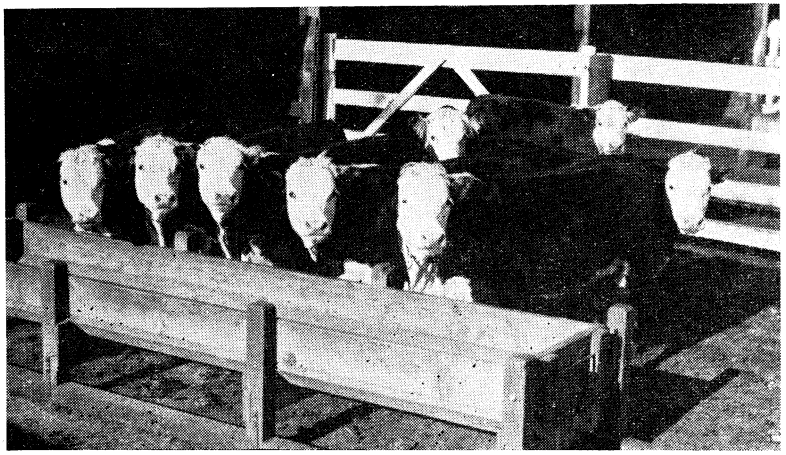
Beef Cattle Feeding Investigations

W. L. Blizzard



AGRICULTURAL EXPERIMENT STATION
OKLAHOMA AGRICULTURAL AND MECHANICAL COLLEGE
STILLWATER

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By W. L. Blizzard*

INTRODUCTION

This bulletin summarizes a series of experiments in the feeding of beef calves conducted at the Oklahoma Agricultural Experiment Station for the period December 4, 1929, to April 18, 1937.

Many of the experiments conducted were prompted by inquiries received by the Department of Animal Husbandry from cattle feeders throughout the State. Changing conditions have suggested that other problems should be studied so that experimental data could be used as a basis for recommendations.

The best utilization of Oklahoma feeds in producing cattle of the weight, quality and finish in greatest market demand has been the guiding force in planning and conducting the various investigations.

Experimental Procedure

The experiments herein reported were conducted in the Experimental Beef Cattle Shed. The different lots were penned in identical lots 30 feet wide by 36 feet long with a shed 24 feet deep across the north end. The shed had a dirt floor and was cleaned whenever necessary. The pen in front of the shed was paved. All hay and other roughage was fed under this shed. Grain was fed either in movable bunks, which were placed under the shed in bad weather, or in self-feeders providing ten feet of feeder space. These self-feeders were available in six of the ten lots. They were built in the pen fence, next to the feed alley, and thus were under cover at all times.

Water was provided from metal tanks which were located in the partition fence between lots. Hence, one tank served two lots.

Extreme care was taken to obtain the best possible allotment of the calves used in the different experimental lots. All lots were made as nearly alike as was possible in regard to number, average weight, quality, condition, age, and indications of probable outcome. Calves of one brand were preferred for each experiment and were used in most instances.

An average of three consecutive days weights was taken as the initial and final weights of individual steers in each experiment. Each steer was also weighed individually once each month throughout the experiment.

Calves Used

High grade Hereford steer calves were used each year. The calves were delivered at Stillwater at least ten days before the feeding trials were started so that all effects of weaning and shipping would be over before the actual experiment started. The places at which the calves were secured are listed by years in the following table:

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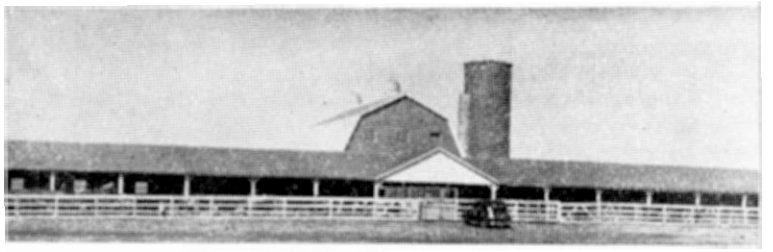
* The experiments were supervised by:
L. E. Hawkins, 1929-1935; O. S. Willham, 1935-1936; Bruce R. Taylor, 1936-1937.



