



University of Arizona

College of Agriculture
Agricultural Experiment Station

FATTENING YEARLING STEERS ON DRY-FARMS

BY R. H. WILLIAMS, E. B. STANLEY,
AND CHAS. A. SMITH



Yearling steers in Lot II when the test began, November 15, 1922.

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Fig. 1.—Yearling steers in Lot I after being on feed 105 days. They were fed a ration of Papago sweet corn silage for 88.5 days, Red Amber sorghum silage for 23.5 days, and alfalfa hay and cottonseed meal throughout the test.

FATTENING YEARLING STEERS ON DRY-FARMS

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INTRODUCTION

Small areas, suitable for growing feeds by means of dry-farming, flood-water irrigation, or shallow pumping, are found in widely separated districts in Arizona. The primary use for feeds grown on dry-farms in Arizona is to supplement the forage for breeding stock on adjacent ranges during periods of drouth, but farmers and cattlemen also desire information regarding the use of dry-farm feeds for finishing cattle for market.

PART I

OBJECTS OF THE EXPERIMENT

During the summer of 1922 about 100 tons of silage were produced on the Prescott Dry-Farm, which made possible the feeding test herein reported. The object of this investigation was to make three distinct comparisons in feeding yearling range steers as follows:

1. Feeding Papago sweet corn silage versus Red Amber sorghum silage.
2. Feeding horned, yearling steers versus dehorned, yearling steers.
3. Continuous feeding of one kind of silage versus alternating with different kinds of silage.

ANIMALS USED

Forty yearling steers were selected from the King ranch in the Big Chino Valley for this feeding test. These animals were fairly uniform, ranging in age from 12 to 20 months, and representing good yearlings in the Prescott district. They were purchased at \$5.00 per hundred-weight, averaging \$26.25 per head.

PRELIMINARY FEEDING

From October 18 to November 15, the steers were pastured on the Prescott Dry-Farm. They were allowed to graze on 8 acres of Sudan grass, 19 acres of corn stalks bearing a few small ears of corn, 20 acres of hegari and milo stalks from which the best grain had been topped, and 30 acres of native grass.

FEEDLOTS, EQUIPMENT, AND WEATHER CONDITIONS

The feedlots were enclosed with a stout, woven-wire fence and were 48 by 60 feet in size. Each contained a manger 38 feet long and a water trough. Fresh water and rock salt were available at all times. No shed or covering was provided, and at times the animals suffered from the cold, wet weather.



Fig. 2.—General view of the cattle in the feedlots when the test began, November 15, 1922.

WEIGHING THE ANIMALS

The steers were delivered to the Prescott Dry-Farm on October 18, 1922, after being driven 33 miles in 2 days. On reaching the farm they averaged 525 pounds per head. At the end of 4 weeks on pasture, they averaged 532.5 pounds per head.

During the 16 weeks the animals were on test, they were weighed every week except at the end of the first, second, and ninth weeks. The weights were taken in the afternoons between 2 and 3 o'clock.

FEEDS USED AND COST OF FEEDS

The feeds used in this test were silage grown on the Prescott Dry-Farm, and alfalfa hay and cottonseed meal purchased in the Salt River

Valley. The silage was mostly Red Amber sorghum and Papago sweet corn preserved in separate silos. A third silo contained silage grown on one-quarter acre plots, which consisted of 30 varieties of corn, broom corn, grain sorghums, sweet sorghums, and sunflower, the last constituting about one-third of this mixed silage. The quality of the feeds was good, and they were valued as follows:

Papago sweet corn silage	\$ 6.00 per ton
Red Amber sorghum silage	6.00 per ton
Mixed silage	6.00 per ton
Alfalfa hay (baled)	20.00 per ton
Cottonseed meal	50.00 per ton

The chemical composition of the feeds as determined by the Agricultural Chemistry Section is given in Table I.

TABLE I—CHEMICAL COMPOSITION OF THE FEEDS USED
(Expressed in percent of fresh substance.)

Feed	Water	Ash	Crude Protein	Carbohydrates		Fat
				Fiber	Nitrogen-free extract	
	Percent	Percent	Percent	Percent	Percent	Percent
<i>Silages</i>						
Papago sweet corn	71.23	1.96	2.24	7.59	16.13	0.85
Red Amber sorghum	67.86	2.30	2.3)	7.2S	19.65	0.64
Sunflower	64.07	12.71	2.3)	8.39	11.28	1.16
Alfalfa hay	7.67	7.36	12.64	34.08	36.98	1.2S
Cottonseed meal	6.03	6.75	40.02	9.01	27.81	10.38

RATIONS

Throughout the test the animals received all the silage and alfalfa hay they would consume. The allowance of cottonseed meal was limited to an average of 3 pounds per head daily during the entire feeding period. Table II gives the rations fed the different lots of animals.

TABLE II—RATIONS FED THE DIFFERENT LOTS OF ANIMALS.

Lot number	Ration in addition to cottonseed meal and alfalfa hay.
I	Papago sweet corn silage, 88.5 days; Red Amber silage, 23.5 days
II	Red Amber sorghum silage, 112 days.
III	Red Amber sorghum silage, 112 days.
IV	Red Amber sorghum silage, 30.5 days; Papago sweet corn silage, 43 days; mixed silage, 38.5 days

METHOD OF FEEDING

At the beginning of the test the cattle were given 7 pounds of alfalfa hay, $\frac{1}{2}$ pound of cottonseed meal, and 10 pounds of silage per head daily. The amounts of feed were gradually increased until each animal was receiving an average of 35 pounds of silage and 2.4 pounds of cottonseed meal, the alfalfa hay on the other hand, having been reduced to 3 pounds at the beginning of the third week.

