

efficient than those fed the two cottonseed meal rations. The digestibility of the protein was significantly lower in the two cottonseed meal rations than in the soybean-sesame meal combination or sesame meal ration. This difference in digestibility is believed to be one reason for the difference obtained in feed efficiency. However, other ration factors very likely are involved, and it is the purpose of experimentation of this type with simplified rations to sort out those factors and their influences and bring them under control in practical feeding operations. With this in mind, further tests are being made with these and other supplements which will lead to practical recommendations in selecting protein sources for sheep and cattle. As a brief summary of these initial results it may be said that in a single trial with simplified rations, lambs fed sesame meal or a combination of soybean and sesame meal made more efficient use of their feed than lambs fed two specially prepared cottonseed meals of low and high nitrogen solubility. The protein in the cottonseed meal rations was low in digestibility.

The Effect of Level of Wintering Upon the Production of Two-Year-Old Slaughter Steers

By A. B. NELSON and GLEN BRATCHER

For several years the Oklahoma Agricultural Experiment Station has conducted studies on the effect of level of wintering steer calves upon their subsequent performance as yearlings, two-year-olds, and three-year-olds. The best level of wintering apparently depends upon the management system used during the summer and the age at which the steers are sold. Should steers which are to be sold as two-year-olds be wintered at a "high" or a "low" level?

The most recent study relating to this problem was started in 1954 and completed during the summer of 1956. This test was part of an experiment initiated in 1952 with the following objectives:

1. To determine the effect of level of wintering for two successive winters upon the performance of two-year-old steers fed corn on grass during the second summer grazing season.
2. To compare two levels of feeding corn on grass to two-year-old steers which have been wintered at the same level of nutrition.
3. To compare the management systems of producing two-year-old feeder and slaughter steers.

The first two trials of this experiment were completed in the summer of 1954 and 1955 and the results were summarized in Oklahoma Agricultural Experiment Station MP-43 and MP-45, respectively. The results of the third and last trial are reported here.

Procedure

Fifty head of choice-quality grade Hereford steer calves were divided into two groups on October 30, 1954 (30 in one group and 20 in the

other). Each group was confined in a 2-acre trap and fed prairie hay and 1.25 pounds of pelleted cottonseed meal per head daily during the winter months. In addition, the steers in the second group were fed 3 pounds of ground yellow corn per head daily. The ration containing corn has been designated as the "high" level of wintering and the ration without corn has been designated as the "low" level. At the end of the wintering period all calves were allowed to graze the native grass pastures at the Lake Carl Blackwell experimental range area.

At the end of the first summer grazing period the 30 yearling steers which were in the "low" level group as calves were divided into 3 lots (lots 1, 2, and 3) of 10 head each on the basis of initial weight and yearly gain. Also, the 20 head fed on the "high" level were divided into 2 lots of 10 head (lots 4 and 5). The steers were divided after having been in the experiment for one year instead of at the beginning of the test in order that gains for the first year within the two levels of wintering would be approximately equal.

During the winters the yearling steers were returned to the small traps and fed prairie hay and 1.25 pounds of pelleted cottonseed meal. In addition, some of the steers were fed corn. Those in lots 1 and 2 were continued on the "low" level of wintering. Those in lot 3 were fed at the "low" level as calves but changed to the "high" level as yearlings. Those in lots 4 and 5 were fed on the "high" level for both seasons.

As two-year-olds, all steers were allowed to graze native grass pastures. Those in lot 1 were sold on August 4, which was thought to be the most desirable time for selling two-year-old feeder steers in that particular season. The steers in the other four lots were fed 3 pounds of ground yellow corn per head daily while on grass. This was continued until late June at which time the amount of corn fed to the steers in lots 2, 3, and 4 was gradually increased until they were on a full-feed of corn. The steers of lot 5 continued to be fed 3 pounds of corn per head daily. Those in lots 2, 3, 4, and 5 were sold when it was estimated that their carcasses would grade approximately U. S. Choice when slaughtered.

A mineral mixture composed of 2 parts ground rock salt and 1 part steamed bone meal was available in all lots.

Results

A summary of the results is given in Table 1. The chemical composition of feeds and grasses is given in Table 2.

The gains during the winter as calves and during the following summer as yearlings are in agreement with previous results which indicate that cattle which gain the most during the winter will gain the least during the following summer.

