

THE UTILIZATION OF BLUESTEM GRASS  
IN FATTENING LIVESTOCK

by

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## THE PROBLEM

This thesis is based on a study of cattle feeding experiments conducted at the Kansas Agricultural Experiment Station. The object of these experiments was to secure information with reference to the profitable utilization of bluestem grass in the Flint Hills area of Kansas.

There are about 5,000,000 acres of land in East Central Kansas and Northern Oklahoma which produce a rich growth of fine bluestem, a grass famous for its fattening qualities. Most of this land is unsuited for cultivation but the soil is a rich cherty limestone formation which, in addition to being very fertile, contains all the essential mineral elements necessary for the proper nutrition of animals. It produces a cheap feed that makes good beef. Thousands of mature steers from Texas were formerly turned on these pastures in the spring and were taken directly to the market in the fall without having had a bushel of grain.

Cattle were grown and fattened cheaply in those days and the advantages of young, quick maturing, highly



finished cattle were not so marked. Mature beeves brought the best prices.

Prior to the Civil War feed was plentiful and practically unsaleable except through livestock. No attempt was made to market a steer until he was fully mature. The animal that would grow to the greatest size and carry the most corn, hay and grass to market was considered best.

In a reproduction of an early circular is a record of 100 head of cattle fed by B. P. Harris, of Champaign County, Illinois. These cattle when marketed in 1856 averaged 2377 pounds per head and were four years old.

In 1897 well fattened baby beef began selling for as high prices per hundred pounds in Kansas City and Chicago as mature steers of the same quality. The packers in 1900 reported that they could not supply the demand for baby beef. Butchers wanted light cuts.

The handling of aged steers has become less and less profitable in recent years. There has been an increasing public preference for smaller cuts of beef which has resulted in a swing away from the old fashioned heavy cattle. The major demand now calls for young well finished good quality steers weighing less than 1000 pounds and

good quality well finished heifers weighing less than 750 pounds. There is a limited demand for heavier cattle but the prices are usually too low for profitable production.

Feeders have learned by experience that the kind of cattle preferred on the market at the present time cannot be produced by feeding grass or any other kind of roughage without concentrates. Young cattle are inclined to grow instead of fatten and it is necessary to feed rations that will enable them to consume enough feed to meet the demands for growth as well as for maintenance and the production of fat. However, young cattle produce gains cheaper than aged steers due to their greater efficiency in making gains. The results of tests conducted at the Kansas Agricultural Experiment Station as early as 1900 indicated that calves up to one year of age required only from one-third to three-fourths as much grain as was required with full grown steers to make beef.

In later experiments conducted for three different years 1919-1922 at the Kansas Station to compare results from feeding calves and aged steers it was found that it took 25 per cent less grain to make 100 pounds gain on calves than on aged steers. The calves used in these tests averaged 426 pounds into the feed lot and the older

steers 1,063 pounds each.

The changing conditions in the economics of production and market demands have made it necessary to find new methods of utilizing bluestem grass based on young cattle. If grass is to be utilized these young cattle must be fed grain in combination with grass, since young cattle will not get fat enough for slaughter purposes on grass alone.

The work done previous to 1922 at the Kansas Agricultural Experiment Station indicated that some method of wintering, grazing and then full feeding of young cattle might be worked out. But it was not until the fall of 1924 that a definite long-time project was started which has resulted in the system of feeding now known as the "deferred system". Two preliminary tests were run in 1922-'24 which were important in the development of this system of feeding because the information obtained during these two years was needed in planning the long-time project which followed.

The first year (1922-23) a comparison was made between full feeding in dry lot during the summer and full feeding on bluestem pasture. The animals used for this test were calves previously roughed through the winter. From April 1 to May 1, 1923, these calves all received a

ration consisting of cane silage, alfalfa hay, corn and cottonseed meal. On May 1, half of these calves were placed on bluestem pasture and full-fed on ground corn and cottonseed meal. The other half remained in a dry lot all summer where they were full-fed on corn, cottonseed meal, alfalfa hay and corn silage.

The calves on pasture were found to require less grain per unit of gain and sold for a better price and thus at a greater profit than calves roughed through the winter and finished in dry lot.

The second preliminary test was started in the fall of 1923 for the purpose of comparing results that might be secured from half-feeding through the winter and full-feeding on grass all summer, with half-feeding through the winter, grazing on grass without additional feed from May 1, to August 1, and then full-feeding on grass from August 1, to November 1.

Calves in each of two lots were fed the following daily ration per calf during the winter from December 7, to May 5th.

