BULLETIN B-483 — MAY 1, 1965

52ND ANNUAL LIVESTOCK FEEDERS' DAY

1964-65 PROGRESS REPORTS

KANSAS AGRICULTURAL EXPERIMENT STATION, KANSAS STATE UNIVERSITY

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SHEEP

CATTLE

SWINE

ON THE COVER

Yearling steers on experimental grazing unit. Range raised cattle are used in tests involving rate of stocking, pasture burning, deferred grazing and many other aspects of grass utilization.

52nd Annual Livestock Feeders' Day

SATURDAY, MAY 1, 1965

ANIMAL HUSBANDRY DEPARTMENT

KANSAS STATE UNIVERSITY

MANHATTAN, KANSAS

8:00-10:00 a.m.

Arena, Experimental livestock on exhibit

10:00 a.m.

Arena—Presiding, Mel Harper, Sitka, Kansas, President, Kansas Livestock Association

Brief Summaries of:

Heifers wintered on dry grass, protein requirements
Calves wintered on pasture, vitamin A and phosphorus
Pasture burning, deferred grazing, stocking rates, 15 years
Cattle wintering rations of prairie hay and urea
Full-grain-fed cattle fed cottonseed hulls and wheat bran
Fattening steers on high and low levels of silage
Comparison of southwest, northwest, northeast, and southeast Kansas forages for fattening steers
Steers build their own protein from non-protein nitrogen
Sorghum silage fortified with additives
Soybean meal, dehydrated alfalfa and urea for fattening cattle
Cane molasses vs. wood molasses for cattle
Lights in the cattle feed lot
Additives in rations of young pig
Wheat and its by-products for swine
Maximizing feed value of milo for hogs
Fineness of grinding of milo and wheat for hogs
Meats, sheep and lambs, and other summary reports

12 noon

Lunch, Arena

1:30 p.m.

GUEST SPEAKER—

MR. KEN MONFORT, GREELEY, COLORADO
Commercial Cattle Feeder
and
Packing Plant Operator

2:00 p.m.

Questions

3:00 p.m.
Adjournment

6:30 p.m.
Block and Bridle Banquet for visiting stockmen and parents

FOR THE LADIES

Friday, April 30, 1965

6:30 p.m.
Dinner, Gillett Hotel

Saturday, May 1, 1965

9:30 a.m.
Coffee, Justin Hall, Animal Husbandry ladies

10:30 a.m.
Demonstrations, College of Home Economics

12:00 noon
Lunch, Animal Husbandry Arena

6:30 p.m.
Block and Bridle Banquet (See general program)

Sheep

Investigations of Milk-fat Lamb Production Practices for Western Kansas, Colby.*

Results for 1963-64 Creep-feeding Tests and 1964 Ewe Preflushing and Flushing Tests.

C. S. Menzies, Animal Husbandry Department, Kansas State University
Evans Banbury, Superintendent, Colby Branch Station
Henry Elliott, Livestock Project Leader, Colby Branch Station

Experimental Sheep

A flock of approximately 450 commercial finewool ewes is maintained at the Colby Branch Experiment Station. They have produced second, fifth and sixth lamb crops. The ewes were purchased in southwest Texas as yearlings, and have been in production since. Purebred Hampshire rams are used.

General Procedure

The ewe flock is handled in an early-lambing program with the breeding season beginning June 1 and terminating September 1. Lambs are creep-fed and sold as milk-fat lambs during spring and early summer.

Three separate tests are conducted during the year. (1) The effects of varying levels of energy intake by ewes, during a preflushing period, on lambing performance. (2) Testing various rations for flushing ewes and ration effects on lambing performance. (3) A study of different management practices and rations for creep-feeding lambs.

Lamb Feeding Tests, 1963-1964

Procedure: To study effects of various creep-feeding rations and management practices on lamb gains and production of milk-fat lambs for a spring market, ewes and lambs were divided into eight test groups. The division into groups was based on type of lamb birth (multiple or single) and lamb age. After ewes lambed, ewes and lambs were given an adjustment period of 7-10 days. Lambs were docked at 1-2 days of age with rubber bands and were knife castrated when 7 to 10 days of age.

After being allotted to test groups, all ewes received a uniform nursing ration until lambs were weaned, except that Lot 2 ewes received rye pasture only. The lambs in Lots 1 and 3 were weaned when 8 to 10 weeks old. Ewes in those two lots then were fed a maintenance ration. Lambs in the various lots had access to a creep as soon as assigned to test groups. Lamb rations were self-fed in an open trough.

Lamb and ewe treatments follow:

Lot no.	Lamb ration and treatment	Ewe treatment
1	Mixture: 45% dry-rolled sorghum grain 55% ground alfalfa hay Weaned 8 to 10 weeks of age	Standard nursing ration[1] until lambs were weaned, then maintenance ration[2]
2	Rye pasture Whole sorghum grain Alfalfa hay	Rye pasture—Nov. 6, '63, through April 6, '64, except Feb. 15 through Feb. 21 and March 19 through April 6. Fed 1 pound alfalfa and silage free choice during those periods in addition to pasture

* Contribution No. 330, Department of Animal Husbandry, Kansas State University, Kansas Agricultural Experiment Station, and No. 25, Colby Branch Agricultural Experiment Station.

1. Standard nursing ration—1 pound sorghum grain, 1.25 pounds alfalfa hay, full feed of silage (average consumption per ewe per day, 9.8 pounds).
2. Maintenance ration—1 pound alfalfa hay plus 6 pounds sorghum silage.

Lot No.	Lamb ration and treatment	Ewe treatment
3	Complete pellet: 45% dry-rolled sorghum grain 55% ground alfalfa hay Weaned 8 to 10 weeks of age	Standard nursing ration until lambs were weaned, then maintenance ration
4	Mixture: 45% dry-rolled sorghum grain 55% ground alfalfa hay	Standard nursing ration
5	Whole sorghum grain Alfalfa hay	Standard nursing ration
6	Mixture: 35% dry-rolled sorghum grain 10% soybean oil meal 55% ground alfalfa hay	Standard nursing ration
7	Mixture: 95% dry-rolled sorghum grain 5% salt Alfalfa hay (free choice)	Standard nursing ration
8	Mixture: 98.5% dry-rolled sorghum grain 1.5% ground limestone Alfalfa hay (free choice)	Standard nursing ration

Lambs were marketed in five shipments at Denver or Omaha. First shipment was April 6, 1964; last, June 29, 1964. The lambs were marketed at approximately 100 pounds each.

Results and Discussion: Performance and cost of gain for various treatment groups are shown in Table 1. As in past years, lambs on rye pasture receiving the standard creep ration of whole sorghum grain and alfalfa hay (Lot 2) produced higher and more economical daily gains than lambs in other lots. Lambs in the dry lot fed a creep ration of a mixture containing 10% soybean meal, 35% ground sorghum grain, and 55% ground alfalfa hay made gains almost equal to those in Lot 2. Those two groups also had the youngest average market age, 160 days.

Adding 5% salt to ground sorghum grain fed free choice with alfalfa hay reduced grain consumption and lowered daily gain.

Feed consumption per lamb and feed required to produce 100 pounds of gain were higher for lambs weaned at 8-10 weeks of age than for lambs receiving the same ration and remaining with their mothers. However, reduced feed costs for ewes of the early weaned group resulted in a slight advantage for the early weaned group in total feed cost per 100 pounds lamb gain. Although the difference is small, it has been consistent in all instances of early weaning. Feeding a pelleted ration resulted in more daily gain and more efficient feed conversion than was produced by the same ration in ground-mixed form. Feed cost per 100 pounds lamb produced was higher for the pelleted ration.

Urinary calculi developed in all lots except those fed concentrates and hay in a ground mixture or pellet. Lambs fed ground-mixed or pelleted rations were forced to eat considerably more alfalfa hay than lambs consumed when grain and hay were fed separately. Highest incidence of calculi occurred in the group on rye pasture. In past tests lambs on rye pasture showed lower incidence of urinary calculi than lambs in the dry lot.

Table 1
Lamb performance and feed cost of gain by treatments, 1963-1964.

Lot no.	1	2	3	4	5	6	7	8
Treatment	Mixture: 45% dry-rolled sorghum grain, 55% ground alfalfa hay (weaned 8-10 weeks)	Rye pasture, whole sorghum grain, alfalfa hay	Pelleted: 45% ground sorghum grain, 55% ground alfalfa hay (weaned 8-10 weeks)	Mixture: 45% ground sorghum grain, 55% ground alfalfa hay	Whole sorghum grain, alfalfa hay	Mixture: 10% SBOM, 35% ground sorghum grain, 55% ground alfalfa hay	95% ground sorghum grain, 5% salt, alfalfa hay	98.5% ground sorghum grain, 1.5% ground limestone, alfalfa hay
No. lambs per lot	58	44	56	55	52	54	52	56
Av. market wt., lbs.[1]	101.28	104.88	102.99	102.83	102.65	104.01	102.98	103.30
Av. total gain, lbs.[2]	91.17	94.61	92.45	92.15	91.96	93.16	92.68	92.34
Av. daily gain, lbs.	.52	.59	.54	.56	.51	.58	.49	.54
Av. market age, days	175	160	171	165	181	160	190	171
Av. daily feed per lamb, lbs.:								
Mixture	2.34	....	....	1.86	....	1.88	....	....
Pelleted ration	....	....	2.22	....	....	....	....	....
Grain mix or sorghum grain	....	1.23	....	....	1.24	....	1.12	1.30
Alfalfa hay	....	.19	....	....	.57	....	.70	.48
Av. lbs. feed per cwt. gain:								
Mixture	449.2	....	....	333.0	....	322.89	....	....
Pelleted ration	....	....	410.6	....	....	....	....	....
Grain mix or sorghum grain	....	208.0	....	....	244.1	....	229.6	240.7
Alfalfa hay	....	32.1	....	....	112.2	....	143.5	88.9
Total	449.2	240.1	410.6	333.0	356.3	322.89	373.1	329.6
Lamb feed cost per cwt. gain[3]	$7.95	$3.91[5]	$8.83	$5.89	$5.71	$6.68	$6.31	$5.74
Ewe feed cost to 4/6/64 per cwt. gain[4]	$6.19	$2.38	$6.23	$8.82	$9.00	$8.58	$8.78	$8.72
Total feed cost per cwt. gain	$14.14	$6.29	$15.06	$14.71	$14.71	$15.26	$15.09	$14.46

1. Weight of lambs at Station prior to shipment to market.
2. Market weight minus birth weight.
3. Based on following prices: sorghum grain, $1.65 per cwt.; alfalfa hay, $30 per ton; soybean oil meal, $95 per ton; salt, $1 per cwt.; limestone, $1.15 per cwt.; grinding, $0.10 per cwt.; and mixing, $0.10 per cwt. Processing pelleted ration, $0.40 per cwt.; freight on same, $0.10 per cwt.
4. Includes cost of feed for ewes nursing lambs and dry ewes having lambs weaned up to April 6, 1964, when all lambs were weaned.
5. Does not include any charge for rye pasture. This was charged to ewe feed cost at 1½ cents per day.

Following is some market information on lambs sold during 1964:

Number of lambs	496
Av. market date	5/9/64
Av. feed lot wt. at market date	101.23
Av. sale wt.	96.75
% shrink to market (feed lot wt. to market wt.)	4.43%
Av. selling price per cwt.	$23.41
Trucking cost per cwt.	.82
Other marketing costs per cwt.	.71
Total marketing costs per cwt.	1.53
Av. return per lamb (after marketing costs)	21.48
Av. lamb return per ewe	24.16

Table 2
Number of lambs affected and number lost to indicated disease, by lots.

Lot no.	Urinary calculi	Founder and enterotoxemia	Lameness and stiffness	Scours	Other causes	Death loss[1]
1	....	....	14	3	2	2
2	12	2	9	....	2	5
3	....	....	11	2	1	1
4	....	....	16	3	4	1
5	3	....	15	3	3	4
6	....	....	10	3	1	2
7	2	2	6	....	3	3
8	2	....	10	1	1	....

1. Five lambs died due to urinary calculi; 2, enterotoxemia; 1, scours; and 10, various other causes.

Preflushing Test, Spring 1964

Procedure: 431 commercial finewool ewes were divided into four groups for the preflushing test. Division was on type of lamb birth the previous lambing season. Ewes were assigned to respective groups April 10, 1964, and treated as follows:

Lot A—Low-energy ration, April 27 to May 14 (17 days)
Lot B—Maintenance ration, April 27 to May 14 (17 days)
Lot C—Low-energy ration, April 10 to May 14 (34 days)
Lot D—Maintenance ration, April 10 to May 14 (34 days)

The low-energy ration consisted of 2 pounds alfalfa hay per ewe per day; the maintenance ration, 2 pounds of alfalfa hay, ¼ pound of whole sorghum grain, and 3 pounds of sorghum silage per ewe per day. From the time lambs were sold or weaned until April 10, ewes received a maintenance ration of 1 pound alfalfa hay and 6 pounds sorghum silage per ewe per day. Lots A and B were fed this ration until April 27, when they were placed on test.

Ewes were weighed April 10, April 27, and May 14 to check weight changes due to various treatments.

Results and Discussion: Effects of preflushing treatment on weight change during preflushing and flushing periods and on lambing performance are reported in Tables 3 and 4. Ewes receiving a low-energy ration for 34 days lost 11.30 pounds. They lost about 50% less during the second 17 days than during the first 17 days. A weight loss of 6.90 pounds resulted from feeding the maintenance ration 17 days. Ewe weight was maintained for the 17-day preflushing period by feeding the maintenance ration (Lot B), but ewes on that ration for 34 days lost 2.53 pounds each (average). Ewes fed the low-energy ration preflushing gained more during the flushing period than did ewes fed the maintenance ration.

Ewes on the maintenance ration had a slight advantage for earliness in lambing and percentage of ewes lambing. Also they produced more multiple births and, consequently, a higher lamb crop percentage. The lot receiving the maintenance ration for 17 days had a larger lamb crop than ewes fed the same ration for 34 days.

A year-by-year summary of results of preflushing treatments for 5 years is presented in Table 5.

Table 3
Effect of preflushing treatment on weight changes of ewes.

Preflushing treatment	No. of ewes	Av. preflushing gain or loss per ewe, lbs. 1st 17 days	2nd 17 days	Total	Av. flushing gain per ewe
Low energy (17 days)	108		−6.90	−6.90	13.53
Maintenance (17 days)	108		−0.50	−0.50	8.72
Low energy (34 days)	108	−7.81	−3.49	−11.30	13.95
Maintenance (34 days)	107	−2.00	−0.53	−2.53	8.60

Table 4
Lambing performance of ewes on different preflushing rations.

Preflushing treatment	No. of ewes	Cumulative % ewes lambing Days after first lamb birth 10	20	30	40	Total % lambing	% lamb crop[1]
Low energy (17 days)	108	9.26	36.11	84.26	91.66	95.37	123.15
Maintenance (17 days)	108	8.33	34.26	85.18	91.67	97.22	129.63
Low energy (34 days)	108	4.63	25.93	84.26	87.96	91.66	121.30
Maintenance (34 days)	107	4.67	30.84	86.92	92.53	97.20	126.17

1. Includes all ewes exposed to rams and all lambs born.

Ewe Flushing Test, Spring 1964

Procedure: The 431 ewes included in the preflushing test were assigned to six groups May 14, 1964, after the preflushing test was completed. They were divided on number of lambs produced the previous year and on preflushing treatment. The six groups were fed these rations 34 days:

Lot 1—Cereal crop pasture.
Lot 2—Cereal crop pasture + 1 lb. whole sorghum grain.
Lot 3—Buffalograss pasture.
Lot 4—Buffalograss pasture + 2 lbs. whole sorghum grain.
Lot 5—2 lbs. alfalfa hay + 2 lbs. whole sorghum grain.
Lot 6—4 lbs. alfalfa hay.

During the breeding season (June 1-September 1) 18 purebred Hampshire rams were used. The rams were randomly assigned to six groups of 3 rams and each group was rotated to a different ewe lot twice each week. The rams were put into the ewe lots at night only and were removed during the day.

At the end of the 34-day flushing period, June 18, ewes were individually weighed and turned together. Then the 18 rams were turned with the ewes as a group. After being flushed, ewes were grazed on buffalograss pasture, supplemented with cereal crop and sudangrass pasture, until lambing. Beginning August 28, ewes were fed ¼ pound of barley which was increased to ¾ pound by September 2. Later, the

Table 5
Summary of preflushing treatments, 1960-1964.

Preflushing ration[1]	No. of ewes	Av. pre-flushing gain or loss	Av. flushing gain	Cumulative % of ewes lambing — Days after first lamb birth — 10	20	30	40	Total	Sets of twins	% lamb crop
					1960					
A	75	−12.0	16.2	10.67	26.67	90.67	96.00	98.67	24	131
B	75	−7.8	14.2	6.67	29.33	88.00	93.33	97.33	19	124
					1961					
A	171	−2.0	13.1	2.92	18.13	80.70	91.23	95.85	42	120
B	169	+4.0	9.0	4.33	20.17	79.29	86.39	94.67	35 1 triplet	117
					1962					
A	161	−11.65	14.61	16.77	48.45	91.30	93.17	95.65	42 1 triplet	123
B	163	+.24	4.98	16.56	44.75	87.73	92.02	96.32	49	126
					1963					
A	72	−11.36	11.70	6.94	29.17	75.00	88.89	98.61	25	133
B	73	−1.08	4.55	1.37	27.40	76.71	94.52	97.26	26 2 triplets	138
C	72	−10.34	12.61	6.94	23.61	70.83	95.83	95.83	14	117
D	74	+1.73	4.31	5.41	20.27	77.03	87.84	94.59	21 1 triplet	127
					1964					
A	108	−6.90	13.53	9.26	36.11	84.26	91.66	95.37	30	123
B	108	−0.50	8.72	8.33	34.26	85.18	91.66	97.22	34	130
C	108	−11.30	13.95	4.63	25.93	84.26	87.96	91.66	28 2 triplets	121
D	107	−2.53	8.60	4.67	30.84	86.92	92.53	97.20	31	126

1. A—Low-energy ration, 2 pounds alfalfa hay, 17-day period.
B—Maintenance ration, ¾ pound sorghum grain, 2 pounds alfalfa hay, 3 pounds sorghum silage, 17-day period.
C—Low-energy ration, 34-day period.
D—Maintenance ration, 34-day period.

barley was replaced with sorghum grain. Silage was fed at 2 pounds per ewe each day, beginning October 2. Alfalfa was fed beginning October 10 and was gradually increased to 1 pound per head per day. Silage and grain were increased to 3 and 1 pound per head per day, respectively, and the ewes continued on buffalograss until they lambed.

Results and Discussion: Results of lambing performance and gains of ewes fed various flushing rations 34 days the spring of 1964 are presented in Tables 6 and 7.

Table 6
Gains and lambing performance of ewes fed one of indicated flushing rations, spring 1964.

Lot no.	No. of ewes	Total gain	No. ewes lambing	Total no. lambs	No. sets of twins	% lamb crop[1]
1	72	4.78	69	92	23	127.78
2	71	10.82	68	85	17	119.72
3	72	11.42	71	99	26 1 triplet	137.50
4	72	16.81	67	91	24	126.39
5	72	15.83	68	90	22	125.00
6	72	7.58	68	82	12 1 triplet	113.89

1. Includes all ewes exposed to rams and all lambs born.

Table 7
Effect of flushing ration on cumulative percentage of ewes lambing.