A view of the experimental pens.
(February, 1936)

Year	Number of calves	Source of calves
1929-30	50	Kansas City Market.
1930-31	60	Phil Lowery, Loco, Oklahoma.
1931-32	56	R. A. Maple Ranch, Mocane, Oklahoma.
1932-33	51	R. A. Maple Ranch. Mocane, Oklahoma.
	13	L. H. Duncan, Mill Creek, Oklahoma.
1933-34	64	E. C. Mullendore, Osage County, Oklahoma.
1934-35	64	E. C. Mullendore, Osage County, Oklahoma.
1935-36	64	George Smith Ranch, Pawhuska, Oklahoma.
1936-37	64	E. C. Mullendore, Osage County, Oklahoma.

PART I

COTTONSEED MEAL FED IN VARYING AMOUNTS IN CALF FATTENING RATIONS OF GROUND SHELLED CORN, COTTONSEED MEAL, PRAIRIE HAY AND GROUND LIMESTONE.

(Four year average, 1930-31-33 and 34)
(Average length of test, 173 days)

Lot number	1	2	3
Number of steers per lot	9	9	9
	Pounds	Pounds	Pounds
Average initial weight	397.90	396.10	396.40
Average final weight	759.40	766.60	758.40
Average total gain	361.50	370.50	362.00
Average daily gain	2.09	2.14	2.09
Average daily ration:			
Ground shelled corn	8.60	7.74	6.84
Cottonseed meal (43%)	1.45	2.47	3.52
Prairie hay	4.19	4.21	4.26
Kafir silage*	6.69	6.93	6.64
Ground limestone	.19	.18	.17
Total concentrates per head per day	10.05	10.21	10.36
Feed required per 100 lbs. gain:			
Concentrates	480.90	477.10	495.70
Roughage	226.90	223.90	230.30
Shrink in marketing	30	33	31
Dressing percentage	58.8	58.9	58.6

* Silage was fed only one year.

Methods of Feeding

The steers were full fed ground shelled corn, prairie hay and silage in 1930 and 1931. The allowance of cottonseed meal was mixed with the corn at feeding time. In 1933 and 1934 the cottonseed meal was mixed with the corn at the following rates:

Lot 1—1933 Ground shelled corn 6 parts; cottonseed meal 1 part.
1934 Ground shelled corn 5 parts; cottonseed meal 1 part.

Lot 2—1933 Ground shelled corn 3 parts; cottonseed meal 1 part.
1934 Ground shelled corn 3 parts; cottonseed meal 1 part.

Lot 3—1933 Ground shelled corn 2 parts; cottonseed meal 1 part.
1934 Ground shelled corn 3 parts; cottonseed meal 2 parts.

This concentrate mixture was full fed. The actual amounts of cottonseed meal fed in the different lots correspond closely to those amounts fed in 1930 and 1931 when 1½, 2½ and 3½ pounds were fed respectively in lots 1, 2 and 3.

Ground limestone was fed in all lots at the rate of 2 pounds per 100 pounds of concentrates. The steers had access to common salt at all times.

