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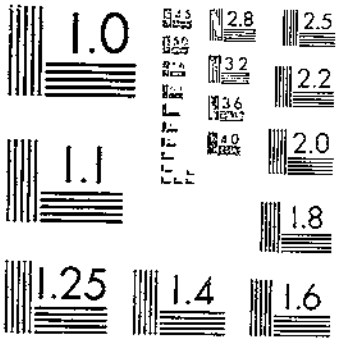

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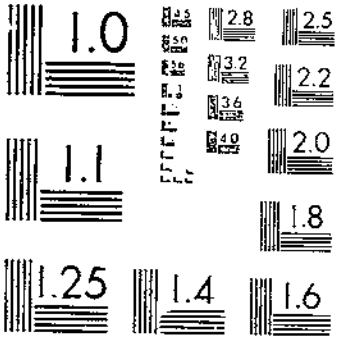

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COMPARISON OF GRAIN RATIONS FOR BEEF CALVES BEFORE AND AFTER WEANING

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CONTENTS

RECENT TREND IN BEEF PRODUCTION

The American beef market in recent years has shown an increasing demand for lighter cuts of meat. In an attempt to meet this changing demand in a practical way, producers have striven to make cattle fat enough for slaughter at comparatively early ages. The more economical use of grain by younger cattle has been a contributing factor in the growth of this practice, though the ability of older cattle to make more extensive use of roughage has offset this advantage to some extent. However, when calves to be fattened are raised instead of purchased, the breeding herd of beef cows utilizes to advantage the roughage that the calves do not consume. Consequently, the maintenance of a breeding herd and the fattening of older cattle on many farms.

To meet the demand for smaller cuts of beef and to produce beef more economically, it has been found practical under certain conditions to give well-bred beef calves a full feed of grain while they are suckling and have them fat enough for slaughter at weaning time or a few months thereafter. Three years of cooperative work by the United States Department of Agriculture and the University of Missouri at Sni-a-Bar Farms, Grain Valley, Mo.,[2] showed that grain-fed calves weighed about 100 pounds more at weaning time than simi-

[1] Acknowledgment is made to A. T. Semple, associate animal husbandman, Bureau of Animal Industry, U.S. Department of Agriculture, for valuable assistance in the preparation of this bulletin, and to E. M. Jones and M. W. Hazen, junior animal husbandmen, joint employees of the Bureau of Animal Industry and the University of Missouri. Mr. Jones was in immediate charge of these experiments from their beginning to May 1, 1930, and Mr. Hazen from that time until their completion.

[2] BLACK, W. H., and TROWBRIDGE, E. A. BEEF FROM CALVES FED GRAIN BEFORE AND AFTER WEANING. U.S. Dept. Agr. Tech. Bul. 268, 24 p., illus., 1930.

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lar calves fed no grain and were usually fat enough for slaughter when weaned at 8 months of age. When such calves were not marketed at weaning time, the practice of feeding grain shortened the subsequent feeding period. The most suitable grain ration for such feeding became a problem of importance.

OBJECT OF EXPERIMENTS

The object of the experiments reported in this bulletin was to compare the following three grain rations for feeding calves from the time they were old enough to eat grain until weaning time and for fattening them in dry lot: (1) Shelled corn, (2) shelled corn (8 parts) and cottonseed cake (1 part), and (3) shelled corn (2 parts) and oats (1 part). The mixtures were made by weight. Alfalfa hay and corn silage were used for roughage.

CATTLE USED

Steer calves were used in all the experiments and heifer calves also were used in the experiment with cottonseed cake and corn. These investigations were carried on at Sni-a-Bar Farms, Grain Valley, Mo. All the calves were grade Shorthorns sired by excellent purebred Shorthorn bulls. The dams of all these calves showed a predominance of Shorthorn breeding. They were descendants of red cows, with evidence of Shorthorn blood, which had been shipped from nearby States to the Kansas City stockyards and purchased there in 1913 as foundation cows for the breeding demonstration work at Sni-a-Bar Farms.[3] The original cows were of "medium to good" grade, of average size for cows of the West Central States, and gave plenty of milk for their calves. The daughters, granddaughters, and great-granddaughters of these original red cows were sired by purebred Shorthorn bulls of good individuality.

The average weights of the dams of the calves used in the experiments were somewhat greater than those of the foundation cows or of the average cows of the section of the country in which the experiments were conducted. The dams produced milk in such quantities that it was necessary occasionally to milk some of them when the calves were young. Heifers were bred so that they would calve at about 30 months of age. Every calf raised on the farm is marked with a serially numbered ear tag, which is the key to its breeding.

EXPERIMENTAL PROCEDURE

METHODS OF FEEDING AND HANDLING CATTLE

The dams of the calves used in the experiments were wintered each year on bluegrass pasture and such quantities of hay, silage, and other feed as were necessary to keep them thrifty but not fat. Cows which calved during the winter were given a little grain after calving when it was needed. Open sheds or timber furnished shelter. Each summer the cows and calves were kept on good pasture, the cows receiving no grain. Ample shade, good water, and salt were available at all times.