The steers were fed silage at 7:30 a. m., and at about 4:30 p. m. After all the lots of steers had received the silage, cottonseed meal was sprinkled uniformly over it. Hay was fed once a day, about 10:30 a. m., when the morning's allowance of silage and meal was usually well cleaned up.

DURATION

At noon, November 15, 1922, the animals were weighed and divided into four lots of 10 steers each, at which time the test proper began. The steers were continued on feed until noon, March 7, 1923, a period of 112 days.

VALUE OF THE CATTLE WHEN THE TEST ENDED

The cattle were purchased by a butcher in Jerome at \$7.00 per 100 pounds, after standing 12 hours without feed or water. The following were considered the relative values of the animals of the different lots at the close of the test.

TABLE III—RELATIVE VALUES OF THE ANIMALS BY LOTS AT CLOSE OF TEST.

Lot number	I	II	III	IV
Value per 100 pounds	\$7.10	\$6.95	\$7.05	\$6.90

Very little difference in the condition and value of the cattle was found in the lots. The steers in Lot I were a little fatter and more thickly covered than were those in any of the other lots. Although the cattle in Lot III were hardly so fat as were those in Lot I, yet these animals were more uniform and also more attractive, on account of not having horns.

Feeding these cattle was not profitable, unless securing a market for the silage was a consideration. A margin of fully \$2.50 per 100 pounds would be necessary to feed profitably yearling steers over a period of 16 weeks with the rations given these animals and with the gains secured in this investigation. If fatter steers, which would finish in about 10 weeks, could be secured, no doubt a margin of \$2 would prove fairly profitable for fattening yearlings.

TABLE IV.—COMPLETE SUMMARY OF 112-DAY FEEDING TEST AT THE PRESCOTT DRY-FARM, NOVEMBER 15, NOON, 1922, TO MARCH 7, NOON, 1923.

Lot number.....	I	II	III	IV
Number steers in lot. ..	10 Yearlings horned	9 Yearlings horned	10 Yearlings dehorned	10 Yearlings horned
Ration	Alfalfa hay, Cottonseed meal, Silage*	Alfalfa hay, Cottonseed meal, Red Amber sorghum silage	Alfalfa hay, Cottonseed meal, Red Amber sorghum silage	Alfalfa hay, Cottonseed meal, Silage*
Average initial weight per steer	Pounds 535.00	Pounds 521.00	Pounds 539.00	Pounds 535.00
Average final weight per steer.....	738.00	714.00	734.00	720.00
Average gain per steer.....	203.00	193.00	195.00	185.00
Average daily gain per steer	1.81	1.72	1.74	1.65
Average daily ration per steer	Pounds	Pounds	Pounds	Pounds
Alfalfa hay.....	3.00	2.99	3.00	2.99
Cottonseed meal.....	2.77	2.77	2.77	2.77
Silage	35.22	34.77	34.78	35.16
Feed required per 100 pounds gain	Pounds	Pounds	Pounds	Pounds
Alfalfa hay.....	166.00	173.00	172.00	181.00
Cottonseed meal.....	153.00	160.00	159.00	168.00
Silage	1,948.00	2,013.00	1,997.00	2,129.00
Total feed.	2,267.00	2,346.00	2,328.00	2,478.00
Cost of 100 pounds gain	\$11.33	\$11.78	\$11.69	\$12.39
Initial cost at \$5.00 per cwt.....	\$26.75	\$26.05	\$26.95	\$26.75
Feed cost per head.....	22.95	22.79	22.80	22.92
Interest at 8%.....	.66	.64	.66	.66
Estimated cost marketing	.25	.25	.25	.25
Total cost	\$50.61	\$49.73	\$50.66	\$50.58
Value per cwt., March 7, 1923.....	\$ 7.10	\$ 6.95	\$ 7.05	\$ 6.90
Returns per head less 2.95% shrinkage.....	50.85	48.16	50.22	48.21
Profit per steer.....	.24			
Loss per steer		1.57	.44	2.37
Necessary selling price per cwt.....	7.07	7.18	7.11	7.24
Necessary margin	2.07	2.18	2.11	2.24

*See Table II, page 63.

DRESSING QUALITY

The cattle were shipped to Jerome and dressed for the local meat trade. Although the butcher estimated that they would dress about 52,50

percent, the actual dressing percentage was 51.64 percent, cold weight. The steers did not have much kidney fat, but a nice layer of fat covered the carcass, which made the beef desirable for the local trade.



Fig. 3.—General view of the steers after 105 days in the feedlots.

RATIONS CONSUMED BY THE LOTS

The actual rations given the animals in the various lots are presented in Table V by 4-week periods.

TABLE V.—RATIONS IN POUNDS CONSUMED DAILY PER ANIMAL BY THE DIFFERENT LOTS BY FOUR-WEEK PERIODS.

