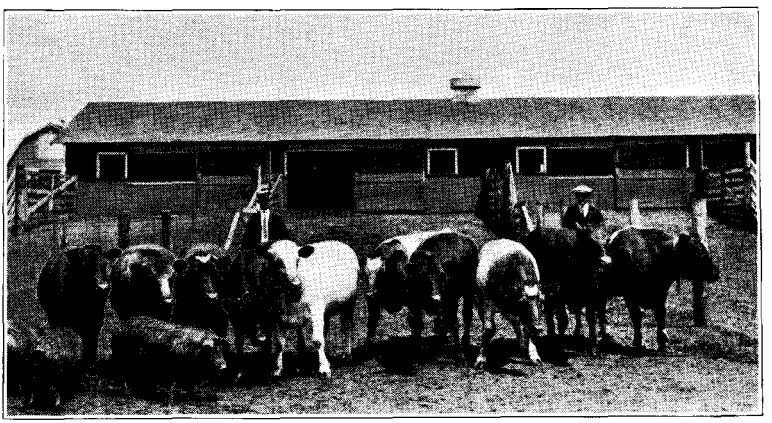

Fig. 10. Purebred Shorthorn steer calves at close of 1922-1923 trial, after 217 days on ground shelled corn, ground oats, linseed meal, corn silage, and clover hay. Average weight 986.02 pounds.

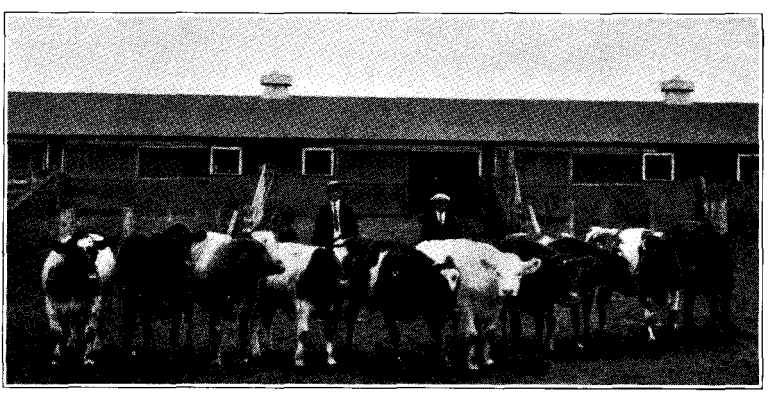

Fig. 11. Purebred Shorthorn steer calves at close of 1922-1923 trial, after 217 days on ground shelled corn, ground oats, linseed meal, corn silage, and clover hay. These calves were limited to 2 pounds of concentrates per head daily during the first 112 days, then full fed. Average weight 883.10 pounds.

Fig. 12. Purebred Shorthorn steer calves at close of 1922-1923 trial, after 217 days on corn-and-cob meal, linseed meal, corn silage, and clover hay. Average weight 993.28 pounds.

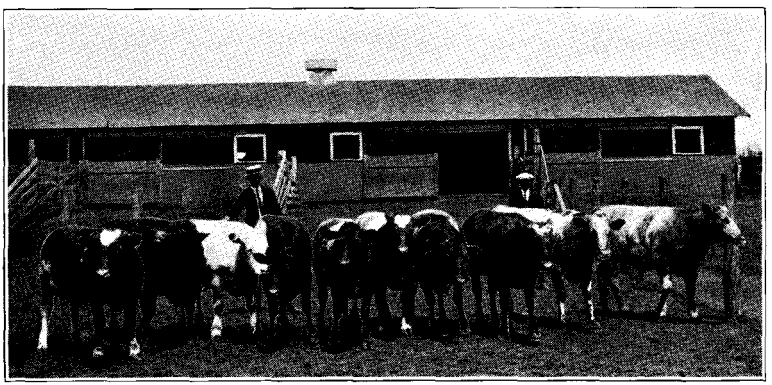

Fig. 13. Purebred Shorthorn steer calves at close of 1922-1923 trial, after 217 days on ground shelled corn, ground oats, corn silage, and clover hay. Average weight 956.50 pounds.

Fig. 14. Purebred Shorthorn steer calves at close of 1922-1923 trial, after 217 days on ground shelled corn, ground oats, and clover hay. Average weight 978.10 pounds.

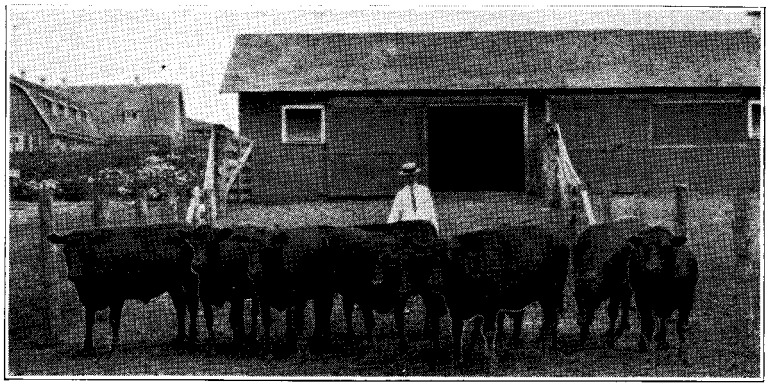

Fig. 15. Purebred and grade Aberdeen-Angus steer calves at close of 1923-1924 trial, after 224 days on shelled corn, whole oats, linseed meal, corn silage, and alfalfa hay. Average weight 936.77 pounds.

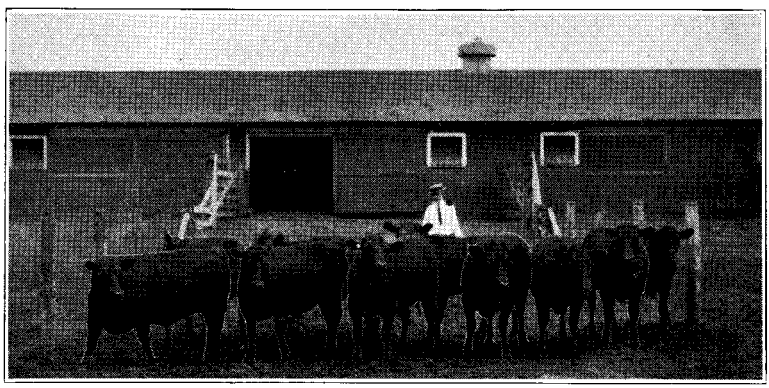

Fig. 16. Purebred and grade Aberdeen-Angus steer calves at close of 1923-1924 trial, after 224 days on corn-and-cob meal, linseed meal, corn silage, and alfalfa hay. Average weight 951 pounds.

Fig. 17. Purebred and grade Aberdeen-Angus steer calves at close of 1923-1924 trial, after 224 days on shelled corn, linseed meal, corn silage, and alfalfa hay. Average weight 966.60 pounds.

Fig. 18. Purebred and grade Aberdeen-Angus steer calves at close of 1923-1924 trial, after 224 days on shelled corn (self-fed), linseed meal, corn silage, and alfalfa hay. Average weight 954.42 pounds.

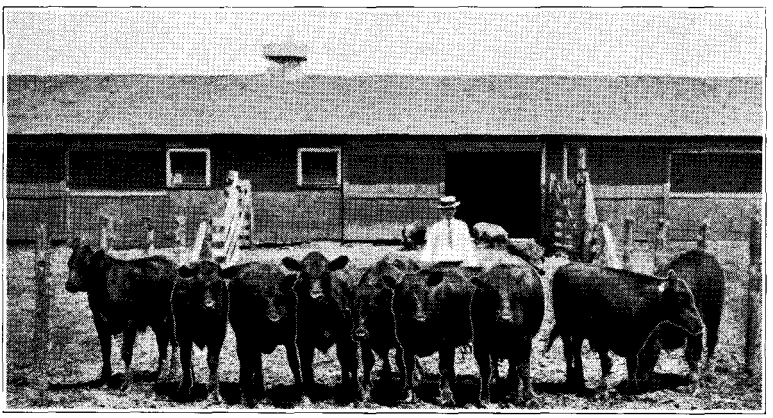

Fig. 19. Purebred and grade Aberdeen-Angus steer calves at close of 1923-1924 trial, after 224 days on shelled corn, corn silage, and alfalfa hay. Average weight 898.43 pounds.