Table 1.—The effect of level of wintering on the production of two-year-old steers.

Lot number ¹	1	2	3	4	5
Level of feeding, Winter I	Low	Low	Low	High	High
Level of feeding, Winter II	None	Low	High	High	High
Level summer suppl. feed	None	High	High	High	Low
WINTER 1954-55 as calves (170 days)					
Average weight per steer (lbs.)					
Initial 10-30-54	430	440	434	439	440
Final 4-19-55	567	575	556	630	616
Gain in winter	137	135	122	191	176
Daily gain	0.81	0.79	0.72	1.12	1.04
Financial (dollars)					
Feed cost ²	29.21	29.21	29.21	42.26	42.26
Initial cost @ \$21.50 per cwt.	92.45	94.60	93.31	94.38	94.60
Value per steer ³	121.00	122.76	118.58	131.36	128.57
Return per steer in winter	-0.66	-1.05	-3.94	-5.28	-8.29
SUMMER 1955 as yearlings (197 days)					
Average weight per steer (lbs.)					
Initial 4-19-55	567	575	556	630	616
Final 11-2-55	807	808	807	840	830
Gain in summer	240	233	251	210	214
Daily gain in summer	1.22	1.18	1.27	1.07	1.09
Total gain to date	377	368	373	401	390
Financial (dollars)					
Cost of grass and mineral	14.12	14.12	14.12	14.12	14.12
Value per steer ⁴	140.94	141.12	140.94	146.70	144.90
Return in summer	5.82	4.24	8.24	1.22	2.21
Return to date	5.16	3.19	4.30	-4.06	-6.08
WINTER 1955-56 as yearlings (182 days)					
Average weight per steer (lbs.)					
Initial 11-2-55	807	808	807	840	830
Final 5-2-56	942	944	970	969	963
Gain in winter	135	136	163	129	133
Daily gain in winter	0.74	0.75	0.90	0.71	0.73
Total gain to date	512	504	536	530	523
Financial (dollars)					
Feed cost ⁵	43.97	43.97	55.50	55.50	55.50
Value per steer ⁶	155.38	155.72	159.97	159.80	158.78
Return in winter	-29.53	-29.37	-36.47	-42.40	-41.62
Return to date	-24.37	-26.18	-32.17	-46.46	-47.70
SUMMER 1956 as two-year-olds					
Average weight per steer (lbs.)					
Initial 5-2-56	942	944	970	969	963
Final 8-4-56 (94 days)	1126	1152	1175	1176	1175
Final 8-18-56 (108 days)	—	1178	1202	1204	1193
Gain to 8-4-56	184	208	205	207	212
Gain to 8-18-56	—	234	232	235	230
Daily gain to selling	1.96	2.17	2.15	2.18	2.13
Financial (dollars)					
Feed cost to 8-4-56 ⁷	17.61	38.96	38.76	38.76	25.23
Feed cost to 8-18-56 ⁷	—	43.13	43.13	43.13	26.36
Value per cwt. 8-4-56 ⁸	18.93	20.60	20.60	20.60	20.60
Value per cwt. 8-18-56 ⁸	—	21.84	21.84	21.50	20.50
Return per steer 8-4-56	29.56	30.88	31.17	31.54	45.89
Return per steer 8-18-56	—	45.54	46.31	43.03	47.12
Return to date 8-4-56	5.19	4.70	-1.00	-14.92	-1.81
Return to date 8-18-56	—	19.36	14.14	-3.43	-0.58

Table 1.—The effect of level of wintering on the production of two-year-old steers. (Continued)

