

Experiment Station
Bulletin No. B-270
October, 1943



Where Oklahoma calves
test Oklahoma feeds.
The experimental cattle
feeding barn at the
Oklahoma Agricultural
Experiment Station.

OATS as a feed FOR BEEF CATTLE

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and

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Calves like these provide a market for 28 bushels of oats per head more than two and half times the elevator price. This lot of calves typical of the animals used in the feeding tests reported in this bulletin.



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OATS AS A FEED FOR BEEF CATTLE

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Relatively more oats and less corn has been available in Oklahoma for beef cattle feeding in recent years. Oat acreage has increased, while corn has decreased in both acreage and yield per acre. More farms can grow oats than can grow corn.**

Experiments to determine the place of oats in wintering and fattening rations for choice beef steers were started by the Oklahoma station in 1937 and continued through six successive winter feeding periods.† These tests covered both the feeding value of oats and methods of using them most efficiently. In most cases, the results are supported by those obtained in tests at other experiment stations, which are summarized in Table I.

Steers Add Profit to Oats

Oats sold through beef calves brought more than two and a half times as much as the elevator price in these tests—83 cents per bushel as compared to 32 cents—over a five-year period (Table II).

The advantage of marketing oats through beef calves is even greater if comparison is made with the farm price rather than the elevator price. The farm price of oats at threshing time each year was materially less than the elevator price. In 1941, the oats charged to the experiment at the elevator price of 32 cents per bushel were purchased on the farms of southeastern Oklahoma for 15 cents per bushel at harvest time.

* Respectively, Dean of the School of Agriculture and Director of the Experiment Station, and Associate Professor of Animal Husbandry (Beef Cattle). Dean Blizzard was Head of the Department of Animal Husbandry at the time the feeding tests reported in this bulletin were made.

** From 1933 to 1942, Oklahoma's corn and oat crops were about equal in size. In the preceding ten years, the corn crop had been about double the oat crop. Over half the counties in the state annually produce more oats than corn. A new winter oat, the Wintok, recently developed by the Oklahoma station, gives promise of somewhat increased per acre yields of oats. Meanwhile, the proportion of the oat crop used for horse feed has been reduced by the greater use of tractors.

† The methods used in conducting these tests are described in the Appendix, page 22.

Table I.—Substituting Oats for Part or All the Corn in Fattening Rations for Beef Cattle.
(A Summary of Numerous Trials.)

Station and year	Ref. No.*	Age of Cattle	Length of Feed (Days)	Ratio of Corn to Oats	AV. DAILY GAIN (LBS.)		AV. DAILY RATION (LBS.)		Effect on Selling Price	FEED REQUIRED PER 100 LBS. GAIN (LBS.)	
					Corn	Corn and Oats	Corn	Corn and Oats		Corn	Corn and Oats
Nebraska, 1922-23	(4)	Calves	175	2:1	2.47	2.40	11.20	11.85	-\$0.25	453	495
Minnesota, 1923-24	(8)	Calves	224	4:1	2.32	2.19	13.45	13.19	- 0.20	579.74	602.28
Ohio, 1927-28	(9)	Yearlings	140	1:1	2.21	2.12	10.00	10.00	None	450.00	470.00
Indiana, 1928-31	(14)	2 yr.	150	0:1	2.18	2.19	12.80	12.14	- 0.22	590.16	554.55
Indiana, 1928-31	(15)	2 yr.	150	0:1	2.18	2.31	12.80	12.74	+ 0.13	590.16	553.81
Michigan, 1929-30	(1)	Calves	190	0:1	2.08	2.04	7.38	7.31	- 0.45	355.00	357.00
Michigan, 1930-31	(1)	Calves	196	0:1	2.17	2.15	7.60	7.40	+ 0.05	351.50	344.10
Michigan, 1931-32	(1)	Calves	196	0:1	2.03	2.04	8.40	8.20	- 0.10	413.00	401.00
Kansas, 1932-33	(17)	Calves	200	0:1	2.11	2.02	9.36	8.94	- 0.25	444.00	442.00
Kansas, 1933-34	(18)	Calves	200	1.3:1	2.14	2.13	10.16	11.02	- 0.25	476.00	517.00
Illinois, 1935-36	(12)	Calves	250	2.5:1	2.06	2.02	9.20	9.60	None	447.00	472.00
Average					2.18	2.15	10.21	10.17	- 0.14	468.14	473.52

* Refers to "Bibliography," page 21.

Table II.—Comparative Value of Oats Sold as Beef and Sold as Grain.

	Approximate Elevator Price at Stillwater*	Return Made by Beef Calves**
1937-38	\$0.27 per bushel	\$0.37 per bushel
1938-39	0.26 per bushel	1.04 per bushel
1939-40	0.30 per bushel	0.70 per bushel
1940-41	0.32 per bushel	0.92 per bushel
1941-42	0.43 per bushel	1.11 per bushel
Average	0.32 per bushel	0.83 per bushel
Increase in cents per bushel		0.51 per bushel
Increase in percent		162%

* The price at which oats were actually charged in the experiments summarized in Table III.

