THE RELATIONSHIP OF FEEDER GRADE OF HEIFER CALVES TO FEEDLOT PERFORMANCE AND CARCASS CHARACTERISTICS

by

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INTRODUCTION

Livestock producers have long expressed the opinion that certain animals respond more readily to feed than others and produce better carcasses. They have based their judgment on many different factors. The United States Department of Agriculture has set up standards for grading market classes of cattle based largely on conformation, finish and quality. Little weight has been given to production factors such as gaining ability and economy of gains or to the relationship of these factors to the feeder and finished grades of animals. However, for a number of years leaders in the livestock and meat industry have appreciated the importance of devoting further study to this phase of the problem.

The producer's interest in this subject is broader than that of anyone else. Price differentials large enough to be important to feeders often exist among the various grades. The producer is concerned with production factors such as rate and economy of gain; also with animal grades, grade factors and the relationships among the production and grade factors. He is indirectly concerned with the relationships between the slaughter animal and carcass grades and the significance of carcass grade from the viewpoint of the consuming public.

The buyer of animals for slaughter is directly concerned with the relation between slaughter-animal grade and carcass grade. Together with the retailer he is vitally interested in the reaction of the public to the different grades of meat. Interest in the grading of meat in recent years has increased

greatly among consumers.

This paper presents the results of a study of the relationship of feeder grade to rate and economy of gain, slaughter grade and carcass characteristics.

REVIEW OF LITERATURE

Cattlemen in general realize the importance of knowing how certain kinds or grades of cattle will respond in the feedlot and what type or grade of finished animal will result. The literature as reviewed here is in two general groups: (1) that which emphasizes relationships among production and grade factors, and (2) that which is concerned primarily with production factors.

Relationship among production and grade factors from 2,073 cattle used in cooperative meat investigations by 18 state experiment stations and the U. S. Department of Agriculture was reported on as follows by Hankins and Burk (1938):

1. More gain was required for a high grade feeder (choice, for example) to produce a choice grade carcass than for a low grade feeder (medium) to produce a medium grade carcass.

2. Heavy weight, faster gaining feeders produced distinctly higher grading carcasses than light weight, slower gaining cattle (of equal feeder grade) when total gains were equal.

3. Choice and good feeder calves produced choice grade carcasses after gains of approximately 380 and 450 pounds; good carcasses after gains of about 150 and 200 pounds.

4. Choice heifer calves produced choice carcasses at weights exceeding 750 pounds, the steers at about 820 pounds.

5. Feeder grade was closely related with width and depth of body, thickness of finish, shape of head of feeder, but none of these characteristics was a reliable index of the relative rate of gain of the animals in the feedlot.

6. Thickness of flesh and uniformity of width were very closely related to carcass grade and to each other.

7. Thickness of external fat was the one characteristic most highly correlated with marbling.

8. Production factors such as initial weight, length of feeding period, total gain; and grade factors such as width, depth, refinement, thickness, marbling, firmness of lean, are all correlated with each other.

The material as summarized above and which was reported on by Hankins and Burk is the most complete coverage of this subject known to the writer.

A report by Gibbons and Burk (1930) shows that it is reasonable to expect a definite correspondence between the grade of the animal and its carcass. More than 2,000 cattle and their carcasses were graded. Each of the seven grades was divided into three thirds. It was found that over one-third of the 2,000 carcasses were placed in the same third of a grade as had been the live animals from which the respective carcasses were derived.

In approximately one-half of them the difference between live and dressed grading was only one-third of a grade, and in about 15 percent it was two-thirds of a grade. Approximately 96 percent of the carcasses were placed within the same grade as had been the live animals which produced them.

In a comparison of choice and medium grade Shorthorn steers, U. S. Department of Agriculture workers (1937) found that low choice feeder steers produced low choice carcasses, and high medium feeders produced average medium carcasses. The choice grade steers were fatter, dressed higher and produced slightly more juicy and more desirable meat.