Cane silage	24.38	pounds
Alfalfa hay	2.00	"
Cottonseed meal	.91	"
Corn	4.69	"

Both lots were on pasture from May 5, to November 1, 1924, or 180 days. One lot was full-fed throughout the pasture period while the other lot was grazed without grain for the first 90 days and then full-fed the second 90 days.

The yearlings which had been full-fed for 180 days averaged 1,117 pounds when sold November 1. They were almost too heavy to meet the general demand for good light-weight beef. Although they carried slightly more finish, they sold for the same price per hundredweight as the yearlings which were full-fed for only 90 days.

The yearlings which had been grazed without grain for the first 90 days of the pasture period returned a net profit of \$20.88 per head more than the yearlings which had been full-fed during the entire 180 days of the pasture period.

It was evident that more information was needed and that results which had been obtained must be duplicated in subsequent experiments before the information thus gathered could be considered reliable enough to be used in making recommendations to cattlemen.

## THE DEVELOPMENT OF THE DEFERRED SYSTEM OF FEEDING

In the fall of 1924 a project was started for the purpose of finding more definite and complete methods of utilizing pasture in beef cattle feeding. This work has continued until the present time and has resulted in what is now known as the deferred system of feeding.

### Yearling Steers Wintered Well Versus Yearling Steers Roughed Through the Winter

On December 6, 1924, three lots of 10 yearling steers were selected to determine the value of roughing and half-feeding as methods of wintering yearlings that are to be grazed on bluestem grass from about May 1, to July 31, and full-fed August 1, to November 1.

These steers averaged approximately 540 pounds in weight. Lot 1 and 2 were fed a limited grain ration during the winter averaging 4.83 pounds of corn and one pound of cottonseed meal per head daily with two pounds of alfalfa hay and 33.93 pounds of cane silage. Lot 3 received the same amounts of cane silage and cottonseed meal but no corn or alfalfa hay. All three lots were placed on



bluestem pasture on May 5, where they were grazed without grain until August 3. After this grazing period lot 1, was placed in dry lot and full-fed for 90 days on corn, cottonseed meal and alfalfa hay, while lots 2 and 3 were full-fed on corn and cottonseed meal on pasture.

The steers in lot 1, made a margin over steer cost and feed cost of \$9.60 per head. A charge of \$8.00 per head had been made for pasture which the steers in this lot did not use after August 3. If the grass could have been utilized by other cattle for the remainder of the year, the actual cost per head for pasture in the case of lot 1, would have been only \$4.00. This would have left a margin of \$13.60 per head for lot 1. The steers in lots 2 and 3 showed margins of \$4.39 and \$8.99 respectively.

The results of this experiment indicated that when yearling steers were to be used the most profitable and satisfactory method would be to winter well, graze without grain until August 1, and then full-feed in dry lots until November 1.

Previous work done at this station had given conclusive evidence that aged steers could not profitably be used with this general system of feeding. Since it

was a long step down from an aged steer to a calf it became evident that a comparison should be made between calves and yearlings handled by this same method.

### Calves Versus Yearlings

An experiment was started in the fall of 1925 for the purpose of securing data that would help answer two questions:

(1) How do calves compare with yearlings when this general system of handling is used?

(2) How would full feeding in dry lot after August 1, compare with full feeding on pasture after that date?

Two lots of yearlings and two lots of calves were selected for this experiment. The yearlings averaged about 622 pounds per head and the calves averaged about 464 pounds per head.

The four lots of steers were fed from January 1, to May 11, 1926 on a ration limited to approximately five pounds of corn, one pound of cottonseed meal and two pounds of alfalfa hay per day and all the cane silage they would consume.

During the grazing phase of 81 days from May 11, to August 1, all lots were grazed on bluestem grass with-



out any supplementary feed.

Then on August 1, one lot of yearlings (Lot 3) and one lot of two year olds (Lot 1) were placed in dry lot while the other two lots (2 and 4) which were now two years old were placed on pasture.

Then on August 1, lot 3, now yearlings and lot 1, now two year olds were placed in dry lots while lots 2, and 4, which were now two year olds and yearlings respectively were continued on pasture. It must be remembered that the animals which were calves and yearlings when the experiment started the previous fall were now yearlings and two year olds.

Lot 1, which had been wintered well, grazed on bluestem without any supplementary feed for 81 days, then full fed 100 days in a dry lot, sold the following fall as two year olds, requiring a selling price of \$9.76 per hundredweight to break even. They sold for \$10.75 per hundredweight and left a margin of \$11.41 above steer and feed cost.

