

of dry mature bluestem pasture. The second lot of 11 heifers was put in drylot.

The roughage portion of the ration for the pasture and drylot heifers consisted of dry bluestem grass and prairie grass hay, respectively. The concentrate fed to both lots of heifers consisted of a mixture of 75 percent ground sorghum grain, 10 percent dehydrated alfalfa meal, 10 percent soybean oil meal, and 5 percent molasses made into a  $\frac{3}{8}$ -inch pellet. Both the roughage and concentrate were fed free choice.

#### Observations and Results

The results of this experiment appear in Table 26. Observations and results under the conditions of this trial were as follows:

1. Heifers fattened in drylot were more desirable in practically every respect. They made 0.64 pound more average daily gain, and consequently gained 65 pounds more per head for the fattening period of 176 days.

2. Drylot-fattened heifers produced gain for \$2.60 less per cwt. than the pasture-fattened heifers.

3. The pasture-fattened heifers sold for less on the market, had a greater shrink to market, but yielded slightly higher than the drylot heifers.

4. The average carcass grade for the drylot- and pasture-fattened heifers was average good and high standard, respectively. This is an advantage of two thirds of one grade for the drylot heifers.

5. The drylot heifers had larger ribeyes, more marbling, a firmer lean, and thicker fat at the 12th rib.

Table 26

Fattening heifer calves on dry bluestem pasture versus fattening in the drylot.

December 12, 1957, to June 8, 1958—176 days.

Treatment	Pasture	Drylot
No. calves per lot	10	11
Av. initial wt. per head	346	351
Av. final wt. per head	643	713
Av. gain per head	297	362
Av. daily gain per head	1.69	2.05
Av. daily ration:		
Pasture	6 months	
Prairie hay, lbs.		3.6
Pellet, lbs. <sup>1</sup>	10.6	13.3
Lbs. feed per cwt. gain:		
Pasture	6 months	
Prairie hay, lbs.		175
Pellet, lbs.	628	647
Feed cost per cwt. gain	\$19.94	17.34
Selling price per cwt. at market	25.00	26.00
% shrink to market	4.6	3.3
Dressing %	58.5	58.0
Carcass data, USDA grades:		
Av. standard	3	
High standard	4	
Low good	2	3
Av. good	1	2
High good		5
Low choice		1
Av. carcass grade <sup>2</sup>	15.1	17.4
Av. fat thickness at 12th rib <sup>3</sup>	5.0	4.0

1. Pellet— $\frac{3}{8}$  inch diameter pellet composed of 75% ground sorghum grain, 10% dehydrated alfalfa meal, 10% soybean oil meal, and 5% molasses.

2. Low choice, 19; high good, 18; average good, 17; low good, 16; high standard, 15; average standard, 14.

3. Very thick, 1; thick, 2; moderately thick, 3; modestly thick, 4; slightly thin, 5.

Table 26 (Continued)

Av. degree of marbling <sup>1</sup>	9.5	8.2
Av. size of ribeye <sup>2</sup>	5.0	4.0
Av. firmness of lean <sup>3</sup>	4.2	4.0

4. Modest, 6; small amount, 7; slight amount, 8; traces, 9.

5. Very large, 1; large, 2; moderately large, 3; modestly large, 4; slightly small, 5.

6. Very firm, 1; firm, 2; moderately firm, 3; modestly firm, 4; slightly soft, 5; soft, 6.

Adapting Roughages Varying in Quality and Curing Processes to the Nutrition of Beef Cattle, 1958-1959. Project 370.

Pelleted Alfalfa Hay and Dehydrated Pelleted Forage-Type Sorghum in the Winter Ration of Heifer Calves.

F. W. Boren, E. F. Smith, B. A. Koch, D. Richardson, and R. F. Cox

Alfalfa hay and sorghum silage are used extensively in the winter rations of cattle in Kansas, and considerable experimental work has been done with these two roughages to determine their value in winter rations.

In recent years much attention has been given to the physical form in which a roughage should be harvested, stored, and fed to cattle. This experiment is to compare the feeding value of alfalfa fed as long hay or coarsely-ground hay pellets, and forage-type sorghum fed as silage or dehydrated forage sorghum pellets.