U. S. Department of Agriculture workers (1937) in a study of coefficient of correlation between carcass grade and 32 other production and quality factors for 728 beef carcasses, showed that degree of finish exerted the greatest influence on carcass grade. Coefficients of correlation between carcass grade and such factors as rate of gain, weight of rib eye, and tenderness ranged mostly between 0.1 and 0.3.

That beef grade is affected chiefly by feeder grade and feedlot gain was the conclusion reached by Hankins and Burk (1934) after a study involving 441 feeder steer calves. Another important finding of this investigation was that at any given gain the spread in average carcass grades tended to be less than the spread in the grades of the cattle as feeders. Finish was shown to be one of the most important factors in determining carcass grade. Variation in initial weight within a feeder grade influenced the grade of carcass to some extent.

In an experiment where the steers were graded good, fair and common, Smith (1910) reported that the steers grading good did not always make the larger gains, but they did fatten more readily and sold for a higher price per pound. The coarse, more rangy steers in the lower grade gained just as rapidly.

Peters (1932) conducted two feeding trials with good, medium and common grade steers to determine their relative return to the feeder. The following observations were made:

1. Appearance of beef breeding, the skeletal shape of the animal, the amount of natural flesh, the amount of fat present and the quality of bone seem to be the important characteristics that receive attention by market operators in grading and pricing cattle.

2. In dropping from the higher grades to the lower ones, a wider range of difference between individuals within a single grade is to be found.

3. In each of the two trials conducted, the feeder steers of the common grade gained in weight a trifle more rapidly than those of the good grade. In each trial the steers of the common grade used their feed a little more effectively for producing gain in weight than did those of the good grade.

4. The dressing percent averaged lower for the lower grades.

5. As the grade of feeder animal was lowered, the margin of selling price over cost price increased.

In an experiment conducted by Bentley et al. (1933), medium and common grades of feeder cattle were found to make greater gains and more profit than good feeders. In another test by Bentley and Ziegler (1935) no significant difference in rate and economy of gain was found among good, medium and common feeders. It was concluded that factors other than the ability to make gains on given amounts of feed must be considered in selecting steers for the feedlot. Choice steers outperformed lower grades of feed-

er steers in both gaining ability and efficiency of gain in a demonstration conducted by Barrick (1941). Black and Southwell (1945) found that higher grade steers may be expected to gain more rapidly and to continue gaining at a higher rate during a longer feeding period than steers of the lower grades. The good steers also made more efficient gains in a 140-day test and their carcasses graded high good, which was one full grade above the common steers. They also dressed 1.75 percent higher. The common steers made greater net returns for an 84-day fattening period. During the three-year period that the tests were conducted the common feeder steers averaged about 550 pounds in weight and the good feeder steers about 620 pounds at the beginning of the experiments.

Research workers generally have concluded that a close relationship exists between feeder, slaughter and carcass grades. The influence of such factors as degree of finish and total gain on slaughter and carcass grade has been found by several writers to be large. The relationship of such grade factors as dressing percent and size of eye muscle has not been determined. Neither is it possible to conclude from a study of the literature that gaining ability or economy of gain has been correlated definitely with any factor. The correlation of either one of these two production factors with any other grade or production factor would in itself be a major undertaking. With these problems in mind this work was undertaken in order to retest some relationships already found and perhaps establish other relationships.

EXPERIMENTAL PROCEDURE

Twenty range-bred grade Hereford heifers purchased in southwest Texas during the fall of 1946 were selected from a group of 75 heifers and used as a source of data for this study. They were lotted in two lots, 10 in each lot, and placed on feed December 5, 1946, and continued on feed until July 2, 1947, 209 days. The average feeder grade of the heifers in one lot was good, in the second lot, choice. The lots were open, with shed and feed bunks on the north side and a water tank on the south side. Ground corn, Atlas silage, alfalfa hay and cottonseed meal made up the ration with ground limestone at the rate of about one-tenth of a pound per head daily. The salt was self-fed. The alfalfa hay was substituted for the silage about the last 40 days of the test. Both lots were started on feed December 5, 1946, with about 10 pounds of ground corn, a full feed of silage and 10 pounds of cottonseed meal daily per lot. The amount of corn was increased gradually during the first 56 days until they were receiving a full feed of grain. Both lots were then self-fed grain after that date. Silage was fed twice daily in amounts that the heifers would clean up. The alfalfa was fed twice daily, four pounds per head to the good feeders and six to the choice. These amounts were in relation to the amounts of silage that they had been eating.