Lot no.	Days after first lamb birth — 10	20	30	40	90	Total lambing
1	9.72	34.72	87.50	93.06	95.83	95.83
2	5.63	33.81	85.98	90.21	95.85	95.85
3	6.94	33.33	88.89	95.83	98.61	98.61
4	5.56	33.33	83.33	87.50	93.06	93.06
5	4.17	22.22	75.00	87.50	94.44	94.44
6	8.33	33.33	90.28	91.67	94.44	94.44

Ewes receiving buffalograss pasture only as a flushing ration produced a larger lamb crop than any other group. In previous years ewes flushed on buffalograss generally ranked below (in lamb crop produced) ewes fed cereal crop pasture plus grain or cereal crop pasture only. Table 8 summarizes all flushing rations fed during 6 years and performance of ewes on each ration, measured by percentage of lamb crop produced. Also, ewes flushed on cereal crop pasture only produced a larger lamb crop than did ewes flushed on 1 pound of sorghum grain and cereal crop pasture. The lowest lamb crop percentage resulted from feeding 4 pounds of alfalfa hay per ewe per day during the flushing period. However, that flushing ration resulted in one of the earliest lambing groups. Lots 3 and 1 ewes grazed on buffalograss only and cereal crop pasture only, respectively, also lambed earlier than other ewes.

Table 8

Summary of 6 years of tests showing percentage lamb crop for ewes on various flushing rations by years.

Flushing ration	1959	1960	1961	1962	1963	1964
Cereal crop pasture	102[1]	102	128	133	124	128
¾ lb. whole sorghum grain 1¼ lbs. alfalfa hay Full feed of silage	98	110	109	107		
Buffalograss pasture	128	114	119	126	109	138
¾ lb. whole wheat grain 1¼ lbs. alfalfa hay Full feed silage		102				
Cereal crop pasture ½ lb. sorghum grain		121	127	155		
Buffalograss pasture ½ lb. sorghum grain		109	109			
¾ lb. sorghum grain Full feed alfalfa hay			119			
1½ lbs. sorghum grain 1¼ lbs. alfalfa hay Full feed silage				117		
¾ lb. sorghum grain ⅓ lb. soybean pellets Full feed silage				109		
Cereal crop pasture 1 lb. sorghum grain					128	120
Buffalograss pasture 2 lbs. sorghum grain[2]					104	
Buffalograss pasture 2 lbs. sorghum grain					126	126
Buffalograss pasture 1 lb. sorghum grain					107	
2 lbs. sorghum grain 3 lbs. alfalfa hay						125
4 lbs. alfalfa hay						114

1. Cereal crop pasture first 13 days only—supplemental or substitute ration afterward (primarily green chopped cereal crop).

2. 2 pounds sorghum grain first 17 days only; no grain for remainder of 34-day period.

Lamb Feeding Tests, 1964-1965.

Procedure: Lambs born during the fall of 1964 were allotted to eight test groups. After lambing, the ewes and lambs were given a 7- to 10-day adjustment period. The lambs were docked at 1 to 2 days of age and castrated at 7 to 10 days of age. They were then assigned, on the basis of type of birth and age, to various test lots. Creep feed was made available thereafter. All creep rations were self-fed.

Lamb and ewe treatments for the various lots follow:

Lot no.	Lamb creep ration	Ewe nursing ration
1	Mixture: 35% ground sorghum grain 10% SBOM 55% ground alfalfa hay Lambs weaned (8 to 10 weeks of age)	Standard nursing ration[1] until lambs are weaned, then maintenance ration[2]

1. Standard nursing ration: 1 pound whole sorghum grain, 1.25 pounds alfalfa hay, sorghum silage fed to limit of appetite per ewe daily.

2. Maintenance ration: 1 pound alfalfa hay, 6 pounds sorghum silage per ewe daily.

Lot no.	Lamb creep ration	Ewe nursing ration
2	Cereal crop pasture Mixture: 45% ground sorghum grain 55% ground alfalfa hay Lambs weaned (8 to 10 weeks of age)	Cereal crop pasture (standard nursing ration when necessary) until lambs are weaned—then maintenance ration
3	Mixture: 45% ground sorghum grain 55% ground alfalfa hay Lambs weaned (8 to 10 weeks of age)	Standard nursing ration until lambs are weaned, then maintenance ration
4	Mixture: 45% ground sorghum grain 55% ground alfalfa hay	Standard nursing ration
5	Standard ration[4]	Standard nursing ration
6	Standard ration[4] + NH_4Cl—starting Dec. 10, ¼ oz. per head per day for each lamb 20 days of age or older	Standard nursing ration
7	High concentrate to lower concentrate[3]	Standard nursing ration
8	Mixture: 65% ground sorghum grain 35% ground alfalfa hay	Standard nursing ration

3. High concentrate to lower concentrate:

	SBOM	Ground sorghum grain	Ground alfalfa
First 30 days on test	20	70	10
Second 30 days on test	15	60	25
Third 30 days on test	10	50	40
Ninety days to market	10	35	55

4. Whole sorghum grain, alfalfa hay free choice.

Ammonium chloride added to the ration at low levels, as for Lot 6 above, is recommended to prevent urinary calculi in feed lot lambs and steers by Dr. H. R. Crookshank of the USDA, ARS. Mixing that chemical, a fine salt, with whole grain has been a problem. Simply mixing ammonium chloride with whole dry grain allowed the ammonium chloride to "sift out" too rapidly. Mixing it with a small quantity of ground grain and placing the mixture over whole grain also let it "sift out." Sprinkling an aqueous solution of ammonium chloride on the grain has resulted in even distribution of the additive throughout the feed for uniform consumption.

Results and Discussion: This test will be concluded in 1965 and the results and summary will appear in the 1966 report.

Grazing Studies

Field grazing of forage-producing crops has been investigated to a limited extent.

Procedure: Cereal crops planted for pasture were on preirrigated land—a condition similar to summer fallow. Winter wheat, rye, and barley were planted in August for fall and winter grazing by ewes and lambs. Spring barley, winter wheat, and winter rye were planted in April for grazing in May and June by ewes only—during the flushing period and immediately after it.

Limited data were collected during the 1964-65 fall and winter grazing season on estimates of feed available per acre by weighing clippings. Clippings were taken from each plot when grazing began and the amount of dry matter per acre was computed.

Pounds of forage clippings per acre and grazing production are presented in the following table.

Crop	Date of clipping	Green forage wt. per acre, lbs.	Dry matter per acre, lbs.	Av. ewe and lamb grazing days per acre	Av. gain per ewe, lbs.
Will barley	11-11-64	18,068	4,580	533	3.2
Scout wheat	12-15-64	8,467	3,793	477	2.4
Balbo rye	1-6-64	4,082	3,463	—[1]	

1. Grazing data not available.

Results and Discussion: Table 9 shows average amount of grazing produced by certain crops over a period of years. Each crop listed produced very good grazing results.

Table 9
Grazing production of various crops.

Crop	Planting time	No. of years in average	Season grazed	Av. grazing days per acre
Balbo winter rye	August	3	Fall	607 ewe
Balbo winter rye	August	3	Fall and winter	469 ewe and lamb
Meimi winter barley	Early April	3	Late May through June	516 ewe
Otis spring barley	Early April	4	Late May to early June	484 ewe
Scout winter wheat	August	1	Fall	477 ewe and lamb[2]
Will winter barley	August	1	Fall	533 ewe and lamb[2]
Buffalograss[1]	(native)	2	Summer and fall	284 ewe

1. Taken from pasture which had been lightly grazed.
2. From Dec. 2, 1964, until lambs were weaned (at 8-10 weeks of age). Nursing ewes grazing cereal crop pasture (Lot 2) increased in weight 6.49 pounds while nursing ewes in dry lot lost weight (Lot 3: −4.31 pounds; Lot 4: −3.32 pounds). Lambs in all lots received the same creep ration.

The following are equations that might be used as "rules-of-thumb" to estimate potentials of cereal crop pasture or other pasture where the average number of grazing days per acre is available.

$$\frac{\text{No. of acres of pasture} \times \text{average grazing days per acre}}{\text{Grazing period (in days)}} = \text{number of ewes that can be grazed for the period}$$

$$\frac{\text{Grazing period (in days)} \times \text{no. of ewes in flock}}{\text{Average grazing days per acre}} = \text{acres of pasture required for flock for period}$$

$$\frac{\text{Acres of pasture available} \times \text{average grazing days per acre}}{\text{No. of ewes in flock}} = \text{period of grazing to expect}$$

Lamb Feeding Experiments, Garden City, 1964-1965.*

C. S. Menzies, K.S.U., and A. B. Erhart, Garden City

Lamb and Pretest Treatment

Delivery of 601 finewool, wether feeder lambs was accepted at Menard, Texas, October 8, 1964. Average weight was 68.9 pounds; cost, $19.25 per cwt. Lambs were shorn (average fleece weight, 3.2 pounds) and shipped 543 miles to Garden City on a triple-deck truck. They arrived October 9, a.m., weighing an average of 60.4 pounds. They were divided into groups of about 50 lambs and fed a ration of medium-quality alfalfa hay and chopped sorghum stubble until started on test.

Experimental Procedure

Half the lambs were vaccinated October 14 with Clostridium perfringens type D toxoid for enterotoxemia. October 22 all lambs, except 50, were drenched with Thibenzole, weighed, implanted with 3 mgs. stilbestrol, and allotted with equal numbers of vaccinated and non-vaccinated lambs in each lot November 2.

Treatments for the 11 lots follow:

Lot no.	Treatment	How fed
1	Standard ration of sorghum silage, whole sorghum grain, .75 pound sun-cured alfalfa pellets, .10 pound C.S.M.	Hand
2	Sorghum silage in standard ration replaced by corn silage	Hand
3	Mixture of 35% whole sorghum grain and 65% sun-cured alfalfa pellets	Self
4	Pelleted ration of 35% sorghum grain and 65% sun-cured alfalfa	Self
5	Pelleted ration of 26% sorghum grain, 9% animal fat and 65% sun-cured alfalfa	Self
6	Pelleted ration of 32% sorghum grain, 3% animal fat and 65% sun-cured alfalfa	Self
7	Mixture of 35% whole sorghum grain and 65% dehydrated alfalfa pellets	Self
8	Ground mixed ration of 35% sorghum grain and 65% sun-cured alfalfa	Self
9	Pelleted high concentrate ration plus 9% animal fat. (See Table 1)	Self
10	Pelleted high concentrate ration—no added fat. (See Table 1)	Self
11	Same as Lot 4 (pelleted ration of 35% sorghum grain and 65% sun-cured alfalfa)—not drenched for internal parasites	Self

Lambs in Lots 9 and 10 were adjusted to the final rations over a 5-week period. Rations fed in Lots 9 and 10 by periods are listed in Table 1.

All other self-fed lambs received their rations from the start of the test. Those in Lots 1 and 2 were fed twice daily starting with 15 pounds whole sorghum grain, 18 pounds sun-cured alfalfa pellets and 2.5 pounds cottonseed meal poured on top and mixed with 75 pounds silage to each lot of 50 lambs per feeding. This amounted to a starting daily ration per lamb of .60 pound sorghum grain, .72 pound alfalfa, .10 pound cottonseed meal and 3 pounds silage. Amounts of cottonseed meal and alfalfa remained constant throughout the test. Sorghum grain was in-

* Contribution No. 529, Department of Animal Husbandry, Kansas State University, Kansas Agricultural Experiment Station, and No. 77, Garden City Branch Agricultural Experiment Station.

Table 10
Rations fed in Lots 9 and 10 by periods.

	Lot no.	% sorghum grain	% fat	% sun-cured alfalfa	% C.S.M.	% ground limestone
First 2 weeks	9	41	9	50		
	10	50		50		
Third week	9	51	9	40		
	10	60		40		
Fourth week	9	50	9	30	10	1
	10	59		30	10	1
Fifth week	9	60	9	20	10	1
	10	69		20	10	1
Remainder of test	9	70	9	10	10	1
	10	79		10	10	1

creased at the rate of 2 pounds per feeding every 2 days until each feeding reached 36 pounds (1.44 pounds per lamb per day). Silage was added or reduced, depending on consumption. Salt and heated water were available in all lots.

Because of rapid gains and heavy weight of lambs, the experiment was concluded January 25 after an 84-day test. Two hundred twenty-four of the heaviest and fattest lambs were marketed then.

Heavy death losses due to enterotoxemia among unvaccinated lambs made them good subjects to determine the value of antitoxin and bacterin injected late in the feeding period, to prevent death losses from enterotoxemia. Previously unvaccinated lambs were divided into three lots of 44 lambs each. Lot 1 lambs were vaccinated with antitoxin. Lot 2 lambs remained unvaccinated and Lot 3 lambs were vaccinated with bacterin. A fourth lot was composed of lambs vaccinated at start of original test. Similar rations were fed to all lots.

Feed prices, processing charges, and miscellaneous costs were:

	Per ton
Alfalfa hay	$27.00
Dehydrated alfalfa pellets	38.00
Sun-cured alfalfa pellets	34.00
41% cottonseed meal	72.00
Corn silage	8.00
Sorghum silage	7.00
Ground limestone	16.50
Salt	20.00
Sorghum grain	1.95 per cwt.
Animal fat	7.50 per cwt.
Grinding	4.00 per ton
Grinding and pelleting	7.00 per ton
	Per head
Thibenzole drench	.17
Vaccination	
Toxoid	.10
Bacterin	.10
Antitoxin	.25

Results are reported in Tables 11, 12, and 13.

Table 11
Hand-fed and self-fed rations for fattening lambs, October 11, 1964, to January 25, 1965—84 days.

Lot no.	1	2	9	10	4	11
Treatment	Standard sorghum silage	Standard corn silage	Pelleted high-concentrate, 9% fat	Pelleted high-concentrate, no fat	Pelleted 35% sorghum grain, 65% alfalfa hay	Pelleted 35% sorghum grain, 65% alfalfa hay, not drenched
No. lambs	48	43	48	46	46	48
Av. initial wt., lbs.	64.6	66.5	65.8	67.3	66.6	62.8
Av. final wt., lbs.	107.0	111.6	104.1	103.3	117.3	108.0
Av. total gain, lbs.	42.4	45.1	38.3	36.0	50.7	45.2
Av. daily gain, lbs.	.50	.54	.46	.43	.60	.54
Vaccinated	.53	.55	.45	.45	.61	.54
Unvaccinated	.47	.53	.46	.40	.60	.53
Daily feed per lamb, lbs.:						
Whole milo	1.32	1.32	....	....	....	....
Sorghum silage	4.63	....	....	....	....	....
Corn silage	....	4.78	....	....	....	....
Alfalfa hay	.72	.72	....	....	....	....
41% C.S.M.	.10	.10	....	....	....	....
Pellets	....	....	3.22	3.05	4.68	4.36
Salt	.019	.022	.025	.024	.023	.025
Feed per cwt. gain, lbs.:						
Whole milo	264.0	244.4	....	....	....	....
Sorghum silage	926.0	....	....	....	....	....
Corn silage	....	885.1	....	....	....	....
Alfalfa pellets	144.0	133.3	....	....	....	....
41% C.S.M.	20.0	18.4	....	....	....	....
Pelleted ration	....	....	700.0	709.3	780.0	807.4
Salt	3.8	4.1	5.4	5.6	3.8	4.6
Av. feed cost per cwt. gain[1]	$11.60	$11.28	$19.51	$15.59	$14.94[2]	$15.47
Av. feed cost per lamb[1]	$ 4.92	$ 5.09	$ 7.47	$ 5.61	$ 7.57[2]	$ 6.99
Enterotoxemia deaths:						
Vaccinated	0	0	0	0	1	0
Unvaccinated	2	7	2	5	3	2
No. slipping wool	3	0	0	22	6	15

1. Does not include cost of stilbestrol implants, Thibenzole drench, or enterotoxemia vaccination.
2. Costs increase to $15.27 and $7.74 when cost of drenching is included.

Table 12
Self-fed rations for fattening lambs, October 11, 1964, to January 25, 1965—84 days.

Lot no.	8	3	7	4	5	6
Treatment	Ground-mixed: 35% sorghum grain, 65% alfalfa hay	Mix: 35% whole sorghum grain, 65% sun-cured alfalfa pellets	Mix: 35% whole sorghum grain, 65% dehydrated alfalfa pellets	Pelleted: 35% sorghum grain, 65% alfalfa hay	Pelleted: 26% sorghum grain, 9% fat, 65% alfalfa hay	Pelleted: 32% sorghum grain, 3% fat, 65% alfalfa hay
No. lambs	43	44	47	46	47	49
Av. initial wt., lbs.	66.2	65.7	65.4	66.6	65.4	64.3
Av. final wt., lbs.	105.8	115.0	108.6	117.3	115.9	115.8
Av. total gain, lbs.	39.6	49.3	43.2	50.7	50.5	51.5
Av. daily gain, lbs.	.47	.59	.51	.60	.60	.61
Vaccinated	.48	.58	.50	.61	.64	.62
Unvaccinated	.47	.60	.53	.60	.57	.61
Daily feed per lamb, lbs.:						
Mix or pellets	3.92	4.35	3.82	4.68	4.09	4.23
Salt	.016	.028	.025	.023	.025	.025
Feed per cwt. gain, lbs.:						
Mix or pellets	834	737.3	749.0	780.0	681.6	693.4
Salt	3.4	4.7	4.9	3.8	4.2	4.1
Av. feed cost per cwt. gain[1]	$14.72	$13.23	$14.41	$14.94	$16.47	$14.14
Av. feed cost per lamb[1]	$ 5.83	$ 6.52	$ 6.22	$ 7.57	$ 8.32	$ 7.44
Enterotoxemia deaths:						
Vaccinated	1	0	0	1	0	0
Unvaccinated	6	5	2	3	2	1
No. slipping wool	4	6	3	6	0	2

1. Does not include cost of stilbestrol implants, Thibenzole drench, or enterotoxemia vaccination.

Table 13
Death losses and performance of lambs not vaccinated or vaccinated with enterotoxemia antitoxin, bacterin or toxoid, January 29 to March 2, 1965—32 days.

Lot no.	1	2	3	4
Treatment	Vaccinated with antitoxin 1/29/65	Not vaccinated	Vaccinated with bacterin 1/29/65	Vaccinated with toxoid 10/14/64
No. lambs	44	44	44	176
Initial wt., lbs.	103.2	103.2	102.9	103.2
Final wt., lbs.	116.7	117.8	115.2	117.4
Av. daily gain, lbs.	.42	.46	.38	.44
Death losses[1]	1	7	2	2

1. Urinary calculi was cause of death for lamb dying in Lot 1. All death losses in Lots 2 and 3 were caused by enterotoxemia. Cause of death was not recorded for those dying in Lot 4.

Observations

Enterotoxemia killed 46 lambs (43 unvaccinated and 3 vaccinated). Losses occurred in all lots, with considerable variation among lots. Vaccination did not affect rate of gain.

Extreme wool slippage was observed in the 1963-64 tests, so wool slippage in this year's tests was recorded. A total of 61 lambs fell in that category. Approximately equal numbers of vaccinated and unvaccinated lambs slipped wool and only 7 of the 61 died. Added fat seemed to protect lambs. Greatest slippage occurred in Lot 10 fed the high-concentrate ration without fat, and in Lot 11 whose lambs had not been drenched. Resistance of lambs not drenched probably was down.

Lambs in all lots made rapid and efficient gains. As in past years, those hand-fed silage rations made cheaper gains than those self-fed mixed or pelleted rations.

Corn silage was more palatable and produced slightly faster and cheaper gains than sorghum silage.