Lot 3, which had been started in the fall as calves handled the same as lot 1, sold as yearlings requiring a selling price of \$9.58 per hundredweight to break even. They sold for \$11.00 per hundredweight and left a margin

of \$14.73 per head above steer cost and feed cost.

These results are shown in Table I. A study of this table will also show that there was an advantage in finishing in dry lot as well as an advantage in favor of calves. This test as well as all previous tests indicated that calves could be more profitably used than older cattle. Packers wanted steers weighing less than 1000 pounds when finished. The Kansas Agricultural Experiment Station, since that time has therefore used calves exclusively in all experiments in which the deferred system of full-feeding has been involved.

Table I. Calves Versus Yearlings.

1925-'26

Lot	1	2	3	4
Kind of Cattle	Yearlings		Calves	
Method of Handling	Wintered	Wintered	Wintered	Wintered
	well.	well	well.	well.
	Grazed	Grazed	Grazed	Grazed
	May 11, to	May 11	May 11, to	May 11,
	Aug. 1.	to Aug. 1	Aug. 1.	to Aug. 1.
	Full-fed	Full-fed	Full-fed	Full-fed
	100 days	100 days	100 days	100 days
	in dry	on pas-	in dry	on pas-
	lot	ture	lot	ture
Winter Portion (daily)	Pounds	Pounds	Pounds	Pounds
Shelled Corn	4.92	4.92	4.98	4.98
Cottonseed meal	1.00	1.00	1.00	1.00
Alfalfa Hay	1.98	1.98	1.98	1.98
Cane Silage	34.15	34.15	20.92	20.92
Grazing Ration	Pasture	Pasture	Pasture	Pasture
Full Feeding Ration (daily)	Pounds	Pounds	Pounds	Pounds
Ground Corn	16.27	16.17	16.33	16.72
Cottonseed Meal	1.00	.98	1.00	.99
Alfalfa Hay	5.76	-----	5.78	-----
Gains	Pounds	Pounds	Pounds	Pounds
Winter Gain (130 days)	230.20	246.33	191.67	188.74
Pasture Gains (81 days)	54.20	55.40	87.60	83.78
Full -feed Gain (100 days)	240.33	207.13	301.07	238.37
Total Gains	524.73	508.34	580.34	510.89
Necessary selling price per cwt.,	9.76	9.53	9.58	9.86
Selling price per cwt. less 75				
cents per cwt. to cover shrinkage				
and shipping expense Nov. 8, 1926.	\$10.75	\$10.00	\$11.00	\$10.25
Margin per head	11.41	5.30	14.73	3.79

## Wintering with Grain Versus Wintering Without Grain

Experiments conducted with calves during the winters of 1922-'23 and 1923-'24, and experiments conducted with yearling steers in 1924-'25 have already been discussed. These experiments indicated that wintering calves on a light feed of corn in addition to silage, alfalfa hay and cottonseed meal; then grazing without other feed from May 1, to August 1; and then full feeding for 100 days in dry lot might be a satisfactory method of producing well finished cattle. Cattlemen had learned by experience, however, that thin steers will gain more on grass than fleshy steers. They were interested in maximum gain on grass and so there was still a question as to the necessity of feeding any grain during the winter period.

To help answer this question a series of tests was started in the fall of 1926 and continued for three years. Each of these three years one lot of calves was fed a light feed of corn during the winter with cane silage, alfalfa hay and cottonseed meal; and another lot was fed through the winter without any grain. Both lots were

grazed from May 1, to August 1, without any feed other than grass and full-fed 100 days in dry lots after August 1. The three year average of the more important results of these experiments is summarized in the following table. (See Table II).

Table II. - Summary of Three Experiments - 1926-27;  
1927-28; 1928-29; Wintering with Grain  
Versus Wintering without Grain: Grazing:  
and then Full Feeding in a Dry Lot after  
August 1.

Lot	1	2
Kind of Calves	Steer Calves	Steer Calves
Method of Handling	Wintering well grazed May 1, to August 1. Full-fed 100 days in dry lot:	Roughed through the winter. Grazed May 1, to August 1. Full-fed 100 days in dry-lot
Winter Ration (daily)		
Shelled Corn	4.55 pounds	None
Cottonseed meal	.97 "	.97 pounds
Cane Silage	18.40 "	24.04 "
Alfalfa Hay	2.00 "	2.00 "
Winter gain (136 days)	257.61 pounds	182.68 Pounds
Pasture " (90 days)	98.02 "	123.34 "
Full-feed " (100 " )	255.96 "	262.61 "
Total-gain (326 " )	611.59 "	568.63 "
Corn consumed per steer	36.9 bushels	26.2 bushels
Necessary selling price per cwt:	\$10.39	\$10.16
Selling price per cwt.	\$14.92	\$14.58
Margin per head	43.54	40.54

Attention is directed to the fact that this three year average shows that calves in lot 1 fed 4.55 pounds of corn per head daily during the winter produced 611.59 pounds of gain in 326 days on 36.9 bushels of corn and a small amount of cottonseed meal, plus roughage including pasture. They made 16.6 pounds of gain for each bushel of corn consumed.

