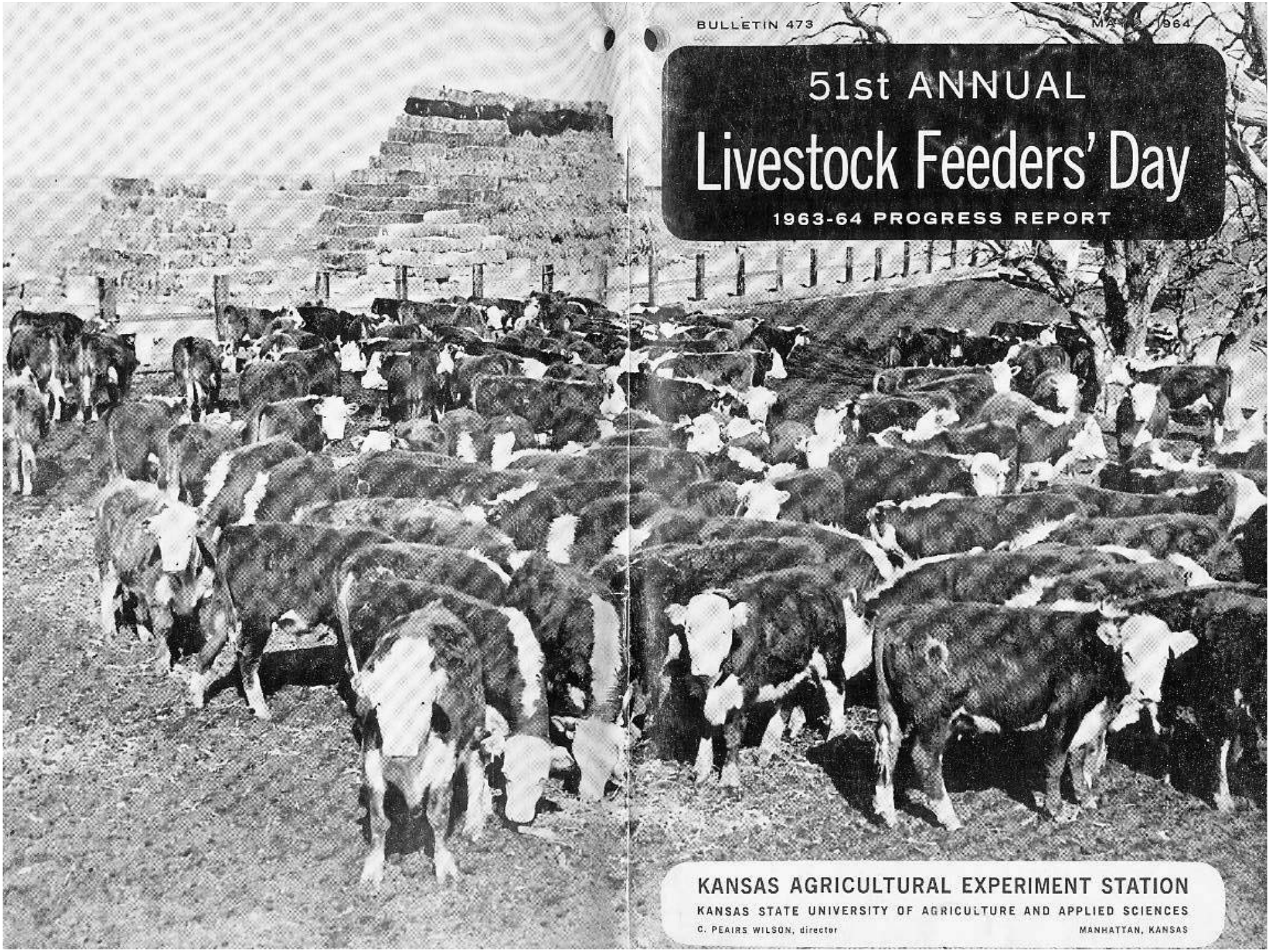
BULLETIN 473 MAY, 1964



51st ANNUAL Livestock Feeders' Day

1963-64 PROGRESS REPORT

KANSAS AGRICULTURAL EXPERIMENT STATION
KANSAS STATE UNIVERSITY OF AGRICULTURE AND APPLIED SCIENCES
C. PEAIRS WILSON, director
MANHATTAN, KANSAS

CONTENTS

ON THE COVER

The steer calves shown on the cover are choice Kansas ranch-raised stock calves from the Warner Ranches of Cimarron, Kansas. These ranches are owned by Mr. Leigh Warner and his son, Sid, and managed by Mr. Willis Wenrich. They have ranches in several counties of Kansas. These calves are from the Rice county ranch.

51st Annual Livestock Feeders' Day

KANSAS STATE UNIVERSITY

MANHATTAN, KANSAS

Saturday, May 2, 1964

8 to 10 a.m.

