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**THE USE OF SUDAN GRASS PASTURES AND
OTHER FEEDS FOR BEEF PRODUCTION**

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In experiments to determine the most efficient utilization of sudan pasturage in farm beef production, it has not been profitable to supply yearling steers with concentrate supplements while they were being grazed on the sudan.

Thin yearling steers made rapid gains on sudan pasturage with or without concentrate supplements while fleshy yearling steers made much smaller gains.

Cottonseed cake, ground ear corn, mixtures of concentrate feeds, and cane molasses were self-fed to yearling steers while on sudan pasture without ill effect from scouring or going "off feed."

It was possible to market creditably finished yearling steers directly from the sudan fields by self-feeding cottonseed cake or ground ear corn with the grazing; however, carcasses of steers so fed showed yellow color of external fat now not preferred by the beef trade.

Steer calves, fed 2 pounds of cottonseed meal and 2 pounds of ground ear corn in addition to silage or small grain pasturage may be expected to make more than 1.5 pounds daily gain in wintering periods of about 180 days.

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THE USE OF SUDAN GRASS PASTURE AND OTHER FEEDS FOR BEEF PRODUCTION

J. H. Jones, J. M. Jones, R. A. Hall, E. M. Neal*

For the last ten years the Beeville Station has conducted trials to determine practicable methods of utilizing farm feeds, farm resources, and various feed supplements in the production of finished yearling steers in that area. In the light of results of these trials, the general plan now followed includes the purchase of high-grade steer calves of weaning age in the fall, winter feeding them to make good gains, following with a period of sudan grazing in spring and summer, and finishing with a short period of dry lot feeding in the fall.

This bulletin reports three years of work upon problems of farm beef production conducted at Substation No. 1, Beeville, Texas.

The first experiment extended from May 19, 1938 to December 14, 1938, and was a study of the utilization of sudan grazing in fattening yearling steers, with and without various feed supplements.

The second experiment was a study of the winter feeding of steer calves and extended from November 16, 1938 to May 15, 1939.

The third experiment extended from October 6, 1939 to November 13, 1940, and included studies of the winter maintenance feeding of steer calves and the utilization of sudan grazing in fattening yearling steers with and without various feed supplements.

The method of presentation is to report each year of work separately with discussion and to conclude with a summary of such factors as were common to the three experiments.

UTILIZATION OF SUDAN GRAZING IN FATTENING YEARLING STEERS

The general object of this experiment was to obtain information in regard to the utilization of sudan grazing in fattening yearling steers, but the immediate objects were to determine whether (1) steers grazed on sudan should or should not be fed supplementary concentrate feeds, (2) steers could be self-fed concentrate feeds while on sudan grazing,

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Fig. 1. Representative lot of steers, sudan grazing and feeding trial for 1938, when started on sudan grazing May 19, 1938. Note thin condition.

and (3) a high protein concentrate such as cottonseed cake would produce as much gain when fed with sudan grazing as would a balanced grain fattening ration.

The experiment included (1) a grazing period on sudan grass, May 19 to July 28, and a period of finishing in dry lot, July 28 to December 14. Lot 1 was not fed during the sudan grazing period, but Lots 2 and 3 were self-fed. During the finishing period in dry lot, all lots received similar rations.

The period of sudan grazing was limited to 70 days because of the summer drouth. The dry lot finishing periods of 139 days for Lot 1 and 100 days for Lots 2 and 3 were sufficient for the steers to become well finished.

On May 13, 33 good grade but thin (See Fig. 1) 451-pound Hereford yearling steers were secured from Mason County, Texas, and cost upon delivery to the Station \$8.34 per cwt. They were grazed on sudan from the start and on May 17, 18, and 19 were weighed and divided as equally as possible into three groups.

The ground ear corn* fed during the grazing period was from the 1937 crop, while that fed during the dry lot period was from the 1938 crop. The hegarı heads and milo heads were grown in 1938. The old crop corn

*In this bulletin the feed described as "ground ear corn" is correctly identified as "ground ear corn with shuck."



Fig. 2. Sudan grazing at start of sudan grazing and feeding trial for 1938, May 19, 1938. Sudan grass is planted in 36-inch rows and it is grazed when it becomes 12 to 14 inches high. No cases of hydrocyanic acid poisoning have ever been observed among steers grazed on sudan at the Beeville Station.

cost 65 cents per bushel, and the new crop corn 40 cents. All of the ground grain feeds were charged at the same price per ton for both periods of feeding. The condition of the sudan grazing at start of test is shown in Fig. 2.

In the sudan grazing period, Lots 2 and 3 were hand fed for 9 days as a precautionary measure before the self-feeders were used. Afterwards the self-feeders were never allowed to become empty. This practice was observed to prevent any over-eating which might have occurred had the steers been allowed to clean out the feeders and go hungry. In the dry lot, all of the feeds were mixed together at time of feeding, being supplied twice daily.

Sudan Grazing Period

Table 1 shows the average rations consumed and the gains in pounds per head during the sudan grazing period. Small amounts of silage and of ground ear corn were fed the first day of the first period but are not shown in Table 1. This was done in order to be sure that all of the steers were accustomed to these feeds.

The 33 steers had 40 acres of sudan grass which was divided into four 10-acre pastures. To equalize the grazing the three lots of steers were rotated on the pastures each week with one pasture being unoccupied. Lots 2 and 3, which were self-fed, grazed much less than Lot 1, unfed, but the difference could not be measured and each lot was charged the same amount for pasturage.

The yearlings were expected to make large gains because they were thin at the start. Lot 1 made high gain during the first period when the sudan was in good condition but made little gain toward the close when the

Table 1. Grazing Period: Average rations consumed and gains in pounds per head

Ration	5/19—6/16 28 days	6/16—7/14 28 days	7/14—7/28 14 days	Average 5/19—7/28 70 days
Lot 1—Sudan grazing only				
Salt, ounces.....	.93	1.87	1.25	1.38
Total gain.....	107.2	56.5	8	172
Average daily gain.....	3.83	2.02	.56	2.45
Lot 2—Self-fed cottonseed cake				
Cottonseed cake, pounds.....	8.57	11.36	14.94	10.97
Salt, ounces.....	.62	.31	.31	.43
Total gain.....	108	82	32	222
Average daily gain.....	3.83	2.94	2.28	3.16
Lot 3—Self-fed concentrate ration*				
Mixed concentrate ration, lbs....	9.61	17.56	22.08	15.32
Salt, ounces.....	.62	.73	.73	.69
Total gain.....	124	97	24	245
Average daily gain.....	4.43	3.46	1.71	3.49

*Concentrate ration consisting of 10% cottonseed meal, 30% cottonseed, 17% ground hegari heads, and 43% ground ear corn.

