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Agricultural Experiment Station

Bulletin No. 91



Steers in Lot VI, February 12, 1920

Fattening Native Steers for Market: 1920

By R. H. Williams

Tucson, Arizona, September 1, 1920

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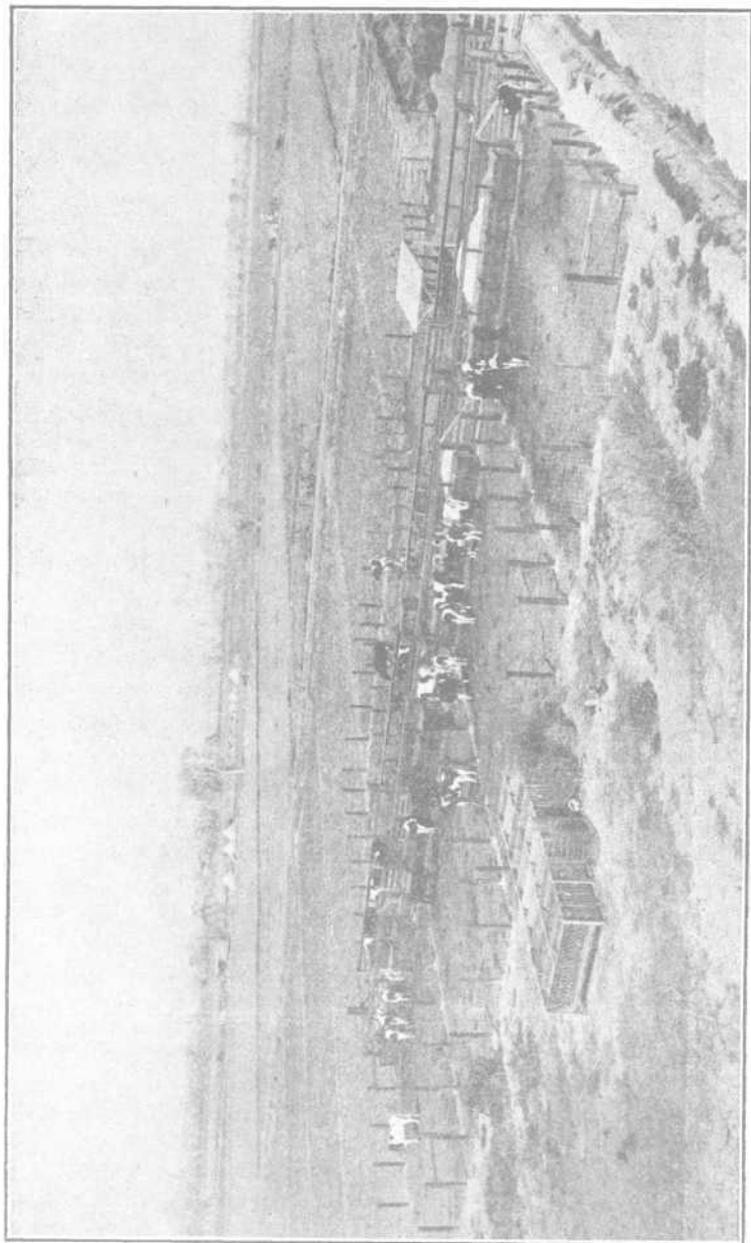
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Experiment steers in feed lots, January 23, 1920

Fattening Native Steers for Market: 1920

By R. H. Williams

INTRODUCTION

Cattle feeding has been an important industry for many years in the irrigated valleys in Arizona. Annually upwards of 30,000 cattle are finished for market in the Salt River Valley alone. Conditions have been especially favorable there for cattle feeding. A diversified system of crop production and rotation is necessary in the irrigated districts. Certain high-priced crops must have other crops rotating with them to maintain fertility and occupy the ground. Cattle offer a special means for marketing home-grown feeds; in this way bulky feeds may be concentrated into gains in weight and the finished animals shipped to market. On almost all farms can be found certain by-products, such as cotton stalks, Bermuda grass, Johnson grass, corn stalks, or even silage and winter pasturage, which cannot find a profitable market except through livestock. Barley and other green feeds may be secured at small expense and animals finished for market on these feeds alone.

Arizona is favorably situated for cattle feeding. The light rain fall and absence of cold stormy weather, combined with bright sunny winters with even temperatures, are favorable for cattle feeding from December to April. Range cattle are grown close to the irrigated farms and may be taken into the valleys after the fall round-ups and fed during the winter months when there is little other work to do.

Not only the Salt River Valley but the other irrigated districts in Arizona, as well as dry farms, are suited to cattle feeding. The area of irrigated lands will be greatly increased and a large acreage suitable for dry-farming by means of floodwater will be developed. Large quantities of feed will be produced. These home-grown feeds are of a bulky nature so that it is difficult to secure a market for them. There is always a good local demand for home grown beef, and Arizona farmers should be able to supply this market rather than have meat shipped in from other states.

The cattle-feeding industry is in its infancy in Arizona. There are many new problems to be solved in this phase of the business. A careful investigation is necessary in order to supply feeders with practical information regarding the cattle-feeding industry.

PLAN OF THE EXPERIMENT

The Agricultural Experiment Station conducted a cattle-feeding test during the winter of 1920 at the Salt River Valley Farm. Little has been done, heretofore, to study the various phases associated with this industry.

The object of the steer-feeding trials was to obtain information relating to the problems of feeding these animals. The effect of the various rations was one of the aims. These rations were so planned that common feeds in the district could be studied. Since a large number of steers are fed on alfalfa hay alone, one of the lots was given this feed for a ration. Two of the lots were not given any alfalfa hay, five lots were given silage, and four cottonseed meal. The detailed objects of the experiment from the standpoint of the rations alone were: (I) To compare alfalfa hay with a ration of alfalfa hay and silage; (II) To compare silage and alfalfa hay with silage and cottonseed meal, and also to compare these two rations together forming one of silage, alfalfa hay, and cottonseed meal; (III) to compare the addition of alfalfa hay to a basal ration of silage and cottonseed meal with the addition of ground milo maize; and (IV) to determine the effect of adding alfalfa hay to a basal ration of silage, cottonseed meal, and ground milo maize. Other secondary considerations included: (1) the amount of feed cattle will consume, (2) rate of gains made by steers; (3) feed required per pound gain; (4) dry matter, total digestible nutrients, and therms consumed per hundred pounds gain; (5) cost of gains in live weight; (6) the margin in cattle feeding; (7) length of time required to finish cattle for market; (8) the dressed percentage of cattle as affected by the different rations, (9) kind of cattle to feed; (10) shrinkage in shipping fat cattle, and other matters of general interest.

ANIMALS USED

Thirty-six steers were selected for the experiment. Twenty-seven of these were polled, being out of native cows, mostly Holsteins, and sired by a Polled Shorthorn bull. The remaining nine were high-grade Holsteins. All the animals were raised in the Salt River Valley and were in good pasture condition averaging 889 pounds, and about 30 months old. The steers had been maintained on alfalfa pasture, but some of them were accustomed to eating hay. These cattle were divided into six lots of six steers each. Each lot was made as nearly alike as possible in size, condition, age, previous treat-

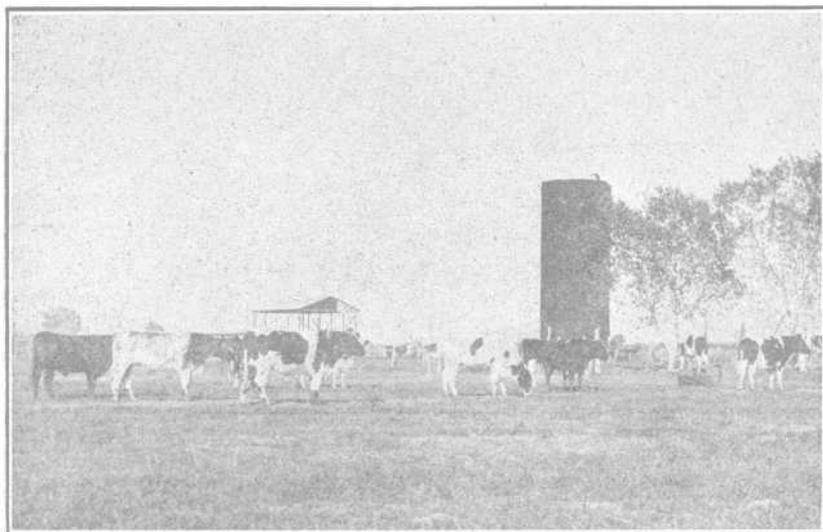


Fig. 2.—Experiment steers as they came from the field, January 8, 1920

ment, conformation, weight, and other characteristics, with the one exception that the animals in Lot I were high-grade Holsteins, and Lots IV, V, and VI each contained one of the high-grade Holstein steers. There was very little difference in the condition of the different animals, but the Holstein steers were probably a little thinner than those sired by the Polled Shorthorn bull. The animals cost 10 cents a pound, the weights being taken after they were driven about six miles without feed or water. Each of the animals was

TABLE I—ANIMALS AT THE BEGINNING OF THE EXPERIMENT,
JANUARY 9 1920

Lot	Average weight of steer in lot	No. of steers in lot	Weight distribution of the steers in the lots				
			1000 lb.	900 to 1000 lb.	800 to 900 lb.	700 to 800 lb.	600 to 700 lb.
I	<i>Pounds</i> 891	6	0	2	4	0	0
II	889	6	1	3	1	0	1
III	890	6	1	1	3	1	0
IV	889	6	1	2	2	1	0
V	889	6	1	2	2	1	0
VI	888	6	1	2	2	1	0

given a number to identify him and records were taken throughout the test according to the number of the animals. Table I gives a statement of the steers in each lot at the beginning of the experiment.

Lot I averaged 891 pounds or a little heavier than any of the other lots. The average weight of the steers in Lots II, IV, and V was 889 pounds. Lot III weighed an average of 890 pounds, and Lot VI was the lightest, averaging 888 pounds.

Although there was considerable difference among the steers in each lot, yet the animals in the various lots were similar. The animals in Lot I were slightly thinner than those in the other lots, but they were the most uniform in weight. Two of them weighed between 900 and 1000 pounds, and the other four between 800 and 900 pounds. Lot III contained three animals whose weight ranged between 800 and 900 pounds, one animal over 1000 pounds, one between 900 and 1000 pounds, and the other between 700 and 800 pounds. Lot II had one animal that weighed over 1000 pounds, three weighed between this and 900 pounds, one in the 800 to 900 pounds group; and one weighed a little less than 700 pounds. The animals in Lots IV, V, and VI fell into the same general distribution.