Lot number ¹	1	2	3	4	5
Level of feeding, Winter I	Low	Low	Low	High	High
Level of feeding, Winter II	Low	Low	High	High	High
Level summer suppl. feed	None	High	High	High	Low
	<i>Summary 10-30-54 to Selling in Summer 1956</i>				
Days on experiment	643	657	657	657	657
Average weight per steers (lbs.)					
Initial	430	440	434	439	440
Final	1126	1178	1202	1204	1193
Gain to selling	696	738	768	765	753
Financial (dollars)					
Initial cost @ \$21.50 per cwt.	92.45	94.60	93.31	94.38	94.60
Total feed cost ²⁰	104.91	130.43	141.96	155.01	138.24
Selling price per cwt.	18.93	21.84	21.84	21.50	20.50
Value per steer (5% shrink)	202.55	244.39	249.41	245.96	232.26
Return per steer	5.19	19.36	14.14	-3.43	-0.58
Dressing percentage ²¹	60.3	60.7	60.3	60.5	60.3
Carcass grade					
Low choice	0	0	1	0	0
High good	3	4	2	1	2
Average good	1	4	5	2	3
Low good	4	0	1	6	4
High standard	1	2	1	1	1
Low standard	1	0	0	0	0
Total feed					
Corn (lbs.)	0	945	1491	2001	1380
Cottonseed meal (lbs.)	440	440	440	440	440
Pasture (summer)	ad lib	ad lib	ad lib	ad lib	ad lib
Prairie hay (winter, lbs.)	5702	5702	5384	5146	5146

¹ Ten steers per lot.

² During the winter of 1954-55 as calves the average feed consumption per head in lots 1, 2 and 3 was prairie hay, 12.1 lbs. and cottonseed cake, 1.25 lbs. The steers in lots 4 and 5 were fed 10.7 lbs. of prairie hay, 1.25 lbs. cottonseed cake, and 3 lbs. ground yellow corn per head daily.

³ Based on appraised price of \$22 per cwt. in lots 1, 2, and 3 and \$21.50 in lots 4 and 5 with 3% shrink.

⁴ Based on appraised price of \$18 per cwt. and 3% shrink.

⁵ Average daily feed consumption was: Prairie hay, 20 lbs. in lots 1 and 2 and 18.3 lbs. in lots 3, 4, 5; and cottonseed meal, 1.25 lbs. In addition, the steers in lots 3, 4, and 5 were fed 3 lbs. of ground yellow corn.

⁶ Based on appraised price of \$17 per cwt. and 3% shrink.

⁷ Cost of pasture and mineral in lot 1 and corn, in addition, for the remaining lots. The lot 5 steers were fed 3 lbs. ground yellow corn per head daily. The consumption of corn by the steers in lots 2, 3, and 4 was gradually increased to 21 lbs. for the last 3 weeks of the test. Total consumption of corn during the summer was 945 lbs. in lots 2, 3, and 4 and 324 lbs. in lot 5.

⁸ Selling price for slaughter in lot 1. Appraised price for these steers as feeders was \$18.50. Appraised price per cwt. as slaughter steers for lots 2, 3, 4, and 5.

⁹ Selling price as slaughter steers.

¹⁰ Based on prices prevailing during the test (See Okla. Agr. Expt. Sta. MP-43 and MP-45).

¹¹ Based on market weight and cold carcass weight.

Lot 1 (grazing only) vs. Lot 2 (corn on grass).

The steers in both lots 1 and 2 were wintered on the "low" level for both winters. The two-year-olds grazing native grass without supplemental corn (lot 1) were sold for slaughter on August 4, 1956 at an average price of \$18.93 per cwt. At this time they were valued at \$18.50 per cwt. as feeders. During the two previous years the value of steers for slaughter was the same as their value as feeders.

The steers of lot 2 were sold August 18, 1956. This selling was approximately two months earlier than in preceding years because the cattle appeared to be in higher condition than previously. The

Table 2.—Chemical composition of feeds and grasses.

	Percent dry matter	Percentage composition of dry matter						
		Ash	Crude protein	Ether extract	Crude fiber	N-free extract	Ca	P
1954-55								
Prairie hay	94.11	7.94	4.80	3.05	32.19	52.02	.46	.05
Cottonseed meal	94.76	6.81	41.30	7.59	8.21	36.09	.20	1.03
Corn	91.24	1.59	9.37	4.08	2.06	82.90	.03	.23
Native grass ¹								
May		8.60	11.42	2.92	29.16	48.23	.30	.18
August		7.65	3.47	3.54	32.66	53.92	.34	.04
1955-56								
Prairie hay	94.96	6.56	5.33	2.88	33.60	51.63	.45	.05
Cottonseed meal	93.18	7.42	42.73	5.99	12.51	31.35	.20	1.20
Corn	90.72	1.44	10.78	4.65	1.90	81.23	.03	.32
Native grass ¹								
May		7.44	13.17	2.96	29.20	47.23	.32	.15
August		6.83	3.66	2.33	34.41	52.77	.42	.06