The calves in lot 2, fed no corn during the winter before going to grass produced 568.63 pounds of gain per head during the 326 days on 26.2 bushels of corn. They made 21.7 pounds of gain for each bushel of corn consumed.

The calves that made the cheapest gains did not produce the greatest profits. The calves that made only 16.6 pounds of gain per bushel of corn consumed netted \$3.00 per head more than the calves that made 21.7 pounds of gain per bushel of corn consumed. One year these two lots sold for the same price per hundredweight but the other two years the cattle fed a small amount of corn during the winter out sold the others.

This three-year test indicates that on the average it is more profitable to feed a limited amount of grain during the winter in addition to silage, alfalfa hay and protein supplement if calves are to be grazed on bluestem grass to August 1 and then full-fed in a dry lot during the summer.



## Full Feeding in a Dry Lot Versus Full Feeding on Bluestem Pasture

There was still a question in the minds of cattlemen as to whether it might not be advisable to finish cattle on grass after August 1, when this general plan of handling was followed rather than to finish in a dry lot after that date. A series of tests was started in the fall of 1929 and repeated the second and third years. The purpose of these tests was to secure data that would help answer this question and also to find out whether it might not be advisable to full-feed all summer on grass.

Three lots of calves were wintered on silage, alfalfa hay, about one pound of cottonseed meal per head per day and an average of 4.75 pounds of shelled corn per head per day.

Lots 1 and 2 were grazed without other feed May 1, to August 1; then lot 1, was full-fed 100 days in dry lot and lot 2, was full-fed 100 days on bluestem grass. Lot 3 was full-fed 146 days on bluestem grass beginning May 1.

The straight average of the results of the three years is summarized in the following table.



Table III. - Summary of Three Experiments: 1929-1930: 1930-1931:  
1931-1932. Full Feeding in a Dry Lot Versus Full  
Feeding on Bluestem Pasture.

Lot	1	2	3
Kind of Cattle	Steer Calves	Steer Calves	Steer Calves
Method of Handling	Wintered well Grazed May 1, to Aug 1. Full: fed 100 days in dry lot	Wintered well Grazed May 1, to Aug 1. Full: fed 100 days on pasture	Wintered well Full fed 146 days on pasture after May 1.
Winter Ration (daily)			
Shelled corn	4.75 pounds	4.75 pounds	4.75 pounds
Cottonseed meal	.99 "	.99 "	.99 "
Cane Silage	18.68 "	18.68 "	18.68 "
Alfalfa hay	2.00 "	2.00 "	2.00 "
Winter gain (135 days)	269.69 pounds	269.11 pounds	267.72 pounds
Pasture gain (90 days)	90.89 "	93.33 "	- - - -
Full-feed gain	285.67 "	270.75 "	283.00 "
Total gain	646.25 "	633.19 "	550.72 "
Corn consumed (per steer)	39.25 bushels	39.07 bushels	42.65 bushels
Necessary selling price per hundredweight to cover steer cost plus feed cost	\$7.82	\$7.65	\$8.75
Appraised price per hundredweight (Kansas City basis less \$.75 per hundredweight)	\$9.00	\$8.08	\$8.83
Margin per head above steer and feed cost	\$11.76	\$4.17	0.69

These data show that the cattle full-fed in dry lot sold for more per hundredweight than cattle similarly full-fed on bluestem pasture. They seemed to have a better finish when full-fed in dry lot although their carcass grades and dressing percentages showed that the cattle full-fed on pasture were fatter and firmer than their hair and general appearance indicated. The cattle full-fed on pasture dressed from 59 to 60 per cent and those full-fed in a dry lot 60 to 61 per cent.

In comparing the profits made by the three lots we find that the lot full-fed on grass during the entire grazing season was the least profitable of all. The cattle finished in dry lot after they had been wintered well and grazed 90 days after May 1, showed the largest profits.