Lambs fed high-concentrate rations (90% concentrate in final ration) consumed less feed, made slower, more expensive gains but required less feed per unit gain compared with lambs in Lot 4 fed a 35% concentrate ration. Adding 9% animal fat to the high-concentrate ration increased gains slightly, reduced death losses and prevented wool slippage. It did not improve efficiency of gain, and at $7.50 per cwt., increased feed costs considerably. Somewhat in contrast, adding 3% or 9% fat to the 35% concentrate and 65% hay ration materially reduced the amount of feed required to produce a unit of gain, but did not affect rate of gain. Efficiency was nearly the same for both lots.

Among self-fed lots receiving 35% sorghum grain and 65% alfalfa prepared in different forms, best overall performance (rate gain, efficiency, and cost) was made by Lot 3 lambs fed the mixture of whole sorghum grain and sun-cured alfalfa pellets. Lambs in Lot 4 gained equally fast, but the $7 per ton charge for pelleting increased feed costs. Dehydrated alfalfa pellets produced slower and more expensive gains than sun-cured pellets. The ground-mixed ration produced slowest, least efficient gains.

Treatment of this particular group of lambs with Thibenzole appeared to be beneficial, since untreated lambs in Lot 11 consumed less feed and made slower, less efficient gains.

Vaccination of lambs with Clostridium perfringens antitoxin or bacterin after 87 days on feed was beneficial in preventing death losses from enterotoxemia. Two lambs receiving bacterin died from enterotoxemia during the 32-day test period; however, these deaths occurred within 7 days following vaccination. These lambs probably did not have enough time to build up immunity. Antitoxin gives immediate protection.

while it usually takes about 2 weeks for immunity to develop following vaccination with bacterin. There was very little difference in feed lot performance of vaccinated and nonvaccinated lambs.

Heritabilities, Genetic and Phenotypic Correlations Between Carcass and Live Animal Traits in Sheep.

C. S. Menzies, G. Ahlschwede, J. D. Wheat, D. L. Mackintosh, and D. H. Kropf

Data were collected on 91 lambs of known breeding born during the fall, 1963. The lambs were from ewes in the original fine-wool flock and were sired by 10 performance-tested Hampshire rams (see 1963 Feeders' Day Report for ram performance data). This was the ewe's fifth lamb crop.

All lambs were creep fed a pelleted ration of 45% dehydrated alfalfa, 45% sorghum grain, 7.5% molasses, and 2.5% soybean oil meal. The ration contained 10 to 15 mgs. aureomycin per pound. Half the male lambs were castrated and half were left intact. Lambs were weaned and weighed at 65 days of age. When they weighed approximately 95 pounds, they were sheared and these measurements obtained: length of right fore cannon, circumference of right fore cannon, length of rump, width at second lumbar vertebra, and circumference of right rear leg. All lambs were then slaughtered and various quality factors influencing carcass grade were scored by a representative of the Federal Grading Service. Loin-eye area, fat thickness, and weight of trimmed wholesale cuts were obtained; the racks were dissected into fat, lean, bone, overflow and intercostal muscle, and the loins were sent to the home economics department for additional analyses.

Data are currently being collected on the sixth lamb crop sired by performance-tested Hampshire rams (see 1964 Feeders' Day Report for performance data). The lambs are being handled as the 1963 lamb crop was except that a sonoray machine is being used to estimate depth of fat cover and loin-eye area at the 12th rib of lambs before slaughter.

Results and Discussion

Uncorrected data for 1963-64 lambs are reported in Table 14, and those for 1964-65 lambs in Table 15. Effect of lamb sex on growth performance is reported in Table 16. Effects of sex on carcass data are reported on page 21.

Variation was only 21 days between sire groups in age of 1963-64 lambs at slaughter. Although data have not been statistically analyzed, there appears to be some correlation between rate of gain of sires and their lambs. However, ram 10, the slowest gaining one, sired lambs that gained somewhat faster than lambs of several rams that gained faster during the performance test.

There was considerable variation in average loin-eye area among sire groups.

Twin lambs gained considerably slower than singles. Ram lambs gained faster than wethers, and ewe lambs made the slowest gains.

Table 14
Uncorrected data for 1963-64 lambs.[1]

Ram no.	2	3	4	5	6	7	8	9	10
Ram A.D.G., lbs.[2]	.64	.74	.70	.56	.69	.73	.54	.63	.47
No. single lambs	5	8	8	9	2	5	8	4	3
No. twin lambs	6	2	2	0	0	6	2	6	0
Av. 65-day weaning wt., lbs.:									
Single lambs	61.4	59.0	53.1	55.4	65.0	61.0	55.6	50.5	63.7
Twins	45.5	42.5	47.0	....	....	44.2	42.5	48.7	....
Av. slaughter wt., lbs.	94.3	99.5	99.0	98.4	98.5	97.4	96.0	97.1	98.3
Av. age at slaughter:									
Single lambs	117.2	122.1	122.2	129.9	113	110.8	128.5	132	118
Twins	152.4	146.0	145.5	....	....	149.6	139.0	135.7	....
Av. wt. per day of age at slaughter:									
Single lambs	.81	.81	.80	.76	.87	.88	.74	.73	.83
Twins	.61	.70	.69	....	....	.65	.70	.72	....
Av. loin-eye area	2.01	2.03	2.30	2.34	2.58	2.34	2.33	2.23	2.38

1. Not corrected for sex or birth weight.
2. Gain made on performance test.

Table 15
Effect of sex of lamb on rate of gain.

Sex	Ewe	Wether	Ram
No. of lambs	36	16	21
Av. age at slaughter	138	127	117
Av. wt. at slaughter	96.3	97.3	99.3
Av. wt. per day of age at slaughter	.70	.76	.85

Table 16
Uncorrected data for 1964-65 lambs.[1]

Ram	No. single lambs	Av. 65-day weaning wt., lbs. (singles)	No. twin lambs	Av. 65-day weaning wt., lbs. (twins)
Ahlschwede 12	6	59.2	2	48.0
Cox 1098	7	48.4	2	34.0
Eberle 54	3	51.3	2	31.5
Eberle 530	7	50.9	0	....
Gilmore 6323	6	53.0	6	35.3
KSU 6312	5	52.8	2	31.5
KSU 6328	5	57.2	....	....
Newell 244	5	51.4	2	37.0
McCosh 339	3	54.6	2	37.5
McCosh 378	7	59.3	2	28.0

1. Not corrected for sex or birth weight.

Comparison of Slaughter and Carcass Characteristics of Ram, Wether and Ewe Lambs.

D. H. Kropf, D. L. Mackintosh, L. C. Hinnergardt, R. C. Fletcher, C. S. Menzies, Dorothy L. Harrison, and Lois Anderson

Preliminary Report

Lambs of known history were individually slaughtered as they attained 95 pounds live weight. Quality and quantity factors were evaluated and measurements taken after carcasses were chilled 48 hours. Carcasses were broken into wholesale cuts and weights were obtained. Loin weights are with kidney knob and hanging tenderloin removed. The leg and loin were further trimmed of external fat to ⅛ inch thick and trimmed weights obtained.

No sex differences (Table 17) were noted with regard to caul or stomach fat, feathering, fat streaking in secondary flank muscles, color of flesh, shoulder weight, trimmed loin weight, leg and trimmed leg weight, total weight or percentage of trimmed leg and loin or in average loin-eye muscle area.

Dressing % was highest for ewe lambs, lowest for rams, and intermediate for wethers. Conformation scores were highest for ewe lamb carcasses and lowest for rams, perhaps due partly or wholly to more external fat on ewes and less on ram carcasses. Ewe lamb carcasses had more overflow fat, more kidney and pelvic fat, higher rib-eye marbling scores, and higher carcass grades. Rams had the least overflow fat, less kidney and pelvic fat, less rib-eye marbling and lowest average

Table 17
Comparison of slaughter and carcass characteristics of ram, wether, and ewe lambs.

	Group averages[1]		
	Ram	Wether	Ewe
No. of animals	24	21	41
Slaughter wt., lbs.	87.5	87.5	86.6
Cold dressed wt., lbs.	46.0	48.5	49.5
Cold dressing %	52.6	55.4	57.2
Pelt wt., lbs.	10.1	9.1	8.9
Caul fat wt., lbs.	1.1	1.2	1.7
Conformation score[2]	7.5	8.1	8.6
Quantity external fat score[3]	8.1	8.3	9.1
Feathering score[4]	5.8	5.6	5.9
Overflow fat score[4]	4.4	4.6	5.2
Fat streaking flank steak[4]	4.0	4.5	4.9
Fat streaking, other flank muscles[4]	3.9	4.0	4.3
Kidney and pelvic fat score[4]	4.2	5.0	6.0
Rib-eye marbling score[4]	4.5	5.4	5.9
Rib-eye firmness score[5]	10.0	10.4	10.4
Fat firmness score[5]	8.2	9.6	9.6
Rib-eye color score[6]	10.8	10.8	10.7
Color reading, L. dorsi[7]	13.1	12.8	12.7
Color reading, flank steak[7]	19.3	18.9	18.9
U.S.D.A. grade	8.4	9.2	9.7
Fat thickness, in.	0.16	0.22	0.26
Breast wt., lbs.	8.1	8.4	8.6
Shoulder wt., lbs.	12.8	12.9	12.8
Rack wt., lbs.	4.6	4.9	5.1
Loin wt., lbs.	4.9	5.2	5.4
Trimmed loin wt., lbs.	4.8	4.9	5.0
Leg wt., lbs.	15.1	15.6	15.3
Trimmed leg wt., lbs.	14.8	15.0	14.7
Trimmed leg + loin wt., lbs.	19.5	20.0	19.7
% trimmed leg + loin	42.4	41.2	39.8
Kidney knob wt., lbs.	0.7	1.0	1.5
Loin-eye muscle area, sq. in.	2.32	2.22	2.17
Fat, hotel rack, gms.	619.7	718.1	854.7
Bone, hotel rack, gms.	375.2	366.8	339.8

1. Lot averages underlined with same line are not significantly different at 5% level of probability.
2. Conformation score: Low prime = 9, choice + = 8, av. choice = 7.
3. Quantity external fat: Moderately thick = 9, slightly thick = 8.
4. Quality score: Modest = 6, small = 5, slight = 4.
5. Firmness score: Firm = 10, moderately firm = 9, slightly firm = 8.
6. Color score: Light pink = 11, slightly dark pink = 10.
7. Color read on photovolt color difference meter: Darker colors have lower numbers.

carcass grade, while wether carcasses were intermediate. Ram carcasses yielded fewer pounds of breast, rack or loin, and less kidney and pelvic fat. Hotel racks were dissected into lean, fat and bone to study sex effect on carcass composition. Less fat, more muscle and more bone were found in the rack from ram carcasses, while ewe carcasses had more fat, less muscle and less bone in the rack.

No large differences were found in taste panel evaluations of flavor, juiciness or tenderness of lamb loin roasts (Table 18). Roasts from rams showed a higher volatile cooking loss, a lower drip loss and a lower total cooking loss. The greater drip loss of ewe loin roasts probably is due to their greater fatness. A higher shear value was noted for cooked samples from ram loins than ewe loins, indicating less tenderness.

Table 18
Cooking time, cooking losses and taste panel evaluations of loin roasts from ram, wether, and ewe lambs.

	Ram	Wether	Ewe
Mean cooking time, min. per lb.	39.0	37.5	38.0
Volatile cooking loss, %	8.7	8.1	8.0
Drip cooking loss, %	2.6	4.0	4.7
Total cooking loss, %	11.6	12.3	12.8
Flavor intensity score	4.7	4.6	4.6
Flavor desirability score	5.5	5.4	5.5
Juiciness score	6.0	6.1	6.1
Press fluid, mls. per 25 gms.	8.0	8.1	8.2
Shear value, ½-inch core, lbs.	8.2	7.2	6.9
Final tenderness score	5.3	5.5	5.5

Cattle

Dicalcium Phosphate and Vitamin A for Calves on Winter Bluestem Pasture, 1963-1964 (Project 253-2).

E. F. Smith, D. Richardson, F. W. Boren, and C. V. DeGeer

The 42 heifer calves, 10 or 11 per treatment, used in this experiment were good to choice Herefords from near Fort Davis, Texas, assigned on a random-weight basis to treatments. They were pastured together in a 190-acre bluestem pasture. During winter, so the three groups could get their experimental rations (Table 19), they were penned and fed three times weekly. Dicalcium phosphate (0.1 pound per heifer daily) and vitamin A (10,000 I.U. daily), when fed, were mixed with soybean meal. The experimental rations were discontinued April 3 and only salt was supplied during summer grazing.

The heifers were bred July 1 to October 1. From July 1 to August 15 they were penned each night and those in heat were artificially bred, using Hereford semen; from August 15 to October 1 a Hereford bull was with the heifers.

Results (Table 19) indicate no apparent advantage to feeding dicalcium phosphate, vitamin A or a combination of the two to heifer calves during winter grazing on bluestem pasture.

Table 19
Dicalcium phosphate and vitamin A for calves on winter bluestem pasture, December 6, 1963, to November 11, 1964—341 days.

Lot no.	7	8	9	10
Treatment	Control	Dicalcium phosphate	Vitamin A	Dicalcium phosphate and vitamin A
No. of heifers	11	10	11	10
Initial wt. per heifer, lbs.	437	437	428	437
Winter grazing period—December 6, 1963, to April 3, 1964—120 days.				
Daily gain per heifer, lbs.	0.36	0.15	0.17	0.15
Daily ration per heifer, lbs.:				
Soybean oil meal	1.0	1.0	1.0	1.0
Ground sorghum grain	1.0	1.0	1.0	1.0
Dicalcium phosphate		0.1		0.1
Vitamin A, 10,000 I.U.			Yes	Yes
Bluestem pasture	Free choice			
Salt	Free choice			
Summer grazing—April 3, 1964, to November 11, 1964—221 days.				
Initial wt. per heifer, lbs.	480	446	448	455
Daily gain, lbs.	1.21	1.34	1.29	1.33
Summary—December 6, 1963, to November 11, 1964—341 days.				
Final weight, lbs.	747	742	732	750
Gain per heifer, lbs.	310	305	304	313
Daily gain per heifer, lbs.	0.91	0.89	0.89	0.92
No. of heifers pregnant	11	9	11	8

Table 20

A comparison of different methods of managing bluestem pastures, May 5, 1964, to September 27, 1964—145 days.

Pasture number	1	2	3	4, 5, 6	9	10	11
Management	Moderately stocked	Over-stocked	Under-stocked	Deferred and late-spring burned[1]	Early-spring burned	Mid-spring burned	Late-spring burned
Number of steers per pasture	18	25	13	54[2]	13	13	13
Acres in each pasture	60	60	60	3-60[3]	44	44	44
Acres per steer	3.3	2.4	4.6	3.3	3.4	3.4	3.4
Initial wt. per steer	556	571	573	568	575	582	577
Gain per steer	214	196	196	209	225	231	218
Daily gain per steer	1.48	1.35	1.35	1.44	1.55	1.59	1.50
Gain per acre	64.8	81.7	42.6	63.3	66.2	67.9	64.1

1. Deferred pasture number 6 was late-spring burned.
2. Ten of the steers in this pasture were counters only, because they came from a different source.
3. Three 60-acre pastures.

Different Methods of Managing Bluestem Pasture, 1964 (Projects 253-3-5).

E. F. Smith, K. L. Anderson, F. W. Boren, and C. V. DeGeer

This experiment was to determine the effect of different stocking rates, of deferred grazing, and of pasture burning on cattle performance, productivity of pastures, and range condition as determined by plant population changes. In addition to the yearly report, a summary of cattle gains for the past 15 years is included.

Experimental Procedure

Yearling Hereford steers with an average U.S.D.A. feeder grade of choice were used in 1964. They were purchased as calves the previous fall near Sterling, Kansas, and received silage, prairie hay, and about 4 pounds per head daily of a mixture of grain, dehydrated alfalfa and bran in dry lot during winter before the test started. They were assigned to pastures on a random-weight basis.

The experimental treatment for each pasture was:

Pasture 1—Moderate stocking rate, 3.3 acres per steer.

Pasture 2—Overstocked, 2.4 acres per steer.

Pasture 3—Understocked, 4.6 acres per steer.

Pastures 4, 5, 6—Deferred grazing and burning, moderate stocking rate, 3.3 acres per steer. The steers were grazed on pastures 4 and 5 from May 5 to July 1. They were then moved to pasture 6 where they remained until September 17, when they were grazed in all three pastures until September 27, close of the trial. Deferred pasture 6 was burned April 30.

Pasture 9—Burned March 31, 1964, moderate rate of stocking.

Pasture 10—Burned April 8, 1964, moderate rate of stocking.

Pasture 11—Burned April 30, 1964, moderate rate of stocking.

The steers were gathered in the afternoon, held over night without feed or water and weighed the following morning about 8:00. Starting and final weights were obtained after putting all steers together and weighing them in random order.

Observations

Results are reported in Tables 20, 21, 22, and 23. Gain per steer under the various treatments ranged from 231 to 196 pounds per steer. Mid- and late-spring burning produced the highest gain, over- and understocking produced the least gain. It was dry and a 10-15 mile-per-hour wind

Table 21

Grass decreasers and grass increasers shown as percent of total vegetation and an estimated range condition percentage based on percent of the vegetation that is "original."

Pasture number	1	2	3	Av. of 4 & 5	6[1]	9[2]	10[2]	11[2]
Range site	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)
Ordinary upland								
Grass decreasers	38	25	31	39	52	40	63	67
Grass increasers	38	45	46	45	30	32	17	15
Range condition	73	37	47	51	68	52	78	82
Limestone breaks								
Grass decreasers	49	34	54	57	68	54	62	72
Grass increasers	30	43	29	27	24	23	24	19
Range condition	72	61	77	78	90	80	84	92

1. Burned late spring, 1964, before deferment.
2. Burned annually early, mid, and late spring, respectively.

Table 22

Yearly account of summer gains (pounds per steer) under different methods of grazing pastures; 15-year summary, 1950-1964, the summer season of approximately 150 days.

Pasture no.	1	2	3	4, 5, 6	9	10	11
Management	Moderately stocked	Over-stocked	Under-stocked	Deferred rotated	Early-spring burned	Mid-spring burned	Late-spring burned
1950	221	210	214	205	216	254	230
1951	242	256	290	234	243	265	254
1952	246	209	228	197	251	278	283
1953	226	194	233	197	205	217	234
1954	261	237	236	214	270	271	306
1955	270	224	253	213	282	305	307
1956	179	184	168	154	212	234	216
1957	243	236	244	209	261	256	279
1958	208	207	207	198	222	270	253
1959	252	241	262	203	254	275	295
1960	267	242	255	235	299	289	314
1961	255	217	227	187	243	245	237
1962	232	177	215	167	201	205	212
1963	202	180	195	170[1]	187	200	233
1964	214	196	196	209[1]	225	231	218
Average	235	214	228	200	238	253	258

1. The deferred pasture of these three pastures was burned in late spring in 1963 and 1964.

Table 23

Per acre production and disappearance of forage, weeds, and mulch, Donaldson pasture, near Manhattan, Kansas, 1964.

Range site		Pasture number: 1	2	3	Av. of 4 & 5	6	9	10	11
		lbs./acre	lbs./acre	lbs./acre	lbs./acre	lbs./acre	lbs./acre	lbs./acre	lbs./acre
				Production					
OU (Ordinary upland)	Forage	1925	2412	3663	2974	3093	1681	2341	2892
	Weeds	308	456	535	311	181	267	262	205
	Mulch	1207	366	1985	976	229	....	....	....
LB (Limestone breaks)	Forage	1392	1165	2546	2703	2244	1460	2346	2366
	Weeds	388	639	295	121	35	337	156	22
	Mulch	1401	262	2493	1029	291	....	....	....
			Disappearance (index of amount grazed)						
OU	Forage	773	1993	848	711	2081	729	670	1128
	Weeds	141	106	271	97	132	106	174	130
	Mulch	—	—	156	—	90	....	....	....
LB	Forage	86	856	621	795	1167	729	1061	396
	Weeds	117	311	123	—	—	187	84	—
	Mulch	—	—	53	119	108	....	....	....
			Remainder (amount left ungrazed at end of season)						
OU	Forage	1152	419	2815	2263	1012	952	1671	1764
	Weeds	167	350	264	214	49	161	88	75
	Mulch	1207	366	1829	976	139	....	....	....
LB	Forage	1306	309	1925	1908	1077	731	1285	1970
	Weeds	271	328	172	121	35	150	72	22
	Mulch	1401	262	2440	910	183	....	....	....

