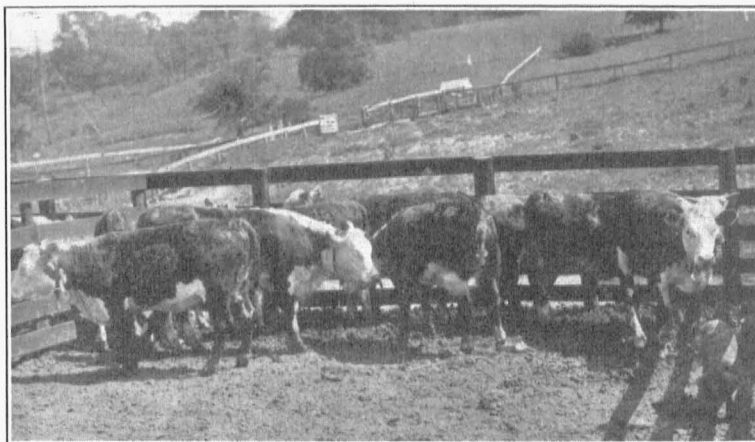


UNIVERSITY OF MISSOURI COLLEGE OF AGRICULTURE
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Yearling Heifers and Steers for Beef Production

E. A. TROWBRIDGE and H. C. MOFFETT



Finished Heifers in University Feed Lots.

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THIS BULLETIN AT A GLANCE

1. Heifer calves gained less rapidly and economically, but developed market condition more quickly than steers.

2. There was only a slight difference in the selling price of fat heifers and steers when they weighed approximately 725 pounds. Heifers which weighed approximately 900 pounds sold for 14.5 per cent per cwt. less than similar steers.

3. Carcasses from fat heifers weighing less than 725 pounds were as desirable as carcasses from similar steers; however, carcasses from fat heifers weighing approximately 900 pounds showed slightly more waste and less desirable conformation than carcasses from comparable steers.

4. Information obtained from these trials indicates that it is usually more satisfactory from the standpoint of the producer of cattle and the consumer of meat to market fat heifers when they weigh less than 725 pounds.

Yearling Heifers and Steers for Beef Production

E. A. TROWBRIDGE AND H. C. MOFFETT*

ABSTRACT.—This bulletin deals with the relative merits of “good” to “choice” steer and heifer calves in the feed lot, and in their use as beef by consumers. The steers gained more rapidly and economically although the heifers attained a finished condition in a shorter feeding period. When marketed weighing less than 725 pounds there was little difference in selling price although the heifers dressed higher and yielded carcasses with more finish. When comparable steers and heifers were fed until they weighed approximately 900 pounds, steers sold at a considerably higher price than heifers, yielded a lower percentage of beef, but smoother, less wasteful carcasses. Palatability tests from both groups of cattle showed few significant differences due to sex. The 9th, 10th and 11th ribs cut from heifers contained more fat than similar cuts from comparable steers.

The logical disposal of surplus heifers not required for breeding, approximately one-fourth the yearly beef calf crop, has been through the channels of market meat production. They have usually sold for lower prices than steers, as feeders, and as fat cattle when over fifteen months of age or above 700 pounds in weight. With younger cattle the difference has been less pronounced.

Packers' objections to heifers summarized below reflect the consumers' ideas and desires, and the problems of economy of slaughter.

- A. As the age of heifers advances, they develop the less desirable conformation of cows.
- B. They are likely to be “in calf” which adds waste and is said to make the flavor of the meat less desirable.
- C. They tend to carry excessive fat which makes carcass waste.
- D. The shape and texture of the better cuts in the “good” to “choice” animals are less desirable than in steers.

As early as 1894, Wilson and Curtis^{1,†} pointed out that in American markets “Even when the heifer is well fed, custom consigns her to a lower class than the steer of equal breeding, while the heifer beef in some countries sells higher than steer beef.”

Steer calves fed by Gramlich² cost more but sold for more when fat than open heifers. Steers gained more rapidly and economically but showed a lower dressing percentage than heifers. Open yearling heifers compared with yearling steers for a 175-day feeding period, made more rapid and economical gains, dressed higher, but sold for less per cwt.

*The authors wish to acknowledge help as follows: Jessie Alice Cline and other members of the Department of Home Economics of the University of Missouri with the United States Department of Agriculture conducted the cooking and palatability tests. W. S. Ritchie of the Agricultural Chemistry Department of the University of Missouri with the United States Department of Agriculture conducted the analytical tests. Two representatives of the United States Department of Agriculture and one from the experiment stations cooperating on the National project “Cooperative Meat Investigations,” graded the cattle and carcasses. M. T. Foster of the Department of Animal Husbandry was responsible for slaughter data.

†Numerals refer to list of references on page 24.

McC Campbell and Horlaker,⁴ and Vaughan⁵ have shown that steer calves gain more rapidly and economically and sold higher than heifers, although the heifers were fatter.

Bohstedt⁶ pointed out the possibilities of heifer calves in beef making.

In 1925 Maynard and Morton⁷ suggested, "When fed together steer calves apparently do not bother open heifers enough to affect gains secured."

Bull, Olson and Longwell⁸ report heifer calves eating and gaining slightly more than steers with little difference in economy of gain during 140 days but the heifers were fatter. For 200 days feeding there was little difference in rate of gain but steers had gained more economically, while heifers were fatter but sold for less per cwt. Slaughter tests showed no significant carcass differences after 140 days feeding, but after 200 days heifers dressed slightly higher than steers. Heifers showed more "killing" and "cutting" fat than steers slaughtered at the same time.

Except for relatively heavier flanks in heifers, there were no percentage differences in the whole cuts of the carcasses due to sex but physical analyses showed the heifers carried more fat. No differences in firmness of fat, color of lean or palatability of cooked beef due to sex were found.

Experiments⁹, including co-operative work by the Arkansas, Colorado, Michigan, Missouri, Mississippi, and Ohio Stations with the U. S. D. A. indicate that well-bred heifer calves of beef type reached a desirable market finish as light yearlings more quickly and at lighter weights than similar steer calves. It follows that the heifers passed the point of desirable finish at a lighter weight than the steers. These light, open heifers showed a dressing percentage fully as high as the steers and the beef from heifers was fully equal to that from steers in palatability when the two were slaughtered at the same time.

THE PROBLEMS CONSIDERED

The investigation here reported was conducted to secure further data concerning the following more important questions regarding steer and heifer calves of "good" to "choice" quality in the feed lot, on the hook, and in their use by consumers:

1. Do heifer calves gain less rapidly and economically, but develop market condition more quickly than steers?
2. Do the age and weight at which heifers are marketed affect their selling price?
3. Do heifer calves produce less desirable carcasses than steers?
4. Is there any general suggestion as to the best method of handling heifers to be fattened and sold for beef?

PLAN OF EXPERIMENT

Two trials were conducted with heifer and steer calves as nearly alike as it was possible to secure them.