#### Experimental Procedure

The hay used in this study consisted of good-quality, third-cutting alfalfa. It was cut, cured, and baled in the field and stored in a conventional hay shed. After having been in storage 2 months, a part of the alfalfa hay was removed from the barn, coarsely ground through a  $\frac{1}{4}$ -inch screen, made into  $\frac{3}{8}$ -inch pellets by a local feed processor, and stored for later feeding.

The forage-type sorghum was field harvested in mid-October with the usual silage equipment. The loads were alternately ensiled in upright silos or dehydrated, finely ground, and pelleted into  $\frac{3}{8}$ -inch pellets. These pellets were then stored in bulk for later feeding.

The prairie hay used was of good quality. It was grown on a local farm meadow.

Fifty head of choice-quality heifer calves from the Jeff Ranch, Fort Davis, Texas, were used in this experiment. They were allotted into five lots, 10 head per lot, on the basis of live weight. They were fed a winter ration consisting entirely of alfalfa hay or pellets and either sorghum silage or dehydrated pelleted sorghum for 126 days.

The winter ration fed each lot per head daily was as follows:

Lot 1. Five pounds alfalfa hay plus sorghum silage free choice.

Lot 2. Five pounds alfalfa pellets plus sorghum silage free choice.

Lot 3. Five pounds alfalfa hay plus dehydrated sorghum pellets free choice.

Lot 4. Five pounds alfalfa pellets plus dehydrated sorghum pellets free choice.

Lot 5. Five pounds alfalfa pellets plus dehydrated sorghum pellets free choice plus 1.0 pound prairie hay.

#### Results and Observations

The results of this experiment are reported in Table 27. An examination of this table reveals the following:

1. Average daily gains made by the heifers were considered satisfactory in all lots.

2. Using lot 1, which received alfalfa hay and silage, as a control, there was a statistically significant difference between the average daily gains made by the heifers in lot 1 and lots 2, 3, 4, and 5.

3. The percentage increase in average daily gain made by the heifers in lots 2, 3, 4, and 5 over lot 1 was 20, 28, 50, and 43, respectively.

4. There was no statistically significant difference between the gains made by lots 2 and 3 or lots 4 and 5. This may be interpreted as meaning that the increased average daily gains due to pelleting either alfalfa hay or forage-type sorghum over nonpelleting were significant, and that the addition of 1 pound of prairie hay per head per day to an all-pelleted roughage ration did not significantly change the average daily gains.

5. The increased gains resulting from feeding pelleted alfalfa hay and dehydrated pelleted forage sorghum together were significantly greater than when only one of the roughages was pelleted.

6. Under this system of feeding where the alfalfa hay pellets were limited to 5 pounds per head per day and the dehydrated pelleted forage sorghum was fed free choice, the pelleted alfalfa hay affected the variability of gains between lots 28 percent, whereas the pelleted forage sorghum effect was 52 percent. Therefore, it was more advantageous to pellet the forage sorghum than the alfalfa under this feeding regime.

7. There were no adverse effects of an all-pelleted forage ration upon the heifers in lot 4. This was the most uniformly performing lot of the experiment.

8. The average dry matter consumed per head per day increased sharply when dehydrated pelleted forage sorghum was fed. The dry matter consumed increased 2, 34, 39, and 41 percent for lots 2, 3, 4, and 5, respectively, over lot 1.

9. The largest quantity of dry matter required per cwt. gain was in lot 1 where alfalfa hay and silage were fed. The smallest quantity of dry matter required per cwt. gain was by lot 2, silage and alfalfa pellets, and lot 4, pelleted alfalfa hay and dehydrated pelleted forage sorghum.

10. Feed cost per cwt. gain reflects not only the price of feed, but the increased dry matter consumption. As the dry matter consumption increased, the cost per cwt. gain increased.

Table 27

The effect of pelleted alfalfa hay and dehydrated pelleted forage-type sorghum<sup>1</sup> on the winter performance of weaning heifer calves.