— No apparent disappearance.
.... No mulch in burned pastures.

was blowing when the early-spring-burned pasture was burned; there was very little grass to burn and only about half the pasture burned. Very little of the late-burned pasture actually burned due to lack of old grass and much new growth. The deferred pasture, 6, was burned in late spring and more of it burned than any of the other burning treatments but parts of it failed to burn.

Despite greater precipitation in 1964, yields of herbage were not significantly greater than in the dry season of 1963. The growing season of 1963 had started with ample reserve of soil moisture, so herbage growth continued well into the summer. Amounts of moisture at the beginning of the 1964 season were low in the upper 6 feet of soil, and the reserve was not replenished during the year.

Amounts of mulch remaining at the close of the 1964 growing season were generally somewhat smaller than a year earlier, reflecting the reduced production of dry 1963.

Range condition estimates in 1964 revealed little change from 1963. Light stocking, deferred grazing, and mid- to late-spring burning have resulted in increased grass production, however.

Supplementing Prairie Hay Rations with Urea and Trace Minerals, 1964-65 (Project 253-4-6).

E. F. Smith, F. W. Boren, D. Richardson, and D. W. Loeppke

The trace minerals, cobalt, iodine, copper, and zinc, were added to a prairie hay-limited sorghum grain ration in an effort to improve utilization of prairie hay. Since increased quantities of urea are being successfully used in high-energy rations, its value as a protein extender in a primarily prairie hay ration was tested.

Prairie hay and rolled sorghum grain were the base feeds in all rations. In two of the lots, 18 and 19, those two feeds supplied the only source of protein. Lot 19 was fed a trace mineral supplement described in Footnote 1, Table 24. Lots 20 and 21 received enough urea to build their protein equivalent intake to 1.50 pounds per animal daily; one of those lots, 21, received the trace mineral supplement. Lots 22 and 23 received soybean oil meal to increase protein intake to 1.50 pounds per steer daily; Lot 23 received the trace mineral supplement.

The 60 steer calves, 6 lots of 10 steers each, used in the trial were choice-grade feeder calves purchased near Alden, Kansas.

As much prairie hay was offered the calves as they would clean up without wasting it. The grain was fed once daily; mixed with it each day was 1 pound of finely ground sorghum grain carrier per steer to which the additives listed in Footnote 1, Table 24, were added as well as the urea and trace minerals for the indicated lots. Soybean meal fed to Lots 22 and 23 was fed once daily and mixed with the grain.

The urea supplement was unpalatable. It took from one feeding to another, 24 hours, for it to be eaten. After the first two weeks, 5% molasses was added but it seemed to have little effect. All the steers had been receiving some sorghum grain prior to the start of the test. The first one or two times urea was fed mixed with the sorghum grain, the animals ate it readily but then started to leave feed so that four hours after a feeding half the feed would be left. The cattle were not accustomed to soybean oil meal; lots receiving it did not clean up their feed the first one or two feedings but they quickly found it quite palatable.

Urea as well as soybean oil meal increased hay intake and rate of gain and reduced the amount of feed required to produce a pound of gain compared with the prairie hay-sorghum grain diet.

Performance was best in lots where soybean oil meal was fed.

This trial shows that urea is utilized in a prairie hay and limited sorghum grain diet but less efficiently than soybean oil meal.

The added cobalt, iodine, copper, and zinc seemed to have little measurable effect on the steers.

Table 24
Supplementing prairie hay rations with urea and trace minerals, December 23, 1964, to March 31, 1965—98 days.

	Prairie hay, sorghum grain		Urea, prairie hay, sorghum grain		Soybean oil meal, prairie hay, sorghum grain	
Experimental treatment	No trace minerals added	Trace minerals added	No trace minerals added	Trace minerals added	No trace minerals added	Trace minerals added
Lot no.	18	19	20	21	22	23
Initial wt. per steer, lbs.	438	450	447	454	441	436
Daily gain per steer, lbs.	.76	.88	1.28	1.14	1.66	1.67
Daily ration per steer, lbs.:						
Urea[1]	....	....	0.15	0.15	....	....
Soybean oil meal	....	....	....	....	1.0	1.0
Sorghum grain, rolled	5.0	5.0	4.85	4.85	4.0	4.0
Prairie hay	8.0	8.8	10.1	10.1	10.2	10.2
Trace minerals (cobalt, iodine, copper, and zinc)[1]		Yes		Yes		Yes
Monosodium phosphate, stilbestrol, aureomycin, vitamin A and molasses[1]	Yes	Yes	Yes	Yes	Yes	Yes
Feed per lb. of gain, lbs.:						
Concentrates	6.6	5.7	3.9	4.4	3.0	3.0
Prairie hay	10.5	10.1	7.8	8.9	6.2	6.1
Total	17.1	15.8	11.7	13.3	9.2	9.1

1. The urea and trace minerals were added to finely ground sorghum grain fed at 1 pound per steer daily. Cobalt sulfate, potassium iodine, copper carbonate, and zinc carbonate were added to supply per head daily: 1 mg. cobalt, 1.1 mg. iodine, 52 mgs. copper, 312 mgs. zinc. Other materials were fed in the following quantities: monosodium phosphate to supply 5 grams of phosphorus per head daily; stilbestrol, 10 mgs. per steer daily; aureomycin, 50 mgs. per head daily; vitamin A, 10,000 I.U. per steer daily. Five percent molasses was added to the 1 pound of sorghum grain two weeks after the trial began.

A Comparison of Different Methods of Getting Cattle on a High Grain Ration and the Value of Prairie Hay in Finishing Rations.

M. C. Clark, E. F. Smith, D. Richardson, F. W. Boren, and L. Dunn

Cottonseed hulls have been used extensively in cattle rations as a source of roughage; the content in the ration is usually gradually lowered until the desired amount of concentrate is being consumed. In this study wheat bran was compared with cottonseed hulls for roughage. Since the question whether either feed was necessary arose, a third treatment was added where the heifers were turned directly on a self-feeder filled with a concentrate mixture containing 92% rolled sorghum grain; prairie hay was available for those turned directly on the self-feeder, in addition to the concentrate mixture in the self-feeder.

Under all three treatments, cottonseed hulls, wheat bran and turning on rolled sorghum grain directly, there were two lots of 10 heifers each. One lot was fed prairie hay and the other, no hay. All heifers going directly on feed received hay initially which was gradually eliminated (about 4 weeks) in one of the lots.

The heifers used were good to choice grade yearling Herefords that had been wintered on silage and prairie hay; some had received a small amount of grain; they were equally divided among treatments. For 6 weeks before the test, all heifers were on a ration of prairie hay, 4 pounds of ground corn and 1.25 pounds of soybean oil meal per head daily.

The wheat bran used had been pelleted (3/16 inch in diameter). It was then run through a roller to break it to several pieces and is referred to as wheat bran crumbles.

All the rations fed contained 11% or more protein and were formulated as nearly as possible to meet all the nutrient requirements for finishing heifers. With the cottonseed hull ration it was necessary to add soybean oil meal and urea to build the protein to the required level.

A 1000-pound mix of each one of the rations listed in Table 25 was prepared. When nearly all of the first 1000 pounds was consumed, for example wheat bran crumbles (W1), the next 1000 pounds (W2) were put in the self-feeder. When all four formulations had been placed in the feeder (W1, W2, W3, W4), it was filled with rolled sorghum grain ration (R1). Eventually, after the last lot had consumed its 4000 pounds of starter ration, all lots (wheat bran crumble lots and cottonseed hull lots) were on the same ration, R1, Table 25, as were the two lots of heifers that started on that ration (R1).

Prairie hay, when fed, was in amounts the heifers would clean up. After about 2 weeks, that was about 2 pounds per heifer daily.

The experimental treatments were:

Lot 18—Self-fed a ration made up initially of 50% wheat bran crumbles (Table 25, ration W1) and gradually reduced in wheat bran until it was omitted entirely. About as much hay was fed as the heifers desired.

Lot 23—Same as Lot 18, except no hay was fed.

Lot 20—Self-fed a ration made up initially of 40% cottonseed hulls (Table 25, ration C1) and gradually reduced in hulls until they were omitted entirely. About as much prairie hay was fed as the heifers desired.

Lot 19—Same as Lot 20 except no hay was fed.

Lot 22—Started on a rolled sorghum grain ration (ration R1 in Table 25) at the same time the other lots were introduced to their starter ration of bran or hulls. Prairie hay was available at all times.

Lot 21—Same as Lot 22, except the hay was gradually reduced until no hay was fed after about 4 weeks.

No digestive disturbances were observed among any animals except in Lot 20, a lot receiving cottonseed hulls and hay. About the time their last ration containing hulls (C4) was replaced with the rolled sorghum grain ration (R1), their droppings became loose and they went "off feed." No heifers foundered, at least none severely enough to be noticed

Table 25
Composition of rations.

	Each of the rations below was self-fed about 5 to 6 days, gradually decreasing the bran or hulls and finally switching to the rolled sorghum grain ration (R1). This ration fed to Lots 18 and 23 — Wheat bran crumbles				This ration fed to Lots 19 and 20 — Cottonseed hulls				This ration self-fed Lots 21 and 22 entire test and all other lots after about first 3 weeks. Rolled sorghum grain
Ration no.	W1	W2	W3	W4	C1	C2	C3	C4	R1
Composition, %:									
Wheat bran crumbles	50.00	40.00	20.00	10.00	....	....	....	....	
Cottonseed hulls	....	....	....	....	40.00	30.00	15.00	7.50	
Rolled sorghum grain	39.50	49.50	69.50	83.00	40.75	53.25	70.25	83.00	92.00
Dehydrated alfalfa meal	10.00	10.00	10.00	5.00	10.00	10.00	10.00	5.00	5.00
Soybean oil meal	....	....	....	....	7.50	6.00	3.00	2.50	1.00
Urea	....	....	....	1.00	1.00	1.00	1.00	1.00	1.00
Ground limestone	....	....	....	0.50	0.25	0.25	0.25	0.50	0.50
Salt	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Trace mineral[1] Aureomycin[2] Diethylstilbestrol[3] Vitamin A[4]	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25

1. Trace mineral premix supplied by Calcium Carbonate Co., Chicago, Ill.
2. Aureomycin supplied by American Cyanamid Co. and fed at rate of 4 mgs. per lb. of ration.
3. Diethylstilbestrol mixed to supply 0.5 mg. per lb. of feed.
4. Vitamin A added to supply 750 I.U. per lb. of feed.

Table 26
Methods of getting cattle on a high grain ration, May 6 to October 2, 1964—149 days.

Experimental treatment	These lots were self-fed either bran or hull rations listed in Table 25 for about the first 3 weeks or until bran or hulls were eliminated, then they were self-fed the rolled sorghum grain ration (R1) for the remainder of the test				Self-fed rolled sorghum grain ration R1 (see Table 25) entire test	
	Self-fed wheat bran crumble rations initially		Self-fed cottonseed hull rations initially			
	Fed hay	No hay	Fed hay	No hay	Fed hay	No hay[1]
Lot no.	18	23	20	19	22	21
No. of heifers per lot	10	10	10	10	10	10
Initial wt. per heifer, lbs.	632	615	600	620	622	618
Performance first 19 days on test, lbs.:						
Daily gain	2.89	2.32	2.32	3.00	2.79	2.53
Concentrate mixture consumed per head daily	17.5	15.9	20.3	20.9	7.5	8.5
Prairie hay consumed per head daily	5.0		4.3		4.2	4.0[1]
Final wt. per heifer	955	973	931	971	939	948
Av. daily gain, entire test	2.16	2.40	2.21	2.36	2.11	2.22
Feed consumption per heifer daily, lbs:						
Concentrate mixture	17.4	17.9	19.0	17.8	17.1	16.5
Prairie hay	2.4		2.3		2.3	0.7[1]
Total feed	19.8	17.9	21.3	17.8	19.4	17.2
Feed per lb. of gain, lbs.	9.16	7.45	9.59	7.56	9.14	7.74
Feed cost per cwt. gain[2]	$16.80	$15.43	$17.89	$15.74	$16.69	$15.34
Carcass data:						
Carcass grade score[3]	18.7	18.0	19.1	20.0	19.5	19.2
Marbling score[4]	6.3	6.4	6.0	5.6	5.8	5.9
Rib-eye size, sq. in.	10.7	11.1	10.6	10.9	10.4	10.3
Fat thickness, in.	.9	1.0	1.0	1.0	1.1	1.1

1. Prairie hay was fed to Lot 21 only the first 31 days on test.
2. Cost per ton of ration delivered: wheat bran, $43.30; cottonseed hulls, $44.29; sorghum grain, $41.19.
3. Carcass grade score: High good, 18; low choice, 19; av. choice, 20.
4. Marbling score: Lower score indicates greater degree of marbling.

in the lots. When the heifers were driven to the scales each 28 days to be weighed, two in Lot 22 that were placed directly on the sorghum grain ration seemed to be slightly sore footed during the latter part of the test. They may have experienced slight founder.

The cottonseed hull lots were changed from their last hull ration (C4, Table 25) to the rolled sorghum grain ration (R1, Table 25) after about 20 days on test, and at about 22-24 days the wheat bran lots were changed to ration R1.

From this test it seems that wheat bran compares favorably with cottonseed hulls for gradually introducing a high grain ration to finishing cattle.

Starting cattle on a high grain ration (92% sorghum grain) remains yet to be completely tested. Ten heifers brought in from pasture in the fall of 1964 were started on such a ration. Two of the ten experienced severe digestive upsets and one nearly died. The ration was somewhat different from the one outlined here but contained about the same percentage of grain.

During the first 19 days on test (Table 26) the heifers on the high grain ration (R1), Lots 21 and 22, had a much lower concentrate intake than the other heifers, about 8 pounds per head daily compared with 16-17 pounds for the wheat bran lots. Cottonseed hull rations seemed to be most palatable of all at around 20 pounds of intake daily. Low intake of Lots 21 and 22 is unexplained. Their ration was available at all times in a self-feeder. Performance over a short period (19 days) is difficult to evaluate due to variation in cattle weights from day to day. All lots seemed to be gaining satisfactorily, however.

For the entire 149-day trial, lots where hay was omitted gained more and required less feed per pound of gain than when hay was fed. Heifers in Lots 18 and 23, wheat bran lots, graded about a third of a grade lower than those on other treatments.

Level of Protein for Heifer Calves Wintered on Bluestem Pasture, 1963-65 (Project 253).

C. V. DeGeer, E. F. Smith, D. Richardson, and D. L. Good

The 66 heifers used were good-to-choice Herefords purchased near Fort Davis, Texas, assigned to treatments on a random weight basis.

The heifers were rotated between pastures to minimize any differences due to pastures during the first winter grazing period and the summer grazing period. Dicalcium phosphate was fed to standardize phosphorus intake between groups during the first winter grazing period.

Heifers were fed the experimental rations shown in Table 27 three times weekly. During summer grazing only salt was fed.

The heifers were bred from July 1 to October 1, 1964. From July 1 to August 15, the heifers were penned each night and those in heat artificially bred, using semen from a Hereford bull. From August 15 to October 1, a Hereford bull was with the heifers.

The results are reported in Table 27.

The heifers receiving only sorghum grain gained less than either of the other treatments during the first winter grazing period.

The results indicate there was no advantage to feeding 2 pounds of soybean oil meal compared to feeding 1 pound of sorghum grain and 1 pound of soybean oil meal.

Heifers received only sorghum grain slightly outgained heifers on the other treatments during the summer grazing period.

During the second winter grazing period, heifers receiving only sorghum grain lost weight, an average of 0.46 pound per head daily. As the amount of soybean oil meal increased, performance improved. Heifers receiving 1 pound of soybean oil meal and 1 pound of sorghum grain per head daily gained an average of 0.48 pound per head daily, while those receiving 2 pounds of soybean oil meal gained an average of 0.69 pound per head daily.

Table 27

Level of protein for heifer calves wintered on bluestem pasture, December 6, 1963, to March 4, 1965—451 days.

Treatment	Sorghum grain		Sorghum grain and soybean oil meal		Soybean oil meal	
Lot no.	1	3	2	4	5	6
No. of heifers	11	11	11	11	11	11
Initial wt. per heifer, lbs.	433	424	436	427	426	438
Winter grazing period—December 6, 1963, to May 1, 1964—146 days.						
Daily gain per heifer, lbs.	0	.12	.45	.47	.49	.40
Daily ration per heifer, lbs.:						
Ground sorghum grain	2	2	1	1	....	....
Soybean oil meal	....	....	1	1	2	2
Dicalcium phosphate	.1	.1	.075	.075	.05	.05
Vitamin A. IU	15,000					
Bluestem pasture	Free choice					
Salt	Free choice					
Summer grazing—May 1, 1964, to December 3, 1964—214 days.						
Initial wt. per heifer, lbs.	426	447	502	495	491	494
Daily gain, lbs.	1.03	1.03	.86	.93	.97	.86
No. of heifers pregnant[1]	8	10	11	11	8	10
Winter grazing—December 3, 1964, to March 3, 1965—91 days.						
No. of heifers	8	10	11	11	8	10
Initial wt., lbs.	646	667	687	694	699	678
Daily gain per heifer, lbs.	—.57	—.35	.45	.40	.66	.71
Daily ration per heifer, lbs.						
Ground sorghum grain	2	2	1	1	....	....
Soybean oil meal	....	....	1	1	2	2
Bluestem pasture	Free choice					
Salt	Free choice					
Summary, December 6, 1963, to March 3, 1965—451 days.						
Final wt. per heifer, lbs.	594	635	728	730	759	744
Gain per heifer, lbs.	161	211	289	303	333	306
Daily gain per heifer, lbs.	.36	.47	.64	.67	.74	.68

1. Average weights and gains from this point are based on pregnant heifers only.

Over the entire period, heifers receiving only sorghum grain gained less (an average daily gain of 0.37 pound per head) than either those receiving 1 pound of sorghum grain and 1 pound of soybean oil meal per head daily (an average daily gain of 0.66 pound per head) or those receiving 2 pounds of soybean oil meal per head daily (an average daily gain of 0.71 pound per head).

The results indicate level of protein in the winter ration had no effect on conception rate.

Improvement of Beef Cattle Through Breeding (Project 286).

W. H. Smith, J. D. Wheat, and H. G. Spies

The purebred Shorthorn cattle breeding program was continued during 1964 according to the plan initiated in 1949. Inbreeding of the two lines has been continued. The Wernacre Premier Line is in its fifth generation and the Mercury line in its fourth generation of inbreeding. The inbreeding program for both lines has been basically to continue successive generations of half-sibbing.

The study was initiated to study the inheritance of production traits in beef cattle, to evaluate the effects of inbreeding in cattle and to explore the feasibility of using inbred lines of beef cattle for the breeding improvement of their production traits. No extensive line crossing has been attempted because of the relatively low levels of inbreeding represented in both lines to date, and the limited number of animals in the project during its progress. Inbreeding levels will continue to be increased as a major objective.