In each of the 3 years the steer calves were divided, according to age, weight, and grade, into three lots having practically the same

[3] BURCH, D. S., SHEETS, E. W., WATERS, H. J., and TROWBRIDGE, E. A. GRADING UP BEEF CATTLE AT SNI-A-BAR FARMS. U.S. Dept. Agr. Misc. Circ. 74, 28 p., illus. 1926.

number of calves. Each of these lots received the grain ration both before and after weaning. The heifer calves were fed cottonseed cake and corn before weaning in the 1929 and 1930 experiments and after weaning in the 1929 experiment.

The calves were kept with their dams on pasture during the suckling period. A small corral, usually known as a "creep", so constructed that the calves, but not the cows, could enter was conveniently located in each pasture. All grain was placed in the troughs within the creeps, where the calves entered and ate, unmolested by their dams. Grain was fed daily in such quantities that a little feed always remained. The troughs were observed twice daily and were kept sweet and clean.

At the beginning the calves were driven into, and in some cases confined within, the creeps for a short period during each day. This practice was discontinued as soon as they learned to enter the creeps of their own accord. At the end of the suckling period the calves were weaned and individual weights of cows and calves were obtained.

At the time of weaning, the calves were placed in dry lots and full fed the same grain ration they had received on pasture. They were also given an allowance of alfalfa hay and corn silage. Grain was fed twice daily in such quantities as to be cleaned up in from 30 to 40 minutes, after which hay was fed. The silage was fed before the grain. All feeds were weighed at feeding time and salt and water were constantly available. Each group of calves had 20 by 36 feet of space in a shed open to the south and 36 by 40 feet of lot space. All feed was given in troughs under the shed. The lots were surfaced with crushed rock so that they did not become very muddy during wet weather. Enough bedding was used to provide the cattle a dry place to lie down.

FEEDS USED

The corn was of uniform quality and of no. 2 yellow grade. The oats were of fair to good weight and quality. The cottonseed cake contained 43 percent protein. The cake ranged in size from that of a pea to about three fourths inch in diameter, the greater portion being of pea size.

The alfalfa hay was locally grown and of fair quality. It was of good color and contained from 10 to 25 percent of fine grasses, principally bluegrass. The silage was from corn grown on the farm. It was estimated that this corn would yield about 50 bushels of grain per acre, and it was harvested when well matured. The pastures consisted chiefly of bluegrass with some white clover, orchard grass, and alsike clover. The prices for feed used for the 3 years of the experiments are shown in table 1.

TABLE 1.—*Prices for feeds used in each of the 3 years of the experiments*

Feed	1928	1929	1930
Corn, per bushel	$0.85	$0.84	$0.60
Oats, do	.50	.40	.35
Cottonseed cake, per ton	55.00	50.00	36.00
Corn silage, do	6.50	6.50	5.00
Alfalfa hay, do	20.00	20.00	18.00

WEIGHTS AND APPRAISALS

Records were kept of the weights of the cattle and quantities of feed consumed. During the suckling period of 140 days, the quantity of feed remaining in the creeps was deducted from the total quantity fed. The average initial and final weights of the animals, as recorded, consisted of an average of the weights taken in the morning after the calves had finished eating, on 3 consecutive days. The calves were weighed individually at 28-day intervals.

In case a calf died, its record was eliminated, so far as possible, by deducting quantity of feed in proportion to its live weight for the time it was in the experiment.

All lots were appraised at weaning time and at the close of the feeding period. Commission merchants from the Kansas City stockyards valued them on the basis of what they would bring on that market.

DISCUSSION OF RESULTS

INITIAL WEIGHTS AND GAINS OF DAMS

Table 2 shows the average initial weight of the dams of the calves used in each experiment, together with the gains or losses in weight of the dams during the suckling period. Lot 1 consisted of the steer calves receiving only corn as the grain ration; lots 2S and 2H, the steer and heifer calves, respectively, receiving corn and cottonseed cake; and lot 3, the steer calves receiving corn and oats. Since the steer calves were divided on the basis of age, weight, and grades, variation in the weights of their dams was unavoidable.

TABLE 2.—*Average initial weights and gains or losses of dams during suckling periods for the three lots of calves*

Lot no.	Year	Dams	Average initial weight	Average gain (+) or loss (−)
		Number	*Pounds*	*Pounds*
1	1928	9	1,054	+37
	1929	11	978	−33
	1930	12	967	+206
	Average		995	+77
2S	1928	10	1,021	+32
	1929	11	1,028	+10
	1930	12	910	+93
	Average		983	+47
2H	1928	[1]8	931	+45
	1929	8	1,060	+70
	1930	8	995	+57
	Average		995	+57
3	1928	9	1,100	+31
	1929	12	977	−28
	1930	12	967	+32
	Average		1,007	+10

[1] Two of these dams were removed from the experiment because of sickness 2 weeks before the close of the nursing period. Data are given for the 6 dams used during the entire experiment.