** The return per bushel of oats is calculated by placing the profit of the feeding operation on the oats fed and considering all other feeds at their actual cost. Each calf actually marketed 28 bushels of oats.

USE OF OATS IN FATTENING RATIONS

Oats Not a Complete Substitute for Corn

Substituting all oats for all of the corn in a calf-fattening ration will usually result in lower-selling, lower-yielding fat cattle. A pound of oats will produce as much gain as a pound of corn, but it will not produce as much finish. This is true regardless of whether whole or ground grains are used.

The foregoing facts have been amply proved by tests at other experiment stations, therefore no tests on this point were conducted in Oklahoma.

At the Indiana station (14),* a three-year trial with two-year-old steers showed that a ration of shelled corn, cottonseed meal, silage, and clover hay was not improved by substituting medium ground oats for the shelled corn. The steers fed oats gained at the same rate, produced more gain per unit of feed, but sold for \$0.22 less per hundredweight. Pork credits were materially lower in the lot fed oats.

An average of three Michigan trials (1) with calves reveals that the replacement of shelled corn with ground oats in a calf fattening ration of shelled corn, linseed cake, silage, and alfalfa hay did not significantly change the rate or economy of gain but did lower the selling price of the cattle two years out of three. In these 194-day trials, the average reduction in sale price due to the feeding of oats was \$0.17 per hundredweight.

* Numerals in parentheses refer to "Bibliography," page 21.

At the Kansas station, No. 3 whole oats were substituted for No. 2 shelled corn, both self-fed, in a calf fattening ration of shelled corn, cottonseed cake, silage and alfalfa hay. In this 200-day trial, gains and finish were almost equal for the first 84 days of the trial. During the remaining 116 days the gains made were similar, but the corn-fed calves became fatter and were valued \$0.75 per hundredweight over those fed oats.

Oats Can Replace Half the Corn

Oats can be used satisfactorily to replace half the corn in a calf-fattening ration. Gains are equal, dressing percentage is improved, and selling price is usually the same or close to it. Beef calves eat oats as readily as corn. The bulkier oats-corn mixture (ground) has a definite advantage over ground corn for the average feeder because the calves go on feed easier and stay on it with more regularity.

Feeding Value of Oats

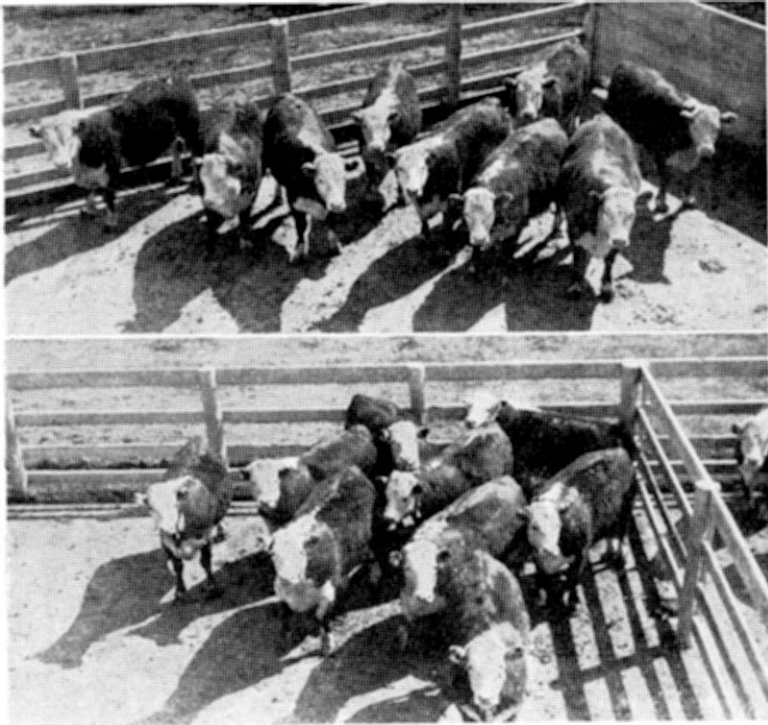
When oats replaced half the corn in a fattening ration, two bushels of oats were as valuable as one bushel of No. 2 corn, as an average of five years' test (Table III). Pound for pound, oats had 85 percent the value of corn. (In wintering rations, oats had a higher relative value. See pages 16-18.)