The heifers were graded on official B.A.E.[1], B.A.I.[2] feeder

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[1]Bureau of Agricultural Economics, United States Department of Agriculture.

[2]Bureau of Animal Industry, United States Department of Agriculture.

cattle grading charts No. 100, slaughter-cattle grading charts No. 101, and beef-carcass grading charts No. 102. The grades used are described in the following table.

Table 1. Description of feeder-cattle, slaughter-cattle and carcass grades used in this experiment.

Feeder-Cattle Grades	Slaughter-Cattle Grades	Carcass Grades
2 - 6 = fancy	2 - 6 = prime	2 - 6 = prime
8 - 12 = choice	8 - 12 = choice	8 - 12 = choice
14 - 18 = good	14 - 18 = good	14 - 18 = good
20 - 24 = medium	20 - 24 = commercial	20 - 24 = commercial
26 - 30 = common	26 - 30 = utility	26 - 30 = utility
32 - 36 = inferior	32 - 36 = cutter	32 - 36 = cutter
	38 - 42 = canner	38 - 42 = canner

The feeder and slaughter grades for individuals in both lots were estimated by four and five, respectively, animal husbandry specialists representing Kansas State College, and the averages of their grades were used. Two independent sets of grades were made on each carcass, one an average of four Kansas State College graders, the other by an official of the B.A.E., Meat Grading Service, who used his own grading system.

The initial and final weights were checked by weighing two days in succession and using the average weight carried to the nearest pound.

Measurements of the thickness of the longissimus dorsi (rib eye muscle) were obtained by Mackintosh's method (1935). The

measurement of degree of external fatness was a continuation of the above method of measurement at a designated point.

DISCUSSION OF RESULTS

The Relation of Feeder Grade of Heifer Calves to Feedlot Performance

The test period extended from December 5, 1946, to July 2, 1947, or 209 days. The average initial weight of Lot 1 was 383 pounds, and its average grade was low good as is shown in Table 2. Lot 2 graded low choice and its average initial weight was 454 pounds. As exhibited in Plate II, Lot 2 was a much more uniform group of heifers, displaying those qualities most sought after in choice feeder cattle: close made, large heart girths, large middles, good heads, quality and style. Lot 1 was inferior to Lot 2 (Plates I and II). Greater variation between individuals was to be found in Lot 1 than in Lot 2. These heifers were somewhat lighter bodied, finer in bone and had narrower heads. A few tended to be rangy. They seemed to lack the natural fleshing found in Lot 2.

The heifers in Lot 2 gained an average of 47 pounds per head more than the heifers in Lot 1 during the 209-day period. Lot 2 made an average daily gain of 1.77 pounds; Lot 1, 1.54 pounds. The gains made by Lot 1 were much more erratic than the gains made by Lot 2 (Table 4). Larger middles and heavier initial weights appeared to be contributing factors in the larger gain of Lot 2. Smith (1910), Knox and Koger (1946) also attributed larger gains to these reasons.

Table 2. The relation of feeder grade of heifer calves to feedlot performance, December 5, 1946, to July 2, 1947.

	Lot 1	Lot 2
Number of heifers per lot	10	10
Number of days on test	209	209
Average feeder grade	17.5[1]	11.5[1]
Average initial weight (lbs.)	383	454
Average final weight (lbs.)	706	825
Average total gain (lbs.)	323	371
Average daily gain (lbs.)	1.54	1.77
Average daily feed consumed per heifer (lbs.)		
Atlas sorgo silage	7.56	10.51
Alfalfa hay	.86	1.27
Cottonseed meal	1.31	1.31
Ground shelled corn	9.14	9.48
Ground limestone	.09	.09
Total feed consumed per 100 pounds of gain (lbs.)		
Atlas sorgo silage	489.16	592.05
Alfalfa hay	55.57	71.29
Cottonseed meal	84.91	73.98
Ground shelled corn	591.39	533.91
Ground limestone	5.67	4.89
Total digestible nutrients consumed per 100 pounds gain	655.26	627.42
Market value per cwt.		