COMPARISON OF THREE RATIONS FOR SUCKLING CALVES

INITIAL AND FINAL WEIGHTS AND TOTAL GAINS

Steer calves averaging from 2 to 3 months of age were divided into three lots, on June 27, 1928, June 25, 1929, and June 24, 1930, respectively, for the three experiments. The animals averaged practically 3 months of age at the beginning of the experiment in 1928. The next 2 years they were about 10 days younger and correspondingly lighter in weight. The heifer calves averaged 18 days older but weighed less than the steers at the beginning of each experiment. The fact that the heifer calves were smaller for their age was probably due to a larger proportion of their dams being heifers. The average initial and final weights, total gains, and final appraised value, per hundredweight, of the calves for the three suckling periods are given in table 3. The 3-year averages show that the steer calves getting corn and cottonseed cake (lot 2S) gained 21 pounds more in 140 days than those getting corn (lot 1), and these in turn gained 3 pounds more than those getting corn and oats (lot 3). The steer calves in lot 2 gained 10 pounds more than the heifer calves receiving the same grain mixture.

TABLE 3.—*Average initial and final weights, total gains, and appraised values of the calves during suckling periods of each experiment*

Lot no.	Period	Calves	Average age at beginning of period	Average weight		Average total gain	Average appraised final value per hundredweight
				Initial	Final		
		Number	*Days*	*Pounds*	*Pounds*	*Pounds*	*Dollars*
1	June 27–Nov. 14, 1928	[1] 10	93	251	520	269	12.00
	June 25–Nov. 12, 1929	[2] 13	72	208	468	260	11.90
	June 24–Nov. 11, 1930	12	76	213	521	308	12.00
	Average		79	222	501	280	11.63
2S	June 27–Nov. 14, 1928	10	87	247	545	298	12.75
	June 25–Nov. 12, 1929	12	79	207	511	304	12.50
	June 24–Nov. 11, 1930	12	78	212	513	301	11.00
	Average		81	221	522	301	12.08
2H	June 27–Nov. 14, 1928						
	June 25–Nov. 12, 1929	8	97	191	483	292	12.50
	June 24–Nov. 11, 1930	8	97	216	506	290	11.00
	Average		97	203	494	291	11.75
3	June 27–Nov. 14, 1928	[1] 10	87	248	545	297	12.50
	June 25–Nov. 12, 1929	13	79	208	466	258	11.75
	June 24–Nov. 11, 1930	12	79	211	493	282	10.50
	Average		81	220	496	277	11.63

[1] 1 of these calves died; its record is not included.
[2] 1 of these calves was removed from the experiment on account of being badly crippled; its record is not included.

COMPARATIVE VALUES OF CALVES

The appraised selling price may be considered as an expression of the packers' opinion as to finish, dressing percentage, and quality of cattle. Consequently, this price was used as a means of evaluating the merits of the finished product.

The appraised values per hundredweight at the end of the suckling period are given in table 3. The steer calves fed corn and cottonseed cake (lot 2S) had an average appraised value of $12.08 per hundredweight, the highest of any lot. The heifers (lot 2H) fed the same ration as lot 2S were valued at the same price as the steers for each of the two experiments in which they were included. As prices were generally higher for all lots during the 1928 experiment, the 2-year average for heifers is somewhat less than the 3-year average for the corresponding lot of steers. The total gains of these two lots exceeded those of the others, a fact which, together with the increased value, indicates a somewhat higher degree of finish due to the seemingly greater palatability of the corn-and-cottonseed-cake ration. The appraised value of the steer calves fed corn and oats (lot 3) was the lowest of all the groups but only slightly lower than that of lot 1 fed shelled corn.

GRAIN RATIONS AND DAILY GAINS

The average grain rations and daily gains of the calves during each 28-day period before they were weaned are given in table 4.

TABLE 4.—*Average grain rations consumed and daily gains per head, in pounds, during each 28-day period before the calves were weaned*

Beginning of experiment	Period no.	Average daily grain ration and gains per head							
		Lot 1		Lot 2S		Lot 2H		Lot 3	
		Ration	Gain	Ration	Gain	Ration	Gain	Ration	Gain
1928	1	0.1	1.6	0.3	1.7	.....	.....	0.3	1.8
	2	1.3	3.0	1.9	2.5	.....	.....	2.2	2.4
	3	4.7	1.8	4.4	2.1	.....	.....	5.8	2.0
	4	5.7	1.3	6.2	2.0	.....	.....	8.1	2.2
	5	7.2	2.0	7.2	2.3	.....	.....	8.2	2.2
Average	.....	3.8	1.9	4.0	2.1	.....	.....	4.9	2.1
1929	1	1.2	1.9	1.3	2.2	2.3	2.0	.6	1.5
	2	3.2	1.7	3.2	1.9	4.5	1.0	2.9	1.8
	3	4.7	1.9	4.9	2.5	6.8	2.8	5.4	2.4
	4	6.7	2.4	7.8	2.0	7.8	2.2	7.9	1.5
	5	7.9	1.5	8.4	2.2	8.0	1.8	8.9	1.7
Average	.....	4.7	1.9	5.1	2.2	5.9	2.1	5.1	1.8
1930	1	.1	1.8	1.1	1.7	1.9	2.0	1.9	1.6
	2	.7	2.0	3.0	1.5	4.0	1.9	3.8	2.6
	3	2.6	2.1	4.9	2.3	5.8	1.6	5.2	1.6
	4	3.1	2.2	3.8	2.7	5.4	2.5	5.0	1.6
	5	4.0	3.0	5.4	2.5	7.3	2.3	8.0	2.7
Average	.....	2.1	2.2	3.6	2.1	4.9	2.1	4.8	2.0
1928, 1929, and 1930	1	.5	1.8	.9	1.9	2.1	2.0	1.0	1.7
	2	1.8	2.2	2.8	1.9	4.2	1.7	3.0	2.2
	3	4.0	1.9	4.7	2.3	6.3	2.2	5.4	2.0
	4	5.1	2.0	5.9	2.3	6.1	2.3	6.9	1.7
	5	6.3	2.2	7.0	2.3	7.6	2.1	8.4	2.2
Average	.....	3.5	2.0	4.3	2.1	5.4	2.1	5.0	2.0