Experimental livestock on exhibit, Animal Husbandry Arena

10 a.m.

Arena—Presiding, Bill House, Cedar Vale, Kansas, President, Kansas Livestock Association

11 a.m.—Dedication of Weber Hall

Review of Experiments —Animal Husbandry Staff

Dehydrated alfalfa vs. synthetic vitamin A, with and without Aureomycin for fattening steers (two-year summary).

Response of steers wintered and fattened on feeds produced in four widely separated locations in Kansas.

Protein formation in the rumen of steers, from single or mixed sources of nitrogen in the ration.

Varying levels of vitamin A following various wintering levels for steer calves.

Response of wintering calves to forage sorghum silage field dried for varying lengths of time.

Lighted feedlots—effects on gains of calves.

Sheds vs. no protection for calves in the feedlot.

Response of calves wintered on prairie hay to vitamin A.

Supplementing winter bluestem pasture for heifers.

Fourteen years of pasture burning, deferred grazing and rates of stocking studies.

Levels of protein with sorghum grain for fattening cattle.

Effect of different phosphorus levels on reproductive performance of Hereford heifers.

Wheat shorts vs. soybean oil meal as protein supplements for fattening cattle.

Inbreeding studies with beef cattle.

Factors influencing rate of gain and feed efficiency of beef calves on performance studies.

Is "limited feeding" of swine practical?

Whole grain, rolled grain, steam rolled grain for pigs.

Test your own pigs.

Factors affecting the eating quality of beef.

Influence of sire on quality of beef.

Influence of breeding and length of feeding period on carcass characteristics and palatability of beef.

Effects of heating and pelleting lamb-fattening rations.

Breeding for improved lamb production.

Alfalfa pasture for fattening lambs (Garden City Station).

Preflushing and flushing rations for ewes (Colby Station).

12 noon

Lunch, Arena

1 p.m.

Awards to Beef Production Contest Winners, Tommy Benton, Agricultural Commissioner, Chamber of Commerce, Kansas City, and Extension Animal Husbandry staff

1:50 p.m.

Review of Experiments (continued), Animal Husbandry staff

2:40 p.m.

Questions

3 p.m.

Adjournment

6:30 p.m.

Banquet for visiting stockmen and ladies, Kansas State Union, by Block and Bridle Club

Honoring Distinguished Livestock Men

FOR THE LADIES

Friday, May 1, 1964

6:30 p.m.

Dinner, Gillett Hotel (Make reservations with Mrs. R. F. Cox, 421 Edgerton, Manhattan)

Presiding, Mrs. Walter Broadie, Ashland, Kansas, President, Kansas Cow Belles

Saturday, May 2, 1964

9:30 a.m.

Coffee, Justin Hall (Home Economics Building), Animal Husbandry ladies

10:30 a.m.

Demonstrations, Students, College of Home Economics, Kansas State University

12 noon

Lunch, Animal Husbandry Arena

6:30 p.m.

Block and Bridle Banquet (See general program)

Sheep

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

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

Data were collected on 94 lambs of known breeding born the fall of 1962. The lambs were from ewes in the original fine-wool flock sired by eight unrelated Suffolk yearling rams. This was the ewes' fourth lamb crop.

All lambs were creep fed a pelleted ration consisting 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. Lambs were weaned and weighed at 60 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 of the Agricultural Experiment Station for additional analyses.

Twelve Hampshire ram lambs were obtained at approximately 3 months of age and performance tested the spring of 1962 (see 1963 Feeders' Day Report). Ten of the rams were used on the ewe flock during the summer of 1963; the resulting lambs are being slaughtered this spring. One half of the male lambs in each sire group were left as intact males. Lambs are otherwise being handled similar to the 1962-63 lamb crop.

Eleven more Hampshire ram lambs were obtained when they were approximately 3 months of age from breeders during the spring of 1963. After a two-week adjustment period the rams were sheared and individually self-fed the same ration used to creep feed crossbred lambs. After 100 days, when all were fed together (1.5 pounds grain and alfalfa hay), they were again placed in individual pens where they were self-fed a pelleted ration of 65% dehydrated alfalfa, 25% sorghum grain, 5% soybean meal and 5% molasses, for another 90 days. These rams will be used to breed ewes during the summer of 1964.

Results and Discussion

Uncorrected data for 1962-63 lambs sired by Suffolk rams are reported in Table 1. Performance data on ram lambs tested during 1962 were reported in 1963 Feeders' Day Report and data on rams tested during 1963-64 are reported in Table 2.

There was a variation of 23 days between sire group in age of lambs at slaughter and a variation of up to .15 square inch in loin eye area.

Hampshire ram lambs made more efficient gains during the first 90 days than during the last period. They were carrying considerable finish when started on the last test period. Rate and efficiency of gain varied widely but correlation between performance during first and last 90-day periods appears to be small.

Table 1
Uncorrected[1] data for 1962-63 lambs sired by 8 Suffolk rams.