Numerous production data have been collected on both lines. Some data have been subjected to preliminary statistical analyses.

Management of the experimental cattle includes weighing each cow and calf immediately following parturition. Summer pasture breeding is practiced and the calves are born during the spring and early summer each year. Creep feeding during the suckling period is not practiced. Calves are weaned, weighed and scored for type at approximately 6 months and the standardized weaning age for weaning weight adjustment is 180 days. All calves are placed on individual feeding trials for record-of-performance tests for 182 days shortly after they are weaned. The final age at the termination of the feeding test is approximately 365 days. Feed consumption and live weight gains are maintained during the feeding period. The calves are weighed and scored for type at the termination of the feeding trials. Individuals possessing higher gains or weight per day of age and type scores have been retained for breeding replacements.

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. No calves have been castrated and fed as steers since 1957.

Production data for the 1963 calves are summarized in Table 28. The 1964 calves had not completed their feeding tests when this was written. Thirty-seven calves of the 1964 calf crop are being fed individually.

To date, no abnormalities attributable to inbreeding have occurred in either inbred line. More calves have been still-born in the Mercury line than the Wernacre Premier.

Table 28
Summary of the 1963 Shorthorn calves.

Tag no.	Coefficient of inbreeding	Birth weight	Weaning weight	Weaning score	Days fed	Initial weight	Final weight	Total gain	Av. daily gain	Final score	T.D.N. per cwt. gain
					Mercury Line, Bulls						
5	18.75	43	317	2	182	260	770	410	2.25	2−	540
6	12.50	67	400	2+	182	440	835	395	2.17	1−	532
8	16.24	79	359	1	182	391	845	454	2.49	2+	472
13	9.38	75	405	2	182	430	960	530	2.91	2+	447
14	17.19	67	293	2+	182	327	830	503	2.76	1−	406
18	6.25	51	338	2−	182	385	840	455	2.50	3+	409
19	5.25	55	322	2−	182	365	750	385	2.12	3+	510
21	12.50	48	325	2	182	352	850	498	2.74	1−	461
23	15.50	61	370	2	182	395	895	500	2.75	2	444
25	14.69	80	312	2	182	340	821	481	2.64	2−	421
28	13.50	60	349	2	182	380	805	425	2.34	2−	422
30	16.25	79	355	1−	182	384	848	464	2.55	2	463
32	7.81	80	398	2	182	432	840	408	2.24	2+	461
33	15.63	61	272	2−	182	315	740	425	2.34	3+	448
34	12.50	72	310	2−	182	342	760	418	2.30	3	490
Av.	12.93	65	342	2	....	376	826	450	2.47	2	462
					Heifers						
1	15.63	55	235	2	182	260	617	357	1.96	2	533
2	13.45	55	241	2	182	255	580	325	1.79	2	478
9	15.63	65	240	2	182	230	565	335	1.84	2−	455
10	7.18	76	358	1	182	380	778	398	2.19	1	455
12	15.92	75	225	1−	182	233	566	333	1.83	1−	586
16	15.63	73	295	1	182	335	740	405	2.23	1	464
17	18.75	61	257	3+	182	275	640	365	2.01	2+	486
24	16.75	59	219	3+	182	245	612	367	2.02	2	421
27	17.50	48	315	2+	182	340	655	315	1.73	1−	528
35	7.81	61	250	2	182	257	585	328	1.80	2	511
Av.	14.43	63	264	2	....	281	634	353	1.94	2+	492
					Wernacre Premier Line, Bulls						
11	33.05	55	325	3	182	355	835	480	2.64	3+	464
20	30.86	70	340	3+	182	369	850	491	2.70	3	508
37	29.81	73	370	3	182	398	880	482	2.65	3+	492
Av.	31.24	66	345	3	....	371	855	484	2.66	3+	488
					Heifers						
3	31.43	75	193	3−	182	206	575	369	2.03	3−	432
7	30.25	68	300	2−	182	325	685	360	1.98	3+	557
22	30.86	70	215	3	182	222	550	328	1.80	3	381
26	34.05	83	280	3−	182	285	640	355	1.95	3	605
29	28.27	70	311	3	182	340	650	310	1.70	3−	663
38	34.09	80	370	3	182	398	730	332	1.82	3+	686
Av.	31.49	74	278	3	....	296	638	342	1.88	3	554

The Value of Feed Lot Lighting, 1964

F. W. Boren, R. Lipper, E. F. Smith, and D. Richardson

In the two tests reported here the concentrate mixture or roughage-concentrate mixture was before the animals at all times. In addition a small amount of prairie hay was fed. In Lots 6 and 3 yearling Hereford feeder heifers were used, in Lots 17 and 13, yearling Hereford steers were the experimental animals. All the animals graded good to choice as feeders.

The lighting arrangement consisted of three 25-watt incandescent lamps, spaced about 8 feet apart and suspended under sheet-metal reflectors about 7 feet high. A photoelectric control automatically turned the lights on at dusk and off at dawn. The low mounting height and the reflectors were used to limit lighting to the lighted lot. In one comparison the two lots were about 80 feet apart; in the other they were about 100 feet apart.

It is doubtful whether the lights had any effect on the performance of the animals, although in the one test the weight gains were increased .40 of a pound per steer daily. However, the yield for those steers was 2.1% less, which indicates that the increased gain may have been at least partially intestinal fill, since all other carcass measurements were about the same (Table 29).

Table 29
The value of feed lot lighting.

Treatment	Concentrate mixture, self-fed		Roughage-concentrate mixture, self-fed	
	Lights	No lights	Lights	No lights
Duration of study	140 days May 6 to September 24, 1964		138 days May 8 to September 28, 1964	
Lot numbers	6	3	17	13
Number animals per lot	10	10	8	10
Average initial wt., lbs.	588	596	792	817
Average final wt., lbs.	917	941	1134	1104
Daily gain per animal, lbs.	2.34	2.46	2.48	2.08
Daily ration per steer, lbs.:				
Concentrate mixture[1]	18.2	18.6		
Roughage-concentrate mixture[2]			27.8	26.5
Prairie hay	1.8	1.8	1.5	1.6
Feed per pound of gain, lbs.:				
Concentrate mixture	7.8	7.6		
Roughage concentrate mixture			11.2	12.7
Prairie hay	.8	.8	.6	.8
Total	8.6	8.4	12.8	13.5
Carcass data, av. per animal:				
Carcass wt., lbs.	574	580	667	673
Dressing %	63	62	58.8	60.9
Carcass grade[3]	18.2	18	17.1	17.2
Rib-eye area, sq. in.	11.3	11	11.9	11.6
Fat thickness, in	.94	.92	.86	.86

1. The concentrate mixture self-fed to Lots 3 and 6 on a percentage basis consisted of rolled sorghum grain, 84.4; soybean meal, 3.6; molasses, 5; dehydrated alfalfa, 5; ground limestone, 0.5; urea, 0.5; premix, 1. The premix supplied per head daily 70 mgs. aureomycin, 10 mgs. stilbestrol and 15,000 I.U. vitamin A. It also contained a commercial trace mineral mixture (Calcium Carbonate Co., Chicago, Ill.).

2. The roughage-concentrate mixture self-fed to Lots 17 and 13 on a percentage basis consisted of soybean oil meal, 10; rolled sorghum grain, 40; ground rice hulls, 35; molasses, 10; urea, dicalcium phosphate and premix, 1% each. The premix supplied per head daily 10 mgs. stilbestrol, 70 mgs. aureomycin and 28,000 I.U. of vitamin A.

3. The numerical grade, 17, represents average good; 18 is high good.

Cane Molasses and Hemicellulose Extract (Wood Molasses) in Rations for Finishing Steers. The Value of Shelter for Finishing Cattle, 1964 (Project 370).

F. W. Boren, H. B. Pfost, E. F. Smith, and D. Richardson

The only variable planned in the diet was type of molasses, which composed 10% of the self-fed roughage-concentrate mixture. Cane molasses was used in two lots; hemicellulose extract,* in two lots. The self-fed roughage-concentrate mixture was composed of these ingredients: soybean oil meal, 10%; rolled sorghum grain, 40%; ground rice hulls, 35%; molasses, 10%; urea, dicalcium phosphate and premix, 1% each. The premix supplied 10 mgs. stilbestrol, 70 mgs. aureomycin and 28,000 I.U. vitamin A per steer daily.

The average proximate analysis of the mixture was 14% protein, 1.9% fat and 14.2% fiber. In addition to the roughage-concentrate mixture, which was before the animals at all times, they were fed about all the prairie hay they would eat, about 3 pounds per head daily for the first seven weeks of the test and less later.

One lot receiving cane molasses and one receiving hemicellulose extract were in pens with no shed shelter. The concrete pens were 30 × 43 feet, with a 15- × 30-foot soil-floor shed open to the south. The shed was about 7 feet high at the rear, 12 feet high in front.

The steers used were choice-grade feeders that had been used in other tests and were relotted to minimize any differences due to prior treatment.

* A by-product of wood hardboard manufacture furnished by Masonite Corporation, Chicago, Ill.

Table 30
Cane molasses and hemicellulose extract in rations for finishing steers. The value of shelter for finishing cattle, May 8 to September 28, 1964—138 days.

Treatment	Cane molasses		Hemicellulose extract	
	Shed	No shed	Shed	No shed
Lot no.	13	15	16	14
Steers per lot	10	10	9	10
Initial wt., lbs.	817	820	811	812
Daily gain, lbs.	2.08	2.37	2.22	2.30
Daily ration per steer, lbs.:				
Roughage-concentrate mixture[1]	26.5	29.6	28.9	28.8
Prairie hay	1.6	1.5	1.4	1.5
Feed per lb. of gain, lbs.:				
Roughage-concentrate mixture	12.7	12.5	13.0	12.5
Prairie hay	.8	.6	.6	.6
Total	13.5	13.1	13.6	13.1
Carcass data:				
Av. carcass wt.	673	697	682	672
Av. dressing %	60.9	60.7	61.1	59.5
Av. carcass grade[2]	17.2	17.4	17.3	17.1
Av. rib-eye area, sq. in.	11.6	11.9	11.7	10.8
Av. fat thickness, in.	.86	.88	.92	.82

1. Identical rations fed to all lots, except cane molasses was fed to Lots 13 and 15 and wood molasses to Lots 14 and 16. The composition in percent was: soybean oil meal, 10; rolled sorghum grain, 40; ground rice hulls, 35; molasses, 10; urea, 1; dicalcium phosphate, 1; premix, 1. The premix supplied per head daily 10 mgs. stilbestrol, 70 mgs. aureomycin, 28,000 I.U. vitamin A.

2. The numerical grade, 17, represents average good.

The type of molasses fed seemed to have very little influence on rate of gain, feed consumption, palatability, efficiency or carcass characteristics measured (Table 30).

In the comparison where two lots of the steers had access to a shed and two did not, those without the shed shelter made a slightly greater daily gain. Probably 10 to 20% of the days were hot enough to cause panting by the steers. Steers with access to shade used it those days.

The Effects of Silage Additives on the Feeding Value of Forage Sorghum Silage, 1964-65 (Project 623).

F. W. Boren, G. M. Ward, E. F. Smith, and D. Richardson

This experiment was to determine effects from adding glucose, sucrose and starch to forage sorghum (DeKalb FS1a), immediately prior to ensiling, on the feeding value of the subsequent silage.

When the forage sorghum grain was at medium-to-hard dough stage, it was field chopped with a conventional silage cutter. Dry matter of the forage was determined at harvesting and equalized by adding water. Each additive was added to the forage prior to ensiling. The sorghum forage was ensiled in 40-ton concrete stave silos.

Two trials were conducted. In one, steer calves were fed in groups of 10; in the other, 3 steers were individually fed the silages. The steer calves used were good-to-choice Herefords from the Warner Ranch, Cimarron, Kansas. They were assigned to experimental diets on a random-weight basis.

The amount of glucose, sucrose and starch added was 5.7, 5.6, and 5.6% of dry matter, respectively.

Table 31 presents a summary of the group and individual feeding experiments. Although there were differences in average daily gains made by the calves, the differences were not statistically significant. Under the conditions of the experiment, silage additives used had no effect on average daily gains.

The silages fed were excellent quality, indicating that sorghum silage can be made from forage that is high (40%) in dry matter.

Table 31
The effects of silage additives on the feeding value of forage sorghum silage.

	December 4, 1964, to March 15, 1965 Group fed—100 days				December 4, 1964, to March 15, 1965 Individually fed—100 days			
Silage additive	None	Glucose	Sucrose	Starch	None	Glucose	Sucrose	Starch
Lot no.	3	4	5	6	3	4	5	6
No. steers	10	10	10	10	3	3	3	3
Initial wt., lbs.	417	416	417	417	417	417	417	417
Final wt., lbs.	551	564	563	558	542	552	550	535
Av. daily gain, lbs.	1.34	1.48	1.46	1.41	1.25	1.35	1.33	1.18
Av. daily ration, lbs.:								
Silage, free choice	26.2	26.4	25.6	25.0	24.5	24.5	24.1	23.0
Soybean oil meal	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25
Dicalcium phosphate	.10	.10	.10	.10	.10	.10	.10	.10
Salt	Free choice				Free choice			
Silage dry matter, %	40.2	40.1	39.6	40.2	40.2	40.1	39.6	40.2
Silage dry matter consumed per head daily, lbs.	10.5	10.6	10.1	10.1	9.85	9.82	9.54	9.25
Silage dry matter per lb. of gain, lbs.	7.84	7.16	6.92	7.16	7.88	7.27	7.17	7.84
Feed cost per cwt. gain[1]	$11.89	$10.82	$10.75	$10.96	$11.38	$11.30	$11.32	$12.42

1. Feed prices on page 72. Cost does not include salt consumed.

Table 32

Use of soybean oil meal, dehydrated alfalfa and urea in a sorghum grain finishing ration, May 6, 1964, to September 23, 1964—140 days.

Experimental treatment	Group fed: Soybean oil meal, dehydrated alfalfa, urea	Group fed: Dehydrated alfalfa, urea	Group fed: Urea	Individually fed: Soybean oil meal, dehydrated alfalfa, urea	Individually fed: Dehydrated alfalfa, urea	Individually fed: Urea
Ration no.	1	2	3	1	2	3
No. heifers per lot	10	10	10	4	4	4
Av. initial wt., lbs.	596	596	575	428	429	432
Av. final wt., lbs.	941	964	914	781	808	760
Av. daily gain, lbs.	2.46	2.63	2.42	2.53	2.70	2.35
Av. daily ration, lbs.:						
Rolled sorghum grain	15.69	17.31	16.29	13.93	14.91	13.93
Soybean meal	.67	....	....	.59	....	....
Molasses	.93	.99	.88	.83	.85	.76
Dehydrated alfalfa	.93	.99	....	.83	.85	....
Ground limestone	.09	.10	.13	.08	.09	.11
Urea	.09	.22	.23	.08	.19	.20
Premix[1]	.19	.20	.16	.17	.17	.15
Av. daily concentrate consumption, lbs.	18.59	19.81	17.69	16.51	17.06	15.14
Av. daily prairie hay consumption, lbs.	1.84	1.84	1.84	1.64	1.64	1.64
Total	20.43	20.65	19.43	18.15	18.70	16.78
Feed per lb. of gain, lbs.:						
Complete ration	7.56	7.53	7.39	6.55	6.32	6.44
Prairie hay	.75	.70	.76	.65	.61	.70
Total	8.31	8.23	8.15	7.20	6.93	7.14
Feed cost per cwt. gain[2]	$22.07	$21.56	$21.45	$19.12	$18.12	$18.72
% protein of concentrate rations	13.3	13.2	13.2	....	....	....
Concentrate ration components, %:						
Rolled sorghum grain	84.40	87.40	92.00	....	....	....
Soybean meal	3.60	....	....	....	....	....
Molasses	5.00	5.00	5.00	....	....	....
Dehydrated alfalfa	5.00	5.00	....	....	....	....
Ground limestone	0.50	.50	.70	....	....	....
Urea	0.50	1.10	1.30	....	....	....
Premix[1]	1.00	1.00	1.00	....	....	....
Carcass data:						
Chilled carcass wt., av.	580	596	560	474	480	449
Dressing %, av.[3]	62	62	61	61	59	59
Carcass grade:						
High choice			1			
Av. choice	3	3	1			
Low choice	1	6	4			
High good		1	2	2	2	
Av. good	5			1	1	2
Low good	1		2	1	1	2
Av. carcass grade score[4]	18.0	19.2	18.5	17.25	17.25	16.50
Rib-eye area, 12th rib, sq. in.	10.95	10.95	10.83	9.39	9.79	9.25
Rib-eye area per 100 lbs. chilled carcass wt., sq. in.	1.89	1.84	1.93	1.98	2.04	2.06
Rib-eye area per 100 lbs. slaughter wt., sq. in.	1.16	1.14	1.18	1.20	1.21	1.23
Fat thickness, 12th rib, in.	.92	1.00	.95	.67	.80	.75

1. Each pound of premix contained 76,000 I.U. vitamin A, 352 mgs. aureomycin, 50 mgs. stilbestrol, and enough suitable carrier to make the total equal 1% of the finished feed. A trace mineral mixture was included, supplied by Calcium Carbonate Co., Chicago, Ill.

2. Feed prices: Lots 3 and 6, $2.83 per cwt.; Lots 4 and 7, $2.78 per cwt.; Lots 5 and 8, $2.81 per cwt.; prairie hay, $0.90 per cwt.

3. Based on chilled carcass weight.

4. Carcass grade score: High choice, 21; av. choice, 20; low choice, 19; high good, 18; av. good, 17; low good, 16.

Use of Soybean Oil Meal, Dehydrated Alfalfa and Urea in a Sorghum Grain Finishing Ration, 1964.

F. W. Boren, K. L. Gaudt, E. F. Smith, and D. Richardson

The following ingredients were used with rolled sorghum grain, which contained 10% protein, to formulate a 13% protein mixture: (1) soybean oil meal, dehydrated alfalfa and urea; (2) dehydrated alfalfa and urea; and (3) urea. In addition to the concentrate mixture which was self-fed, less than 2 pounds of prairie hay was fed per head daily. The heifers had been on a ration of wheat bran, dehydrated alfalfa and rolled sorghum grain. They were reallotted to minimize any previous treatment effect. Sorghum grain was increased until it made up to 85% of the ration. Then the above experimental rations were started.

Two different tests are reported in Table 32. One where the three diets were tested by heifers under group feeding and one where the three diets were fed to animals penned individually.

Heifers fed the combination of alfalfa and urea gained slightly more than those fed soybean oil meal or urea. Feed consumption was slightly lower on the urea ration. The experimental rations had little effect on feed efficiency or carcass characteristics measured except that carcass grade was about one third grade higher under group feeding where dehydrated alfalfa and urea were fed and grade was slightly lower under individual feeding with the urea ration.

Level of Vitamin A in Beef Steer Finishing Ration Fed on High and Low Levels of Silage (Project 567).

D. Richardson, E. F. Smith, L. H. Harbers, and T. P. Buamah

Sixty Hereford steer calves from Warner's Ranch in Rice County were wintered on a ration of 1 pound soybean oil meal, sorghum silage, sorghum grain and minerals. The calves weighed 450 to 550 pounds; 30 were fed 4 pounds of grain and 30 were fed 8 pounds of grain per head daily for 112 days. They averaged approximately 743 pounds at the end of the wintering period.

The 60 steers were allotted to 6 lots of 10 each and numbered consecutively from 7 to 12. Each lot received 5 steers that had been fed 4 pounds of grain and 5 steers that had been fed 8 pounds of grain. Three lots (7, 8, and 9) received a low level (10 pounds) of silage and three lots (10, 11, and 12) received a high level (20 pounds) of silage. One lot on each level of silage received no added vitamin A (Lots 7 and 10), 15,000 I.U. of vitamin A (Lots 8 and 11) and 30,000 I.U. of vitamin A (Lots 9 and 12).