Fig. 20. Purebred and grade Aberdeen-Angus steer calves at close of 1923-1924 trial, after 224 days on shelled corn and alfalfa hay. Average weight 915.63 pounds.

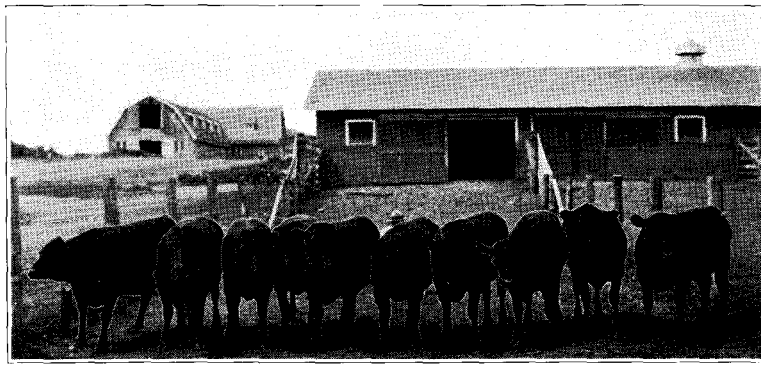

Fig. 21. Grade Aberdeen-Angus steer calves at close of 1924-1925 trial, after 210 days on shelled corn, linseed meal, corn silage, and alfalfa hay. Average weight 904.83 pounds.

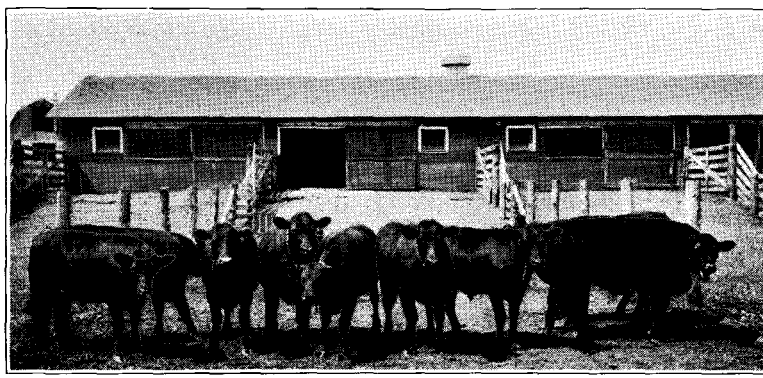

Fig. 22. Grade Aberdeen-Angus steer calves at close of 1924-1925 trial, after 210 days on corn-and-cob meal, linseed meal, corn silage, and alfalfa hay. Average weight 882.57 pounds.

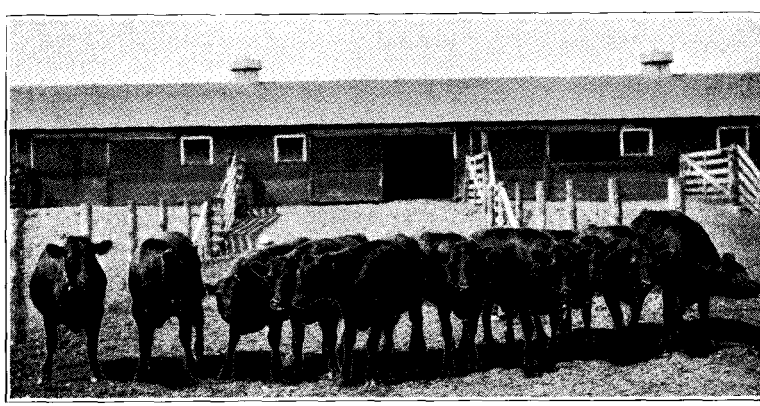

Fig. 23. Grade Aberdeen-Angus steer calves at close of 1924-1925 trial, after 210 days on corn-and-cob meal (85 per cent of full feed), linseed meal, corn silage, and alfalfa hay. Average weight 891.07 pounds.

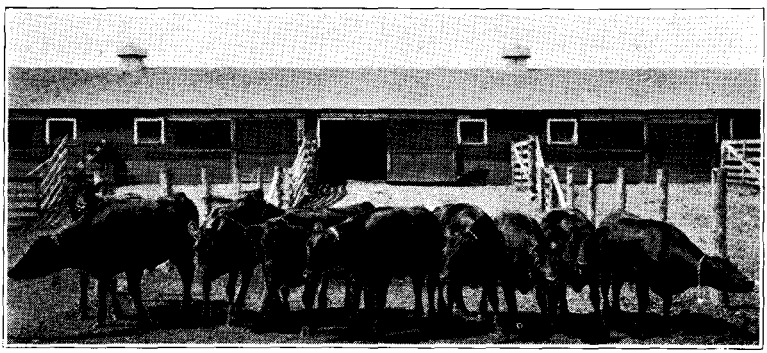

Fig. 24. Grade Aberdeen-Angus steer calves at close of 1924-1925 trial, after 210 days on corn-and-cob meal (70 per cent of full feed), linseed meal, corn silage, and alfalfa hay. Average weight 854.83 pounds.

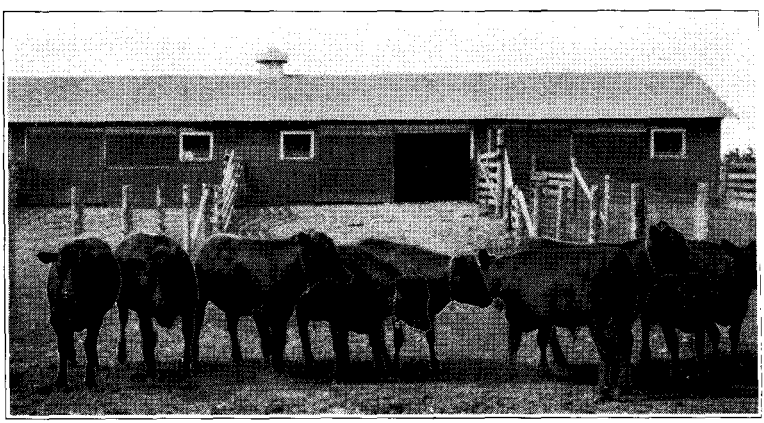

Fig. 25. Grade Aberdeen-Angus steer calves at close of 1924-1925 trial, after 210 days on corn-and-cob meal (60 to 100 per cent of full feed), linseed meal, corn silage, and alfalfa hay. Average weight 856.73 pounds.

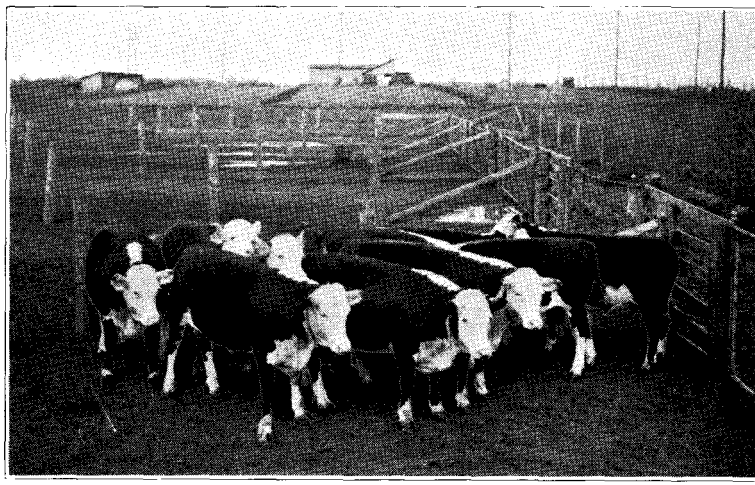

Fig. 26. Purebred and grade Hereford steer calves at close of 1925-1926 trial, after 217 days on corn-and-cob meal, linseed meal, corn silage, and alfalfa hay. Average weight 964.93 pounds.