Table 2. Summary of Grazing Period, May 19 to July 28, 1938—70 days

Lot number.....	1	2	3
	10	11	11
Number of steers per lot.....			
Treatment.....	Sudan only	Self-fed	
		Cottonseed Cake	Concentrate Mixture
Averages in Pounds Per Steer			
Initial weight.....	455	450	453
Final weight.....	627	671	698
Gain.....	172	221	245
Average daily gain.....	2.46	3.16	3.49
Total Feeds Per Steer			
Sudan allowed, acres.....	1.21	1.21	1.21
Cottonseed cake or cottonseed meal.....		768	107
Cottonseed.....			321
Ground ear corn or ground hegari heads.....			643
Salt.....	6.0	2.0	3.0
Feed cost per cwt. gain.....	\$1.37	\$5.57	\$4.75
Financial Statement			
Initial cost at \$8.34 per cwt.....	\$ 37.95	\$ 37.53	\$ 37.78
Feed cost, including charge for grazing.....	2.36	12.31	11.63
Total cost.....	40.31	49.84	49.41
Cost per cwt. at close of period.....	6.43	7.43	7.08
Valuation at \$8.34 per cwt.....	52.29	55.96	58.21
Increase in value above costs.....	11.98	6.12	8.80

Feed prices per ton: Ground grain feeds, \$13.60; cottonseed meal or cottonseed cake, \$26.00; cottonseed, \$22.00; salt, \$15.00; sudan grazing, \$0.033 per head daily.

sudan had matured and was dry and stemmy. Lots 2 and 3 continued to make good gains throughout despite the increasing maturity of the sudan. The large amount of feed which Lots 2 and 3 consumed while on grazing produced no ill effect in regard to scouring or going off feed. A summary of the sudan grazing period is shown in Table 2.

It was not possible to make a strict evaluation of the financial results of the sudan grazing period since the steers were not appraised at the close of the period. Lots 2 and 3 had definite advantage in finish over Lot 1 yet could not have been described as slaughter steers. At the same valuation per pound, Lot 1 had the advantage because of lower feed cost and in this connection it may be noted that sudan grazing, charged at only \$0.033 per head daily, supplied a very cheap feed.

Finishing Period in Dry Lot

The steers were placed in dry lot at the close of the sudan grazing period. Table 3 shows the average rations consumed and the gains in pounds per head for the dry lot finishing period.

Lot 1 had an advantage in receiving a larger percentage of ground ear corn and less of the ground grain sorghum heads than Lots 2 and 3 during the finishing period. They also had greater appetite for feed, and consumed, on the average, slightly more grain and silage than Lots 2 and 3.

Table 3. Finishing Period—Average rations consumed and gains in pounds per head

Ration	7/28 to 8/25 28 days	8/25 to 9/22 28 days	9/22 to 10/20 28 days	10/20 to 11/17 28 days	11/17 to 12/14 27 days	Average 7/28 to 12/14 139 days
Lot 1						
Grain*	12.44	15.8	16.22	17.24	18.24	16.3
Cottonseed meal	2.83	2.7	2.83	2.52	2.98	2.83
Silage	15.44	7.0	6.57	4.76	5.72	7.39
Salt, ounces	.21	.16	.22	.01	.28	.26
Oyster shell	.1	.1	.1	.1	.1	.1
Hegari stover				1.91		.38
Total gain	78	60	48	86	55	327
Average daily gain	2.72	2.14	1.7	3.05	2.03	2.35
				10/20 to 11/5 16 days		Average 7/28 to 11/5 100 days
Grain**	14.22	16.61	16.29	15.93		15.75
Cottonseed meal	2.94	2.98	2.86	2.54		2.86
Silage	9.12	6.09	6.02	4.32		6.33
Salt, ounces	.42	.26	.10	.17		.26
Oyster shell	.1	.1	.1	.1		.1
Hegari stover				1.5		.24
Total gain	85	57	46	36		223
Average daily gain	3.03	2.03	1.62	2.23		2.23
Lot 3						
Grain**	14.58	16.17	15.33	15.42		15.46
Cottonseed meal	2.94	2.87	2.86	2.52		2.83
Silage	9.12	5.93	6.01	4.32		6.29
Salt, ounces	.21	.1	.21	.11		.19
Oyster shell	.1	.1	.1	.1		.1
Hegari stover				1.3		.21
Total gain	68	54	42	50		214
Average daily gain	2.44	1.92	1.51	3.15		2.14

*Consisting of 68.5% ground ear corn, 9.5% ground hegari heads, 22% ground milo heads.

**Consisting of 52% ground ear corn, 17.4% ground hegari heads, 30.6% ground milo heads.

Table 4 is a summary of the finishing period in dry lot.

Table 4. Summary of finishing period in dry lot, July 28 to November 17 and December 14, 1938

Lot number	1	2	3
Number of steers per lot	10	11	11
Days fed	139	100	100
Former treatment on sudan grazing	Sudan only	Self-fed	
		Cottonseed Cake	Mixture
Averages in Pounds per Steer			
Initial weight	627	671	698
Final weight	953	894	912
Gain	326	223	214
Average daily gain	2.35	2.23	2.14
Total Feed Consumed			
Cottonseed meal	393	286	283
Ground grain heads	2266	1575	1546
Silage	1028	633	629
Ground hegari fodder	54	24	21
Salt	2.07	1.64	1.09
Pulverized oyster shell	14	11	11
Feed cost	\$ 22.45	\$ 15.59	\$ 15.33
Feed cost per cwt. gain	6.89	6.99	7.16

Feed prices per ton: Ground grain feeds, \$13.60; cottonseed meal, \$26.00; silage, \$3.00; ground hegari fodder, \$10.00; salt and pulverized oyster shell, \$15.00.

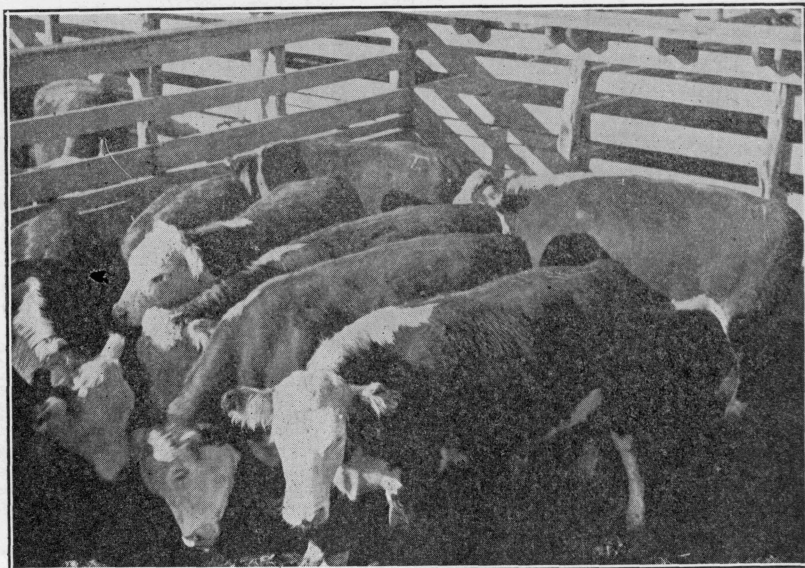


Fig. 3. Lot 2 at close of 100 day dry lot finishing period, sudan grazing and feeding trial for 1938, at Fort Worth market, November 8, 1938. Lot 3, marketed at the same time were equally as well finished. Compare with Fig. 4.