A Comparison of Three Methods of Utilizing  
Bluestem Grass in Fattening Young  
Cattle for Market

An experiment was started in the fall of 1932 to compare three methods of finishing young cattle that have been wintered well and then grazed 90 days without other feed.

Three lots of calves were wintered well. The average daily winter ration per calf consisted of 4.89 pounds of shelled corn, 1.00 pound of cottonseed meal, 18.49 pounds of cane silage and 2.00 pounds of alfalfa hay. They were fed this ration from December 17, 1932 until May 1, 1933. Then each lot of calves was placed on pasture and grazed until July 30. For the next 100 days three different methods of handling were followed in full feeding these three lots.

Lot 1 was full-fed in dry lot for the entire 100 day period on an average daily ration per steer of 14.03 pounds of ground shelled corn, 1 pound cottonseed meal and 4.51 pounds of alfalfa hay.

Lot 2 was full-fed on bluestem pasture for the entire period on an average daily ration consisting of

15.38 pounds of ground shelled corn, 1.00 pound of cottonseed meal plus the bluestem grass.

Lot 3 was full-fed on bluestem pasture 60 days and then 40 days in a dry lot. The average daily ration of lot 3 for the 100 days was 15.04 pounds of ground shelled corn, 1.00 pound cottonseed meal, 3.39 pounds alfalfa hay plus the bluestem grass during the first 60 days while on pasture.

The cattle in lot 1, full-fed in dry lot 100 days after July 30, returned \$ .40 per head over cattle cost plus feed cost. Those in lot 2, full-fed on bluestem grass 100 days after July 30 failed by \$4.79 per head to return cattle cost plus feed cost. The cattle in lot 3, full-fed on bluestem grass 60 days after July 30, and then 40 days in a dry lot failed by \$ .71 per head to return cattle cost plus feed cost. This indicates that full-feeding 100 days in a dry lot is a better method than either full feeding 100 days on bluestem pasture or full feeding 60 days on bluestem grass than 40 days in a dry lot. However, the lot full-fed 60 days on pasture, then 40 days in a dry lot increased the selling price \$ .25 per hundredweight and returns per steer \$4.08 over selling price per hundredweight and returns per steer in lot 2, which was full-fed 100 days on bluestem grass.

These results show that it might be possible to start full feeding on grass August 1, and finish in a dry lot. More work needs to be done to determine how long cattle should be fed in dry lot to make them as attractive to buyers as those fed in a dry lot 100 days.

During the past year, 1933-34, this experiment, full feeding 60 days on grass followed by 40 days in dry lot was repeated but grazing conditions were so unfavorable during August and September that gains were abnormally low and the results were discarded.

### Grazing With and Without Grain

The question arose as to the possibility of obtaining better results with this general plan of producing beef by either discontinuing the winter allowance of grain gradually when the cattle go to grass May 1, or by continuing the winter allowance through the grazing period instead of discontinuing the grain abruptly on May 1. A test was started in December 1933 to get data which would help answer this question.

Three lots of steer calves were wintered well from December 17 1933, to May 1, 1934, receiving an average daily ration per steer consisting of 4.32 pounds of shelled corn, 20.93 pounds of silage, 1.99 pounds of alfalfa hay and 1.00 pounds of cottonseed meal.

On May 1, 1934 all three lots were placed on blue-stem pasture. Lot 1 received no grain after May 1. The winter allowance of grain being discontinued abruptly when they were placed on pasture. The winter allowance of grain was discontinued one pound each week in lot 2 so that in four weeks they were receiving no grain. In lot 3, the winter allowance of grain was continued throughout the grazing period.

All three lots were placed in a dry lot on July 31,

and full-fed 100 days. The average daily feed consumed per steer for the three lots during this full feeding period was:

Lot 1: Ground shelled corn 15.26 pounds; cottonseed meal one pound; alfalfa hay, 4.41 pounds; straw 1.75 pounds.

Lot 2: Ground shelled corn 15.10 pounds; cottonseed meal one pound; alfalfa hay, 4.41 pounds; straw 1.75 pounds.

Lot 3: Ground shelled corn 15.88 pounds; cottonseed meal one pound; alfalfa hay 4.28 pounds; straw 1.75 pounds. Straw was used to furnish part of the roughage this year because of the high price of alfalfa hay.

The results of this test are shown in the following table:



Table IV. — A Three Phase Plan - Wintering,  
Grazing, and Full Feeding.