FEED LOTS AND EQUIPMENT

Six feed lots 48 by 60 feet were used for the experiment. In each lot was a feed manger 3 feet wide and 36 feet long, which was ample for containing the feed. An automatic drinking fountain placed in each lot kept fresh water before the animals at all times. No covering or shed was needed, and the earth floor of the lots was dry and firm throughout the test except after a few light rains. The highest temperature while the experiment was in progress was 82 degrees F. and the lowest was 31 degrees F. No snow fell during the time the steers were in the feed lots. The days were bright and clear there being a total of only 3.13 inches rainfall during the feeding period. The cattle were in a public place where many visitors inspected them, so that they were more restless than they would be on an average farm.

WEIGHING THE ANIMALS

At the beginning of the test each animal was weighed. The cattle at this time had suffered a reasonable shrinkage in weight from the time they left the pasture field. Every Friday morning throughout the test the animals were weighed individually. On Thursday night they were given a regular feed but no water till after weighing.

Frequently a small amount of feed was left in the mangers from the night before, but the cattle were weighed with a small shrinkage estimated to be about 2 percent, or half the amount usually allowed in marketing such animals. The cattle were weighed as soon after 8 o'clock as possible and according to a regular system, so that the weights would be uniform each week.

FEEDS USED

The feeds selected were those most available and commonly used by cattle feeders in the Salt River Valley. Loose alfalfa hay, sorghum silage, cottonseed meal, thrashed ground milo maize, and thrashed ground hegari were used in this experiment. The prices of these feeds at the time the experiment began were as follows:

- Loose alfalfa hay, \$25 per ton.
- Sorghum silage, \$8 per ton.
- Thrashed ground milo maize, \$54 per ton.
- Thrashed ground hegari, \$54 per ton.
- Cottonseed meal. \$80 per ton.

The above prices have been used in calculating the cost of the rations and the cost of producing gains. The quality of the feeds was about average. The hay was fairly free from weeds but somewhat coarse in texture. The sorghum silage varied somewhat from time to time, but it had been cut when fairly green and was of about average quality. While the cottonseed meal was purchased and labelled to contain 47 percent protein, the direct analysis showed that it had only 38.46 percent of protein. The chemical composition of the various feeds used was determined by direct analysis by the Department of Agricultural Chemistry as given in Table II.

TABLE II—CHEMICAL COMPOSITION OF FEEDS USED
(Expressed in percent of fresh substance)

Feed	Dry Substance	Protein	Carbohydrates		Ash	Fat
			Fiber	Nitrogen free extract		
	%	%	%	%	%	%
Alfalfa hay	96.30	15.73	29.75	40.59	8.02	1.67
Sorghum silage	24.83	1.13	6.41	13.93	2.88	0.48
Corn silage	25.57	1.89	7.30	14.13	1.84	0.42
Cottonseed meal	94.45	38.46	12.23	31.38	6.44	5.94
Ground milo maize	91.41	12.13	1.81	74.67	1.60	1.20
Ground hegari	89.76	9.41	1.88	75.27	1.44	1.76

RATIONS

The experiment was planned after consulting many local feeders who have made a careful study of the business. It was finally decided to use rations bulky in character, similar to those most frequently used in the district. Cattle are not made prime in Arizona. The local market pays as much for half-finished cattle as for those that are fat. Since the last hundred pounds of gain usually requires a longer time and more feed, as well as a ration of more concentrated nature, local feeders prefer to give only small amounts of grains. The lots receiving cottonseed meal were limited to a maximum of three pounds per steer daily, and at no time was more than six pounds of ground milo maize fed to a steer. The animals receiving silage or hay were given all of either or both of these feeds they would consume. The various lots received a bulky ration not suitable for making large or rapid gains. The rations supplied the animals are given in Table III

TABLE III --RATIONS FED THE DIFFERENT LOTS

Lot	RATION
I	Loose alfalfa hay ad lib
II	Alfalfa hay ad lib, sorghum silage ad lib
III	Silage ad lib, cottonseed meal 2.66 lb
IV	Silage ad lib, cottonseed meal 2.66 lb, alfalfa hay ad lib
V	Silage ad lib, cottonseed meal 2.66 lb, ground milo maize 5.70 lb
VI	Silage ad lib, cottonseed meal 2.66 lb, ground milo maize 5.77 lb, alfalfa hay ad lib

The steers in Lot I received all the loose alfalfa hay they would eat; no other feed was given them. Lot II was fed a combination of alfalfa hay and sorghum silage. The aim was to supply each lot with as much of these rations as they would consume and not have any left over. Lot III received a ration of all the silage they would eat together with 2.66 pounds of cottonseed meal per head daily. The steers in Lot IV were given all the silage and alfalfa hay they would eat and in addition an average of 2.66 pounds of cottonseed meal per head daily. This lot was a combination of Lots II and III from the standpoint of feed. Lot V. was allowed all the silage they would eat and 2.66 pounds of cottonseed meal per head daily and 5.70 pounds of ground milo maize. This lot was fed the same as Lot III but given the addition of a light feed of grain. The cattle in Lot VI were given all four of the feeds, being allowed all the silage

and hay they would eat, but limited to 2.66 pounds of cottonseed meal and 5.77 pounds of ground milo maize.

PLACING CATTLE ON FEED

The cattle were in dry lots throughout the test, and they could not receive anything that they were not given. The daily allowance of feed was given the steers in two feeds, one in the morning after 8 A. M. and the evening feed from 4 to 6 P. M. From the outset, the animals receiving hay and silage were given all of these feeds they would consume. The first week all the cattle receiving cottonseed meal were given one pound per head daily; the second week this amount was increased to two pounds, and after the third week they were given three pounds per head daily. The steers in Lots V and VI were given four pounds of thrashed ground milo maize per head daily the first week, five pounds the second, and six pounds throughout the rest of the experiment.

CHANGES IN FEEDS

From January 9 to February 14 the sorghum was the Goose Neck and Honey Drip varieties. This sorghum was cut somewhat green and produced silage that was sour and not so good in quality as the silage used after February 14. After this time the silage was from Orange Cane sorghum. This was riper, sweeter, and had more grain than the sorghum previously fed. The steers preferred this silage to the varieties fed up to this date.

Beginning March 15 the cattle were given corn silage made from Mexican June corn and a small amount of cowpeas. The steers did not eat this silage with as much relish as the sorghum silage previously used. They seemed restless, nosed over the silage, ate a few bites, and then moved around the corral. A few days were required for them to change to the corn silage, which they eventually ate with relish.

Thrashed ground milo maize was fed from January 9 to February 29 covering a period of 51 days. Beginning March 1 hegari that had been thrashed and then ground was supplied the animals until the end of the test. In discussing the results "milo maize" is used, but it should be remembered that hegari replaced the milo maize after March 1. No difference was observed in the palatability or feeding quality of these two grains.

REFUSED FEED

A small quantity of the feed given the cattle in each lot was wasted. Good mangers were used and an effort was made to supply the cattle with only the amount of feed they would consume without waste. Small quantities of feed dropped from the mouths of the cattle to the ground and some waste resulted in this manner. All feed the animals did not eat and left in the manger was weighed and a careful record kept of it. The alfalfa hay was easily separated from the other feed and a close record of the amount of hay actually consumed by the animals was secured. The silage lost moisture so that the record of the refused silage has little significance. The cracked grain and cottonseed meal became so mixed with the silage that it was difficult to ascertain how much of each of these feeds was refused by the different lots. It was noticed, however, that the cattle made an effort to eat the grain and cottonseed meal, and no doubt only small quantities of these concentrates were left behind as refuse. The amount of feed refused in the various lots is given in Table IV.

TABLE IV—HAY AND SILAGE REFUSED BY THE CATTLE IN THE DIFFERENT LOTS

Lot	Feed refused by the steers			
	Alfalfa hay		Silage	
	Pounds 316	% 2	Pounds	%
I				
II	181	4	65	0.3
III			297	1.0
IV	164	8	70	0.2
V			618	3.0
VI	138	8	60	0.3

As was to be expected, Lot I left more alfalfa hay than any of the other lots, but the refused hay in this lot was only 2 percent, although a total of 316 pounds of hay was weighed back. Lots II, IV, and VI refused from 138 to 181 pounds of alfalfa hay, this amount being from four to eight percent of the total given these lots. Lots III and V received no alfalfa hay. It is believed that if they had been allowed the refused alfalfa hay from the other four lots they would have eaten it and probably made better gains.

Lot V refused 618 pounds of silage. This was more than twice as much as the silage refused by Lot III. Most of the silage refused

by Lot V was during the time that two steers in this lot were off feed. These were the only two steers in the experiment that were not always ready to eat their feed. The proportion of loss of silage is much less than that of refused alfalfa hay. Lot V had 3 percent of the silage weighed back; Lot III 1 percent, and Lots II, IV, and VI each less than 1 percent. Here again it is believed that if the refused silage in the five lots had been given the steers in Lot I that received no silage, they would have made good use of it. Since these amounts of feed are ordinarily wasted in practical feeding, and the steers selected the best of the feed, leaving the inferior portions, the steers were charged with all the refused feeds in calculating the costs.

DURATION

The steers were placed in the feed lot on January 9, 1920, and the test was completed after the cattle had been on feed 77 days ending March 25. At this time, an offer of 11 cents per pound live weight, deducting 4 percent shrinkage from the filled weight was accepted. This was an extremely satisfactory price, considering the market at that time. During January and February the outlook for higher prices was especially favorable. February 20 a local buyer offered 12 cents a pound for the animals for delivery April 1. This was a good price and would have allowed a profit on the feeding operations. Other feeders in the district had been offered 13 cents a pound for similar steers to be delivered April 1. Shortly after this time Kansas City packers began shipping dressed beef to the Salt River Valley. This intimidated the local butchers, as the Kansas City beef was placed on the market at a lower price than the cost of beef from home fed cattle. Towards the first of April the Federal Government sold large quantities of frozen beef that had been in storage two years. Los Angeles, one of the most promising markets for cattle fed in the Southwest, purchased large quantities of this frozen beef at very low prices. Another contributing factor to the drop in prices of finished cattle resulted from the desert range being unusually good, and the cattle maintained on these ranges were sufficiently fat for butchers as early as the middle of April. With all these contributing factors, as well as a depressed market in Denver and Kansas City, we felt extremely fortunate in being able to secure 11 cents a pound for the steers. They were purchased by Cowden and Babbitt, and shipped to Flagstaff for local consumption.

