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UTILIZATION OF HOME GROWN FEEDS
IN FATTENING STEERS IN THE
TRANS-PECOS REGION

J. H. JONES, J. M. JONES, AND J. J. BAYLES

Division of Range Animal Husbandry

in cooperation with
Bureau of Animal Industry
U. S. Department of Agriculture



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In a series of eight steer fattening trials conducted at Substation No. 9, Balmorhea, from 1932 to 1939, more than 400 good to choice quality Hereford yearling steers were used in studying feeding problems common to the area. The studies involved methods of utilizing hegari fodder and alfalfa hay crops, supplemented with limited amounts of concentrated feeds.

It was possible to produce desirable market finish on heavy fleshy yearling steers in feeding periods of approximately 200 days with rations containing only 25 to 30 per cent of concentrate feeds and 70 to 75 per cent of roughage feeds. This is almost twice as long a feeding period as is usually required for fattening with rations high in grain, but the longer feeding period permits the utilization of large amounts of roughage feeds which may reduce feed costs.

Cottonseed, fed in limited amount, proved to be a good and usable feed in fattening yearling steers, particularly when the rations were somewhat limited in total concentrates.

Alfalfa hay was less valuable than ground well headed hegari fodder used in fattening rations either limited or high in concentrates.

The utilization of rations high in ground well headed hegari fodder enabled the marketing of $1\frac{1}{2}$ to 2 tons of hegari per steer at satisfactory prices.

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UTILIZATION OF HOME GROWN FEEDS IN FATTENING STEERS IN THE TRANS-PECOS REGION

J. H. Jones, J. M. Jones, and J. J. Bayles*

Division of Range Animal Husbandry, Texas Agricultural Experiment Station, cooperated with the Bureau of Animal Husbandry, U. S. Department of Agriculture, in this study from 1931 to 1935

The farming section served by the Balmorhea Station consists of an irrigated valley of approximately 11,000 acres surrounded by range lands used for cattle and, to some extent, for sheep production. It is typical of the farming communities in the Trans-Pecos Region where the growing of crops is almost entirely dependent upon irrigation. Most of the alluvial lands along the Rio Grande and Pecos rivers are irrigated and other important areas are farmed by irrigation from springs. The principal cash crops are cotton and alfalfa; because of climatic conditions only a limited variety of other crops are grown. In drouth years, alfalfa and other forage roughages may be sold advantageously for the maintenance of range cattle. As early as 1932, cotton, the most important cash crop, was becoming less profitable, and since 1932, because of restrictions under the AAA program, cotton has yielded acreage to various feed crops.

Substation No. 9 is located on the Old Spanish Road approximately four miles east of Balmorhea. The elevation is 3200 feet above sea level. The Station consists of 200 acres of land, of which 80 acres have an irrigation water right and 120 acres are in dry range. Additional crop acreage is leased for the production of feeds. Most of the farm work is performed with tractor power and equipment and two or three laborers are employed.

The Hereford breed predominates to the practical exclusion of other beef breeds on the range lands. (1) Cattle are comparatively free of diseases and parasites and, except for limited rainfall, the area is well adapted to livestock production. The winters are short and mild and as a rule the cold weather of winter is characterized by a steady cool temperature with much sunshine and moderate amounts of wind. The long summers are characterized by clear hot days, but the temperatures, especially at night, are modified by the high elevation of the region. The production of high grade feeder calves and yearlings is sponsored by the Highland Hereford Breeders Association, the annual Highland Hereford show and sale of feeder cattle at Marfa, Texas, being one of the most important livestock shows and sales in the range area.

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Hegari has been grown as the principal feed crop at the Station since the start of the Station's cattle feeding investigations. Only small acreages of the grain sorghums are grown for grain because of rather low yields and extensive damage by birds at harvest. Small acreages of oats and barley are planted for winter grazing and harvest. The sweet sorghums such as red top are grown for hay and silage. Atlas sorgo promises to be well adapted as a silage crop. Sudan grass has a limited use as a hay and temporary pasture crop. Cottonseed are sometimes available as a feed at an advantageous price because the area is within the pink boll worm quarantine zone and there is no local cottonseed oil mill.

Feeding Problems

The lack of a steady market, particularly for low grades of alfalfa hay, and decreasing returns from cotton were operating in 1932 to suggest a program of livestock farming. Since that time the conditions have not changed materially and increased tonnages of sorghums have been produced. The scarcity of locally grown grains and the cost of transporting purchased grains, \$5.00 to \$8.00 per ton, from the South Plains farming area has been a handicap to fattening and has created a special problem in cattle feeding, forcing the utilization of large amounts of roughage feeds.

When the Station began feeding steers in 1931-32 as a farm enterprise and as a means of aiding farmers in the locality to create a market for their roughages, it was not known whether livestock feeding could be fitted into the farm program in the area. It was apparent, however, that a program of feed utilization could not be complete without cattle. The Station was cognizant of the fact that types of livestock production are governed by the feed supply, that crops and markets determine the livestock that can be most advantageously fitted for market, and that the judgment shown in purchasing a class of cattle suitable for the available feeds, the labor situation and the time of marketing all contribute to the success or failure of the enterprise. Since the Station operated its feeding enterprise under a program of self-maintenance, practical considerations were necessarily observed.

The nature of the available feeds offered two main problems; first, the selection of a class and grade of cattle which would make the most economical use of rations high in roughage, and second, the combination of the available feeds into efficient rations. It was assumed without the benefit of experimental work at the Station that yearling steers of high feeder grade would be the most profitable class of feeders to utilize roughage feeds in fattening. In instances the steers were purchased and placed immediately on feed in dry lot; in other instances they were given as much preliminary grazing as was available on the farm.

Review of Literature

Many feeding trials variously entitled have been conducted by other experiment stations with reference to the feeding of rations limited in concentrates, and much of this work has been reviewed.

Bohstedt (2), while at the Ohio Station, reported that in fattening calves, yearlings, and two-year-olds, a full corn allowance in the case of all age classes caused the cattle to gain more quickly and get into better market condition; and that because of the demand of the market for good covering of flesh, heavy corn feeding proved more profitable in every instance. In another trial, a ration of alfalfa hay and corn silage did not produce gains large nor economical enough to make a profitable ration, and oil meal in the ration made for better gains and appearance, and proved an economical addition. Corn full fed during the last part of the feeding period resulted in the best gains, most compensating market price, and most profit.

Gerlaugh (3), also at Ohio, reported a 266-day trial with yearling steers in which the lot full fed corn gained 2.04 pounds daily; the lot fed $\frac{3}{4}$ as much corn gained 1.88 pounds; and the lot fed $\frac{1}{2}$ as much corn gained 1.65 pounds. Cost of gain, finish and market valuation all favored the larger amounts of corn.

At the Nebraska Station (4), in a short test in which three lots of light calves were fed for 114 days on 3, 6, and 9 pounds of ground shelled corn with alfalfa and silage, the average daily gain for all groups seemed to be in proportion to the grain fed, the heaviest fed calves gaining 2.26 pounds daily.

At the Iowa Station, Evvard (5) stated that: "In years of relatively cheap corn when the dry matter in the corn silage costs practically as much as in the corn grain, the limitation of the corn grain for cattle such as those used (two-year-old steers) is doubtful, particularly since the heavy grained cattle sell for more per cwt."

Kennedy (6), also of the Iowa Station, reported that in a 189-day feeding period it did not appear to be possible to finish cattle on light or medium grain rations so as to sell for as high a price as similar cattle fed on heavy grain rations, but that gains on fattening cattle could be made at smaller cost with light or medium grain rations than with heavy grain rations.

Pew (7), also of the Iowa Station, made the following statement: "In comparing limited feeding and full feeding two-year-old steers for a period of 120 to 160 days, the difference in daily and total gains is small but somewhat in favor of the heavy grain feeding. Whether or not limited or full feeding should be followed is dependent largely on the final selling value. When there is but very little spread between the well and the light corn fed cattle, the limited corn fed cattle will pay out the best."

Gramlich (8), of the Nebraska Station, after posing the question, "Can beef be made without corn?", reported as the result of a 130-day test that "The feeding of a heavy silage ration did not produce as much finish as the feeding of corn in conjunction with cottonseed cake and alfalfa, but did result in considerable fleshing and a market price which left a margin of profit."

Allison (9) of the Missouri Station stated that: "If the most extensive use is to be made of corn silage in fattening cattle, it is desirable to feed some high protein concentrate in the ration." As the result of another test (10) with two-year-old steers fed for 133 days, he stated that: "The average daily gain in live weight made by the cattle in the lots which received no corn other than that contained in the silage, while not as large as when shelled corn was fed, were satisfactory for fattening cattle."

Trowbridge (11), of the Missouri Station, in reporting a 100-day feeding trial with two-year-old steers that averaged 1028 pounds initial weight, made the following statements which are of interest: "When corn silage and legume hay are relatively cheap, as compared with corn, extensive use, with or without a small quantity of linseed oil meal, is shown to be advisable, especially during the early part of a feeding period. Slightly better results were obtained where cattle were started on corn silage, legume hay and linseed meal, with a full feed of corn added during the last 40 days of a 100-day feeding period, than where cattle were fed corn silage, legume hay, linseed meal and a half ration of corn throughout the 100-day feeding period. Neither of the lots so fed made much more gain than a lot fed similarly but without corn. Full fed steers gained about 25 per cent more than those which did not receive corn."

The Minnesota Station (12 and 13) reported trials in fattening steer calves in which corn and cob meal was full fed, 85% full fed, 70% full fed, and in another lot 60% full fed for 56 days, 70% and 85% full fed in two ensuing 56-day periods and full fed in the final 42 days. The 85 per cent full fed lot made greater gain and as much finish as the full fed lot. Results from limiting the amount of concentrates to 60 per cent for the first 56 days and then making increases to 100 per cent full fed were better than for 70 per cent full fed; but neither produced as good results as 85 per cent full feeding or 100 per cent full feeding. In another trial, 78 per cent full feed of shelled corn returned more profit than a 91 per cent full feed and both returned greater profit than a 100 per cent full feed of corn and cob meal. In two trials a full feed of corn and cob meal surpassed a full feed of shelled corn in profit. The general conclusions were stated as follows: "(1) Baby beeves can be fattened most profitably by limiting the allowance of concentrates somewhat below a full feed. (2) A full feed of corn and cob meal surpassed a full

pounds daily, increased the average daily gain 0.74 pound; a small amount, 5.42 pounds daily, increased the gain .21 pound; and the addition of corn during the last 40 days increased the gain .12 pound above that secured with no corn and the basal silage ration.

In tests at Spur, Texas, (22) heavy feeder yearling steers were brought to reasonably good market finish in about 7 months on rations consisting of 5 to 5½ pounds of cottonseed meal and a full feed of sumac silage. In another test (23) steers which were fed 8 pounds of ground milo heads per head daily for the last 98 days made slightly (18 pounds) more gain but carried less finish than steers which were fed 4 pounds of ground milo heads daily for the entire 196-day feeding period when both lots received the same amounts of cottonseed meal and sumac silage was fed according to appetite.

In tests at Big Spring, Texas (24), steer calves full fed milo grain made greater gain, higher finish, sold at a higher price per pound, and returned a larger profit than those receiving a limited amount of milo grain; however, the ones fed the limited grain consumed less total concentrates per pound of gain than those which were full fed.

The results of the feeding trials which have been conducted in limiting the allowance of total concentrates in fattening rations, show that within certain limits, gain, finish, and dressing percentage are proportional to the amounts of concentrates which are fed, provided the rations are properly supplemented. The literature, however, shows many instances in which large amounts of roughage feeds were profitably marketed in fattening mature cattle. In fattening it is apparent that calves require a higher percentage of grain in the ration for finishing within a designated period than mature cattle. The slight restriction of grain feeds in fattening appears to make for economy of gain and does not necessarily appear to decrease marketability. The method of restricting the allowance of grain by not feeding grain until the latter part of the fattening period has apparently been more advantageous than restricting the grain throughout the feeding period. The question as to the amount of grain which should be fed cannot be answered definitely owing to varying prices of beef in relation to grain costs, length of feeding period, and other factors; however, the individual feeder with good information upon various phases of feeding will usually be able to determine a satisfactory procedure.

Purposes of These Experiments

Considered as a whole, the various feeding trials were conducted in order to develop a method of feeding whereby large amounts of roughage feeds could be used advantageously in fattening yearling steers. In addition to presenting the results of various comparisons between feeds and rations, information is given in regard to prices of feeds, cattle, and

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financial outcome of the feeding trials in order that stockmen similarly situated might have means of measuring the soundness of the feeding enterprise and the merit of the various methods of feeding.