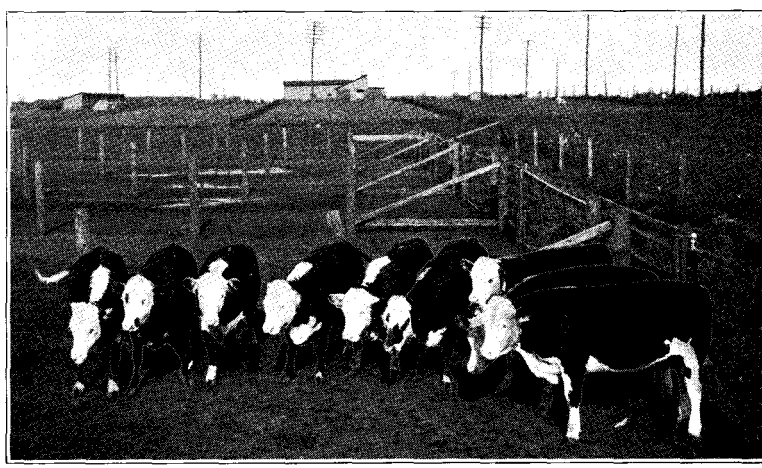

Fig. 27. Purebred and grade Hereford steer calves at close of 1925-1926 trial, after 217 days on corn-and-cob meal (85 per cent of full feed), linseed meal, corn silage, and alfalfa hay. Average weight 955.34 pounds.

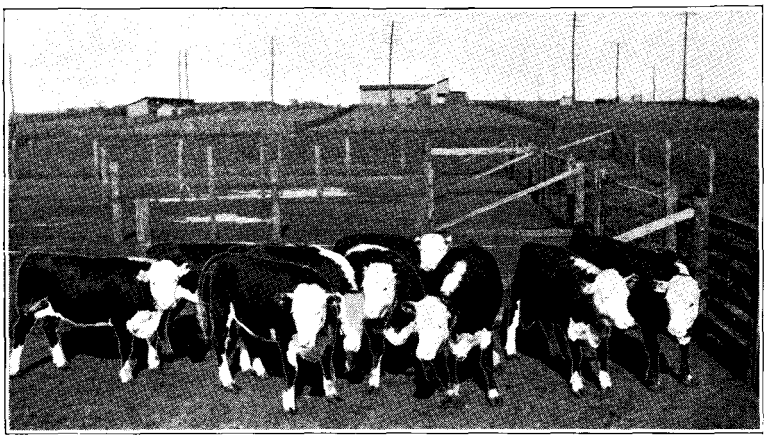

Fig. 28. Purebred and grade Hereford steer calves at close of 1925-1926 trial, after 217 days on shelled corn (equal to shelled corn in full feed of corn-and-cob meal), linseed meal, corn silage, and alfalfa hay. Average weight 960.85 pounds.

Fig. 29. Purebred and grade Hereford steer calves at close of 1925-1926 trial, after 217 days on shelled corn (equal to shelled corn in 85 per cent of a full feed of corn-and-cob meal), linseed meal, corn silage, and alfalfa hay. Average weight 958.27 pounds.

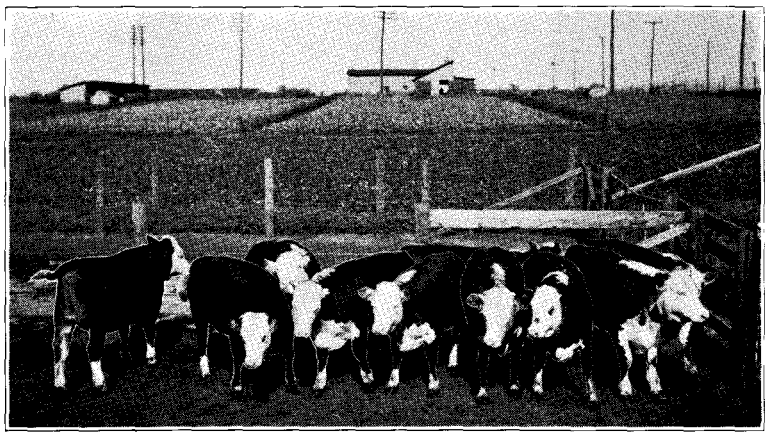

Fig. 30. Purebred and grade Hereford steer and heifer calves at close of 1925-1926 trial, after 217 days on shelled corn (equal to shelled corn in full feed of corn-and-cob meal), linseed meal, corn silage, and alfalfa hay. Average weight 940 pounds.

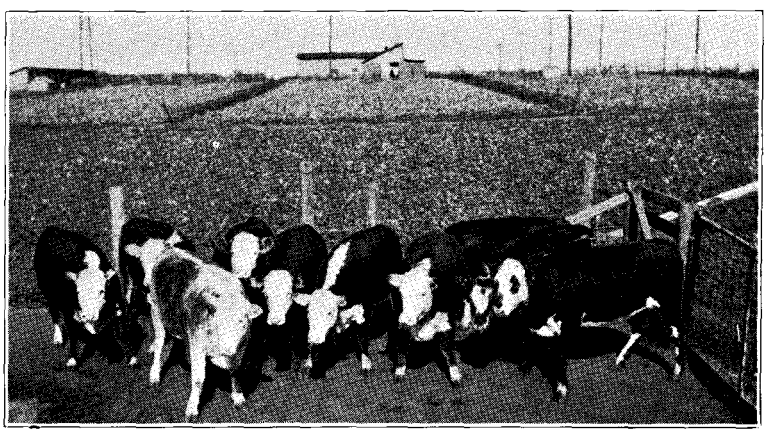

Fig. 31. Purebred and grade Hereford heifer calves at close of 1925-1926 trial, after 217 days on shelled corn (equal to shelled corn in full feed of corn-and-cob meal), linseed meal, corn silage, and alfalfa hay. Average weight 941.70 pounds.

SHALL CORN-AND-COB MEAL BE FULL FED OR LIMITED TO SOME DEGREE IN A RATION WITH SILAGE?

Two trials were conducted to determine whether it is advisable to limit to some degree the amount of corn-and-cob meal consumed by fattening calves, provided the calves also receive corn silage as a part of their ration.

First Trial

In the first trial, lasting 210 days, one lot of 10 grade Aberdeen-Angus steer calves was fed twice daily all the corn-and-cob meal, all the corn silage, and all the alfalfa hay they would eat. This lot was also fed linseed meal throughout the trial, at the rate of 2 pounds per head daily, after the calves had been brought up to a full feed of concentrates.

A second and similar lot was fed in the same manner, except that the allowance of both corn-and-cob meal and linseed meal was limited to 85 per cent of the amount consumed by the first lot. In other words, Lot 2 was fed 85 pounds of corn-and-cob meal for every 100 pounds of the meal consumed by Lot 1. Lot 2 also received 1.7 pounds of linseed meal per head daily in place of the 2 pounds given to Lot 1. Each lot was fed as much corn silage and alfalfa hay as the calves would eat.

A third and similar lot was fed in the same manner but was limited to 70 per cent of the full allowance of corn-and-cob meal and linseed meal given to Lot 1.

A fourth and similar lot of calves was limited to 60 per cent of a full allowance of concentrates for the first 56 days of the trial. This allowance was increased every 56 days, first to 70 per cent, then to 85 per cent, and finally to 100 per cent. The calves received 100 per cent for the last 42 days of the trial. (See Figs. 22, 23, 24, and 25.) The results at the end of 210 days are given in Table XIII.

When the allowance of corn-and-cob meal and linseed meal was limited to 85 per cent of a full feed, the consumption of corn silage and alfalfa hay was increased considerably and the pork credit was reduced more than one-third. Nevertheless the feed cost per 100 pounds of gain was reduced $1.20 by limiting the concentrates to 85 per cent of a full feed, the rate of gain in the 85 per cent lot was slightly greater than in the full-fed lot, the degree of finish was fully equal to the full-fed lot, the selling price was nearly as high, and the 85 per cent lot returned the greater profit. Therefore, *with silage and a legume hay included in the ration*, it proved profitable to limit the amount of concentrated feeds to 85 per cent of a full feed.

TABLE XIII

COMPARISON OF FULL AND LIMITED ALLOWANCES OF CORN-AND-COB MEAL
November 21, 1924 to June 19, 1925—210 days

	Full fed	85 per cent	70 per cent	60-100 per cent
Initial weight, lbs.	419.57	419.00	420.13	417.67
Final weight, lbs.	882.57	891.07	854.83	856.73
Average daily gain, lbs.	2.20	2.25	2.07	2.09
Average daily feed:				
Corn-and-cob meal, lbs.	14.14	11.97	9.97	11.34
Linseed meal, lbs.	1.88	1.59	1.33	1.48
Corn silage, lbs.	4.01	7.62	10.13	8.43
Alfalfa hay, lbs.	1.81	2.70	3.14	2.76
Cost of feeds, 100 lbs. gain*	$12.88	$11.68	$11.46	$12.11
Initial cost per cwt.	$7.75	$7.75	$7.75	$7.75
Initial cost per head	32.52	32.47	32.56	32.37
Total cost of feeds	59.63	55.12	49.80	53.18
Final cost per head	92.15	87.59	82.36	85.55
Selling price, South St. Paul	$11.05	$10.85	$10.00	$10.45
Selling price, University Farm	10.55	10.35	9.50	9.95
Value per head, University Farm	93.11	92.23	81.21	85.24
Pork credit per calf, lbs.	41.82	25.88	16.58	25.62
Pork credit, at $11 per cwt.	4.60	2.85	1.82	2.82
Margin per calf over feed cost	$5.56	$7.49	$0.67	$2.51

* Feed prices charged: Ear corn $1 per bushel, linseed meal $47 per ton, corn silage $6, alfalfa hay $16. Cost of grinding ear corn, 8 cents per hundredweight.