1933-34 Study - (a) Grazing with and Without Grain

Methods: Lot 1 - wintered well; grazed 90 days without grain; then full fed 100 days in a dry lot.  
 Lot 2 - wintered well; grazed 90 days, the winter allowance of grain decreased gradually but completely within four weeks; then full fed 100 days in a dry lot.  
 Lot 3 - wintered well; grazed 90 days, the winter allowance of grain continued through the grazing phase; then full fed 100 days in a dry lot.

PHASE I. - Wintering - December 17, 1933 to May 1, 1934.

1-Lot Number	: 1	: 2	: 3
2-Age of cattle at beginning of test	: calves	: calves	: calves
3-Number of calves (steers) per lot	: 10	: 10	: 10
4-Daily Ration per steer:	: pounds:	: pounds:	: pounds
Shelled corn	: 4.32 "	: 4.32 "	: 4.32 "
Cotton seed meal	: 1.00 "	: 1.00 "	: 1.00 "
Cane silage	: 20.93 "	: 20.93 "	: 20.93 "
Alfalfa hay	: 1.99 "	: 1.99 "	: 1.99 "
5-Initial weight per steer December 17	: 417.17 "	: 418.83 "	: 415.50 "
6-Weight per steer at end of wintering phase - May 1	: 671.00 "	: 672.50 "	: 651.00 "
7-Gain per steer - wintering: phase - 134 days	: 253.83	: 253.67 "	: 235.50 "
8-Daily gain per steer - wintering phase - 134 days	: 1.89	: 1.89 "	: 1.76 "
9-Cost per 100 pounds gain - wintering phase	: \$ 4.13	: \$ 4.13	: \$ 4.45
10-Initial cost per steer @ \$5.50 per cwt.	: \$ 22.94	: \$ 23.04	: \$ 22.85
11-Feed cost per steer wintering phase - 134 days	: \$ 10.49	: \$ 10.49	: \$ 10.49
12-Steer cost plus feed cost to May 1	: \$ 33.43	: \$ 33.53	: \$ 33.34
13-Necessary selling price at home at end of wintering phase (May 1) to cover steer and feed costs	: \$ 4.98	: \$ 4.99	: \$ 5.12



Table IV. — (con't.)

## PHASE II - Grazing with and without grain May 1 to July 30.

	:	Grazed	:	Grazed	:	Grazed
	:	no	:	Winter	:	winter
	:	grain	:	allowance:	:	allowance
	:		:	grain	:	grain
14-Method of handling	:		:	decreased:	:	continued
during grazing phase	:		:	gradually:	:	
	:		:	but	:	
	:		:	completely:	:	
	:		:	in four	:	
	:		:	weeks	:	
	:		:		:	
15-Amount ground shelled	:		:		:	
corn consumed per steer	:	None	:	1.24 bu:	:	7.75 bu.
during grazing phase -	:		:		:	
90 days	:		:		:	
	:		:		:	
	:	Pounds	:	Pounds	:	Pounds
16-Weight per steer, to	:		:		:	
grass (yearlings) May 1	:	671.00	:	672.50	:	651.00
	:		:		:	
	:		:		:	
17-Weight per steer, end	:		:		:	
grazing phase - July 30	:	771.50	:	781.00	:	795.50
	:		:		:	
	:		:		:	
18-Gain per steer during	:		:		:	
grazing phase - May 1	:	100.50	:	108.50	:	144.50
to July 30	:		:		:	
	:		:		:	
	:		:		:	
19-Daily gain per steer	:		:		:	
during grazing phase	:	1.12	:	1.21	:	1.61
May 1 to July 30	:		:		:	
	:		:		:	
	:		:		:	
20-Steer cost plus feed	:		:		:	
cost to July 30,	:		:		:	
including full season's	:	\$ 36.43	:	\$ 37.57	:	\$ 42.85
grazing charge	:		:		:	
	:		:		:	
	:		:		:	
21-Necessary selling price	:		:		:	
per cwt. at home at end	:		:		:	
of grazing phase	:	\$ 4.72	:	\$ 4.81	:	\$ 5.39
(July 30) to cover	:		:		:	
steer and feed costs	:		:		:	
	:		:		:	

Table IV. — (con't.)