The method of the bulletin is to present the information classified according to years of work, summarizing the salient features of the several years of work with respect to the compared feeds and methods of feeding. The trials extended through eight successive years in which 420 steers were fed in 43 different lots. Numerous tests were made in feeding cottonseed, pulverized oyster shell or pulverized limestone as a calcium supplement, and different amounts of alfalfa hay with hegari fodder and silage. Comparisons were made between (1) alfalfa and ground hegari fodder as the roughage portion of the ration, (2) average and "stunted" or short-aged yearling steers, (3) ground hegari fodder and hegari silage, and (4) hand feeding and self-feeding; however, the principal study during the years was directed toward the utilization of large amounts of roughage feeds in fattening rations.

INFORMATION REGARDING EIGHT YEARS OF WORK

The conditions attendant to each feeding trial in the experiments here reported, such as cattle used, methods of feeding, feeds fed, analysis of feeds, feed prices, and other information, are presented.

Weights and Division Into Groups

Duplicate ear tag numbers were used for identification. The steers were weighed individually on three consecutive days at the beginning and end of each experiment, the averages of the three initial and final weighings respectively constituting the initial and final weights. Individual weights were taken at regular intervals during each of the feeding trials. The procedure which was followed with few exceptions was to start weighing Lot 1 at 1:00 p. m. on each weighing date and to proceed without interruption until the weights for all lots had been completed. The steers were divided as equally as possible with respect to size, type and feeder quality after the initial weight was secured. In most of the years, to aid in equal division into lots, two or more graders scored the feeders according to BAE-BAI Form 100, "Feeder Cattle Grading chart."

Feeds Used

The grain feeds consisted of threshed milo and milo heads which were purchased and the hegari grain contained in the hegari bundles. Much of the cottonseed which was used was produced by the Station farm. The alfalfa hay fed in 1932 was described as of low grade, that fed in

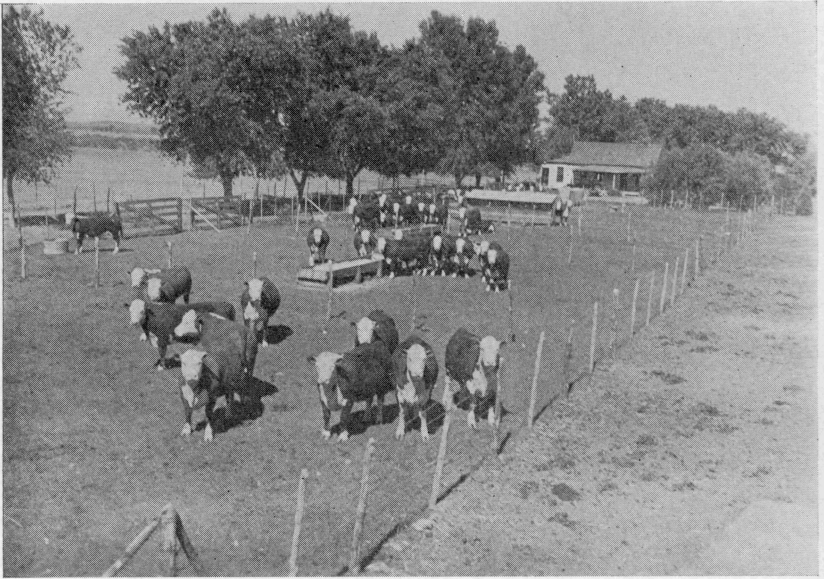


Figure 1. General view of feedlots showing self feeder in background, and drinking tank left rear.

1932-33 as medium to grassy, and that fed in 1936-37 as below average quality. In the other years it was considered as of about No. 2 grade.

Hegari fodder grown on the Station farm formed the principal roughage feed. It was generally of good quality and contained, with slight variation from year to year, approximately 25 per cent of grain. In one year, 1934-35, it was described as of 28-30 per cent grain content but in other years as of only 20-25 per cent grain content. Hegari silage was fed in only one test, 1938-1939.

Grinding

The hegari fodder was ground finely enough to also grind the contained grain. A hammer mill was used for grinding the grain and roughages except in 1938-39. While the dusty roughage resulting from the use of the hammer mill was somewhat objectionable, it was apparently palatable. The alfalfa hay was ground when the object of the test demanded the consumption of a definite percentage of alfalfa; otherwise, it was fed unground. Cottonseed was fed unground while threshed milo and milo heads were finely ground.

Feed Prices

The prices used for alfalfa hay, hegari fodder, cottonseed, sudan hay, and hegari silage were the estimated prevailing farm prices for the 10-

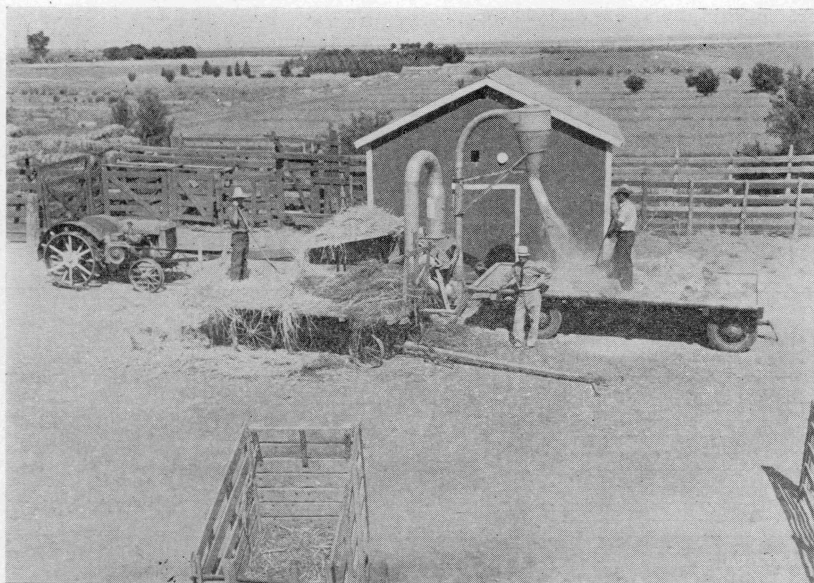


Figure 2. Feed grinding equipment. Feed storage house for ground fodder.

cality. Nominal charges were made for grinding or chopping the grain and roughage feeds, and these charges were included in the prices of the respective feeds. The prices for cottonseed meal, threshed milo, milo heads, salt, and pulverized oyster shell were the prices paid on purchase. All prices are shown in Table 1.

Except for two years, 1934-35 and 1935-36, alfalfa hay was consistently charged at a higher price than hegari fodder. Cottonseed meal was higher in price every year, 1933-34 excepted, than either cottonseed or

Table 1. Feed prices per ton

Feeds	1931-32	1932-33	1933-34	1934-35	1935-36	1936-37	1937-38	1938-39	Average price
Cottonseed meal -----	\$25.00	\$21.95	\$21.80	\$48.15	\$31.00	\$38.50	\$27.50	\$28.50	\$30.30
Cottonseed -----	8.00	9.00	12.00	36.50	36.00	33.18	17.50	-----	21.74
Ground threshed milo -----	17.00	16.00	25.00	47.20	26.00	22.00	25.50	17.67	24.55
Ground milo heads -----	-----	-----	-----	-----	-----	-----	-----	-----	13.50
Alfalfa hay -----	10.00	6.00	11.50	23.00	9.00	17.83	20.00	12.50	13.73
Ground hegari fodder -----	8.50	6.00	8.00	23.00	9.00	10.00	10.00	8.00	10.31
Hegari silage -----	-----	-----	-----	-----	-----	-----	-----	-----	3.50
Pulverized oyster shell -----	-----	-----	25.00	25.00	20.00	-----	-----	-----	23.33
Salt -----	20.00	18.00	17.00	19.00	17.00	17.00	17.00	17.00	17.75

ground threshed milo, and milo was slightly higher in price than cottonseed, except in 1935 and 1937. These conditions favored the feeding of cotton seed in most of the years in which it was fed.

Chemical Composition of Feeds Used

Table 2 shows the average values for the feeds in chemical composition and mineral content for the years in which analyses were obtained, as made by the Division of Chemistry.

Table 2. Percentage composition of feeds used during experiments including mineral content

Kind of feed	No. of samples analyzed	Protein	Fat	Crude Fiber	Nitrogen-free Ext.	Water	Ash	Ca	P	Mg
Cottonseed meal										
1931-32	2	41.54	9.88	11.14	26.86	5.79	4.80	.20	.90	---
1932-33	1	42.64	9.82	9.43	27.79	4.65	5.67	---	---	---
1933-34	3	43.64	8.19	9.47	28.39	4.95	5.37	.16	.89	---
1934-35	1	41.55	8.68	10.59	29.48	4.51	5.19	.17	.86	---
1935-36	2	44.02	7.68	9.67	26.37	6.68	5.58	---	---	---
1936-37	1	44.61	6.29	9.67	28.24	5.67	5.52	---	---	---
1937-38	1	42.99	9.25	8.42	26.25	6.95	6.14	---	---	---
Average		43.0	8.54	9.77	27.63	5.60	5.47	.18	.82	---
Ground threshed milo										
1931-32	2	11.62	3.02	1.94	71.06	10.84	1.51	.04	.24	---
1932-33	1	12.00	2.86	2.33	73.17	7.72	1.92	---	---	---
1933-34	5	12.48	2.81	2.18	71.91	8.89	1.75	.04	.27	.23
1934-35	1	13.50	2.84	2.56	69.98	9.46	1.66	.03	.27	.22
1935-36	1	11.20	3.02	2.89	68.66	12.64	1.59	---	---	---
Average		12.16	2.91	2.38	70.96	9.91	1.69	.04	.27	.22
Ground hegari fodder										
1931-32	2	6.08	1.36	20.20	55.60	9.04	7.72	.42	.14	---
1932-33	1	6.74	1.35	21.65	54.55	6.90	8.81	.28	.14	---
1933-34	6	8.07	1.75	14.19	61.17	7.87	6.96	.23	.19	.35
1934-35	1	6.02	1.83	17.26	57.90	8.19	8.80	.30	.13	.32
1935-36	1	6.50	1.63	21.53	49.77	11.96	8.61	.29	.17	---
1936-37	3	5.53	1.82	19.96	55.09	10.01	7.58	.27	.15	---
1937-38	1	5.30	1.69	19.13	50.67	15.37	7.84	.29	.14	---
Average		6.32	1.63	19.13	54.96	9.91	8.04	.31	.15	.34
Alfalfa hay										
1931-32	2	13.58	1.39	28.90	38.92	8.12	9.06	---	---	---
1932-33	2	14.56	1.91	29.36	40.24	5.47	8.46	1.14	.17	---
1933-34	5	15.17	2.08	28.65	38.53	6.77	8.79	1.06	.19	.57
1934-35	1	13.83	1.67	26.62	41.89	6.89	9.40	1.46	.12	---
1935-36	1	16.59	2.39	23.29	40.12	7.42	10.19	1.36	.17	---
1936-37	4	13.96	1.94	27.27	39.07	8.58	9.17	1.05	.15	---
1937-38	1	12.98	2.04	26.54	40.97	7.19	10.28	1.22	.12	---
Average		14.38	1.92	27.23	39.96	7.16	9.34	1.21	.15	.57
Ground milo heads										
1936-37	2	10.52	2.24	8.06	63.64	10.85	4.70	.12	.24	---
Ground mixed hegari and milo fodder										
1936-37	1	7.76	1.55	23.51	51.66	6.92	8.60	.36	.18	---
Ground milo fodder										
1936-37	1	9.05	1.71	23.02	48.71	9.73	7.78	.36	.17	---

Mineral Content of Stock Water

The cattle received water from an irrigation ditch each year except during 1932 when they were watered from a shallow well. Three samples of the water from the irrigation ditch were analyzed by the Division of Chemistry for mineral content as shown in Table 3.

Table 3. Analyses of stock water for mineral content: parts per million

Substance	Sample 1 12-20-33	Sample 2 5-15-34	Sample 3 5-11-37	Average of 3 samples
Carbonate of lime.....	168	148	106	141
Sulphate of lime.....	413	352	389	385
Sulphate of magnesia.....	346	141	185	224
Sulphate of soda.....	126	41	44	70
Chloride of soda.....	934	535	663	711
Total.....	1987	1217	1387	1531

Since the calcium content of the water, as well as of the feeds, may be expected to affect the results from feeding calcium carbonate supplements with fattening rations, the water consumption was measured for one lot of 10 steers during 1933-34. The average daily consumption for 126 days for steers of an average weight of 840 pounds was 6.86 gallons or approximately 0.81 gallon per cwt. liveweight daily. On this basis the average daily consumption of calcium from the water amounted to about 4.5 grams, about one-sixth ounce per head. Fattening steer calves fed a ration high in grain content at the Big Spring Station consumed, in the course of a 196-day fattening period, approximately 0.70 gallon per cwt. liveweight daily.

Equipment

The feedlots used were approximately 45x75 feet. The feed troughs were 3 feet wide and 20 feet long. The self feeder used during the last three years was built onto a regular feed trough and was open on one side only. Stock water was supplied from a well the first year but afterwards the water was taken from the irrigation ditch. The arrangement was such that there was a continuous small flow through the small water troughs.