When the allowance of concentrates was limited to 70 per cent of a full feed, the daily gains were so much decreased that at the end of 210 days not only were the steers lighter in weight, but they were decidedly lacking in the finish necessary to command a satisfactory price. Tho their cost of feed was almost $10 per head less than in the full-fed lot, they were worth almost $12 per head less at the finish and the pigs following them made $2.78 less in pork per steer, so that the 70 per cent calves showed practically no margin over feed cost. They ate more pounds of feed than any other lot, but the quality of their ration was not good enough to produce the rate of gain and the finish needed in order to sell to advantage. They made the least profit of any of the four lots.

When the allowance of concentrates was limited to 60 per cent of a full feed at the start, and then increased every 56 days, first to 70 per cent, then to 85 per cent, and finally to 100 per cent, the results were better than in the 70 per cent lot, but were not equal to the 85 per cent and full-fed lots.

With higher prices for concentrates or lower prices for silage and hay, the lots fed the more limited grain rations would have made relatively better showings. However, if the charge for silage had been reduced from $6 to $2 per ton, and the charge for alfalfa hay from $16 to $8 per ton, the full-fed lot and the 85 per cent lot still would

have surpassed in profit the 70 per cent lot and the 60-100 per cent lot. If the more limited lots had been carried longer on feed in order to give them a good finish, they would have been carried into hot weather and fly-time, and it is doubtful whether they could have equaled the other lots in profit.

Following the close of the trial the four lots were carried along for 10 days on the same rations fed during the trial. They were shipped by rail to the South St. Paul market on the tenth day, were sold on the eleventh day, and were slaughtered by Swift & Co. on the twelfth day. The average dressing percentages based on chilled carcass weights were as follows:

	Dressing percentage
Full fed lot	60.42
85 per cent lot	61.11
70 per cent lot	58.94
60-100 per cent lot	59.14

The results of this trial indicate that baby beeves require very nearly a full feed of corn-and-cob meal in order to derive the greatest profit from fattening them on a ration composed of corn-and-cob meal, linseed meal, corn silage, and alfalfa hay.

Second Trial

A second trial, using purebred and grade Hereford steer calves, 10 calves per lot, was conducted in order to verify the results obtained in the first trial with the full-fed and 85 per cent lots (see Figs. 26 and 27). The results of the second trial, set alongside the results of the first trial for comparison, are given in Table XIV.

The second trial verified the results of the first trial. It again proved economical and profitable to limit the allowance of corn-and-cob meal and linseed meal to 85 per cent of a full feed. In the second trial the rate of gain, selling price, and production of pork in the two lots was nearly the same, but the cost of feed was $3.70 per head less in the 85 per cent lot than in the full-fed lot. Therefore the 85 per cent lot returned the most profit.

The difference between the two trials in respect to the hog gains is probably explained by the fact that the ear corn was more finely ground in the second trial than in the first.

In the first trial, after the calves had been brought up to full feed, the full-fed lot consumed an average of about 2.23 pounds of corn-and-cob meal per 100 pounds live weight, and the 85 per cent lot consumed an average of about 1.94 pounds. In the second trial the full-fed calves consumed an average of about 2.35 pounds of corn-and-cob meal per 100 pounds of live weight after getting on full feed, and the 85 per cent lot consumed an average of about 2 pounds.

TABLE XIV

COMPARISON OF FULL AND LIMITED ALLOWANCES OF CORN-AND-COB MEAL
First trial—November 21, 1924 to June 19, 1925—210 days
Second trial—November 13, 1925 to June 18, 1926—217 days

	First trial		Second trial		Average of two trials	
	Full fed	85 per cent	Full fed	85 per cent	Full fed	85 per cent
Initial weight, lbs.	419.57	419.00	450.17	449.97	434.87	434.49
Final weight, lbs.	882.57	891.07	964.93	955.34	923.75	923.21
Average daily gain, lbs.	2.20	2.25	2.37	2.33	2.29	2.29
Average daily feed:						
Corn-and-cob meal, lbs.	14.14	11.97	15.18	12.90	14.66	12.44
Linseed meal, lbs.	1.88	1.59	2.00	1.70	1.94	1.65
Corn silage, lbs.	4.01	7.62	4.49	8.32	4.25	7.97
Alfalfa hay, lbs.	1.81	2.70	1.37	1.79	1.59	2.25
Cost of feeds, 100 lbs. gain*	$12.88	$11.68	$8.86	$8.29	$10.87	$9.99
Initial cost per cwt.	$7.75	$7.75	$8.00	$8.00	$7.88	$7.88
Initial cost per head	32.52	32.47	36.01	36.00	34.27	34.24
Total cost of feeds	59.63	55.12	45.61	41.91	52.62	48.52
Final cost per head	92.15	87.59	81.62	77.91	86.89	82.75
Selling price, South St. Paul	$11.05	$10.85	$9.95	$9.90	$10.50	$10.38
Selling price, University Farm	10.55	10.35	9.45	9.40	10.00	9.88
Value per head, University Farm	93.11	92.23	91.19	89.80	92.15	91.02
Pork credit per calf, lbs.	41.82	25.88	13.56	13.43	27.69	19.66
Pork credit, at $11 per cwt.	4.60	2.85	1.49	1.48	3.05	2.17
Margin per calf over feed cost	$5.56	$7.49	$11.06	$13.37	$8.31	$10.43
Return per bushel ear corn	1.13	1.21	0.84	0.93	0.99	1.07

* Feed prices charged: (First trial) Ear corn $1 per bushel, linseed meal $47 per ton, corn silage $6, alfalfa hay $16. Cost of grinding ear corn, 8 cents per hundredweight. (Second trial) Ear corn 60 cents, linseed meal $48, corn silage $4.50, alfalfa hay $14.25. Cost of grinding ear corn, 8 cents per hundredweight.

The conclusion may be drawn from the two trials that with a full feed of corn silage and alfalfa hay in the ration, it is profitable to limit the allowance of corn-and-cob meal to about 2 pounds per 100 pounds live weight, and to limit the linseed meal to 1.7 pounds per head daily.

SHELLED CORN VS. CORN-AND-COB MEAL, WHEN BOTH ARE FULL-FED

In the foregoing pages it is seen: (1) That a mixture of shelled corn and whole oats proved superior to a mixture of ground shelled corn and ground oats for fattening baby beeves. (2) That shelled corn surpassed a mixture of shelled corn and whole oats. (3) That corn-and-cob meal also surpassed a mixture of shelled corn and whole oats. The next step is to compare shelled corn and corn-and-cob meal as grain feeds for fattening baby beeves.

What happens when two lots of calves are fed linseed meal, corn silage, and alfalfa hay, one lot receiving a full feed of shelled corn and the other a full feed of corn-and-cob meal? Two trials have been

conducted to obtain this information. Purebred and high-grade Aberdeen-Angus steer calves were used, 10 calves per lot. (See Figs. 16, 17, 21, and 22.) The results are given in Table XV.