Summary and Conclusions

1. A comparison of lots 1 and 2 indicates that the replacing of .86 pound of corn with 1.02 pounds of 43 percent cottonseed meal increased the rate and economy of gain so slightly that it is of no significance from those standpoints. It did, however, increase the selling price of the steers an average of $0.25 per hundred weight.
2. In lots 1 and 3 the replacing of 1.76 pounds of corn with 2.07 pounds of cottonseed meal maintained the same rate of gain but increased the concentrates required to produce 100 pounds gain by 3 percent and the roughage requirement by 2.36 percent.
3. Lot 3, that received 3.5 pounds of cottonseed meal, averaged 12.5 cents per hundred weight higher in selling price than lot 1 that received 1.5 pounds of cottonseed meal.
4. There was no significant difference either in shrink in marketing or in dressing percentage resulting from the feeding of 14, 24 or 34 percent of the concentrates in the form of cottonseed meal in lots 1, 2, and 3, respectively.
5. These results indicate that approximately 1.5 pounds of 43 percent cottonseed meal will adequately supply the needed protein in a ration of ground shelled corn, prairie hay and ground limestone, but the feeding of 2.5 pounds per head per day will produce more bloom, slightly better coats of hair and may add to the selling price.
6. The substitution of 43 percent cottonseed meal for ground shelled corn, after the need for protein is met, will be profitable only when cottonseed meal sells for considerably less per ton than corn.
7. The actual point at which this substitution can profitably be made, from the standpoint of rate and economy of gain, was found in these tests to be when the cost of 43 percent cottonseed meal is not more than 84 percent the cost of ground shelled corn.

PART II

THE VALUE OF ADDING GROUND LIMESTONE TO A CALF FATTENING RATION OF GROUND SHELLED CORN, COTTONSEED MEAL AND PRAIRIE HAY.

(Two year average, 1930-1931)
(Average length of test, 164 days)

Lot number	1	2
Number of steers per lot	10	10
	Pounds	Pounds
Average initial weight	404.90	405.10
Average final weight	752.80	776.80
Average total gain	347.90	371.70
Average daily gain	2.12	2.27
Average daily ration:		
Ground shelled corn	8.50	8.45
Cottonseed meal	2.52	2.53
Prairie hay	5.15	5.21
Ground limestone		.17
Total concentrates per head per day	11.02	10.98
Feed required per 100 lbs. gain:		
Concentrates	519.80	483.70
Roughage	242.90	229.50
Shrink in marketing	34.80	40.80
Dressing percentage	58.51	58.70

Methods of Feeding

Each lot was fed the same basal ration of ground shelled corn and prairie hay, both full fed, and approximately 2.5 pounds of cottonseed meal per head per day. In addition, lot 2 received 2 percent of finely ground limestone mixed with the concentrate allowance.

Summary and Conclusions

1. The results of the two years' work indicate definitely that the addition of .17 pound of finely ground limestone will improve both the rate and economy of gain on steer calves receiving a ration of corn, cottonseed meal and prairie hay.
2. The steers that received the ground limestone sold $0.50 per hundred weight higher than the check lot in 1931 and at the same price in 1930.
3. The dressing percentage of the two lots shows but little difference in carcass yield.
4. The shrink in marketing was determined largely, no doubt, by the fill at market; but shows a slight advantage for lot 1, the check lot.

PART III

SUBSTITUTING COTTONSEED MEAL FOR GROUND SHELLED CORN IN A FATTENING RATION OF CORN, COTTONSEED MEAL, AND ALFALFA HAY FOR STEER CALVES.

(November 10, 1931, to April 27, 1932; 169 days)

Lot number	1	2	3
Number of steers per lot	8	8	8
	Pounds	Pounds	Pounds
Average initial weight	363.00	355.00	362.00
Average final weight	669.00	653.00	660.00
Average total gain	306.00	298.00	298.00
Average daily gain	1.81	1.76	1.76
Average daily ration:			
Ground shelled corn	6.81	6.40	4.64
Cottonseed meal (43%)	.15	.58	2.31
Alfalfa hay	4.15	4.14	4.14
Ground limestone	.14	.14	.14
Total concentrates per head per day	6.96	6.98	6.95
Feed required per 100 lbs. gain:			
Concentrates	384.00	396.60	394.90
Roughage	299.00	235.00	235.00

Methods of Feeding

The three lots of steers were fed rations of ground shelled corn, cottonseed meal and alfalfa hay varying only in the proportion of cottonseed meal to corn. As the amount of cottonseed meal was increased in lots 2 and 3, over that amount fed in lot 1, the amount of corn fed was reduced a corresponding amount. Thus, the total amount of concentrates fed in all lots was practically the same.