## PHASE III - Full Feeding phase - July 30 to November 7

	:	:	:	:
	:	Dry	:	Dry
22-Where full fed	:	Lot	:	Lot
	:	:	:	:
	:	:	:	:
23-Daily ration per steer (average)	pounds	:	pounds	:
Ground shelled corn	:	15.26	:	15.10
Cotton seed meal	:	1.00	:	1.00
Alfalfa hay-100 days	:	4.41	:	4.41
Straw - 100 days	:	1.75	:	1.75
Bluestem pasture	:	----	:	----
24-Maximum daily ground shelled corn consumption per steer	:	19.20	:	19.20
25-Weight per steer at beginning of full feeding phase - July 30:	771.50	:	781.00	:
26-Weight per steer at end of full feeding phase-Nov. 7.	:	1049.83	:	1033.83
27-Gain per steer - full feeding phase - 100 days	:	278.33	:	252.83
28-Daily gain per steer - full feeding phase - 100 days	:	2.78	:	2.53
29-Cost per 100 pounds gain - full feeding phase	:	\$ 10.72	:	\$ 11.71
30-Feed cost per steer - full feeding phase - 100 days	:	\$ 29.83	:	\$ 29.60
31-Steer cost plus fd. cost at end of full feeding phase November 7.	:	\$ 66.26	:	\$ 67.17
32-Necessary selling price per cwt. at home at end of full feeding phase (Nov.7) to cover steer and feed costs	:	\$ 6.31	:	\$ 6.50
33-Value per cwt. at home at end of full feeding phase (appraised price per cwt. Kan., City basis less \$0.75 per cwt. to cover shrinkage, shipping and selling expenses)	:	\$ 7.25	:	\$ 7.00
34-Margin per cwt. over steer and feed costs	:	\$ .94	:	\$ .50
35-Margin per steer over steer and feed costs	:	\$ 9.87	:	\$ 5.17
36-Total gain per steer all three phases (pounds)	:	632.66	:	615.00
37-Total corn fed per steer all three phases (bushels)	:	37.58	:	38.54
	:	:	:	:

The steers in lot one made an average gain per steer of 278.33 pounds or an average daily gain per steer for the 100 days of 2.78 pounds. The steers in lot two made an average gain per steer of 252.83 pounds or an average daily gain per steer of 2.53 pounds for the 100 days. Lot three made an average gain per steer of 260.33 pounds or an average daily gain per steer of 2.60 pounds during the 100 days.

When the steers were ready for market November 7, the weight per steer in lot one averaged 1049.83 pounds. Lot two averaged 1033.83 pounds per steer and lot three averaged 1055.83 pounds per steer.

The appraised value per hundredweight of the steers in lots one and three, less \$0.75 to cover shipping expense and shrinkage was \$7.25 while in lot two it was \$7.00.

The steers in lot one where the winter grain allowance had been discontinued abruptly when they were placed on pasture May 1, made a margin per steer over steer and feed cost of \$9.87. The steers in lot two where the winter grain allowance had been discontinued gradually over a period of four weeks when they were placed on pasture May 1, made a margin per steer over steer and feed cost of \$5.17. The steers in lot three

where the winter grain allowance had been continued throughout the grazing period made a margin per steer over steer and feed cost of only \$3.06.

During the wintering phase of this experiment the prices charged for feeds were as follows:

Shelled corn	\$ .42 per bushel
Cottonseed meal	27.50 per ton
Silage	2.50 per ton
Alfalfa hay	6.00 per ton

During the grazing and full feeding phases the prices charged for feeds were:

Ground shelled corn	\$ .84 per bushel
Cottonseed meal	\$38.70 per ton
Alfalfa hay	20.00 per ton
Straw	7.00 per ton
Pasture	3.00 per head

The results of this experiment indicate that it is not profitable to feed grain during the grazing phase of this three phase plan. The cattle whose grain allowance was continued through the grazing phase gained 44 pounds more per head during this phase than the cattle whose grain allowance was discontinued abruptly when they were turned on bluestem grass. Those whose winter grain allowance was discontinued gradually gained eight pounds more per head during this phase than those whose grain

allowance was discontinued abruptly. During the full feeding phase, however, the difference in gains during the grazing phase disappeared to a large extent. Definite conclusions cannot be drawn until this experiment is repeated at least twice.

## GENERAL DISCUSSION

There are many advantages of this three phase plan of producing beef with young cattle.

Calves make about one-third more gain than mature steers on the same amount of feed. About 600 pounds of gain can be produced for each 40 bushel of corn. The average over a period of several years at the Kansas Agricultural Experiment Station has been around 625 pounds. At the Nebraska Experiment Station 1 calves made more economical gains than any of the other classes of cattle in a comparison which was made of the rate and economy of gains of three-year olds, two-year olds and yearling steers and steer calves on a ration of shelled corn and alfalfa hay.