TABLE XV

SHELLED CORN VS. CORN-AND-COB MEAL, WHEN BOTH ARE FULL-FED
First trial—November 2, 1923 to June 13, 1924—224 days
Second trial—November 21, 1924 to June 19, 1925—210 days

	First trial		Second trial		Average of two trials	
	C.-and-c. meal	Shelled corn	C.-and-c. meal	Shelled corn	C.-and-c. meal	Shelled corn
Initial weight, lbs.	445.07	447.37	419.57	418.33	432.32	432.85
Final weight, lbs	951.00	966.60	882.57	904.83	916.79	935.72
Average daily gain, lbs.	2.26	2.32	2.20	2.32	2.23	2.32
Average daily feed:						
Corn-and-cob meal, lbs.	15.08	.....	14.14	.....	14.61	.....
Shelled corn, lbs.	.....	13.45	.....	13.09	.....	13.27
Linseed meal, lbs.	1.85	1.85	1.88	1.88	1.87	1.87
Corn silage, lbs.	4.14	4.34	4.01	4.01	4.08	4.18
Alfalfa hay, lbs.	1.33	1.33	1.81	1.84	1.57	1.59
Cost of feed, 100 lbs. gain*	$9.47	$9.61	$12.88	$13.35	$11.18	$11.48
Initial cost per cwt.	$7.00	$7.00	$7.75	$7.75	$7.38	$7.38
Initial cost per head	31.15	31.32	32.52	32.42	31.84	31.87
Total cost of feeds	47.91	49.88	59.63	64.96	53.77	57.42
Final cost per head	79.06	81.20	92.15	97.38	85.61	89.29
Selling price, South St. Paul	$10.40	$10.10	$11.05	$11.20	$10.73	$10.65
Selling price, University Farm	9.90	9.60	10.55	10.70	10.23	10.15
Value per head, University Farm	94.15	92.79	93.11	96.82	93.63	94.81
Pork credit per calf, lbs.	30.70	28.14	41.82	56.17	36.26	42.16
Pork credit, at $6.30 per cwt.	1.93	1.77	.....	.....	0.97	0.89
Pork credit, at $11 per cwt.	.....	.....	4.60	6.18	2.30	3.09
Margin per calf over feed cost	$17.02	$13.36	$5.56	$5.61	$11.29	$9.49
Return per bushel ear corn	0.98	0.88	1.13	1.11	1.06	1.00

* Feed prices charged: (First trial) Ear corn 63 cents per bushel, shelled corn 65 cents, linseed meal $48 per ton, corn silage $5, alfalfa hay $17. Cost of grinding ear corn, 8 cents per hundredweight. (Second trial) Ear corn $1, shelled corn $1.02, linseed meal $47, corn silage $6, alfalfa hay $16. Cost of grinding ear corn, 8 cents per hundredweight.

Both corn-and-cob meal and shelled corn gave good results when full fed in combination with linseed meal, corn silage, and alfalfa hay. However, certain differences in results are noticeable. In both trials the shelled-corn lot made somewhat larger gains, but the corn-and-cob meal calves made their gains at lower cost and their gains were also rapid enough to produce a good finish and make possible a satisfactory selling price. The average of the two trials shows a somewhat larger pork credit for the shelled-corn lot.

In each of the two trials a larger return was obtained per bushel of ear corn when the ear corn was fed as corn-and-cob meal than when the bushel was shelled, the cobs thrown away, and the corn fed as shelled corn. The corn-and-cob meal ration also proved excellent for starting the calves on feed and had a slight advantage in keeping them steadily on feed throughout the fattening period.

WHY DOES A FULL FEED OF CORN-AND-COB MEAL GIVE A LARGER PROFIT THAN A FULL FEED OF SHELLED CORN?

It has been seen that in one trial a full feed of corn-and-cob meal was more profitable than a full feed of shelled corn and oats, and in two trials a full feed of the meal gave a larger return per bushel than did a full feed of shelled corn, when used in a ration which also included a protein supplement, corn silage, and legume hay. When corn-and-cob meal surpasses shelled corn under these conditions, it must be for one or more of the following reasons:

1. It is possible that the presence of the bulky ground cob in the corn-and-cob meal *makes the ground corn more completely digestible* than it would be if the ground cob were not mixed with it. To determine this, 5 calves were fed the usual full-fed corn-and-cob meal ration, except that the ground corn was fed by itself and the ground cob was fed mixed with the silage. The 5 calves made slightly larger gains per head than a lot of 10 similar calves fed corn-and-cob meal, thus apparently eliminating this possible advantage of corn-and-cob meal from further consideration.

2. The kernels of corn in corn-and-cob meal are in a cracked or ground condition, and it is a well known fact that cattle *digest ground grain somewhat more completely than whole grain.* In one trial, calves fed ground shelled corn and ground oats made more rapid gains than calves fed the whole grain, but they did not show as much profit after charging them with the cost of grinding the grain. This agrees with the majority of similar trials with fattening cattle at other stations. Further consideration of this second possible advantage of corn-and-cob meal may, therefore, be eliminated.

3. *Corn cobs probably have some feeding value.* One of our trials indicated that ground corn cobs have more feeding value than ground wheat straw. Ground corn cobs probably have a nutritive value no greater than oat straw, pound for pound, but they are less bulky than oat straw. If a bushel of ear corn can be shelled at a cost of 2 cents or ground at a cost of 6 cents, the grinding costs 4 cents more than shelling but produces 14 pounds of ground cobs which the cattle are compelled to eat. At this rate a ton of ground cobs may be said to cost $5.72, and the grinding of the four tons of kernels which were on the cobs would cost nothing. The feeding of corn cobs to fattening calves may be profitable under certain conditions, especially when feeds are high in price.

4. Still another reason why a full feed of corn-and-cob meal fed to baby beeves gives a larger profit than a full feed of shelled corn may be the following: Corn-and-cob meal is approximately twice as

bulky as the same weight of shelled corn, and cattle given a full feed of the meal do not consume as many bushels of corn as do those full fed on shelled corn. Probably some of the advantage of corn-and-cob meal over shelled corn, when both are full fed, is due to the fact that *the cob limits the consumption of corn*, thereby cheapening the daily feed cost and the cost per pound of gain. In two trials, the shelled-corn calves consumed an average of 113.5 bushels of corn for every 100 bushels consumed by the meal-fed calves.

What would happen if two lots of calves were fed exactly the same number of bushels of corn, one lot receiving shelled corn and the other lot corn-and-cob meal? With this question in mind, the trial reported in the following pages was carried out.

SHELLED CORN vs. CORN-AND-COB MEAL, FED BUSHEL FOR BUSHEL

This trial was planned to answer the following question: If two lots of beef calves are to be fed the same number of bushels of ear corn daily in a ration that includes silage, shall we grind the ear corn and feed it as corn-and-cob meal, or shall we shell the ear corn, throw the cobs away, and feed the shelled corn only?

Four lots of purebred and grade Hereford steer calves, 10 calves per lot (Figs. 26, 27, 28, and 29), were fed as follows: Each lot was fed twice daily all of the corn silage and alfalfa hay the calves would clean up, in addition to the following concentrates, which were also fed twice daily:

Lot 1—Corn-and-cob meal, full fed. Linseed meal 2 pounds per head daily.

Lot 2—85 per cent of the corn-and-cob meal and linseed meal fed to Lot 1.

Lot 3—Shelled corn and linseed meal in amounts exactly equal to these feeds in the ration of Lot 1.

Lot 4—Shelled corn and linseed meal in amounts exactly equal to these feeds in the ration of Lot 2.

A bushel of ear corn weighs 70 pounds and contains, on the average, 56 pounds of shelled corn and 14 pounds of cobs. In other words, ear corn averages 80 per cent shelled corn and 20 per cent cobs. Therefore, the calves in Lots 3 and 4 were fed 80 pounds of shelled corn for every 100 pounds of corn-and-cob meal consumed by Lots 1 and 2.

The average of a number of shelling tests which were made from time to time during the trial indicated that the ear corn used in this trial contained approximately 80 per cent of grain and 20 per cent of cobs.

Lot 1 was the "pace-maker" in this trial. For every 100 pounds of corn-and-cob meal fed to Lot 1, Lot 2 received 85 pounds of corn-and-cob meal, Lot 3 received 80 pounds of shelled corn, and Lot 4 received 68 pounds of shelled corn.

Lots 1 and 3 received 2 pounds of linseed meal per head daily, and Lots 2 and 4 received 85 per cent as much, or 1.7 pounds of linseed meal per head daily.

All lots received as much corn silage and alfalfa hay as they would eat in addition to their concentrates.

The results are given in Table XVI.