Table 5. Summary of sudan grazing and dry lot finishing periods, May 19, to December 14, 1938

Lot number.....	1	2	3
	10	11	11
Number of steers per lot.....	209	170	170
Days fed.....			
Treatment on sudan grazing.....	Sudan only	Self-fed	
		Cottonseed Cake	Mixture
Averages in Pounds Per Steer			
Initial weight.....	455	450	453
Final weight on farm.....	953	894	912
Final weight at market.....	906	842	858
Gain, basis farm weight.....	498	444	459
Gain, basis market weight.....	451	392	405
Average daily gain, basis farm weight.....	2.38	2.61	2.70
Average daily gain, basis market weight.....	2.16	2.31	2.38
Shrinkage enroute to market, lbs.....	47	52	54
Shrinkage enroute to market, percent.....	4.93	5.82	5.92
Slaughter Data			
Carcass weight (hot).....	549.5	516	520
Hide weight, untrimmed.....	69.6	66	69
Dressing %, basis hot carcass and market wt...	60.6	61.3	60.6
Carcass plus hide as percent of market wt.....	68.3	69.1	68.6
Carcass grades:			
Strictly good to choice.....	6	2	4
Top medium to good.....	4	6	4
Medium.....	0	3	3
Total Feed Consumed			
Sudan grazing, days.....	70	70	70
Cottonseed cake or cottonseed meal.....	393	1054	390
Cottonseed.....			321
Ground grain feeds.....	2266	1575	2189
Silage.....	1028	633	629
Ground hegari fodder.....	54	24	21
Salt.....	8.07	3.64	4.09
Pulverized oyster shell.....	14.0	11.0	11.0
Feed cost per cwt. gain—farm weight.....	\$ 4.98	\$ 6.28	\$ 5.87
Feed cost per cwt. gain—market weight.....	5.50	7.12	6.66
Financial Statement			
Initial cost at \$8.34 per cwt.....	\$ 37.95	\$ 37.53	\$ 37.78
Feed cost, including charge for grazing.....	24.81	27.90	26.96
Marketing cost.....	4.34	4.21	4.29
Total cost.....	67.10	69.64	69.03
Selling price.....	9.12	9.03	9.03
Amount received.....	82.63	76.03	77.48
Profit.....	15.53	6.39	8.45

Feed prices per ton: Ground grain feeds, \$13.60; cottonseed meal or cottonseed cake, \$26.00; cottonseed, \$22.00; silage, \$3.00; ground hegari fodder, \$10.00; salt and pulverized oyster shell, \$15.00; sudan grazing, \$0.033 per head daily.

In order to make the data more comparable, the same feed prices were used for both the summer and fall feeding periods; however, the actual prices were somewhat less during the latter period.

Lots 2 and 3, self-fed while on grazing, were judged to be fat enough for slaughter after 100 days of feeding in dry lot and were marketed at Fort Worth November 8. (See Fig. 3.) Lot 1, not fed while on sudan, was judged to have reached about the same finish after 139 days in dry lot as Lots 2 and 3 reached after 100 days and was marketed at San Antonio, December 15 (See Fig. 4). A summary of the entire experiment, including the sudan grazing period and dry lot finishing period, is shown in Table 5.

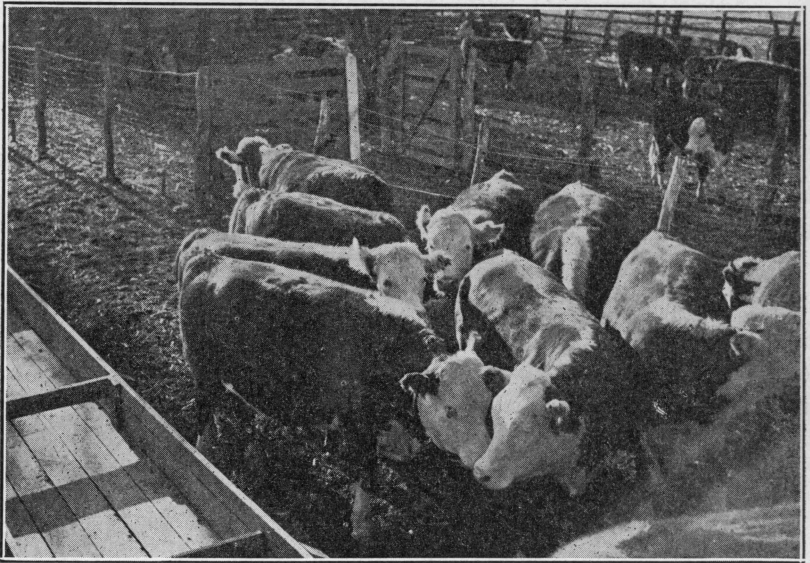


Fig. 4. Lot 1 at close of 139 day dry lot finishing period, sudan grazing and feeding trial for 1938, at feed lot December 14, 1938. Note fair to good finish and compare with Fig. 1 as feeders.

Discussion

Both cottonseed cake and a concentrate mixture consisting of 10% cottonseed meal, 30% cotton seed, and 60% ground ear corn were successfully self-fed to thin yearling steers while on sudan grazing.

The steers so fed consumed very large amounts of concentrates. Lot 2, self-fed cottonseed cake, consumed an average of 10.97 pounds per head daily with a maximum of 14.9 pounds, and Lot 3, self-fed the mixed ration, consumed an average of 15.32 pounds per head daily with a maximum of 22.1 pounds.

Lot 3, fed the mixed ration, made slightly greater gain and, at the prices charged for feeds, a slightly cheaper gain than Lot 2, self-fed cottonseed cake. Both rations, one extremely high in protein and the other well balanced and comparatively high in energy, produced good gains.

Lot 1, which received sudan only, made lower gain and less finish than Lots 2 and 3, but made a much cheaper gain and had an advantage in cost at the close of the period.

Lots 2 and 3 reached marketable finish after 100 days in dry lot, while Lot 1 did not reach the same approximate finish until they had been fed for 139 days in dry lot. In attaining comparable finish, Lot 1 made approximately 50 pounds greater gain per head and also made a slightly cheaper and more rapid gain than Lots 2 and 3.

Lot 3, which had received the concentrate mixture maintained a slight advantage in gain and finish over Lot 2 which had received cottonseed cake; however, there was little difference in market value between the lots.

The results show that the additional gain and finish, obtained as a result of feeding concentrates with sudan grazing, is produced at high cost.

Considering the sudan grazing and the dry lot finishing period as one period, Lot 1 made a greater gain, a cheaper gain, and more profit than Lots 2 and 3. These results strongly indicate that the average costs of gain will be less in using sudan grazing if the steers do not receive their concentrate feeds until they are placed in dry lot.