Lot number	Ration	First period	Second period	Third period	Fourth period	Average for entire test
		Pounds	Pounds	Pounds	Pounds	Pounds
I	Alfalfa hay	3.78	2.95	2.73	2.51	3.00
	Cottonseed meal ..	1.97	2.68	3.02	3.41	2.77
	Silage (1)	29.73	35.89	36.79	38.48	35.22
II	Alfalfa hay	3.78	2.92	2.73	2.51	2.99
	Cottonseed meal ..	1.97	2.68	3.02	3.41	2.77
	Red Amber sorghum silage ..	28.91	35.75	36.25	38.18	34.77
III	Alfalfa hay	3.78	2.95	2.73	2.51	3.00
	Cottonseed meal ..	1.97	2.68	3.02	3.41	2.77
	Red Amber sorghum silage ..	29.11	35.89	35.98	38.13	34.78
IV	Alfalfa hay	3.78	2.95	2.73	2.51	2.99
	Cottonseed meal ..	1.97	2.68	3.02	3.41	2.77
	Silage (2)	29.39	35.82	36.70	38.73	35.16

(1) Papago sweet corn silage was fed 88.5 days; Red Amber sorghum silage was fed 23.5 days.

(2) Red Amber sorghum, Papago sweet corn, and other kinds of silage were fed. Changes in the kind of silage were made very frequently.

The capacity of the steers for feed gradually increased as the test continued. During the last 4-week period of the test, the steers consumed daily an average of 9 pounds or 31 percent more silage, and 73 percent more cottonseed meal than they did during the first 4-week period. On the other hand, the quantity of alfalfa hay consumed decreased 34 percent between the first and the last 4-week periods.

The average daily ration per head during the 112 days of the test was 3.00 pounds of alfalfa hay, 2.77 pounds of cottonseed meal, and 34.77 to 35.22 pounds of silage. This ration should be sufficient to fatten good, yearling steers during a period of 16 weeks.

FEED REQUIRED FOR ONE HUNDRED POUNDS GAIN

The amount of feed required to make 100 pounds gain in weight has been compiled for each of the lots for 4-week periods, and is given in Table VI.

TABLE VI.—FEED IN POUNDS REQUIRED FOR 100 POUNDS GAIN FOR THE DIFFERENT LOTS.

(Classified according to periods of 4 weeks each.)

Lot number	Ration	First period	Second period	Third period	Fourth period	Entire test
		Pounds	Pounds	Pounds	Pounds	Pounds
I	Alfalfa hay	199	118	239	149	166
	Cottonseed meal	104	107	264	201	153
	Silage	1,570	1,436	3,219	2,268	1,948
II	Alfalfa hay	184	131	168	253	173
	Cottonseed meal	96	120	186	344	160
	Silage	1,412	1,595	2,228	3,848	2,013
III	Alfalfa hay	234	162	131	175	173
	Cottonseed meal	123	147	145	236	159
	Silage	1,811	1,971	1,722	2,636	1,997
IV	Alfalfa hay	207	140	178	220	181
	Cottonseed meal	108	127	197	299	168
	Silage	1,614	1,700	2,390	3,389	2,129

PAPAGO SWEET CORN SILAGE VERSUS RED AMBER SORGHUM SILAGE

The feeding qualities of Papago sweet corn silage compared with those of Red Amber sorghum silage are of interest to stockmen. The latter crop usually yields more heavily than does corn, and is especially drouth-resistant.

WEIGHTS AND GAINS

The steers in Lot I fed Papago sweet corn weighed an average of 535 pounds when the test began, and they gained an average of 1.81 pounds per head daily. The steers in Lot II fed Red Amber sorghum

silage had an average weight of 521 pounds at the beginning of the test, and gained an average of 1.72 pounds per head daily. The total gain per animal in Lot I was 203 pounds, as compared with 193 pounds per animal in Lot II. The Papago sweet corn silage was only 5 percent better than was the Red Amber sorghum silage for making gains in weight.

GAINS ACCORDING TO FOUR-WEEK PERIODS

The average daily gain per head classified according to periods of 4 weeks is given in Table VII.

TABLE VII.—AVERAGE DAILY GAIN PER ANIMAL DURING THE FOUR-WEEK PERIODS.

Lot number.	First period	Second period	Third period	Fourth period	Entire test
	Pounds	Pounds	Pounds	Pounds	Pounds
I	1.89	2.50	1.14	1.70	1.81
II	2.05	2.24	1.63	0.99	1.72



Fig. 4.—Yearling steers in Lot I when the test began, November 15, 1922.

During the first 4 weeks, the steers receiving Red Amber sorghum silage gained an average of 0.16 pound per head daily more than did the animals given Papago sweet corn silage. During the second and fourth periods of 4 weeks each, the steers in Lot I fed Papago sweet corn silage made larger gains than did those in Lot II. The animals given Papago sweet corn silage continued to make satisfactory gains to the end of the test, while those fed Red Amber sorghum silage decreased in the rates of gain from month to month.

RATION AND FEEDS REQUIRED FOR GAINS

The steers in Lot I receiving Papago sweet corn bilage were given .45 pound more silage per day than were those in Lot II receiving the Red Amber sorghum silage. Calculated on the basis of live weight the steers in Lot II received a little more feed per 1000 pounds than did those in Lot L. It will be noticed that more feed was required to product 100 pounds gain with the bteers in Lot II than with those in Lot L.