It was nearly a month after the experiment was begun in 1928 before all the calves were eating grain in the creeps. Even during the second month the calves of lot 1 did not eat so much as they should have because their creep was too far from shade. After they were moved to another pasture on August 15 they ate much better. In

lot 2S there was a marked tendency for the calves to eat the coarse cottonseed cake and leave the corn. The reverse was true when the cake had been pulverized to a meal. By supplying approximately one fifth of the supplement in the form of meal and the remainder as cake the consumption was more satisfactory.

During the first month of the 1929 experiment, all lots ate considerably more than they did in the same period of 1928. It is doubtful, however, whether such small quantities of feed as were eaten would materially affect the rate of gain.

In the 1930 experiment, the calves in lot 1 ate practically no grain during the first period of creep feeding, yet they gained slightly more than either of the other lots of steer calves. Even during the second period, the grain consumed by lot 1 was less than 1 pound per head daily. The consumption of grain by lot 1 continued low throughout the experiment and averaged only about half of that of the other two lots of steer calves.

During the experimental feeding, the heifer calves ate, on the average, about 25 percent more grain than the steer calves getting the same ration. The steer calves, however, made practically the same daily gains as the heifer calves.

The results obtained for the 3 years showed that all the calves were slow in learning to eat grain, especially corn. The palatability of the ration appears to have had an important effect on the rate of grain consumption. The calves fed shelled corn alone (lot 1) ate 0.5 pound daily in the first period. The steer calves fed shelled corn and cottonseed cake (lot 2S) and those fed shelled corn and oats (lot 3) ate about twice as much grain in this period as did lot 1. The heifers (lot 2H) consumed about four times as much grain as lot 1 during the first period.

Feed consumption also was apparently affected by the location of the creeps with respect to convenience of water, shade, and pasture. At the beginning of the 1929 experiment the feed consumption of lot 3 was below normal. By changes in the location of and the entrance to the creep, the calves entered it more readily and feed consumption increased to normal.

An increase in the daily consumption of grain in each successive period previous to weaning occurred in practically all cases. At weaning time the daily grain consumption of the steer calves was greatest with the lot getting shelled corn and oats, somewhat less when shelled corn and cottonseed cake were fed, and least when the grain ration was shelled corn alone. The heifers consumed more feed during the first three periods than did any of the steer lots but during the last two periods somewhat less than the steers getting corn and oats. The heifers, however, consumed 8 percent more feed than did the steer lot having the greatest feed consumption.

The total grain consumption of the calves fed shelled corn and oats was about 40 percent greater than that of the calves receiving shelled corn alone. The steer calves getting shelled corn and cottonseed cake ate about 20 percent more grain than those getting only shelled corn as their grain ration. When 1 part of cottonseed cake had been added to 8 parts of shelled corn, the calves in lot 2S and 2H not only consumed the additional feed in the form of cottonseed cake but ate approximately 7.5 and 25 percent, respectively, more shelled corn than the calves in lot 1 fed shelled corn alone. The calves of lot 3 consumed, on

the average, 32 pounds less of shelled corn than those in lot 1, getting shelled corn alone, but in its place ate 232 pounds of oats per head during the 140-day suckling period.

The daily gains made by all lots of calves were in general satisfactory. For the three experiments the calves made practically the same gains on the three rations. The average gains of the heifers for the two experiments were essentially the same as those of the steers for the three experiments. In no case were the differences in gains significant. The calves receiving both corn and cottonseed cake on the whole made more uniform gains than the others. The severe drought of the summer of 1930 reduced the carrying capacity of the pastures though usually the pastures were good, especially in the fall during the latter part of the feeding period.

GRAIN CONSUMPTION PER 100 POUNDS OF GAIN

Table 5 shows the quantities of grain consumed per 100 pounds of gain by 28-day periods. As the suckling period advanced the grain consumed per 100 pounds of gain increased in most instances. During the first two 28-day periods the calves in lot 1 produced 100 pounds of gain with considerably less grain than either of the other lots. The smaller grain requirement by lot 1 was due to the fact that the calves were slower in learning to enter the creeps regularly for feed than were those in any of the other lots. This was the case especially in the first and third experiments.