An even higher value for oats was found in the Indiana tests (14), which indicated that a pound of oats was superior to a pound of corn when oats replaced one-third of the corn in fattening two-year-old steers for 150 days. On the other hand, the Kansas station (18) in a one-year trial with calves found oats to have only 59% of the value of a pound of corn when approximately half oats were fed in a 200-day feeding trial. In Nebraska, Gramlich (4) replaced one-third of the corn in a calf-fattening ration with oats and found oats to have a slightly lower value than corn pound for pound. Rusk and Snapp (12) of the Illinois station found that substituting 25 percent whole oats for shelled corn in a calf-fattening ration had no material effect on the rate of gain and none on the selling price. In this instance a pound of oats proved to be 82% as valuable as a pound of corn, which figure is in close agreement with the Oklahoma work.

Market Value of Steers

Calves fed a ration in which as much as half of the corn is replaced with oats will sell approximately the same as corn-fed cattle. In the five years of the Oklahoma tests, choice calves so fed sold as high or higher three years and lower two years.

In Indiana (15), two-year-old steers fed one-third oats



Oats are superior to corn for feeding with molasses. The upper lot, either gain or finish. The lot of calves at the top received corn, those at the bottom, oats. The oats lot gained as fast, dressed higher, and sold as high or higher three years out of five.

sold higher than the check lot fed corn for each of three years. No difference in sale price resulted in an Ohio experiment (9) where oats replaced half the corn nor in an Illinois test (12) in which oats replaced one-fourth of the corn.

However, in Nebraska (4) and Kansas (18) tests the substitution of oats for corn produced cattle which sold 25 cents per hundredweight lower, and in a Minnesota test (8) they sold 20 cents lower. These trials were, in general, the longer feeding periods (Nebraska, 174 days; Kansas, 200 days; and Minnesota, 224 days).

Dressing percentage was increased in the Oklahoma tests when half the corn was replaced with all the oats the calves could eat. Similar results were obtained at the Nebraska station (4) when oats replaced one-third of the corn.

Table III.—Oats as a Partial Substitute for Corn in Fattening Beef Calves

(Average of 5 years, 1937-38 to 1941-42)

	LOT 1 Ground Corn	LOT 2 Ground Corn and Ground Oats
Average weights per steer (lbs.)		
Initial weight	473	471
Final weight	841	838
Total gain	368	367
Daily gain	2.25	2.24
Average daily ration (lbs.)*		
Ground shelled corn	10.47	5.27
Ground oats		5.42
43% cottonseed cake	1.98	1.98
Silage**	10.63	10.34
Ground limestone	.10	.10
Feed required per 100 lbs. gain (lbs.)		
Ground shelled corn	465.33	235.27
Ground oats		241.96
43% cottonseed cake	88.00	88.39
Silage	472.44	461.61
Market value		
Selling price at Oklahoma City	\$11.38	\$11.31
Shrinkage in marketing	23.20 lbs.	23.00 lbs.
Dressing percentage (chilled)	60.78%	61.33%
Carcass grades	Choice, 33 Good, 9	Choice, 31 Good, 11

Average length of feeding period, 163.8 days. Average number of steers per lot, 8.6.

* Shelled corn and whole oats were fed in 1941-42.

** During one of the five years silage was fed as desired by the steers in each lot, but the results are so similar that all five years' work are included in this table. This fact accounts for the silage consumption of the two lots not being exactly identical.

Steers Eat Oats Readily

Oats proved to be more palatable than corn in the Oklahoma tests, where all grain rations were hand fed. The calves fed oats consumed 5.4 pounds of oats per head per day in place of the 5.2 pounds of corn withheld from their ration. As shown by Table I, all experiments except the Ohio trial (9) and the Minnesota trial (8) report that a mixture of corn and oats is more palatable than corn alone for fattening beef calves.

The combination of ground corn and ground oats had a definite advantage over ground corn in starting and keeping calves on feed. Those fed oats and corn went on feed easier and stayed on feed with greater regularity. This fact was also true in 1940-41 when whole grains were fed. In 1940-41 the calves fed oats and corn consumed an average of 1.5 pounds

more grain per day during the first 55 days of the trial. This advantage is unimportant to an experienced feeder, but indicates that the more bulky ration is safer for the average man.

Mixture of Oats and Corn Gives Best Results

Feeding a mixture of half oats and half corn throughout the fattening period proved superior to feeding all oats the first half and all corn the last half (Table IV). The calves fed the mixture gained slightly faster, sold higher, yielded slightly higher, and graded equal to those finished on corn for the last 88 days of an 170-day feeding period.