TABLE XVI

SHELLED CORN VS. CORN-AND-COB MEAL, FED BUSHEL FOR BUSHEL
November 13, 1925 to June 18, 1926—217 days

Lot number	1	2	3	4
Grain	Corn-and-cob meal		Shelled corn	
Concentrate allowance	Full-fed	85%	Equal Lot 1	Equal Lot 2
Initial weight, lbs.	450.17	449.97	451.00	449.80
Final weight, lbs.	964.93	955.34	960.85	958.27
Average daily gain, lbs.	2.37	2.33	2.35	2.34
Average daily feed:				
Corn-and-cob meal, lbs.	15.18	12.90	.....	.....
Shelled corn, lbs.	.....	.....	12.14	10.33
Linseed meal, lbs.	2.00	1.70	2.00	1.70
Corn silage, lbs.	4.49	8.32	7.57	15.06
Alfalfa hay, lbs.	1.37	1.79	1.61	2.21
Cost of feeds, 100 lbs. gain*	$8.86	$8.29	$8.98	$8.74
Initial cost per cwt.	$8.00	$8.00	$8.00	$8.00
Initial cost per head	36.01	36.00	36.08	35.98
Total cost of feeds	45.61	41.91	45.77	44.45
Final cost per head	81.62	77.91	01.85	80.43
Selling price, South St. Paul	$9.95	$9.90	$10.00	$9.75
Selling price, University Farm	9.45	9.40	9.50	9.25
Value per head, University Farm	91.19	89.80	91.28	88.64
Pork credit per calf, lbs.	13.56	13.43	36.60	60.02
Pork credit, at $11 per cwt.	1.49	1.48	4.03	6.60
Margin per calf over feed cost:				
Omitting pork	$9.57	$11.89	$9.43	$8.21
Including pork	11.06	13.37	13.46	14.81
Return per bushel ear corn	$0.84	$0.93	$0.89	$0.97

* Feed prices charged: Ear corn 60 cents per bushel, shelled corn 62 cents, lineed meal $48 per ton, corn silage $4.50, alfalfa hay $14.25. Cost of grinding ear corn, 8 cents per hundredweight.

Comparison of the results in Lots 1 and 3 shows that when shelled corn was fed in an amount exactly equal to the corn contained in a full feed of corn-and-cob meal, the shelled corn produced about 5 pounds *less* beef and 23 pounds *more* pork per calf. The cost of feed was practically the same in the two lots. The shelled corn lot made the greater profit, owing, chiefly, to the larger pork credit.

The largest item in the feed bill for each of these lots was the charge for corn. If the profits in feeding these calves are applied to the corn which they consumed, Lot 1 returned 84 cents per bushel of ear corn, while Lot 3 returned 89 cents, or 5 cents per bushel more. Both lots also returned $48 per ton for linseed meal, $4.50 for silage, and $14.25 for alfalfa hay. Lot 1 also paid 8 cents per hundredweight for grinding ear corn, and Lot 3 paid 2 cents per bushel for shelling.

Comparison of Lots 2 and 4 shows that shelled corn again excelled corn-and-cob meal, fed bushel against bushel. In this instance the feeding of shelled corn produced about 3 pounds more beef and 47 pounds more pork per calf than did the feeding of corn-and-cob meal. However, the shelled-corn calves ate much more silage and somewhat more hay, so that their feed bill was larger than that of the meal-fed calves. Furthermore, the shelled-corn calves were valued slightly lower. But in spite of these handicaps they surpassed the meal-fed calves in profit, because of the much greater production of pork from waste in the shelled corn lot.

The deciding factor in this trial and the one which enabled shelled corn to surpass corn-and-cob meal in profit, was the larger pork credits in the two lots in which the calves were fed shelled corn. If the hog gains had been reduced in value from $11 to $8 per hundredweight, the shelled corn lots still would have surpassed the corn-and-cob meal lots in profit.

If the hogs following cattle are not properly managed, shelled corn may not produce as much profit as corn-and-cob meal. Thrifty shoats weighing around 100 pounds are best for following cattle, and they should be given enough additional feed to make rapid gains. Slow gains by fattening hogs mean less efficient use of feed, higher cost per pound of pork, and a smaller pork credit per calf. In feeding hogs as in feeding cattle, rapid gains are necessary for greatest economy and profit. During a seven months' feeding period at least two lots of shoats should be finished, one following the other.

SHALL SHELLED CORN BE FULL FED OR LIMITED TO SOME DEGREE IN A RATION WITH SILAGE?

As shown in Table XVI, baby beeves (Lot 4) limited to a daily average of 10.33 pounds of shelled corn and 1.7 pounds of linseed meal per head, and given daily all the corn silage (15.06 pounds) and alfalfa hay (2.21 pounds) they would eat, made very satisfactory gains and returned more profit than another lot (Lot 3) which was fed daily an average of 12.14 pounds of shelled corn and 2 pounds of linseed meal, plus corn silage and alfalfa hay.

In two previous trials (Table XV), beef calves given a *full feed* of shelled corn consumed an average of 13.27 pounds of shelled corn per head daily, in a ration which included 1.87 pounds of linseed meal per head daily and all the corn silage and alfalfa hay the calves would eat.

On the basis of the foregoing figures, it appears that Lot 4, in Table XVI, received about 78 per cent of a full feed of shelled corn, and Lot 3 received about 91 per cent. The 78 per cent allowance gave a larger profit than the 91 per cent allowance. Both the 78 and 91 per cent allowances resulted in larger margins of profit than was obtained in Lot 1, that was given a full feed of corn-and-cob meal. In two previous trials (Table XV) a full feed of corn-and-cob meal surpassed a full feed of shelled corn in profit.

The foregoing facts seem to justify the statement that where silage is fed it will ordinarily be most profitable to limit the allowance of shelled corn to about 78 per cent of a full feed. This allowance amounts to about 1.6 pounds of shelled corn daily per 100 pounds live weight.

The following conclusions may be drawn (Tables XIII, XIV, and XVI) for those who desire to fatten beef calves on a ration of corn, linseed meal, corn silage, and a legume hay, and with feed prices such as prevailed in Minnesota in the course of these trials:

1. Baby beeves can be fattened most profitably by limiting the allowance of concentrates somewhat below a full feed.

2. A full feed of corn-and-cob meal surpassed a full feed of shelled corn because the cob limited the consumption of grain.

3. A full feed of corn-and-cob meal still provided too generous an allowance of grain for best results. Eighty-five per cent of a full feed of corn-and-cob meal proved more profitable.

4. With pigs following the cattle and with these pigs so managed as to obtain rapid hog gains, best results of all were obtained by feeding baby beeves (Fig. 29) shelled corn limited to about 1.6 pounds daily per 100 pounds live weight. No doubt this allowance should be varied in accordance with the amount of grain present in the silage. The silage used in the trials contained almost no grain. We believe that compensation may be made for varying amounts of grain in the silage by feeding as follows: At feeding time, first feed a generous allowance of shelled corn yet limited in amount just enough so that, when the grain is fed, *all the calves will come up to the feed bunk immediately and remain there until all the grain is eaten.* Feed with the corn 1.7 pounds of linseed meal per head daily. After the concentrates are eaten, feed all the corn silage and alfalfa hay the calves will clean up.

EFFECTS OF VERY LIMITED GRAIN FEEDING DURING FIRST HALF OF FEEDING PERIOD

If baby beeves are to be fattened during a period of seven months, is it advisable to carry them almost entirely on corn silage and legume hay for the first half of the period, followed by a full feed of grain for the second half of the period? In other words, is it not possible and practicable first to grow the calf on cheap roughages during the winter, and then to fatten him on heavy grain feeding in dry lot during the spring?

Two similar lots, each containing 10 purebred Shorthorn steer calves, were used in this trial. Both lots were fed the same feeds, but one lot received a heavy feed of grain throughout the feeding period of 217 days, whereas the other lot was fed only 2 pounds of grain per head per day during the first 112 days, followed by heavy grain feeding for the remaining 105 days of the trial. (See Figs. 10 and 11.)

During the first 168 days, the grain mixture fed to both lots was composed of ground shelled corn 60 per cent, ground oats 30 per cent, and linseed meal 10 per cent. During the remaining 49 days, the mixture fed to both lots was changed to ground shelled corn 75 per cent, ground oats 15 per cent, and linseed meal 10 per cent. Each lot was fed as much corn silage and clover hay as it would eat. The results are given in Table XVII.