A careful estimate was made of the value of the steers in the differ-

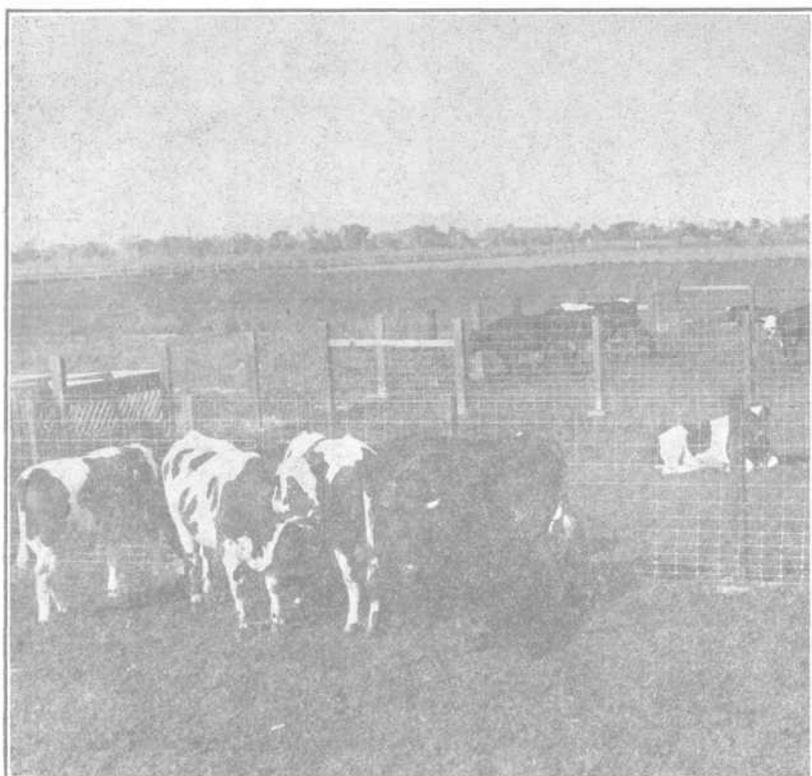


Fig. 3.—Steers in the feed lots, March 29, 1920

ent lots at the close of the test. Table V gives the value of the animals at the end of the first 77 days on feed.

TABLE V.—ESTIMATED VALUE OF ANIMALS AT THE END OF 77 DAYS

	Lot I	Lot II	Lot III	Lot IV	Lot V	Lot VI
Value per hundred live weight.	\$10.25	\$10.75	\$10.60	\$11.20	\$11.35	\$11.50

Local butchers estimated that there was a range of \$1.25 per hundred between the value of the steers in Lots I and VI. Lot II was fatter than Lots I and III and estimated to be worth 15 cents per hundred more than Lot III. Lots IV, V, and VI were distinctly fatter than any of the other lots.

RESULTS OF THE EXPERIMENT

Extreme care was exercised in planning and conducting the experiment to secure results which would be reliable and accurate for the different lots. The weighing of the feeds and the animals was as thorough and uniform as possible. The results of the experiment and the following discussion are based on these weights.

ALFALFA HAY COMPARED WITH ALFALFA HAY AND SILAGE

A few years ago, when alfalfa hay cost \$5 to \$10 per ton, it was often used as an exclusive ration for fattening cattle. Since 1918 the price of this feed has increased greatly, and now feeders are endeavoring to secure a more effective ration than alfalfa hay alone. Many silos have been constructed in the State, and feeders wish to know if silage when added to alfalfa hay will make larger and more economical gains.

Two lots of steers containing six animals each were used for this test. Lot I was given all the alfalfa hay they would eat, and Lot II allowed all the alfalfa hay and silage they cared for. The steers were fed twice a day. In Table VI is given a summary of the results giving a comparison of the weights, gains, average daily rations, feeds required per pound gain, nutrients required per 100 pounds gain, cost of 100 pounds gain, and the total cost of the animals, their value and profit at the end of the test in Table VI.

At the beginning of the test, the six steers in Lot I averaged 2 pounds heavier than those in Lot II. During the 77 days the steers fed on alfalfa hay alone gained 107 pounds per head, while those fed on alfalfa hay and silage gained 184 pounds per head. The average daily gain was only 1.40 pounds per head in Lot I, and 2.39 pounds in Lot II. Not one of the steers in Lot I gained as much as the lightest steer gained in Lot II. This shows that the addition of silage to alfalfa hay made the animals gain more rapidly. Steers fed on alfalfa hay alone will gain an average of about 1.40 pounds per head daily during the first 11 weeks. On the other hand, if silage is added to a ration of alfalfa hay, they will gain almost a pound more daily. This increased gain in the lot where the steers were allowed all the silage they cared for in addition to alfalfa hay means the difference between rapid and slow gains. The steers in Lot I gained slowly and would have required a long feeding period to finish, while the steers in Lot II made what would be considered medium gains.

TABLE VI.—SUMMARY OF THE RESULTS FOR LOTS I AND II FED 77 DAYS

	Lot I	Lot II
Number of steers in lot	6	6
Ration	Alfalfa hay	Alfalfa hay and silage
Average initial weight.....	891 lb.	889 lb.
Average final weight.....	998 lb.	1073 lb.
Average gain.....	107 lb.	184 lb.
Average daily gain.....	1.40 lb.	2.39 lb.
Average daily ration:		
Alfalfa hay.....	28.63 lb.	8.99 lb.
Silage.....		47.14 lb.
Feed required per pound gain:		
Alfalfa hay.....	20.51 lb.	3.76 lb.
Silage.....		19.71 lb.
Nutrients required per 100 lbs. gain:		
Dry matter.....	1860.29 lb.	793.72 lb.
Total digestible nutrient.....	1055.00 lb.	456.49 lb.
Number of therms.....	700.00 therms	442.68 therms
Cost of 100 pounds gain.....	\$25.63	\$12.58
Initial cost per head at \$10.00 cwt.....	\$89.10	\$88.90
Feed cost per head.....	27.55	23.18
Interest on investment at 8%.....	1.50	1.50
Estimated cost of marketing.....	1.45	1.45
Total cost.....	\$119.60	\$115.03
Value per cwt. March 26.....	\$ 10.25	\$ 10.75
Returns per head without shrink.....	102.33	115.38
Loss per head.....	17.27	
Profit per head.....		.35
Necessary selling price per cwt.....	11.98	10.72

The average daily ration consumed by the steers in Lot I was 28.63 pounds of alfalfa hay. The first four weeks they consumed an average of 25.87 pounds per day; the second four weeks, 30.30 pounds; and the last three weeks 30.08 pounds. Steers weighing 891 pounds and about 30 months old will consume slightly less than 30 pounds of alfalfa hay daily for the first 11 weeks they are in the feed lot. The first few days they will probably be nervous and not accustomed to the feed, but after the first month they should reach their maximum capacity. The steers in Lot II consumed an average of 47.14 pounds of silage and 8.99 pounds of alfalfa hay per head daily throughout the test. At the outset these cattle ate more hay and less silage, but as the period progressed they ate less alfalfa hay and more silage. In each of the lots, the animals seemed to be well contented with their feed and did as well as could be expected from the kind of feed given them.

The steers in Lot II did not require as much dry matter, total

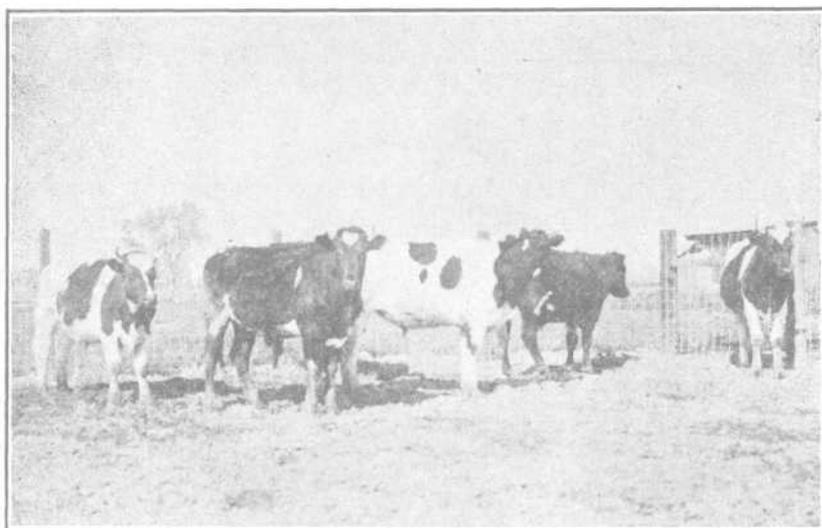


Fig. 4.—Steers in Lot I, February 12, 1920

digestible nutrients, or therns to make 100 pounds of gain as the cattle in Lot I. This would indicate that the addition of silage to a basal ration of alfalfa hay balanced the feed constituents in some way so that the animals could utilize the nutrients more efficiently. Owing to the greater variety in the ration supplied to the steers in Lot II, they consumed more feed, or else the ration was more concentrated so the cattle could make greater gains and at less cost. Gain in Lot I cost \$25.63 per 100 pounds and in Lot II only \$12.58, or a little less than half as much. The total cost of feed in Lot I was higher than in Lot II, so that the cattle fed on alfalfa hay alone required more money to buy the feed for them than where a combination ration was fed. Gains, however, were not in proportion to the cost of the feed, and the increase in the value of the animals was also less with the steers fed on alfalfa hay. This means that alfalfa hay alone is not so good a ration as alfalfa hay and silage from the standpoint of rate of gains, cost of the daily feed ration, cost of gains, or increasing the value of the animals. The steers fed on alfalfa hay lost an average of \$17.27, while the cattle fed on alfalfa hay and silage made an average profit of 35 cents per head. To break even, the selling price would have had to be \$10.72 per hundred for Lot II and \$11.98 for Lot I. In every particular it was found that the addition of silage to a ration of alfalfa hay was beneficial.

SILAGE AND ALFALFA HAY COMPARED WITH SILAGE AND COTTONSEED MEAL; ALSO WITH SILAGE, ALFALFA HAY, AND COTTONSEED MEAL

Having proved that a ration of silage and alfalfa hay is better than alfalfa hay alone for fattening steers, it is next desired to compare this ration with silage and cottonseed meal and with a combination of all three of the feeds. Three lots of steers were used to make this study. Lot II was fed on silage and alfalfa hay, Lot III, silage and cottonseed meal, and Lot IV, silage, cottonseed meal, and alfalfa hay. Each lot receiving silage or alfalfa hay was given all of these feeds they would eat, and Lots III and IV were given an average of 2.66 pounds cottonseed meal per head daily for the entire period. It will be noted that Lot IV was given a combination of the rations given Lots II and III. A detailed summary of the results of this test is given in Table VII.