Ground limestone was fed in all lots to the extent of 2 percent of the concentrate allowance. All lots had access to common salt.

Summary and Conclusions

1. Substituting .43 pound of cottonseed meal for .41 pound of ground shelled corn in lot 2 reduced only slightly the rate and economy of gain and was probably of no significance from this standpoint.
2. A comparison of lot 1, that received .15 pound of cottonseed meal with lot 3, that received 2.31 pounds shows that substituting 2.16 pounds of cottonseed meal for 2.17 pounds of ground shelled corn did not significantly affect the rate nor economy of gain.
3. A comparison of lots 2 and 3, that gained exactly alike, shows that 1.73 pounds of cottonseed meal fully replaced 1.76 pounds of ground shelled corn in a corn, cottonseed meal and alfalfa hay ration for steer calves.

4. The relative value of 43 percent cottonseed meal ranged from 95 to 102 percent the value of ground shelled corn per pound when fed to steer calves being fattened on a ration of ground shelled corn, alfalfa hay and cottonseed meal.
5. This trial has been conducted only one year. No definite conclusions can be made until the trial has been repeated several times.
6. The results of this experiment do not agree with those of Part I where prairie hay was used as the roughage. The difference in roughages used does not make the two experiments strictly comparable. The alfalfa hay used in this experiment was, without doubt, much higher in its content of vitamin A than the prairie hay used in Part I.

PART IV

A COMPARISON OF GROUND SHELLED CORN, GROUND THRESHED DARSO AND GROUND DARSO HEADS IN FATTENING RATIONS FOR STEER CALVES.

(October 19, 1932, to April 18, 1933; 181 days)

Lot number	1	2	3
Number of steers per lot	8	7*	8
	Pounds	Pounds	Pounds
Average initial weight	404.00	401.00	404.00
Average final weight	775.00	726.00	700.00
Average total gain	371.00	325.00	296.00
Average daily gain	2.05	1.80	1.63
Average daily ration:			
Ground shelled corn	7.35		
Ground threshed darso		7.84	
Ground darso heads			8.04
Cottonseed meal	2.46	2.63	2.69
Prairie hay	4.10	4.10	4.10
Ground limestone	.19	.21	.21
Total concentrates per head per day	9.81	10.47	10.73
Feed required per 100 lbs. gain:			
Concentrates	479.00	581.70	658.30
Roughage	200.00	227.70	251.50

* One calf was lost November 25 from the effects of dehorning.

Methods of Feeding

The steers were full fed the concentrate mixtures made up of three parts of the different grains tested and one part of cottonseed meal. Prairie hay was fed at the same rate in all lots. Ground limestone was mixed with the grain at the rate of 2 pounds per 100 pounds of grain. All lots had access to common salt.

Summary and Conclusions

1. By referring to the table it will be seen that lot 1, fed ground shelled corn, gained 2.05 pounds per head daily; lot 2, fed ground threshed darso, 1.80 pounds; and lot 3, fed ground darso heads, only 1.63 pounds.
2. Lot 2, fed ground threshed darso, made 12 percent less gain per day and consumed 6.7 percent more concentrates per day than lot 1, fed ground shelled corn.
3. Lot 3, fed ground darso heads, made 20 percent less gain per day and consumed 9.4 percent more concentrates per day than lot 1, fed ground shelled corn.
4. The steers receiving either the ground threshed darso or the ground darso heads consumed more total concentrates per head per day than the steers receiving ground shelled corn. The rations containing darso in either form were highly palatable to the calves.
5. On the basis of market finish and selling price the three lots of steers ranked in the following order: lot 1, fed ground shelled corn; lot 2, fed ground threshed darso; and lot 3, fed ground darso heads.