The first trial, December 21, 1925 to October 25, 1926, included two lots each of steer and heifer calves handled as follows:

- Lot 1. Steer calves full fed 168 days in dry lot.
- Lot 6. Heifer calves full fed 168 days in dry lot. (Same as Lot 1).
- Lot 3. Steer calves fed $\frac{1}{2}$ as much grain as Lot 1 with legume hay and corn silage ad libitum until spring (140 days), then full fed on bluegrass pasture 168 days.
- Lot 7. Heifer calves fed $\frac{1}{2}$ as much grain as Lot 6 with legume hay and corn silage ad libitum until spring (140 days), then full fed on grass 168 days. (Same as Lot 3).

The second trial, November 25, 1926 to October 27, 1927, was a duplication of the previous year's experiment, except the calves full fed through the winter were fed 196 days and the winter period was 168 days for the two lots to be full fed on pasture.

CATTLE USED IN EXPERIMENT

The cattle used in both trials were "good" to "choice" Hereford steer and open heifer calves purchased from the Matador Ranch in Texas. They arrived in Columbia near the middle of November and were treated for blackleg and hemorrhagic septicemia. The calves were given from one to three weeks to recover from the shipment and vaccinations, and to become accustomed to eating the feeds which were to be used in the experiment.

WEIGHTS OF CATTLE

Each calf, identified by a neck strap bearing an individual number, was weighed on three consecutive mornings at the beginning and the average of the three weights was taken as its initial weight. The same method was used to obtain the final weights at the end of the trials. During the trials each calf was weighed individually at the end of each 28-day period. All weights on the calves were taken early in the morning before the calves had been fed or watered.

QUALITY AND KIND OF FEEDS

The feed used the first year consisted of mixed corn No. 3 grade, old process pea size linseed oil meal, guaranteed 34 per cent protein, alfalfa hay of choice quality, and corn silage made from good corn that would yield 50 bushels per acre.

The second year the corn was mixed corn of No. 3 grade, and the protein feed was pea sized 43 per cent cottonseed meal. The hay was

alfalfa of choice quality, and the corn silage was made from good 50 bushel corn. The grain ration for the 1925-1926 test consisted of shelled corn 6 parts, linseed oil meal 1 part, by weight. Due to a change in price of protein concentrates the second year's mixture was made up of shelled corn 8 parts, cottonseed meal 1 part, by weight.

EQUIPMENT AND METHODS OF FEEDING

The test was conducted at the University Experimental Feeding Plant which includes a series of lots each 100 feet long and 19 feet wide with a shed 20 feet deep along the north side. The lots slope gently to the south, allowing reasonably good drainage, but they are not paved and consequently become muddy during bad weather. Grain and silage were fed in flat-bottomed feed bunks in the lots. Hay was fed in mangers in the shed.

All feeds were hand fed twice daily—in the morning and in the evening. The cattle were fed all the hay and silage they would eat from the beginning of the experiment. The corn and protein concentrate were hand mixed and fed after the silage had been eaten. Hay was fed after the grain. Salt was kept before the cattle.

PORK GAINS CREDITED TO CALVES

Each lot of calves was credited with the pork produced by the pigs following the cattle.

The pigs were fed some of the same grain mixture as was fed the cattle. The amount of pork credited to each lot of calves was the difference between the total hog gain and the gain produced from the grain fed to the pigs. One pound of pork was deducted for each 5 pounds of grain fed.

CARCASS COOKING AND PALATABILITY STUDIES

Each animal was graded at the beginning and close of the feeding and in the carcass by the grading committee provided for by the National Project, "Cooperative Meat Investigations," previously designated as "A Study of the Factors Which Influence the Quality and Palatability of Meat." The committee consisted of two representatives of the United States Department of Agriculture, one each from the Bureau of Agricultural Economics and the Animal Husbandry Division of the Bureau of Animal Industry, and one from the cooperating Experiment Station. In each case the committee average was taken as the individual grade.

The grading charts¹⁰ used were based on the classification of feeder and slaughter cattle and carcasses developed by the United States Department of Agriculture. They provide for detailed study of conformation, finish and quality of cattle and carcasses, with perfection in each case represented by 100 per cent. Evaluation of the various

factors is based upon relative weight, demand, and price of parts involved. Five-year-average of prices of wholesale cuts at the Chicago market were used as the basis for evaluating the grading charts.

The percentage of dressed beef was calculated, and chemical analyses, and cooking tests were made of meat from sample carcasses of each lot of cattle.

MEASURING RESULTS

Among the most important factors in evaluating the results of a cattle feeding enterprise are:

1. The rapidity of gain, that is, the average daily gain in weight of the cattle, the weights of the cattle at the beginning and close of the feeding period, and the total gain in weight on cattle and hogs which follow them.

2. The amount of feed consumed per pound of gain produced during the various parts of the feeding period and in total.

3. The condition of the cattle at the close of the feeding period as judged by carcass grades, dressing percentages, the finished appearance of the cattle, and any other factors which may be available.

DATA AND DISCUSSION

Daily Feed Consumed

The grain ration fed consisted of shelled corn and nitrogenous supplement while the roughness fed was silage and legume hay in winter and bluegrass pasture in summer.

The calves increased their feed consumption more slowly than older cattle. While this is usually the case, it is particularly true of calves such as these which have never had grain.

The full fed calves were started on $1\frac{1}{2}$ pounds grain daily and required 30 to 40 days to get to a full allowance of grain. The daily grain consumption increased from 2.64 pounds for the steers and 2.68 pounds for the heifers during the first period to 13.52 pounds and 13.32 pounds respectively during the seventh and last period. The roughness eaten gradually increased for 140 days and then decreased slightly. The hay consumption during the early days of the feeding period was somewhat greater during the first trial than during the second because the hay was of slightly better quality and grain was added more slowly. Sex caused no appreciable difference in the consumption of grain or roughness.

Steers and heifers wintered on a limited grain ration and roughness consumed practically the same amount of the various feeds during that period. During the first trial slightly more roughness was consumed by both steers and heifers than during the second, due to