TABLE 5.—*Average quantities of grain consumed per 100 pounds of gain by 28-day periods for all experiments*

Period	Pounds of grain consumed per 100 pounds of gain			
	Lot 1	Lot 2S	Lot 2H	Lot 3
No. 1	27	50	108	58
No. 2	82	142	244	134
No. 3	210	205	237	272
No. 4	256	263	279	405
No. 5	290	298	360	385
Average [1]	177	199	247	251

[1] Based on the total quantity of feeds and total gain for entire period.

For the total suckling period the steer calves fed shelled corn and cottonseed cake (lot 2S) consumed the same quantity of corn per 100 pounds of gain as those getting shelled corn alone (lot 1) but ate in addition 22 pounds of cottonseed cake. The heifers (lot 2H) fed shelled corn and cottonseed cake were still less efficient, as they required 48 pounds more corn and 32 pounds more cottonseed cake than the steers (lot 2S) fed similarly. The steers fed shelled corn and oats (lot 3) required 10 pounds less corn than lot 1 but consumed in addition 84 pounds of oats per 100 pounds of gain.

COMPARISON OF THREE RATIONS FOR FATTENING CALVES IN DRY LOT AFTER WEANING

The calves which were fed grain from the beginning of each experiment until weaning were fat enough for slaughter at that time. However, they were full fed in dry lots for 196 days to compare the three grain rations which had been fed during the suckling period. The 196-day period was adopted in order that all the lots of calves might be in very acceptable market condition when sold for slaughter.

The numbers of calves in the various lots during the suckling period and during the subsequent fattening period do not necessarily coincide because some calves were removed at weaning time.

INITIAL AND FINAL WEIGHTS AND TOTAL GAINS

The average initial and final weights and total gains for each lot, each year, and for 3 years, are given in table 6.

TABLE 6.—*Average initial and final weights and total gains of the calves for the 3 dry-lot fattening periods of 196 days each*

Lot no.	Period	Calves	Average weight		Average total gain
			Initial	Final	
		Number	*Pounds*	*Pounds*	*Pounds*
1	Nov. 14, 1928–May 29, 1929	9	520	862	342
	Nov. 12, 1929–May 28, 1930	12	468	795	327
	Nov. 11, 1930–May 26, 1931	11	523	885	362
	Average		502	845	343
2S	Nov. 14, 1928–May 29, 1929	10	545	928	383
	Nov. 12, 1929–May 28, 1930	[1] 12	511	804	293
	Nov. 11, 1930–May 26, 1931	[2] 11	542	918	376
	Average		532	880	348
2H	Nov. 14, 1928–May 29, 1929				
	Nov. 12, 1929–May 28, 1930	8	483	769	286
	Nov. 11, 1930–May 26, 1931				
3	Nov. 14, 1928–May 29, 1929	9	545	898	353
	Nov. 12, 1929–May 28, 1930	[3] 13	469	791	322
	Nov. 11, 1930–May 26, 1931	11	496	862	366
	Average		500	846	346

[1] 1 of these calves died; its record is not included.
[2] 2 of these calves died; their records are not included.
[3] 1 of these calves was removed from the experiment on account of being badly crippled; its record is not included.

The calves in lot 2S, fed corn and cottonseed cake, were the heaviest calves at the close of the 196-day dry-lot fattening period, but their total gain was not significantly greater than that of lot 1, fed shelled corn, and lot 3, fed shelled corn and oats, the differences being respectively 1.46 and 0.58 percent. Even though the differences in gains for the various groups of steer calves in the dry lot were insignificant, the corn-and-cottonseed-cake ration was responsible for significantly greater gains for the entire experiment owing primarily to greater gains during the creep-feeding period.

In the one fattening experiment (1929–30) with the heifers (lot 2H) fed the same ration as lot 2S, their total gain was lower than that of any of the lots of steers during the three experiments. Their total gain for the 1929–30 experiment, however, compared favorably with that of the corresponding lot of steers.

GRAIN RATIONS AND DAILY GAINS

The average grain rations and daily gains for each 28-day period of the three experiments are given in table 7.

TABLE 7.—*Average grain rations and daily gains per head, in pounds, for each 28-day period during fattening in dry lot*

