animals in the project and the relatively low level of inbreeding which has prevailed in the breeding herds. The line crossing practiced thus far in the study has been largely the result of the fact that bulls of the Wernacre's Premier line have not been available to accommodate the breeding of that line in its entirety during some years. This has necessitated the breeding of a limited number of Wernacre Premier line females to Mercury line bulls.

No abnormalities which could be attributed to inbreeding have occurred in either of the inbred lines. Inbreeding has lowered the weaning weights of calves; however, this breeding plan has had no apparent effects on rate of gain or efficiency of feed utilization on the calves as evidenced by analyses of data collected on these characteristics.

The weight of each cow and the weight of each calf are taken immediately after the time of calving. Summer pasture breeding is practiced and the calves are born in the spring of each year. The calves are not creep fed during the suckling period. Calves are weaned, weighed, and scored for type when they are approximately 6 months old. After a short preliminary adjustment period following weaning, they 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 calves are scored for type again as yearlings on completion of their feeding trials.

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

Production data for the 1959 calves are summarized in Table 17.

Because the Wernacre Premier line was established somewhat earlier than the Mercury line, the Wernacre Premier calves have been more highly inbred than the Mercury calves during the progress of the project. Three line-cross calves produced by Wernacre Premier cows are included in the 1959 calf crop.

The 1960 calves have not completed their feeding tests at the time of this report, so data for them are not included. Thirty calves of the 1960 calf crop are being individually fed.

Artificially Dried Corn in Cattle Rations.

D. Richardson, E. F. Smith, B. A. Koch, F. W. Boren, and J. K. Ward

With improved harvesting machinery, farmers tend to harvest grain earlier to prevent loss by lodging or inclement weather. This often results in grain being too high in moisture for normal storage, and means that it must be stored in an air-tight container or dried, if it is to enter normal storage. There are ways of drying grain with and without heated air.

The wet milling industry for many years has had difficulty in processing corn artificially dried at high temperatures. Opinions vary about the effect that drying grain has on its feeding value. Reports of controlled work to evaluate any effect produced are few. This test was conducted to compare the feeding value of corn dried with and without heated air in beef cattle rations.

Experimental Procedure

The corn was produced at the Courtland Irrigation Research Farm near Belleville. The drying was done by the University's agricultural engineering department. All the corn came from the same field. Three lots of 10 heifer calves each were used. Sorghum silage was fed as the roughage and each animal received 1 pound of soybean oil meal daily. Minerals and salt were fed free choice. The corn for each lot was dried as follows:

Control. Harvested November 2, initial moisture 25%, final moisture 13.5%, dried 394 hours with 1½ hp Butler natural air-drying system (no heat).

Note: Due to weather conditions, corn for following lots could not be harvested until November 24 and 30.

180°F. Harvested November 24, initial moisture 19.3%, final moisture 13.2%, dried in 250-bushel Tox-O-Wik Batch Dryer with air heated to 180°F.

230°F. Harvested November 30, initial moisture 21.2%, final moisture 12.7%, dried in 250-bushel Tox-O-Wik Batch Dryer with air heated to 230°F.

All corn was sacked and stored. It was ground as needed.

Rumen samples were obtained from each animal to study the concentration and percentage distribution of volatile fatty acids in the rumen fluid.

Results and Discussion

There was very little scorching of grain even at the highest temperature. However, corn dried with heated air, especially at 230°F., tended to lose its bright yellow color and also to separate from the outer coat on cracking. The animals did not want to eat the corn dried at 230°F.; however, they started eating satisfactorily on the second day and no further serious palatability trouble was encountered. While the grain was in storage, it was observed that mice ate the air-dried corn very readily, some of that dried at 180°F., but very little of the corn dried at 230°F.

There were no significant differences in the total concentration of acetic, propionic, or butyric acids in the rumen fluid or in the proportions of acetic and butyric acids. The proportion of propionic acid increased at higher drying temperatures with levels of 23.2, 26.7, and 28.1 percent respectively, for the control, 180°F. and 230°F. drying temperatures. Differences in the proportions of propionic acid approached significance at the 5 percent level.