[1]A description of grades is given in Table 1.

The choice heifers in Lot 2 consumed more feed than the good heifers in Lot 1, particularly roughage (Table 2). This is in keeping with their larger gain and bears out the observation that they had larger middles. Due to the amount of gain made by the

EXPLANATION OF PLATE I

Heifers in Lot 1 as they appeared prior to marketing at an average weight of 706 pounds. As feeders they graded an average low good, made an average daily gain of 1.54 pounds. The average carcass grade was good, with a dressing percent of 62.1.

PLATE I

EXPLANATION OF PLATE II

Heifers in Lot 2 as they appeared prior to marketing at an average weight of 825 pounds. They graded low choice as feeders and made an average daily gain of 1.77 pounds. Their average carcass grade was good, with a dressing percent of 60.4.

PLATE II

choice heifers they were able to make a more favorable showing in the amount of feed consumed per 100 pounds gain. Twenty-eight more pounds of total digestible nutrients were required by Lot 1 to make a 100-pound gain than was required by Lot 2. Previous studies have not always shown an advantage in favor of the better grades in efficiency of gain.

The Relation of Feeder Grade of Heifer Calves to Slaughter Grade and Carcass Characteristics

As shown in Table 3, initially there existed one feeder grade difference between the average feeder grades of Lot 1 and Lot 2. When they were graded as slaughter heifers 209 days later; Lot 1 had raised its average by having two heifers in the choice grade. On the other hand, Lot 2 had declined in grade. Four heifers changed from the grade of choice to good. When graded as slaughter cattle, only about two-thirds of a grade existed between the two lots. The carcass grades indicated still more improvement of Lot 1 over Lot 2. Four heifers in Lot 2 which graded choice as slaughter cattle were moved to the good grade as carcasses. For clarification it might be said that the carcass grades made by the B.A.E. grader were name grades only such as "high good". However, these descriptive grades coded into the regular B.A.E. grading chart and for the purpose here were assigned numerical values. The carcass grades in Table 3 show that the difference which existed between the two lots of heifers as feeders had practically disappeared when they were graded as carcasses by the B.A.E. grader. Table 4 shows quite a discrepancy between the carcass grades

Table 3. The relation of feeder grade of heifer calves to slaughter grade, and carcass characteristics, December 5, 1946, to July 2, 1947.

	Lot 1	Lot 2
Feeder grades[3]		
Choice		9
Good	8	1
Commercial	2	
Average feeder grade[3]	17.5[1]	11.5[1]
Slaughter grades[3]		
Choice	2	5
Good	6	5
Commercial	2	
Average slaughter grade[3]	17.1[1]	13.2[1]
Carcass grades[4]		
Choice	1	1
Good	7	9
Commercial	2	
Average carcass grade[4]	15.8[1]	15.0[1]
Dressing percentage	62.1	60.4
Average thickness of outside covering of fat (cm.)	1.29[2]	1.25[2]
Average thickness of eye muscle (cm.)	51.3[2]	61.6[2]

[1]A description of grades is given in Table 1.

[2]Derived by Mackintosh's method (1935).

[3]Kansas State College graders.

[4]B.A.E. grader.

for Lot 2 as graded by K.S.C.[1] graders and the B.A.E. grader. This difference presents a problem which the writer is not able to answer. These findings are not in agreement with Hankins and Burk

[1]Kansas State College, Manhattan, Kansas.

(1934) and several others who found beef grade affected chiefly by feeder grade and feedlot gain. Lot 2 graded choice as feeders and made an average of 47 pounds more gain than Lot 1, yet as carcasses the two lots were graded about the same by the B.A.E. grader.

A partial explanation for this small difference in grades between the two lots could be the greater amount of roughage consumed by Lot 2 which thereby decreased their consumption of corn. However, they still consumed considerably more corn than Lot 1. Hankins and Burk (1934) also found that at any given gain the spread in average carcass grades tended to be less than the spread in the grades of the cattle as feeders.