PART V

THE VALUE OF ADDING SILAGE TO A FATTENING RATION OF GROUND SHELLED CORN, COTTONSEED MEAL, PRAIRIE HAY AND GROUND LIMESTONE FOR STEER CALVES.

(Two year average, 1932-1933)
(Average length of test, 175 days)

Lot number	1	2
Number of steers per lot	8	8
	Pounds	Pounds
Average initial weight per steer	388.50	386.50
Average final weight	723.50	752.50
Average total gain	335.00	366.00
Average daily gain	1.91	2.09
Average daily ration:		
Ground shelled corn	6.49	6.53
Cottonseed meal	2.17	2.18
Prairie hay	4.40	2.27
Kafir silage		6.67
Ground limestone	.17	.17
Total concentrates per head per day	8.66	8.71
Feed required per 100 lbs. gain:		
Concentrates	453.40	416.70
Hay	230.40	108.60
Silage		319.10

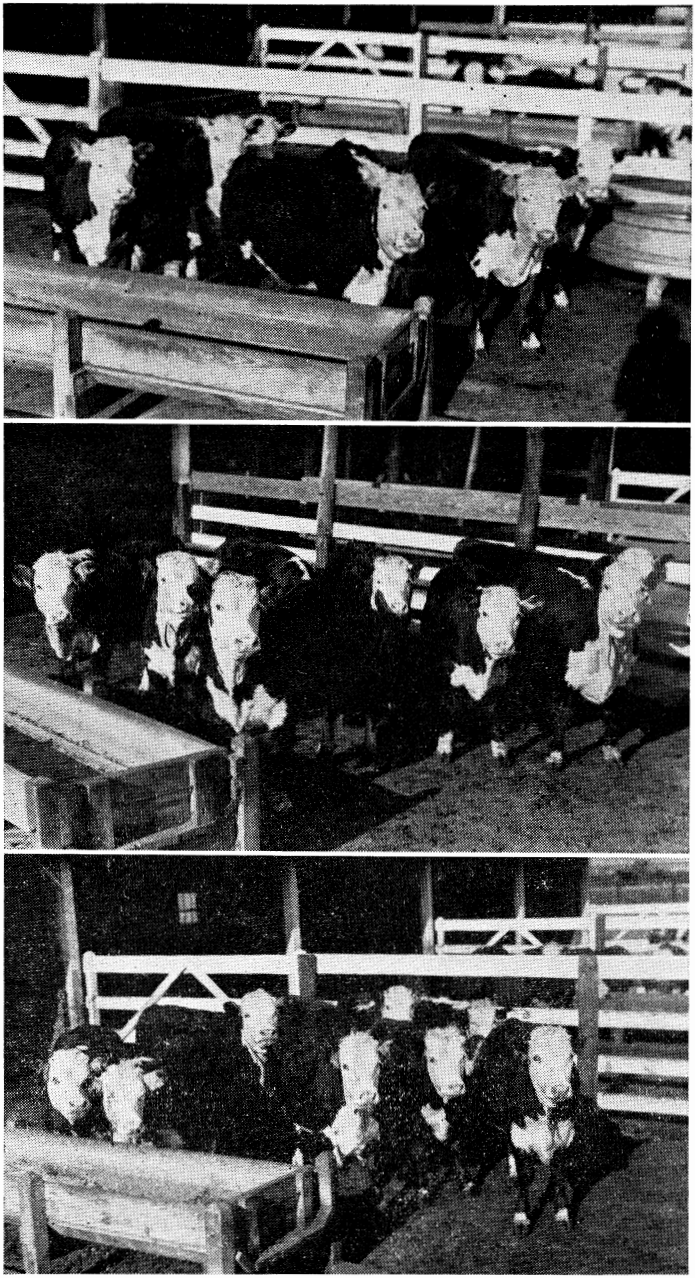
Methods of Feeding

Both lots were full fed a concentrate mixture of 3 parts ground shelled corn to 1 part of 43 percent cottonseed meal, and prairie hay. In addition, lot 2 was given all the kafir silage the steers would clean up twice daily.