TABLE 1.—AVERAGE DAILY FEED CONSUMED PER ANIMAL BY PERIODS

(Average of 2 Years' Results)

| 28-Day Periods | | Full fed in dry lot | | Half grain ration with hay and silage during winter. Full fed grain on grass during summer | |
|----------------------|--------|---------------------|----------------|--|-----------------|
| | | Lot I Steers | Lot VI Heifers | Lot III Steers | Lot VII Heifers |
| WINTER PERIOD | | | | | |
| 1 | Grain | 2.64 | 2.68 | 1.34 | 1.31 |
| | Hay | 3.74 | 3.74 | 3.86 | 3.78 |
| | Silage | 8.07 | 7.81 | 8.32 | 8.13 |
| 2 | Grain | 6.71 | 6.72 | 3.20 | 3.26 |
| | Hay | 3.07 | 3.24 | 3.60 | 3.53 |
| | Silage | 9.04 | 8.93 | 10.34 | 10.80 |
| 3 | Grain | 8.65 | 8.65 | 4.40 | 4.41 |
| | Hay | 3.00 | 2.95 | 3.50 | 3.56 |
| | Silage | 9.38 | 9.43 | 11.70 | 11.58 |
| 4 | Grain | 9.82 | 9.72 | 4.94 | 4.92 |
| | Hay | 3.16 | 3.15 | 3.70 | 3.93 |
| | Silage | 10.24 | 10.15 | 12.56 | 12.25 |
| 5 | Grain | 11.49 | 11.44 | 5.84 | 5.75 |
| | Hay | 2.99 | 2.88 | 4.00 | 4.76 |
| | Silage | 10.96 | 10.55 | 13.62 | 13.55 |
| 6* | Grain | 12.95 | 12.93 | 6.47 | 6.45 |
| | Hay | 2.04 | 2.22 | 3.80 | 5.23 |
| | Silage | 7.01 | 9.88 | 12.75 | 13.64 |
| SUMMER PERIOD | | | | | |
| 7 | Grain | 13.52 | 13.32 | 9.29 | 8.53 |
| | Hay | 3.35 | 3.34 | | |
| | Silage | 5.01 | 4.91 | | |
| 8 | Grain | | | 12.33 | 11.72 |
| 9 | Grain | | | 15.37 | 15.14 |
| 10 | Grain | | | 16.85 | 16.51 |
| 11 | Grain | | | 15.96 | 14.81 |
| 12 | Grain | | | 16.80 | 14.32 |

*1925-26 average only.

slightly greater size in the calves at the outset and to the better quality of the hay. Average data for the two years show that during the first 112 days on full feed on pasture little difference occurred in the feed eaten, but during the last 56 days the heifers showed less appetite and actually ate less than the steers. The steers grazed somewhat better than the heifers although both lots of cattle grazed well.

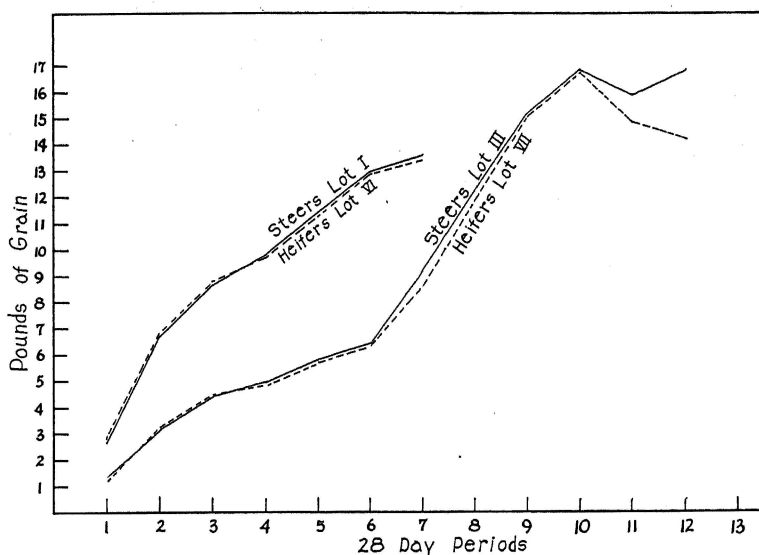


Fig. 2.—Pounds of grain consumed per head daily.

The calves fed limited grain in winter ate considerably more roughness during that period than the full fed cattle. The calves full fed through the winter increased their feed consumption through the entire period. The daily grain consumption of those steer calves finished on grass remained nearly constant during the last 112 days of the feeding period while the daily grain consumption of the heifers decreased slightly during the last two months.

The steer calves full fed through the winter made slightly greater daily gains than the heifers, but in both cases the gains were economical and satisfactory. The average daily gain on the steers showed a tendency to increase throughout the period, while the heifers showed this tendency to a less extent. Heifers appeared to be somewhat fatter than the steers at the time of marketing.

Where the limited grain was fed during the winter there was little difference between the steers and heifers in the rate of gain, but the heifers appeared to be somewhat fatter than the steers when put on pasture. When full fed on pasture the daily gain of the steers was more consistent than that of the heifers and averaged 20 per cent more. This difference in the rate of gain was particularly noticeable during the latter half of the full feeding period, yet the heifers appeared fatter at the time of marketing.

The cattle wintered on a limited grain ration gained approximately three-fourths as rapidly during that period as the calves which were full fed. The average daily gain for the entire period made by the

TABLE 2.—AVERAGE DAILY GAIN PER ANIMAL BY PERIODS
(Average of 2 Years' Results)

| 28-Day Periods | Full fed in dry lot | | Half grain ration with hay and silage during winter. Full fed grain on grass during summer | |
|---------------------------------|---------------------|----------------|--|-----------------|
| | Lot I Steers | Lot VI Heifers | Lot III Steers | Lot VII Heifers |
| 1 | 1.45 | 1.46 | .78 | 1.17 |
| 2 | 1.99 | 1.72 | 1.42 | 1.36 |
| 3 | 2.18 | 2.17 | 1.64 | 1.66 |
| 4 | 2.45 | 2.25 | 1.73 | 1.79 |
| 5 | 2.53 | 1.97 | 1.94 | 1.88 |
| 6* | 2.52 | 2.23 | 2.18 | 2.28 |
| AVERAGE FOR WINTER PERIOD | | | | |
| | 2.15 | 1.96 | 1.62 | 1.64 |
| 7 | 2.20 | 1.84 | 1.71 | .88 |
| 8 | | | 2.29 | 2.04 |
| 9 | | | 2.38 | 2.01 |
| 10 | | | 2.00 | 1.97 |
| 11 | | | 1.71 | 1.04 |
| 12 | | | 2.16 | 1.83 |
| AVERAGE FOR SUMMER PERIOD | | | | |
| | 2.20 | 1.84 | 2.05 | 1.64 |
| AVERAGE DAILY GAIN BOTH PERIODS | 2.16 | 1.94 | 1.84 | 1.64 |

*1925-26 Average only.