Beginning of experiment	Period no.	Lot 1			Lot 2S		
		Grain	Roughage [1]	Gain	Grain	Roughage [1]	Gain
1928	1	9.1	2.6	1.6	9.7	2.8	2.0
	2	10.6	[2] 3.3	1.9	11.1	[2] 3.6	1.9
	3	10.2	[2] 4.0	1.0	11.4	[2] 4.7	1.5
	4	10.1	[2] 4.4	2.3	11.9	[2] 4.5	2.6
	5	11.4	[2] 4.1	1.6	12.9	[2] 4.2	1.5
	6	12.8	3.4	1.5	14.5	3.5	2.0
	7	13.7	3.3	2.2	15.6	3.4	2.1
Average		11.1	3.6	1.7	12.4	3.8	1.9
1929	1	8.2	3.3	1.3	8.7	3.3	1.2
	2	8.3	3.4	1.3	9.2	3.5	1.7
	3	8.9	[2] 4.3	1.7	10.5	[2] 4.4	1.9
	4	10.5	[2] 4.4	1.9	10.8	[2] 4.4	1.6
	5	12.8	[2] 4.1	2.2	12.4	[2] 4.1	1.5
	6	14.0	2.9	2.1	13.3	2.9	2.1
	7	13.8	2.7	1.2	13.7	2.5	.6
Average		10.9	3.6	1.7	11.2	3.6	1.5
1930	1	8.9	1.9	1.5	9.6	2.0	1.9
	2	11.1	2.6	2.0	11.3	2.6	1.9
	3	12.2	2.5	2.1	12.2	2.5	2.2
	4	12.6	[2] 2.9	1.7	13.2	[2] 2.9	1.8
	5	13.4	[2] 3.3	3.0	13.4	[2] 3.3	1.9
	6	13.6	2.6	.9	15.3	2.8	2.1
	7	15.0	2.9	1.8	13.0	3.0	.8
Average		12.4	2.7	1.8	13.0	3.2	1.9
1928, 1929, and 1930	1	8.7	2.6	1.5	9.4	2.8	1.7
	2	9.9	3.1	1.7	10.6	3.3	1.2
	3	10.4	3.6	1.6	11.5	4.0	1.9
	4	11.1	3.9	1.9	12.1	4.0	1.9
	5	12.6	3.8	2.3	13.0	3.9	1.7
	6	13.5	2.9	1.5	14.4	3.1	2.1
	7	14.2	2.9	1.7	14.1	2.9	1.2
Average		11.5	3.3	1.7	12.2	3.4	1.8

See footnotes at end of table.

TABLE 7.—*Average grain rations and daily gain per head, in pounds, for each 28-day period during fattening in dry lot*—Continued

Beginning of experiment	Period no.	Lot 2H			Lot 3		
		Grain	Roughage [1]	Gain	Grain	Roughage [1]	Gain
1928	1				10.2	2.7	2.3
	2				11.9	[2] 3.4	1.3
	3				11.4	[3] 4.2	1.9
	4				11.1	[3] 4.4	2.2
	5				10.6	[4] 4.1	1.3
	6				12.9	3.3	1.3
	7				13.5	3.3	2.8
Average					11.7	3.6	1.8
1929	1	8.6	2.3	1.8	9.3	3.1	1.6
	2	9.2	3.3	1.1	9.8	3.3	1.3
	3	9.2	[3] 4.1	1.4	10.5	[3] 4.2	2.0
	4	8.9	[3] 4.2	1.1	11.0	[3] 4.2	1.7
	5	11.1	[3] 4.1	1.8	12.3	[3] 4.0	1.6
	6	11.6	2.9	1.8	13.3	2.7	2.2
	7	13.4	3.0	1.1	13.9	2.6	1.1
Average		10.3	3.4	1.5	11.4	3.4	1.6
1930	1				9.5	2.0	2.1
	2				11.3	2.6	1.9
	3				12.0	2.5	2.1
	4				12.7	[5] 2.9	1.6
	5				13.2	[3] 3.3	2.4
	6				13.5	2.6	2.0
	7				14.2	2.9	1.1
Average					12.4	2.7	1.9
1928, 1929, and 1930	1	8.6	3.3	1.8	9.6	2.6	2.0
	2	9.2	3.3	1.1	10.8	3.1	1.5
	3	9.2	4.1	1.4	11.3	3.5	2.0
	4	8.9	4.2	1.1	11.6	3.8	1.8
	5	11.1	4.1	1.8	12.1	3.8	1.8
	6	11.6	2.9	1.8	13.3	2.8	1.9
	7	13.4	3.0	1.1	13.9	2.9	1.4
Average		10.3	3.4	1.5	11.8	3.2	1.8

[1] Consisted of alfalfa hay except when otherwise noted.
[2] Silage was fed the last 4 days of this period. The total quantity was divided by 3 to reduce it to a dry basis, and the result added to the total quantity of hay consumed to obtain the average ration of roughage for the period. This method was followed in succeeding periods when silage was fed.
[3] Silage was fed throughout the period.
[4] Silage was fed the first 22 days of the period.
[5] Silage was fed the last 18 days of the period.

There was a tendency throughout each experiment for the steers in all lots to consume a gradually increasing quantity of concentrates. The quantity of roughages consumed remained more or less constant until the last two periods. These same statements apply to the heifers during their 1-year fattening experiment. However, their average feed consumption was slightly less than that of the steers. The cattle getting the ration containing oats showed a tendency to increase their grain consumption somewhat more rapidly at the outset than those getting the other rations. However, during the latter part of the feeding period these same cattle showed a tendency to drop behind the others, with the exception of the heifers, in feed consumption. Cattle eating corn as the only grain were slowest in getting to full feed.

During the first experiment, cattle in lots 2S and 2H refused a portion of the cottonseed cake without other usual symptoms of being "off feed." Cottonseed meal was substituted for cake, was continued for a few feedings, and then was gradually replaced by the cake. After the cattle were put back on cake no further trouble was experienced. The probable causes for refusal to eat the cake were difficulty in mastication and sore mouths during cold weather.