TABLE VII—SUMMARY OF THE RESULTS WITH LOTS II, III, AND IV

	Lot II	Lot III	Lot IV
Number of steers in lot	6	6	6
Ration	Silage alfalfa hay	Silage cottonseed meal	Silage alfalfa hay, cottonseed meal
Average initial weight	889 lb	890 lb	889 lb
Average final weight	1073 lb	1041 lb	1086 lb
Average gain	184 lb	151 lb	197 lb
Average daily gain	2.39 lb	1.96 lb	2.55 lb
Average daily ration			
Alfalfa hay	8.99 lb		4.20 lb
Silage	47.14 lb	61.76 lb	60.68 lb
Cottonseed meal		2.66 lb	2.66 lb
Feed required per pound gain			
Alfalfa hay	1.76 lb		1.65 lb
Silage	19.71 lb	31.49 lb	23.78 lb
Cottonseed meal		1.36 lb	1.04 lb
Nutrients required per 100 pounds gain			
Dry matter	793.72 lb	843.37 lb	789.41 lb
Total digestible nutrients	456.49 lb	520.41 lb	479.61 lb
Number of therms	442.68 therm ^s	628.06 therm ^s	532.55 therms
Cost of 100 pounds gain	\$12.58	\$18.03	\$15.73
Initial cost per head at \$10.00 cwt	\$ 88.90	\$ 89.00	\$ 88.90
Feed cost per head	23.18	27.22	30.93
Interest on investment at 8%	1.50	1.50	1.50
Estimated cost of marketing	1.45	1.45	1.5
Total cost	\$115.03	\$119.17	\$122.78
Value per cwt March 6	\$ 10.75	\$ 10.60	\$ 11.20
Returns per head without shrink	115.38	110.35	121.59
Loss per head		8.82	1.19
Profit per head	35		
Necessary selling price per cwt	10.72	11.45	11.31

Although the steers were as nearly alike as possible at the beginning of the test, yet the ration given them soon began to prove that the steers in Lot IV were making the most rapid gains and Lot III the slowest. At the end of 77 days the average gain in Lot IV was 197 pounds; Lot II, 184 pounds; and Lot III only 151 pounds. The average daily gain was 2.55 pounds in Lot IV, 2.39 pounds, in Lot II and 1.96 pounds in Lot III. The average steer in Lot IV gained .16 pound per day more than the average steer in Lot II and .59 pound more than those in Lot III. The steers given all three feeds made the most rapid gains, and those fed on alfalfa hay and silage gained more rapidly than steers given a limited quantity of cottonseed meal and all the silage they would eat.

Each lot received all the silage they would eat. Lot II ate only 47.14 pounds of silage along with 8.99 pounds of alfalfa hay. Lot III consumed most silage, averaging 61.76 pounds per day, along with 2.66 pounds of cottonseed meal; and Lot IV ate about a pound less of silage per day than Lot III, the same quantity of cottonseed meal, and in addition 4.20 pounds of alfalfa hay. Owing to the small gains made by the steers in Lot III, and the large gains by the animals in Lot IV, relatively less feed and nutrients were required to produce an equal gain in weight in Lot IV than in Lot III. The steers in Lot II seemed to make better use of their feed than those in Lot IV, except in the total amount of dry matter required to produce 100 pounds gain. The cost of 100 pounds gain was lowest in Lot II, averaging \$12.58; highest in Lot III, being \$18.03; and Lot IV ranked between the other two, costing an average of \$15.73. The steers in Lot IV made the largest gain, but at the highest feed cost. These steers were much fatter than those in the other lots and were valued at a higher price at the end of the test. The difference in the condition of the cattle in Lot IV and the greater gain in weight did not overcome the more effective utilization and the lower feed cost of the steers in Lot II, so that the steers in this lot made a profit of 35 cents per head, while those in Lot IV lost an average of \$1.19 per head. The ration in Lot III was decidedly inferior to that in Lots II and IV, for the average steer in Lot III lost more money than the entire six steers in Lot IV. The necessary selling price per 100 pounds at the end of the 77 days, in order to break even without gain or loss, was \$10.72 for Lot II, \$11.31 for Lot IV, and \$11.45 for Lot III. These selling prices are based on a cost price of \$10 per hundred for the feeders, the cost of the feeds consumed, the interest on the money

invested for cattle, and cost of marketing, as well as the rate of gain made by the different lots. A margin between the cost price of feeders and the selling price of the finished steers at the end of 77 days of 72 cents per hundred for Lot II, \$1.31 for Lot IV and \$1.45 for Lot III would have been necessary to cover the entire expenses in the different lots.

ALFALFA HAY COMPARED WITH GROUND MILO MAIZE AS A SUPPLEMENT TO SILAGE AND COTTONSEED MEAL

Lots IV and V were used for this test. The steers in Lot IV were given all the silage and alfalfa hay they would eat and 2.66 pounds of cottonseed meal per head daily. Each steer in Lot V received 2.66 pounds of cottonseed meal, 5.70 pounds of ground milo maize, and all the silage they would eat. The daily consumption of silage in Lot IV was 60.68 pounds per steer, while those in Lot V ate 52.70 pounds. Each steer in Lot IV ate 7.98 pounds more silage daily, the same amount of cottonseed meal, and 4.20 pounds of alfalfa hay in place of 5.70 pounds of ground grain consumed in Lot V. Table VIII gives the summary of the results with this test.

The steers in the two lots weighed an average of 889 pounds at the beginning, but those in Lot IV gained 197 pounds and the steers in Lot V 189 pounds each. At the end of the test the steers in Lot IV had gained an average of 8 pounds more than those in the other lot. Less dry matter, total digestible nutrients, and therms were required to produce 100 pounds of gain in Lot IV than in Lot V. The animals fed more evenly in Lot IV throughout the test and seemed to be more vigorous and to relish their feed better than those in Lot V. Two steers were off feed for a week in Lot V, and three in this lot gained less than 140 pounds each, while the lightest gain in Lot IV was 160 pounds.

Owing to the greater gain made by the steers in Lot IV and the apparently more effective use of the feed, which was of a bulky nature costing less than the concentrated feed given Lot V, the cost of gains was less in Lot IV than in Lot V. The cost of feed to produce 100 pounds of gain in Lot IV was \$15.73, and in Lot V it was \$19.18. During the feeding period the average steer in Lot IV cost \$30.93 for feed, and in Lot V, \$36.28. In spite of the larger gains made by

TABLE VIII—SUMMARY OF THE RESULTS WITH LOTS IV AND V FED 77 DAYS

	Lot IV	Lot V
Number of steers in lot	6	6
Ration	Silage, cottonseed meal, alfalfa hay	Silage, cottonseed meal, ground milo maize
Average initial weight	889 lb	889 lb
Average final weight	1036 lb	1078 lb
Average gain	197 lb	189 lb
Average daily gain	2.55 lb	2.46 lb
Average daily ration		
Alfalfa hay	4.20 lb	
Silage	60.68 lb	52.70 lb
Cottonseed meal	2.66 lb	2.66 lb
Ground milo maize		5.70 lb
Feed required per pound gain		
Alfalfa hay	1.65 lb	
Silage	23.78 lb.	21.45 lb
Cottonseed meal	1.04 lb	1.08 lb.
Ground milo maize		2.32 lb
Nutrients required per 100 pounds gain		
Dry matter	789.41 lb	795.12 lb
Total digestible nutrients	479.61 lb	450.81 lb
Number of therms	532.55 therms	648.37 therms
Cost of 100 pounds gain	\$15.73	\$19.18
Initial cost per head at \$10.00 cwt	\$ 88.90	\$ 88.90
Feed cost per head	30.93	36.28
Interest on investment at 8%	1.50	1.50
Estimated cost of marketing	1.45	1.45
Total cost	\$122.78	\$128.13
Value per cwt March 26	\$ 11.20	\$ 11.35
Returns per head without shrink	121.59	122.39
Loss per head	1.19	5.74
Profit per head		
Necessary selling price per cwt	11.31	11.88

the steers fed on silage, cottonseed meal, and alfalfa hay, the steers given silage, cottonseed meal, and ground milo maize fattened more rapidly and were valued at 15 cents more per hundred at the close of the experiment than those in the other lot. The steers in Lot IV seemed to grow rather than to finish for market. The average steer in Lot IV lost \$1.19 and in Lot V the average lost \$5.74. In order to break even on the two lots, it would have been necessary to sell the steers in Lot IV at \$11.31 per 100 pounds and those in Lot V at \$11.88 per 100 pounds. The margin required to feed the steers in Lot IV was \$1.31 per 100 pounds, and in Lot V it would have been necessary to sell the animals at \$1.88 more than their purchase price.

ALFALFA HAY ADDED TO A RATION OF SILAGE, COTTONSEED MEAL, AND GROUND MILO MAIZE

A variety of feeds is considered advisable in a ration for animals. Two lots of six steers each were fed in making this test. The steers in Lot V were given 2.66 pounds of cottonseed meal, 5.70 pounds of milo maize, and all the silage they would consume. In Lot VI the steers were given the same amount of cottonseed meal, almost the same quantity of ground milo maize, and allowed free choice of alfalfa hay and silage. A summary of results with Lots V and VI is given in Table IX.

TABLE IX.—SUMMARY OF RESULTS WITH LOTS V, AND VI, FED 77 DAYS

	Lot V	Lot VI
Number of steers in lot	6	6
Ration	Silage, cottonseed meal, ground milo maize	Silage, cottonseed meal, ground milo maize, alfalfa hay
Average initial weight.....	889 lb.	888 lb.
Average final weight.....	1078 lb.	1080 lb.
Average gain.....	189 lb.	192 lb.
Average daily gain.....	2.46 lb.	2.49 lb.
Average daily ration:		
Alfalfa hay.....		3.97 lb.
Silage.....	52.70 lb.	48.38 lb.
Cottonseed meal.....	2.66 lb.	2.66 lb.
Ground milo maize.....	5.70 lb.	5.77 lb.
Feed required per pound gain:		
Alfalfa hay.....		1.60 lb.
Silage.....	21.45 lb.	19.43 lb.
Cottonseed meal.....	1.08 lb.	1.07 lb.
Ground milo maize.....	2.32 lb.	2.32 lb.
Nutrients required per 100 pounds gain:		
Dry matter.....	795.12 lb.	893.98 lb.
Total digestible nutrients.....	550.81 lb.	605.62 lb.
Number of therms.....	648.37 therms	669.88 therms
Cost of 100 pounds gain.....	\$19.18	\$20.30
Initial cost per head at \$10.00 cwt.....	\$ 88.90	\$ 88.80
Feed cost per head.....	36.28	38.91
Interest on investment at 8%.....	1.50	1.50
Estimated cost of marketing.....	1.45	1.45
Total cost.....	\$128.13	\$130.66
Value per cwt. March 26.....	\$ 11.35	\$ 11.50
Returns per head without shrink.....	122.39	124.20
Loss per head.....	5.74	6.46
Profit per head.....		
Necessary selling price per cwt.....	11.88	12.10

The rations in the two lots were the same except that the steers in Lot VI consumed an average of 3.97 pounds alfalfa hay per head daily, while those in Lot V were given no alfalfa hay and they ate 4.32 pounds more silage per head daily than the steers in Lot VI. The steers in Lot V gained a total of 189 pounds or an average of 2.46 pounds per head daily, and those in Lot VI gained 192 pounds during the feeding period, or an average of 2.49 pounds per head daily. The amount of feed required per pound gain was very similar in each lot, Lot VI using 2.02 pounds less silage, but 1.60 pounds more of alfalfa hay.