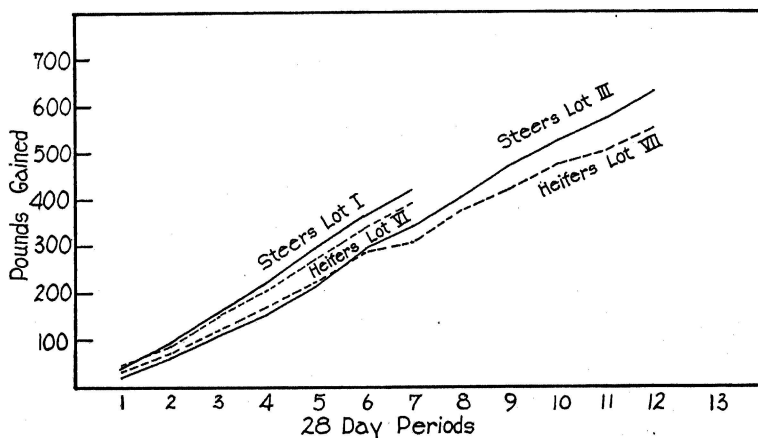


Fig. 3.—Gain produced by periods.

calves full fed through the winter and then sold was slightly greater than that made by the calves wintered on a limited grain ration and then full fed on pasture. The use of a limited grain ration during the winter and the longer period involved in their production explains this difference. The feeding period of the cattle finished on grass was

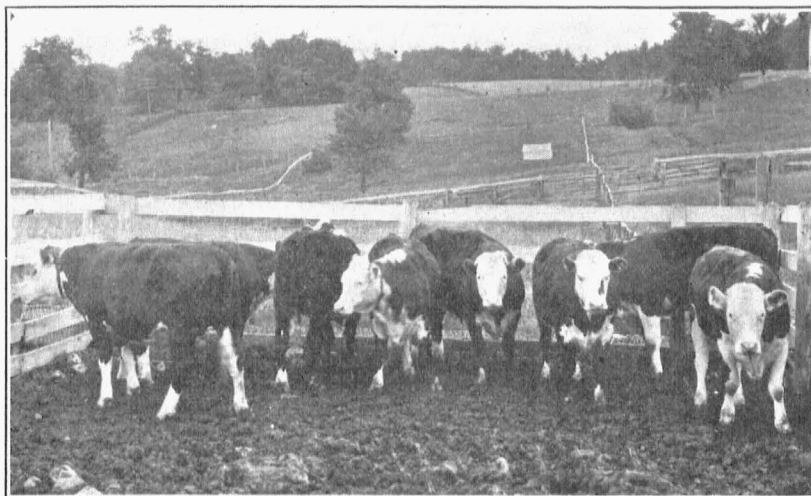


Fig. 4.—Light steers as they appeared after being full fed grain in dry lot 196 days.

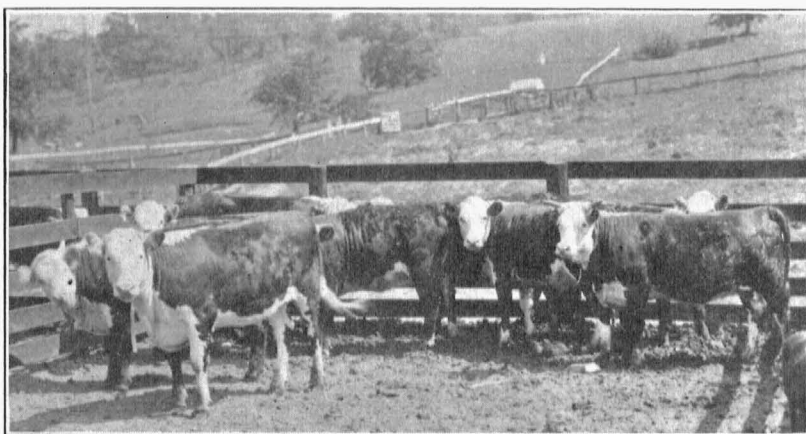


Fig. 5.—Light heifers as they appeared after being full fed grain in dry lot 196 days.

distributed over nearly a year and involved the use of more roughness and grass than was used by the cattle finished by full feeding in the winter.

Where the fattening process continued over a relatively long period the superior ability of the steers to continue to grow as the fattening period progressed was very noticeable.

Weights and Gains

Ten per cent greater total gain was made by the steer calves full fed through the winter than by the heifers similarly handled, but the gains of both lots were satisfactory.

When steer and heifer calves were fed a half grain ration through the winter little difference in total gain between the sexes resulted. When these same calves were later full fed for 168 days on pasture, however, the steers made 20 per cent greater gains than the heifers.

Both steers and heifers full fed through the winter practically doubled their initial weight, while the cattle finished on grass increased 160 per cent in weight from the beginning until marketed. Therefore, a relatively large part of the weight marketed was produced in the fattening process. While more time is required to fatten calves than older cattle, the calves require less initial investment to market

TABLE 3.—SUMMARY WEIGHTS AND GAIN PER ANIMAL WITH PORK CREDITED
(Average of 2 Years' Results)

| | Full fed in dry lot | | Half grain ration with hay and silage during winter. Full fed grain on grass during summer | |
|------------------------|---------------------|----------------|--|--------------------|
| | Lot I Steers | Lot VI Heifers | Lot III Steers | Lot VII Heifers |
| WINTER PERIOD | 154 Days | 154 Days | 154 Days | 154 Days |
| Initial Weight | 358.8 | 357.5 | 358.1 | 353.8 |
| Final Weight | 691.1 | 658.7 | 607.6 ¹ | 605.8 ² |
| Gain | 332.3 | 301.2 | 249.5 | 252.1 |
| Pork | 16.4 | 12.45 | 6.6 | 9.28 |
| SUMMER PERIOD | 28 Days | 28 Days | 168 Days | 168 Days |
| Initial Weight | 691.1 | 658.7 | 604.3 ³ | 606.2 ⁴ |
| Final Weight | 752.7 | 710.2 | 948.7 | 881.1 |
| Gain | 61.6 | 51.5 | 344.3 | 274.9 |
| Pork | 4.5 | 5.5 | 64.9 | 63.9 |
| TOTAL FOR BOTH PERIODS | 182 Days | 182 Days | 322 Days | 322 Days |
| Initial Weight | 358.8 | 357.5 | 358.1 | 353.8 |
| Final Weight | 752.7 | 710.2 | 948.7 | 881.1 |
| Gain | 393.9 | 352.7 | 593.8 | 527.0 |
| Pork | 20.9 | 18.01 | 71.5 | 73.2 |

¹Average of 9 steers in winter of 1925-26.

²Average of 8 steers summer of 1925-26.

³Average of 9 heifers in winter of 1926-27.

⁴Average of 8 heifers in summer of 1926-27.

At close of the winter period in 1925-26 a steer was removed from Lot III for slaughter test. At close of the winter period in 1926-27 a heifer was removed from Lot VII for slaughter test.

a given quantity of feed, minimize the speculative features of the venture, and make the most of the quality purchased. Since the steers show greater total gains than the heifers their advantage in this respect is clear.

No appreciable difference appears in the amount of pork produced behind the steers and heifers either when full fed through the winter or when finished on grass. The gain on the hogs following the calves full fed in dry lot was approximately 5 per cent as much as the gain on the cattle, or .78 pound per bushel of corn fed. The pork produced behind cattle finished on grass equalled 12 per cent of the gain on the cattle, or 1.55 pounds per bushel of corn fed the cattle. While the gain on hogs per bushel of corn fed the cattle usually increases as the age of the cattle advances, it must be borne in mind that hogs following cattle full fed on pasture have the advantage of the grazing which is effective in the production of pork gains.