WINTER MAINTENANCE FEEDING OF STEER CALVES

It is often advisable to purchase feeder calves in the fall and winter feed them in order to have yearlings available for the sudan grazing in the spring. In following this plan the operator encounters a number of questions and among them the following may be mentioned: How well should the calves be fed? What rate of gain is most desirable? How much grain or cottonseed meal should be feed along with silage or stover? To what extent can small grain grazing be used? Should a supplement of concentrates or of roughage be fed with small grain grazing? In order to gain further information upon such questions, the Beeville Station conducted an experiment in the winter feeding of steer calves from November 16, 1938 to



Fig. 5. Steer calves used in winter maintenance feed trial November 16, 1938, to May 15, 1939. Note excellent feeder type flesh and conformation.

May 15, 1939. The immediate object of the experiment was to determine the utility of small grain grazing in such feeding.

The experiment involved a comparison between two lots of steer calves: Lot 1 which was maintained in dry lot on a silage ration with supplements of ground ear corn, cottonseed meal, and chopped hegari bundles, and Lot 2 which was maintained insofar as possible, on small grain grazing. Forty good to choice Hereford steer calves in good flesh (See Fig. 5) were received on the Station October 13, 1938. From October 13 to November 16, they were grazed 24 days on a field of second growth hegari and were fed for 10 days in dry lot, receiving an average daily ration of 19.6 pounds sorgo silage, 1.36 pounds ground ear corn, and .77 pound cottonseed meal. When divided into two equal groups of 20 each and started on test November 16, the 40 head averaged 445 pounds and had cost \$8.65 per cwt.

Feeding and Grazing Period

During the first 56 days, November 16 to January 11, both lots of steers were fed together in dry lot on a silage ration with supplements of ground ear corn, cottonseed meal, and chopped hegari bundles.

During the next 42 days, January 11 to February 22, Lot 2 was turned on oat grazing without supplement other than chopped hegari bundles. In the ensuing 56 days, February 22 to April 19, Lot 2 was continued on oat grazing but was fed the same supplements of ground ear corn and

Table 6. Average rations consumed and gains in pounds per head, November 16 to May 15—180 days

Ration	11/16— 1/11 56 days	1/11— 2/22 42 days	2/22— 4/19 56 days	4/19— 5/15 26 days	Average 11/16— 5/15 180 days
Lot 1					
Cottonseed meal.....	1.945	2.0	2.0	1.7	1.94
Ground ear corn.....	2.0	2.0	2.0	1.7	1.95
Silage.....	25.9	26.2	25.0	.....	21.91
Dry fodder.....	.60	4.1	3.2	.....	2.1
Grazing.....	.....	.....	.....	green sudan	.....
Salt, ounces.....	.28	.62	.51	1.3	.59
Total gain.....	115.4	88.5	87.4	24.8	316.1
Average daily gain.....	2.06	2.11	1.56	.95	1.76
Lot 2					
Cottonseed meal.....	1.945	.....	1.98	1.7	1.47
Ground ear corn.....	2.0	.....	1.48	1.7	1.32
Silage.....	25.9	.....	.50	.....	8.21
Dry fodder.....	.6	2.27	3.3	.....	1.76
Grazing.....	.....	green oats	green oats	green sudan	.....
Salt, ounces.....	.28	.36	.19	1.3	.42
Total gain.....	123.4	59.2	144.8	47.0	374.4
Average daily gain.....	2.20	1.41	2.59	1.81	2.08

Table 7. Summary of winter feeding period, November 16, 1938, to May 15, 1939, 180 days

Lot number.....	1	2
	20	20
Treatment.....	In dry lot silage	On oat grazing and in dry lot
Averages in Pounds Per Steer		
Initial weight.....	446	444
Final weight on farm.....	762	819
Weight at San Antonio market.....	713	772
Gain basis farm weight.....	316	375
Gain basis market weight.....	267	328
Average daily gain, basis farm weight.....	1.76	2.07
Average daily gain, basis market weight.....	1.49	1.82
Shrinkage via truck to market, pounds.....	49	46
Shrinkage via truck to market, percent.....	6.43	5.62
Slaughter Data		
Carcass weight (hot).....	433	476
Hide weight, untrimmed.....	63.9	65.2
Dressing %, basis hot carcass and market weight.....	60.7	61.8
Carcass plus hide as percent of market weight.....	69.7	70.1
Carcass grades (Swift & Co.)		
Strictly good to choice.....	8	11
Top medium to good.....	10	6
Medium.....	2	3
Carcasses showing yellow color of external fat.....	3	9
Total Feed Consumed		
Ground ear corn.....	351	237
Cottonseed meal.....	350	264
Sorgo silage.....	3945	1478
Chopped hegari fodder.....	378	316
Salt.....	6.62	4.71
Days sudan grazing.....	26	26
Days oat grazing.....		98
Feed cost per cwt. of gain—farm weight.....	\$ 4.86	\$ 3.39
Feed cost per cwt. of gain—market weight.....	5.75	3.88
Financial Statement		
Initial cost at \$8.65 per cwt.....	\$ 38.58	\$ 38.41
Feed cost including charge for grazing.....	15.35	12.71
Marketing cost at \$0.341 per cwt.....	2.43	2.63
Total cost.....	56.36	53.75
Amount received at \$9.60 per cwt.....	68.45	74.11
Profit.....	12.09	20.36

Feed prices per ton: Ground ear corn, \$13.00; cottonseed meal, \$27.00; sorgo silage, \$3.00; chopped hegari fodder, \$8.00; salt, \$15.00; grazing, \$0.033 per head daily.

cottonseed meal as supplied to Lot 1, continued in dry lot with silage rations.

In the final 26 days, April 19 to May 15, both lots received sudan grazing. The average rations consumed and gains in the different periods of feeding are shown in Table 6.

While all of the steers were fed together during the first 56-day period, those which formed Lot 2 made slightly greater gain. In the ensuing 42-day period when Lot 2 was turned on oat grazing without supplementary feed other than chopped hegari bundles, Lot 1, continued in dry lot, made an average of 30 pounds per head greater gain. Since it was not desired that any great difference should obtain between the two groups because of the test planned for a sudan grazing period, the feeding of supplements was resumed in Lot 2. During the remainder of the trial Lot 2 made the

greater gain and showed to considerable advantage in the final 26-day period on sudan grazing. The sudan grazing was cut short by drouth and the cattle were marketed directly from the sudan fields. A summary of the trial, November 16, 1938 to May 15, 1939, is shown in Table 7.

Discussion

Lot 2, which grazed 98 days on small grain pasturage made approximately 60 pounds more gain per head and at the same time received smaller amounts of supplementary feeds than Lot 1 which was fed in dry lot on silage for the major portion of the 180-day feeding period.

The marked advantage for Lot 2 in gain, in saving of supplementary feeds, and in financial return strongly indicate a high value for small grain pasturage in the winter feeding of calves.

In connection with the excellent performance of Lot 2, the evidence indicates that it was the use of grazing in combination with the supplementary concentrates and dry roughage which produced the gratifying results.

The value of the combination of grazing and supplementary feeds was shown particularly by the fact that in a 42-day period when the Lot 2 steers did not receive supplementary concentrates, they failed to keep pace with the steers fed in dry lot. Following the addition of concentrate supplements, their gains increased rapidly and they outstripped the steers fed in dry lot. This performance also afforded evidence that the small grain grazing was superior to the silage which was fed.