TABLE XVII

EFFECTS OF VERY LIMITED GRAIN FEEDING DURING FIRST HALF OF FEEDING PERIOD
November 21, 1922 to June 26, 1923—217 days

	Heavy grain feeding throughout	Heavy grain feeding last 105 days only
Initial weight, lbs.	485.30	484.70
Final weight, lbs.	986.02	883.10
Average daily gain, lbs.	2.31	1.84
Average daily feed:		
Ground corn, lbs.	9.97	6.39
Ground oats, lbs.	3.95	2.16
Linseed meal, lbs.	1.55	0.95
Corn silage, lbs.	12.29	17.65
Clover hay, lbs.	2.17	2.83
Cost of feeds, 100 lbs. gain*	$10.20	$9.52
Initial cost per cwt.	$7.17	$7.17
Initial cost per head	34.80	34.75
Total cost of feeds	51.07	37.94
Final cost per head	85.87	72.69
Selling price, South St. Paul	$10.50	$9.15
Selling price, University Farm	10.00	8.65
Value per head, University Farm	98.60	76.39
Pork credit per calf, lbs.	51.48	31.63
Pork credit, at $6.30 per cwt.	3.24	1.99
Margin per calf over feed cost	$15.97	$5.69

* Feed prices charged: Shelled corn 59 cents per bushel, oats 34 cents, linseed meal $49 per ton, corn silage $4.25, clover hay $12.11. Cost of grinding grain, 8 cents per hundredweight.

Limiting the allowance of concentrates to only 2 pounds per head per day during the first half of the 217-day feeding period, lowered the feed cost to a marked degree and resulted in cheaper gains, but the calves gained at a comparatively slow rate. Their gains were large enough to provide for growth, but were not large enough to provide a good marketable finish in addition to growth. They sold at a much lower price than the calves which had been heavily fed on concentrates throughout the 217 days. Their pork credit was also less than that of the heavily fed lot. They realized only a little more than one-third as much profit.

HOW LONG A FEEDING PERIOD IS REQUIRED FOR BEST RESULTS?

As a rule it is most profitable to feed baby beeves until they are well finished before marketing them. This requires generous grain feeding and the use of a well balanced ration during a fattening period of at least seven months. The long feeding period results in a higher finish and a greater margin between cost price and selling price per pound, and brings the calves on the market in June or July, at which time the prices paid for baby beeves are usually higher than for beeves of the same kind and quality marketed in April or May.

In all of these baby beef feeding trials the calves were valued by a committee of commission men and packer buyers from the South St. Paul market. In four of the trials the calves were valued at the end of 140 or 168 days on feed, and also at the end of the trial after they had completed a period of 210 days or more. The amount of profit which would have resulted from selling the calves at various stages during the trials was then determined.

Tables XVIII and XIX show that in the majority of instances there was a marked advantage in feeding the calves for more than 200 days before marketing them.

TABLE XVIII

VALUATIONS AT VARIOUS STAGES IN FATTENING BABY BEEVES

	Sex	Initial weight	Type of ration*	Selling price, University Farm		
First trial—November 21, 1922 to June 26, 1923—217 days						
				140 days	168 days	217 days
Lot 1.....	Steers	484	AA	$8.00	$8.50	$10.00
Lot 2.....	"	485	AA	8.25	8.50	10.00
Lot 3.....	"	485	aa	6.35	7.25	8.65
Lot 4.....	"	486	AA	7.75	8.25	9.50
Lot 5.....	"	497	B	8.00	8.50	9.50
Lot 6.....	"	498	C	7.50	8.00	9.50
Second trial—November 2, 1923 to June 13, 1924—224 days						
					168 days	224 days
Lot 1.....	Steers	447	AA		$9.00	$9.40
Lot 2.....	"	445	AA		9.125	9.90
Lot 3.....	"	447	AA		9.00	9.60
Lot 4.....	"	447	AA		9.125	9.80
Lot 5.....	"	445	B		8.50	8.95
Lot 6.....	"	447	C		8.75	9.20
Third trial—November 21, 1924 to June 19, 1925—210 days						
					168 days	210 days
Lot 1.....	Steers	418	AA		$10.15	$10.70
Lot 2.....	"	420	AA		10.00	10.55
Lot 3.....	"	419	Aa		9.70	10.35
Lot 4.....	"	420	Aa		9.00	9.50
Lot 5.....	"	418	Aa		9.35	9.95
Fourth trial—November 13, 1925 to June 18, 1926—217 days						
				140 days	168 days	217 days
Lot 1.....	Steers	450	AA	$8.25	$8.80	$9.45
Lot 2.....	"	450	Aa	8.25	8.80	9.40
Lot 3.....	"	451	Aa	8.30	8.85	9.50
Lot 4.....	"	450	Aa	8.00	8.65	9.25
Lot 5.....	Steers and Heifers	449	Aa	8.25	8.85	9.45
Lot 6.....	Heifers	449	Aa	8.15	8.65	9.10

* Types of rations:

AA—Grain full fed, linseed meal, corn silage, legume hay.

Aa—Same as AA, except concentrates slightly or moderately limited.

aa—Same as AA, except concentrates limited to 2 pounds per head during first 112 days, then full fed.

B—Grain full fed, corn silage, legume hay.

C—Grain full fed, legume hay.

TABLE XIX

MARGINS OF PROFIT AT VARIOUS STAGES IN FATTENING BABY BEEVES

	Type of ration*	Margin per head over feed cost			Average margin per head per day		
First trial—November 21, 1922 to June 26, 1923—217 days							
		140 days	168 days	217 days	First 140 days	Next 28 days	Last 49 days
					cents	cents	cents
Lot 1.....	AA	$5.73	$7.50	$18.92	4.1	6.3	23.3
Lot 2.....	AA	7.09	5.72	15.97	5.1	—4.9	20.9
Lot 3.....	aa	—6.18	—1.56	5.69	—4.4	16.5	14.8
Lot 4.....	AA	1.41	5.81	18.30	1.0	15.7	25.5
Lot 5.....	B	4.59	6.38	13.61	3.3	6.4	14.8
Lot 6.....	C	—0.59	0.63	13.10	—0.4	4.4	25.4
Second trial—November 2, 1923 to June 13, 1924—224 days							
			168 days	224 days		First 168 days	Last 56 days
Lot 1.....	AA		$7.71	$9.86		4.6	3.8
Lot 2.....	AA		10.79	17.02		6.4	11.1
Lot 3.....	AA		8.73	13.36		5.2	8.3
Lot 4.....	AA		9.21	14.86		5.5	10.1
Lot 5.....	B		6.97	10.72		4.1	6.7
Lot 6.....	C		9.04	13.86		5.4	8.6
Third trial—November 21, 1924 to June 19, 1925—210 days							
			168 days	210 days		First 168 days	Last 42 days
Lot 1.....	AA		$5.03	$5.61		3.0	1.4
Lot 2.....	AA		5.43	5.57		3.2	0.3
Lot 3.....	Aa		5.43	7.49		3.2	4.9
Lot 4.....	Aa		0.42	0.67		0.3	0.6
Lot 5.....	Aa		1.30	2.52		0.8	2.9
Fourth trial—November 13, 1925 to June 18, 1926—217 days							
		140 days	168 days	217 days	First 140 days	Next 28 days	Last 49 days
Lot 1.....	AA	$2.23	$6.18	$11.06	1.6	14.1	10.0
Lot 2.....	Aa	4.49	7.86	13.37	3.2	12.0	11.2
Lot 3.....	Aa	4.48	7.64	13.46	3.2	11.3	11.9
Lot 4.....	Aa	3.81	8.98	14.81	2.7	18.5	11.9
Lot 5.....	Aa	2.71	6.73	11.48	1.9	14.4	9.7
Lot 6.....	Aa	2.80	5.98	9.16	2.0	11.4	6.5

* See footnote, Table XVIII.

If all of the 60 calves in the first trial are thrown together as one lot, the general averages show that each calf returned an average profit over feed cost amounting to 1.4 cents per day during the first 140 days, 7.4 cents per day during the next 28 days, and 20.8 cents per day during the remaining 49 days of the trial. These figures show the marked increase in profit which resulted from carrying the calves on feed for seven months. This was true for each of the six lots. The long feeding period was the most profitable because it gave the calves a thoroly good finish and brought them on the market in the latter part of June, 1923, at which time the market for fat cattle was higher than in April or May of the same year.

If the 60 calves in the second trial are thrown together as one lot, each calf returned an average profit over feed cost amounting to 5.2 cents per day during the first 168 days. During the remaining 56 days each calf returned an average profit of 8.1 cents per day. There was no rise in the price of fat cattle at South St. Paul between April 18 and June 13, 1924, so that the increased profit from the longer feeding period in this instance was due entirely to the higher finish resulting from the longer feed.