Ground limestone was mixed with the grain to the extent of 2 percent of the concentrate allowance. Both lots had access to common salt at all times.

Summary and Conclusions

1. In these trials one ton of kafir silage replaced 3 bushels of corn, 57 pounds of cottonseed meal and 763 pounds of prairie hay in a calf fattening ration of corn, cottonseed meal, prairie hay and ground limestone.
2. Lot 2, that received kafir silage, gained .18 pound more per head daily and consumed practically the same amount of concentrates as lot 1, that received no silage.
3. There was no significant difference in shrink in marketing between the two lots of steers.
4. Lot 2, that received silage, sold at an average of $0.25 per hundred weight higher than lot 1, that received only prairie hay as roughage.



Three lots of steers at the close of the 1934 experiment.

PART VI

COTTONSEED HULLS COMPARED TO PRAIRIE HAY AS ROUGHAGES IN FATTENING RATIONS OF GROUND SHELLED CORN, COTTONSEED MEAL AND GROUND LIMESTONE FOR STEER CALVES.

(Five year average, 1932-1936)
(Average length of test, 173 days)

Lot number	1	2
Number of steers per lot	8	7.4
	Pounds	Pounds
Average initial weight	374.60	372.20
Average final weight	739.80	731.60
Average total gain	365.20	359.40
Average daily gain	2.11	2.08
Average daily ration:		
Ground shelled corn	8.12	6.77
Cottonseed meal (43%)	2.38	2.75
Prairie hay	3.90	
Cottonseed hulls		5.35
Ground limestone	.20	.19
Total concentrates per head per day	10.50	9.52
Feed required per 100 lbs. gain:		
Concentrates	497.60	458.00
Roughage	184.80	257.20
Percentage of total ration consumed as roughage	27%	36%

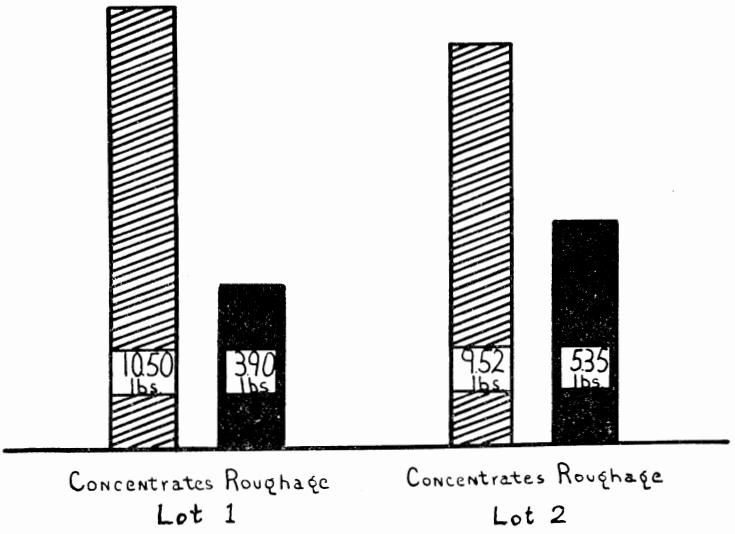
Methods of Feeding

Each lot was full fed ground shelled corn and their respective roughage. An amount of cottonseed meal was fed that would make the nutritive ratio of both rations the same. Two percent of finely ground limestone was mixed with the grain allowance. In addition a mineral mixture of equal parts steamed bone meal, ground limestone and common salt was provided, free choice, in 1935 and 1936. Access to common salt was provided at all times.

Summary and Conclusions

1. There was no significant difference in the average daily gain per steer in the two lots.
2. Lot 2, that received cottonseed hulls, produced 100 pounds of gain on 39.6 pounds less concentrates but required 72.4 pounds more roughage than lot 1, that received prairie hay.
3. The steers in lot 1, that received prairie hay, maintained more regular appetites than the steers receiving cottonseed hulls. This was especially noticeable two years of the five.
4. Approximately .37 pound more cottonseed meal was required to balance the daily ration of the steers that received cottonseed hulls as compared to those receiving prairie hay as roughage.