While Lot 2 made greater gain, had less shrinkage enroute to market, and made higher dressed yield, there was little difference between the lots with respect to carcass grade. Most of the carcasses in the two lots ranged from top medium to good; however, nine carcasses in Lot 2 were noted for yellow color of external fat as compared to only three in Lot 1.

It is difficult to arrive at a value for small grain grazing or to determine what charges should be assessed per acre for grazing from the standpoint of cost of production. The arbitrary charge of \$0.033 per head per day assessed in this trial for grazing enabled Lot 2 to show a nice profit in comparison to Lot 1 fed silage in dry lot.

Under the conditions which obtained, concentrate supplements of 2 pounds of cottonseed meal and 2 pounds of ground ear corn fed per head daily with silage or in combination with silage and oat grazing, were sufficient to produce average daily gains of 1.75 to 2.07 pounds.

As a final word with reference to the winter feeding of steer calves on the farm, it is believed that it is a good practice to feed sufficient amounts of concentrates with silage or grazing to insure gains of 1.5 to 2.0 pounds per head daily. If this is done, the steers started as calves in the fall will be as yearlings in the spring in condition to (1) continue

on high grade grazing with or without supplementary feed, (2) go into dry lot for a finishing feed, or (3) to sell as medium grade, lightweight slaughter steers.

UTILIZATION OF SUDAN GRAZING AND VARIOUS SUPPLEMENTS IN FATTENING YEARLING STEERS

One of the main objects in this experiment was to obtain economical utilization of the available farm feeds, but, more specifically, to determine (1) whether steers grazed on sudan should or should not be fed supplementary concentrate feeds, (2) whether heavy fleshy yearling steers could be finished with concentrates self-fed during an average period of sudan grazing, and (3) whether ground ear corn, 43% protein cottonseed cake, or cane molasses would be the most desirable for self-feeding with sudan grazing.

The experiment included (1) a winter feeding period in which all of the steers were fed together, (2) a grazing period on sudan grass, May 1 to September 18, and (3) a short period of finishing in dry lot.

Forty good to choice Hereford steer calves produced in Bee County were received on October 5. On basis of purchase at \$10.00 per cwt. with 3% shrink, they cost \$38.98 per head delivered to the Station. They were uniform in breeding and in age, having been dropped from March 1 to March 15. (See Fig. 6.)



Fig. 6. Weaned steer calves at time of purchase, November 6, 1939. Note excellent quality and conformation.

Winter Feeding Period

In a preliminary period of 53 days, October 6 to November 27, the calves were grazed on second growth grain sorghum fields and started on supplementary feeds. With the exhaustion of field grazing, they were placed in dry lot on a limited concentrate ration with grain sorghum silage. At this time their average weight was 498.6 pounds per head.

Table 8. Average rations consumed and gains in pounds per head, October 6, 1939, to May 1, 1940

Ration	Preliminary Period 10/6—11/27 53 days	11/27—12/27 30 days	12/27—1/24 28 days	1/24—2/21 28 days	2/21—3/20 28 days	3/20—4/17 28 days	4/17—5/1 14 days	Average* 11/27—5/1 156 days
Field grazing.....	yes	.....	.....	.....	.....	.....	.....	.....
Cottonseed meal.....	1.79	1.97	2.0	2.0	2.0	2.0	2.0	1.99
Ground ear corn.....	1.91	1.97	2.0	2.0	2.0	2.0	2.0	1.99
Grain sorghum silage.....	.....	22.13	22.2	24.8	30.0	34.5	36.9	27.58
Salt, ounces.....	.20	.13	.21	.14	.42	.56	.42	.30
Total gain.....	109.0	43.2	32.3	52.5	56.1	50.0	22.7	257.0
Average daily gain.....	2.05	1.43	1.15	1.87	1.99	1.80	1.58	1.65

*Preliminary period not included in averages.

The excellent performance of the calves during the preliminary period is largely ascribed to the fact that they had been creep fed. They were both weaned and dehorned, yet made an increase of 109 pounds per head over pay weight, at purchase, in the 53-day period. The average rations consumed and gains in pounds per head of the preliminary grazing period and the dry lot winter feeding period are shown in Table 8.

The preliminary period of 53 days is not shown in the averages (Table 8). It has been included in Table 9, summary of the period October 6 to May 1, 1940.

Table 9. Summary of Winter Feeding Period, October 6, 1939, to May 1, 1940
209 days

Averages in Pounds Per Steer	
Number of steers.....	40
Initial weight.....	389.8
Final weight.....	755.3
Gain.....	365.5
Average daily gain.....	1.75
Total Feeds Per Steer	
Cottonseed meal.....	405
Ground ear corn.....	412
Grain sorghum silage.....	4302
Salt.....	3.6
Pulverized limestone*.....	11.9
Feed cost per cwt. gain.....	\$ 5.56
Financial Statement	
Initial cost.....	\$ 38.98
Feed cost including charge for grazing.....	20.31
Total cost.....	59.29
Valuation appraisal at \$9.50 per cwt.....	71.75
Increase in value above costs.....	12.46

*Pulverized limestone during last 120 days.

Feed prices per ton: Ground ear corn, \$24.00; cottonseed meal, \$35.00; silage, \$3.00; salt, \$12.00; limestone, \$10.00; grazing, \$0.033 per head per day.



Fig. 7. Representative lot of steers when started on sudan grazing and feeding test, May 1, 1940. Note young growth of sudan and storage tank for molasses in background.

At the close of the wintering period the steers had good flesh (See Fig. 7) and might have been termed "three-way cattle," for they could have been (1) sold for slaughter, (2) placed on heavy concentrate for a quick finish, or (3) turned on grazing for further development as was done. At an appraised valuation of \$9.50 per cwt., they showed a profit which resulted from the increase in weight of 365 pounds per head at a feed cost of only \$5.56 per cwt. of gain. Dry weather eliminated the possibility of small grain grazing. Had it been available it is probable that the cost of winter feeding would have been reduced.

Sudan Grazing Period

The forty steers were divided as equally as possible at the close of the wintering period into four groups of ten each and turned on sudan pasturage May 1, 1940 where they remained until September 18, a period of 140 days. Lot 1 was not fed, Lot 2 was self-fed 43% protein cottonseed cake, Lot 3 was self-fed ground ear corn, and Lot 4 was self-fed molasses. At the close of the 140-day grazing and feeding period, Lots 2 and 3 were marketed while Lots 1 and 4 were placed on a finishing ration in dry lot for an additional 56 days. The average rations consumed and gains in pounds by 28-day periods are shown in Table 10.

In order to equalize differences in the pasturage, the four groups were grazed separately and in weekly rotation upon four 15-acre sudan pastures. The watering places were near shade but the self-feeders in which the cottonseed cake, ground ear corn, and molasses were supplied were some distance away from both shade and water. The question arose as to whether the self-feeders should have been placed near the shade and water, and in this connection it was noted that the steers supplied molasses did not consume average amounts unless they were grazed upon the pastures in which they were forced to pass by the molasses feeder enroute to or from water. The consumption of only small amounts of molasses under the condition of self-feeding upon sudan was unexpected. Much larger amounts of ground ear corn and cottonseed cake were consumed under the same conditions.