Ram no.	1	2	3	4	5	6	7	8
Wt. of rams	197	178	317	192	160	206	257	138
No. of lambs	15	10	14	9	9	12	14	11
Av. days age at slaughter	148.3	150.4	140.3	134.7	143.0	146.7	137.8	127.4
Av. slaughter wt., lbs.	94.9	95.8	97.3	94.2	96.1	96.8	96.4	97.0
Av. loin eye area	2.17	2.25	2.26	2.19	2.29	2.27	2.14	2.19

1. Not corrected for sex or type of birth.

Table 2
Performance data on Hampshire rams tested during 1963-64.

Ram	Date of birth	Birth wt., lbs.; type of birth[1]	Lbs. gain 90 days, 6/3-9/5	Lbs. feed per cwt. gain	Lbs. gain 100 days, 9/1-12/10	Lbs. gain 90 days, 12/10-3/10	Lbs. feed per cwt. gain	Wt. 3/10, lbs.	Wt. per day age, lbs.
Abbott 515[2]	1-15-63	13S	35	1011.4	38				
Ahlschwede 12	1-19-63	11S	35	1005.1	30	42	1309.5	209	.50
Cox 1098	2- 7-63	11.3T	53	644.9	30	33	1390.9	191	.48
Eberle 521	1-11-63	11S	34	1041.2	33	33	1542.4	188	.44
Eberle 530	2-13-63	13S	45	702.0	33	46	1080.4	191	.49
Gilmore 6323	3-15-63	14S	41	847.3	32	53	1003.8	215	.60
K.S.U. 6312	1-16-63	7.8T	40	816.2	27	48	1141.7	209	.50
K.S.U. 6328	2- 4-63	11.5S	41	860.2	38	42	1569.0	215	.54
Newell 214	1-19-63	10T/S	47	771.3	32	40	1257.5	214	.52
McCosh 339	1-29-63	13S	33	829.2	38	57	978.9	223	.55
McCosh 378	3- 4-63	11S	40	990.9	41	74	1032.4	233	.63

1. S = single; T = twin, and T/S means born twin; raised single.
2. Died from obstructed intestine 1-1-64.

Animal Fat in Fattening Lamb Rations

C. S. Menzies

Animal fats often are added in small amounts (1-2%) to mixed commercial feeds primarily to reduce dustiness and to lubricate machinery. High-energy poultry rations often contain higher levels of animal fat. This test was conducted to obtain more information on fat's value when added to fattening lamb rations.

Experimental Procedure

Forty-two weaned ewe and wether Rambouillet and Suffolk x Rambouillet crossbred lambs were sheared and divided into two lots. Lambs were self-fed 3/16" pelleted rations. The ration fed Lot 1 consisted of 35% sorghum grain, 45% alfalfa hay, 10% soybean meal, and 10% stabilized animal fat. Lot 2 was fed a ration containing 45% sorghum grain, 45% alfalfa hay, and 10% soybean meal. Fat used was chiefly beef tallow rendered by the meats division of the Animal Husbandry Department. It had been stabilized by adding an antioxidant. Pellets were made by the University feed mill.

There was considerable variation in age and weight (22 pounds to 90 pounds) of lambs at the beginning of the test, June 12. Twenty-three lambs were marketed July 8 after 25 days on feed. Remaining lambs were fed until July 13.

Results and Discussion

Results are presented in Table 3. Lambs fed the ration containing fat ate less, gained just as fast as control lambs, and consequently made more efficient gains (21% less feed required per cwt. gain). There were no digestive disturbances due to added fat. However, this was a very short-term feeding trial (28 days).

Table 3
Results from adding animal fat to lamb fattening rations.

Treatment	10% fat	Control
Days on feed	28.1	28.4
No. of lambs	21	21
Av. initial wt., lbs.	63.1	64.7
Av. final wt., lbs.	76.7	78.1
Av. total gain, lbs.	13.6	13.4
Av. daily gain, lbs.	.482	.471
Daily feed per lamb, lbs.	2.53	3.14
Av. feed per cwt. gain, lbs.	524.6	666.2
Av. feed cost per cwt. gain[1]	$12.06	$12.46

1. Feed prices used were: ground sorghum grain, $1.75 per cwt.; animal fat, 6¢ per lb.; ground alfalfa hay, $25 per ton; and soybean meal, $74 per ton. Mixing and pelleting cost, $3 per ton. With those charges the control pellet cost $37.40 per ton and the pellet containing 10% fat, $45.90 per ton.

Effects of Heating and Pelleting of Rations and of Hay Particle Size on Lamb Performance and Ratio of Rumen VFA (Project 236).