5. Both lots of steers consumed approximately the same total pounds of feed per head per day but lot 1, that received prairie hay, consumed 37 percent as much roughage as concentrates, whereas lot 2, that received cottonseed hulls, consumed 56 percent as much hulls as they did of concentrates.
6. Cottonseed hulls proved a more palatable roughage than the prairie hay fed in these tests when each was fed with ground shelled corn, cottonseed meal and ground limestone. The amount of hulls fed should probably be limited if maximum grain consumption is to be secured.
7. Lot 1, that received prairie hay, sold higher two years and lot 2, that received cottonseed hulls, sold higher three of the five years this problem was studied. The average of the five years reveals a $0.10 per hundred weight advantage for lot 1, that received prairie hay.



Proportion of concentrates to roughage selected by steer calves full fed a concentrate mixture of corn and cottonseed cake and either prairie hay (Lot 1) or cottonseed hulls (Lot 2) free choice.

PART VII

A Comparison of Four Different Roughages in Fattening Rations for Steer Calves.

(Two-year average, 1935-1936)
(Average length of test, 166 days)

Lot number	1	2	3	4
Number of steers per lot	8	8	7[1]	8[2]
	Pounds	Pounds	Pounds	Pounds
Average initial weight	359.50	359.50	362.50	359.00
Average final weight	764.00	773.00	737.50	738.00
Average total gain	404.50	413.50	375.00	379.00
Average daily gain	2.44	2.49	2.26	2.28
Average daily ration:				
Ground shelled corn	10.27	10.74	8.40	9.68
Cottonseed cake	2.55	1.50	2.68	2.42
Prairie hay	3.20			
Alfalfa hay		3.59		
Cottonseed hulls			5.41	
Kafir silage				7.82
Total concentrates per head per day	12.82	12.24	11.08	12.10
Feed required per 100 lbs. gain:				
Concentrates	525.40	491.60	490.30	530.70
Roughage	131.10	144.00	239.30	343.00

[1] One steer was removed from lot 3 in 1935 due to urinary calculi and another in 1936 because of pneumonia.

[2] One steer was lost in lot 4 in 1935 due to choking.

Methods of Feeding

The four lots of steers were hand-fed grain for the first twenty days in the first and twenty-eight days in the second trial; after which time the steers were placed on self-feeders and the concentrate mixture was kept before them at all times. The concentrate mixtures used were as follows:

Lot 1—Ground shelled corn 4 parts; cottonseed cake 1 part.

Lot 2—Ground shelled corn 7 parts; cottonseed cake 1 part.

Lot 3—Ground shelled corn 3 parts; cottonseed cake 1 part.

Lot 4—Ground shelled corn 4 parts; cottonseed cake 1 part.

Each lot was full fed its respective roughage at all times. Ground limestone was mixed with the grain at the rate of 2 pounds per 100 pounds of grain. In addition a mineral mixture of equal parts of steamed bone meal, finely ground limestone and common salt was kept before all lots. Common salt was also provided in separate boxes.

Summary and Conclusions

1. A comparison of lots 1 and 2 that gained almost identical amounts, shows that one ton of alfalfa hay fully replaced 1,819 pounds of prairie hay, 376 pounds of corn and 94 pounds of cottonseed cake in a fattening ration for steer calves.
2. Lot 2, that received the alfalfa hay, required less total feed to produce 100 pounds gain than the other lots in this experiment.
3. A comparison of lots 3 and 4, in which the daily gains are almost identical, shows that one ton of cottonseed hulls replaced 1.43 tons kafir silage, 330 pounds of corn and 82.5 pounds of cottonseed cake in a calf fattening ration.
4. All the rations used in this experiment proved satisfactory from the standpoint of rate and economy of gain as well as producing market finish.
5. The total consumption of concentrates was highest in lot 1, that received prairie hay, and lowest in lot 3, that received cottonseed hulls. The steers receiving the cottonseed hulls consumed fully 1 pound less total concentrates per head daily than lot 4, the next lowest consuming lot.