The grazing was relatively abundant throughout, but became rather dry and much less attractive during the last two 28-day periods. The supplementary feeds were consumed in progressively larger amounts during the grazing period and Lot 3, fed corn, consumed such large amounts toward the close as to preclude the use of an appreciable amount of grazing. Lot 2 also consumed rather large amounts of cottonseed cake daily; however, there was no difficulty from undue looseness among the lots at any time. A summary of the sudan grazing period is shown in Table 11.

The total gains were rather low for all lots during the sudan grazing period and the gains for the first period of 28 days were mostly negative. Considering that the initial weight for the period was obtained while the

Table 10. Grazing and feeding period. Average rations consumed and gains in pounds per head

Ration*	5/1— 5/29 28 days	5/29— 6/26 28 days	6/26— 7/27 28 days	7/27— 8/21 28 days	8/21— 9/18 28 days	9/18— 10/16 28 days	10/16— 11/13 28 days	Average 5/1— 9/18 140 days	Average 9/18— 11/13 56 days
Lot 1									
Cottonseed meal.....						2.88	2.97		2.93
Ground ear corn.....						13.20	18.54		15.9
Silage (Atlas).....						19.49	8.12		13.8
Salt, ounces.....	.80	1.0	.83	.51	1.09	.74	.74	.85	.74
Total gain.....	-10.4	52.0	44.0	31.5	-1.1	84.6	46.8	116.0	131.0
Average daily gain.....	-0.37	1.86	1.57	1.12	-0.04	3.02	1.67	.83	2.35
Lot 2									
Cottonseed cake.....	4.8	4.42	5.9	8.5	9.85			6.69	
Salt, ounces.....	.8	1.0	.54	.34	.40			.62	
Total gain.....	1.3	58.5	43.5	52.5	46.6			202.0	
Average daily gain.....	.05	2.09	1.55	1.88	1.66			1.44	
Lot 3									
Ground ear corn.....	7.2	8.72	12.2	15.6	17.5			12.26	
Salt, ounces.....	.80	1.0	.77	.46	.61			.74	
Total gain.....	-18.8	78.5	59.0	23.0	50.0			192.0	
Average daily gain.....	-0.67	2.80	2.11	.82	1.79			1.37	
Lot 4									
Cottonseed meal.....						2.89	2.93		2.91
Ground ear corn.....						13.27	18.58		15.9
Silage (Atlas).....						20.53	7.96		14.3
Molasses.....	1.5	1.19	2.8	3.02	4.36			2.57	
Salt, ounces.....	.80	1.38	.86	.83	.85	.74	.46	.94	.60
Total gain.....	-19.7	71.0	18.5	40.5	28.3	90.7	45.3	138.0	136.0
Average daily gain.....	-0.70	2.54	.66	1.45	1.01	3.24	1.62	.99	2.43

*0.10 pound pulverized limestone fed per head daily during 56 days in dry lot.

Table 11. Summary of Grazing Period—May 1 to September 18, 1940, 140 days

Lot number.....	1	2	3	4
Number of steers per lot.....	10	10	10	10
Treatment.....	Sudan only	Self-fed C. S. Cake	Self-fed Ground Ear Corn	Self-fed Molasses
Averages in Pounds Per Steer				
Initial weight.....	755	756	755	756
Final weight.....	871	958	947	894
Gain.....	116	202	192	138
Average daily gain.....	.83	1.44	1.37	.99
Total Feeds Per Steer				
Sudan allowed, acres.....	1.5		1.5	1.5
Cottonseed cake.....		937.0		
Ground ear corn.....			1716	
Molasses (cane).....				360
Salt.....	7.4	5.4	6.4	8.25
Feed cost per cwt. gain.....	\$ 4.02	\$ 10.42	\$ 11.36	\$ 5.34
Financial Statement				
Initial cost appraised at \$9.50 per cwt.....	\$ 71.73	\$ 71.82	\$ 71.73	\$ 71.82
Feed cost, including charge for grazing.....	4.66	21.05	21.82	7.37
Total cost.....	76.39	92.87	93.55	79.19
Appraised value per cwt. San Antonio market.....	9.05	10.50	10.50	9.50
Appraised value (no reductions for shrink or marketing)...	82.74	100.59	99.43	84.93

steers were upon a full feed of silage in dry lot and that after placement upon sudan the steers were driven about one mile to the scales for weighing, the poor gains shown for the period could be expected.

A financial statement is included in the summaries of the various periods since monetary outcome is interesting to the feeder. The prices charged for feeds affect such outcome; however, the prices reflect the conditions prevailing during the course of the trial and for this reason financial return can be used as a partial measure of the soundness of compared feeding methods.

The appraised valuation of the steers at the close indicate that financial return was about the same for the various lots during the sudan grazing period. The increase in valuation for Lots 2 and 3 and their greater gain was offset by the cost of the supplementary feeds which they had consumed. There was little indication of value from the self-feeding of molasses not only because of the small amount consumed but because Lot 4, so fed, showed no greater finish and only slightly greater gain than Lot 1 which had sudan grazing only.

Lots 2 and 3, receiving cottonseed cake and ground ear corn, respectively, made much greater gain and finish than either of Lots 1 and 4. Both showed sufficient finish (See Figs. 8 and 9) to be classed as marketable slaughter steers and they were sold at \$10.50 per cwt., basis delivery to and weight without fill at the San Antonio market. Lots 1 and 4 were appraised at \$9.50 per cwt. but were not deemed to be suffi-

ciently well finished for sale, (see Figs. 10 and 11) by representative cattlemen. They were accordingly held for an additional 56-day period of feeding in dry lot; the summary of which period is shown in Table 12.

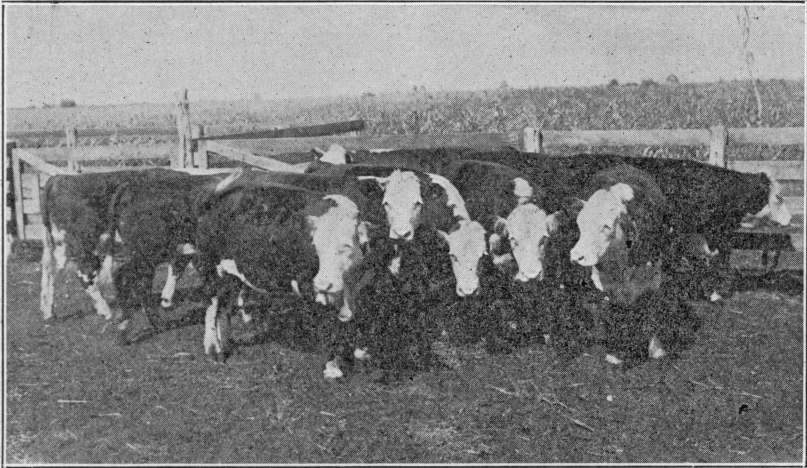


Fig. 8. Lot 2, self-fed cottonseed cake, at close of sudan grazing and feeding period, September 18, 1940.