Lot 1 dressed higher than Lot 2. Since Lot 1 was lacking in middle and perhaps unable to carry as much fill to market, this is not surprising. It may be noted that Lush (1932), Knox and Koger (1946) associated shallow-bodied, high-flanked, rangy steers which were fat, with high dressing percent.

On an average, the carcasses from Lot 1 and Lot 2 carried approximately the same degree of fat. This fact tends to uphold the carcass grades made by the B.A.E. grader. However, wide individual differences within the lots are very noticeable (Table 4). Degree of finish has been found to be closely correlated with carcass grade in most instances, notably by U. S. Department of Agriculture workers (1937). In this test they do not appear to be associated, except on the average.

Lot 2, on the average, was about 10 cm. larger in thickness of eye muscle than Lot 1; this was in accord with the appearance

Table 4. Individual differences in feeder grade, initial weight, total gain, final weight, slaughter grade and carcass characteristics, Dec. 5, 1946, to July 2,1947

Heifer number	Feeder grade[1]	Ave. Init.	wt. Final	Total gain	Slaugh. grade	Carcass grade K.S.C.[2]	Carcass grade B.A.E.[3]	Dress. percent	Thick. of fin.[4]	Thickness of ers muscle[4]
Lot 1:		Pounds		Pounds						
114	14.7	365	755	390	15.3	13.0	14.0	62.0	1.4	60.5
36	15.0	345	610	265	17.8	14.4	14.0	63.1	.9	61.8
171	15.7	340	710	370	18.3	14.6	14.0	61.4	1.7	51.0
92[5]	15.7	355	685	330	12.0	13.2	12.0	62.1	1.4	58.5
53[5]	16.0	385	663	278	17.0	16.5	14.0	63.8	1.2	39.9
23	16.0	440	900	460	12.4	9.8	14.0	61.9	2.3	42.6
160[5]	18.0	345	725	380	17.2	14.6	16.0	61.8	1.7	62.4
157[5]	18.5	385	608	223	19.6	16.6	16.0	62.7	1.4	42.9
116	21.9	375	673	298	17.4	17.9	20.0	62.4	.4	45.0
166[6]	23.0	490	735	245	24.2	22.8	24.0	60.2	.5	48.8
Average	17.5	383	706	323	17.1	15.3	15.8	62.1	1.29	51.3
Lot 2:										
138[5]	9.0	448	875	427	9.5	11.1	12.0	60.7	1.3	55.8
197[5]	9.2	420	610	190	18.4	15.6	14.0	65.2	1.7	42.2
190	9.4	460	865	405	10.5	10.4	14.0	58.7	1.5	42.0
68	9.7	465	815	350	11.6	10.9	14.0	61.7	1.5	70.4
5	11.3	450	783	333	12.2	13.5	16.0	60.5	.7	74.9
117	12.2	460	870	410	12.2	12.5	14.0	58.9	1.4	60.8
17	12.2	440	868	428	13.5	11.9	18.0	57.7	1.1	71.3
9	12.3	483	895	412	15.6	13.6	16.0	60.3	1.0	64.8
79	13.0	483	893	410	14.4	8.6	14.0	61.7	1.5	74.8
112	15.3	435	780	345	14.5	16.8	18.0	58.8	.8	58.5
Average	11.5	454	825	371	13.2	12.5	15.0	60.4	1.25	61.6

1 A description of grades is given in Table 1.
2 Kansas State College graders.
3 Bureau of Agricultural Economics, Meat Grading Service.
4 Measurements obtained by Mackintosh's method (1935).
5 Foundered.
6 Calved June 8, 1947; calf died.

of the heifers on foot. In Table 4 it may be seen that the individuals in Lot 2 were somewhat larger in eye muscle.