PART VIII

A COMPARISON OF FOUR DIFFERENT ROUGHAGES IN WINTERING RATIONS FOR STEER CALVES BEING FED TO GAIN 1.5 POUNDS PER HEAD PER DAY.

(Three-year average, 1935-1936-1937)
(Average length of test, 165 days)

Lot number	1	2	3	4
Number of steers per lot	8	8	8	8
	Pounds	Pounds	Pounds	Pounds
Average initial weight	375.00	375.00	375.00	375.00
Average final weight	618.90	633.30	621.40	627.60
Average total gain	243.90	257.80	246.40	252.60
Average daily gain	1.48	1.56	1.49	1.53
Average daily ration:				
Ground shelled corn	4.06	2.79	2.64	2.28
Cottonseed cake	1.48	.67	1.85	1.15
Prairie hay	7.94			
Alfalfa hay		10.13		
Cottonseed hulls			12.03	
Kafir silage				26.93
Total concentrates per head per day	5.54	3.46	4.49	3.43
Feed required per 100 lbs. gain:				
Concentrates	374.30	221.80	301.30	224.20
Roughage	536.50	649.40	807.40	1760.00

Methods of Feeding

Each lot was full fed its respective roughage and hand fed concentrates twice daily. In 1935 and 1936 the concentrate mixture consisted of ground shelled corn and cottonseed cake as follows:

Lot 1—Ground shelled corn 3 parts; cottonseed cake 1 part.

Lot 2—Ground shelled corn 3 parts; cottonseed cake 1 part.

Lot 3—Ground shelled corn 2 parts; cottonseed cake 1 part.

Lot 4—Ground shelled corn 3 parts; cottonseed cake 1 part.

The concentrate allowance was varied from time to time in order to produce a weight gain on the steers of 1.5 pounds per head per day.

In 1937 the four lots of steers were full fed their respective roughage and hand-fed ground shelled corn and cottonseed cake twice daily. Lots 1 and 4 received 1.5 pounds; lot 2, .50 pound and lot 3, 2 pounds of cottonseed cake per head per day. Ground shelled corn was fed so as to produce 1.5 pounds daily gain per steer.

Each year a mineral mixture of equal parts steamed bone meal, ground limestone and common salt was kept before all lots at all times. Bulk salt was also provided in all lots. In 1937 lots 1, 3 and 4 had .10 pound finely ground limestone added to the daily grain allowance for each steer.

Summary and Conclusions

1. The quality of the four different roughages varied widely from year to year. The quality of the alfalfa hay seemed to vary more, however, than that of the other roughages. In 1935 only .55 pound of concentrates was required to produce the desired 1.5 pounds daily gain in lot 2, the alfalfa hay lot, whereas in 1937, 4.52 pounds were required to produce a similar gain.
2. Lot 2, that received alfalfa hay, sold for an average of $0.25 per hundred weight more than the other three lots which averaged selling at one price.
3. Using alfalfa hay as the standard and figuring the other lots by it, the replacement values for alfalfa hay are as follows:

   One ton of alfalfa hay replaced 1,652 pounds of prairie hay; 379 pounds of corn and 89 pounds of cottonseed cake when lot 1, receiving prarie hay and lot 2, receiving alfalfa hay, are compared.

   One ton of alfalfa hay replaced 1.24 tons of cottonsceed hulls and 245 pounds of cottonseed cake. This fact is shown by a comparison of lots 2 and 3.

   One ton of alfalfa hay replaced 2.7 tons of kafir silage in these trials as shown by a comparison of lots 2 and 4.