Fig. 9. Lot 3, self-fed ground ear corn, at close of sudan grazing and feeding period, September 18, 1940.

Table 12. Summary of finishing period in dry lot for Lots 1 and 4, September 18 to November 13, 1940—56 days

Lot number.....	1	4
Number of steers per lot.....	10	10
Former treatment on sudan grazing.....	Sudan only	Molasses
Averages in Pounds Per Steer		
Initial weight.....	871	894
Final weight.....	1002	1030
Gain.....	131	136
Average daily gain.....	2.35	2.43
Total Feeds Consumed Per Head		
Cottonseed meal.....	164	163
Ground ear corn.....	890	890
Silage.....	773	801
Salt.....	2.59	2.1
Pulverized limestone.....	5.6	5.6
Feed cost.....	\$ 12.95	\$ 12.99
Feed cost per cwt. gain.....	9.89	9.55

Feed prices per ton: Cottonseed cake, \$35.00; ground ear corn, \$20.00; molasses, \$15.00; salt, \$12.00; pulverized limestone, \$10.00; sudan grazing, \$0.033 per head daily.

As may be noted from Table 12, Lot 4, which had received molasses during the 140-day sudan grazing period had slight advantage in gain and feed cost per cwt. of gain during the finishing period in dry lot. The rate of gain was quite satisfactory and after 56 days both lots were judged to have attained good marketable finish.



Fig. 10. Lot 1, sudan grazing only, at close of sudan grazing and feeding period, September 18, 1940.

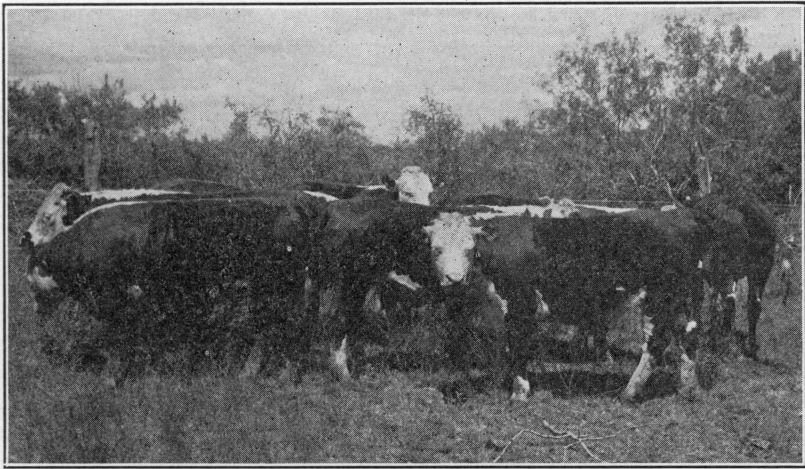


Fig. 11. Lot 4, self-fed cane molasses, at close of sudan grazing and feeding period, September 18, 1940.

A combined summary of the sudan grazing period and of the dry lot fattening period for Lots 1 and 4, together with slaughter and marketing data, is shown in Table 13. As previously indicated, the supply of cottonseed cake or ground ear corn, self-fed to heavy fleshy yearling steers during a 140-day grazing period, produced slaughter steers showing excellent finish. Lots 2 and 3, so fed, and marketed directly from the sudan fields were, to judge from slaughter data, equally as well fattened as Lots 1 and 4 which were fed a balanced concentrate ration for 56 days in dry lot following the 140-day grazing period. Carcass grades were approximately the same between the two pairs of lots, and while dressed yield and shrinkage from feedlot to market favored Lots 2 and 3, they showed yellow color of external fat whereas Lots 1 and 4 had somewhat whiter fat. The period of feeding in dry lot on corn and silage evidently had marked effect in changing yellow color of external fat to white color; however, it seemed to be too short to eliminate the tendency toward yellow color.

There was practically no difference in gain between Lot 2, self-fed cottonseed cake, and Lot 3, self-fed ground ear corn during the grazing period. Carcass weights were practically the same but Lot 3 was more desirable in carcass grade and white color of external fat. Financial return with cottonseed cake at \$35.00 per ton and ground ear corn at \$20.00 per ton slightly favored the lot fed the cottonseed cake.

In the above connection it may be explained that neither cottonseed cake alone nor ground ear corn alone are to be considered as ideal supplements for fattening steers on sudan pasturage. In the first three periods, Lot 3, receiving ground ear corn, made greater gains than did Lot 2, receiving

Table 13. Summary of sudan grazing and dry lot fattening period, May 1 to September 18, and September 18 to November 13

Lot number.....	1*	2	3	4*
Number of steers per lot.....	10	10	10	10
Days fed.....	196	140	140	196
		Self-fed		
Treatment on sudan grazing.....	Sudan only	Cottonseed Cake on sudan	Ground Ear Corn on sudan	Molasses on sudan
Averages in Pounds Per Steer				
Initial weight.....	755	756	755	756
Final weight on farm.....	1002	958	947	1030
Weight, San Antonio market.....	952	906	903	974
Gain, basis farm weight.....	247	202	192	274
Gain, basis market weight.....	197	150	148	218
Average daily gain, basis farm weight.....	1.26	1.44	1.37	1.40
Average daily gain, basis market weight.....	1.01	1.07	1.06	1.11
Shrinkage, via truck to market, pounds.....	50.8	51.6	43.0	56.3
Shrinkage, via truck to market, percent.....	5.07	5.39	4.54	5.46
Slaughter Data				
Carcass weight (hot).....	585.2	571.4	572.2	603.4
Hide weight untrimmed.....	87.7	68.6	70.4	87.2
Dressing %, basis hot carcass and market weight.....	61.5	63.03	63.33	61.95
Carcass plus hide as percent of market weight.....	70.68	70.64	71.16	70.9
Carcass grades (Swift & Co.)				
Strictly good to choice.....	7	2	8	8
Top medium to good.....	3	8	1	1
Medium.....			1	1
Carcasses showing yellow color of external fat.....	1	10	10	3
Total Feed Consumed				
Sudan grazing (days).....	140	140	140	140
Cottonseed cake or cottonseed meal.....	164	937		163
Ground ear corn.....	890		1716	890
Molasses.....				360
Silage.....	773			801
Salt.....	9.99	5.4	6.4	10.35
Pulverized limestone.....	5.6			5.6
Feed cost per cwt. of gain— farm weight.....	\$ 7.13	\$ 10.42	\$ 11.36	\$ 7.43
Feed cost per cwt. of gain— market weight.....	8.94	14.03	14.74	9.34
Financial Statement				
Initial cost appraised at \$9.50 per cwt.....	\$ 71.73	\$ 71.82	\$ 71.73	\$ 71.82
Feed cost, including charge for grazing.....	17.61	21.05	21.82	20.36
Marketing cost.....	2.50	2.50	2.50	2.50
Total cost.....	91.84	95.37	96.05	94.68
Amount received at \$10.50 per cwt.....	99.96	95.13	94.81	102.27
Profit.....	8.12	— .24	— 1.24	7.59

*Finished in dry lot.