The calves fed all oats the first 82 days went on feed slightly faster and with greater ease of feeding. For this

Table IV.—Comparison of (a) a Mixture of Corn and Oats Throughout the Feeding Period With (b) All Oats the First Half and All Corn the Last Half.
(Average of two years, 1940-41 and 1941-42)

	LOT 1 Mixture* of shelled corn and oats** throughout trial	LOT 2 Oats 82 days, followed by shelled corn 88 days
Average weights per steer (lbs.)		
Initial weight	486	486
Final weight	875	864
Total gain	389	378
Daily gain	2.29	2.22
Average daily ration (lbs.)		
Shelled corn**	5.63	6.70
Oats**	6.02	4.37
Cottonseed cake	2.00	2.00
Silage	8.57	8.48
Ground limestone	.10	.10
Feed required per 100 lbs. gain (lbs.)		
Shelled corn	245.85	301.81
Oats	262.88	196.85
Cottonseed cake	87.34	90.09
Silage	374.24	381.89
Market value		
Selling price at Oklahoma City	\$13.00	\$12.88
Shrink in marketing	31 lbs.	28 lbs.
Dressing percentage (chilled)	61.54%	61.25%
Carcass grades	Choice, 10 Good, 8	Choice, 10 Good, 7†

Average length of feeding period, 170 days. Average number of steers per lot, 9.

* Lot 1 was fed exactly half the corn consumed by a check lot not shown in this table plus all of the oats they would eat. Hence the proportions of corn and oats are not exactly half and half.

** The shelled corn and oats were fed ground in 1940-41 and whole in 1941-42.

† One steer in Lot 2 became crippled at the end of the experiment and was not marketed with his lot mates.

reason they gained somewhat faster for the first 28 days. However, the calves fed the mixture of corn and oats (Lot 1) had gained more by the time the change from oats to corn was made in Lot 2 each year of the trial.

Oats Better Than Corn for Feeding With Molasses

In a test comparing oats and corn for feeding with molasses, a mixture of approximately half ground oats and half molasses produced almost as much gain as a standard corn ration and was definitely superior to a mixture of ground shelled corn and molasses in the same proportions (Table V). Similar results have been found with swine at Minnesota (3) and with sheep at the Oklahoma station (2). The Oklahoma tests with sheep indicated that molasses has a depressing effect on the digestibility of fat in corn. Hence, it combines poorly with corn.

The calves fed the oats-molasses mixture (Lot 3, Table V) gained almost as fast as those fed corn and required only 39 pounds more of concentrates and slightly more hay in pro-



Oats are superior to corn for feeding with molasses. The upper lot, fattened on half oats and molasses, sold for \$10.00. The lower lot, fattened on corn and molasses, brought only \$9.35. The lower lot showed lack of bloom, in addition to being made unattractive by the molasses and dirt on their coats.

Table V.—Comparison of Corn and Oats for Feeding With Molasses.

(One year, Nov. 3, 1936 to April 14, 1937; 162 days.)

	LOT 1 Corn 100%	LOT 2 Gr. Corn 47% Molasses 53%	LOT 3 Gr. Oats 47% Molasses 53%
Average weights per steer (lbs.)			
Initial weight	477	474	474
Final weight	810	762	797
Total gain	333	288	323
Daily gain	2.06	1.78	2.00
Average daily ration (lbs.)			
Ground shelled corn	11.44	5.54	
Ground oats			5.55
Molasses		6.24	6.25
Cottonseed cake	1.83	1.83	1.33
Prairie hay	3.65	4.05	4.04
Ground limestone	.10	.10	.10
Feed required per 100 lbs. gain (lbs.)			
Ground shelled corn	555.40	311.04	
Ground oats			277.95
Molasses		349.85	313.36
Cottonseed cake	88.60	102.40	91.70
Prairie hay	176.97	227.06	202.34
Costs*			
Feed cost per 100 lbs. gain	\$14.17	\$13.58	\$10.78
Initial cost per steer	34.56	34.33	34.35
Feed cost per steer	47.31	39.20	34.84
Steer cost plus feed cost	81.87	73.53	69.19
Returns			
Value per cwt. at feed lot	\$11.00	\$ 9.35	\$10.00
Return per steer over steer cost and feed cost	\$ 7.23	\$ 1.26	\$10.51
Dressing percentage (chilled)	58.4 %	57.6 %	57.3 %

Number of steers per lot, 8.

* Initial cost of steers was \$7.25 per cwt. Feed costs were: Corn, \$1.15 per bu.; oats, \$0.50 per bu.; molasses, \$22.00 per ton; cottonseed cake, \$40.00 per ton; prairie hay, \$11.50 per ton.

ducing 100 pounds of gain. They were appraised at \$1.00 per hundredweight less than the check lot.

The calves of Lot 2, fed approximately half corn and molasses, gained at a slower rate, consumed 12% more concentrates per unit of gain, and sold \$0.65 per hundredweight under the calves which received the oats-molasses ration. Dressing percentage figures and carcass grades indicate the corn-molasses cattle were more nearly equal to those fed oats and molasses than \$0.65 per hundredweight; but the superior

bloom, attractiveness and freedom from molasses about the head and forequarter of the calves in Lot 3 made them decidedly more attractive to everyone, including packer buyers.