From the standpoint of the efficiency of the rations as indicated by the nutrients required to make a hundred pounds of gain, the steers in Lot V seemed to have a distinct advantage in this respect. In dry matter, total digestible nutrients, and number of therms required to produce 100 pounds of gain, the steers in Lot VI required about ten percent more than those in Lot V. The feed in Lot V seemed to be more efficient than in Lot VI in making gain, or else the tables giving the digestibility of feeds are not reliable for Arizona conditions. Throughout it was observed that there was an apparently greater food value attached to alfalfa hay than actually obtained in this test, or the constituents in silage as given in text-books on the subject were underestimated. There is an apparently illogical condition in the tables giving the nutrients consumed or required to produce 100 pounds gain.

The feed cost was \$36.28 for an average steer in Lot V and \$38.91 in Lot VI. The gains in Lot VI were not sufficiently greater to counteract this increased cost of the food, for gain costs \$19.18 per 100 pounds in Lot V and \$20.30 in Lot VI. Both of the lots lost money, Lot V losing \$5.74 per head and Lot VI \$6.46. In order to purchase the animals, to supply them with feed, pay interest on the cost price of the steers, and to market them, \$11.88 per 100 pounds was necessary in Lot V and \$12.10 in Lot VI.

The chief differences between the two lots were: (1) greater uniformity of gains made by the steers in Lot VI; (2) the animals in Lot VI finished more rapidly for market; (3) better appetites of the animals in Lot VI; and (4) the higher price received for them at the end of the test. There seemed to be some quality associated with the alfalfa hay which had a beneficial effect on the animals. The steers in Lot VI were all in good vigorous condition with ready appetites but two of the steers in Lot V went off feed during the test.

These were the only steers in the entire experiment that showed a tendency to refuse feed at any time. Three of the animals in Lot V made very light gains, and two of them gained large amounts. In Lot VI all the steers made large gains, and at the end of the test the animals in this lot were much more uniform and fatter than those in Lot V. One may conclude that, from the standpoint of keeping animals in good condition, with good vigorous appetites, and in order to make them finish for market at an early date, without many culls, the addition of alfalfa hay to a ration of silage, cottonseed meal, and milo maize is beneficial.

In each of the lots receiving alfalfa hay, with the exception of Lot I where the steers were fed exclusively on this feed, alfalfa hay seemed to have a beneficial effect. Animals do not care for more than three or four pounds of alfalfa hay per day, but they will do better if given this amount. They will gain more rapidly, feed more uniformly, and take on flesh faster than when no alfalfa hay is given them. Apparently the cost of producing gains may be slightly more when the alfalfa hay has been fed, but at least a small amount of alfalfa hay or some other good substitute for it should be used in cattle feeding.

FINANCIAL STATEMENTS

FINANCIAL STATEMENT FOR 36 STEERS, 1920

Cost of steers (32,020 lb.) at 10 cents.....	\$3202.00
Cost of feed.....	1360.29
Interest on investment at 8%.....	54.00
Estimated cost of marketing.....	52.20
Total cost.....	\$4668.49
Returns from 23 steers Wt. (25,398 4% shrink) at 11 cents.....	\$2682.03
Returns from 13 steers Wt. (14,892 4% shrink) at 11 cents.....	1572.60
Total returns.....	\$4254.63
Loss.....	413.86
Loss per steer.....	11.50

FINANCIAL STATEMENT ASSUMING ALL STEERS WERE SOLD AT THE END OF 77 DAYS AT 11 CENTS PER LB. AND 4% SHRINK

Cost of steers (32,020 lb.) at 10 cents pound.....	\$3202.00
Cost of feed.....	1104.45
Interest on investment at 8%.....	54.00
Estimated cost of marketing.....	52.20
Total cost.....	\$4412.65
Returns from 26 steers (38,140 lb. 4% shrink) at 11 cents.....	\$4027.58
Loss.....	\$ 385.07
Loss per steer.....	10.70

GENERAL DISCUSSION

COST OF 100 POUNDS GAIN WITH VARYING FEED PRICES

The main object in feeding cattle is to make a profit. In order to make a profit the feeder must select feeds which will produce good gains at low cost. The use of home-grown feed will often bring a larger return if marketed through live stock than when shipped to some distant market. Table X has been prepared to give the cost of 100 pounds of gain with varying prices of feed.

TABLE X.—COST OF 100 POUNDS GAIN WITH VARYING FEED PRICES

Alfalfa hay	\$12.00			\$18.00			\$25.00			Alfalfa hay		
	\$ 6.00	\$ 8.00	\$10.00	\$ 6.00	\$ 8.00	\$10.00	\$ 6.00	\$ 8.00	\$10.00	\$12.60	\$18.00	\$25.00
Silage												
Lot I—Alfalfa hay....										12.30	18.45	25.63
Lot II—Alfalfa hay and Silage.....	8.17	10.14	12.12	9.29	11.26	13.24	10.61	12.58	14.56			
Lot III—Silage and cottonseed meal....												
Cottonseed meal.....												
\$60	13.52	16.67	19.82									
\$70	14.20	17.35	20.50									
\$80	14.88	18.03	21.18									
Lot IV—Alfalfa hay, Silage and Cottonseed meal.....												
Cottonseed meal.....												
\$60	11.25	13.63	16.01	11.74	14.12	16.50	12.32	14.70	17.08			
\$70	11.77	14.15	16.53	12.26	14.64	17.02	12.84	15.22	17.60			
\$80	12.29	14.67	17.05	12.78	15.16	17.54	13.36	15.74	18.12			
Lot V—Silage, milo and cottonseed meal												
Milo.....	30.00	40.00	54.00									
Cottonseed meal.....												
\$60	13.17	16.47	20.25									
\$70	13.71	17.01	20.79									
\$80	14.25	17.55	21.33									
Lot VI—Alfalfa hay, silage, milo and cottonseed meal												
Milo.....	30.00	40.00	54.00	30.00	40.00	54.00	30.00	40.00	54.00			
Cottonseed meal.....												
\$60	13.47	16.57	20.14	13.95	17.05	20.62	14.50	17.60	21.17			
\$70	14.00	17.10	20.67	14.48	17.58	21.15	15.03	18.13	21.70			
\$80	14.54	17.64	21.21	15.02	18.12	21.69	15.57	18.67	22.24			

The different prices have been taken for the various feeds as follows: Alfalfa hay, \$12, \$18, and \$25 per ton; silage \$6, \$8, and \$10 per ton; cottonseed meal \$60, \$70, and \$80 per ton; and ground milo maize \$30, \$40, and \$50 per ton.

The method of using this table is as follows: Suppose the feeder is considering what the cost of 100 pounds of gain will be with alfalfa hay at \$25 per ton, silage at \$8, cottonseed meal at \$80, and milo maize at \$40 per ton. First look under the heading of alfalfa at \$25

per ton; follow down the column marked silage at \$8 per ton until the milo column marked \$40 a ton is reached; follow down from here to the figure opposite cottonseed meal at \$80 per ton, and the sum of \$18.67 is found. This amount is the cost of 100 pounds of gain if the above prices are used and gains are made the same as the steers in Lot VI. Other combinations of feeds and prices are found in the same manner. Thus alfalfa hay at \$12 per ton, silage at \$6 and cottonseed meal at \$60 a ton will cost \$11 25 to make 100 pounds of gain at the rate made by the steers in Lot III. Where alfalfa hay alone is fed, the cost of 100 pounds of gain is about the same as the cost per ton of the hay.

Table X has been given to supply a ready reference to cattle feeders. It is believed that it will give a close approximation of the costs of making 100 pounds gain in steers with any of the six rations used in this test. Before beginning the feeding operations, it would be wise to compare the ruling prices of feeds with this table to ascertain whether to feed or not. It almost always costs more to make cattle gain in live weight than one can secure for the finished animals. With a two cent margin over a short feeding period one can expect the cost of gains to be two to four cents per pound greater than the fat cattle will bring.

In order to give a brief summary of the test which will enable one to follow the data from the lots fed in the six different ways and make a comparison of them a complete summary is presented in Table XI. Some secondary factors of interest to stockmen are found in this table. Among these may be mentioned: (1) amount of feed cattle will consume; (2) rate of gain made by steers; (3) feed required per pound gain; (4) dry matter, total digestible nutrients, and therms consumed per 100 pounds gain; (5) cost of gains in live weight; (6) margin in cattle feeding; (7) length of time required to finish cattle for market; and (8) dressed percentage of cattle as affected by the different rations.