The average results of four trials showed that the two and three-year olds made more rapid gains during the first 100 days than did the yearlings and calves but during the second half of the feeding period the calves gained more rapidly than older cattle. Calves made as much gain from 61.2 pounds of feed as yearlings did from 92.2 pounds, two-year olds from 94.2 pounds and three-



year olds from 100 pounds. The three-year old cattle required less time for finishing than the younger classes of animals. These data show the desirability of using young cattle in this three phase method of producing beef. Young cattle dressing 60 per cent or better can be produced in this way and only a small percentage of the trade demands a higher finish.

This plan demands the use of good quality cattle. Only calves of strictly beef type will fatten at so early an age and it is necessary that these calves grade near the top so that they will command a premium when they are marketed. During the fall months the stock markets receive thousands of head of grass fattened steers and cows and heifers that are culled from breeding herds at the end of the grazing season. This causes a decline in prices of low grade slaughter cattle in the fall. But while the prices of low grade cattle are declining there is normally a seasonal rise in the prices of the better grades of fat cattle which ordinarily reaches its highest level in October and November because of the small proportion of fed cattle at that time.

The three year test conducted from 1926 to 1929 indicated that on the average it is more profitable to feed a limited amount of grain to calves during the winter when this general plan of feeding is to be followed. This

is due to the fact that when calves are wintered well they carry more finish the following fall when they are marketed. The market is usually sufficiently discriminating to pay for the corn consumed during the winter period. Calves should be kept growing and in good condition so that they will carry the desired finish when marketed. The desirability of wintering well has been questioned by some because of the small gain secured from grass. But in this case a larger gain on grass does not mean a larger ultimate margin per steer.

The results of experiments conducted at the Kansas Agricultural Experiment Station indicate that with this general plan of feeding cattle it is profitable to graze steers 90 days on bluestem grass with no other feed beginning May 1. Grass in this way can be utilized to its maximum capacity during that portion of the year when it is at its best.

Twice as many cattle can be grazed per unit of pasture for the first 90 days as for the entire grazing season.

Feeding experiments indicate that larger and more economical gains can be made in a dry lot after August 1, than on pasture. Cattle fed in the dry lot from August 1,



until marketed in the fall show more finish and sell for more than the pasture fed cattle. During the three years of tests made at the Kansas Experiment Station for 1929 to 1932 the average appraised value when marketed was \$0.92 per hundredweight more for the dry lot fed cattle.

All cattle used for this comparison had been previously wintered well and then grazed without grain. The cattle full fed on bluestem grass did not look as well finished when marketed as the cattle full fed in dry lot. Market men commented that the cattle full fed on pasture looked "green".

Cattle feeding problems in other states are quite different than the problems encountered in the bluestem area of Kansas. It is interesting to note, however, that experiments conducted in other states have shown that under other conditions where the so called deferred system is not followed, better results have been obtained by summer dry lot feeding than by summer pasture feeding.

A test made at the Illinois Station /2 using mature steers showed that 10 per cent more concentrates per 100 pounds of gain were required on pasture than in dry lot. It must be remembered, however, that this comparison was made using mature steers.

The "deferred" system of feeding utilizes large amounts of bluestem grass; produces a maximum of gain from a minimum of grain and produces lightweight good quality cattle which are in most demand on the cattle market.

These cattle will continue to make economical gains for 60 to 90 days if the feeder desires to carry them on to a higher degree of finish.

### CONCLUSIONS

All of the problems which have arisen in considering a plan of utilizing bluestem grass in fattening cattle for market have not yet been solved. Certain points are mere indications and may yet be disproved. However, it is believed that certain conclusions can be drawn as regards this general plan of producing beef and information which has been obtained from the results of the experiments conducted up to the present time can be used as a basis for the following recommendations to cattle feeders in the bluestem pasture area.

1. Cattle feeders in this area should start with well bred, quick maturing steer calves in the fall which weigh approximately 350 to 400 pounds.

2. The calves should be wintered well. The winter ration used will depend on the availability of feeds and individual conditions, but it is desirable to feed a limited grain ration. The following winter ration has proved satisfactory at the Kansas Agricultural Experiment Station. Corn, four to five pounds, alfalfa hay, two pounds, Cottonseed meal, one pound, and all the silage they will eat.

3. About May 1, these steers should be placed on bluestem pasture and grazed until August 1.

4. About August 1, they should be placed in a dry lot and full-fed for 100 days. The following ration has proved to be very satisfactory although any ration should be varied somewhat to meet individual conditions of feed supply and fluctuations in availability and prices of different feeds:

Ground shelled corn	15.50 pounds per head daily.
Cottonseed meal	1 pound per head daily.
Alfalfa hay	4.50 pounds per head daily.

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