Although it is often conceded that cattle soon tire of a heavy allowance of molasses, the cattle in this and also in subsequent trials showed no indication of tiring of mixtures of corn or oats and molasses which contained from 50 to 75 percent molasses.

In these tests, the molasses was mixed with one part of warm water to each two to three parts of molasses. In more recent work with molasses, the dilution with water was omitted with equally satisfactory results. Half ground oats and molasses makes a heavy mash, whereas half ground shelled corn and molasses makes a sticky liquid mass that will pour.

METHODS OF PREPARING OATS

Grinding oats for fattening beef calves generally does not pay for the grinding, although coarsely ground oats are recommended for cattle over one year of age. Rolling oats for beef calves being fattened for short periods not only does not pay, but actually decreases the value of the oats fed.

Grinding oats for calves (under one year of age) is occasionally justified where oats are fed in mixtures (for example, when feeding with molasses). However, mixtures of half whole oats and half shelled corn have been fed with success at the Oklahoma station. No trouble was experienced with the calves selecting from the mixture the grain they liked best.

Oats are difficult to grind satisfactorily in a buhr or plate mill. A hammer mill was found satisfactory.

In an Oklahoma test comparing whole and ground oats (Lots 1 and 2, Table VI), grinding resulted in a saving of two pounds of oats per bushel; but this saving is practically always less than the cost of grinding a bushel of oats. In one Kansas trial (18), ground oats was actually worth less than whole oats; and in Indiana (8) it was found unprofitable to grind a mixture of oats and corn for beef calves.

In feeding two-year-old cattle at the Indiana station (14), coarsely ground oats were superior to whole, finely ground, or medium ground oats.

The calves fed rolled oats in the Oklahoma test (Lot 3, Table VI) consumed less oats per day, gained less, and required more oats per unit of gain than calves fed either whole or ground oats. In an Illinois test (11), rolling was inferior to grinding as a method of preparing a mixture of wheat and oats for two-year-old steers.

Table VI.—Comparison of Whole, Ground and Rolled Oats
for Fattening Calves.
(One year, 1941-42; 87 days.)

	LOT 1 Whole Oats	LOT 2 Ground Oats	LOT 3 Rolled Oats
Average weights per calf (lbs.)			
Initial weight	360	360	359
Final weight	543	546	517
Total gain	183	186	158
Average daily gain	2.11	2.14	1.82
Average daily ration (lbs.)			
Whole oats	7.20		
Ground oats		6.85	
Rolled oats			6.11
Cottonseed cake, 43%	1.96	1.96	1.96
Silage	9.55	9.55	9.55
Ground limestone	.10	.10	.10
Feed required per 100 lbs. gain (lbs.)			
Whole oats	340.87		
Ground oats		320.61	
Rolled oats			336.09
Cottonseed cake, 43%	92.86	91.58	107.65
Silage	451.93	446.54	524.93
Ground limestone	4.73	4.68	5.50
Feed cost per 100 lbs. gain	\$7.29	\$7.40	\$8.10
After finishing on corn for 68 days:			
Average daily gain per calf, 155 days (lbs.)			
	2.15	2.15	1.94
Total gain consumed per calf (bu.)			
Oats	19.6	18.6	16.6
Corn	12.6	12.6	12.6

Feed Prices: Whole oats, \$0.43 per bu.; ground or rolled oats, \$0.47 per bu.; 43% cottonseed cake, \$41.00 per ton; Atlas sorgo silage, \$3.50 per ton; ground limestone, \$12.00 per ton.

Either grinding or rolling oats decreases the consumption of oats. Calves fed whole oats consumed an average of 7.2 pounds daily, those on ground oats 6.85 pounds, and those on rolled oats only 6.11 pounds (Table VI). These differences may have been differences in palatability, but are probably due to the fact that:

- 1 bushel measure of whole oats weighed 32.5 pounds
- 1 bushel measure of ground oats weighed 26 pounds
- 1 bushel measure of rolled oats weighed 16 pounds

Thus, the bulk of the rolled and ground oats became a factor in oats consumption. The calves did not, and probably could

not, consume as much of the bulkier rolled or ground oats as they could of the whole oats.

Although the extreme bulkiness of rolled or ground oats is a disadvantage in a ration for calves on a short feed, it is quite often an advantage in the feeding of show or breeding cattle where more time is taken to fatten the animals.

USE OF OATS IN WINTERING RATIONS

In tests of oats in wintering rations, they proved even more valuable than in fattening rations. A bushel of oats was two-thirds as valuable as a bushel of corn;* and less than 2¼ pounds of No. 2 oats fully replaced one pound of cottonseed cake when the roughage was of high quality.

Two series of tests using oats in wintering rations for beef calves have been made at the Oklahoma station. In one series, oats were substituted for all of the 43% cottonseed cake in a standard wintering ration. In the other series, oats, shelled corn and cottonseed cake were compared when added to a balanced ration of silage, cake, and ground limestone.