AMOUNT OF FEED CATTLE WILL CONSUME

According to the results obtained in this test, steers weighing 891 pounds will consume an average of 28.63 pounds of alfalfa hay per day. For the same length of time a similar animal, when given free choice of alfalfa hay and silage, will consume 8.99 pounds of the former and 47.14 pounds of the latter. When steers are given a limited amount of concentrated feed along with roughage consisting of silage or alfalfa hay or both, the amount of roughage consumed will

TABLE XI—COMPLETE SUMMARY OF THE TEST FOR 77 DAYS

	Lot I	Lot II	Lot III	Lot IV	Lot V	Lot VI
Number of steers in lot	6	6	6	6	6	6
Ration	Alfalfa hay	Alfalfa hay & silage	Silage cottonseed meal	Alfalfa hay silage cottonseed meal	Silage cottonseed meal milo maize	Alfalfa hay silage cottonseed meal milo maize
Average initial weight	Pounds 891	Pounds 889	Pounds 890	Pounds 889	Pounds 889	Pounds 888
Average final weight	998	1073	1041	1086	1073	1080
Average gain	107	184	151	197	189	192
Average daily gain	1.40	2.39	1.96	2.55	2.46	2.49
Average daily ration	Pounds	Pounds	Pounds	Pounds	Pounds	Pounds
Alfalfa hay	28.63	8.99		4.20		3.97
Silage		47.14	61.76	60.68	52.70	48.38
Cottonseed meal			2.66	2.66	2.66	2.66
Milo maize					5.70	5.77
Feed required per lb gain	Pounds	Pounds	Pounds	Pounds	Pounds	Pounds
Alfalfa hay	20.51	3.76		1.65		1.60
Silage		19.71	31.49	23.78	21.45	19.43
Cottonseed meal			1.36	1.04	1.04	1.07
Milo maize					2.32	2.32
Nutrients required per 100 lbs gain	Pounds	Pounds	Pounds	Pounds	Pounds	Pounds
Dry matter ①	1869.29	793.72	843.37	789.41	795.12	893.98
Total digest nutrients ②	1055.00	156.49	520.41	479.61	550.81	605.62
Therms ③	700.00	442.68	628.66	532.55	648.37	669.88
Cost of 100 lbs gain	\$25.63	\$12.58	\$18.03	\$15.73	\$19.18	\$20.30
Initial cost at \$10.00 cwt	\$89.10	\$88.90	\$89.00	\$88.90	\$88.90	\$88.80
Feed cost per head	27.55	23.18	27.22	30.93	36.28	38.91
Interest 18%	1.0	1.50	1.50	1.50	1.50	1.50
Estimated cost of marketing	1.45	1.45	1.45	1.45	1.45	1.45
Total cost	\$119.60	115.03	\$119.17	\$122.78	\$128.13	130.66
Value per cwt March 26	\$ 10.25	\$ 10.75	\$ 10.60	\$ 11.20	\$ 11.35	\$ 11.50
Returns per head	\$102.33	\$115.38	\$110.35	\$121.59	\$122.39	\$124.20
Loss per steer	\$ 17.27		\$ 8.82	\$ 1.19	\$ 5.74	\$ 6.46
Profit per steer		\$ 35				
Necessary selling price	\$ 11.98	\$ 10.72	\$ 11.45	\$ 11.31	\$ 11.88	\$ 12.10
Necessary margin	\$ 1.98	\$.72	\$ 1.45	\$.13	\$ 1.88	\$ 2.10
Time required to finish ④ steers for market	139 days	81 days	99 days	76 days	79 days	78 days
Dressing percent	54% ⑤	57% ⑥	57.2% ⑦	57.7% ⑧	58.5% ⑨	58.9% ⑩

① "Feeds and Feeding" by Henry and Morrison

② Based on the length of time it would require the steers to gain 194.5 pounds at the rate of 2.55 pounds gain per day

③ Estimated dressing per cent at the end of 110 days

④ Estimated dressing per cent from 77 days and 110 days

⑤ Actual dressing per cent at the end of 77 days

⑥ Estimated for only 1 steer at the end of 77 days, the others at the end of 110 days

depend upon the quantity of concentrated feed. If 2.66 pounds of cottonseed meal are fed to steers, they will consume an average of 61.76 pounds of sorghum silage per day. Steers given 2.66 pounds of cottonseed meal will consume an average of 4.20 pounds of alfalfa hay and 60.68 pounds of silage per day. When 2.66 pounds of cottonseed meal and 5.70 pounds of milo maize are given, an average steer will take 52.70 pounds of silage. When all four of the feeds are combined, the steers being limited to 2.66 pounds of cottonseed meal and 5.77 pounds of milo maize, an average of 3.97 pounds of alfalfa hay and 48.38 pounds of silage will be about the daily consumption. It is believed that the above amount of feeds will be a close approximation to what it may be expected 2-year-old steers weighing 889 pounds will consume during the first 77 days in the feed lot. Steers that have been accustomed to silage before being placed in the feed lot will consume relatively larger quantities of silage and less alfalfa hay when these feeds are in the ration. It should be a simple matter for stockmen to estimate the amount of feed the animals will require daily when any of these rations are used. A slight modification may be made in the amount of feeds animals will consume if other rations are planned.

RATE OF GAINS MADE BY STEERS

The average daily gain made by the steers in the various lots ranged from 1.40 pounds to 2.55 pounds. The steers receiving alfalfa hay, silage, and cottonseed meal made the most rapid gains, averaging 2.55 pounds per head daily. The second largest gain was made by Lot VI on alfalfa hay, silage, cottonseed meal, and milo maize, these steers averaging 2.49 pounds per head daily. Lot V, receiving silage, cottonseed meal, and milo maize, ranked third with a daily gain of 2.46 pounds. The steers fed on alfalfa hay and silage made an average daily gain of 2.39 pounds. Lot III gained an average of 1.96 pounds per head daily from a ration of silage and cottonseed meal. The lowest daily gain was obtained in Lot I fed on alfalfa hay alone, and they averaged only 1.40 pounds per head daily.

FEED REQUIRED PER POUND GAIN

The amount of feed required to make a pound of gain was 20.51 pounds of alfalfa hay in Lot I. Lot II consumed 3.76 pounds of alfalfa hay and 19.71 pounds of silage for every pound of gain. Lot III consumed 31.49 pounds of silage and 1.36 pounds of cottonseed meal per pound of gain. The feed required to make a pound of gain

in Lot IV was 1.65 pounds of alfalfa hay, 23.78 pounds of silage, and 1.04 pounds of cottonseed meal. In Lot V 21.45 pounds of silage, 1.08 pounds of cottonseed meal, and 2.32 pounds of ground milo maize were required to make a pound of gain. Lot VI required 1.60 pounds of alfalfa hay, 19.43 pounds of silage, 1.07 pounds of cottonseed meal and 2.32 pounds of ground milo maize to make a pound of gain.

DRY MATTER, TOTAL DIGESTIBLE NUTRIENTS, AND THERMS CONSUMED PER 100 POUNDS GAIN

Lot I consumed the largest amount of dry matter and total digestible nutrients as well as the greatest number of therms for 100 pounds gain, the amount being 1869.29 pounds dry matter, 1055.00 pounds total digestible nutrients, and 700.00 therms. This lot received distinctly more of the constituents required to make gains than any of the other lots. Lot VI ranked the next highest, averaging 893.98 pounds of dry matter, 605.62 pounds of digestible nutrients and 669.88 therms. In total dry matter Lot III was the third highest, but in the other constituents Lot V ranked decidedly ahead of Lot III. Lot II consumed slightly more dry matter than Lot IV, but in total digestible nutrients and therms required to produce 100 pounds of gain Lot II was the most efficient in the experiment. It is interesting to note that less than half as much dry matter or digestible nutrients were required to make 100 pounds of gain in Lot II as in Lot I. There seems to be a close association between the rate of gains and the amount of nutrients required to produce them. The rule is that steers gaining most rapidly require relatively smaller amounts of nutrients to make gains than the animals that increase slowly in weight. A slight tendency was observed in lots receiving relatively larger proportions of concentrates to require more nutrients to make gains.

COST OF GAINS IN LIVE WEIGHT

The cost of making 100 pounds of gain in the steers varies from \$12.58 in Lot II to \$25.63 in Lot I. Thus gain was produced in Lot II at about half the cost of gain in Lot I. The other four lots varied from \$15.73 in Lot IV to \$20.30 in Lot VI. Lot III cost \$18.03 to make 100 pounds of gain, and Lot V \$19.18. Several factors seem to have a pronounced effect upon the cost of gain. The first undoubtedly was the cost of the different feeds. Alfalfa hay was very expensive when fed in large amounts. Cottonseed meal and milo maize also seemed to be more expensive than silage. The rate of

gain made by the animals was one of the prominent factors affecting the cost of making 100 pounds increase in weight. Another factor was the combination of the feed. Thus alfalfa hay when fed alone was too bulky to be suitable for making rapid gains. On the other hand, when this feed was supplemented with silage the cheapest gains were secured. It is interesting to note that the lots making the cheapest gains were fed on alfalfa hay and silage, and alfalfa hay, silage, and cottonseed meal.

MARGIN IN CATTLE FEEDING

The margin, which is the difference between the cost price of feeders and the selling price of the finished animal, often determines whether or not a profit is made in feeding cattle. As a rule, the longer cattle are fed the wider must be the margin. These cattle were fed only 77 days, and it was necessary to have a margin of from 72 cents to \$2.10 in order to pay for the feed and other expenses in feeding the animals. The necessary margin for the different lots varied closely according to the cost of producing gains in live weight. Lots II, IV, and III were distinctly the lowest, while Lots I, V, and VI required \$1.98, \$1.88, and \$2.10 respectively. Lot VI required the largest margin of all the lots due to the highest cost of feed and the greatest finish made by the animals. In a measure this wide margin was justified, for the animals were worth more than those of any other lot at the close of the test. In spite of the fact that the cost of feed amounted to less in Lot I than in Lots IV, V, and VI, it was necessary to secure a margin of \$1.98, or more than twice as much as in Lot II, in order to avoid loss. When prices of feeds are as high as during this test, it is necessary to receive a margin of at least \$2.00 per 100 pounds to break even.

LENGTH OF TIME REQUIRED TO FINISH CATTLE

"The shorter the feeding period the lower the cost of making gains and the greater the profit," is the rule often followed by stockmen. All the steers in Lots IV and VI were considered finished for market at the end of 77 days. During this time Lot IV had made a gain of 197 pounds and Lot VI, 192 pounds per head. From these data it was calculated that steers gaining 2.53 pounds daily would be finished for market when they had gained 194.5 pounds. There will be variations from this weight due to individuality and a tendency for the cattle to grow rather than to fatten. Calculated according to this basis, Lot IV required 76 days, Lot VI 78 days, Lot V 79 days,

Lot II 81 days, Lot III 99 days, and Lot I would have required 139 days to finish. From these data it will be noticed that the steers receiving a ration of hay, silage, and cottonseed meal, or these feeds and the addition of ground grain, make an early finish. Steers fed on alfalfa hay alone require approximately twice as long to come to a finish as where alfalfa hay, silage, cottonseed meal, or these with the addition of ground milo maize are fed.

DRESSED PERCENTAGE OF CATTLE

The report from Babbitt Brothers, Flagstaff, Arizona, who dressed the animals and retailed the beef, was that the carcasses from the steers were satisfactory for that trade.