Individual Differences in Feeder Grade, Initial Weight, Total Gain, Slaughter Grade and Carcass Characteristics

Table 4 lists the individual heifers in Lot 1 and Lot 2 in descending order as they were graded as feeders. Lot 2 was much more uniform in initial weight and made a more uniform gain. In Lot 1, heifer No. 166 calved about a month prior to marketing. The calf died. Two of the heifers foundered, No. 53 about six weeks after going on test and No. 157 about 70 days prior to marketing. In Lot 2, No. 197 foundered about 80 days prior to marketing. Table 4 shows that none of these heifers gained as much as the average of their respective lots. It is of interest to note that the largest gain made was 460 pounds by heifer No. 23 in Lot 1. She was a large-chested, rugged, rangy sort of a heifer and somewhat larger than the average of the lot.

Individual feed records, of course, are not available on the heifers, since they were fed by lots, so efficiency of individual animals, such as No. 23, cannot be calculated. Efficiency of gain is usually closely associated with rapid gains. This has been pointed out by Winters and McMahon (1934) and observed by others. However, this is not always true and where animals differ significantly in size or fatness it does not seem to hold true because of the increased maintenance requirement of the larger animals, Knapp and Baker (1944).

The slaughter grades show, with some exceptions, that indi-

EXPLANATION OF PLATE III

Fig. 1. Heifer No. 92, Lot 1, an average good feeder that gained 330 pounds, about the average of the lot, final weight 685 pounds. This heifer produced the only choice carcass in Lot 1. Compare her middle and fine bone with No. 138 that produced the choice carcass in Lot 2.

Fig. 2. Heifer No. 11, Lot 1, was a medium feeder that stayed that way. This heifer gained 298 pounds and had a final weight of 673 pounds. Her carcass graded commercial, which was well below the average of the lot (Table 4).

Fig. 3. Heifer No. 138, Lot 2, was an outstanding heifer and one of the top gainers, with 427 pounds gain. As a feeder she was the highest grading heifer of the group. With a finished weight of 875 pounds this heifer produced a choice carcass. She was a large-chested, big-middled heifer with plenty of feed capacity. Compare her with No. 92 that produced the other choice grading carcass.

Fig. 4. Heifer No. 5, Lot 2, a choice feeder that made 333 pounds gain, finished at 783 pounds with a carcass that graded good. This heifer lacked the gain and thickness of finish found in the average of the lot. A very good picture.

PLATE III

Fig. 1

Fig. 3

Fig. 2

Fig. 4

viduals in both lots tended to maintain their order of ranking as feeders. When the carcasses were graded the differences which were so noticeable in the feedlot disappeared. It is interesting to note how closely Lot 1 approached Lot 2 in carcass grades. Of further interest is the fact that the K.S.C. graders and the B.A.E. grader were much closer together in their grading of Lot 1 than Lot 2, where the K.S.C. graders were uniformly higher than the B.A.E. grader. A fact which is not surprising is the higher carcass grade and dressing percent made by the foundered heifers Nos. 53, 157 and 197. Due to their painful condition they seemed to eat more corn than roughage. They were firmer fleshed and carried less fill when marketed. The heifers in Lot 1 averaged higher in dressing percent than Lot 2. Little explanation can be given for this except the heifers in Lot 2 had larger middles, which perhaps was a contributing factor. In thickness of finish and size of eye muscle, Lot 1 showed wide individual variation in keeping with their appearance on foot. Heifer No. 23, the fattest heifer in either lot, had a very small eye muscle. Lot 2 was noticeably larger in size of eye muscle than Lot 1; however, individually, they varied considerably.

Evaluation by t Test of Differences Found Between Good and Choice Feeder Heifers

Using the t test the data obtained in this study were treated statistically so that more information might be obtained on the two groups as choice and good feeders. Nine of the heifers that graded choice and nine that graded good as feeders were used as a source of data. It was decided to omit from the test two of the

heifers that graded commercial as feeders so that the two groups would be more comparable. Table 5 shows that the difference in feeder grade and initial weight between the two groups was highly significant; furthermore, a significant difference in favor of the choice heifers was found in final weight, slaughter grade and the carcass grade of K.S.C. graders. The choice heifers had a large but non-significant advantage in total gain and thickness of eye muscle. In Table 4 it may be seen that although the average difference between the lots appears large, within the lots wide differences exist. For instance in Lot 1 the total gain per heifer ranges from 223 pounds to 460 pounds, in Lot 2 the range is from 190 to 428 pounds. It may be noted that where significant differences exist, the differences are fairly consistent.