Oats Can Be Substituted for Protein Supplement

Standard weight oats can be used as a substitute for high-protein supplements such as 43% cottonseed cake in wintering calves on silage when 140 to 150 bushels of oats can be purchased for the price of one ton of high-protein supplement.

In the first year of a three-year test (Table VII), 2.2 lbs. of No. 2 oats proved superior to 1 lb. of 43% cottonseed cake. However, during the second and third trials 2 pounds of No. 1 oats were slightly inferior to 1 pound of 43% cottonseed cake. Thus, the average allowance of oats fed, 2.06 pounds, is slightly less valuable than the pound of cake for which it was substituted, but it seems safe to assume that approximately 2.25 pounds of No. 2 or higher grade oats will fully replace one pound of cottonseed cake in wintering rations for calves if the roughage is of high quality.

The market value placed on each lot was the same in the first two trials. In the third trial the oats-fed calves were valued \$0.25 per hundredweight higher because they were slightly thinner and lighter that particular year.

Calves wintered on oats grazed as well as those fed 43% cottonseed cake as the protein supplement. On two occasions the steers wintered on oats made the least winter and the most

* The per bushel value of oats was only one-half that of No. 2 corn in the fattening trials. See page 8.

Table VII.—Comparison of Oats and 43% Cottonseed Cake as Supplements to Silage and Grain for Wintering Steer Calves.
(Average of three years, 1940-41 to 1942-43.)

	LOT 1 43% Cottonseed Cake as Supplement	LOT 2 Oats as Supplement
Average weights per steer (lbs.)		
Initial weight	421	422
Final weight	666	650
Total gain	245	228
Average daily gain	1.46	1.36
Average daily ration (lbs.)		
Silage	22.24	21.27
Cottonseed cake	1.00	
Oats		2.06
Ground barley or oats*	2.50	2.50
Ground limestone	.10	.10
Feed required per 100 lbs. gain (lbs.)		
Silage	1,530.44	1,565.19
Cottonseed cake	69.46	
Oats		152.24
Ground barley or oats*	171.67	185.89
Ground limestone	6.91	7.45
Value per hundredweight at feed lot, April 18	\$13.25	\$13.35

Average length of feeding period, 168 days. Average number of steers per lot, 9.
Feed Prices: 43% cottonseed cake, \$37.33 per ton; oats, \$0.45 per bu.; ground barley, \$0.61 per bu.; silage, \$3.67 per ton; ground limestone, \$12.00 per ton.
* Oats were used in place of barley in 1940-41.

summer gain, whereas the reverse was true for the other year of the trial.

The oats ration was less palatable than the one using cottonseed meal, and the steers fed oats were usually slowest in cleaning up their daily allowance.

The steers which received oats had slightly less bloom and attractiveness two of the three years. However, they showed the most bloom in 1940-41, the year they gained more than the calves fed cottonseed cake.

The feeds used in the foregoing test showed the following percentage of protein:

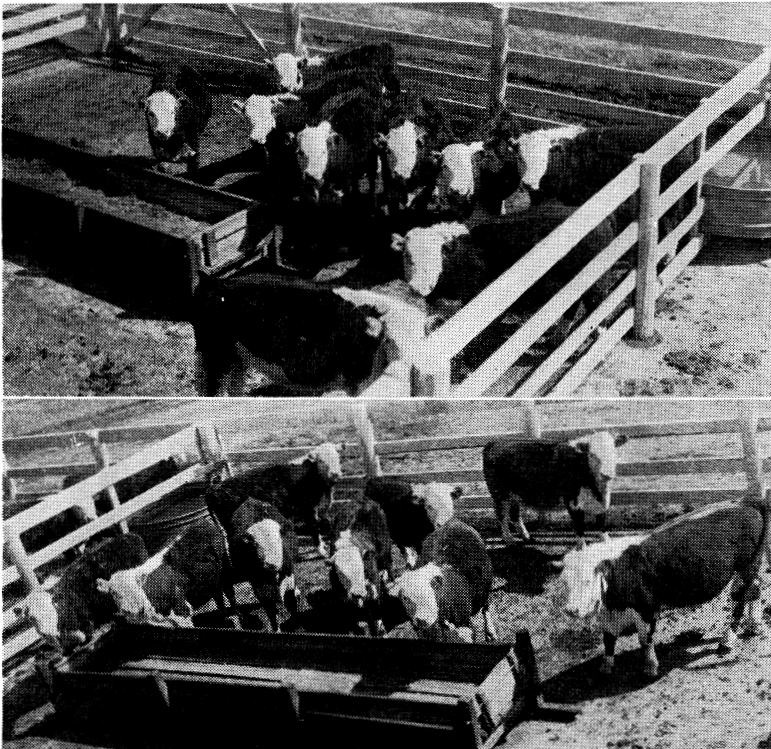
	1940-41	1941-42	1942-43	Average
43% Cottonseed Cake	44.5	43.5	41.9	43.33
Oats (No. 2)	11.62	11.40	11.42	11.48

Oats Equal to Cake After Protein Need Is Met

After the need for protein is met by 43% cottonseed cake or other high-protein supplement, oats are fully equal, pound for pound, to 43% cake. They are better than corn under those same conditions.