COST OF ONE HUNDRED POUNDS GAIN

Gains were made at a cost of \$11.33 per 100 pounds by the steers in Lot I and at a cost of \$11.78 per 100 pounds by the steers in Lot II. With a value of \$6.00 per ton for Red Amber sorghum bilage, the Papago sweet corn silage was worth \$6.24 per ton for making gainb in yearling steers.

DEDUCTIONS

The steerb in Lot I, receiving Papago sweet corn silage made a profit of 24 cents per head, as compared with a loss of \$1.57 per head for the steers in Lot II fed Red Amber sorghum silage. On the basis of gainb made and the cost of 100 pounds gain in this test, Papago sweet corn silage has a value of 25 to 30 cents more per ton than does sweet sorghum silage.

Some of the grain from the Red Amber sorghum silage passed through the animals whole. The kernels of corn seemed to be softer and were better digested, for very little of it was found in the droppings.

It was observed that the Red Amber sorghum silage kept better than did the Papago sweet corn silage. If the latter is not fed off to a depth of 3 or 4 inches every 2 or 3 days it spoils badly. On the other hand, the Red Amber sorghum silage packed more firmly and did not bpoil in the winter even if not fed off for 6 to 8 days.

FEEDING HORNED YEARLING STEERS VERSUS YEARLING STEERS DEHORNED AT BEGINNING OF FEEDING PERIOD

Most of the cattle raised on ranges in Arizona are horned animals, In recent years cattle producers and feeders have become interested in dehorned and polled stock. The steers in lots II and III were used to compare the feeding of horned, yearling steers with similar animals dehorned when placed in the feedlots.

The horns were sawed off of the animals in Lot III on November 17. The steers were securely snubbed to a post and the horns sawed off close to the head with an ordinary handsaw. The cattle bled profusely and their heads were sore for 3 to 6 weeks. During this time these steers became more gentle in the feedlots and did not abuse one another as much as did those in the other lots.

GAINS IN HORNED AND DEHORNED YEARLINGS

Table VIII gives a summary of the gains according to 4-week periods.

TABLE VIII—GAINS IN POUNDS PER ANIMAL BY HORNED AND DEHORNED STEERS.

Lot number	First period	Second period	Third period	Fourth period	Entire test
	Pounds	Pounds	Pounds	Pounds	Pounds
II. Horned steers	2.05	2.24	1.63	0 99	1.72
III. Dehorned steers	1.61	1.82	2.08	1 45	1.74

The dehorned steers in Lot III gained an average of 2 pounds more per head during the entire test than did the horned animals in Lot II. Dehorning the steers in Lot III retarded the gains the first 8 weeks. During the first 4 weeks the horned steers gained an average of .44 pound more per head daily than did the dehorned cattle; during the second period of 4 weeks they gained an average of .42 pound more per head daily than did the dehorned stock. During the last 8 weeks the dehorned steers gained so much faster than did the horned ones, that at the end of the feeding period they had gained a total of 195 pounds per animal, as compared with 193 pounds each for the horned animals.

COST OF ONE HUNDRED POUNDS GAIN

The cost of 100 pounds gain with the horned steers in Lot II and the dehorned cattle in Lot III is given in Table IX in 4-week periods.

TABLE IX—COST OF ONE HUNDRED POUNDS GAIN BY FOUR-WEEK PERIODS.

Lot number	First period	Second period	Third period	Fourth period	Entire test
II Horned steers	\$ 8.48	\$ 9.09	\$13 01	\$22.67	\$11.78
III Dehorned steers	10.84	11.21	10 09	15.56	11.69

Gains cost 28 percent less with the horned steers in Lot II during the first 4 weeks, and 23 percent less during the second period of 4 weeks than they did with the dehorned steers in Lot III for the same 8-week period. On the other hand, during the last 8 weeks of the test, the dehorned steers in Lot III were distinctly more efficient feeders than were the horned animals. During the third period of 4 weeks the dehorned steers in Lot III made gains at 29 percent less cost, and during the last 4-week period at 46 percent less cost than did the horned steers in Lot II.

That the steers in Lot III suffered from the effects of dehorning during the first 8 weeks was shown by the lower average daily gain which

they made, compared with the gain made by the horned steers in Lot II. After they had recovered from the shock of being dehorned, they were more gentle in the lot and at the feed mangers, than were any of the groups of steers with horns.

DEDUCTIONS

The test indicates that dehorning yearling steers is not profitable when the animals are fed over a short period, but when cattle are to be fed 16 weeks or longer, dehorning is profitable.

If cattle are to be dehorned, however, it is considered best to remove the horns 6 to 8 weeks before the feeding begins.



Fig. 5.—Dehorned yearling steers in Lot III on February 26, 1923, after being on feed for 105 days. They were fed a ration of Red Amber sorghum silage, alfalfa hay, and cottonseed meal.

CONTINUOUS FEEDING OF ONE KIND OF SILAGE VERSUS ALTERNATING WITH DIFFERENT KINDS OF SILAGE

When it is necessary to change the kind of silage for cattle on feed, feeders claim that the animals fail to make normal gains over a period of about a week. Assuming that there is a temporary check in the rates of gain in cattle caused by changing from one kind of silage to another, it was considered that gains would be extremely low if the silage were changed every few days. The cattle in Lot IV were used to make a study of the effect of changing the kind of silage on the rate and cost of gains in cattle. This lot was fed Papago sweet corn silage, Red Amber sorghum silage, sunflower silage, and a mixed silage made from 30 varieties of corn, sweet sorghums, and grain sorghums.