C. S. Menzies, D. Richardson, N. A. Ansari, R. F. Cox, C. W. Deyoe, and H. B. Pfost

Recent research indicates that heat treatment of concentrates and roughages and particle size of feed ingredients may affect cattle and sheep feedlot performance by changing the ratio of acetic and propionic acids produced in the rumen. Previous work at this station showed that pelleting complete lamb rations increased gain and improved feed efficiency. Both increased feed consumption of pelleted rations and improved performance from pelleting, with feed consumption nearly equal, resulted

(Kansas Agr. Exp. Sta. Cir. 358). This test was designed to determine the effect of (1) heating grain or roughages, (2) pelleting, and (3) particle size of hay on lamb performance and ratio of acetic, propionic, and butyric acids in rumen contents.

Experimental Procedure

Fine wool ewe and wether feeder lambs produced February 4, 1963, were used. They were drenched for internal parasites and vaccinated for enterotoxemia soon after arrival, and implanted with 3 mgs. stilbestrol.[2] weighed and divided into 12 lots of 9 lambs per lot February 18 on the basis of sex and weight, and fed the following rations:

Lots 1 and 2—55% ground alfalfa hay, 35% ground sorghum grain, and 10% molasses.

Lots 3 and 4—55% ground alfalfa hay, heated to 180° F., 35% ground sorghum grain, and 10% molasses.

Lots 5 and 6—55% ground alfalfa hay, 35% ground sorghum grain heated to 180° F., and 10% molasses.

Lots 7 and 8—Pelleted ration of 55% ground alfalfa hay, 35% ground sorghum grain, and 10% molasses.

Lots 9 and 10—Pelleted and then reground ration of 55% ground alfalfa hay, 35% ground sorghum grain, and 10% molasses.

Lots 11 and 12—55% fine ground alfalfa hay, 35% ground sorghum grain, and 10% molasses.

One lot of lambs on each of the six basic rations was self-fed and the other was hand-fed twice daily. Hand-fed lambs were fed the amount of feed consumed by the hand-fed lot eating the least amount of feed. Salt was supplied free choice to all lots.

Particle size of hay in rations fed all lots except 11 and 12 was equal to a ½-inch grind. Feed for Lots 11 and 12 was ground through a 1/16-inch screen.

Feed ingredients in the pelleted rations or pelleted and reground rations were heated to 180° F. in the pelleting process. This was the same temperature used for the other heated feeds.

Approximatly five weeks after starting lambs on test, rumen samples were obtained by means of a stomach tube and vacuum pump. Samples were taken in the early afternoon and frozen until analyzed for total acid and for acetic, propionic, and butyric acids by column chromatography.

Results and Discussion

Results are reported in Table 4.

Self-fed lambs ate more feed and made highly significant ($p<.01$) faster gains than hand-fed lambs. Efficiency of gain, however, was not necessarily correlated with rate of gain. Carcasses from self-fed lambs graded approximately one-third grade higher than hand-fed carcasses.

There was no significant difference in rate of gain due to ration treatment. However, hand-fed lambs in Lots 7 and 9 fed the reground pelleted ration and the pelleted ration made faster, more efficient gains than other hand-fed lots. Self-fed lambs fed these two rations also made very efficient gains.

Ration preparation had no significant effect on ratio of acetic and propionic acids in rumen samples. However, butyric acid concentration was increased ($p<.01$) by heating either hay (Lots 3 and 4) or grain (Lots 5 and 6). Butyric acid also tended to be higher in Lot 6 fed the fine ground alfalfa hay. It is also evident that rumen samples from hand-fed lambs contained higher total VFA mm. per 100 ml. than those from self-fed lambs. Time of sampling after feeding possibly affected this.

2. Supplied by Chas. Pfizer and Co., Inc., Terre Haute, Ind.

Table 4

Lamb performance and proportions of VFA and total VFA in rumen samples, February 18, 1963, to May 6, 1963—77 days.

	No. lambs	Av. daily gain, lbs.	Daily feed per lamb, lbs.	Feed per cwt. gain, lbs.	Av. carcass grade[1]	Molar % VFA			Total VFA mm./100 ml.
						Acetic	Propionic	Butyric	
Control									
1 hand-fed	9	.471	3.49	741.0	9.0	65.0	20.6	14.3	11.2
2 self-fed	9	.579	4.19	723.7	10.0	64.1	20.2	14.1	9.4
Hay heated									
3 hand-fed	9	.438	3.49	796.8	9.1	65.5	17.7	16.7	8.9
4 self-fed	9	.568	4.24	746.5	10.5	65.3	18.3	16.5	11.6
Grain heated									
5 hand-fed	9	.469	3.49	744.1	8.9	65.2	17.6	17.3	8.6
6 self-fed	9	.573	4.72	823.7	9.7	67.3	17.6	14.8	7.5
Pelleted and reground									
7 hand-fed	8	.573	3.48	607.3	9.1	67.0	19.0	14.1	12.6
8 self-fed	9	.588	4.07	692.2	9.8	66.6	18.8	15.1	8.3
Pelleted									
9 hand-fed	9	.516	3.42	662.8	9.6	66.2	19.4	14.3	14.6
10 self-fed	9	.632	4.02	646.3	10.2	65.1	21.2	13.7	7.4
Fine ground hay									
11 hand-fed	9	.461	3.43	744.0	9.3	66.9	17.4	15.7	12.9
12 self-fed	9	.545	4.14	759.6	9.7	64.8	18.6	16.6	9.0

1. USDA carcass grade based on prime, 14; choice, 11; good, 8; utility, 5; and cull, 2.

Pelleting and Heat Treatment of Fattening Lamb Rations (Project 236).