In the second series of wintering ration tests (Table VIII), an average of 2.28 pounds of ground oats proved fully equal to 2.31 pounds of 43% cottonseed cake or 2.68 pounds of ground shelled corn. In other words, No. 2 ground oats and cottonseed cake were of equal value, but corn was only 85% as valuable per pound as either of the other feeds. Corn was consistently less efficient in each of the three years.

The foregoing results would also hold true for older cattle



Oats are equal to 43% cottonseed cake, pound for pound, after the need for protein is met. Both lots shown here were fed 24.4 lbs. of silage and 1.4 lbs. of cake. In addition, the upper lot had an extra 2.3 lbs. of cake while the lower lot had 2.3 lbs. of oats. Results were equal.

on any roughage. After the need for protein has been met in the ration with cottonseed cake or a similar protein supplement, oats are equal to 43% cottonseed cake, pound for pound.

No observable differences existed between the appearance of the three lots of calves in regard to amount of flesh, thrift or bloom at the close of the 160-day trial.

In this experiment it was deemed advisable to produce 225-250 pounds of winter gain on the steer calves. This amount of gain is excessive for the man who wishes to graze the full season and sell feeder yearlings in October of each year. However, the plan being tested consisted of wintering calves well, grazing for 90 to 100 days without grain, and then full-feeding them 100 days in dry lot or on bluestem or buffalo

Table VIII.—Comparison of Oats, Shelled Corn, and Cottonseed Cake as Concentrates Added to a Balanced Ration for Wintering Calves Well.*
(Average of three years, 1937-38 to 1939-40.)

	LOT 1 Ground Shelled Corn Added	LOT 2 Ground Oats Added	LOT 3 Additional Cottonseed Cake Added
Average weights per steer (lbs.)			
Initial weight	396	395	396
Final weight	647	646	647
Total gain	251	251	251
Average daily gain	1.57	1.57	1.57
Average daily ration (lbs.)			
Ground shelled corn	2.68		
Ground oats		2.28	
Cottonseed cake (to replace grain)			2.31
Cottonseed cake	1.40	1.40	1.40
Silage	24.40	24.41	24.40
Ground limestone	.08	.08	.08
Feed required per 100 lbs. gain (lbs.)			
Ground shelled corn	170.70		
Ground oats		145.22	
Cottonseed cake	89.17	89.17	236.31
Silage	1,554.14	1,554.78	1,554.14
Cost of feed per 100 lbs. gain	\$5.75	\$5.28	\$6.15
Value per hundredweight at feed lot	\$9.25	\$9.25	\$9.25

* The feed shown under the lot number for each lot was added to a basal ration of cottonseed cake, silage, and ground limestone. This basal ration was the same in all lots.

Feed Prices: Corn, \$0.57 per bu.; oats, \$0.28 per bu.; cottonseed cake (43%), \$29.00 per ton; silage, \$3.50 per ton.

grass pasture. This plan has worked well in Kansas and is known as the Kansas Deferred Feeding Plan. Rather large winter gains are essential under this plan in order that the calves will be finished after 100 days of grain feeding following 90 to 100 days on grass. This plan will produce approximately 600 pounds gain in twelve months' time and is fully as promising for Oklahoma as it has proved valuable to Kansas.

SUMMARY AND CONCLUSIONS

1. Choice Oklahoma calves returned 162 percent more than elevator price for Oklahoma-grown oats over a five-year period when oats were used to replace half the corn in a calf-fattening ration of corn, cottonseed cake, silage, and ground limestone. The average elevator price of oats (32 cents per bushel) was increased to 83 cents per bushel by marketing oats as beef rather than as oats. (See Table II.)

2. A pound of No. 2 oats is 85 percent as valuable as a pound of No. 2 shelled corn when oats replace half the corn in a calf-fattening ration. Thus, two bushels of No. 2 oats will fully replace one bushel of No. 2 corn when the substitution of oats for corn does not exceed 50 percent of the corn ration in fattening beef calves.

3. Feeding a mixture of half oats and half corn (either whole or ground grains) is superior to feeding all oats the first half and all corn the last half of an 170-day feeding period. Calves fed the mixture gained faster, sold higher, yielded superior, and graded equal to those finished on corn for the last 88 days. They were also easier to keep on feed both trials that this question was studied at the Oklahoma Agricultural Experiment Station.