All the steers in Lots IV and VI were sent to market after being in the feed lots 77 days. In each of Lots III and V one steer was thin. None of the steers in Lot I were sold at this time, and only one in Lot II. This made it necessary to estimate the dressed percentage of the steers in the various lots at the end of the 77 days. In Lots IV and VI the dressed yield was 57.7 and 58.9 percent respectively. Making allowance for the one steer in Lot V, it was estimated that this lot would average 58.5 percent, and similarly in Lot III, 57.2 percent. It is doubtful if Lot I would have dressed as high as 54 percent, while 57 percent was estimated for Lot II. The actual dressed percentage of the animals remaining 110 days was secured. From these figures it may be concluded that the steers with milo maize in their ration were fatter and dressed a higher percentage than those receiving no concentrates. The following table gives the weight of the cattle off cars at Flagstaff, dressed weight of the cooled beef, and the percentage yield in beef:

TABLE XII—DRESSED PERCENTAGE OF STEERS

Number of steers	23 steers	13 steers	Total for 36 steers	Average per steer
Weight at Flagstaff off cars	22290 lb	12810 lb	35100 lb	975 lb
Dressed weight	13029 lb	7272 lb	20301 lb	564 lb
Dress percentage	58.45%	56.77%	57.84%	57.84%

The 23 steers weighed a total of 22,290 pounds off the cars and yielded 13,029 pounds of beef, which was an average of 58.45 percent. The 13 steers gave a dressed percentage of 56.77 percent. The average dressed percentage of beef from the 36 steers was 57.84. The average weight of the 36 steers was 975 pounds weighed off the cars at Flagstaff, and they gave 564 pounds of beef, which was 57.84 percent of the live weight.

KIND OF CATTLE TO FEED

A study was made of the steers in this experiment to determine the effect of size on the rate of gain and length of time required to finish them. The steers were classified into large, medium, and small sizes. The basis of this classification was the size of the frames and the conformation of the animals. The animals varied imperceptibly from large to medium and from medium to small; and it was extremely difficult to secure a different standard for these different groups. As a rule the large steers weighed more than those in either of the other groups. There were twenty steers in the large sized group and eight in each of the other groups.

At the end of the test the steers were classified according to their condition. The fullness of the cuds, and the thickness and covering of flesh over the body and flanks were used as a basis in estimating the condition of the steers. The animals were grouped by this method into fat, medium, and thin classes. None of the steers, however, were prime, so that the term fat is of relative importance indicating that group was among the more fleshy ones in the experiment. Table XIII gives the number and percentage of the animals of different sizes, finishing fat, medium, and thin.

TABLE XIII—CONDITION OF THE ANIMALS AS AFFECTED BY SIZE

Size	Number and percentage finishing					
	Fat		Medium		Thin	
	No	%	No	%	No	%
20 Large	13	65.0	6	30.0	1	5.0
8 Medium	7	87.5	1	12.5	0	0.0
8 Small	4	50.0	3	37.5	1	12.5

There was a tendency for the large animals to become fat more rapidly than the small ones; but a greater percentage of the medium-sized steers was fat at the end of the test than of any of the other groups. None of the medium-sized steers were considered thin at the end of the experiment.

The steers were grouped into three classes according to the amount of gain made. Group I was called "Good" and contained steers which gained from 170 to 343 pounds. Steers in the "Medium"

group gained from 140 to 159 pounds; and the "Low" group gained less than 139 pounds. The data showing the effect of the size of the animals on the rate of gains made by them are given in Table XIV.

TABLE XIV—SIZE OF STEERS AS AFFECTING THE AMOUNT OF GAINS

Size	Good gains		Medium gains		Low gains	
	No	%	No	%	No	%
20 Large	10	50 0	4	20 0	6	30 0
8 Medium	4	50 0	2	25 0	2	25 0
8 Small	2	25 0	3	37 5	3	37 5

Of the 16 steers that made good gains ten were large, four medium, and two small. There seemed to be a slight tendency for the medium-sized steers to make larger gains than either of the other lots. The small steers made distinctly less gains than the medium or the large-sized animals.

In order to make a comparison of the size of the animals and the average gain made by them, the Table XV has been prepared.

TABLE XV—ACTUAL GAINS MADE BY THE STEERS CLASSIFIED AS LARGE, MEDIUM AND SMALL

Size	Initial weight	Final weight	Gains
20 Large	<i>Pounds</i> 947	<i>Pounds</i> 1116	<i>Pounds</i> 169
8 Medium	856	1025	169
8 Small	779	952	173

There was little or no difference in the average gain made by steers from the large, medium or small groups. The three groups varied only from 169 to 173 pounds.

A further study of the animals shows that there was a greater range among the individuals of the same groups than the average of the different groups. The study, however, goes to indicate that there may be a slight advantage in selecting medium-sized, blocky steers that are smooth in conformation, in preference to the large, coarse steers or the small, fine animals. It was unfortunate that the individual dressing percentage could not be secured for each of the animals, for probably there is a closer relationship between the dressed percentage and the size than in any other respect.

From the standpoint of making gains and rapid finish, it is more important to select steers which are vigorous and gentle than to select according to size. Fleshy animals are better than thin ones, for they will be ready for market sooner, and not so wide a margin is necessary with such cattle. Other things being equal, the steers of medium size with short legs, wide, deep bodies, broad foreheads, short well-dished faces, large heart girths, strong loins, large barrels, and showing beef breeding will be best.

SHRINKAGE IN FAT CATTLE

A study of the shrinkage in the animals when ready for market was made with the steers in the feeding test. In Arizona the custom has been to stand cattle 12 hours in a dry lot without feed or water or deduct 4 percent from the feed lot weight

There is a distinct difference in the shrinkage of cattle, whether they are weighed out of the feed lot or after having been driven from one to ten miles through the dust in the warm weather. Cattle driven even a short distance will undoubtedly lose weight more rapidly than when standing or lying down contentedly in the feed lot. The more nervous and restless animals are, the more they will lose in weight. Cattle driven to market will perspire and lose more excrement than when maintained in the feed lots where they are quiet and contented.

Twenty-three of the thirty-six steers were in the feed lot for 77 days and the remaining 13 for 117 days. The method of handling these steers previous to weighing was slightly different. The 23 steers were weighed between 4 and 5 p. m. after having received nothing since the morning's feed. The 13 steers received their regular morning feed and about 3 p. m. an additional quantity of four pounds of alfalfa hay per steer. These steers ate most of their hay, and, as water was in the lots, probably drank freely of it. About 4:30 p. m. each of the lots were weighed and returned to their respective feed lots; they were again weighed about 8:30 o'clock the next morning. Some of the animals had a small amount of feed left from the morning's rations, and this was removed at 7 p. m. and the water fountains adjusted so the cattle could receive no more water. After weighing the animals the next morning, they were turned back to the feed lots for about an hour, then allowed to mix together in an open space where they frisked around for half an hour. After this the steers were driven to the Mesa stockyards, a distance of two miles, and weighed at 11 45 a. m. The steers were shipped to Phoenix the same evening, unloaded, given hay and water, and shipped to Flagstaff

the next day, where they were weighed off cars. The weather was quite warm when the 13 steers were shipped to market, but cool and comfortable the day the 23 were shipped. The summary of the weights of the cattle, pounds lost, and the percentage of shrink at different times are given in Table XVI.

The 23 steers after being off feed and water for 16 hours lost 1026 pounds in weight, or 4.04 percent of the total weight; and the 13 steers under similar conditions, except that they were given about 4 pounds of alfalfa hay, lost a total of 698 pounds or a shrinkage of 4.69 percent. No doubt the large shrinkage in the group of 13 steers was due in part to the steers having taken large quantities of water after consuming the alfalfa hay; but the weather was also warmer and this may have been a contributing factor. It is interesting to note, however, that each lot lost fully 4 percent in weight during the 16 hours which elapsed between the weighings.

Between the time they were weighed at 8:30 a. m. and again at 11:45 a. m., the 23 animals lost a total of 342 pounds and the 13 lost 519 pounds. The loss due to shrinkage was 1.40 percent with the large group and 3.66 percent with the 13 steers. It is noteworthy that in $3\frac{1}{4}$ hours these steers lost an average of 2.23 percent while standing in the feed lots, walking a distance of two miles, and remaining in the stock yards.

TABLE XVI—STATEMENT OF SHRINKAGE FOR 36 STEERS

Number of steers	23 steers	13 steers	Total for 36 steers	Average per steer
Filled weight in feed lot, 1-5 P M	25398 lb	14892 lb	40290 lb	1119 lb
Shrunk weight in feed lot 8-9 A M	24372 lb	14194 lb	38566 lb	1071 lb.
Shrinkage.	1026 lb	698 lb	1724 lb	47.89 lb.
Percent of shrinkage	4.04%	4.69%	4.28%	4.28%
Weight at yards after driving two miles, 11:45 A M	24030 lb	13675 lb	37705 lb	1047 lb
Shrinkage	342 lb	519 lb	861 lb	23.92 lb
Percent of shrinkage	1.40%	3.66%	2.23%	2.23%
Weight at Flagstaff off cars	22290 lb	12810 lb	35100 lb	975 lb
Shrinkage	1740 lb	865 lb	2605 lb	72.36 lb
Percent of shrinkage	7.24%	6.33%	6.91%	6.91%
Total shrinkage	3108 lb	2082 lb	5190 lb	144.17 lb
Total percent of shrinkage	12.68%	14.68%	13.42%	13.42%

The weights off cars at Flagstaff showed that the 23 steers had lost in transit 1740 pounds, or 7.24 percent from the time they were weighed in the Mesa stock yards. The total shrinkage of the 23 steers from the time they were weighed directly out of the feed lots until they were unloaded at Flagstaff was 3,108 pounds or 12.68 percent. The 13 steers lost a total of 2082 pounds or 14.68 percent from the time they were weighed out of the feed lots until they were weighed off cars at Flagstaff.

The average shrinkage of the two groups of steers was 13.42 percent. This is divided into an average loss of 4.28 percent for the first 16 hours shrinkage in the feed lot, 2.23 percent lost between the shrunk weight out of the feed lot and the weight of the animals after 3¼ hours in the stock yards two miles distant, and 6.91 percent lost between the Mesa and Flagstaff stockyards. The percentage losses in the two groups were very similar in every respect, except that the 13 steers had a greater total loss of 2 percent, which took place during the first 19 hours. These steers were weighed several times in the stockyards at Mesa. They lost 2.78 percent during the drive from the feed lot, .91 percent the first 45 minutes they were in the feed lot, 1.76 percent between 11:45 a. m. and 3 p. m. During the four hours these steers were in the stock yards they lost an average of 7.02 pounds an hour, or .66 percent per hour. The weather was warm and the cattle restless; for during this time they were hair branded.

SUPPLEMENTAL TEST—FEEDING 9 STEERS FOR 40 DAYS

Nine of the 13 steers remaining from the first test were continued in two lots until May 4. Lot I had four steers and Lot II five. The animals remained in the same lots as previously and all were given 2.56 pounds of cottonseed meal per head daily and all the alfalfa hay and silage they would eat. The steers in Lot I were high-grade Holsteins and those in Lot II were sired by a Polled Shorthorn bull. Those in Lot I were much thinner than the steers in Lot II and had been fed previously on alfalfa hay, while those in Lot II received alfalfa hay and silage. The first three days the steers in Lot I were fed alfalfa hay, and those in the other lot alfalfa hay and silage. After this a mixed ration was given. The weight of each steer was taken weekly and a careful record kept of the amount of feed consumed. The objects of this test were to learn if the high-grade Holsteins would make as rapid gains as the other steers, to study the effect of previous rations on the rate of gains, and to learn the amount of roughages these animals would consume when given a small amount of cotton-seed meal.