The following is a statement of the periods that the different kinds of silage were fed to the cattle in Lot IV.

Red Amber sorghum silage was fed from November 15, noon, to November 22, noon,—7 days;

Papago sweet corn silage was fed from November 22, noon, to November 29, noon,—7 days;

Mixed silage was fed from November 29, noon, to January 6, evening,—38.5 days;

Papago sweet com silage was fed from January 7, morning, to February 11, evening,—36 days; and

Red Amber sorghum silage was fed from February 12, morning to March 7, noon,—23.5 days.

WEIGHTS AND GAINS

The average initial weight of the steers in lots I and IV was 535 pounds, and that of the steers in Lot II was 521 pounds. The steers in Lot IV gained only 185 pounds during the 16 weeks of the test, as compared with a gain of 193 pounds for the steers in Lot II, and a gain of 203 pounds for the steers in Lot I. The gains per head, classified according to periods of 4 weeks each, and the total gains during the 112 days of the feeding test are given in Table X.

TABLE X.—AVERAGE DAILY GAINS PER ANIMAL BY FOUR-WEEK PERIODS.

Lot number.	First period	Second period	Third period	Fourth period	Entire test
	Pounds	Pounds	Pounds	Pounds	Pounds
I	1.89	2.50	1.14	1.70	1.81
II	2.05	2.24	1.63	0.99	1.72
IV	1.82	2.11	1.54	1.14	1.65

The steers in lots I and IV made more uniform gains throughout the test than did those in Lot II. The alternate changing of the silage with the steers in Lot IV reduced their rate of gain 10 percent, as compared with that of the steers in Lot I fed Papago sweet corn silage, and 5 percent as compared with that of the animals in Lot II fed Red Amber sorghum silage throughout the test.

FEEDS CONSUMED AND COST OF GAINS

Valuing the silage at \$6.00 per ton, the cost of 100 pounds gain increased from \$11.33 with the steers in Lot I, or from \$11.78 with the steers in Lot II, to \$12.37 with the steers in Lot IV. This shows the cost of producing 100 pounds gain with the steers in Lot IV to be 9 percent greater than with those in Lot I, and 5 percent more than with the animals in Lot II

DEDUCTIONS

The results of this test indicate that yearling steers receive a small check in the rates of gain when changed from one kind of silage to another. Whether these cattle became accustomed to changing the silage from one kind to another, and on that account did not suffer as great a check due to these changes, was not proved by the investigation.

SUMMARY

I. Silage from Papago sweet corn versus Red Amber sorghum.

1. For making gains, 96 pounds of Papago sweet corn silage are equal to 100 pounds of Red Amber sorghum silage.

2. With Red Amber sorghum silage valued at \$6.00 per ton, the test proved Papago sweet com silage to be worth \$6.24 per ton for feeding yearling steers.

II. Feeding horned, yearling steers versus yearling steers dehorned at beginning of feeding period.

1. During the first 8 weeks, the steers dehorned at the beginning of the feeding period gained only 80 percent as much as did the horned animals, and required 25.5 percent more feed to produce a unit of gain.

2. During the last 8 weeks the dehorned cattle gained 34.7 percent more than did the horned cattle and required 39.1 percent less feed to make a unit gain in weight.

3. Dehorned cattle are more gentle than are horned stock in the feedlots. They ship better, shrink less, and do not bruise one another as much.

4. The dehorned cattle lost an average of 44 cents per head, compared with a loss of \$1.57 per head for the horned animals.

III. Continuous feeding of one kind of silage versus alternating with different kinds of silage.

1. Cattle do not make as rapid or as uniform gains if the kind of silage fed is frequently changed.

2. Changing the kind of silage seemed to give the cattle a setback.

3. Frequent changing of the kind of silage increased the cost of gains 9 percent over the lot of cattle fed Papago sweet corn silage, and 5 percent over the cattle fed continuously Red Amber sorghum silage.

PART II

In the winter and spring of 1924, the following cattle-feeding test was conducted as a continuation of the series of investigations begun in 1922-1923 at the Prescott Dry-Farm. The experiment was conducted at the Sulphur Spring Valley Dry-Farm near Cochise. Aside from the general purpose of the test, the minor considerations differed from those of the preceding test.

OBJECTS OF THE EXPERIMENT

1. To study further the practicability of fattening yearling steers on dry-farms.
2. To study the comparative feeding values of sweet sorghum silage, sweet sorghum fodder, and sunflower silage, when fed with hay and cottonseed meal to yearling steers.
3. To study the value of hay in the ration.

ANIMALS USED

Forty yearling range steers were used in this test. They were an inferior, poorly-bred lot of animals which ordinarily would be called "cutbacks," and were representative of the poorer grade of range cattle. These steers had been raised on an overgrazed range and were in poor condition. They were a uniform lot of animals, averaging 420 pounds per head at the beginning of the test.

ALLOTMENT AND RATIONS FED

These cattle were divided into four groups of 10 animals each. Care was exercised in making the groups as uniform as possible as to weight, quality, and condition. The allotment with the rations fed is given in Table XL.