Feed Consumed Per 100 Pounds Gain

The feed required to produce 100 pounds gain on steers and heifers full fed 182 days showed only slight variations for the two sexes during the first 100 days, but thereafter the gain on the steers showed decidedly greater economy. As the fattening period advanced the difference in economy of gain became more noticeable and the heifers appeared to approach finish more rapidly than the steers. Eleven per cent more grain and 20 per cent more roughness were required to make 100 pounds gain on the heifers than on the steers for the entire period. The increased cost of gain as the feeding period advanced is evident from the fact that during the last 56 days of the feeding period the steers required 98 per cent more grain and ate only 65 per cent as much roughness per 100 pounds gain as they required during the first 56 days, while the heifers required 120 per cent more grain and 70 per cent as much roughness as they did during the first 56-day period.

Steers and heifers wintered on a limited grain ration with roughness consumed approximately the same amount of feed per 100 pounds gain during the first 140 days of the winter feeding period. In the last period of the winter the heifers required 22 per cent more grain and 40 per cent more roughness to produce 100 pounds of gain than the steers. They were noticeably fatter than the steers.

During the summer feeding period steers made their gains somewhat more economically and much more regularly than heifers, especially during the latter part when the heifers became somewhat irregular in feed consumption. In the first period of summer of the 1926-1927 trial the heifers made only slight gains; therefore, the feed requirement per 100 pounds gain was relatively high. Likewise, the

TABLE 4.—FEED REQUIRED TO PRODUCE 100 POUNDS GAIN
(Average of 2 Years' Results)

| 28-Day Periods | | Full fed in dry lot | | Half grain ration with hay and silage during winter. Full fed grain on grass during summer | |
|--------------------------------|--------|---------------------|----------------|--|-----------------------|
| | | Lot I Steers | Lot VI Heifers | Lot III Steers | Lot VII Heifers |
| WINTER PERIOD | | | | | |
| 1 | Grain | 189.87 | 183.02 | 165.37 | 110.37 |
| | Hay | 293.01 | 253.5 | 511.3 | 334.1 |
| | Silage | 638.6 | 530.4 | 1115.4 | 726.0 |
| 2 | Grain | 340.08 | 396.38 | 227.46 | 251.43 |
| | Hay | 150.6 | 184.7 | 251.78 | 265.2 |
| | Silage | 453.1 | 517.23 | 732.2 | 822.41 |
| 3 | Grain | 401.73 | 408.58 | 275.09 | 267.96 |
| | Hay | 133.67 | 132.45 | 214.91 | 213.06 |
| | Silage | 427.66 | 435.78 | 715.06 | 695.15 |
| 4 | Grain | 401.11 | 433.07 | 286.73 | 274.29 |
| | Hay | 128.48 | 141.56 | 214.21 | 219.96 |
| | Silage | 417.61 | 415.42 | 725.16 | 683.84 |
| 5 | Grain | 453.99 | 581.42 | 305.51 | 306.50 |
| | Hay | 117.27 | 146.71 | 210.72 | 255.61 |
| | Silage | 433.06 | 535.31 | 706.75 | 722.56 |
| 6* | Grain | 512.74 | 551.99 | 230.15 | 282.52 |
| | Hay | 80.70 | 94.74 | 135.08 | 229.21 |
| | Silage | 278.05 | 422.03 | 453.33 | 597.74 |
| SUMMER PERIOD | | | | | |
| 7 | Grain | 615.20 | 790.78 | 605.16 | 15372.00 ¹ |
| | Hay | 152.58 | 183.02 | Grass | Grass |
| | Silage | 228.48 | 285.05 | Grass | Grass |
| 8 | Grain | | | 587.26 | 567.41 |
| | Grass | | | | |
| 9 | Grain | | | 671.67 | 728.18 |
| | Grass | | | | |
| 10 | Grain | | | 841.39 | 846.69 |
| | Grass | | | | |
| 11 | Grain | | | 933.13 | 2288.89 ² |
| | Grass | | | | |
| 12 | Grain | | | 774.25 | 784.38 |
| | Grass | | | | |
| AVERAGE FOR ALL PERIODS | | | | | |
| | | 182 Days | 182 Days | 322 Days | 322 Days |
| | Grain | 421.7 | 468.2 | 516.6 | 552.2 |
| | Hay | 114.6 | 161.9 | 97.0 | 117.9 |
| | Silage | 399.5 | 450.4 | 297.0 | 335.8 |
| | Grass | ----- | ----- | 168 Days | 168 Days |

*Average of 1926-27 only.

Note: In the 1925-26 test the cattle made only small gains during these periods. If the total feed consumed for the period for both years is divided by total gain for both years the resulting feed per 100 pounds of gain would be as follows: 1 = 970.1 lbs. — 2 = 1415 lbs.

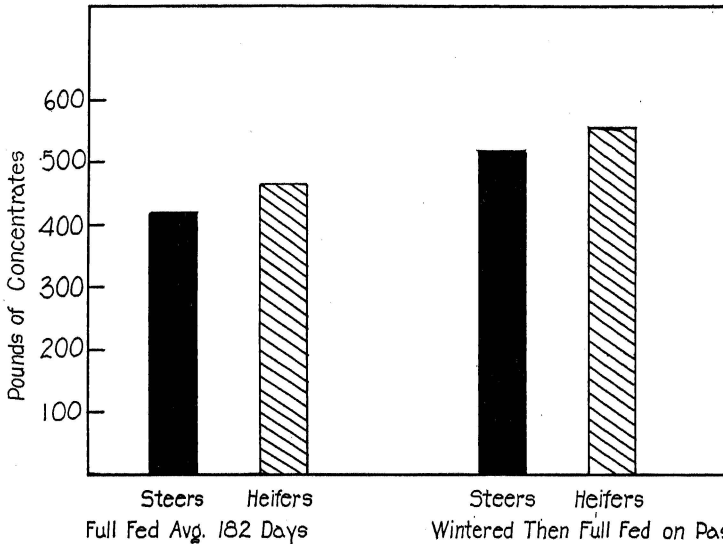


Fig. 6.—Pounds of concentrates required to produce 100 pounds gain.

gain for the eleventh period is unduly expensive because of the small gain made during that period.

For the entire period the heifers required 7 per cent more grain and 15 per cent more roughage than the steers for every 100 pounds gain. During the period that the cattle were on grass, however, the heifers required 12 per cent more grain to produce 100 pounds of gain.

Only slight and regular increase in the grain required to produce gain occurred with either steers or heifers while on a limited grain ration during the winter, but after they were put on full feed on pasture the requirement increased materially. The tendency for the grain requirement for both heifers and steers to remain constant during the last three periods may be due to the better feeding weather of fall covered by this period. However, the grain per 100 pounds gain required by the steers during the last 56 days was more than 400 per cent greater than during the first 56 days and the difference was considerably greater than this with the heifers. During the summer period all the cattle had what grass they would consume and this should be borne in mind in considering these data.