4. Ground oats are definitely superior to ground corn as a carrier for a heavy allowance of blackstrap molasses in the calf-fattening ration. Calves fed half ground oats and molasses gained .22 pound more per head daily, utilized 12 percent less feed per unit of gain, and sold \$0.65 per hundredweight higher than calves fed ground shelled corn and molasses in the same proportions. Bloom and attractiveness as well as finish were superior in the oats-molasses lot.

5. Grinding oats for calves under a year of age is not recommended. A saving of 2 lbs. of oats per bushel was realized by coarse grinding, but this saving is practically always insufficient to pay the cost of grinding a bushel of oats.

6. Rolling oats for commercial cattle is less desirable than coarse grinding. Calves fed rolled oats consumed less oats, gained at a slower rate and at greater cost than calves

fed either ground or whole oats. Rolled oats proved to be too bulky for beef calves being fed for quick finishing in dry-lot. (See Table VI.)

7. No. 2 whole oats can be substituted for 43% cottonseed cake in wintering rations for calves at the ratio of 2.25 lbs. of oats to 1 lb. of cottonseed cake if the roughage fed is of high quality.

8. No. 2 whole oats are $\frac{2}{3}$ as valuable as corn per bushel when used as a concentrate to be added to a balanced ration in wintering calves well.

9. Oats are fully equal to 43% cottonseed cake, pound for pound, when fed in excess of that amount of cottonseed cake needed to balance a wintering ration for beef calves.

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APPENDIX

Methods and Materials Used in Making Tests

Cattle Used

Choice Hereford steer calves from the Mullendore Trust Co. Ranches, Osage County, Oklahoma, were fed each year. They were received at weaning time in October. They were fleshy calves with excellent bloom. Sixty-five to seventy-five head were selected annually from approximately five hundred steer calves on the ranch. Those selected were further divided into a light and heavy half on the basis of weight and the heavy half used in full-feeding and the lighter half in wintering trials. Highly uniform lots of strictly choice calves resulted from this procedure.

In the experiment on the preparation of oats (Pages 12-15) mixed steer and heifer calves were used. They included some Mullendore calves and the balance were from the Experiment Station's experimental herd of choice Hereford cows.

Equipment and Management

The calves were fed in the eleven-pen Experimental Cattle Feeding Shed. Each lot was fed in a 30x36 foot paved lot having an open front shed across the north end. Grain and silage were fed in movable feed bunks placed under the cover of the shed.

Weights were obtained by weighing each steer individually every 28 days. Individual identification was maintained by numbered neck chains or neck straps.

All grain rations were hand-fed in the experiments reported herein. Full-fed rations were hand-fed twice daily in such amounts that the calves could not quite "clean-up" by the next feed after the calves had been carefully advanced to a fullfeed in approximately fifty-six days' time.

Common ground rock salt and a simple mineral mixture composed of equal parts steamed bone meal, powdered limestone, and salt were provided free choice.

Feeds Used

The grades, test weights, and chemical analyses of the oats and corn used are shown in Appendix Table I.

The silage fed was Atlas sorgo silage and varied in grain yield from approximately 15 to 30 bushels per acre. The average yield was approximately 25 bushels. The average carotene content for the four years for which it was determined was 5 parts per million on the wet basis.

The blackstrap molasses used in 1936-37 was found to be 68.54% solids, 7.8% ash, and 49.43% total sugar. The corn used that year was No. 2 yellow, and the oats graded No. 2 with a standard test weight of 32 lbs.

Appendix Table I.—Grades, Test Weights, and Chemical Analyses of the Oats and Corn Fed.

Year	Grade	Test Weight	H ₂ O	Ash	Protein	Fat	Fiber	N. F. E.
Oats (Oklahoma grown)								
1937-38	No. 3	30.0	10.75	3.36	13.88	3.30	10.42	58.29
1938-39	No. 4	25.5	9.40	3.62	12.28	4.46	14.38	55.67
1939-40	No. 3	34.5	10.23	3.49	11.62	4.36	8.84	61.46
1940-41	No. 2	32.5	10.10	4.04	11.96	4.32	10.10	59.10
1941-42	No. 1	32.5	9.66	3.89	11.42	3.74	10.65	60.64
1942-43	No. 1	32	9.66	3.89	11.42	3.74	10.65	60.64
Yellow Corn (purchased as No. 2 Corn)*								
1937-38	No. 2	56	13.89	1.29	9.89	3.19	2.14	69.60
1938-39	No. 1	55	11.10	1.23	9.95	3.87	1.68	72.17
1939-40	No. 2	55	9.10	1.66	10.47	4.74	2.50	71.53
1940-41	No. 2	55	13.95	1.64	10.00	4.15	2.45	67.81
1941-42	No. 2	56	11.05	1.43	10.18	4.17	2.00	71.70

* The corn fed every year represented several different purchases with the exception of the No. 1 corn fed in 1938-39.