The good heifers outdressed the choice lot by 1.4 percent, which was also non-significant. Little or no difference was found in thickness of finish, or in B.A.E. carcass grades between the two groups.

Table 5. Comparison of good and choice feeder heifers, December 5, 1946, to July 2, 1947.[1]

	P[2]	Nine feeder heifers grading good	Nine feeder heifers grading choice
Feeder grade	.01	16.2[3]	10.9[3]
Initial weight (lbs.)	.001[2]	377	457
Final weight (lbs.)	.02[2]	715	830
Total gain (lbs.)	.33	338	374
Slaughter grade	.04[2]	16.0[3]	13.1[3]
Carcass grade, K.S.C.	.03[2]	14.4[3]	12.0[3]
Carcass grade, B.A.E.	.82	14.7[3]	14.7[3]
Dressing percentage	.13	62.0	60.6
Thickness of finish	.60	1.4[4]	1.3[4]
Thickness of eye muscle	.12	53.1[4]	61.9[4]

[1] These data were compiled from Table 4, using the nine feeder heifers grading good and the nine grading choice.

[2] A probability (P) of .05 or less was considered to indicate significance, and one of .01 or less to indicate highly significant.

[3] For description of grades see Table 1.

[4] Derived by Mackintosh's method (1935).

SUMMARY AND CONCLUSIONS

The experiment reported in this paper covers a feeding period of 209 days, December 5, 1946, to July 2, 1947. Twenty grade Hereford heifer calves raised under similar conditions and handled in an identical manner were used in the test. They were fed in two lots of 10 each. Lot 1 graded low good as feeders and Lot 2 graded low choice.

Observations by other workers show that larger middled, heavier weight cattle, such as the choice heifers in this test, make larger and more efficient gains. However, not all reports are in agreement with this finding. Most of the studies have found feeder grade, total gain and thickness of finish associated with carcass grade. Slaughter and carcass grades have been found closely correlated. The spread in average carcass grades has been reported to be less than the spread in the grades of the cattle as feeders. Other workers have found that a wider range of difference between individuals within a single grade is to be found in the lower grades.

1. In this test heifers graded as choice feeders were uniform in size and weight, had large heart girths, were close made, large middled, had good heads, and displayed quality and style.

2. The heifers that graded good varied widely in some respects, a few of them tended to be rangy, some were light middled and narrow chested, and most of them had fine bones and narrow heads.

3. The choice heifers weighed more at the beginning and close of the feeding trial, and graded higher as slaughter cattle and in

the carcass when graded by Kansas State College graders than heifers which were graded as good feeders. These differences when treated by means of the t test were found either highly significant or significant.

4. The choice heifers made appreciably more gain and had thicker eye muscles, on the average, than the good heifers. However, these average differences were not statistically significant owing to the wide variations within the lots.

5. More feed, particularly roughage, was consumed by the choice heifers.

6. In efficiency of gain the choice heifers excelled, making a 100-pound gain on 28 pounds less total digestible nutrients.

7. The differences observed between the two lots as slaughter cattle were not so apparent when the carcasses were graded. The Bureau of Agricultural Economics grader found less than a third of a grade difference in favor of the lot which had been graded choice as feeders.

8. The good heifers outdressed the choice heifers by more than one percent. They measured slightly thicker in outside covering of fat, yet neither of these differences was found to be significant.

9. In this test there was a considerable relationship between feeder grade and initial weight, final weight and slaughter grade, but its relationship to carcass grade was not so apparent. The feeder and slaughter grade of the heifers showed little relationship with the carcass grade assigned by the B.A.E. grader. This fact is deserving of more study. Furthermore, it appears that a

favorable relationship may exist between feeder grade and total gain, thickness of eye muscle and dressing percent, although the small number of animals used in this test made it impossible to verify this fact. More research is needed with production factors and grade factors in definitely establishing their relationship to feeder grade.

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