When silage was fed, the steer calves receiving corn and cottonseed cake ate somewhat more of it than the cattle in the other lots of steers. When, for some reason or other, such as temporary shortage of water, the cattle went off feed, those in lot 2S were the first to return to full feed. Cattle in all lots became very fat during the progress of this experiment, and the gains during the last periods were relatively small and the appetites somewhat irregular.

Lot 2S consumed 133 pounds, or 6 percent, less corn than lot 1, fed shelled corn alone, but ate 265 pounds of cottonseed cake per head during the 196 days. The total corn consumption per head by lot 3 for 196 days was 709 pounds, or 31 percent, less than by lot 1, but the former lot consumed 772 pounds of oats in addition to the corn. The heifer calves consumed 8 percent less corn and cottonseed cake per head than the steers on the same ration.

The average daily gains per head by 28-day periods, as shown in table 7, were irregular for all lots. From the average of the individual weights obtained at the end of each 28-day period, the average daily gain per head was calculated. The gain obtained by one weighing does not in all cases represent the actual gain made. This discrepancy may be due to the quantity of feed and water consumed immediately before the weight was obtained. The greater the degree of "fill" the greater would be the apparent rate of gain for that period with the tendency for the rate to be less for the following period. The average rate of gain for the 196-day dry-lot feeding period differed only slightly for all lots of steers. In the 1929 experiment, when heifers also were used, the same average daily gains were made by the heifers and steers fed similar rations.

FEED CONSUMPTION PER 100 POUNDS OF GAIN

The average quantities of feed consumed per 100 pounds of gain by 28-day periods for the three experiments are given in table 8. There is a tendency for the quantity of grain required to produce 100 pounds of gain to increase as the fattening period advances, although table 8 shows some irregularity in this respect, especially in the case of heifers (lot 2H). All lots with the exception of lot 1 consumed more grain per 100 pounds of gain during the last 28-day period than at any other time.

TABLE 8.—*Average quantities of feed consumed per 100 pounds of gain by 28-day periods for all experiments*

Period	Pounds of feed consumed per 100 pounds of gain							
	Lot 1		Lot 2S		Lot 2H		Lot 3	
	Grain	Roughage [1]	Grain	Roughage [1]	Grain	Roughage [1]	Grain	Roughage [1]
No. 1	587	176	553	102	478	185	491	131
No. 2	587	182	575	177	822	293	722	204
No. 3	630	222	603	208	662	298	562	180
No. 4	576	201	618	206	777	374	655	214
No. 5	546	155	780	236	618	225	671	209
No. 6	897	195	670	143	640	159	707	152
No. 7	633	173	1,186	248	1,166	282	976	204
Average [2]	657	187	686	193	765	241	669	183

[1] In obtaining the quantities of roughage for the second, third, fourth, and fifth periods, the quantities of silage consumed per 100 pounds of gain have been divided by 3 to reduce them to a dry basis and added to the quantities of alfalfa hay.

[2] Based on total quantity of feeds and total gain for entire period.

The average quantities of feed consumed per 100 pounds of gain for the entire fattening period for each experiment, the cost of feed per 100 pounds of gain, and the final appraised values for each lot are given in table 9. The heifer calves (lot 2H) consumed 45 pounds less grain per 100 pounds of gain than the steers (lot 2S) on the same ration. The consumption of roughage per 100 pounds of gain by the two lots of calves was practically the same.

TABLE 9.—*Average quantities of feed consumed and cost per 100 pounds of gain, and average final appraised value of the calves for entire fattening period of the three experiments*

Lot no.	Beginning of experiment	Average quantity of rations per 100 pounds of gain			Cost of feed per 100 pounds of gain	Average final appraised value per hundredweight
		Grain	Alfalfa hay	Corn silage		
		Pounds	*Pounds*	*Pounds*	*Dollars*	*Dollars*
1	1928	638	177	87	11.73	14.25
	1929	654	190	74	11.96	11.75
	1930	673	136	27	8.49	7.75
	Average	657	108	61	10.64	11.25
2S	1928	636	162	97	12.46	14.75
	1929	750	212	84	14.48	12.50
	1930	679	138	28	8.80	8.25
	Average	686	170	70	11.80	11.83
2H	1928					
	1929	705	216	85	13.70	11.25
	1930					
	Average	705	216	85	13.70	11.25
3	1928	647	172	84	11.91	14.50
	1929	695	185	74	11.04	12.00
	1930	602	134	27	8.39	8.00
	Average	669	163	60	10.63	11.50

At the close of each experiment each lot was appraised by Kansas City livestock commission merchants. In the first experiment 7 steers of lot 2S were appraised at $15 per hundredweight and 3 at $13.75. An appraisal of $14.75 also was made of the entire lot. In lot 3, 5 steers were valued at $14.85 per hundredweight and 4 at $14, or the entire lot at $14.50, which was $0.25 lower than lot 2S. The steers in lot 1 were not finished to so high a degree as were those in the other two lots, and a lower value was placed on them. Five steers of this lot were valued at $14.75 per hundredweight and 4 at $13.75, or the entire lot at $14.25. In the first experiment the spread between lot 1 and the other lots of steers was $0.25 less at the end of the dry-lot period than it was at the end of the suckling period.