Feed prices per ton: Cottonseed cake, \$35.00; ground ear corn, \$20.00; molasses, \$15.00; salt, \$12.00; pulverized limestone, \$10.00; sudan grazing, \$0.033 per head daily.

cottonseed cake. The sudan grass was young and tender during these periods. In the fourth period when the grass was dry and stemmy, Lot 2 made the greater gain. During the fifth period when summer rains had freshened the grazing, Lot 3 again made the better gain. Therefore

an intelligent plan for supplementary feeding on sudan pasturage would contemplate the use of both feeds, the amounts or percentages of which would be varied according to the state of growth and quality of the sudan grazing. Sudan, when young, fresh, and green, is high in protein; when mature and dry, it is low in protein. Accordingly, a mixture of about 10% cottonseed meal and 90% ground ear corn would be indicated when the sudan is fresh and green, and a mixture of about 20% cottonseed meal and 80% ground ear corn would be indicated when the sudan is mature and dry.

As indicated in previous discussion, Lots 1 and 4 were paired together for comparison with Lots 2 and 3 in regard to color of external fat as affected by a finishing period in dry lot. The only difference in treatment between Lots 1 and 4 was the 360 pounds of molasses per head which Lot 4 consumed during the sudan grazing period. The chief difference in results was an advantage of 21 pounds per head in gain for Lot 4 on basis of market weight; however, Lot 4 also had slight advantage over Lot 1 in dressing percentage. Slight advantage in financial return accrued to Lot 1 as compared to Lot 4, but Lot 4 had the advantage over Lots 2 and 3. The data, however, do not indicate that molasses as a feed was responsible for the advantage of Lot 4 over Lots 2 and 3, but tend to show that the small amount of molasses consumed, practically amounting to the lot not being fed, was responsible.

The final returns from the four lots did not favor the supply of a supplementary feed to yearling steers on sudan grazing. It was true that either cottonseed cake or ground ear corn, self-fed, increased rate of gain and finish to such extent that the steers so fed were marketed directly from the sudan fields; however, the cost of gain was increased and the steers did not have desired slaughter quality, showing yellow color of external fat. Less expensive gain and more desirable slaughter quality was obtained by use of sudan grazing only, and then following with a finishing period in dry lot. The cheaper gain resulted when the same prices were charged during both periods for the principal feeds when, as a matter of fact, corn was cheaper during the dry lot finishing period than during the grazing period. This price situation may be expected each year because new crop corn does not become available until late summer and the feeding which may be done during the spring and early summer, must be done with old crop corn or with the early maturing grain sorghums.

Considering the cattle feeding operation in its entirety—starting with the purchase of weaned steer calves of approximately 400 pounds initial weight, October 6, 1939, and ending with the sale of fattened yearlings of approximately 950 pounds at the San Antonio market, November 13, 1940, a period of 405 days—the enterprise afforded a profitable market for a miscellany of farm feeds. Using Lot 1 as an example of a recommended practice, we find that a single average steer received 53 days of field grazing in the fall, 140 days of grazing in spring and summer,

and spent 212 days in dry lot, 156 days of which elapsed between the time field grazing was exhausted in the fall until sudan became available in the spring. In addition to the grazing, the steer received approximately 569 pounds of cottonseed meal, 1,302 pounds of ground ear corn, 5,075 pounds of silage, 13.6 pounds of salt, and 17.5 pounds pulverized limestone. The total gain from weight at purchase to weight at sale was 562 pounds, which changed a feeder calf to a fattened yearling steer. The purchase price was \$10.00 per cwt. and the sale price was \$10.50 per cwt., which prices represent prices of good to choice cattle for the 1939-40 period.

Discussion

Good to choice grade steer calves of weaning age made gains averaging 1.65 pounds per head daily during a winter maintenance feeding period on an average daily ration consisting of 2 pounds ground ear corn, 2 pounds cottonseed meal, 28 pounds grain sorghum silage and 0.10 pound pulverized limestone.

The gains made by these fleshy feeder yearlings during the ensuing grazing period of 140 days upon sudan with or without supplements of cottonseed cake, ground ear corn or molasses were moderate to small. Despite mediocre rate of gain, fleshy yearling steers of 755 pounds initial weight, self-fed either cottonseed cake or ground ear corn, made good finish and were salable as slaughter steers at the close of the 140-day sudan grazing and feeding period.

The steers marketed directly from sudan grazing and having been self-fed cottonseed cake or ground ear corn showed yellow color of external fat whereas similar steers fed a balanced concentrate ration in dry lot for an ensuing 56-day period had much whiter fat; however, under such a short period of feeding in dry lot, the yellow tendency still persisted in a few instances.

Steers self-fed cane molasses during the 140-day sudan grazing period consumed an average of only 2.57 pounds per head daily while a similar lot, self-fed, consumed 6.69 pounds cottonseed cake and another similar lot consumed 12.26 pounds ground ear corn.

Financial return did not favor the supply of a supplementary feed to yearling steers during the sudan grazing period because it was possible to produce a more desirable and a less expensive market finish in the subsequent 56-day dry lot finishing period.

The purchase of steer calves of weaning age in the fall and their development and sale as finished yearling steers the following fall afforded a profitable market for a miscellany of farm feeds. Comparatively small amounts of concentrate feeds were required for finishing and large amounts of roughage feeds and grazing were used in their growth and development. It is believed that the method of producing finished yearling steers in a period of about one year demands the use of weaned steer calves of good to choice feeder grade.

SUMMARY

Financial return did not favor the supply of supplementary concentrate feeds to yearling steers when grazed on sudan; however, certain conditions might justify such feeding.

A greater total gain, cheaper gain, more desirable market finish, and more desirable killing quality as evinced by color of external fat resulted when steers were finished in dry lot after the sudan grazing period than when the steers were finished and marketed directly from the sudan fields.

Heavy fleshy yearling steers were creditably finished in a period of 140 days when self-fed supplements of either cottonseed cake or ground ear corn in addition to sudan pasturage. Similar steers, unfed or self-fed cane molasses, required an additional feeding period of 56 days in dry lot to reach the same finish.

Thin yearling steers self-fed supplements of cottonseed cake or a mixture of concentrates for 70 days in addition to sudan pasturage required 100 days of dry lot feeding to attain creditable market finish while those which were unfed required 139 days.

In winter feeding steer calves, 2 pounds of cottonseed meal and 2 pounds of ground ear corn fed per head daily have been sufficient to produce more than 1.5 pounds daily gain when fed with either silage or small grain pasturage.

Small grain pasturage in one trial appeared as a more valuable feed than silage in the winter feeding of steer calves.

A long period of farm feeding, including the supply of rations to produce from 1.5 to 2.0 pounds of daily gain during the winter, the grazing of sudan grass with or without supplements during the spring and summer, and following with the supply of concentrate rations in dry lot during the fall has provided for an efficient and profitable utilization of farm feeds at the Beeville Station during a period of years.