The corn silage was poor quality and the high-silage groups would not eat 20 pounds per head daily. The amount of silage was lowered to 7 and 14 pounds, respectively, for the low- and high-silage lots. Sorghum grain was fed in the amount that the animals would clean up each day. Except for the added vitamin A, the supplement was the same for all lots. It was fed at the rate of 1.5 pounds per head daily and was composed of 60.5% soybean oil meal, 30.2% dehydrated alfalfa, 4.4% molasses, 4.4% calcium carbonate and 2.5% Aurofac 10 (supplied 70 mgs. aureomycin per head daily).

Results and Observations

Table 33 summarizes the results.

1. Average daily gain tended to be higher on high silage (2.00 pounds vs. 1.89); however, average cost was essentially the same ($19.97 per 100 pounds gain vs. $19.89).

2. There were no significant ($p < .05$) differences in gain except Lot 12 (high silage and 30,000 I.U. of vitamin A).

3. Livers in lots with no vitamin A were extremely low in vitamin A. Levels of added vitamin A were reflected in higher liver storage.

4. There were no significant differences in feed efficiency, carcass grade, dressing percentage, rib-eye area or fat thickness.

5. Level of grain in the wintering ration did not cause any difference in rate of gain (1.91 for those wintered on 4 pounds and 1.93 for those on 8 pounds) or any of the carcass characteristics.

Table 33
Results of feed lot test, March 6 to September 18, 1964—196 days.

Level of silage	Low			High		
Lot	7	8	9	10	11	12
Steers per lot	9[1]	9[2]	10	10	10	10
Initial wt. per steer, lbs.	741	745	742	742	743	744
Final wt. per steer, lbs.	1106	1104	1131	1105	1130	1167
Av. daily gain, lbs.	1.87	1.83	1.98	1.85	1.98	2.16
I.U. vit. A added daily	0	15000	30000	0	15000	30000
Av. daily ration, lbs.:						
Supplement	1.5	1.5	1.5	1.5	1.5	1.5
Sorghum grain	14.6	14.5	15.3	13.9	14.8	15.3
Silage	9.1	9.0	9.1	14.4	15.4	15.7
Feed per cwt. gain, lbs.:						
Supplement	81	83	76	81	76	70
Sorghum grain	783	794	771	750	749	707
Silage	486	492	457	775	777	728
Feed cost per cwt. gain	$19.92	$20.27	$19.49	$20.49	$20.31	$19.13
Shrink to market, %	2.51	2.26	1.68	2.40	2.74	2.10
Av. hot carcass wt., less 2%	688.2	674.2	698.3	693.1	693.1	722.3
Dressing %, feed lot wt.	62.2	61.08	61.74	62.70	61.31	61.89
Dressing %, market wt.	63.8	62.49	62.80	64.24	63.04	63.22
Av. fat thickness, 12th rib, in.	0.85	0.95	1.07	1.01	1.05	1.03
Av. size rib eye, sq. in.	11.71	11.07	11.28	12.00	11.45	11.43
Carcass grades:						
Top choice	....	1	....	....	....	1
Av. choice	2	2	....	3	....	1
Low choice	5	4	5	6	4	4
Top good	2	2	4	1	6	3
Av. good	....	....	1	....	....	....
Low good	....	....	....	....	....	....
Av. liver wt., lbs.	11.11	10.36	10.71	10.19	10.45	10.88
Vit. A per gram liver, I.U.	0.77	16.03	30.06	0.91	14.87	34.36
Total vit. A per gram liver, I.U.	4112	76623	148145	4463	71318	166446
Carotene per gram liver, mcg.	1.06	1.31	0.77	1.25	1.11	1.21
Total carotene per gram liver, mgs.	5.3	6.2	3.9	6.1	5.2	6.0

1. One steer died from gastroenteritis.
2. One steer died from urinary calculi.

Level of Sorghum Grain in Steer Calf Wintering Ration (Project 567).

D. Richardson, E. F. Smith, F. W. Boren, L. H. Harbers, and R. S. Lebdosoekojo

Sixty Hereford steer calves averaging 440 pounds from Warner's Ranch in Rice County were wintered on sorghum silage, 1 pound soybean oil meal and sorghum grain. Thirty steers received 4 pounds grain per head daily and 30 received 8 pounds. The results are shown in Table 34.

After 112 days, the steers were reallotted to six lots of 10 steers each with five from each level of grain. The animals are now on a test to study:

1. 0, 15,000 and 30,000 I.U. of added vitamin A to a sorghum silage, sorghum grain and supplementation.
2. Performance on high and low levels of silage.
3. Level of wintering ration on subsequent performance.

Table 34

Level of sorghum grain in steer calf wintering ration results, November 13, 1964, to March 5, 1965—112 days.

Lot no.	7	8	9	10	11	12
No. steers per lot	10	10	10	10	10	10
Av. initial wt., lbs.	441.0	440.5	440.5	441.5	441.0	441.5
Av. final wt., lbs.	620.5	617.5	622.5	633.0	638.5	642.5
Av. daily gain, lbs.	1.60	1.58	1.63	1.71	1.76	1.79
Av. daily ration, lbs.:						
Sorghum silage	23.4	23.2	23.2	17.7	17.7	17.8
Sorghum grain	4.2	4.2	4.2	7.5	7.5	7.5
Soybean oil meal	1.0	1.0	1.0	1.0	1.0	1.0
Feed per cwt. gain, lbs.:						
Sorghum silage	1461.0	1469.0	1428.6	1035.8	1004.3	990.5
Sorghum grain	263.9	267.5	260.2	440.2	426.8	419.4
Soybean oil meal	67.4	63.3	61.5	58.5	56.7	55.7
Feed cost per cwt. gain	$13.61	$13.78	$13.40	$15.31	$14.84	$14.59

Nutritive Value of Forages as Affected by Soil and Climatic Differences (Project 430).

D. Richardson, E. E. Banbury,[1] A. B. Erhart,[2] Grady Williams,[3] Oliver Russ,[3] E. F. Smith, D. C. Loper, L. H. Harbers, and R. F. Cox

This is the second test to measure differences, if any, in performance of cattle in various parts of Kansas due to location, soil, climate, rainfall and/or local feed.

Forty-eight Hereford steer calves from the same herd (Warner's, near Alden and Sterling, Kansas) averaging 454 pounds each were divided as uniformly as possible into four groups of 12 animals. One group was assigned to each of four locations: Colby, Garden City, Manhattan, and Mound Valley. Uniform-size concrete lots with sheds were used at each location. Each group of 12 animals was subdivided into two groups of six. The wintering ration consisted of locally grown sorghum silage (FS1a) fed free choice with 5 pounds of locally grown second-cutting alfalfa hay per head daily. At the end of the wintering phase, silage was gradually decreased and removed from the ration. At the same time, locally grown sorghum grain was introduced and gradually increased until the grain was self-fed. Salt was the only added mineral throughout the test. Analyses of the feeds used are shown in Table 35.

1. Colby Station.
2. Garden City Station.
3. Mound Valley Station.

Results and Observations

Results of the second test are shown in Table 35. Greater differences in the performance of animals were observed between locations in this test than in the first test. However, satisfactory and economical performance was obtained at all locations. A third test is now in progress.

Table 35

Results of the wintering phase, November 8, 1963, to February 28, 1964—112 days.

Location	Colby		Garden City		Manhattan		Mound Valley	
Lot no.	1	2	1	2	1	2	1	2
No. steers per lot	6	6	6	6	6	6	6	6
Av. initial wt., lbs.	454.2	454.2	453.3	454.2	453.3	454.2	454.2	453.3
Av. final wt., lbs.	572.1	590.1	649.0	616.8	619.2	607.5	608.5	575.7
Av. daily gain, lbs.	1.05	1.21	1.75	1.45	1.48	1.37	1.38	1.09
Av. daily ration, lbs.:								
Sorghum silage	25.2	27.1	23.8	22.3	24.5	24.1	22.8	20.3
Alfalfa hay	4.3	5.0	4.9	4.9	5.0	5.0	5.0	5.0
Feed per cwt. gain, lbs.:								
Sorghum silage	2389	2233	1360	1534	1656	1760	1658	1858
Alfalfa hay	405	408	278	334	338	365	362	454
Total dry matter per cwt. gain, lbs.	954	921	680	786	886	947	807	949
Feed cost per cwt. gain	$14.62	$14.03	$8.92	$10.31	$11.05	$11.60	$11.16	$13.11
Results for fattening phase, February 29 to September 25, 1964—210 days.								
Initial wt. per steer, lbs.	572.1	590.1	649.0	616.8	619.2	607.5	608.5	575.7
Final wt. per steer, lbs.	1077	1090	1153	1078	1011	1046	1029	1037
Av. daily gain, lbs.	2.40	2.38	2.40	2.20	1.87	2.09	2.00	2.19
Av. daily ration, lbs.:								
Alfalfa hay	4.71	4.98	4.05	4.75	4.78	4.94	4.60	4.65
Sorghum grain	15.77	17.21	16.43	14.88	14.62	14.84	13.53	15.18
Feed per cwt. gain, lbs.:								
Alfalfa hay	196	209	169	216	256	237	230	212
Sorghum grain	656	723	684	677	784	711	676	692
Feed cost per cwt. gain[1]	$14.26	$15.62	$14.42	$14.89	$17.31	$15.76	$15.05	$15.01
Shrink to market, %	2.09	3.29	3.24	2.16	1.65	2.63	2.69	3.20
Av. hot carcass wt., lbs.	664.2	668.7	709.7	662.8	617.3	629.2	616.2	622.7
Av. cold carcass wt., lbs.	649.5	659.2	695.0	648.8	605.7	617.3	600.5	609.2
Dressing %, feed lot wt.	60.33	60.17	60.27	60.17	59.92	59.06	58.39	58.77
Dressing %, market wt.	61.61	62.21	62.29	61.50	60.92	60.62	60.00	60.71
Av. fat thickness, 12th rib, in.	0.78	0.65	0.88	0.64	0.73	0.66	0.44	0.55
Av. size rib eye, sq. in.	11.53	11.28	11.97	11.52	11.23	11.02	11.53	11.52
Av. degree marbling[2]	7.0	7.7	6.3	6.7	7.2	7.3	7.7	7.3
Carcass grades:								
Top choice	1	....	....	....	....	1	....	....
Av. choice	1	1	3	....	1	....	1	3
Low choice	3	4	3	6	2	2	1	....
Top good	....	....	....	....	....	....	2	....
Av. good	1	....	....	....	1	2	1	2
Low good	....	1	....	....	2	1	1	1
Av. liver wt., lbs.	11.38	11.04	11.04	9.96	9.83	9.71	10.46	9.75
Vit. A per gram liver, I.U.	5.25	3.62	5.96	9.63	3.06	1.64	2.18	1.42
Carotene per gram liver, mcg.	1.75	1.48	2.31	3.11	3.48	1.30	4.67	2.00

1. Alfalfa hay, $35 per ton; sorghum grain, $1.80 per cwt.
2. 5 = moderate, 6 = modest, 7 = small amount, 8 = slight amount, 9 = traces.

Table 36
Feedstuff analyses, 1963-64.

	Moisture, %	Dry matter, %	Protein, %	Ash, %	Ether extract, %	Crude fiber, %	N.F.E., %	Carotene, mgs. per lb.
Colby:								
Sorghum silage	72.14	27.86	1.71	2.42	0.59	6.60	16.54	1.0
Alfalfa hay	5.2	94.8	13.69	7.65	1.68	26.78	45.90	29.2
Sorghum grain								
Dryland	8.5	91.5	9.81	0.91	0.99	0.92	78.87	....
Irrigated	8.5	91.5	10.84	0.93	1.91	1.91	75.91	....
Garden City:								
Sorghum silage	69.0	31.0	1.76	2.42	0.65	7.45	18.72	2.0
Alfalfa hay	6.9	93.1	19.18	9.14	1.55	24.90	19.18	24.9
Sorghum grain	10.7	89.3	8.52	0.77	3.93	1.93	74.15	....
Manhattan:								
Sorghum silage	65.60	34.4	3.15	2.98	1.01	8.52	18.74	2.0
Alfalfa hay	6.50	93.5	16.71	7.32	2.41	24.74	42.32	17.6
Sorghum grain	12.10	87.9	9.97	0.95	2.76	1.47	72.75	....
Mound Valley:								
Sorghum silage	71.70	28.3	1.88	1.91	0.63	6.44	17.42	1.0
Alfalfa hay	6.70	93.3	18.58	9.63	1.82	22.70	40.57	8.8
Sorghum grain	11.30	88.7	9.46	1.02	1.53	2.34	74.35	....

Nutritive Value of Forages as Affected by Soil and Climatic Differences (Project 430), Progress Report.

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This is a progress report on the third test to determine whether there is a difference in the performance of beef steers due to location, soil, climate, rainfall and/or feed produced in farm areas of Kansas: Colby, Garden City, Manhattan, and Mound Valley. Forty-eight Hereford steer calves averaging 475 pounds and from the same herd (Warner's, near Alden and Sterling, Kansas) as steers used in the second test were divided into four groups of 12 animals. One lot was assigned to each of the four locations. The test is being conducted in the same manner as the two previous tests except that concrete has replaced soil floors under the sheds. Feed analyses are shown in Table 39 and results of the wintering phase in Table 37. The animals are now being finished for slaughter.

Note: Some observations are being made on the performance of Angus and Hereford cross at Colby: Charolais-Hereford and Charolais-Angus crosses at Garden City: and Holsteins at Mound Valley. Valid comparisons cannot be made because of source and ancestry of animal samples being used. The results of the wintering phase are shown in Table 38. The animals are being finished for slaughter in the same manner as animals in the regular project.

Table 37

Feed lot results for wintering phase, November 13, 1964, to March 5, 1965—112 days.

Location	Colby		Garden City		Manhattan		Mound Valley	
Lot no.	1	2	1	2	1	2	1	2
No. steers per lot	6	6	6	6	6	6	6	6
Av. initial wt., lbs.	475	475	475	477	476	476	471.8	479.2
Av. final wt., lbs.	615	612	598.2	602.2	620	607.5	662.2	672.2
Av. daily gain, lbs.	1.25	1.22	1.10	1.12	1.29	1.18	1.70	1.72
Av. daily ration, lbs.:								
Sorghum silage	28.9	30.9	23.6	24.2	22.0	22.0	24.6	26.3
Alfalfa hay	4.5	3.7	4.7	4.9	4.9	5.0	4.7	4.2
Feed per cwt. gain, lbs.:								
Sorghum silage	2316	2540	2147	2137	1712	1875	1445	1525
Alfalfa hay	363	302	399	429	383	424	276	246
Total dry matter per cwt. gain, lbs.	1085	1100	1130	1154	964	1060	779	779
Feed cost per cwt. gain	$13.80	$13.94	$13.58	$13.91	$11.64	$12.80	$9.23	$9.18

Table 38

Feed lot results for wintering phase, November 13, 1964, to March 5, 1965—112 days.

Location	Colby		Garden City		Manhattan		Mound Valley
Lot no.	III	IV	III	IV	....	....	III
Animals	Angus x Hereford (steers)	Angus x Hereford (heifers)	Charolais x Hereford	Charolais x Angus	....	....	Holstein
No. of animals	6	6	6	6	....	....	6
Av. initial wt., lbs.	487.5	423.3	499	485	....	....	410.3
Av. final wt., lbs.	598	537	653.5	621.8	....	....	589.2
Av. daily gains, lbs.	1.2	1.16	1.38	1.22	....	....	1.60
Av. daily ration, lbs.:							
Sorghum silage	32.0	26.2	29.6	24.7	....	....	31.0
Alfalfa hay	3.6	4.2	4.9	4.7	....	....	5.0
Feed per cwt. gain, lbs.:							
Sorghum silage	2848	2264	2136	2006	....	....	1940
Alfalfa hay	324	359	346	381	....	....	310
Total dry matter per cwt. gain, lbs.	1219	1065	1078	1063	....	....	988
Feed cost per cwt. gain	$15.44	$13.55	$12.87	$12.78	....	....	$11.64

Table 39
Feedstuff Analyses

	Dry matter, %	Moisture, %	Protein, %	Ash, %	Ether extract, %	Crude fiber, %	N.F.E.	Carotene, mgs. per lb.
Colby:								
Sorghum silage	32.09	67.91	1.95	2.01	0.66	6.86	20.61	2.28
Alfalfa hay	94.17	5.83	17.01	9.70	1.84	30.25	35.37	9.23
Sorghum grain	88.54	11.46	10.71	2.86	1.05	1.09	72.83	....
Garden City:								
Sorghum silage	35.77	64.23	1.58	2.57	0.52	5.67	25.43	3.05
Alfalfa hay	90.80	9.20	13.46	8.89	2.57	29.97	35.91	37.60
Sorghum grain	87.28	12.72	9.23	1.06	1.59	1.82	73.58	....
Manhattan:								
Sorghum silage	35.77	64.23	1.84	1.29	0.70	6.87	25.07	1.07
Alfalfa hay	91.73	8.27	22.54	7.48	2.57	26.59	32.55	5.34
Sorghum grain	87.32	12.68	10.19	1.78	2.38	1.84	71.19	....
Mound Valley:								
Sorghum silage	35.77	64.23	2.47	1.90	0.67	7.15	23.58	0.72
Alfalfa hay	94.96	5.04	19.96	5.96	2.75	33.46	32.84	5.11
Sorghum grain	88.34	11.66	9.69	1.55	2.66	1.89	72.48	....

Influence of Nitrogen Source on Ruminal pH, Ammonia Production and Protein Synthesis (Project 596).

L. H. Harbers, D. Richardson, and R. K. Abe

Previous reports from this station indicate little advantage in feeding combined sources of protein (soybean meal and cottonseed meal) to beef cattle. The results were obtained by determining total nitrogen and protein nitrogen in the rumen of fistulated steers at six hours after feeding. By this technique, data that express the ability of the microorganisms to convert nitrogen to bacterial protein may be rapidly determined. Bacterial protein has high biological value; it is, thus, important that maximum conversion be obtained from nitrogen sources of less biological value. Factors that influence conversion can be carefully controlled using fistulated animals. Once optimum rations are formulated under such conditions of rapid screening, costly feeding trials can be minimized.

Steers fitted with ruminal cannulae were used to study the effect of nitrogen source on ruminal pH, ammonia production, crude protein, and true protein. Soybean meal, cottonseed meal, and urea were the sources of supplemental nitrogen to a basal ration of prairie hay, salt, and steamed bone meal (Table 40). Tests were conducted with and without added grain. Rations within each test contained the same amounts of nitrogen and had the same caloric value.

Results and Discussion

Measurement of ruminal pH is an indication of the amount of acid formed during fermentation following feeding. A pH value of less than 7 indicates acid conditions; a value above 7 indicates alkalinity. Data from these investigations (Figure 1) show no significant differences in pH due to nitrogen source. When grain is added, the values are somewhat lower due to the added carbohydrate that is fermented to volatile fatty acids.