TABLE XI—ALLOTMENT OF ANIMALS WITH THE RATIONS FED

Lot number	Average initial weight Pounds	Ration fed
I	416 0	Sweet sorghum silage* Sunflower silage Mixed hay Cottonseed meal
II	445 0	Sweet sorghum silage Cottonseed meal
III	416 0	Sweet sorghum silage Mixed hay Cottonseed meal
IV	416 0	Sweet sorghum fodder Sweet sorghum silage Mixed hay Cottonseed meal

*Fed for first 30 days only

METHOD OF FEEDING

The animals were placed on feed January 23, 1924. During the first 30 days of the test the steers in lots I, II, and III, were given a full allowance of sweet sorghum silage, and those in Lot IV, a full allowance of sorghum fodder. Mixed hay, consisting of alfalfa and native grass, was fed to all the lots, but was discontinued in Lot II after the first week when steers had become accustomed to the silage. Cottonseed meal was introduced into the rations of the animals at the beginning of the third week and increased gradually until all the lots were receiving a maximum allowance of 2 pounds per head daily.

At the beginning of the second 30-day period, sunflower silage became available in the silo and was fed to the animals in Lot I in place of the sorghum silage that had been fed during the first 30 days of the test. In Lot IV, sweet sorghum fodder was full-fed during the first 76 days of the test, when the supply became exhausted and sorghum silage was substituted for it and for the remaining 24 days of the test.

The silage and cottonseed meal were mixed thoroughly at the time of feeding, and the hay was fed after these feeds were consumed. The stock were fed twice daily, at 8 a. m. and 5 p. m. Salt was available for the animals at all times.

FEEDS USED

HAY

The hay used was grown locally and consisted of about equal parts of alfalfa and native hay. Portions of the hay had been slightly damaged by rain.

SUNFLOWER SILAGE

The sunflowers from which this silage was produced were grown during the years 1922 and 1923, on the Sulphur Spring Valley Dry-Farm. This silage was of fair quality and was ensiled in an 80-ton pit silo. It had an unusually rank odor, together with a bitter, acid taste. The sunflowers were of the Mammoth Russian variety.

SWEET SORGHUM SILAGE

This silage also was produced on the experiment dry-farm from mixed Red and Black Amber sorghum, grown during the seasons of 1922 and 1923. It was a good grade of silage and the stock relished it more than they did the sunflower silage.

SWEET SORGHUM FODDER

This fodder was from the same crop which produced the sweet sorghum silage. It was stacked in a rick unprotected from the weather, but was well preserved and in good condition to feed.

COTTONSEED MEAL

The cottonseed meal was purchased in Phoenix. It was a high-grade product, containing 46.04 percent crude protein.

The chemical composition of the feeds was determined by the Agricultural Chemistry Section of the Experiment Station.

TABLE XII—CHEMICAL COMPOSITION OF FEEDS USED
(In percent of the fresh substance)

Feed used	Water	Ash	Protein	Fat	Fiber	Nitrogen-free extract
Cottonseed meal	6.86	7.37	46.04	8.73	8.12	22.88
Sunflower silage	71.96	3.02	2.95	1.92	7.35	12.80
Sorghum fodder	7.48	10.20	9.01	1.47	28.77	43.07
Sorghum silage	66.49	3.87	3.11	.68	6.85	19.00
Mixed hay	7.30	8.73	16.10	1.80	27.10	38.38

EQUIPMENT AND WEATHER CONDITIONS

The feedlots were 45 by 60 feet in size, with a manger extending across one end. Well water was supplied by an automatic system. The lots were unprotected and no shelter was provided. Cold, inclement weather prevailed during the first 70 days of the test, with occasional snow and rain storms. A temperature variation ranging from 17 degrees to 86 degrees F was recorded during the test.

EXPERIMENTAL RESULTS

The experiment was started on January 23, 1924, continued for a period of 100 days and ended May 2, 1924. The cattle were slow to accept their feed for the first few days of the test, but later they developed a greedy appetite for their rations. The steers in Lot I did not take well to the change from sweet sorghum silage to sunflower silage at the close of the first 30-day period. They ate sparingly of the sunflower silage at first, but gradually became accustomed to it, although they never relished it as much as they did the sorghum silage.

Two steers in Lot I were unthrifty throughout the test. They did not feed well and apparently could not become adjusted to the changed conditions, being timid about feeding with the other steers, and eating but little of the feed.

AVERAGE DAILY GAINS PER ANIMAL

Reviewing the average daily gains made by each lot of steers for the entire period, it was found that the steers in Lot III made the most rapid gains, followed closely by the steers in Lot II. The average daily



Fig. 6.—Yearling steers in Lot I at the close of the test, May 2, 1924. The animals were fed a ration of sunflower silage, mixed hay, and cottonseed meal.



Fig. 7.—Yearling steers in Lot III at the close of the test, May 2, 1924. The animals were fed a ration of sweet sorghum silage, mixed hay, and cottonseed meal.

gains per head made by each of the four lots of animals were as follows: Lot III, 2.16 pounds; Lot II, 2.12 pounds; Lot IV, 1.88 pounds; and Lot I, 1.84 pounds.

Judging from the standpoint of average daily gains, the addition of mixed hay to the rations in Lot III was of little benefit.

The marked increase in the rate of gain made by Lot IV during the third 30-day period is attributed to the substitution of sorghum silage for the sorghum fodder and indicates the advantage of changing the ration to a more succulent and palatable feed during the latter part of the feeding period.