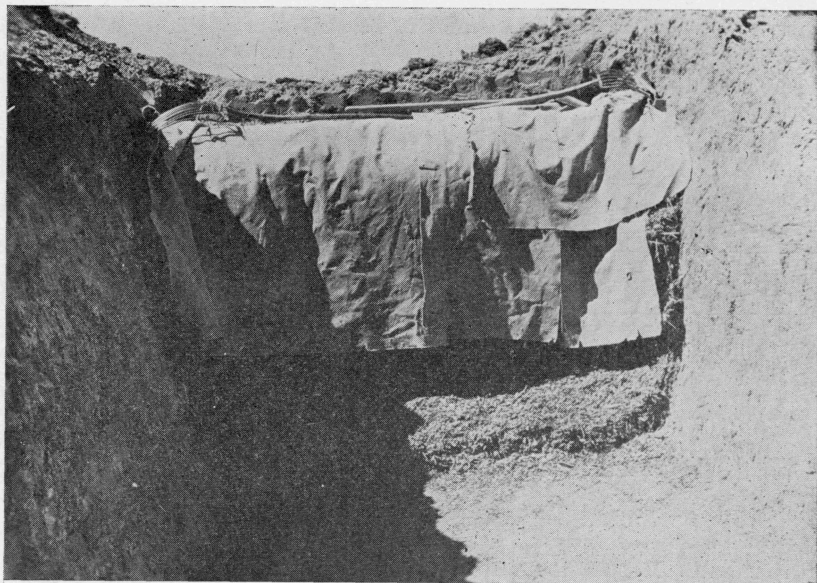


Figure 3. Trench silo. Note walls in foreground are holding up well after removal of silage. Hegari silage covered with old pieces of tarpaulin to protect remaining silage from light and severe drying as encountered in summer. Protection of exposed silage probably decreases losses of carotene from the silage.

Cattle Used

The steers used were above the average grade of cattle fed in most commercial or farm feed lots. High grade feeder steers were purchased because they are subject to a more uniform arrangement into experimental groups than steers of lower grade types.

In the first experiment (1931-32), thirty medium to good grade Hereford yearling steers were purchased November 21, 1931, at a cost of \$27.26 per head. After a preliminary grazing and feeding period of 55 days in which they consumed 1630 pounds of cottonseed and 1300 pounds of cottonseed meal, the 26 head used had an average initial weight of 597 pounds when placed on test, and cost \$4.69 per 100 pounds, not including any charge for grazing.

In the second experiment (1932-33), sixty lightly fleshed, medium to choice grade Hereford yearling steers, averaging approximately 410 pounds, were purchased August 8, 1932, at \$22.50 per head. They were pastured on the Station fields of sudan grass, second crop hegari, and alfalfa for 107 days, August 9 to November 25. They gained approximately one pound per head daily during this period and the 59 head used entered the feedlot at an average weight of 518 pounds and at a

cost, including a charge of 3¢ per head per day for grazing, of \$5.08 per cwt. The 30 heavier steers were fed as Lots 4, 5, and 6; the lighter ones, more or less short-aged and partially stunted, were fed as Lots 1, 2, and 3.

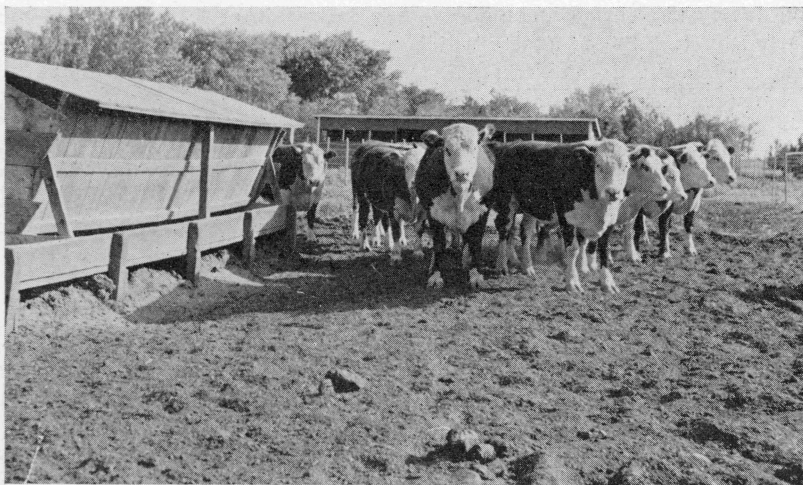


Figure 4. View of self-feeder box as built into feed trough. Used in feeding whole mixed rations of ground hegari fodder, alfalfa, cottonseed meal, and ground threshed milo.

In the third experiment (1933-34), sixty good to choice Hereford yearling steers were purchased October 13, 1933, and cost when delivered \$5.42 per cwt. They were grazed for 52 days on sudan and second growth hegari and were fed 2.5 pounds of cottonseed daily. They were penned December 4, and during a 16-day preliminary period consumed an average of 3 pounds of cottonseed, 1.5 pounds of cottonseed meal, 12 pounds ground hegari bundles, and 2 pounds of alfalfa per head daily. With a gain of 1.83 pounds per head daily for the 68 days of preliminary grazing and feeding, and with feeds used charged at market prices and grazing charged at 3¢ per head per day, the 58 steers used averaged 674 pounds and cost \$5.05 per cwt. when placed on test, December 20, 1933.

In the fourth experiment (1934-35), fifty-five good to choice Hereford yearling steers were purchased October 6 and 9, 1934. They were grazed most of the time on sudan and second growth hegari until placed on test December 12, 1934. During this preliminary period of 68 days they were fed about 3 pounds of concentrates and 7 pounds of roughage per head daily in addition to the grazing. They gained an average of 125.5 pounds per head during this period and entered the test at an average cost of \$5.86 per cwt. Of the 50 steers used, the 30 heavier ones were fed for 154 days while the 20 lighter ones were fed for 196 days.

In the fifth experiment (1935-36), fifty-four good quality Hereford yearling steers were purchased October 19, 1935. Forty head, purchased at the Highland Feeder Sale at Marfa were delivered to the Station October 19 and the remainder on November 9. They were grazed and fed on the Station fields from delivery to start of test November 21, and during this period made an average daily gain of 1.32 pounds. When started on test the 48 steers which were used averaged 595 pounds per head and cost into the test \$7.97 per cwt. The 30 heavier and older steers were fed for 168 days while the remainder were fed for 210 days.

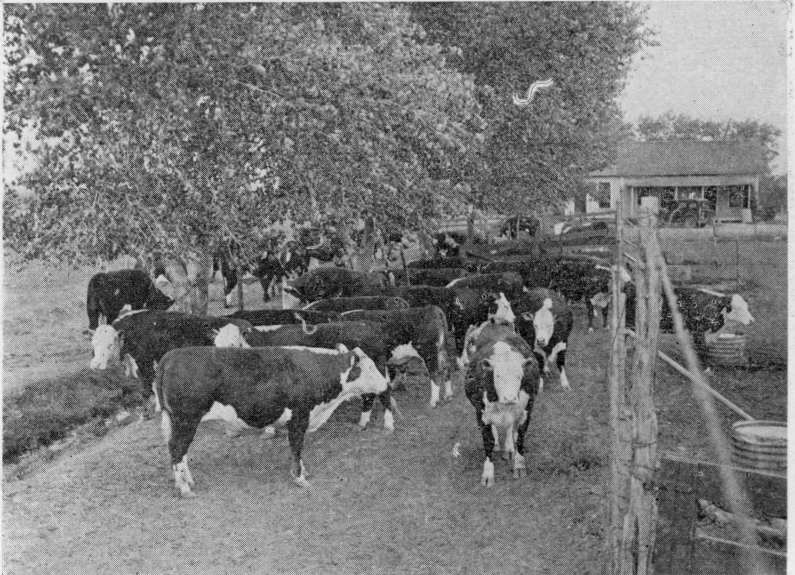


Figure 5. Steers are allowed shade during hot weather.

In the sixth experiment (1936-37), sixty-five good to choice Hereford yearling steers were purchased November 7, 1936. The sixty head selected for the test were in strong grass flesh and weighed an average of 720 pounds when started on test November 13. They cost when started on test \$6.56 per cwt.

In the seventh experiment (1937-38), sixty-five good to choice Hereford yearling steers were purchased at a cost of \$8.49 per cwt. when delivered to the feedlot. They were steers of approximately the same ages and from the same herd as those used in 1936-37, but in medium grass flesh. The sixty head which were selected for the test averaged only 652 pounds per head.

In the eighth experiment (1938-39), sixty good to choice quality Hereford yearling steers were purchased at \$7.75 per cwt. They were in strong grass flesh and weighed an average of 707 pounds when started on test without preliminary feeding, November 4, 1938.

Feeding

In hand feeding the rations were fed according to appetite. The feeds were fed twice daily and were mixed in the troughs at time of feeding. From November to April the feeds were placed in the troughs at 8 a. m. and 5 p. m.; from April to June, 7 a. m. and 6 p. m.; and after June, 6:30 a. m. and 7 p. m. When self feeders were used, approximately a week's supply of mixed ration was placed in the feeders at one time. Salt was supplied free choice with block salt being used for the first two years and granulated salt being used afterwards.

In 1931-32, 1932-33 and 1933-34 grain feeds were fed to all lots throughout the feeding period. Small amounts were fed at the outset and subsequent increases were made very gradually. In 1934-35 and 1935-36 Lots 1, 2 and 3 were fed in the regular manner but Lots 4 and 5 were not fed grain except that contained in hegari fodder for the first five months of the feeding period. After this time they were practically full fed grain until the close of the trials.

In 1936-37, 1937-38 and 1938-39 none of the lots were fed grain other than that contained in the hegari fodder for the first 112 days of the feeding period. Afterwards the feeder used his judgment to determine the amounts of grain needed to produce marketable finish.

On the average the rations used were high in roughage feeds, and low in concentrate feeds. The steers were seldom if ever crowded with concentrate feeds. Cottonseed meal was usually fed in the same amount from start to close of the feeding period and in such amount as to supply ample protein for fattening.

EXPERIMENTAL RESULTS

The conclusions from the several tests were based upon an evaluation of the various data such as gains on basis of both feedlot and market weights, carcass yields and grades, feeds consumed and feeds required per cwt. of gain.



Figure 6. Field Day Meeting, May 1937. Preliminary results of feeding trials are presented at field day meetings in cooperation with the Extension Service of the College.

Results 1931-32

1. Full versus limited feeding of grain, and
2. Influence of cottonseed in limited concentrate ration.

Lot 1 was full-fed ground threshed milo. Lot 2 received the same feeds except that the milo grain was limited to approximately 66 per cent of the amount fed to Lot 1. Lot 3 received a mixture of cottonseed, 1 part, and ground threshed milo, 2 parts, the amount of the mixture being limited to the amount of milo fed to Lot 2. All lots received the same amount of cottonseed meal and a roughage mixture consisting of 2 parts ground hegari fodder and 1 part of low grade alfalfa hay.



Figure 7. Representative lot of steers used in 1931-32 as feeders.

A summary of the test is shown in Table 4.

Table 4. Summary. January 15 to June 3, 1932—140 days

Lot Number.....	1	2	3
Number of Steers.....	8	8	10
Variables: 1. Concentrates	Full fed	Limited	Limited
2. Supplements to grain.....	CSMeal	CSMeal	CSM & CS
Averages in Pounds per Steer.....			
Initial weight.....	619	583	589
Final weight at feedlot.....	957	884	923
Final weight at Fort Worth market.....	901	839	872
Gain basis feedlot weight.....	338	301	334
Gain basis market weight.....	282	256	283
Daily gain basis feedlot weight.....	2.41	2.15	2.39
Daily gain basis market weight.....	2.01	1.83	2.02
Shrinkage enroute to market, per cent.....	5.85	5.09	5.53
Carcass weight (hot).....			
Dressing per cent, basis hot carcass & market wt.	566	519	546
Dressing per cent, basis hot carcass & feedlot wt.	62.81	61.86	62.61
Carcass grades—Armour	59.14	58.71	59.15
33's—top medium to good.....	6	4	8
34's—medium	2	4	2
Total feeds consumed			
Ground threshed milo.....	1412	934	623
Cottonseed			311
Cottonseed meal	262	262	262
Ground hegari fodder.....	759	1045	1098
Alfalfa	380	522	549
Salt	2.08	3.15	2.98
Average ration			
Ground threshed milo.....	10.08	6.67	4.45
Cottonseed			2.22
Cottonseed meal	1.87	1.87	1.87
Ground hegari fodder.....	5.42	7.46	7.84
Alfalfa hay	2.72	3.73	3.92
Salt, ounces .....	.24	.35	.34
Feed consumed per cwt. gain, basis feedlot wt.			
Ground threshed milo.....	418	310	187
Cottonseed			93
Cottonseed meal	78	87	78
Ground hegari fodder.....	225	347	329
Alfalfa hay	112	173	164
Cost of feed per cwt. gain (feed consumed)			
Basis feedlot weight.....	\$ 6.04	\$ 6.10	\$ 5.17
Basis market weight.....	7.24	7.15	6.10
Cost into feedlot at \$4.69 per cwt.....			
Feed cost (feed consumed).....	\$29.03	\$27.34	\$27.62
Marketing cost at \$0.528 per cwt.....	20.42	18.30	17.26
Total cost	4.76	4.43	4.60
Selling price per cwt.....	54.21	50.07	49.48
Amount received.....	5.69	5.28	5.46
Loss (no charge for labor).....	51.30	44.27	47.62
	2.91	5.80	1.86

With a 55-day preliminary feeding and grazing period, the steers had actually been fed for 195 days when marketed although the feeding test was for a period of only 140 days.