C. S. Menzies, D. Richardson, R. F. Cox, C. W. Deyoe and H. B. Pfost

This test is a follow-up of the study reported on page 5 concerning the effects of form and heat treatment of rations on lamb feedlot performance.

Experimental Procedure

The 132 mixed ewe and wether fine wool feeder lambs used were sheared, drenched with phenothiazine-lead arsenate and vaccinated with 5 cc. clostridium perfringens type D bacterin about two weeks before starting on test. November 16, 1963, they were implanted with 3 mgs. stilbestrol,[2] weighed, randomly divided into six lots on the basis of sex, and started on test. A basic ration of 50 percent dehydrated alfalfa (15 percent C.P.), 40 percent sorghum grain, and 10 percent molasses was self-fed to all lots. Ration treatments were:

Lot 1—Alfalfa meal expanded, reground, mixed with other ration ingredients and fed in nonpelleted form.

Lot 2—Basic ration pelleted with conventional pelleting machine.

Lot 3—Basic ration expanded.

Lot 4—Alfalfa meal expanded, reground, mixed in basic ration and pelleted with conventional machine.

Lot 5—Sorghum grain expanded, reground, mixed in basic ration and pelleted with conventional machine.

Lot 6—Basic ration ground, mixed, and fed in nonpelleted form.

The expanded feed ingredients used in rations for Lots 1, 3, 4, and 5 were processed by putting them through an expansion pelleting machine. In this process the ingredients were steam heated to 300°F by the Wenger Mixer Manufacturing Company.

Several lambs in each lot foundered and became severely stiff about one week after starting on test. For two weeks thereafter lambs were supplied free access to wheat straw. They consumed approximately .25 pound per lamb per day. Left on test, all lambs recovered over an extended period and were not identifiable by the end of the test.

Lambs weighing over 95 pounds were marketed February 11 after 87 days on test. Remaining lambs were marketed after 115 days on test, March 10.

Results and Discussion

Feedlot performance is reported in Table 5.

There was little difference in lamb gains and carcass grades among treatments. Lambs fed hay that had been expanded in Lots 1 and 4 required slightly more feed per unit gain than those fed other rations.

2. Supplied by Charles Pfizer and Co., Inc., Terre Haute, Ind.

Table 5
Results from pelleting and heat treating fattening lamb rations.

Lot no.	1	2	3	4	5	6
Treatment	Hay expanded, ground, mixed ration	Conventional pellet	Expanded pellet	Hay expanded, conventional pellet	Grain expanded, conventional pellet	Ground mixed ration
No. lambs	22	22	22	22	22	22
Av. days on test	103.6	103.5	98.4	103.5	102.3	99.7
Av. initial wt., lbs.	57.0	57.4	61.8	60.7	57.5	59.8
Av. final wt., lbs.	98.1	101.0	103.8	101.7	98.0	102.2
Av. gain per lamb, lbs.	41.1	43.6	42.0	41.0	40.5	42.4
Av. daily gain, lbs.	.379	.421	.427	.396	.396	.426
Daily feed per lamb, lbs.	3.13	3.37	3.38	3.35	3.18	3.45
Feed per cwt. gain, lbs.	826.4	809.7	790.9	846.9	804.8	810.6
Av. carcass grade	9.8	10.0	10.2	10.0	9.8	10.1

1. USDA carcass grade based on prime, 14; choice, 11; good, 8; utility, 5; and cull, 2.

Colby Branch Agricultural Experiment Station, Colby, Kansas.

Investigations of Milk-fat Lamb Production Practices for Western Kansas.* Results for 1962-63 Creep-feeding Tests and 1963 Ewe Preflushing and Flushing Tests.

C. S. Menzies, Animal Husbandry Department, Kansas State University, and Evans Banbury, Superintendent, Colby Branch Station.

Experimental Sheep

One hundred fifty yearling ewes were added to the flock in May, 1963, so the ewe flock now consists of approximately 450 two-, five-, and six-year-old fine-wool ewes. All were purchased in southwest Texas as yearlings. Purebred Hampshire rams were used.

General Procedure

This flock is handled in an early-lambing program, with the breeding season starting the last of May and extending to September 1. All lambs are sold as milk-fat lambs during spring and early summer.