Ammonia arising in the rumen is one of the end products of bacterial degradation of feedstuff protein and may be used to synthesize bacterial protein. As seen in Figure 2, the amounts produced from the oil meals do not differ. Those levels of ammonia are capable of being utilized by the bacteria. In the case of urea, most of the ammonia is produced during the first two hours. Those amounts are much greater than the bacteria are able to utilize during that short time. Some ammonia is lost due to absorption by the rumen and is then detoxified to urea by the

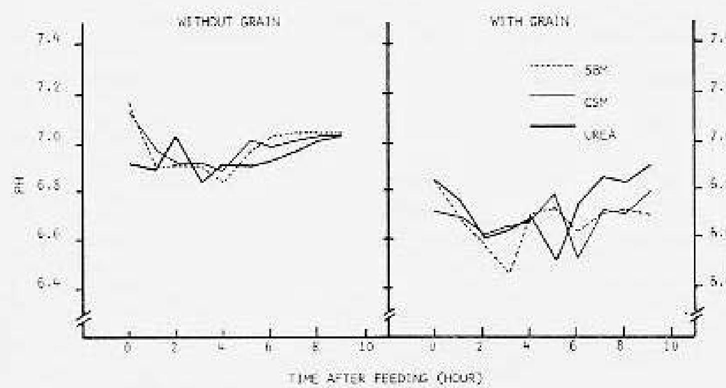

Fig. 1.—Average pH values of rumen liquor from three fistulated steers.

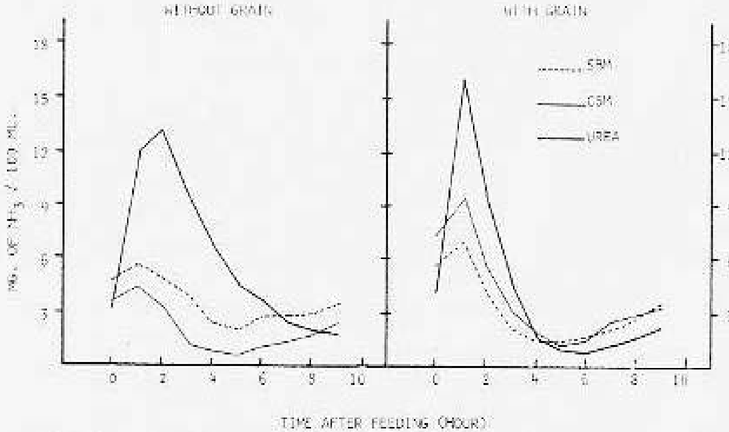

Fig. 2.—Average ammonia level of rumen liquor from three fistulated steers.

liver and subsequently excreted in the urine. A portion of the urea comes back into the rumen through the saliva.

Further evidence of loss of ammonia from urea is presented in Figures 3 and 4. Crude protein (protein nitrogen plus nonprotein nitrogen) and true protein (protein nitrogen) levels are much lower when urea is fed than when the ration is supplemented with either of the oil meals. That may be largely overcome with adequate grain in the diet.

Levels of crude protein and true protein were the same for soybean meal and cottonseed meal, which further indicates that, for all practical purposes, those protein sources are similar, so a combination would not be superior to one or the other.

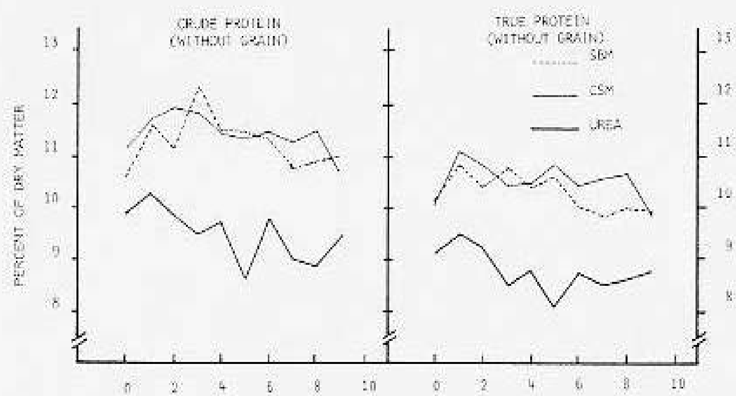

Fig. 3.—Average percentage of crude protein and true protein of dried rumen samples from three fistulated steers.

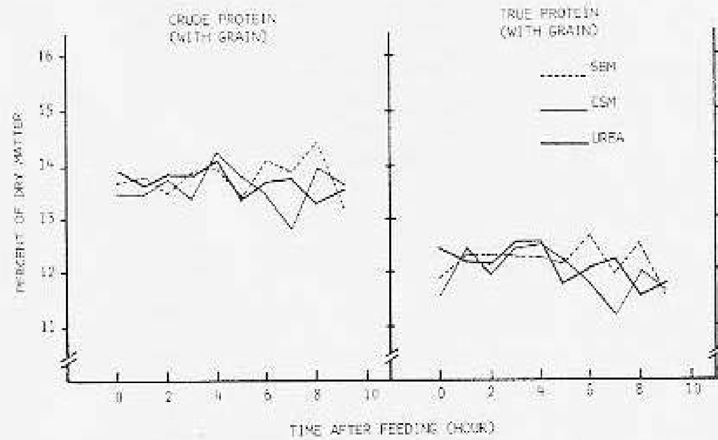

Fig. 4.—Average percentage of crude protein and true protein of dried rumen samples from three fistulated steers.

Table 40
Composition of rations.

	Rations					
	Without added grain			With added grain		
Ingredients	A	B	C	D	E	F
Prairie hay, lbs.	10	10	10	6	6	6
Corn, lbs.			1	6	6	6
Soybean meal, lbs.	1			0.73		
Cottonseed meal, lbs.		1.05			0.78	
Urea, grams			62			40
Basal ration, C.P.	0.56	0.56	0.56	0.97	0.97	0.97
Added C.P., lbs.	0.47	0.47	0.47	0.34	0.34	0.34
Total C.P., lbs.	1.03	1.03	1.03	1.31	1.31	1.31

C.P.: crude protein.

Influence of Breeding and Length of Feeding Period on Carcass Characteristics and Palatability of Beef (Project NC-58, Kansas 639).*

D. L. Mackintosh, D. H. Kropf, R. C. Fletcher, and G. A. Ahlschwede

Phase I. Sire Testing.

During 1962-63, in cooperation with the American Hereford Association, 70 head of Hereford steers, sired by four different bulls, were slaughtered in Kansas City and the rib cut from 40 (10 from each sire group) was purchased for detailed analyses and palatability tests, a procedure followed with all cattle on this phase of the project.

All cattle were classified as "choice" on foot, but dropped nearly one grade in carcass, due to lack of marbling. Final distribution of carcass grades was: Low choice, 3; high good, 4; average good, 13; low good, 46; high standard, 4.

* This project was supported by NC-58 funds and funds from the American Angus Association.

The next year the same cow herd, five (5) bulls (two repeats) and calves sired by two of these bulls, but from a different cow herd, was purchased and fed to find out if the cow herd was responsible for low marbling scores. Progeny of two bulls were also fed in two different feed lots to measure the influence of environment or feeding method.

With the few animals, differences from herd origin or feed lot practice were not significant. Further observations now are being made on herd origin, feed lot practice, and method of management (feeding out cattle as calves instead of yearlings). To date, only one sire has demonstrated a slight advantage in siring marbling. He now is being used more extensively to confirm that finding.

Phase II. Growth and Fattening with Particular Reference to Marbling.

Sixty-four head of Angus steer calves, all sired by the same bull, were purchased, after random selection, from Echo Ranch, Yates Center, Kansas. They were further randomly sorted into eight groups and placed on feed in a commercial feed yard. Eight were slaughtered at time of lotting, a second group 56 days later, and the remaining lots at 28-day intervals thereafter. All were slaughtered at a central packing plant, where slaughter and carcass data were collected. The right side of each carcass was shipped to our laboratory for further study.

Data collected on each steer included feed lot weight; daily gain for entire group, each slaughter group and each individual; yield, U.S. carcass grade; and detailed grade factors; muscle measurements at 16 points with marbling evaluation subjectively at each point; chemical analyses of samples from all 16 points. Earlier evidence indicated the fore-shank as a possible indicator of muscling or edible portion of the carcass. The fore-shank was therefore separated into fat, lean and bone for further study. Boneless weight of the four primal cuts, trimmed to one-fourth inch outside fat (some trim was necessary after 224 days feed), was determined, as were total weight of bone in each carcass, color and pH measurements of the longissimus dorsi.

Samples were also collected at four points of the carcass for later histological studies. Specimens from the cooked samples were preserved for future work. The 6th, 7th, and 8th rib cuts are used by the Department of Foods and Nutrition for palatability studies. Numerous other data are being recorded.

Data so far analyzed indicate that rate of gain was only average, with relatively low gain the last 28-day period. Highest gain was during the 6th period (140-168 days). Daily gain throughout feeding was only nominal, 2.3 pounds per day, but dressing percentage increased as the feeding period progressed.

There was a definite relationship between length of feeding period and carcass grade. Two hundred days on feed, 480 pounds gain, and slaughter weight of 830 pounds seem to be about minimums to produce choice grade carcasses, provided calves have that potential originally.

Area of the muscle with each group, with few exceptions, gradually increases. Increase in area over 224 days ranged from 80 to 160%. Greatest percentage increase is in the area of the semitendinosus or eye of round. Greatest increase of area in square inches is in the semimembranosus or inside round. Samples from all of those muscles are in storage for future histological studies.

First visible indication of marbling was after 84 days on feed. Marbling increased with feeding time. Most marbling was observed at the 12th rib on the longissimus dorsi, with the outside round or biceps femoris a close second.

Greatest change from group 7 to group 8 was increase in percentage of fat (196 to 224 days on feed).

Correlations among weight of the four lean cuts (trimmed), slaughter weight, carcass weight, and length of hind leg were highly significant. Wide variation between groups in several relationships is not understood. Differences are far greater between group 8 and other groups that can be explained by increased fat. The percent lean cuts (trimmed), retail yield as predicted by the Brungardt Formula, U.S.D.A. Cuttability Formula, and weight of lean from the 9th, 10th, and 11th cuts were

correlated with the same 10 measurements. Significant correlations were seldom found, and there was no pattern of significance for any carcass or other measurement.

Principal observations from the data are the novel progress of marbling, percentage fat at the 12th rib (chemical), grade, and percentage fat at 9th, 10th, and 11th ribs. The data indicate that a committee might apply satisfactory subjective standards for marbling.

Phase III

An additional 24 head of steers sired by the same bull were randomly selected and lotted at the same time as those in Phase II. The 24 were pastured in summer, roughed through winter, then eight were slaughtered and the remaining 16 placed on pasture. In August, 1964, eight were slaughtered off grass and the remaining eight placed on full feed. This program is essentially "deferred feeding," so the groups slaughtered in April, August, and January should offer comparable stages of growth to groups slaughtered in Phase II. Procedures and observations will be the same as on steers in Phase II.

Swine

In the experiments reported here purebred Durocs, Poland Chinas and crosses of those breeds were used. So far as possible breeds were equalized among treatments. Further, each litter of pigs was equally represented among the dietary treatments.

All growing-finishing animals were confined to pens on concrete floors. Pens and equipment were cleaned and disinfected between experiments. For identification, buildings are designated by letter. Building W has pens approximately 6 × 8 feet, with adjacent outside concrete area of comparable size. In this unit water was provided three times daily in troughs in the outside pens. Building M is an open-front (south exposure) shed with pens of 8 × 30 feet. Building T is an open-front (south exposure) unit having pens 4 × 16 feet. In the latter two approximately one third the length of each pen was under roof, and automatic, nonfreezing waterers were used.

During the summer mist-spray for cooling was used during daylight hours when temperature was 80° F. and higher. In the winter, bedding, either wood shavings or straw, was used only as necessary to maintain dry sleeping areas. No supplemental heat was provided.

Composition of control rations is shown in Tables 41 and 42. Respective rations were available in self-feeders at all times.

Table 41

Composition of control starter rations in experiments for pigs weaned at 4 weeks.

Ration no.	S-43E	S-43K
Ingredient	%	%
Ground yellow corn	37.75	38.25
Rolled oats	13.10	13.00
Soybean oil meal[1]	19.00	19.00
Dried skim milk	10.00	10.00
Fish meal[2]	5.00	5.00
Sugar	10.00	10.00
Animal fat	2.00	2.00
Dicalcium phosphate	1.00	1.00
Ground limestone	1.00	1.00
Trace mineral mix[3]	0.05	0.05
Salt	0.50	0.50
Vitamin mix[4]	0.20	0.20
Antibiotic	0.40[5]	....
	100.00	100.00
Calculated crude protein, %	20.0	20.0

1. Solvent-processed soybean oil meal guaranteed to contain a minimum of 44% crude protein.

2. Menhaden fish meal.

3. Contained, in %, manganese, 10; iron 10; calcium, 12 to 14; zinc, 5; iodine, 0.3; copper, 0.1; and cobalt, 0.1.

4. Contained, per pound, 240 mgs. riboflavin, 720 mgs. niacin, 480 mgs. pantothenic acid, 17 gms. choline chloride, 660 mcg. vitamin B_{12}, 30,000 I.U. of vitamin D, and 150,000 I.U. of vitamin A.

5. Forty mgs. of chlortetracycline (aureomycin) provided per pound of ration.

Table 42

Composition of control rations in experiments with growing-finishing swine.

Ration no.	S-69, 71, 74, 76	S-70	S-76A	S-76B	S-76C
Ingredient	%	%	%	%	%
Ground milo	77.5	89.0	....	....	....
Ground wheat	....	....	83.5	90.5	96.5
Soybean oil meal[1]	19.0	7.0	13.0	6.0	....
Dicalcium phosphate	1.0	1.0	1.0	1.0	1.0
Ground limestone	1.0	1.0	1.0	1.0	1.0
Trace mineralized salt[2]	0.5	0.5	0.5	0.5	0.5
Vitamin-antibiotic premix[3]	1.0	1.0	1.0	1.0	1.0
Calculated crude protein, %[4]	16.0	12.0	16.0	14.0	12.0

1. Solvent-processed soybean oil meal guaranteed to contain not less than 44% crude protein.

2. Contained, in %, salt, 97; zinc, 0.8; manganese, 0.4; iron, 0.32; copper, 0.048; iodine, 0.011; and cobalt, 0.022. In certain experiments salt plus the trace mineral premix shown in footnote 3 of Table 41 was used.

3. Contained 15,000 I.U. vitamin D_2, 250,000 I.U. vitamin A, 5.12 gms. choline chloride, 212 mgs. riboflavin, 636 mgs. niacin, 424 mgs. pantothenic acid, 530 mcgs. vitamin B_{12} and 1 gm. antibiotic per pound.

4. Figures determined on the basis of guaranteed protein content of soybean oil meal and average protein values for milo and wheat.

Feed Additives in Swine Rations

Continual investigation of the use of feed additives in swine rations is essential to determine (1) the current effectiveness of additives regularly used, (2) the merit of newer products made available for investigational purposes and (3) the efficacy of various combinations of additives (new and old).

Results of five experiments are reported here.

I. Flavoring Compounds and Wood Molasses in Growing-finishing Rations.

B. A. Koch and D. W. Loeppke

Two flavoring compounds, monosodium glutamate (MSG) and flance, were used separately and in combination in rations for growing-finishing swine. Wood molasses, a source of energy, was used with the two flavoring compounds.

Experimental Procedure

Sixty-three pigs were used. Each pen of 9 pigs was confined to a concrete-floored pen in building M. Feed and water were available at all times.

All rations were pelleted, with the test ingredients replacing sorghum grain in the formulation.

Results

Table 43 shows considerable variation in performance among the different groups. None of the combinations of flavoring compounds alone or in combination appeared to affect feed consumption.

Table 43

Effects of monosodium glutamate, flance and wood molasses separately and in combination on performance of growing-finishing swine, June 1 to July 28, 1964.

Lot no.	1	2	3	4	5	6	8	7
Ration	S-68	S-68A	S-68B	S-68C	S-68	S-68-D	S-68F	S-68E
MSG[1]	....	0.3%	....	....	....	0.3%	....	0.3%
Flance[2]	....	....	0.05%	....	....	0.05%	0.05%	0.05%
Wood molasses	....	....	....	5.0%	....	....	5.0%	5.0%
No. of pigs	9	9	9	9	9	9	9	9
Av. initial wt., lbs.	52	50	50	53	53	49	50	50
Av. final wt., lbs.	173	167	170	175	175	163	162	155
Av. daily gain, lbs.:								
First 28 days[3]	1.64	1.46	1.64	1.75	1.71	1.38	1.56	1.30 (1.44)[4]
Last 40 days	1.87	1.90	1.85	1.82	1.85	1.89	1.72	1.72 (1.77)
Total 68 days	1.78	1.72	1.77	1.79	1.79	1.68	1.65	1.55 (1.63)
Av. daily feed, lbs.[5]	4.88	4.68	4.38	5.21	4.96	4.47	4.48	4.49
Feed per lb. of gain, lbs.[5]	2.74	2.72	2.47	2.91	2.77	2.66	2.71	2.90

1. Monosodium glutamate.
2. Flance, flavoring compound.
3. From start to about 95 pounds.
4. Figures in parentheses represent average of 8 pigs. 1 poor-doing pig excluded.
5. For the 68-day period.

II. Comparison of Feed Additives in Rations for Growing-finishing Swine.[1]

B. A. Koch and D. W. Loeppke

Seventy-two pigs were used. They averaged about 50 pounds each at the start of the experiment. During the first 28 days the pigs that received a diet containing Aureo S.P.-250 (100 gms. chlortetracycline, 100 gms. sulfamethazine and 50 gms. penicillin per ton of feed) gained about 13% faster than pigs on diets containing either chlortetracycline or tylosin at 10 gms. per ton of feed.

Table 44 shows the results for the 105-day test.

When either chlortetracycline or tylosin at 10 gms. per ton of feed replaced Aureo S.P.-250, the initial advantage in growth rate was not maintained and average performance was similar for all treatments.

Performance of the different breeds is summarized in Table 45.

1. Contribution No. 331, Department of Animal Husbandry, Kansas Agricultural Experiment Station, Manhattan.

Table 44

Response of growing-finishing swine to indicated feed additives, February 25 to June 9, 1964.

Additive	No. of pigs[1]	Av. daily gain	Feed eff.	Age at 200 lbs.	Carcass length	Carcass grade #1	Carcass grade #2
		lbs.	lbs.	days	in.	#1	#2
Aureomycin[2]	23	1.69	308	167	29.0	22	1
Tylosin[3]	24	1.73	298	164	29.3	20	4
A.S.P.-250[4]	20	1.74	306	164	29.5	19	1
+ Aureomycin[4]	10	1.82	314	159	30.3	9	1
+ Tylosin[4]	10	1.65	298	166	28.7	10	0

1. Six pens of 4 pigs each started on each treatment. Five pigs were removed for reasons not related to dietary treatment.
2. Ten grams of chlortetracycline per ton of feed.
3. Ten grams of tylosin per ton of feed.
4. Two hundred fifty grams of Aureo S.P.-250 per ton of feed for the first 28 days; either 10 grams per ton of aureomycin or tylosin for the remainder of the trial.

Table 45

Durocs, Poland Chinas and Crossbreds fed under similar conditions on concrete, February 25, 1964, to June 9, 1964.