The average daily feedlot gain was 2.41 pounds for the lot which was full fed on grain as compared to 2.15 pounds for the lot which was limited. There was practically no difference in cost of gain between the lots;

however, the full-fed lot acquired higher finish, sold at a higher price and made a more favorable financial return.

Lot 3, limited on concentrates and receiving cottonseed as one-third of the grain allowance, made 2.38 pounds average daily gain, were about as well finished as the full-fed lot and showed more bloom than either of the other lots. The cost of gain was low because of the good rate of gain and the low price charged for the cottonseed.

Only 90 per cent as much concentrate feed was required to produce a cwt. of gain in Lot 3 as was required in Lot 2. On the basis of the feed required to produce 100 pounds of gain in Lots 2 and 3, one pound of cottonseed replaced 1.32 pounds of ground threshed milo.

Results 1932-33

1. Full versus limited feeding of concentrates
2. Fattening "short aged" versus average yearling steers
3. Cottonseed fed to replace one-third of the grain
4. Cottonseed fed to replace cottonseed meal and a portion of the grain.

This experiment continued the 1931-32 observations on the influence of cottonseed in a limited concentrate ration and included a study of replacement of (1) one-third of the grain, and (2) all of the cottonseed meal and a portion of the grain with cottonseed, in a 90 to 95 per cent full-fed concentrate ration. Marked differences in weight of the feeder yearlings used prompted their separation into two groups, one group being light and of short age (Fig. 8), and the other of average weight and age (Fig. 9). Two lots within each group were fed similar rations.

A summary of the test is shown in Table 5.

Table 5. Summary. November 25, 1932, to May 26, 1933—181 days

Lot Number -----	1	2	3	4	5	6
Number of steers-----	10	9	10	10	10	10
Variables:	Stunted yearlings			Average yearlings		
1. Class of steers-----						
2. Concentrates -----						
3. Supplements to grain-----						
Averages in pounds per steer	Full fed CSMeal	Limited CSM&CS	Full fed CSM&CS	Full fed CSMeal	Full fed Cseed	Full fed CSM&CS
Initial weight -----	461	472	463	569	573	566
Final weight at feedlot-----	894	852	869	975	1006	1002
Final weight at Fort Worth market -----	840	805	828	921	945	948
Gain basis feedlot weight-----	433	380	406	406	433	436
Gain basis market weight-----	379	333	365	352	372	382
Daily gain basis feedlot weight--	2.39	2.10	2.24	2.24	2.39	2.41
Daily gain basis market weight--	2.09	1.84	2.02	1.94	2.06	2.11
Shrinkage enroute market, per cent -----	6.04		4.72	5.54	6.06	5.39
Carcass weight (hot)-----	508.7	489.4	515.0	558.8	587.3	599.1
Dressing per cent, basis hot car- cass:						
and market weight-----	60.56	60.80	62.20	60.67	62.15	63.20
and feedlot weight-----	56.90	57.44	59.26	57.31	58.38	59.79
Carcass grades—Armour						
32's—strictly good to choice--	3	-----	1	1	1	3
33's—top medium to good--	6	5	7	5	6	6
34's—medium -----	1	4	1	4	3	1
35's—low medium -----	-----	-----	1	-----	-----	-----
Total feeds consumed						
Ground threshed mlo-----	1546	688	1065	1683	1419	1144
Cottonseed -----	-----	344	503	-----	606	543
Cottonseed meal -----	277	275	277	338	-----	338
Ground hegari fodder-----	1303	1743	1247	1428	1403	1524
Alfalfa hay -----	548	556	514	569	539	554
Salt -----	5.53	4.40	3.96	7.39	6.49	5.23
Average ration						
Ground threshed mlo -----	8.54	3.80	5.72	9.30	7.84	6.32
Cottonseed -----	-----	1.90	2.78	-----	3.35	3.00
Cottonseed meal -----	1.53	1.52	1.53	1.87	-----	1.87
Ground hegari fodder-----	7.20	9.63	6.89	7.89	7.75	8.42
Alfalfa hay -----	3.03	3.07	2.84	3.09	2.98	3.06
Salt, ounces -----	.50	.38	.35	.66	.58	.46
Feed consumed per cwt. gain, basis feedlot weight						
Ground threshed mlo -----	357	181	255	415	328	262
Cottonseed -----	-----	91	124	-----	140	125
Cottonseed meal -----	64	72	68	83	-----	78
Ground hegari fodder-----	301	459	307	352	324	350
Alfalfa hay -----	127	146	127	138	124	127
Cost of feed per cwt. gain (feed consumed)						
Basis feedlot weight -----	\$ 4.85	\$ 4.48	\$ 4.66	\$ 5.71	\$ 4.61	\$ 4.95
Basis market weight -----	5.54	5.11	5.18	6.59	5.37	5.65
Cost into feedlot at \$5.08 per cwt.--	\$23.42	\$23.08	\$23.52	\$28.91	\$29.11	\$28.75
Feed cost (feed consumed)-----	21.01	17.01	18.90	23.20	19.56	21.59
Marketing cost at \$0.481 per cwt--	4.04	3.87	3.98	4.43	4.55	4.56
Total cost -----	48.47	44.86	46.40	56.54	53.62	54.90
Selling price per cwt.-----	6.07	6.15	6.17	6.25	6.16	6.15
Amount received -----	50.99	49.51	51.09	57.56	58.21	58.30
Profit -----	2.52	4.65	4.69	1.01	4.59	3.40

All lots received ground hegari fodder and alfalfa hay as roughage. At the outset, three parts of hegari was fed to one part of alfalfa, but as the feeding progressed, the amount and percentage of hegari was

decreased and as an average for the entire period the steers consumed about $2\frac{1}{2}$ time as much hegari as of alfalfa.

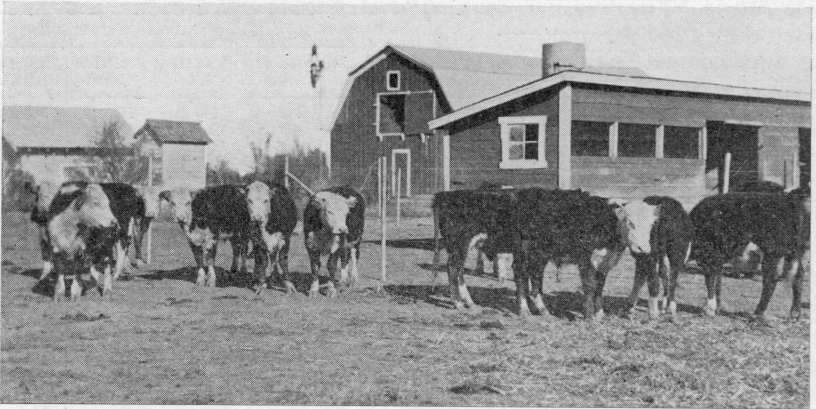


Figure 8. Short aged steer yearlings (1932-33) as feeders. Required less feed per cwt. of gain but did not become as highly finished as the average yearlings.

In two comparisons the light yearlings made a cheaper gain and required less feed to make 100 pounds of gain than the average yearlings, although the average gains were approximately equal between the two groups.



Figure 9. Average steer yearlings (1932-33) as feeders.

In comparing the limited concentrate ration (72 per cent full fed) with the 90 to 95 per cent full fed concentrate ration (Lot 2 versus Lot 3), the full fed ration produced more gain and higher finish. The cost of gain favored the limited ration but the difference was so slight that the greater market value of the steers receiving the full fed ration more than offset the advantage of the cheaper gain. The test did not indicate that a limited concentrate ration is efficient in fattening steers, except under the condition of high prices for concentrates and low prices for roughage.



Figure 10. Representative lot (1932-33) short yearlings as fattened. Full-fed milo grain 181 days.

In comparing cottonseed meal and cottonseed as supplements to a full fed grain and roughage ration, which included 3 pounds alfalfa hay and in which cottonseed was fed to replace the cottonseed meal and a portion of the grain (Lot 4 versus Lot 5), the lot receiving cottonseed made a larger gain, a cheaper gain, and a higher finish.

With cottonseed fed to replace one-third of the grain, Lot 1 versus Lot 3 and Lot 4 versus Lot 6, the results favored the use of cottonseed. Considering the fact that one inferior steer reduced the average daily gain in Lot 3 receiving cottonseed .10 pound, Lots 1 and 3 made practically equal gain on basis of feedlot weights; however, Lot 3 had a higher dressed yield. As between Lots 4 and 6, Lot 6 receiving cottonseed made greater gain, higher yield, and returned carcasses of higher grade.



Figure 11. Representative lot (1932-33) average yearlings as fattened. Full-fed milo grain 181 days. Compare with short yearlings Figure 10.

In comparing cottonseed alone versus cottonseed meal and cottonseed, with the cottonseed fed to replace one-third of the grain (Lot 5 versus Lot 6), Lot 6, receiving cottonseed and cottonseed meal, made slightly higher gain, had higher dressed yield and had carcasses of higher grade.

Results 1933-34

1. Full versus limited feeding of concentrates
2. Effect of pulverized oyster shell supplement in an average fattening ration
3. Cottonseed fed to replace one-third of the grain
4. Cottonseed fed to replace cottonseed meal and a portion of the grain
5. Alfalfa alone versus alfalfa and hegari as the roughage portion of the ration.

A summary of the 154-day test is shown in Table 6.

Table 6. Summary. December 20, 1933, to May 23, 1934—154 days

Lot Number.....	1	2	3	4	5	6
Number of steers.....	10	10	9	9	10	10
Variables:						
1. Concentrates	Full fed	Limited	Full fed	Full fed	Full fed	Full fed
2. Supplements to grain.....	CSMeal	CSM&CS	CSM&CS	Cseed	Oseed	CSM&CS
3. Roughage	Heg&Alf	Heg&Alf	Heg&Alf	Alfalfa	Heg&Alf	Heg&Alf
4. Lime supplement	No	No	No	No	No	Yes
Averages in pounds per steer						
Initial weight	678	674	669	674	675	674
Final weight at feedlot.....	999	1003	1029	1015	1052	1045
Final weight at Fort Worth market	950	943	976	955	991	990
Gain basis feedlot weight.....	321	329	360	341	377	371
Gain basis market weight.....	272	269	307	281	316	316
Daily gain basis feedlot weight.....	2.08	2.14	2.34	2.21	2.45	2.41
Daily gain basis market weight.....	1.77	1.75	1.99	1.82	2.05	2.05
Shrinkage enroute to market, per cent	4.90	5.98	5.15	5.91	5.80	5.26
Carcass weight (hot).....	586.4	579.1	604.7	584.8	608.8	617.6
Dressing per cent, basis hot carcass:						
and market weight.....	61.73	61.41	61.96	61.24	61.43	62.38
and feedlot weight.....	58.70	57.74	58.77	57.62	57.87	59.10
Carcass grades—Armour						
31's—choice	---	---	1	---	1	---
32's—strictly good to choice.....	4	2	5	2	5	2
33's—top medium to good.....	3	6	3	7	4	7
34's—medium	3	2	---	---	---	1
Total feeds consumed						
Ground threshed milo.....	1318	639	912	1114	1110	915
Cottonseed	---	324	453	511	510	454
Cottonseed meal	254	257	257	---	---	258
Ground hegari fodder.....	1203	1513	1252	---	1255	1300
Alfalfa hay	526	582	548	1586	545	546
Salt	5.26	5.95	6.58	3.13	4.15	5.63
Pulverized oyster shell.....	---	---	---	---	---	15.4
Average ration						
Ground threshed milo.....	8.56	4.15	5.92	7.23	7.21	5.94
Cottonseed	---	2.10	2.94	3.32	3.31	2.95
Cottonseed meal	1.65	1.67	1.67	---	---	1.67
Ground hegari fodder.....	7.81	9.86	8.13	---	8.15	8.44
Alfalfa hay	3.41	3.78	3.56	10.30	3.54	3.55
Salt, ounces .....	.54	.62	.64	.32	.43	.59
Pulverized oyster shell.....	---	---	---	---	---	.10
Feed consumed per cwt. gain, basis feedlot weight						
Ground threshed milo.....	411	194	253	327	294	247
Cottonseed	---	98	126	150	135	122
Cottonseed meal	79	78	71	---	---	70
Ground hegari fodder.....	375	461	348	---	333	350
Alfalfa hay	164	177	152	465	145	147
Cost of feed per cwt. gain (feed consumed)						
Basis feedlot weight.....	\$ 8.45	\$ 6.75	\$ 6.98	\$ 7.67	\$ 6.66	\$ 6.89
Basis market weight.....	9.97	8.25	8.19	9.30	7.95	8.09
Cost into feedlot at \$5.05 per cwt.						
Feed cost (feed consumed).....	\$34.24	\$34.04	\$33.78	\$34.04	\$34.09	\$34.04
Marketing cost at \$0.541 per cwt.....	27.12	22.20	25.13	26.14	25.12	25.55
Total cost	5.14	5.10	5.28	5.17	5.36	5.36
Selling price per cwt.....	66.50	61.34	64.19	65.35	64.57	64.95
Amount received	6.75	6.50	7.00	6.75	6.75	7.00
Profit	64.13	61.30	68.32	64.46	66.89	69.30
	-2.37	-.04	4.13	-.89	2.32	4.35

The average daily water consumption per steer in Lot 1 was 6.9 gallons and the highest amount for any single day was 9.8 gallons.