Wintering—November 24, 1958, to March 30, 1959, incl.

Lot number .....	1	2	3	4	5
No. heifers per lot ....	10	10	10	10	10
Av. initial wt. per heifer, lbs. ....	406	406	406	403	406
Av. final wt. per heifer, lbs. ....	538	565	575	602	596
Av. gain per heifer, lbs. ....	132	159	169	199	190
Av. daily gain per heifer, lbs. ....	1.05	1.26	1.34	1.58	1.51
Percentage increase in av. daily gain ....		20	28	50	43
Av. daily ration per heifer, lbs.:					
Alfalfa hay .....	5.0		5.0		
Ground alfalfa hay pellets .....		5.0		5.0	5.0
Sorghum silage <sup>2</sup> ....	21.4	22.0			
Dehydrated pelleted sorghum <sup>2</sup> ..			11.0	11.6	10.9
Prairie hay .....					1.0
Av. dry matter consumed per head per day .....	11.26	11.45	15.08	15.65	15.90

1. Feed prices may be found inside back cover.

2, 3. Contributed by CK Dehydrating Ass'n, Salina, Kans.

Table 27 (Continued)

Percentage increase in dry matter consumption .....	2	34	39	41
Lbs. feed per cwt. gain:				
Alfalfa hay .....	477	373		
Ground alfalfa hay pellets .....		396	317	332
Sorghum silage .....	2041	1744		
Dehydrated pelleted sorghum ....			817	723
Prairie hay .....				66
Av. dry matter required per cwt. gain .....	1074.38	907.18	1121.76	992.66
Av. feed cost per cwt. gain <sup>1</sup> .....	\$7.72	8.91	12.27	12.85
			13.24	

# Improvement of Beef Cattle Through Breeding Methods. Project 286.

W. H. Smith, L. A. Holland, and J. D. Wheat.

The purebred Shorthorn cattle-breeding project was continued during 1958 and thus far in 1959 according to the plans and breeding programs established in 1949. Two inbred lines have been established. These are referred to as the Wernacre Premier and the Mercury lines with reference to the foundation sires which were used initially for the development of the two lines. The Wernacre Premier line has reached the fourth generation of inbreeding, while the Mercury line is in the third generation of inbreeding at present. During 1957 only one inbred Wernacre Premier bull was retained for breeding purposes. This bull proved to be sterile during the early breeding season, which necessitated the breeding of the Wernacre Premier line females to an inbred Mercury line bull. This situation resulted in the production of a number of line-cross calves during 1958. Two inbred Wernacre Premier bulls are available in the experimental cattle at this time. One of these was used as a sire during 1958, so the continuation of the inbreeding program with the Wernacre Premier line has been resumed and will continue in the future. The basic inbreeding plan has been the continued mating of half-brothers to half-sisters during the progress of the study.

This experiment was initiated to study the inheritance of beef cattle production traits and to evaluate the effects of inbreeding on production. To date, no abnormalities, which could be attributed to inbreeding, have occurred in either of the inbred lines. Analyses of the data indicate that inbreeding has lowered the weaning weights of the calves.

To date, no extensive line crossing has been introduced in the experiment. More intensive line crossing will be initiated at some time in the future to study the feasibility of utilizing inbred lines of beef cattle for the breeding improvement of productivity.

Birth weight of calves and the weight of each cow are taken at the time of calving. The calves are born in the spring of each year as the result of summer pasture breeding. The calves are not creep fed during the suckling period while the cows are on grass. Calves are weaned at approximately 6 months of age, at which time they are scored for type and conformation and weighed. After a three-week adjustment period, the calves are placed on individual feeding trials or record-of-performance tests for a 182-day period. Weight gain and feed consumption records are maintained on each calf.

The full-feed ration for the bulls and steers consists of 75 percent cracked corn and 25 percent chopped alfalfa hay; that for the heifers, 55 percent cracked corn and 45 percent chopped alfalfa hay.

Approximately one half of the bull calves were castrated each year prior to 1958. In 1958 none of the bulls was castrated, in order to in-