Feedlot results are shown in Table 18. Rate of gain was affected by severe weather conditions and cases of founder and foot rot which seemed to be distributed equally throughout each lot.

There were no significant differences in rate of gain, feed efficiency, or carcass characteristics.

Under the conditions of this experiment, the nutritive value of grain for cattle was not affected by artificially drying at high temperatures. However, initial acceptability of the grain was affected. Therefore, it seems advisable not to change abruptly from normal to artificially dried grain while fattening cattle. This could result in lowered consumption or possibly "going off feed."

Table 18

The value of artificially dried corn in beef cattle rations.

December 10, 1959, to July 11, 1960—215 days.

	Control	180°F.	230°F.
Number heifers per lot	10	10	10
Av. initial weight per heifer, lbs.	466.5	466.5	465.5
Av. final wt. per heifer, lbs.	811.5	810.5	816.5
Av. gain per heifer, lbs.	345	344	351
Av. daily gain per heifer, lbs.	1.60	1.60	1.63
Total feed consumed, lbs.:			
Soybean oil meal	2150	2150	2150
Corn	22245	22515	22265
Sorghum silage	20025	21105	20100
Salt	75	72	87
Salt and bonemeal, ½ and ½ mix	127	112	127
Av. daily feed per heifer, lbs.:			
Soybean oil meal	1	1	1
Corn	10.3	10.5	10.4
Sorghum silage	9.3	9.8	9.3
Salt	.035	.033	.040
Salt and bonemeal mix	.060	.052	.060

Table 18 (Continued)

Av. feed per cwt. gain, lbs:			
Soybean oil meal	62.3	62.5	61.3
Corn	644.8	654.5	634.3
Sorghum silage	580.4	613.5	572.6
Salt	2.2	2.1	2.5
Salt and bonemeal mix	3.7	3.3	3.6
Feed cost per cwt. gain	$ 16.69	16.96	16.43
Feed cost per animal	$ 57.58	58.34	57.67
% shrink to market	2.8	2.5	2.6
Dressing %, feedlot wt.	59.4	60.3	60.4
Dressing %, pay wt.	61.1	61.8	61.9
Av. carcass wt., lbs.	482	488.7	492.8
Av. finish: Thickness[1]	3.4	3.7	3.4
Distribution[2]	3.8	3.6	3.7
Degree of marbling[3]	6.6	6.8	6.6
Size of ribeye[4]	4.3	4.4	4.6
Degree of firmness[5]	3.5	3.6	3.3
Carcass grades:			
Top choice	..	..	..
Av. choice	2	3	..
Low choice	2	..	4
Top good	4	5	4
Av. good	2	2	2
Av. carcass value (choice 41.5¢) .... (good 39.0¢)	$193.07	194.46	196.81

1. Based on 2, thick; 3, moderate; 4, modest.

2. Based on 2, uniform; 3, moderately uniform; 4, modestly uniform; 5, slightly uneven.

3. Based on 4, slightly abundant; 5, modest; 6, moderate; 7, small amount.

4. Based on 3, moderately large; 4, modestly large; 5, slightly small; 6, small.

5. Based on 2, firm; 3, moderately firm; 4, modestly firm; 5, slightly firm.

The Value of Enzyme Preparation Added to Cattle Rations (Project Com. 5-662)[1]

D. Richardson, B. A. Koch, E. F. Smith, F. W. Boren, and J. K. Ward

Feed is stored nutrients. The value of the feed depends on the nutrients contained and the ability of animals to obtain these nutrients for their bodies to use. Enzymes are organic catalysts that have the primary responsibility of breaking down food in the digestive tract so it can be absorbed and used. The more efficiently this process is done, the greater the value of the feed. This test was conducted to study the value of added commercial enzyme preparations to cattle-fattening rations.