In comparing Lots 2 and 3, the former, fed 77 per cent as much concentrates as the latter, required less concentrates to produce 100 pounds of gain, but made smaller gains, had less finish, and sold at a lower price. On the whole the limited feeding of concentrates was not satisfactory in comparison to 90 to 95% full feeding of concentrates because of lack of finish and lower selling price.

The limited ration containing cottonseed again, as in 1931-32, produced practically equal gain and finish as Lot 1 which was full-fed concentrates but did not receive cottonseed.

An advantage of approximately 3 per cent in gain (Lot 3 versus Lot 6) resulted from the inclusion of the calcium supplement, pulverized oyster shell, in the fattening ration; however, the carcasses of the non-supplemented group were of higher grade.

With cottonseed fed to replace one-third of the milo grain in Lot 3 as compared to Lot 1, not fed cottonseed, the substitution of 2.9 pounds of cottonseed for 2.9 pounds of milo increased gain and finish, lowered the cost of gain, and increased the net return. On basis of feed required to produce 100 pounds of gain, one pound of cottonseed replaced 1.29 pounds of milo.

With cottonseed fed to replace cottonseed meal and a portion of the grain in rations which included about 4 pounds alfalfa hay (Lot 5 versus Lot 1), results favored feeding cottonseed as a supplement. Cottonseed meal was fed at the rate of 1.65 pounds daily as compared to 3.31 pounds of cottonseed. To the extent of Lot 1's appetite, the difference in pounds fed between cottonseed meal and cottonseed was made up with ground threshed milo.



Figure 12. Representative lot (1933-34) as fattened after 168 days.

In previous tests the addition of cottonseed meal markedly increased the efficiency of the milo, cottonseed, hegari and alfalfa ration, but in this trial, (Lot 5 versus Lots 3 and 6), the differences in results were negligible.

The roughage mixture of alfalfa hay and hegari fodder, (Lot 5 versus Lot 4 produced approximately 11 per cent more gain and higher finish than alfalfa alone.

Results 1934-35

1. Alfalfa hay versus ground hegari fodder
2. Effect of pulverized oyster shell supplement in medium heavy concentrate and in light concentrate fattening rations with ground hegari fodder
3. A study of method in using ground hegari fodder for fattening yearling steers

Cottonseed was fed in limited amount to replace a portion of the daily allowances of both grain and cottonseed meal in all of the lots. The study of the effect of a calcium supplement, pulverized oyster shell, was continued between lots fed limited amounts of concentrates, and between lots practically full-fed concentrates. Alfalfa hay and hegari fodder were compared as roughage feeds in practically full-fed concentrate rations. A study of methods of using hegari fodder for fattening was introduced with two lots of the lighter steers, each lot being fed a limited concentrate ration for 154 days and a ration high in concentrates for 42 days.

A summary of the feeding trial is shown in Table 7.

Table 7. Summary. October 6, 1934, to June 26, 1935—196 days

	1	2	3	4	5
Lot Number -----	10	10	10	10	10
Number of steers-----	154	154	154	196	196
Days fed -----					
Variables:	Concentrates full fed			Concentrates deferred	
1. Method of feeding-----					
2. Roughage -----	Hegari	Hegari	Alfalfa	Hegari	Hegari
3. Lime supplement -----	yes	no	no	yes	no
Averages in pounds per steer					
Initial weight -----	622	622	623	553	553
Final weight at feedlot-----	988	1020	999	984	971
Final weight at Fort Worth market	948	962	949	927	914
Gain basis feedlot weight-----	366	398	376	431	418
Gain basis market weight-----	326	340	326	374	361
Daily gain basis feedlot weight--	2.38	2.58	2.44	2.20	2.13
Daily gain basis market weight--	2.12	2.21	2.12	1.91	1.84
Shrinkage enroute to market, per cent -----	4.05	5.69	5.00	5.79	5.87
Carcass weight (hot)-----	606.3	628.3	506.8	562.2	560.6
Dressing per cent basis hot carcass and market weight-----	63.96	65.31	62.88	60.64	61.33
Dressing per cent basis hot carcass and feedlot weight-----	61.37	61.60	59.74	57.13	57.73
Carcass grades—Swift					
11's—choice -----	2	8	1	3	4
12's—strictly good to choice-----	8	2	8	7	5
13's—top medium to good-----	0	0	1	0	1
Total feeds consumed					
Ground threshed milo-----	882	888	1431	357	358
Cottonseed -----	562	565	547	188	189
Cottonseed meal -----	389	390	105	314	314
Ground hegari fodder-----	1374	1000	-----	3289	3298
Alfalfa -----	-----	-----	1068	106	106
Salt -----	3.52	4.50	6.39	10.87	8.32
Pulverized oyster shell-----	15.4	-----	-----	15.4	-----
Average ration					
Ground threshed milo-----	5.73	5.76	9.33	1.80	1.83
Cottonseed -----	3.65	3.67	3.55	.96	.95
Cottonseed meal -----	2.53	2.53	.68	1.60	1.57
Ground hegari fodder-----	8.92	10.39	-----	16.78	17.54
Alfalfa -----	-----	-----	6.93	.54	.54
Salt, ounces -----	.37	.46	.66	.67	.69
Pulverized oyster shell-----	.10	-----	-----	.079	-----
Feed consumed per cwt. gain basis feedlot weight					
Ground threshed milo-----	241	223	381	83	86
Cottonseed -----	154	142	145	44	45
Cottonseed meal -----	106	98	28	73	75
Ground hegari fodder-----	375	402	-----	763	789
Alfalfa -----	-----	-----	284	25	25
Cost of feed per cwt. gain (feed consumed)					
Basis feedlot weight-----	\$ 15.43	\$ 14.85	\$ 16.49	\$ 13.63	\$ 14.04
Basis market weight-----	17.32	17.38	19.02	15.71	16.25
Cost into feedlot at \$5.86 per cwt.-----	\$ 36.45	\$ 36.45	\$ 36.51	\$ 32.41	\$ 32.41
Feed cost (feed consumed)-----	56.46	59.10	62.00	58.75	58.68
Marketing cost at \$0.494 per cwt.-----	4.68	4.75	4.69	4.58	4.52
Total cost -----	97.59	100.30	103.20	95.74	95.61
Selling price per cwt.-----	12.00	12.50	11.50	10.65	10.65
Amount received -----	113.76	120.25	109.14	98.73	97.34
Profit -----	16.17	19.95	5.94	2.99	1.73

The rations were kept as nearly in balance as appetites would permit in the comparisons between hegari fodder and alfalfa hay. Lots 1 and 2, fed hegari, were easier to keep on feed and most of the time had better appetite than Lot 3, fed alfalfa. The hegari fodder contained approximately 30% of grain by weight and with this grain the hegari fed lots consumed an average of about 200 pounds more concentrates than Lot 3, fed alfalfa. The difference in total concentrates consumed was mostly in cottonseed meal, for an average of 390 pounds was fed to Lots 1 and 2 and only 105 pounds to Lot 3. At the prevailing feed prices, the saving in milo grain as effected by feeding the hegari was greater than the saving in cottonseed meal as effected by feeding alfalfa. The hegari fed lots also made slightly greater gain, made higher finish and sold at a higher price.

Lot 2, which did not receive the calcium supplement, and greater appetite, made 9 per cent more gain on basis of feedlot weights, and had much higher finish than Lot 1 fed 0.10 pound pulverized oyster shell per head daily, both lots being fed rations high in concentrates and hegari fodder.

On rations consisting mostly of hegari fodder, Lot 4, fed the calcium supplement, made 9 per cent more gain and had better appearance at the end of the 154 day feeding period than Lot 5 not fed the supplement. At the close of the ensuing 42-day finishing period, the two lots were practically equal in gain; however, Lot 5 had an advantage in finish and carcass grade.

More response is expected from calcium supplements when added to rations high in concentrates than when added to rations low in concentrates for even carbonaceous roughages contain more calcium than the grains. The hegari fodder contained about 0.24 per cent of calcium and the stock water on the basis of an average daily consumption of 7 gallons supplied 1.6 ounces of mineral salts daily, which included about 4.5 grams of calcium. Lot 2, which did not receive the supplement made the highest gain and finish of any of the lots which indicates that the calcium supplement was not needed in the rations which were fed.

Animal measurements, as designated by AH Form 452 of the Bureau of Animal Industry, were secured at the start and at the close of the feeding period. The amount of increase in measurements which might reflect skeletal development was clearly less for Lot 2 than any other lot. Lot 4, fed the calcium supplement, made greater increase than Lot 5, not fed the supplement and Lot 3, fed alfalfa, greater increase than Lot 1, fed hegari fodder with the supplement. Such measurements appeared to increase according to the amount of calcium in the rations.

With respect to the study of method in using large amounts of hegari fodder for fattening the trial shows that marketable steers can be produced when fed large amounts of hegari fodder with limited amounts of concentrate feeds. The average full-fed concentrate ration consisted of

59 per cent concentrate feeds as compared to 20 per cent concentrates in the limited and deferred concentrate ration. Less than 1500 pounds of hegari fodder was used per steer in fattening Lots 1 and 2 in 154 days while 3300 pounds was used in fattening Lots 4 and 5 in 196 days. The latter lots made an average of 43 pounds more gain per head and were nearly as well finished although they received a ration high in concentrates only during the last 42 days. The full fed steers returned greater profit than those receiving the limited and deferred concentrate ration largely because of sale upon an earlier and a higher market.

Results 1935-36

1. Alfalfa hay versus ground hegari fodder
2. Effect of pulverized oyster shell supplement in medium heavy concentrate and in light concentrate fattening rations with ground hegari fodder
3. A study of method in using hegari fodder for fattening yearling steers

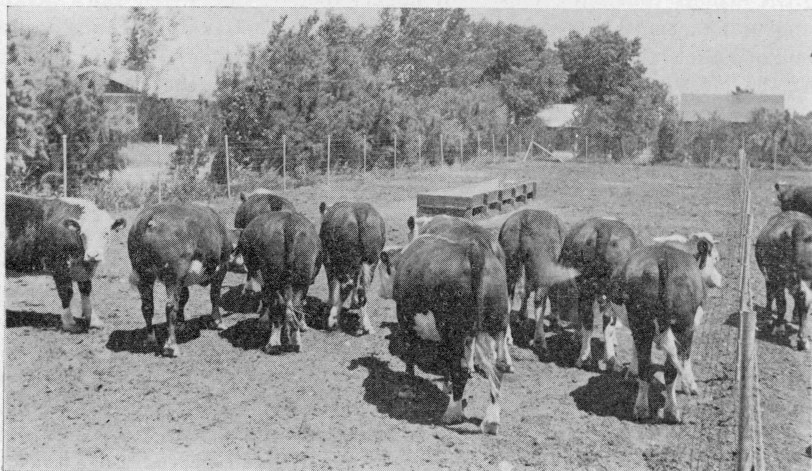


Figure 13. Representative lot (1935-36) as fattened after 168 days.

This experiment repeated the work of 1934-35 with the continued object of determining methods of feeding for fattening adapted to the Balmorea area. The comparison between alfalfa and hegari as roughages was repeated for the two are competing feed crops and hegari is at the present time the favored grain sorghum in the area. The study of the effects of a calcium supplement was continued since the results for 1934-35 were not conclusive.

A summary of the feeding trial is shown in Table 8.