Breed	No. of pigs	Av. daily gain	Feed eff.	Age at 200 lbs.	Carcass length	Carcass grade #1	Carcass grade #2
		lbs.	lbs.	days	in.	#1	#2
Durocs							
Barrows	19	1.83	313	164	29.6	15	4
Gilts	3	1.79	313	166	30.2	3	0
Poland Chinas							
Barrows	9	1.68	299	163	28.9	9	0
Gilts	14	1.55	299	168	28.5	14	0
Crossbreds							
Barrows	10	1.90	300	158	30.0	8	2
Gilts	8	1.63	300	167	29.3	8	0
Overall average							
Barrows	38	1.81		162	29.5	32	6
Gilts	25	1.60		167	29.0	25	0
Both	63	1.73	305	164	29.2	57	6

1. Barrows and gilts were fed together.

III. Feed Additives in Pig Starter Rations.

A. H. Jensen, B. A. Koch, L. H. Harbers, and L. A. Miller

Three experiments were conducted to determine the efficacy of certain feed additives, alone or in various combinations, in improving performance of pigs weaned at 4 weeks of age. In the first two, each treatment group of pigs was confined to a 3½- by 8-foot concrete-floored pen in the central farrowing unit. In the third experiment 3- by 6-foot pens with either flattened expanded metal or wood slat floors were used. A 250-watt light was suspended above the sleeping area in each pen to provide supplementary heat. Wood shavings were used for bedding in the first two experiments, but no bedding was used in the third experiment.

Feed was available at all times from one self-feeder per pen. Water was provided three times daily in troughs in the first two experiments, while self-service drinking cups were available in the third experiment.

Results are shown in Tables 46, 47, and 48.

Rates of gain among ration treatments differed significantly in the first two experiments, and approached significance in experiment 3.

Aureo S.P.-250 at 125 mgs. per pound of ration resulted in the highest rates of gain in experiments 1 and 2. In experiment 2, at 40 mgs. per pound, it stimulated gain at a rate comparable to the other antibiotics.

In experiment 3 the combination of tylosin and neomycin stimulated gains over that of either antibiotic alone.

All pigs appeared healthy and in good condition at the start of each experiment. The beneficial effects of the respective additives appear to be mediated through increased daily feed intake, which resulted in more rapid and efficient gains.

Table 46

Antibiotics and sulfamethazine in starter rations, September 18 to October 16, 1964.

Feed additive	Mgs. per lb. of ration	Source	Av. daily gain, lbs.[5]	Av. daily feed, lbs.	Feed per lb. of gain, lbs.
None	0	....	0.31	0.77	2.47
Chlortetracycline	40	Aurofac-10[1]	0.43	1.01	2.37
Tylosin	40	Tylan-10[1]	0.48	0.93	1.92
Chlortetracycline Sulfamethazine Penicillin	50 50 25	Aureo S.P.-250[2]	0.71	1.12	1.53
Bacitracin	40	Fortracin-Bacitracin[3]	0.40	0.87	2.18
Neomycin	40	Neomycin Sulfate[4]	0.48	0.91	1.88
Bacitracin Neomycin	20 20		0.43	0.89	2.04

1. Contained 10 grams of antibiotic activity per pound.

2. Contained 20 grams each of chlortetracycline and sulfamethazine, and 10 grams of penicillin (from procaine penicillin) per pound.

3. Bacitracin Methylene Disalicylate (S. B. Penick & Co.), 25 grams bacitracin activity per pound.

4. Contained 227.5 grams neomycin activity per pound (S. B. Penick & Co.).

5. Each figure represents an average performance of 2 pens of 5 pigs each. Initial ages and weights were about 30 days and 15.5 pounds, respectively. Test lasted 28 days. Differences in rates of gain were statistically (p<.01) significant.

Table 47

Antibiotics and sulfamethazine in starter rations, December 4, 1964, to January 4, 1965.

Feed additive	Mgs. per lb. of ration	Source	Av. daily gain, lbs.[4]	Av. daily feed, lbs.	Feed per lb. of gain, lbs.
None	0	....	0.52	0.72	1.65
Chlortetracycline	40	Aurofac-10[1]	0.70	1.18	1.68
Tylosin	40	Tylan-10[1]	0.64	1.02	1.64
Neomycin	40	Neomycin-sulfate[2]	0.67	1.05	1.59
Chlortetracycline Sulfamethazine Penicillin	50 50 25	Aureo S.P.-250[3]	0.83	1.42	1.72
Chlortetracycline Sulfamethazine Penicillin	16 16 8	Aureo S.P.-250[1]	0.68	1.15	1.69

1. Contained 10 grams of antibiotic activity per pound.

2. Contained 227.5 grams neomycin activity per pound.

3. Aureo S.P.-250 contains 20 grams each of chlortetracycline and sulfamethazine and 10 grams of penicillin (from procaine penicillin) per pound.

4. Each figure represents an average performance of 2 pens of 5 pigs each. Initial ages and weights average about 29 days and 16.5 pounds, respectively. Test lasted 31 days. Differences in rates of gain were statistically (p<.01) significant.

Table 48

Feed additives in starter rations, March 2 to March 30, 1965.

Additive	Mgs. per lb. or % of ration	Source	Av. daily gain, lbs.[4]	Av. daily feed, lbs.	Feed per lb. of gain, lbs.
None	....	....	0.50	1.04	2.04
Tylosin	40	Tylan-10[1]	0.51	0.96	1.98
Neomycin	40	Neomycin sulfate[2]	0.58	1.01	1.74
Tylosin Neomycin	20 20	Tylan-10 Neomycin sulfate	0.73	1.20	1.64
Kayexolate[3]	1.0%		0.42	0.87	2.13
Kayexolate[3]	3.0%		0.54	1.04	1.97

1. Contained 10 grams of antibiotic activity per pound.

2. Contained 227.5 grams neomycin activity per pound.

3. Sodium polystyrene sulfonate cation exchange resin (equilibrated in Krebs-Ringer Solution prior to mixing in ration).

4. Each figure represents average performance of 11 pigs, 6 pigs and 5 pigs per group in replicates 1 and 2, respectively. Pens were 3' x 6' in size, expanded metal floors for replicate 1 and wood slat floors for replicate 2. Initial ages and weights were about 27 days and 16.5 lbs., respectively. Test lasted 28 and 22 days, respectively, for replicates 1 and 2.

Protein and Amino Acids in Swine Rations (Project 140).

A. H. Jensen and B. A. Koch

The value of a feed protein is determined by its content of available essential amino acids. For example, in relation to the pigs' needs, corn and milo proteins are definitely deficient in the amino acid lysine. Selection of a supplemental protein, therefore, should be based on its lysine content to balance the deficiency. Experimentally, low-protein rations have been supplemented with appropriate amino acids to produce gains and efficiencies equal to those obtained on rations containing 2 to 6% more protein.

Four experiments were conducted to determine the value of amino-acid supplementation to milo and wheat diets and the replacement value of wheat mill feed for milo in rations for growing-finishing swine.

One experiment was designed to evaluate the replacement value of milo for corn in a starter ration.

I. Replacement Value of Milo for Corn in Pig Starter Rations Fed in Meal and Pellet Form.

Sixty pigs weaned at about 4 weeks were used. They were strong and thrifty and averaged about 15 pounds each. Each treatment group of 5 pigs was confined to a pen in building T. The test lasted 32 days.

Results are summarized in Table 49.

There were no significant differences in rate of gain, feed intake and feed efficiency. There was evidence, however, that the 37.75% milo ration was more readily consumed in pellet form than in meal form. Rate of gain and feed efficiency also favored the pelleted ration.

The results suggest that, to the degree used in these rations, good-quality milo satisfactorily replaced corn in a pig starter ration.

Table 49

A comparison of milo and corn in rations for pigs weaned at four weeks of age, September 11 to October 13, 1964.

Ration no.[1]	43E	43F	43G	
% corn	37.75	18.75	....	
% milo	....	19.00	37.75	
Av. initial wt., lbs.:[2]				Av.
Meal	14.9	15.0	14.7	14.9
Pellet	15.0	15.0	14.3	14.8
Av.	15.0	15.0	14.5	
Av. final wt., lbs.:				
Meal	37.0	38.0	32.2	35.7
Pellet	37.5	31.2	35.4	34.7
Av.	37.0	34.6	33.8	
Av. daily gain, lbs.:				
Meal	0.69	0.72	0.54	.65
Pellet	0.68	0.52	0.64	.61
Av.	0.68	0.62	0.59	
Av. daily feed, lbs.:				
Meal	1.19	1.25	0.98	1.14
Pellet	1.11	1.04	1.08	1.08
Av.	1.15	1.14	1.03	
Feed per lb. of gain, lbs.:				
Meal	1.74	1.73	1.80	1.76
Pellet	1.66	1.99	1.69	1.78
Av.	1.70	1.86	1.74	

1. Respective numbers for the pelleted rations (3/16-inch pellets) were 43H, 43I, and 43J.
2. Each figure represents average performance of 2 pens of 5 pigs each.

II. Amino Acid Supplementation of Milo-soybean Meal Rations for Growing-finishing Swine.

Sixty pigs averaging about 45 pounds each were used. All groups of 5 pigs each were confined to pens in building W.

All rations were fed as 3/16-inch pellets.

Results in Table 50 show that adding 0.1% L-lysine to a 12% crude protein ration significantly increased rate of gain and daily feed intake, and decreased feed required per pound of gain. Higher levels of lysine were of no benefit. Growth rates were comparable between the 16%- and 12%-plus-lysine groups but the most efficient gains were obtained on the 16% ration. Thus, although response to added lysine proved the 12% ration to be lysine-deficient, the 12%-plus-lysine rations were still inferior to the 16% rations in total amino acid balance as reflected in feed intake and feed required per pound of gain.

Table 50

Effects of amino acid additions to milo-soybean meal grower rations, July 23 to September 1, 1964.

Ration no.	69	70	70A	70B	70C	70D
Crude protein, %	16	12	12	12	12	12
Lysine added, %[1]	....	....	.10	.20	.30	.20
Methionine added, %	....	....	....	....	....	.10
Av. daily gain, lbs.[2,4]	1.29	0.84	1.37	1.26	1.20	1.19
Av. daily feed, lbs.[3]	3.03	2.80	3.39	3.18	3.26	3.12
Feed per lb. of gain, lbs.	2.34	3.33	2.70	2.52	2.70	2.63

1. Added as Lyamine containing 20% L-lysine activity.
2. Two groups of 5 pigs each, 45-95 pounds.
3. $p < .05$.
4. $p < .01$.

III. An Evaluation of Wheat as a Replacement for Milo and the Effects of Lysine Supplementation in Rations for Growing-finishing Swine.

Sixty pigs were used in this experiment. Each treatment group of 7 or 8 pigs was confined to a pen in building W.

Results in Tables 51 and 52 show that wheat was very efficiently utilized. For the growing period (Table 51) there were no significant differences among criteria measured. Neither protein level nor added lysine materially affected performance. Average daily gain for the wheat diets was 1.40 pounds while that on the milo-soybean meal diet was 1.32 pounds. Daily feed intake and feed required per pound of gain were lower for the wheat rations than for the milo-soybean meal rations.

During the finishing stage (Table 52) wheat and wheat plus 0.10% lysine produced gains and feed efficiency equal to the wheat-soybean meal ration. Lowest daily gain and feed efficiencies were realized from the milo-soybean meal ration.

The differences in feed required per pound of gain among treatments were significant ($p < .05$).

The results suggest that in isonitrogenous rations having soybean meal (44% CP) as supplementary protein, wheat was more efficiently utilized than was milo. Further, for the finishing pig (120 pounds to 200 pounds) wheat plus vitamins, minerals and an antibiotic produced satisfactory gains and efficiencies. Lysine supplementation was not beneficial in this experiment.

Additional experiments are planned to determine relative feeding values of different grains in swine rations.

Table 51

Comparison of milo-soybean meal, wheat-soybean meal, wheat-soybean meal-plus-lysine rations for growing swine, November 23 to December 30, 1964.

Ration no.[1]	S-76	S-76A	S-76B	S-76C
Cereal	Milo	Wheat	Wheat	Wheat
Crude protein, %[2]	16	16	14	14
Added lysine, %[3]	....	....	....	0.12
Av. initial wt., lbs.[4]	66	68	66	65
Av. final wt., lbs.	115	120	118	117
Av. daily gain, lbs.	1.32	1.40	1.40	1.39
Av. daily feed, lbs.	4.25	4.04	4.19	4.12
Feed per lb. of gain, lbs.	3.23	2.90	2.98	2.95

1. Rations pelleted (3/16-inch pellets) for replicate one. Fed as crumbles in replicate 2.
2. Calculated values.
3. Added as Lyamine containing 50% L-lysine activity.
4. Each figure represents average of 2 pens of 8 and 7 pigs each.

Table 52

Comparison of milo-soybean meal, wheat-soybean meal, wheat, and wheat-plus-lysine rations for finishing pigs, December 30, 1964, to January 29, 1965.

Ration no.[1]	S-76H	S-76B	S-76I	S-76JJ
Cereal	Milo	Wheat	Wheat	Wheat
Crude protein, %[2]	12	14	12	12
Added lysine, %[3]	....	....	....	0.10
Av. initial wt., lbs.[4]	115	120	119	117
Av. final wt., lbs.	167	175	176	175
Av. daily gain, lbs.	1.75	1.82	1.91	1.95
Av. daily feed, lbs.	5.50	5.28	5.35	5.44
Feed per lb. of gain, lbs.[5]	3.14	2.90	2.78	2.77

1. Rations in pellet form for replicate 1. Fed as crumbles in replicate 2.
2. Assay values were 13.4, 16.1, 13.9, and 13.5%, respectively.
3. Added as Lyamine containing 50% L-lysine activity.
4. Each figure represents average of 2 pens of 7 and 8 pigs each.
5. $p < .05$.

IV. An Evaluation of Wheat as the Sole Source of Protein and Wheat Plus Lysine for Growing Swine.

Forty-eight pigs averaging about 45 pounds each were used. Each treatment group of 6 pigs was confined to a pen in building M. All rations were pelleted.

The data in Table 53 show that average daily gains were significantly ($p < .01$) affected by ration treatment. Wheat supplemented with vitamins, minerals and antibiotic was inadequate for the 44-pound pig. Daily feed intake was only 2.73 pounds, which was about 11% less than on the other three rations. This reduced feed intake is a characteristic response to an amino-acid-deficient diet. That lysine was the primary limiting amino acid is proved by the stimulatory effect on feed intake resulting from adding lysine. Rate of gain was about the same from the lysine-supplemented rations, but feed required per pound of gain was least with the 0.20% lysine addition. The latter was comparable to that from the wheat-soybean meal 16% crude protein ration.

Rate of gain was less than satisfactory in this experiment. The two apparent reasons for low performance were severe cold weather and relatively low feed consumption. It has been observed that wheat diet pellets are harder than milo diet pellets and may be less readily consumed because of the hardness. Other experiments are planned to study effects of the physical nature of the ration and its acceptability by pigs of different ages.

Table 53

Comparison of wheat-soybean meal, wheat, and wheat-plus-lysine rations for growing swine, January 25 to March 9, 1965.

Ration no.	S-76A	S-76I	S-76J	S-76JJ
Crude protein, %[1]	16	12	12	12
Added lysine, %[2]	....	....	.10	.20
Av. initial wt., lbs.[3]	44	44	46	44
Av. final wt., lbs.	89	73	88	87[4]
Av. daily gain, lbs.[5]	1.07	0.67	0.97	1.02
Av. daily feed, lbs.	3.01	2.73	3.15	3.04
Feed per lb. of gain, lbs.	2.94	4.08	3.24	2.93

1. Assay values were 18.4, 14.5, 14.5, and 14.7%, respectively.
2. Added as Lyamine containing 50% L-lysine activity.
3. Each figure represents an average of 2 pens of 6 pigs each.
4. Two pigs from one pen died. Cause of death unrelated to diet.
5. $p < .01$.

V. Feed Value of Wheat Mill Feed in Rations for Swine.

By-products of wheat flour milling include such things as bran, shorts and middlings. Those fractions represent about a fourth of the kernel weight and usually have a higher protein value than milo or corn. Certain of the by-products have been considered as supplemental feeds, but more realistically should be considered as substitutes for grain in swine rations.

This experiment was to determine effects of substituting wheat mill feed for milo in milo-soybean meal rations for growing-finishing swine.

The results are shown in Table 54. There were no significant differences due to dietary treatment. The highest rate of gain was obtained with the 7.5% level of wheat mill feed. Daily feed intake tended to increase, and feed efficiency decreased with increase in dietary wheat mill feed.

Table 54

Effects of different levels of wheat mill feed in swine rations, November 17, 1964, to January 15, 1965.

	% wheat mill feed[1, 2]				
	0	7.5	15.0	30.0	Av.
84 to 142 lbs. (November 17 to December 23, 1964)					
Av. daily gain, lbs.[3]	1.68	1.91	1.75	1.61	1.74
Av. daily feed, lbs.	5.05	5.77	5.51	5.81	5.53
Feed per lb. of gain, lbs.	3.00	3.00	3.15	3.64	3.20
142 to 183 lbs. (December 23, 1964, to January 15, 1965)					
Av. daily gain, lbs.	1.71	1.88	1.71	1.88	1.79
Av. daily feed, lbs.	6.06	6.23	6.72	7.09	6.52
Feed per lb. of gain, lbs.	3.55	3.30	3.95	3.76	3.64

1. Consisted of approximately 60% bran, 23% shorts, 13% tailings, and 4% red dog. Analyzed about 17% crude protein.

2. The rations analyzed 16.9, 17.1, 18.2, and 18.5% crude protein, respectively, and 2.7, 2.6, 3.3, and 4.2% crude fiber, respectively.

3. Each figure represents average performance of 2 pens of 5 pigs each. They were housed in building M.

Effects of Feed Processing on Ration Utilization (Project 110).

A. H. Jensen, B. A. Koch, and C. W. Deyoe

Previous reports from the Kansas Station have shown that method of processing grains and rations may affect acceptance by the animal and efficiency of utilization.

The experiment reported here was designed to evaluate the effects of grinding fineness (of milo and wheat) on feeding value for growing swine.

I. Effect of Fineness of Grind of Wheat and Milo on Utilization in Diets for Growing Swine.

Forty-eight pigs averaging about 55 pounds each were used. Each treatment group of 6 pigs was confined to a pen in building W.

Either 1/8-inch or 1/16-inch screens were used in the hammer mill grinder to grind the wheat and milo. The respective ground products were mixed with the appropriate ration ingredients, then the ration was pelleted (3/16-inch pellet).

Results are shown in Table 55.

Fineness of grind had no significant effect on rate of gain, daily feed intake or feed required per pound of gain.

Average rate of gain from the milo diets was 1.35 while that from the wheat diets was 1.24 pounds. They reflect the different levels of daily feed intake of 3.60 and 3.22 pounds, respectively. Pigs receiving the milo diet required slightly more feed per pound of gain than those receiving wheat diets.

The results suggest no advantage of 1/16-inch grind over 1/8-inch grind of milo and wheat used in diets for growing swine.

Table 55

Effect of fineness of grind of wheat and milo on utilization in diets for growing swine, January 26 to March 4, 1965.

Ration no.[1]	S-76	S-76N	S-76A	S-76AA
Cereal	Milo	Milo	Wheat	Wheat
Grinder screen	1/8"	1/16"	1/8"	1/16"
Av. initial wt., lbs.[2]	54	55	54	55
Av. final wt., lbs.	104	106	102	100
Av. daily gain, lbs.	1.34	1.37	1.28	1.20
Av. daily feed, lbs.	3.54	3.65	3.34	3.10
Feed per lb. of gain, lbs.	2.63	2.66	2.59	2.58

1. Forty-five percent crude protein soybean meal was used to supplement the respective cereals to provide a 16% crude protein ration.

2. Each figure represents an average of 2 pens of 6 pigs each.

Table 56
Prices of feeds used in beef cattle experiments, 1964-65

Sorghum silage	$ 8.00 ton
Prairie hay	20.00 ton
Sorghum grain	2.00 cwt.
Alfalfa hay	25.00 ton
Soybean oil meal	80.00 ton
Dicalcium phosphate	90.00 ton
Salt	20.00 ton
Rice hulls-concentrate-molasses mixture	39.60 ton