The feed required per unit of gain for the entire period is greater for cattle that were fed a limited grain ration through the winter and finished on grass than for the cattle that were full fed in dry lot, even though the grass is not considered. Twelve per cent more grain per 100 pounds gain was consumed by them. Since the dry roughness was fed only during the winter, while the gain for both winter

and summer is included in the data, the dry roughage per pound gain appears small. Grass which could not be measured was available during the summer while the cattle were on full feed. The cattle getting limited grain through the winter consumed considerably more roughness than the cattle on full feed.

While the cattle marketed at a lighter weight produced more gain from a given amount of feed than cattle fed a half grain ration through the winter and finished on pasture, it is significant that such cattle when fed largely on roughness through the winter and finished on bluegrass pasture, have made a suitable market for the greater amount of coarse feed and have utilized some grass in the fattening process.

Carcasses Produced

While the rapidity and total amount of gain and the feed required to produce it may be accurately recorded, the quality of the product is less easily measured. From the producer's standpoint, the ration, gain, economy of gain and selling price are the important factors involved. The selling price is based on the buyers' estimate of the weight, fatness and dressing percentage of the cattle and the quality of meat. A final evaluation of the meat, however, based upon a study of the carcasses and the cooked meat, is of importance. Therefore, the live cattle and carcasses were graded and cooking tests were conducted.

The average weights at the time of marketing in June of the steers and heifers full fed through the winter were 733 pounds and 696 pounds respectively. The steers made an average gain of 41 pounds more than the heifers which accounts for the difference in the market weights, but is not sufficient to account for any great variation in the price of the two lots of cattle.

The heifers were somewhat fatter than the steers after 168 days feeding in both experiments and this is a basis for price differences indicated. After 168 days feeding in the first year the heifers sold for \$10.00 per cwt., or 25c per cwt., more than the steers. After the same length of feeding period the second year, the heifers were valued at \$10.00 per cwt., and the steers at \$9.50 per cwt. The cattle in the second trial, however, were fed 28 days longer and during that time the steers did exceptionally well so that they actually brought \$11.50 per cwt. when sold and the heifers \$11.00 per cwt.

The somewhat higher degree of fatness of the heifers is reflected in the grades and in the higher dressing percentage which they showed in both experiments. Steers graded slightly higher than heifers at the outset but when finished the reverse was true. When the carcasses were graded the light heifers graded over 3 per cent higher than

TABLE 5.—SELLING WEIGHT, SELLING PRICE, DRESSING PERCENTAGE, AND GRADES AS FEEDER CALVES, SLAUGHTER CATTLE AND CARCASS GRADE
(Average of 2 Years' Results)

| | Full fed in dry lot | | | |
|-----------------------|---------------------|----------------|----------------|-----------------|
| | Lot I Steers | Lot VI Heifers | Lot III Steers | Lot VII Heifers |
| Selling weight (lbs.) | 733 | 696 | 917 | 848 |
| Selling price | \$10.62 | \$10.50 | \$14.45 | \$12.62 |
| Dressing per cent | 57.3 | 59.1 | 59.5 | 60.25 |
| GRADES | | | | |
| Feeder calves | 83.97 | 83.50 | 83.98 | 83.75 |
| | Choice | Choice | Choice | Choice |
| Slaughter cattle | 80.92 | 81.22 | 83.91 | 83.14 |
| | Choice— | Choice— | Choice | Choice— |
| Carcasses | 76.55 | 79.68 | 82.73 | 82.77 |
| | Good | Good+ | Choice— | Choice— |

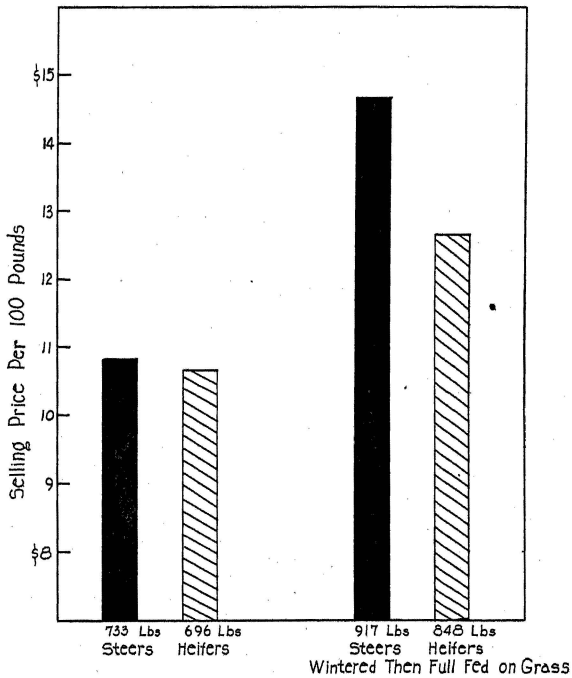


Fig. 7.—Selling price per 100 pounds of steers and heifers of different weights.

the light steers while the heavier heifer and steer carcasses were graded nearly the same. Detailed study of the score cards showed that the heifers were fatter than the steers but showed less fullness of loins and quarters.

In these trials heifers gained economically for 168 days, and developed highly desirable slaughter condition in that time, while the steers required 196 days to show an approximate equal finish but gained with equal economy over this longer period.

The cattle fed through the winter on a half grain ration and all the silage and hay they would eat, gained slightly more than $1\frac{1}{2}$ pounds daily. At the end of the winter the heifers were barely fat enough to sell for slaughter, while the steers would have sold for slaughter only in time of great scarcity of butcher stock. The heifers at this time were valued at 40c per cwt. more than the steers.

After 84 days of full feeding on pasture the heifers were valued at approximately 25c more per cwt. than the steers because they were fatter and of very desirable market weight and condition. Up to this time their gains had been reasonably satisfactory. After 112 days of full feeding the steers were valued slightly higher than the heifers and the difference increased until the end of 168 days of full feeding.

When marketed the steers and heifers weighed 917 pounds and 848 pounds respectively. Their winter gains were approximately the same, but during the summer period the steers gained 70 pounds more than the heifers. The heifers appeared fatter than the steers, but were not as smooth. They showed unevenness at tail-heads, and hip points, had developed undesirably heavy briskets, and had begun to develop the angularity and other characteristics typical of mature female cattle. The price realized for the heifers was \$1.83 per cwt. less than the steers brought.

The heifers showed $\frac{3}{4}$ per cent higher dressing percentage than the steers.

The average feeder, slaughter, and carcass grades of these steers and heifer, differed but little. At the time of slaughter the steers carried a smoother covering of external fat and less internal fat than the heifers. No difference in the marbling of the meat is recorded on the score cards and while the total score is the same for the carcasses, the heifers were graded slightly below the steers on rounds, rumps and loins. This difference is slight and does not seem sufficient to account for the lower selling price of the heifers.