Table 8. Summary. November 21, 1935, to June 18, 1936—210 days

Lot Number -----	1	2	3	4	5
Number of steers-----	10	10	8	10	10
Days fed -----	168	168	163	210	210
Variables:	Concentrates full fed			Concentrates deferred	
1. Method of feeding-----					
2. Roughage -----	Hegari yes	Hegari no	Alfalfa no	Hegari yes	Hegari no
3. Lime supplement -----					
Averages in pounds per steer					
Initial weight -----	619	619	613	558	558
Final weight at feedlot-----	1002	1025	976	992	978
Final weight at Fort Worth mar- ket -----	944	956	911	927	928
Gain basis feedlot weight-----	383	406	363	434	420
Gain basis market weight-----	325	337	298	369	370
Daily gain basis feedlot weight--	2.28	2.42	2.16	2.07	2.00
Daily gain basis market weight--	1.93	2.01	1.77	1.76	1.76
Shrinkage enroute to market, per cent -----	5.97	6.73	6.66	6.55	5.11
Carcass weight (hot)-----	591	599	577	578	578
Dressing per cent basis hot car- cass and market weight-----	62.61	62.66	63.34	62.35	62.28
Dressing per cent basis hot car- cass and feedlot weight-----	58.98	58.44	59.12	58.27	59.10
Carcass grades—Swift					
11's—choice -----	4	5	1	1	-----
12's—strictly good to choice--	6	5	6	7	7
13's—top medium to good-----	-----	-----	1	1	3
14's—medium -----	-----	-----	-----	1	-----
Total feed consumed					
Ground threshed milo-----	1077	1130	1611	426	426
Cottonseed -----	324	325	332	276	276
Cottonseed meal -----	491	494	168	474	474
Ground hegari fodder-----	2002	2088	-----	3414	3435
Alfalfa -----	-----	-----	1400	114	114
Salt -----	9.45	10.4	9.03	10.76	10.76
Pulverized oyster shell-----	16.8	-----	-----	16.8	-----
Average ration					
Ground threshed milo-----	6.41	6.73	9.59	2.03	2.03
Cottonseed -----	1.93	1.94	1.97	1.32	1.32
Cottonseed meal -----	2.92	2.94	1.00	2.26	2.26
Ground hegari fodder-----	11.91	12.43	-----	16.26	16.36
Alfalfa -----	-----	-----	8.69	.54	.54
Salt, ounces -----	.90	.99	.86	.82	.82
Pulverized oyster shell-----	.10	-----	-----	.10	-----
Feed consumed per cwt. gain basis feedlot weight					
Ground threshed milo-----	281	278	444	98	101
Cottonseed -----	85	80	91	64	66
Cottonseed meal -----	128	122	46	109	113
Ground hegari fodder-----	523	514	-----	787	818
Alfalfa -----	-----	-----	402	26	27
Cost of feed per cwt. gain (feed con- sumed)					
Basis feedlot weight -----	\$ 9.58	\$ 9.28	\$10.97	\$ 7.83	\$ 8.08
Basis market weight -----	11.29	11.18	12.14	9.21	9.17
Cost into feedlot at \$7.97 per cwt--	\$49.33	\$49.33	\$48.85	\$44.47	\$44.47
Feed cost (feed consumed)-----	36.70	37.67	36.17	33.99	33.92
Marketing cost at \$0.507 per cwt.---	4.79	4.85	4.62	4.70	4.70
Total cost -----	90.82	91.85	89.64	83.16	83.09
Amount received at \$8.00 per cwt.---	75.52	76.48	73.44	74.16	74.24
Loss -----	15.30	15.37	16.20	9.00	8.85

Ground hegari fodder in this test containing approximately 20 per cent of grain by weight was again as in 1934-35 a more useful feed for fattening than alfalfa hay. The lots fed hegari made approximately 9 per cent greater gain, on basis of feed-lot weights, had higher finish, and were more desirable in carcass grade.

An increased amount of protein supplied by cottonseed meal was fed to Lot 3, receiving alfalfa in the hope of stimulating appetite since in both this and the previous test this lot failed to consume as much feed as the hegari fed lots. The increased amount of cottonseed meal apparently did not increase feed consumption.

If it is assumed that the hegari grain contained in the hegari fodder was fully utilized, then Lots 1 and 2, fed hegari consumed an average of 219 pounds more concentrates than Lot 3, fed alfalfa. The difference in total concentrates consumed was largely in cottonseed meal, an average of 493 pounds being fed to Lots 1 and 2 and 168 pounds to Lot 3.

Financial returns favored feeding the hegari even with hegari and alfalfa charged to the steers at the same price; however, local feed prices valued hegari at \$9.00 and alfalfa at \$14.00 per ton. The saving in milo grain effected by feeding the hegari fodder more than offset the saving in cottonseed meal which resulted from feeding the alfalfa. The results for two years in gains and finish favored hegari fodder instead of alfalfa.

In the full-fed concentrate groups, Lot 2 which did not receive the calcium supplement had greater appetite and made slightly more gain and finish than Lot 1, fed 0.10 pound of pulverized oyster shell per head



Figure 14. Lots 1, 2, and 3 (1935-36) at Fort Worth market. This picture is used to show the finish attained by the steers after the feeding period of 168 days.

daily. With limited concentrate rations, Lot 4 fed the calcium supplement had better appearance and had the advantage in gain over Lot 5 not fed the supplement on basis of feedlot weights, but market weights and dressed carcass weights were the same for the two lots.

In regard to the method of using large amounts of ground hegari fodder for fattening, Lots 4 and 5 consumed 3425 pounds of hegari in 210 days while Lots 1 and 2 consumed 2046 pounds in 168 days. Lots 4 and 5 consumed slightly less of cottonseed and cottonseed meal and only 39 per cent as much milo grain as Lots 1 and 2. Not considering the 20 per cent grain content of hegari, the ration fed Lots 4 and 5 consisted of 75 per cent roughage as compared to 52 per cent roughage in Lots 1 and 2. The long period of feeding with use of large amounts of hegari fodder produced 14.5 per cent more gain, a cheaper gain, and higher financial return in this test, but did not produce quite as much finish or as rapid gain.



Figure 15. Representative lot (1935-36). Fed limited concentrate ration for 168 days. Compare with Figure 13.

Results 1936-37

1. Hand feeding versus self-feeding
2. Different amounts of ground alfalfa hay fed with ground hegari fodder
3. The use of large amounts of roughage feeds in fattening yearling steers



Figure 16. Representative group of yearling steers used 1936-37 as feeders 11/13/36. Note excellent feeder quality of these heavy yearling steers. Well designed for fattening on rations high in roughage feeds.

Since the previous tests indicated that large amounts of the ground hegari fodder could be utilized in fattening yearling steers this trial was designed to make a test of the feeding of even larger amounts. Conditions were favorable to the trial in that the feeders were heavy, fleshy yearling steers, hegari fodder was low in price and concentrates were comparatively high in price. The comparison between hand feeding and self feeding was initiated because of the local practice of using self-feeder barns in feeding rations containing ground hegari fodder. The test with alfalfa hay was conducted because of its importance as a local crop and demands for information in regard to its utility as a source of protein. Cottonseed meal was fed in limited amount in order that the different amounts of alfalfa which were fed would have opportunity to show value from the protein standpoint.

A summary of the feeding trial is shown in Table 9.

Table 9. Summary. November 13, 1936, to May 28, 1937—196 days

Lot Number -----	1	2	3	4	5	6
Number of steers-----	10	10	10	10	10	9
Variables:						
1. Amount of alfalfa-----	2 lbs.	3 lbs.	4 lbs.	4 lbs.	5 lbs.	6 lbs.
2. Method of feeding-----	Hand-fed	Hand-fed	Self-fed	Hand-fed	Hand-fed	Hand-fed
Averages in pounds per steer-----						
Initial weight -----	720	720	720	720	721	729
Final weight at feedlot-----	1107	1104	1118	1124	1107	1075
Final weight at Fort Worth market -----	1014	1021	1028	1042	1033	1008
Gain basis feedlot weight-----	387	384	398	404	386	346
Gain basis market weight-----	294	301	308	322	312	279
Daily gain basis feedlot weight--	1.97	1.96	2.03	2.06	1.97	1.77
Daily gain basis market weight--	1.50	1.54	1.57	1.64	1.59	1.42
Shrinkage enroute to market, per cent -----	8.40	7.52	8.05	7.80	7.50	7.53
Carcass weight (hot)-----	646.7	665.5	674.8	666.4	665.1	663.2
Dressing per cent basis hot carcass and market weight-----	63.78	65.18	65.64	63.95	64.39	65.79
Dressing per cent basis hot carcass and feedlot weight-----	58.42	60.28	60.36	59.29	60.08	61.69
Carcass grades—Swift						
11's—choice -----	3	4	5	1	3	0
12's—strictly good to choice--	3	4	4	2	5	4
13's—top medium to good--	3	2	1	7	2	5
14's—medium -----	1	-----	-----	-----	-----	-----
Total feed consumed						
Ground milo heads-----	479	474	479	479	479	463
Cottonseed -----	384	384	384	384	384	382
Cottonseed meal -----	290	290	290	290	290	288
Ground hegari fodder-----	3235	2896	2915	2862	2640	2288
Ground alfalfa hay-----	390	583	780	780	974	1160
Salt -----	5.88	5.39	5.76	5.76	5.27	5.39
Average ration						
Ground milo heads-----	2.44	2.42	2.44	2.44	2.44	2.36
Cottonseed -----	1.96	1.96	1.96	1.96	1.96	1.95
Cottonseed meal -----	1.48	1.48	1.48	1.48	1.48	1.47
Ground hegari fodder-----	16.51	14.78	14.78	14.60	13.47	11.67
Ground alfalfa hay-----	1.99	2.98	3.98	3.98	4.97	5.92
Salt, ounces -----	.48	.44	.47	.47	.43	.44
Feed consumed per cwt. gain basis feedlot weight						
Ground milo heads-----	124	123	120	119	124	134
Cottonseed -----	99	100	96	95	99	110
Cottonseed meal -----	75	76	73	72	75	83
Ground hegari fodder-----	836	754	732	708	634	661
Ground alfalfa hay-----	101	152	196	193	252	335
Cost of feed per cwt. gain (feed consumed)						
Basis feedlot weight-----	\$ 9.54	\$ 9.61	\$ 9.75	\$ 9.54	\$ 10.14	\$ 11.21
Basis market weight-----	12.56	12.26	12.60	11.97	12.55	13.91
Cost into feedlot at \$6.56 per cwt.--	\$ 47.23	\$ 47.23	\$ 47.23	\$ 47.23	\$ 47.30	\$ 47.82
Feed cost (feed consumed)-----	36.92	36.89	38.80	38.53	39.15	38.80
Marketing cost at \$0.529 per cwt.--	5.36	5.40	5.44	5.51	5.46	5.33
Total cost -----	89.61	89.52	91.47	91.27	91.91	91.95
Selling price per cwt.-----	11.55	12.02	12.01	12.57	12.14	11.43
Amount received -----	117.12	122.72	123.46	130.98	125.41	115.21
Profit -----	27.51	33.20	31.99	39.71	33.50	23.26

Lot 4, hand fed twice daily, made slightly greater gain on basis of feedlot and market weights than Lot 3, self fed; however, carcass grades and weights favored Lot 3.

The differences in finish and gain between the various amounts of alfalfa, 2, 3, 4, 5, and 6 pounds, which were fed, were too small to determine the most desirable amount to feed for fattening with the limited concentrate rations. It was indicated, however, that the least amount of alfalfa, 2 pounds, as fed to Lot 1, and the largest amount, 6 pounds, as fed to Lot 6, were the least desirable amounts to feed for these lots made less gain and finish and sold at a lower price than any of the other lots. Individual steers in Lot 1 were highly finished but Lot 6 did not have a single steer of choice grade. There was no indication of benefit from the supply of increased amounts of protein through the feeding of alfalfa hay.

The rations fed to all lots represent a rather extreme usage of roughage feeds in fattening. If the grain content of the hegari is not considered and the milo heads are considered as only 75 per cent grain content, then the average ration fed to the lots consisted of 22 per cent concentrates and 78 per cent roughage. Some benefit is derived from the grain contained in the hegari fodder, and if the hegari fodder is considered as of 25% grain content, the average ration consisted of 37 per cent concentrates and 63 per cent roughage.

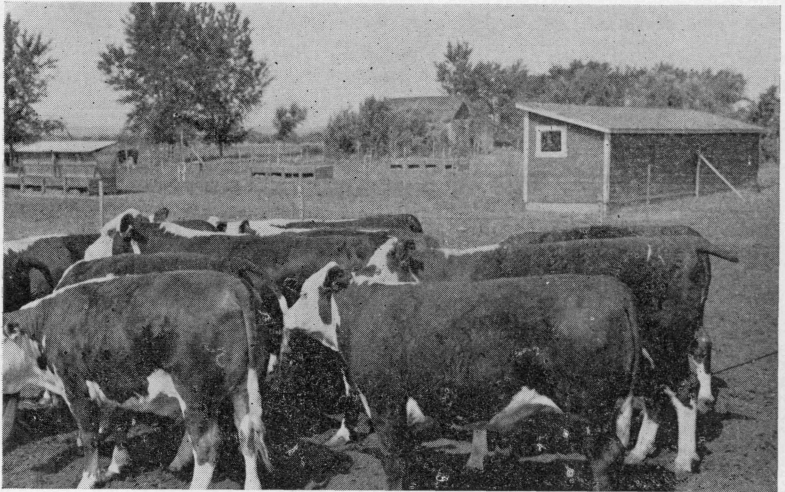


Figure 17. Representative group of steers used 1936-37 as fattened after 196 days on rations high in roughage feeds. Different amounts of alfalfa were fed but pictures of the various lots fail to show such slight differences as may have existed between them.