Three separate tests are conducted during the year. The first attempts to determine the effect that varying the energy intake of ewes during a preflushing period has on lambing performance has on lambing performance. The second compares various rations for flushing ewes, and the third studies various management practices and rations for ewes and lambs.

Lamb Feeding Tests (Winter 1962-63)

Procedure: To determine the value of various rations, early weaning, and castrating male lambs, ewes and lambs were divided into six lots on the basis of lamb age, single ewe lambs, single male lambs, twin lambs, and prior ewe treatment. A 7- to 10-day adjustment period was allowed after lambs were born before ewes and lambs were placed in respective lots. Lambs were docked and castrated during the adjustment period. One half of the single male lambs in each lot were not castrated. All lamb creep rations were self-fed from the time lambs were placed in respective lots until marketed. Lambs were marketed in six shipments at either Denver or Omaha. The first shipment was March 19, 1963, and the last June 29. Lambs were shipped at approximately 100 pounds. All lambs not weaned early or marketed by March 19, 1963, were weaned at that time.

Treatments and rations fed various lots were:

Lot no.	Daily ewe ration	Lamb creep ration and treatment
1	Standard ration[1]	Standard ration[2]
2	Standard ration	Dry rolled sorghum grain, alfalfa hay
3	Standard ration	Dry rolled sorghum grain containing 10% soybean oil meal, alfalfa hay
4	Standard ration	Dry rolled sorghum grain containing 5% salt, alfalfa hay
5	Rye pasture + standard ration when snow covered pasture	Standard ration, rye pasture
6	Standard ration until lambs were weaned, then maintenance ration[3]	Standard ration, lambs weaned 8 to 10 weeks of age

*Contribution No. 302, Department of Animal Husbandry, Kansas State University, Kansas Agricultural Experiment Station, and No. 22, Colby Branch Agricultural Experiment Station.

1. Ewe standard ration: 1 lb. whole sorghum grain, 1¼ lbs. alfalfa hay and full feed of sorghum silage (approximately 10 lbs.) per ewe per day.

2. Lamb standard creep ration: whole sorghum grain and alfalfa hay in separate feeders.

3. Ewe maintenance ration: 1 lb. alfalfa hay and 6 lbs. sorghum silage per ewe per day.

Table 6

Lamb performance and cost of gains by treatments, Fall 1962 and Spring 1963.

Lot no.	1	2	3	4	5	6
Treatment	Whole sorghum grain, alfalfa hay	Rolled sorghum grain, alfalfa hay	Rolled sorghum grain containing 10% SBOM, alfalfa hay	Rolled sorghum grain containing 5% salt, alfalfa hay	Rye pasture, whole sorghum grain, alfalfa hay	Early weaned, whole sorghum grain, alfalfa hay
No. lambs	56	50	41	57	61	52
Av. market wt., lbs.[1]	101.0	101.9	102.0	103.2	107.8	100.8
Av. total gain, lbs.[2]	90.6	91.3	91.5	92.7	97.3	90.2
Av. daily gain, lbs.	.529	.544	.557	.550	.672	.491
Av. market age, days	171	168	164	169	145	183
Daily feed per lamb, lbs.:						
Grain mix	1.35	1.26	1.32	1.21	1.37	1.30
Alfalfa hay	.55	.52	.29	.65	.18	.81
Av. lbs. feed per cwt. gain:						
Grain mix	254.8	231.8	236.6	220.6	204.2	263.8
Alfalfa hay	103.8	96.7	52.0	118.5	26.8	170.4
Total	358.6	327.5	288.6	339.1	231.0	434.2
Lamb feed cost per cwt. gain[3]	$ 5.76	$ 5.50	$ 5.63	$ 5.57	$ 3.77	$ 6.91
Ewe feed cost to 3/19/63 per cwt. gain[4]	$ 8.68	$ 9.28	$10.64	$ 8.28	$ 2.14	$ 7.08
Total feed cost per cwt. gain	$14.44	$14.78	$16.27	$13.85	$ 5.91	$13.95

1. Weight of lambs at station before shipment to market.
2. Market weight minus birth weight.
3. No charge made for rye pasture. This was charged to ewe feed cost at 1½ cents per day.
4. Includes cost of feeding nursing ewes and dry ewes having lambs weaned early up to March 19, when all lambs were weaned. Also includes feed cost for ewes having lambs removed from lots due to sickness or death.

Results and Discussion

Performance and cost of gains of lambs from the six treatment groups are reported in Table 6 (lamb death losses and treatments are reported in Table 7), and performance of single ewe, wether and ram lambs is reported in Table 8.

Lambs fed the standard sorghum grain and alfalfa creep on rye pasture made considerably faster and cheaper gains than lambs in other lots, which confirms results of past tests. However, these lambs had a lower average market price per cwt. (approximately $0.50 to $1) than the other lambs, because they reached market weight earlier in the season when lamb prices were somewhat lower.