The calves marketed in the spring dressed 57 to 59 per cent, were of very desirable weight for the seasonal trade, and produced carcasses which graded "good" to "good+". The heifers dressed higher than the steers and yielded carcasses which were equal and in some cases superior to the steer carcasses.

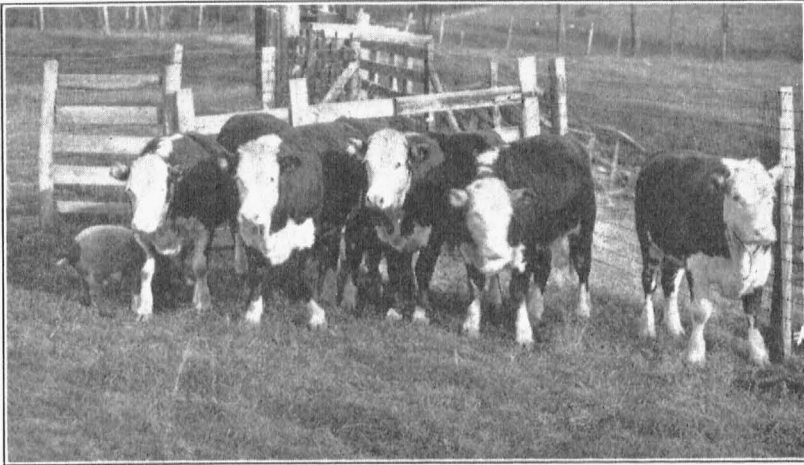


Fig. 8.—Yearling steers as they appeared after being wintered liberally then full fed grain on bluegrass pasture 168 days.

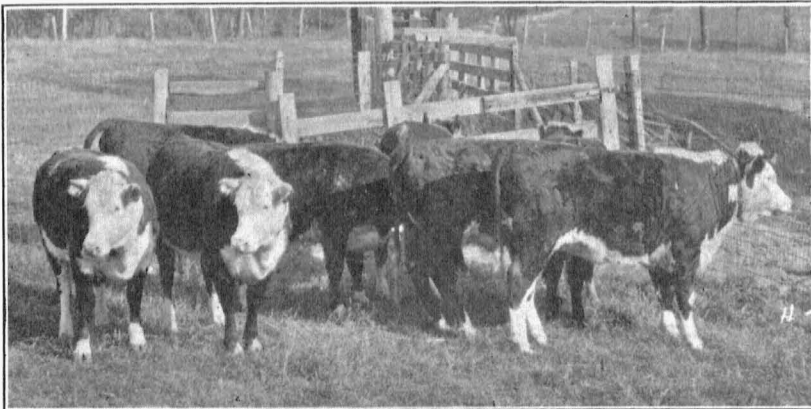


Fig. 9.—Yearling heifers as they appeared after being wintered liberally then full fed grain on bluegrass pasture 168 days.

The cattle which were wintered liberally and full fed 168 days dressed 1 to 2 per cent more than the calves marketed in the spring. There was little difference in the dressing percentage of the heifers and steers. Both steer and heifer carcasses produced highly desirable beef, but the heifers showed some waste and unevenness of covering not evident in the steers.

COOKING DATA

Roasts from the 9th, 10th, and 11th ribs of representative carcasses from each lot of cattle were cooked and studied. The first year all the cooking was conducted by the United States Department of Agriculture cooking laboratories, and in the second year the United States Department of Agriculture and the Home Economics Department at the University of Missouri participated in the work.

Representative roasts from steers and heifers were cooked by the same method and as nearly as possible under the same conditions. The roasts were accurately weighed before and after cooking and the percentage of shrinkage calculated from these weights. When the roasts were cooked and partially cooled they were sliced into uniform pieces approximately 5 mm. thick and placed on warmed, plates to be scored. The scoring was done by a committee familiar with meat investigations. The score cards used for grading the cooked meat included a consideration of aroma, texture, flavor of fat, flavor of lean, tenderness and juiciness.

The cooking tests made from a very limited number of cattle showed few, if any, consistent significant differences due to sex. The data obtained at the end of the 168-day period of the first trial show that the roast from the heifer carcass scored higher on tenderness and flavor of lean than the roast from the steer carcass. It is possible that the higher finish carried by these heifers may have increased the tenderness and flavor of the meat. There was little difference in the shrinkage of the two roasts.

The roast taken from the lot of steer cattle marketed in the spring of the second year's trial graded higher than the roast taken from the heifer lot. These cattle were fed 28 days longer than the cattle in the previous year's test and during the last 28 days the steers did better than the heifers. The steers and heifers showed more nearly the same finish the second year. The relative fatness of these steers may have influenced the cooking qualities of the meat. The roast from the steer shrank 3.77 per cent more than the roast from the heifer.

Roasts from the carcasses of steers and heifers full fed through the summer of the first experiment show only slight differences. The roast from the heifer carcass was graded higher than that from the steer on tenderness but lower in juiciness and showed greater shrinkage in cooking.

The average grades from the roasts of the steers and heifers marketed in the fall of the second test show that the roast from the heifer was somewhat more tender than the roast from the steer. Little difference was recorded between the roasts on flavor of the lean meat and shrinkage in cooking.

ANALYTICAL DATA

Various samples of the 9th, 10th, and 11th rib cuts from a limited number of representative carcasses were analyzed for fat, bone, protein, and moisture. The samples analyzed consisted of the edible portion which was a composite of the fat and lean of the rib cut, the eye of beef or the large back muscle lying above the ribs, the fat which could be hand separated from the lean and bone, the remaining edible portion or that part not included with the eye of beef, hand separable fat and bone, and the 9th, 10th, and 11th rib bones with the attached vertebra.

The first year the rib cuts were shipped to the United States Department of Agriculture laboratories for analyses. The second year the samples were analyzed by the United States Department of Agriculture and the agricultural chemistry department of the University of Missouri.

Analytical data from ribs of a steer and heifer full fed during the winter of the first trial showed that the edible portion of the 9th, 10th, and 11th rib cuts of the heifer contained 6.4 per cent more fat than the steer. In the second year the fat content of rib cut from the steer was slightly higher than the fat content of the same cut from a comparable heifer. The cattle in the second trial were fed 28 days longer than those in the first trial and during the last 28 days the steers made greater gains than the heifers.

The protein content of the eye of rib from the heifer ranged from .81 per cent to 3.7 per cent higher than the same samples from the steer. There was little difference in the edible protein between heifer and steer ribs of the first trial. The protein in the remaining edible portion was higher in the steer samples in both trials.

The fat content of rib samples from heifers wintered liberally, then full fed 168 days on pasture, averaged considerably higher than the fat content from rib samples of steers handled similarly. The protein content of ribs from steers was somewhat higher than comparable samples taken from heifers similarly fed. The carcasses from cattle wintered on a limited ration, then full fed through the summer, contained considerably more fat than corresponding samples from cattle full fed through the winter.