Comparing the rates of gain of the animals in lots I and III fed on the same basis, it would appear that the sorghum silage excelled the sunflower silage. The steers in Lot IV made a fair rate of gain on sorghum fodder, slightly exceeding the gain made by the steers in Lot I fed sunflower silage, but this gain with sorghum fodder was surpassed by the steers in lots II and III fed sorghum silage.

Table XIII gives a summary of the average daily gain per animal for each lot for each 30-day period, and for the entire period of the test.

TABLE XIII.—AVERAGE DAILY GAIN PER ANIMAL BY LOT WITH THE RATIONS FED.

Lot number	Animals used	First 30 days Pounds	Second 30 days Pounds	Third 30 days Pounds	100-day period Pounds	Ration fed
I	Yearling steers	1.20	2.20	1.80	1.84	Sunflower silage Mixed hay Cottonseed meal
II	Yearling steers	1.17	2.93	2.40	2.12	Sorghum silage Cottonseed meal
III	Yearling steers	1.60	2.87	2.20	2.14	Sorghum silage Mixed hay Cottonseed meal
IV	Yearling steers	1.47	1.60	2.87	1.88	Sorghum fodder Sorghum silage* Mixed hay Cottonseed meal

*Substituted for sorghum fodder during last 24 days of test.

AVERAGE DAILY RATION FED

The animals in Lot I receiving sunflower silage consumed an average of 31.55 pounds of silage per head daily, together with 3.14 pounds of hay, and 1.43 pounds of cottonseed meal. These steers did not eat liberally of the sunflower silage and consumed a correspondingly greater amount of hay than did the steers in Lot III fed sweet sorghum silage.

The average daily consumption of silage by the steers in Lot II was 40.74 pounds. This lot received hay only during the first week of the test. The animals in Lot III which received hay throughout the feeding test consumed an average per head daily of 35.56 pounds of sorghum silage, and 2.55 pounds of mixed hay. The 2.55 pounds of hay effected a saving of 5.14 pounds of silage which is negligible, and from this viewpoint the use of hay was not warranted.

Sorghum silage was substituted for fodder in Lot IV during the last 24 days of the test. During this time the animals consumed an average of 37.56 pounds of silage per head daily.

FEED REQUIRED PER HUNDRED POUNDS GAIN

The steers fed sunflower silage required 1714.56 pounds of silage, 170.43 pounds of hay, and 77.71 pounds of cottonseed meal to produce 100 pounds gain live weight. The steers fed sorghum silage required 1646.11 pounds of silage, 118.0 pounds of hay and 66.20 pounds of cottonseed meal to produce a gain of 100 pounds. This is a difference of 68.45 pounds of silage, 52.43 pounds of hay, and 11.51 pounds of cottonseed meal in favor of the animals fed sorghum silage.

Reduced to dry matter, the feed requirements for the steers in lots I and III were 711.14 pounds and 722.66 pounds respectively. This gives a slight advantage to the steers receiving sunflower silage. The more rapid gains, however, made by the steers fed sorghum silage on approximately the same amount of feed as that required by the steers fed sunflower silage is in favor of the sorghum silage.



Fig. 8.—Yearling steers in Lot II at the close of the test, May 2, 1924. The animals were fed a ration of sweet sorghum silage and cottonseed meal.

The animals in Lot II receiving sorghum silage and cottonseed meal made a more efficient use of their feed, than did the animals in Lot III receiving hay in addition to the sorghum silage and cottonseed meal. Although the steers in Lot II consumed 275.58 pounds more silage, than did those in Lot III, they required only 706.9 pounds of feed expressed in dry matter as compared with 722.66 pounds of feed (dry matter) required by the steers in Lot III. Contrary to the results of other similar experiments obtained at this Station, the addition of hay to the ration was not warranted.

The dry matter required to make 100 pounds gain by the steers in Lot IV which were fed sorghum fodder and cottonseed meal was considerably greater than was that in the other lots, amounting to 1023.98

pounds. This indicates strongly the greater value of silage compared with fodder as roughage.

A complete summary of the test is given in Table XIV.

TABLE XIV—SUMMARY OF 100-DAY FEEDING TEST, FATTENING STEERS ON DRY-FARMS, JANUARY 23, 1924, A. M. TO MAY 2, 1924, A. M.

Lot number	I	II	III	IV
No. yearling steers	10	10	10	10
No. days in feedlot	100	100	100	100
Ration	Sunflower silage,* Mixed hay, Cottonseed meal	Sorghum silage, Mixed hay,** Cottonseed meal	Sorghum silage, Mixed hay, Cottonseed meal	Sorghum fodder, Mixed hay, Cottonseed meal, Sorghum silage***
Average initial wt.	Pounds 416.0	Pounds 445.0	Pounds 416.0	Pounds 416.0
Average final wt.	600.0	657.0	630.0	604.0
Average gain	184.0	212.0	214.0	188.0
Average daily gain	1.84	2.12	2.14	1.88
Average daily ration	Pounds 31.55	Pounds	Pounds	Pounds
Sunflower silage		40.74	35.56	9.00
Sorghum silage				13.47
Sorghum fodder				2.63
Mixed hay	3.14	6.266	2.55	1.43
Cottonseed meal	1.43	1.43	1.43	
Feed req. per cwt. gain	Pounds 1714.56	Pounds	Pounds	Pounds
Sunflower silage		1921.69	1646.11	479.47
Sorghum silage				716.49
Sorghum fodder				139.78
Mixed hay	170.43	0.13	118.00	76.06
Cottonseed meal	77.72	67.45	66.20	
Dry matter	711.14	706.90	722.67	1023.98
Initial cost @ \$5	\$20.80	\$22.25	\$20.80	\$20.80
Feed cost per head	14.60	14.03	15.01	18.56
Marketing cost per head	4.70	4.70	4.70	4.70
Interest @ 8%	0.46	0.49	0.46	0.46
Total cost	40.56	41.47	40.97	44.52
Selling price per cwt	\$ 5.00	\$5.00	\$ 5.00	\$5.00
Profit per head				
Loss per head	\$12.53	\$10.78	\$11.54	\$16.31
Necessary selling price	7.24	6.76	6.96	7.37
Necessary margin	2.24	1.76	1.96	2.37

*Sorghum silage fed for first 30 days.