¹ Average by species of four predominant grasses: big bluestem, little bluestem, switch, and Indian.

selling price was \$21.84 per cwt. At the time of selling the average daily corn intake was 21 lbs. per head daily. The total amount of corn consumed during the summer was 945 lbs. Because of this consumption of corn the total feed cost in lot 2 was \$25.52 greater than in lot 1 (\$104.91 vs. \$130.43). The selling value minus feed cost (return) was \$5.19 and \$19.36 for lots 1 and 2, respectively. Thus, it was more profitable to sell two-year-olds that had been fed corn on grass.

These results are not in agreement with those obtained in 1954 and 1955 when it was less profitable to feed corn on grass. The increased net return in lot 2 was due mainly to the increase in price level of slaughter cattle in mid-August. If the lot 2 steers had been sold on August 4 the return would have been \$4.70 which was slightly less than the return in lot 1. Selling 2 weeks later resulted in an increased return of \$14.66 (\$4.70 vs. \$19.36) per head.

The steers of lot 1 were in the experiment for 643 days and gained 696 lbs. Those of lot 2 gained 738 lbs. in 657 days.

Level of Wintering with Full-Feeding on Grass (lots 2, 3, and 4)

A comparison of the results in lots 2, 3, and 4 allows an evaluation of the effect of 3 levels of wintering on the production of two-year-old slaughter steers which were full-fed corn on grass. The steers of lot 2 were not fed corn in either winter. Those of lot 4 were fed corn for both winters. Those of lot 3 were not fed corn the first winter but were fed corn the second winter (designated the "low-high" level of wintering) to determine whether or not feeding corn during the second winter only was as satisfactory as feeding corn both winters. The total gain to selling was 738, 768, and 765 lbs. for lots 2, 3, and 4, respectively. They were sold on August 18 when it was estimated that their carcasses would grade U. S. Choice. However, the grades were over estimated because the carcass grade was approximately high good.

The carcass grades of the lot 3 steers were slightly lower than the grades in the other lots but this difference was not reflected in dressing percentage.

The return was related to the level of wintering in that the steers fed corn both winters (lot 4) lost \$3.43 per head, those fed corn the second winter only (lot 3) returned \$14.14, and those not fed corn returned \$19.36. These results are in agreement with results of the 1955 test but not the 1954 test. Although there were only small differences in return during the 1956 summer period only, differences in previous wintering costs resulted in greater return for the lower levels of wintering. The average consumption of corn during the entire test was 945, 1491, and 2001 lbs. for the steers in lots 2, 3, and 4, respectively.

Lot 4 (full-fed on grass) vs. Lot 5 (3 lbs. corn on grass).

It was more profitable (although the difference was only \$2.85 per head) to feed 3 lbs. of corn per head daily than to full-feed corn on grass to steers that had been fed at a "high" level for two winters. This is in agreement with the 1955 test, but in 1954 the results were in favor of full-feeding. The lot 5 steers had gained only 12 lbs. less in the 657 days than those in lot 4. The packer buyers preferred the lot 4 cattle as indicated by the \$1 per cwt. difference in selling price but this was not reflected in differences in carcass grades and dressing percentage.

Summary

In this test it was most profitable to winter two successive winters at a "low" level and sell two-year-old steers after full-feeding on grass during the summer. When steers were sold after full-feeding corn on grass the return was related to the level of wintering in that the least profit was realized when steers had been wintered at the high level, the greatest profit resulted from the low level of wintering, and the return from wintering at the "low" level the first year and "high" level during the second year was intermediate. Limited feeding on grass after wintering at a high level was more profitable than full-feeding similar cattle on grass. It was more profitable to full-feed corn on grass than to allow grazing only after wintering at the "low" level.

Phosphorus Supplements for Beef Cattle

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Steamed bone meal is recognized as one of the chief sources of supplemental phosphorus for livestock. At present, however, the demand for supplemental phosphorus has far exceeded the supply of steamed bone meal. This has led to the use of inorganic sources, such as defluorinated rock phosphate, dicalcium phosphate, Curacao Island phosphate and colloidal clay. Of the latter three sources, only colloidal clay has failed to produce good results in recent tests at this station.