After being on feed for forty days the animals were sold. At the end of this time they were as fat as the steers sold March 25. Table XVII gives a brief summary of this second test.

TABLE XVII.—SUMMARY OF TEST WITH 9 STEERS FOR 40 DAYS

	Lot I	Lot II
Number steers in lot	4	5
Ration	Alfalfa hay, silage cottonseed meal	Alfalfa hay, silage cottonseed meal
Average initial weight.....	<i>Pounds</i> 1030	<i>Pounds</i> 1070
Average final weight.....	1181	1185
Average gain.....	151	115
Average daily gain.....	3.78	2.88
Average daily ration:		
Alfalfa hay.....	10.67	4.93
Silage.....	48.58	54.23
Cottonseed meal.....	2.56	2.56
Feed required per pound gain:		
Alfalfa hay.....	2.82	1.71
Silage.....	12.85	18.83
Cottonseed meal.....	0.68	0.89
Cost of 100 pounds gain.....	\$11.39	\$13.23

The steers in Lot I averaged 40 pounds lighter than those in Lot II at the beginning of the test. At the end of 40 days the steers in Lot I had gained an average of 151 pounds or 3.78 pounds per head daily; those in Lot II made an average gain of 115 pounds or 21.88 pounds per head daily. The steers in Lot I gained almost a pound a day more per head than those in Lot II. They were allowed the same ration. It is believed that steers which have been maintained

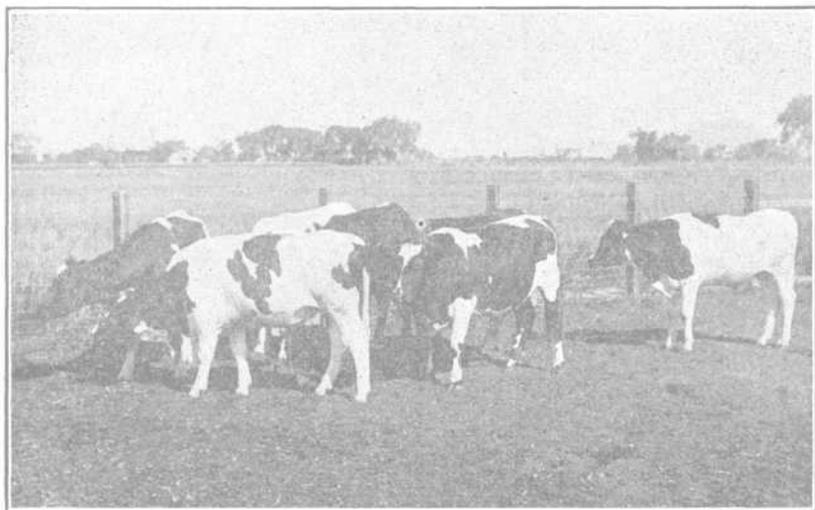


Fig. 5.—Steers in Lot II, May 5, 1920

a considerable length of time on alfalfa hay will make more rapid gains than animals that have been given a combination of feed. No doubt the higher condition of the animals in Lot II induced them to make slower gains than the thinner animals. Neither of the lots, however, were fat. This test also indicated that the grade steers with Holstein blood predominating made just as rapid gains as those with beef blood predominating. There was, however, an apparent difference due to breeding. Lot I did not finish into as full, smooth animals or have as high proportion of high-priced cuts as the steers in Lot II. It was believed that a somewhat longer period would be required to feed the steers in Lot II.

The steers in Lot I consumed 10.67 pounds of alfalfa hay and 48.58 pounds of silage, while those in Lot II ate only 4.93 pounds of alfalfa hay and 54.23 pounds of silage. The steers in Lot I consumed

twice as much hay but hardly as much silage as those in Lot II. It was apparent that steers accustomed to alfalfa hay, but not to silage, required some time to adjust their rations, and there was a tendency for them to reduce the amount of alfalfa hay and increase the consumption of silage.

The cost of 100 pounds of gain was \$11.39 in Lot I and \$13.23 in Lot II. The steers in Lot I consumed more feed when given a variety, and made larger as well as cheaper gains. No doubt the ration of alfalfa hay alone was somewhat bulky, monotonous, and unbalanced; and when a variety and concentrates were added to the alfalfa hay, the animals were induced to consume larger quantities of feed with good results. The test also proved that the Holstein steers made just as rapid and economical gains as the steers sired by a Polled Shorthorn bull when given the same ration.

SUMMARY

MAIN TEST 36 STEERS FOR 77 DAYS

ALFALFA HAY ALONE COMPARED WITH ALFALFA HAY AND SILAGE

1. Steers fed on alfalfa hay gained an average of 1.40 pounds per day; on alfalfa hay and silage, 2.39 pounds. The addition of silage to the alfalfa hay increased the daily gain at the rate of .99 pounds per steer.
2. The addition of silage to a ration of alfalfa hay will make steers gain more rapidly in weight, shorten the feeding period, reduce the cost of making gains, increase the market value of the animals, and increase the profits.
3. Steers averaging 891 pounds and 30 months old will consume about 30 pounds of alfalfa hay daily the first 77 days in the feed lot.
4. Steers fed on alfalfa hay and silage finished more rapidly than those given alfalfa hay and were worth 50 cents per hundred more at the end of the test.
5. Each steer fed on alfalfa hay lost \$17.27, and those given silage and alfalfa hay made a profit of 35 cents per steer.
6. The cost of feed was \$27.55 per steer for alfalfa hay in Lot I, and these steers gained an average of 107 pounds; while in the other lot the cost of feed was \$23.18 per steer, and these steers gained an average of 184 pounds.
7. All the steers given silage and alfalfa hay gained more than any of the steers fed exclusively on alfalfa hay.
8. A margin of \$1 98 per hundred pounds was necessary in the lot fed hay and only 72 cents per hundred pounds was necessary where the steers were fed silage along with hay.
9. The cost of producing a hundred pounds gain was \$25.63 with alfalfa hay and \$12.58 with silage and alfalfa hay, or less than half as much in the lot where silage was fed with alfalfa hay.
10. The addition of 47.14 pounds of silage per head daily decreased the consumption of alfalfa hay 19.64 pounds.
11. The steers receiving alfalfa hay and silage consumed less dry matter, total digestible nutrients, and therms per hundred pounds gain.
12. Alfalfa hay alone is not a balanced ration for fattening two-year-old steers, and the addition of silage to a ration of alfalfa hay was beneficial in every respect.

SILAGE AND ALFALFA HAY COMPARED WITH SILAGE AND COTTONSEED MEAL;
ALSO WITH SILAGE ALFALFA HAY AND COTTONSEED MEAL

1. The steers fed on all the silage and alfalfa hay they would eat and 2.66 pounds of cottonseed meal made the most rapid gains and were worth most at the end of the test.

2. Steers fed silage and cottonseed meal made the lowest and most costly gains and were worth less than either of the other lots at the end of 77 days.

3. When cottonseed meal costs \$80 per ton, it is doubtful if it is a profitable supplement to a ration of silage and alfalfa hay when steers are fed 77 days.

4. When alfalfa hay was added to a ration of silage and cottonseed meal, 7.71 pounds less silage and .32 pounds less cottonseed meal were required to make a pound of gain.

5. The steers receiving alfalfa hay, silage, and cottonseed meal consumed less dry matter than the steers receiving silage and hay or silage and cottonseed meal.

6. Although the steers receiving alfalfa hay and silage did not make as large gains as those in Lot IV, and the animals were not worth as much per hundred pounds at the end of the test, yet the steers brought a profit of 35 cents per head due to the cheapness of bulky feed and low cost of gain.

7. The use of alfalfa hay as a supplement to silage proved more satisfactory than cottonseed meal, giving larger, more rapid, and cheaper gains, and the animals were worth 15 cents more per hundred at the end of the test.

ALFALFA HAY COMPARED WITH GROUND MILO MAIZE TO SUPPLEMENT SILAGE
AND COTTONSEED MEAL FOR FATTENING STEERS

1. The steers fed on silage, cottonseed meal, and alfalfa hay gained an average of .09 pounds more per head daily than those fed on silage, cottonseed meal, and a light feed of ground grain.

2. The cost of feed for the cattle in Lot IV was \$30.93 per steer and in Lot V \$36.28

3. Ground milo maize in the ration fattened the steers more rapidly and increased their selling value 15 cents per hundred.

4. The ration in which alfalfa hay was used as a supplement gave larger gains per steer, was less expensive, and produced gain at less cost.

5. The steers receiving the alfalfa hay supplement consumed less dry matter and apparently made more effective use of the feed than those which received milo maize.

ALFALFA HAY ADDED TO A RATION OF SILAGE, COTTONSEED MEAL, AND GROUND
MILO MAIZE

1. The addition of alfalfa hay to a ration of silage, cottonseed meal, and ground milo maize increased the rate of gain .03 pounds daily per steer.
2. The addition of 3.97 pounds of alfalfa hay per head daily decreased the amount of silage consumed by 4.32 pounds.
3. Steers fed silage, cottonseed meal, and ground milo maize required an expenditure for feed of \$19.18 per hundred pounds of gain; those fed silage, cottonseed meal, ground milo maize, and alfalfa hay required an expenditure of \$20.30 per hundred pounds gain.
4. The steers in Lot V were valued at \$11.35 per hundred pounds, and returned a loss of \$5.74 per steer; the steers in Lot VI were valued at \$11.50 per hundred pounds, and gave a loss of \$6.46 per steer.
5. The addition of alfalfa hay to the ration made the steers finish more rapidly for market.
6. More uniform gains were made by the steers in Lot VI. All the steers in this lot continued well on feed; two of the steers in the lot not receiving alfalfa hay went off feed about a week.
7. The chief advantage of adding alfalfa hay to a ration of silage, cottonseed meal, and milo maize was in the more uniform gains made by the cattle, but at slightly greater cost.

SUPPLEMENTAL TEST, 9 STEERS FOR 40 DAYS

1. Holstein steers will make as rapid and as economical gains as steers from Polled Shorthorn bulls.
2. Steers that have been maintained on a ration of alfalfa hay alone will gain more rapidly when placed on a variety of feed than similar animals that have been maintained on a mixed ration.
3. A few days are required for steers to adjust their appetites to a changed ration. There was a tendency for these steers to reduce the amount of alfalfa hay and increase the silage as the test progressed.