**266 pounds of hay was fed in Lot II during the first 7 days of the test after which the hay was omitted.

***Sorghum fodder was fed to the animals in Lot IV for the first 76 days, after which sorghum silage was fed.

MARKETING THE ANIMALS

The test closed May 2, 1924, after a period of 100 days. The steers had reached a good finish, considering their inferior type and quality. Inability to market the steers locally made it necessary to ship them to Los Angeles where they were sold at the Los Angeles Stock Yards through the commission firm of Johnson and Cook. The cattle were small and not of the type and finish to attract a good price. They were sold without a spread, bringing only 5 cents, the original purchase price, and entailed a loss of from \$10.78 to \$16.31 per head. The market was very dull at this time for this type of animal, partly on account of the presence of the hoof and mouth disease in California. Cattle were required to be slaughtered 48 hours after arrival so that the butcher stock market was paralyzed.

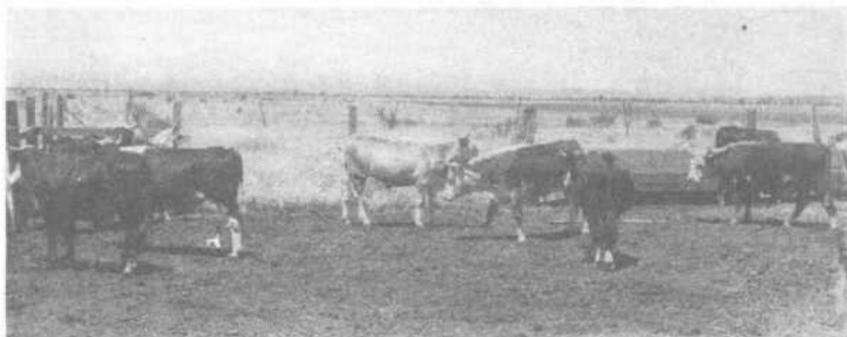


Fig. 9.—Yearling steers in Lot IV at the close of the test, May 2, 1924. The animals were fed a ration of sweet sorghum fodder, mixed hay, and cottonseed meal for 76 days, and of sweet sorghum silage, mixed hay, and cottonseed meal for 24 days.

The shipping charge from Cochise, Arizona, to Los Angeles, California, amounted to \$4.70 per head or at the rate of 80 cents per 100 pounds. This included feed, yardage, and commission costs. The cattle were enroute 60 hours and shrank 6.58 percent.

In order to pay expenses, it would have been necessary for the cattle in the different lots to sell on the following margins: Lot I, \$2.24; Lot II, \$1.76; Lot III, \$1.96; and Lot IV, \$2.37. It is doubtful whether these cattle could have sold at these margins on a good market. If a local market had been available, the cattle could have been disposed of without loss on a small margin. Not considering the cost of shipping to Los Angeles, the necessary margins required to pay all expenses would have been as follows: Lot I, \$0.96; Lot II, \$0.60; Lot III, \$0.74; and Lot IV, \$1.59.

OTHER CONSIDERATIONS

Mention has been made of two animals in Lot I that did not feed well and were unthrifty throughout the test. A comparison of the results obtained with the animals in this lot which received sunflower silage, with those of Lot III receiving sweet sorghum silage indicates a marked advantage in the latter feed. This difference was likely affected to some extent by the condition of the two animals mentioned above.

Five weeks after the beginning of the test, a number of the animals in lots I, III, and IV, became affected with an ailment having the appearance of lump-jaw. A slight swelling appeared about the jawbone on each side of the head. The swellings grew in size, some of them breaking and discharging a thin, watery substance with some pus. The discharge was not characteristic of lump-jaw and, as Lot II which did not receive hay was not affected, the trouble was attributed to the sharp awns of the native hay commonly known as "needle grass."

SUMMARY

The results of this experiment indicate that:

Inferior yearling range steers, representative of the "cutback" class of stock and in poor condition, will make good gains and acquire a fair marketable finish when fed sweet sorghum silage and cottonseed meal for a period of 100 days.

The addition to a ration of sweet sorghum silage and cottonseed meal of a poor grade of mixed hay consisting of alfalfa and native grass did not prove advantageous.

Sunflower silage was not relished as much nor did it give as good results as did the sweet sorghum silage. The results obtained from feeding the sunflower silage, however, were not unfavorable. The adaptability of sunflowers to dry-farming conditions and their productivity as compared **with** sweet sorghum silage are factors that should be considered further in determining their use.

Sweet sorghum silage, as compared with sweet sorghum fodder, gave better results in every way. Fairly good results were obtained, however, by feeding the sweet sorghum fodder.