Experimental Procedure

Three lots of 10 heifer calves each were fed the same ration except for the added enzyme preparations. Ingredients and average daily consumption are shown in Table 19. Lot 1 served as the control. The enzyme preparations were added to the soybean oil meal at the following rates per ton: Lot 2, 2.5 lbs. amylase (acts on carbohydrates); Lot 3, 2.5 lbs. amylase plus 6 lbs. protease (acts on proteins). Rumen samples were obtained to determine the concentration of volatile fatty acids and percentage distribution of acetic, propionic, and butyric acids in the rumen fluid.

Results and Discussion

Results of the feedlot test are shown in Table 19. Rate of gain was affected by severe weather conditions and cases of founder and foot

1. We wish to acknowledge Rohm & Haas Company, Philadelphia, Pennsylvania, for partial support of this project and for supplying the enzyme preparations.

Table 19

Enzymes in beef cattle fattening rations.

December 10, 1959, to July 11, 1960—215 days.

Lot number	1	2	3
Added enzyme preparation	None	Amylase	Amylase+ Protease
Number heifers per lot	10	10	10
Av. initial wt. per heifer, lbs.	466	466	467
Av. final wt. per heifer, lbs.	829	792.5	811
Total gain per lot, lbs.	3630	3265	3440
Av. gain per heifer, lbs.	363	326.5	344
Av. daily gain per heifer, lbs.	1.69	1.52	1.60
Total feed consumed per lot, lbs.:			
Soybean oil meal	2150	2150	2150
Corn	21915	20905	21860
Alfalfa hay	2080	2080	2080
Sorghum silage	21010	20685	20985
Salt	92	67	57
Salt and bonemeal, ½ and ½ mix	137	107	107
Av. daily feed per head, lbs.:			
Soybean meal	1	1	1
Corn	10.2	9.7	10.2
Alfalfa hay	1.0	1.0	1.0
Sorghum silage	9.8	9.6	9.8
Salt	.043	.031	.030
Salt and bonemeal mix	.064	.050	.050
Av. feed per 100 lbs. gain, lbs.:			
Soybean meal	59.2	65.8	62.5
Corn	603.9	640.4	635.5
Alfalfa hay	57.0	63.7	60.5
Sorghum silage	578.8	633.7	610.2
Salt	2.5	2.1	1.7
Salt and bonemeal mix	3.8	3.3	3.1
Feed cost per 100 lbs. gain*	$ 16.22	17.35	17.04
Feed cost per animal	58.88	56.65	58.62
% shrink to market	3.4	3.5	2.9
Dressing %, feedlot wt.	59.6	61.0	59.8
Dressing %, pay wt.	61.7	63.2	61.6
Av. carcass wt., lbs.	493.7	483.6	485.2
Finish:			
Thickness[1]	3.4	3.7	3.7
Distribution[2]	3.9	3.3	3.8
Degree of marbling[3]	5.9	6.6	6.3
Size of ribeye[4]	4.6	4.4	4.3
Degree of firmness[5]	3.2	3.4	3.2
Carcass grades:			
Top choice	1	1	..
Av. choice	1	..	3
Low choice	4	3	2
Top good	2	4	5
Av. good	2	2	..
Av. carcass value (choice 41.5¢) .... (good 39.0¢)	$200.13	193.54	195.25
Av. carcass value less feed cost	$141.25	136.89	136.63

* Not including enzymes.

1. Based on 2, thick; 3, moderate; 4, modest; 5, slightly thin.

2. Based on 2, uniform; 3, moderately uniform; 4, modestly uniform; 5, slightly uneven.

3. Based on 4, slightly abundant; 5, moderate; 6, modest; 7, small amount.

4. Based on 2, large; 3, moderately large; 4, modestly large; 5, slightly small; 6, small.

5. Based on 2, firm; 3, moderately firm; 4, modestly firm; 5, slightly firm.