Creep rations containing dry rolled sorghum grain, or dry rolled sorghum grain containing 10% soybean oil meal or 5% salt in Lots 2, 3, and 4, respectively, produced gains at approximately the same rate as the standard creep ration fed Lot 1. Salt apparently slightly reduced grain consumption; however, this lot of lambs consumed more hay.

As in last year's test, lambs weaned at 8 to 10 weeks of age (Lot 6) gained slightly less than control lambs (Lot 1). The weaned lambs ate more hay than nursing lambs (nonweaned lambs ate some feed with ewes). The saving in ewe feed cost offset the higher lamb feed cost for early-weaned lambs. This resulted in approximately $0.50 less total feed cost per cwt. gain for early-weaned lambs.

Urinary calculi developed in all lots and enterotoxemia in all lots except Lot 5 (rye pasture). Considerably more trouble from these two conditions was experienced in Lot 3 receiving the creep containing 10% soybean meal. Salt did not completely prevent urinary calculi in Lot 4; however, there were only three cases in that lot compared with six and seven in Lots 1 and 2 fed similar rations without salt. All lots had free access to salt.

Ram lambs gained faster and consequently reached market weight at an earlier age than wether lambs. However, they were discounted $1 per cwt. in all instances on the market.

Ewe lambs gained as fast as wether lambs. This is contrary to most research reports, since wether lambs usually rank between ewe and ram lambs in rate of gain. Possibly the high incidence of calculi showed gains of wether and ram lambs.

Eleven ewes in the rye pasture group (Lot 5) produced lambs sired by lambs in this lot before ram lambs were sold or weaned March 19.

Table 7
Lamb diseases and death losses by lots.

Lot no.	Urinary calculi	Founder and enterotoxemia	Lameness and stiffness	Scours	Other causes	Death loss[1]
1	6	6	1	1	4	4
2	7	7	1	2	1	5
3	11	12	3	..	5	10
4	3	2	..	..	..	2
5	0	..	..	..	1	2
6	4	6	..	2	1	6
Total	36	33	4	5	12	29

1. Urinary calculi was cause of death of 11 lambs; enterotoxemia, 13 lambs; and 5 lambs died from various other causes.

Table 8
Performance of single ewe, wether and ram lambs. Fall 1962 and Spring 1963.

	Single ewes			Single wethers			Single rams		
Lot no.	No.	Av. daily gain, lbs.	Av. sale age, days	No.	Av. daily gain, lbs.	Av. sale age, days	No.	Av. daily gain, lbs.	Av. sale age, days
1	16	.615	147	9	.505	177	9	.612	150
2	18	.573	159	7	.588	151	9	.610	148
3	15	.619	152	6	.602	153	6	.583	156
4	18	.593	155	8	.614	152	9	.656	151
5	18	.692	141	10	.711	136	9	.808	128
6	17	.504	178	9	.542	162	8	.619	158
Total	102	.599	155.4	49	.595	155.1	50	.652	147.9

Following is some marketing information on lambs sold during 1963:

Number of lambs	361
Av. marketing date	4/29/63
Av. barn weight	102.3
Av. sale weight	96.9
% shrink to market	5.25
Av. selling price per cwt.	$21.21
Trucking cost per cwt.[1]	$ .85
Other marketing costs per cwt.[1]	$ .70
Total marketing costs per cwt.	$ 1.50
Av. return per lamb[2]	$19.10
Av. lamb return per ewe[2]	$20.51

Preflushing Test—Spring 1963

Procedure: 296 four- and five-year-old ewes were divided into four groups on the basis of number of lambs produced the previous year. Following were the four preflushing treatments:

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

The low-energy ration consisted of 2 lbs. alfalfa hay per ewe per day and the maintenance ration 2 lbs. alfalfa hay, ¼ lb. whole sorghum grain and 3 lbs. sorghum silage per ewe per day.

All ewes were fed a ration of 6 lbs. sorghum silage and 1 lb. alfalfa hay from March 19, when all lambs not already sold were weaned. Ewes in Lots A and B were continued on this ration until the start of their 17-day treatment.

At the end of preflushing equal numbers of ewes from each group were placed in each of six lots and fed various flushing rations. (See flushing tests 1963, page 15.) Ewes were exposed to rams 17 days after being placed on flushing rations.

Results and Discussion

Weight changes of ewes during preflushing and subsequent flushing are reported in Table 9. Lambing performance of preflushed ewes is found in Table 10.

Ewes fed the low-energy rations for either 17 or 34 days lost approximately the same amount of weight during the preflushing period and made about the same gains during the following 34-day flushing period. Ewes fed the low-energy ration for 34 days did not lose as much weight

1. Lambs were marketed at Denver and Omaha.
2. Gross lamb return minus marketing costs. Does not include incentive payment for unshorn lambs.

during the second 17-day period as they did the first 17 days. Possibly some of the initial loss of weight in the two low-energy groups was due to a loss in feed content of the digestive tract.