The protein content of the eye of beef and the edible portion was practically the same in the samples taken from steers and heifers wintered, then summer fed, and the steers and heifers full fed through the winter. The protein content of the remaining edible portion was higher in the younger cattle than in the older cattle.

There were no consistent differences in the percentages of bone in the samples taken.

SUMMARY STATEMENT OF PLAN AND DATA

A study was conducted to determine the relative rapidity and economy of gain, quality, conformation, and usefulness of carcasses produced by heifers and steers handled under two systems of management. One lot of grade Hereford steer calves and one lot of similar heifer calves weighing 350 pounds were full fed 168 days, being marketed in June weighing approximately 725 pounds. Two other lots of similar calves, one of heifers and one of steers, were fed a limited grain ration with hay and silage during the winter, full fed on grass through the summer, and marketed in the fall weighing approximately 900 pounds. The experiment was repeated a second year and the average summarized data with summary statements for the two trials appear below.

TABLE 6.—SUMMARY DATA (Average of 2 Years' Results)*

| | Full fed in dry lot (182 days) | | Half grain ration with hay and silage ad libitum in winter. Full fed grain on grass during summer (322 days) | |
|--|-----------------------------------|-------------------|--|--------------------|
| | Lot I Steers | Lot VI Heifers | Lot III Steers | Lot VII Heifers |
| Average initial weight..... | 358.8 | 357.5 | 358.1 | 353.8 |
| Average final weight..... | 752.7 | 710.2 | 948.7 | 881.1 |
| Total gain..... | 393.9 | 352.7 | 593.8 | 527.0 |
| Average daily gain..... | 2.16 | 1.94 | 1.84 | 1.64 |
| Average daily ration | | | | |
| Grain..... | 9.11 | 9.05 | 9.54 | 9.06 |
| Hay..... | 3.19 | 3.19 | 1.80 | 1.93 |
| Silage..... | 8.74 | 8.78 | 5.49 | 5.50 |
| Feed per 100 pounds gain | | | | |
| Grain..... | 421.7 | 468.2 | 516.6 | 552.2 |
| Hay..... | 114.6 | 161.9 | 97.0 | 117.9 |
| Silage..... | 399.5 | 450.4 | 297.0 | 335.8 |
| Grass..... | ----- | ----- | ----- | ----- |
| Total feed consumed | | | | |
| Grain..... | 1661.1 | 1651.3 | 3067.5 | 2910.0 |
| Hay..... | 569.5 | 571.0 | 576.0 | 621.5 |
| Silage..... | 1573.5 | 1588.5 | 1763.5 | 1769.5 |
| Grass..... | ----- | ----- | 168 days | 168 days |
| Initial cost per cwt..... | \$10.41 | \$9.07 | \$10.41 | \$9.07 |
| Initial cost per head..... | \$37.27 | \$32.46 | \$37.21 | \$32.11 |
| Feed cost per head..... | \$31.84 | \$31.78 | \$61.24 | \$59.24 |
| Marketing cost..... | \$2.94 | \$2.78 | \$3.44 | \$3.19 |
| Total cost..... | \$72.05 | \$67.02 | \$101.89 | \$94.54 |
| Pork Credit..... | \$2.39 | \$2.10 | \$8.20 | \$8.32 |
| Selling price per cwt..... | \$10.62 | \$10.50 | \$14.45 | \$12.62 |
| Market weight..... | 734.6 | 696.2 | 916.6 | 848.5 |
| Value per head (St. Louis)..... | \$77.96 | \$73.08 | \$132.12 | \$107.36 |
| Net for insurance, risk, profit, etc..... | \$8.30 | \$8.16 | \$38.43 | \$21.14 |

*This table is a simple average of the separate summary tables for the two years.

Feed price range: Corn 70c to 90c; linseed oil meal \$50.00 per ton; cottonseed meal \$35.00 to \$40.00; alfalfa hay \$18.00; corn silage \$5.00; grass 75c per month; pork \$10.00 to \$12.50.

SUMMARY

1. Steer feeder calves cost approximately 18 per cent more than heifer feeder calves of corresponding weight and quality.

2. Steer calves full fed an average of 182 days gained 41.2 pounds more than similar heifers fed the same way.

3. Heifers showed suitable market finish 30 to 40 days sooner than steers.

4. The daily feed consumption of steers and heifers full fed 182 days showed little difference.

5. Heifers full fed 182 days required approximately 11 per cent more grain and 25 per cent more roughage than steers to produce 100 pounds gain.

6. There was only slight difference in the selling price of fat steers and heifers weighing under 725 pounds.

7. The heifers full fed 182 days yielded a higher percentage of beef, graded higher as slaughter cattle and in the carcass than steers handled similarly.

8. The feed and marketing costs were approximately the same for steers and heifers full fed 182 days.

9. The steers in the winter fed lots showed slightly greater margin than the heifers for insurance, risk, interest, and profit because of the more economical gains and somewhat higher selling price. To be equally as profitable as steers, heifers handled in this manner must be purchased enough lower to offset their higher cost of gain although they may be finished in less time.

10. Steer and heifer calves wintered on a limited grain ration with hay and silage, then full fed on pasture, were marketed in late October weighing 949 pounds and 881 pounds respectively. The steers had gained 67 pounds more than the heifers.

11. The heifers were estimated to be fat enough to yield "good" carcasses after 60 days feeding on pasture. The steers were noticeably slower to become finished.

12. There was little difference in average daily feed consumption of the steers and heifers wintered, then summer fed, until the last 56 days of the fattening period when the heifers ate somewhat less feed. They were very fat and the warm weather may have been the cause.

13. The heifers required 7 per cent more grain and 15 per cent more roughage per 100 pounds gain than steers. There was little difference in the economy of winter gain, but as the summer feeding period advanced the feed required for gain for the heifers increased more rapidly than that for the steers.

14. The average selling price of heifers weighing 881 pounds was \$1.83 per 100 less than for steers weighing 949 pounds.

15. Heifers full fed during the summer dressed slightly higher and graded the same as slaughter cattle and in the carcasses as steers handled similarly.

16. The total cost of heavy heifers was 7 per cent less than similar steers but the steers had gained 67 pounds more than the heifers and their initial cost was approximately 18 per cent more.

17. The heavy steers returned more than similar heifers for insurance, risk, interest and profits because of their more economical gains and higher selling price.

18. There was no significant consistent difference in palatability of rib roasts from carcasses of steers and heifers of either group.

19. Cattle fed liberally during the winter, then summer fed, produced approximately 50 per cent more gain but required 80 per cent more grain than steers and heifers which were full fed 182 days.

20. Cattle which were marketed in the fall sold on an appreciably better market than the cattle marketed in the spring.

21. Steers and heifers wintered and summer fed dressed from 1 to 2 per cent higher than steers and heifers which had been fed 182 days.

22. Grading data and carcass studies show that cattle wintered, then summer fed, were better finished than cattle fed 182 days.

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