At the end of the second and third experiments the calves in each lot were appraised collectively. During the dry-lot period of the second experiment the difference between the prices of lot 3 and lot 2S decreased from $0.75 to $0.50 per hundredweight. Lot 1 gained less rapidly during the dry-lot period than did lot 3, was therefore not so highly finished at the close, and was valued $0.25 lower per hundredweight.

Steer calves fed a grain ration of corn and cottonseed cake (lot 2S) obtained a higher degree of finish and their average value for the three

experiments was $0.33 per hundredweight higher than lot 3, receiving a grain ration of corn and oats. The calves receiving a grain ration of corn alone were appraised $0.25 per hundredweight lower than calves fed corn and oats.

The feed cost of 100 pounds of gain was $0.78 higher for the steers fed corn and cottonseed cake than for the heifers. But the advantages in feed requirements were more than offset by the $1.25 higher appraised value of the steers. The heifers were rougher than the steers and too heavy for cattle of their sex to sell to the best advantage.

CREEP FEEDING OF CALVES

Since there may be considerable trouble in getting the calves to eat satisfactorily when creep fed, the following observations made in conducting these experiments are included.

A desirable location for a creep is near the watering place and the shade used by all the cattle. When a creep is so located, calves learn more readily to eat. The cattle go to water at least once a day, and if the weather is warm they will spend considerable time in the shade. If the creep is near both of these places, calves 60 days old usually begin to eat grain within a week. If the arrangement suggested cannot be made, feeding a little hay near the creep each day will draw the cows so near that the calves will go into the creep. This may have to be done for perhaps 2 weeks. In case it is not advisable to feed hay, the cattle may be herded around the creep for a short time each day until the calves come up of their own accord, and go to the creep about the same time each day. At first they may go to the creep only once a day, but after they have been eating for a month or so they usually go regularly about twice daily and later they may visit the creep 4 or 5 times a day.

Unless almost ideal conditions exist for locating a creep, it is advisable to separate the calves from the cows, keep feed before the calves, and turn the cows in with the calves twice a day for nursing. The maximum finish at weaning time is obtained by this method.

SUMMARY AND CONCLUSIONS

In creep-feeding experiments carried on for 3 years, steer calves fed a grain mixture consisting of 8 parts, by weight, of shelled corn and 1 part of cottonseed cake made 7.5 percent greater total gain for a period of 140 days previous to weaning than calves fed shelled corn alone. The calves receiving corn and cottonseed cake also made 8.7 percent more gain than calves fed a grain mixture of 2 parts of shelled corn and 1 part of oats.

The calves fed shelled corn alone, however, were more economical in production of beef during the nursing period, as they produced 100 pounds of gain for each 177 pounds of grain fed, whereas the steer calves fed corn and cottonseed cake and corn and oats required 199 and 251 pounds of grain, respectively, for each 100 pounds of gain.

At the end of 140 days of creep feeding (weaning time), the steer calves fed corn and cottonseed cake were appraised at approximately 50 cents per 100 pounds more than the calves fed either shelled corn alone or those fed corn and oats. This increased value considerably more than offset that of the extra feed consumed.

Experiments carried on for 2 years in feeding heifer calves shelled corn and cottonseed cake in creeps showed the gains of heifers to be about 4 percent less than those of steers fed similarly, but the appraised sales values, per 100 pounds, of the two lots were the same at weaning time. The heifers, however, consumed about 24 percent more grain per 100 pounds of gain in weight.

In creep-feeding calves, these experiments showed that although the addition of oats to a shelled-corn ration resulted in practically the same gains and appraised value per 100 pounds of live weight as when corn alone was fed, the grain consumption per 100 pounds of gain was considerably higher with the former ration. The addition of cottonseed cake, however, was advantageous primarily because the calves receiving this ration had the greatest degree of bloom, which resulted in the highest appraised value.

In the dry-lot fattening experiments of 196 days each immediately after weaning, there were no significant differences in total gains made by the three lots of steer calves fed the same type of ration as they received previous to weaning. Steers fed corn and cottonseed cake, however, were the heaviest at the end of the experiment, but most of the difference was due to the greater gain during the creep-feeding experiment.

The quantity of grain required per 100 pounds of gain during the dry-lot fattening period was slightly less in the case of shelled corn alone than in the case of corn and cottonseed meal.

The addition of oats to a shelled-corn ration increased the sales values of the animals slightly, but there was practically no difference in the feed requirements per 100 pounds of gain or in the gain in weight during the dry-lot fattening period.

A 1-year dry-lot fattening experiment with heifers fed corn and cottonseed cake indicated that approximately the same gain can be made by heifers as by steers fed similarly for 196 days following weaning, but that more feed is required per 100 pounds of gain by heifers and their sales value tends to decrease, owing perhaps to unevenness of finish.

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