The average daily gains were below those which would be expected from feeding rations high in grain, averaging for the 6 lots 1.96 and 1.55 pounds per head daily on basis of feedlot and market weights, respectively. Dressed yield on basis of hot carcass and market weights averaged 64.8 per cent and on basis of feedlot weights 60 per cent. While such high dressed yields are indicative of high finish, the carcasses were not as desirable as would have been expected of grain finished steers. In comparing the best lot of steers in this trial with the best lot of grain finished steers in the 1934-35 test with respect to the amount of feed required per cwt. of gain basis feedlot weights, it is noted that the grain finished steers required only 73 per cent as much total feed, only 45 per cent as much hegari fodder, but 61 per cent more concentrates. The steers fattened on concentrates were also more desirable in carcass grade.

Results 1937-38

1. Hand feeding versus self-feeding
2. Different amounts of ground alfalfa hay fed with ground hegari fodder
3. The use of large amounts of roughage feeds in fattening yearling steers.

The tests for 1937-38 represent a continuation of the tests conducted in 1936-37; however, larger amounts of concentrates were fed. It was necessary to secure higher gain in order to finish the available feeders which were some 70 pounds lighter and carried less grass flesh than the ones used in the previous trial, in the same period of time. Less alfalfa was used because of its scarcity and high price. One lot was not fed alfalfa, the large amount of alfalfa, 6 pounds previously used, was dropped from the test and 3 pounds of alfalfa was used as the check amount instead of 4 pounds as in the previous trial.

A summary of the feeding trial is shown in Table 10.

Table 10. Summary. November 13, 1937, to May 26, 1938—194 days

Lot Number.....	1	2	3	4	5	6
Number of steers.....	10	10	10	10	10	10
Variables:						
1. Amount of alfalfa.....	none	2 lbs.	3 lbs.	3 lbs.	4 lbs.	5 lbs.
2. Method of feeding.....	Hand-fed	Hand-fed	Self-fed	Hand-fed	Hand-fed	Hand-fed
Averages in pounds per steer						
Initial weight	652	653	650	652	652	650
Final weight at feedlot.....	1090	1103	1114	1106	1101	1085
Final weight at Fort Worth market	1010	1017	1022	1022	1024	1014
Gain basis feedlot weight.....	438	450	464	454	449	435
Gain basis market weight.....	358	364	372	370	372	364
Daily gain basis feedlot weight.....	2.26	2.32	2.39	2.34	2.31	2.24
Daily gain basis market weight.....	1.85	1.88	1.92	1.91	1.92	1.88
Shrinkage enroute to market, per cent	7.34	7.80	8.26	7.50	6.99	6.54
Carcass weight (hot).....						
Dressing per cent basis hot carcass and market weight.....	657.1	664.3	667.2	663.8	671.8	659.2
Dressing per cent basis hot carcass and feedlot weight.....	65.06	65.32	65.28	64.95	65.61	65.01
Carcass grades—Armour's	60.28	60.23	59.89	60.02	61.02	60.76
31's—choice	1	-----	1	3	2	3
32's—strictly good to choice.....	7	9	8	1	6	5
33's—top medium.....	1	1	1	6	2	2
34's—medium	1	-----	-----	-----	-----	-----
Total feeds consumed						
Ground threshed milo.....	476	476	476	476	476	476
Cottonseed	743	743	743	743	743	743
Cottonseed meal	381	381	381	381	381	381
Ground hegari fodder.....	3010	2599	2468	2278	2244	1848
Ground alfalfa hay.....	-----	388	582	582	776	970
Salt	6.31	6.31	6.06	6.43	6.31	6.18
Average ration						
Ground threshed milo.....	2.45	2.45	2.45	2.45	2.45	2.45
Cottonseed	3.83	3.83	3.83	3.83	3.83	3.83
Cottonseed meal	1.96	1.96	1.96	1.96	1.96	1.96
Ground hegari fodder.....	15.51	13.39	12.72	11.74	11.57	9.53
Ground alfalfa hay.....	-----	2.00	3.00	3.00	4.00	5.00
Salt, ounces .....	.52	.52	.50	.53	.52	.51
Feed consumed per cwt. gain basis feedlot weight						
Ground threshed milo.....	109	106	103	105	106	109
Cottonseed	170	165	160	164	165	171
Cottonseed meal	87	85	82	84	85	88
Ground hegari fodder.....	637	578	532	502	500	425
Ground alfalfa hay.....	-----	86	125	128	173	223
Cost of feed per cwt. gain (feed consumed)						
Basis feedlot weight	\$ 7.51	\$ 7.72	\$ 7.76	\$ 7.72	\$ 8.20	\$ 8.46
Basis market weight.....	9.19	9.54	9.68	9.48	9.90	10.11
Cost into feedlot at \$8.49 per cwt....						
Feed cost (feed consumed).....	\$55.35	\$55.44	\$55.19	\$55.35	\$55.35	\$55.19
Marketing cost at \$0.517 per cwt....	32.91	34.74	36.02	35.07	36.84	36.80
Total cost	5.22	5.26	5.28	5.28	5.29	5.17
Amount received at \$9.60 per cwt....	93.48	95.44	96.49	95.70	97.48	97.16
Profit	96.96	97.63	98.11	98.11	98.30	97.34
Profit	3.48	2.19	1.62	2.41	.82	.18

Self feeding again, as in 1936-37, had slight advantage over hand feeding without allowing for any saving in labor in that Lot 3, self-fed, made slightly greater gain and carried higher finish than Lot 4 which was hand fed twice daily. Lot 4 made a cheaper gain on basis of both feedlot and market weights, but this lot for some unknown reason consumed less than the average amount of feed.

Lots 4 and 5, receiving 3 and 4 pounds of alfalfa per head daily, made slightly more gain than Lot 1, not fed alfalfa, and Lot 6, fed 5 pounds of alfalfa. Considering weight at market and dressing percentage Lot 5, fed 4 pounds of alfalfa was slightly superior to all other lots in gain. Except for Lot 3 (self fed) this lot consumed slightly more dry matter per head daily and received more energy in their ration than any other lot. Results appear to indicate that more than 4 pounds of ground alfalfa, fed per head daily in rations high in hegari roughage, limit appetite and lessen gain.

For the first 112 days of feeding no grain was added but during the last 82 days ground threshed milo was fed in increasing amounts until the steers received a maximum of 8 pounds per head daily. The average daily gains of 2.40 and 2.18 pounds for the first 112 and the last 82 days respectively were satisfactory and show that the steers made steady improvement in both periods of feeding. The method of deferring the supply of milo grain as followed is considered important in the utilization of rations high in roughage feeds for fattening.

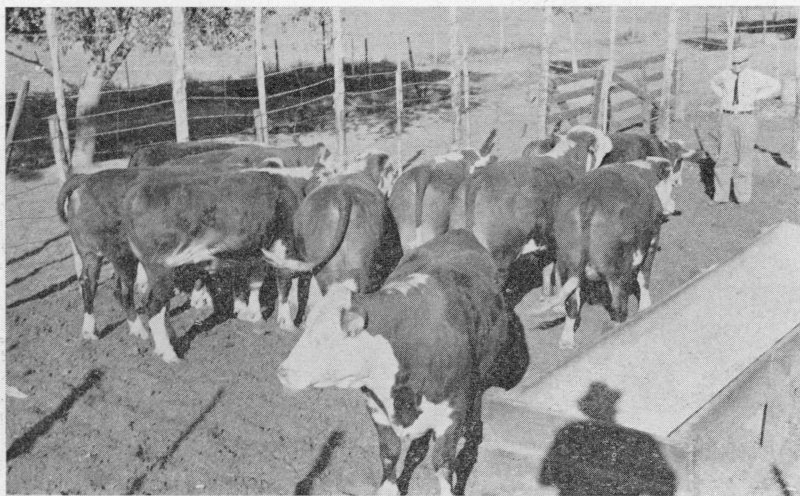


Figure 18. Representative group of steers used 1937-38 as fattened after 194 days on rations high in roughage feeds.

The average ration as fed to all lots consisted of 64.9 per cent roughage feeds (no allowance being made for the 20-25 per cent of grain contained in the hegari fodder) and 35.1 per cent concentrate feeds. The average ration consumed was 23.5 pounds and on dry basis 20.7 pounds, or 2.36 pounds of dry matter consumed per 100 pounds live weight daily.

The average daily gains of 2.26 and 1.83 pounds on basis of feedlot and market weights, respectively, were satisfactory and economical. The average dressing percentage of 65.2 per cent on basis of feedlot and market weights and carcass grades averaging better than "Good," afford evidence of good finish; however, as in the 1936-37 trial with even more limited concentrate rations, the carcasses did not rib down as well as would have been expected of steers fattened on rations high in grain feeds.

Results 1938-39

1. Ground hegari fodder versus hegari silage
2. Different amounts of ground alfalfa hay with ground hegari fodder and with hegari silage
3. The use of large amounts of roughage feeds in fattening yearling steers.



Figure 19. Representative group of yearling steers used 1938-39 as feeders 11/3/38. Note excellent feeder quality and ruggedness. Feeders were secured from the same ranch for 1936-37, 1937-38, and 1938-39.

The tests for 1938-39 present a partial continuation of the tests conducted in the two previous years and introduce three comparisons between ground hegari fodder and hegari silage. These feeds were harvested from the same chop and on an air dry basis were estimated to contain 20 to 25 per cent of grain by weight. Previous satisfactory results in self-feeding rations high in roughage prompted the use of self feeders for all of the lots fed ground hegari fodder. The method of not adding grain feeds until the latter part of the feeding period was continued.

A summary of the feeding trial is shown in Table 11.

Table 11. Summary. November 3, 1938, to May 18, 1939—195 days

Lot Number -----	1	2	3	4	5	6
Number of steers-----	10	10	10	10	10	10
Variables:	Gr. hegari fodder (self-fed)			Hegari silage (hand-fed)		
1. Kind of roughage-----						
2. Amount of alfalfa-----	none	2 lbs.	4 lbs.	none	2 lbs.	4 lbs.
Averages in pounds per steer						
Initial weight -----	708	706	707	707	706	707
Final weight at feedlot-----	1143	1158	1132	1146	1157	1150
Final weight at Fort Worth market-----	1062	1078	1050	1056	1068	1070
Gain basis feedlot weight-----	435	452	425	439	451	443
Gain basis market weight-----	354	371	344	349	362	363
Daily gain basis feedlot weight--	2.23	2.32	2.18	2.25	2.31	2.27
Daily gain basis market weight--	1.82	1.90	1.76	1.79	1.86	1.86
Shrinkage enroute to market, per cent -----	7.15	7.00	7.26	7.88	7.73	6.91
Carcass weight (hot)-----	701.7	695.3	694.4	681.9	694.0	692.1
Dressing per cent basis hot carcass and market weight-----	66.07	64.50	66.13	64.57	64.98	64.68
Dressing per cent basis hot carcass and feedlot weight-----	61.39	60.04	61.34	59.50	59.98	60.18
Carcass grades—Swift's						
11's—choice -----	-----	-----	-----	1	-----	-----
12's—strictly good to choice-----	10	8	7	8	8	7
13's—top medium to good-----	-----	1	2	1	2	3
14's—medium -----	-----	1	1	-----	-----	-----
Total feed consumed						
Ground threshed mlo-----	270	270	270	270	270	270
Ground mlo heads-----	380	380	380	380	380	380
Cottonseed meal -----	768	768	768	768	768	768
Ground hegari fodder-----	3801	3380	2801	-----	-----	-----
Hegari silage -----	-----	-----	-----	8432	7590	6603
Ground alfalfa hay-----	-----	390	780	-----	390	780
Salt -----	5.39	6.48	7.38	6.80	6.84	5.66
Average ration						
Ground threshed mlo-----	1.38	1.38	1.38	1.38	1.38	1.38
Ground mlo heads-----	1.95	1.95	1.95	1.95	1.95	1.95
Cottonseed meal -----	3.94	3.94	3.94	3.94	3.94	3.94
Ground hegari fodder-----	19.49	17.34	14.36	-----	-----	-----
Hegari silage -----	-----	-----	-----	43.24	88.93	33.86
Ground alfalfa hay-----	-----	2.00	4.00	-----	2.00	4.00
Salt, ounces -----	.45	.53	.61	.56	.56	.46
Feed consumed per cwt. gain basis feedlot weight						
Ground threshed mlo-----	63	60	64	62	60	61
Ground mlo heads-----	87	84	89	87	85	86
Cottonseed meal -----	177	170	181	175	170	173
Ground hegari fodder-----	874	748	659	-----	-----	-----
Hegari silage -----	-----	-----	-----	1921	1683	1490
Ground alfalfa hay-----	-----	86	184	-----	86	176
Cost of feed per cwt. gain (feed consumed)						
Basis feedlot weight-----	\$ 7.16	\$ 7.06	\$ 7.54	\$ 7.00	\$ 7.02	\$ 7.31
Basis market weight-----	8.80	8.60	9.31	8.80	8.75	8.92
Cost into feedlot at \$7.75 per cwt... \$ 54.87	\$ 54.72	\$ 54.79	\$ 54.79	\$ 54.79	\$ 54.72	\$ 54.79
Feed cost (feed consumed)-----	31.14	31.91	32.04	30.71	31.67	32.37
Marketing cost at \$0.513 per cwt....	5.45	5.53	5.39	5.42	5.49	5.49
Total cost -----	91.46	92.16	92.22	90.92	91.88	92.65
Amount received at \$10.44 per cwt....	110.87	112.54	109.62	110.25	111.50	111.71
Profit -----	19.41	20.38	17.40	19.33	20.62	19.06

With reference to hegari fed as ground fodder and as silage, Lots 1, 2, and 3, fed fodder, made more gain, 2.57 pounds daily as compared to 2.13 pounds for Lots 4, 5, and 6, fed silage, during the first 112 days; but less gain, 1.81 pounds, as compared to 2.38 pounds, during the last 83 days of the feeding period. The average gains for the two groups of three lots each were much the same on basis of both feedlot and market weights, but the fodder fed lots made slightly higher yield and returned slightly firmer carcasses.