If the 50 calves in the third trial are thrown together as one lot, each calf returned an average profit over feed cost amounting to 2.1 cents per day during the first 168 days. During the remaining 42 days each calf returned an average profit of 2 cents per day. In this trial the only advantage in carrying the calves on feed beyond 168 days and to the end of 210 days was that it made possible the marketing of larger quantities of feeds with practically no decrease in profit per head per day. However, this was not true of Lots 1 and 2. These two lots should have been sold at the end of 168 days if the most profit per day or per bushel of grain was to be obtained. The other three lots were more profitably sold at the end of 210 days.

If all of the calves in the fourth trial are thrown together as one lot, each calf returned an average profit over feed cost amounting to 2.4 cents per day during the first 140 days, 13.6 cents per day during the next 28 days, and 10.2 cents per day during the remaining 49 days of the trials. Here, again, better results were obtained by carrying the calves on feed for 217 days than would have been realized by selling them at the end of 140 or 168 days.

If all of the 230 calves represented in Table XIX are thrown together as one lot, each calf returned an average profit over feed cost amounting to 3.6 cents per day during the first 168 days, and 10.9 cents per day during the remaining 42 to 56 days of the feeding period. The average length of the four feeding periods was 217 days.

The profit over feed cost for the 230 calves amounted to an average of 5.2 cents per head per day for the entire period.

Final gains made by fattening cattle are much more costly than first gains, but the final gains are usually the most profitable gains made at any time during the fattening period. This is true because the final gains raise the selling price per hundredweight, and thereby increase the value of all the grains and all the weight of the animal. Particularly in fattening cattle of good type and quality, it is ordinarily most profitable to give them a thoroly good finish before selling them.

SUMMARY

1. The cattle *feeder* may frequently purchase and feed the lower grades of feeder cattle to advantage.

2. The cattle *breeder* should always aim to produce animals of top quality. Such cattle cost little, if any, more to produce than scrubs, but sell at much higher prices.

3. Steer calves make larger and more economical daily gains than heifer calves, but the heifers fatten in less time.

4. When steer calves and heifer calves of the same breeding are purchased for feeding at the same price per hundredweight, the steers sell at higher prices when finished and return a larger profit.

5. There was little or no evidence that the feeding of mixed lots of steers and open heifers is less profitable than feeding the steers and heifers in separate lots.

6. The self-feeder may be used to advantage to feed the grain to fattening calves if a full feed of grain is to be fed.

7. Baby beeves may be fattened successfully and profitably on a ration of shelled corn and alfalfa or clover hay.

8. There was a slight advantage in the use of corn silage for fattening beef calves, provided the silage was a part of a well-balanced ration.

9. The addition of corn silage to a ration of grain and legume hay was unprofitable.

10. The addition of both corn silage and a protein supplement to a ration of grain and legume hay resulted in more rapid gains and a slight increase in profit.

11. Shelled corn proved much superior to ground barley as a feed for fattening beef calves.

12. Grinding shelled corn and oats for baby beeves did not prove profitable.

13. The addition of oats to a ration of shelled corn, linseed meal, corn silage, and alfalfa hay decreased the gain and lessened the profit.

14. Better results were obtained from feeding corn-and-cob meal than from feeding shelled corn and whole oats. The meal-fed calves gained more rapidly, the gains cost less per pound, and they returned a larger profit.

15. With silage and a legume hay in the ration, it proved profitable to limit the allowance of corn-and-cob meal to about 2 pounds daily per 100 pounds live weight (85 per cent of a full feed), and to limit the linseed meal to 1.7 pounds per head daily.

16. A full feed of corn-and-cob meal surpassed in profit a full feed of shelled corn because the cob limited the consumption of corn and thereby lowered the cost of production.

17. When shelled corn was fed in competition with a full feed of corn-and-cob meal, bushel for bushel, in a ration which included silage, the calves fed shelled corn were fattened as cheaply as the meal-fed calves. The shelled-corn calves returned the larger profit, owing to a larger pork credit.

18. When shelled corn was fed, bushel for bushel, in competition with 85 per cent of a full feed of corn-and-cob meal, the shelled-corn calves again surpassed the meal-fed calves in profit.

19. The best results from the standpoint of economy and profit were obtained by fattening baby beeves on shelled corn limited to about 1.6 pounds daily per 100 pounds live weight. This provided a generous allowance of shelled corn, but was at the same time restricted just enough so that, when the corn was fed, all the calves came up to the feed bunk immediately and remained there until all the grain was eaten. These calves were also fed 1.7 pounds of linseed meal per head daily and all the corn silage and alfalfa hay they would clean up.

20. Limiting the allowance of concentrates to only 2 pounds per head per day during the first half of the feeding period proved much less profitable than full-feeding the grain throughout.

21. It is ordinarily most profitable to give baby beeves a thoroly good finish before marketing them. In most instances a feeding period of 210 days or more returned a larger profit per day than a feeding period of 140 or 168 days. Out of a total of 23 lots of baby beeves fed during four consecutive years, 20 lots returned a larger profit daily for the full period of 210 days or more than could have been realized by selling them at the end of 140 or 168 days.

APPENDIX

Analyses of Feeds Used in Trials

TABLE XX

ANALYSES OF FEEDS USED IN 1921-22 TRIAL

Feed	Moisture	Moisture-free basis				
		Ash	Crude protein	Fiber	N-free extract	Fat
	per cent	per cent	per cent	per cent	per cent	per cent
Shelled corn	14.21	1.20	10.85	1.47	81.34	5.14
Barley	10.18	2.62	15.34	5.46	73.83	2.75
Ground oats	8.45	3.53	14.17	11.83	65.19	5.28
Corn silage	78.63	5.24	6.41	26.48	58.64	3.23

TABLE XXI

ANALYSES OF FEEDS USED IN 1922-23 TRIAL

Feed	Moisture	Moisture-free basis				
		Ash	Crude protein	Fiber	N-free extract	Fat
	per cent	per cent	per cent	per cent	per cent	per cent
Shelled corn	15.06	1.66	11.32	1.75	80.39	4.88
Ground corn	15.15	1.63	11.36	1.79	80.46	4.76
Corn-and-cob meal	14.57	1.77	10.90	6.21	77.02	4.10
Oats	11.26	4.18	13.26	11.98	65.37	5.21
Ground oats	11.25	4.17	13.22	12.11	65.40	5.10
Corn silage	78.97	5.10	6.87	26.33	58.62	3.08
Clover hay	15.73	6.16	11.60	29.22	48.97	4.05

TABLE XXII

ANALYSIS OF FEEDS USED IN 1923-24 TRIAL

Feed	Moisture	Moisture-free basis				
		Ash	Crude protein	Fiber	N-free extract	Fat
	per cent	per cent	per cent	per cent	per cent	per cent
Shelled corn	13.08	1.57	11.03	2.62	80.27	4.51
Corn-and-cob meal	17.41	2.31	10.79	6.89	75.78	4.24
Oats	10.36	4.45	15.82	10.71	63.78	5.25
Linseed meal	9.42	5.78	36.86	9.64	43.47	4.26
Corn silage	82.00	7.37	8.43	25.66	55.53	3.01
Alfalfa hay	14.71	8.65	13.82	27.89	47.24	2.40

TABLE XXIII

ANALYSES OF FEEDS USED IN 1924-25 TRIAL

Feed	Moisture	Moisture-free basis				
		Ash	Crude protein	Fiber	N-free extract	Fat
	per cent	per cent	per cent	per cent	per cent	per cent
Shelled corn	13.36	1.67	11.18	2.38	80.25	4.52
Corn-and-cob meal	12.14	2.08	10.18	6.91	77.30	3.53
Linseed meal	9.93	5.53	37.92	9.72	40.09	6.74
Corn silage	78.10	8.56	7.80	24.95	55.66	3.03
Alfalfa hay	7.62	7.89	12.70	34.27	42.66	2.48

TABLE XXIV

ANALYSES OF FEEDS USED IN 1925-26 TRIAL

Feed	Moisture	Moisture-free basis				
		Ash	Crude protein	Fiber	N-free extract	Fat
	per cent	per cent	per cent	per cent	per cent	per cent
Shelled corn	14.11	1.60	12.03	2.36	79.38	4.63
Corn-and-cob meal	14.13	1.83	10.80	7.65	76.04	3.68
Linseed meal	10.33	5.56	39.11	9.49	41.36	4.48
Corn silage	80.48	6.77	8.23	26.53	55.46	3.02
Alfalfa hay	7.69	7.32	15.84	34.51	40.19	2.14