The results from one trial together with lack of information in regard to costs of handling the two feeds, do not permit conclusions; however, the following observations may be made: The results from feeding hegari in the two forms were practically equal. Each form of feed has its advantages in dry regions. Hegari fodder stored in the open is seldom damaged by rain and if fed the first year after harvest makes feed of excellent quality. It can be self fed, the contained grain can be finely ground, and large amounts can be prepared for feeding in a short time. Stored as silage the feed does not deteriorate and bird damage suffered in field curing is eliminated. Silage, however, must be hand fed and the contained grain with present methods of silage preparation cannot be fully utilized by steers.



Figure 20. Representative group of steers used 1938-39 at the Fort Worth market, as fattened after 195 days on rations high in roughage feeds. Note comparatively good finish and smoothness.

The lots receiving 2 and 4 pounds of alfalfa whether fed fodder or silage made almost exactly the same gain on basis of carcass weights. Lot 1 fed fodder and no alfalfa returned slightly more desirable carcasses and carcasses of slightly greater average weight than any other lot. Lot 4, feed silage and no alfalfa was more desirable in carcass grade than Lots 5 and 6 receiving alfalfa with silage but made less gain. These results appear to indicate that the larger amounts of alfalfa have some effect in lowering carcass grade and that it is desirable to feed small amounts of dry roughage with silage.

The average rations used, with the 20 to 25 per cent grain content of the hegari fodder not considered, were as in 1936-37 very high in roughage feeds. In lots 1, 2, and 3, fodder fed, and with the milo heads considered as 75 per cent grain, the average ration consisted of 26 per cent concentrates and 74 per cent roughages. The lots fed silage received an equally limited concentrate ration. As compared to previous tests the gains were satisfactory averaging 2.26 pounds on the basis of feedlot weight and 1.83 pounds on the basis of market weight. The average dressed yields, 65.2 and 60.4 on basis of hot carcass, market and feedlot weight, respectively, were high. Carcass grades as compared to previous years were unsatisfactory. The external covering was thick enough to



Figure 21. Cattle fed rations containing a high percentage of roughage make slightly smaller daily gains and therefore require longer to reach market finish than those fed a high percentage of concentrates. (See Table 12.)

warrant higher grade and conformation was excellent; however, the carcasses lacked desirability in color and did not "rib down" satisfactorily. A possible explanation of the lower carcass grades in this test is that previously the grain contained in the hegari fodder had been finely ground. In this test, the grain in the hegari fodder was not so finely ground.

Summary

A series of tests in the fattening of yearling steers on feeds common to the Balmorhea area included the use of rations (1) moderately high in concentrate feeds, and (2) high in roughage feeds. Rations moderately high in concentrate feeds were fed only during the first 5 years, 1931-36, while rations high in roughage feeds were fed during 8 years, 1931-39. On the average, rations described as high or moderately high in concentrate feeds consisted of approximately 51% concentrate feeds, and rations described as high in roughage feeds consisted of approximately 71% roughage feeds as shown by Table 12.

During the first 5 years, a total of 164 steers, average initial weight 607 pounds, were fed an average of 164 days on rations high in concentrate feeds; while 77 steers, average initial weight 568 pounds, were fed an average of 179 days on rations high in roughage feeds.

The rations high in concentrate feeds supplied an average daily allowance per head of 7.37 pounds ground threshed milo, 2.26 pounds cottonseed, 1.55 pounds cottonseed meal, 7.24 pounds ground hegari fodder and 3.38 pounds alfalfa hay. The allowances of feeds for the rations high in roughages were, in the same respective order, 3, 1.4, 1.85, 13.4, and 1.8 pounds. The hegari fodder was estimated to contain 25% of grain but this grain was not considered as a concentrate in the above rations.

The average results secured from feeding the two types of rations, one high in concentrates and the other high in roughages, are believed to be typical of the respective rations. The rate of gain, per cent shrinkage from feedlot to market, dressed yield, and carcass grades, all favored the rations high in concentrate feeds. The respective gains were 2.34 and 2.15 pounds per head daily; the shrinkage enroute to market, 5.45 and 5.78 per cent; and the dressed yields 62.4 and 61.6 per cent on basis of hot carcass and market weights. The respective classification of carcasses by grades were: choice, 14 and 11 per cent; strictly good to choice, 38 and 36 per cent; top medium to good, 38 and 36 per cent; and medium, 10 and 17 per cent.

The most striking difference in the results from feeding the two types of rations was in the amount of the different kinds of feeds required to produce 100 pounds of gain. A total of 1000 pounds of feed, 292 pounds of concentrate feeds and 708 pounds of roughage feeds, were required to produce 100 pounds of gain on the steers fed the rations high in roughage feeds. The steers fed the rations high in concentrates

Table 12. Average results (weighted) of five years of tests in feeding rations relatively high in concentrates and high in roughages eight years

	5 1931-36 Concentrates	5 1931-36 Roughages	8 1931-39 Roughages
Number years averaged.....	5	5	8
Years fed.....	1931-36	1931-36	1931-39
Rations fed were high in.....	Concentrates	Roughages	Roughages
Amount concentrates fed.....	51%	29%	29%
Amount roughages fed.....	49%	71%	71%
Average number of days on feed.....	164	179	190
Average number of steers.....	164	77	226
Averages in pounds per steer			
Initial weight at feedlot.....	607	568	649
Final weight at feedlot.....	991	952	1057
Final weight at Fort Worth market.....	937	897	984
Gain, basis feedlot weight.....	384	384	408
Gain, basis market weight.....	330	329	335
Daily gain, basis feedlot weight.....	2.34	2.15	2.15
Daily gain, basis market weight.....	2.01	1.84	1.77
Shrinkage enroute to market, per cent.....	5.45	5.78	6.9
Carcass weight (hot)			
Carcass weight (hot).....	584.7	553	630
Dressing per cent, basis hot carcass & market wt.....	62.4	61.6	64
Dressing per cent, basis hot carcass and feedlot wt.....	59	58	60
Carcass grades, per cent			
Choice.....	14	10	15
Strictly good to choice.....	38	36	49
Top medium to good.....	38	36	28
Medium.....	10	17	8
Total feed consumed			
Ground threshed milo.....	1208	545	348
Milo heads.....	-----	-----	175
Cottonseed.....	370	244	380
Cottonseed meal.....	255	351	392
Ground hegari fodder.....	1187	2397	2633
Alfalfa hay.....	554	323	509
Salt, pounds.....	5.82	7.3	6.5
Average ration			
Ground threshed milo.....	7.4	3.04	1.83
Milo heads.....	-----	-----	0.92
Cottonseed.....	2.3	1.36	2.00
Cottonseed meal.....	1.5	1.85	2.1
Ground hegari fodder.....	7.2	13.4	13.9
Alfalfa hay.....	3.4	1.8	2.7
Salt.....	.04	.04	.03
Feed consumed per cwt. gain, basis feedlot weight			
Ground threshed milo.....	315	142	85
Milo heads.....	-----	-----	43
Cottonseed.....	96	64	93
Cottonseed meal.....	66	86	96
Hegari fodder.....	309	624	645
Alfalfa hay.....	144	84	125
Cost of feed per cwt. gain (feed consumed)			
Basis feedlot weight.....	\$ 8.35	\$ 8.62	\$ 8.54
Basis market weight.....	9.72	10.06	10.40
Cost into feedlot			
Feed cost (feed consumed).....	\$34.59	\$33.62	\$45.78
Marketing cost.....	32.06	33.09	34.84
Marketing cost.....	4.76	4.57	5.09
Total cost.....	71.41	71.28	85.71
Amount received.....	72.59	69.29	96.30
Profit.....	1.18	-1.99	10.59

required 930 pounds of feed, 477 pounds of concentrates and 453 pounds of roughage feeds to produce 100 pounds of gain.

While the comparison between the use of rations high in concentrate feeds and high in roughage feeds are based on data for five years,

data for eight years were secured on the feeding of rations high in roughage feeds. In the eight-year period, 226 steers, average initial weight 649 pounds, were fed for an average of 190 days. The average results for this period were much the same as for the five-year period. The average daily gain was the same, 2.15 pounds, for the 226 steers used in the eight-year period as for the 77 steers used in the five-year period. The percentage classification in carcass grade were practically unchanged; however, the 226 steers made higher dressed yield and required slightly more feed to produce 100 pounds of gain.

The steers fed the rations high in concentrate feeds had slight advantage in financial return; however, the returns based on results for 8 years in feeding rations high in roughage feeds were favorable. On the average, the results do not indicate that one method of feeding is likely to be more profitable than another, largely because of the tendency to charge the farm grown roughage feeds at such a price as to return a profit to the farm. The results show mainly that rations high in roughage feeds may be used in producing reasonably well finished steers if such rations are fed for periods of about 200 days.

Milo grain was supplied in limited amounts throughout the feeding period during the first 3 tests in feeding the rations high in roughage feeds. During the last 5 tests, the supply of milo grain was deferred until after 112 or 140 days. Although the data for the two methods do not permit direct comparison, the deferred feeding of grain may be the better method since uniformly high gains were secured for 112 to 140 days without the addition of milo to rations consisting of ground hegari fodder, cottonseed, cottonseed meal, and alfalfa hay.

Results indicate that only small amounts of alfalfa hay can be used to advantage in rations high in ground hegari fodder. Four pounds per head daily for heavy yearling steers is probably as much as can be fed in such rations without reducing finish. Larger amounts, particularly of ground alfalfa, apparently decrease feed consumption.

With rations high in concentrates and properly supplemented with protein, ground hegari fodder was more desirable than alfalfa hay as the sole roughage and hegari fodder and alfalfa in combination produced higher gain and finish than alfalfa alone. The satisfactory gain and finish obtained in various trials in which large amounts of hegari fodder were fed indicates that the grain in finely ground hegari fodder is well utilized.

In comparisons conducted during 1938-39, ground hegari fodder and hegari silage appeared to have approximately equal value for fattening when used with rations high in roughage feeds.

Under the conditions of these tests, no benefit resulted from feeding 0.1 pound of pulverized oyster shell when hegari fodder was used as the sole roughage.

Self-feeding proved to be an entirely satisfactory method for feeding rations high in ground hegari fodder. Slightly greater gains and higher

finish resulted from self-feeding than from hand-feeding the same rations, but cost of gain, labor not considered, was less for hand-feeding.

Cottonseed when fed in limited amount was a good and usable feed in rations for fattening yearling steers. In these trials it was not fed in excess of 0.4 pound per cwt. live weight daily. When it was fed to replace $\frac{1}{3}$ of the ground milo grain in practically full fed concentrate rations, supplemented by cottonseed meal, gain and finish was increased. Gain and finish was likewise increased when it was fed to replace $\frac{1}{3}$ of the milo grain in rations high in roughage feeds. Cottonseed and milo, with the cottonseed fed to replace both the allowance of cottonseed meal ordinarily supplied as the protein supplement and a portion of the milo, produced higher gain and finish than cottonseed meal and milo in rations which included alfalfa hay and hegari fodder. However, the combination of cottonseed and cottonseed meal with milo produced better gains in two out of three instances than milo and cottonseed meal alone, or milo and cottonseed alone, in rations which included alfalfa hay and hegari fodder.

The conception of cottonseed as a feed gained from the various trials is that it can be used more efficiently as a replacement for a portion of the grain in a fattening ration than as a replacement for cottonseed meal; however, it supplies protein and when it is fed, credit should be allowed for its content of protein as well as for its content of energy.

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