The maintenance ration just about maintained weight in both the 17-day and 34-day preflushing periods. These ewes gained less weight during the following flushing period than the low-energy fed ewes.

There seemed to be no difference in earliness of lambing between preflushed groups. However, the ewes preflushed with the low-energy ration for 34 days had fewer twins and consequently a lower lambing percentage.

Table 9

Weight changes of ewes during preflushing and subsequent 34-day flushing period.

Preflushing ration	No. of ewes	Av. preflushing gain or loss per ewe, lbs.			Av. flushing gain per ewe, lbs.
		First 17 days	Second 17 days	Total	
Low energy (17 days)	73		—11.37	—11.37	11.68
Maintenance (17 days)	76		— 1.06	— 1.06	4.64
Low energy (34 days)	72	— 7.88	— 2.43	—10.31	12.61
Maintenance (34 days)	75	.84	.81	1.65	4.51

Table 10

Lambing performance of preflushed ewes.

Preflushing ration	No. of ewes	Cumulative % ewes lambing — Days after first lamb birth					% lamb crop[1]
		10	20	30	40	Total	
Low energy (17 days)	73	6.9	29.2	75.0	88.9	98.6	133.3
Maintenance (17 days)	76	1.4	27.4	76.7	94.5	97.2	138.4
Low energy (34 days)	72	6.9	23.6	70.8	95.8	97.3	116.7
Maintenance (34 days)	75	5.4	20.3	77.0	87.8	96.0	127.0

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

Ewe Flushing Test, Spring 1963

Procedure: May 14, 1963, the four groups of 296 preflushed ewes were divided into six lots on the basis of number of lambs produced the previous year and preflushing treatment. The 150 yearling ewes purchased May 7 were randomly allotted to the six flushing treatments. Ewes were fed flushing rations for 34 days.

Flushing rations were as follows:

Lot 1—Cereal crop pasture 34 days.
Lot 2—Cereal crop pasture plus 1 lb. whole sorghum grain 34 days.
Lot 3—Buffalograss pasture only for 34 days.
Lot 4—Buffalograss pasture plus 1 lb. whole sorghum grain 34 days.
Lot 5—Buffalograss pasture plus 2 lbs. whole sorghum grain 34 days.
Lot 6—Buffalograss pasture plus 2 lbs. whole sorghum grain for 17 days, then buffalograss only for 17 days.

Eighteen Hampshire rams were used. Breeding season started June 1, 17 days after ewes were started on flushing rations. The 18 rams were divided into six groups of three each. Each group of rams was rotated to a different ewe lot twice a week. Rams were with the ewes during nights

but were separated during the day. Breeding season ended September 1.

At the end of the 34-day flushing period, June 18, all ewes were turned together and grazed together on buffalograss and available cereal crop and sudan pasture. Buffalograss pasture was supplemented with about ¼ lb. of alfalfa hay per ewe from July 10 to August 2. Starting September 14 ewes were fed ¼ lb. barley per ewe per day, which was increased to ¾ lb. within two weeks. Barley was later replaced with sorghum grain. Silage and alfalfa hay feeding was started October 22 and was gradually increased to 3 lbs. silage and 1 lb. hay per ewe per day. Ewes remained on buffalograss pasture until lambing.

Results and Discussion

Gains and lambing performance for 4- and 5-year-old ewes are reported in Tables 11 and 12 and for yearling ewes in Tables 13 and 14.

Older ewes responded to flushing treatments by producing more multiple births than yearlings. Most of the difference in percentage lamb crop among the yearling ewe treatments was due to number of ewes lambing, not to multiple births. Yearling ewes also lambed considerably later in the season than older ewes.

Among the older ewe groups ewes flushed on cereal crop pasture, cereal crop pasture plus 1 lb. sorghum grain per ewe per day, or buffalograss pasture plus 2 lbs. sorghum grain per ewe per day produced more twin lambs. Both yearling and mature ewes flushed on these three rations also lambed earlier than ewes flushed on other rations. As in past years additional grain improved lambing percentage of mature ewes flushed on cereal crop pasture.

Lambing records for the ewe flock by years is reported in Table 15. This is not part of any experiment, but information should be of interest.

Table 11

Gains and lambing performance of 4- and 5-year-old ewes fed six flushing rations, May 14 to June 18, 1963—34 days.

Lot no.	No. of ewes	Av. total gain per ewe., lbs.	No. ewes lambing	No. total lambs	No. sets of twins	% lamb crop[1]
1	47	6.60	47	63	16	134.0
2	49	12.85	48	72	24	146.9
3	51	3.54	50	59	9	115.7
4	47	8.71	45	57	10 + 1 triplet	121.3
5	47	13.84	46	66	18 + 1 triplet	140.4
6	50	4.94	47	58	9 + 1 triplet	116.0
Total	291	8.27	283	375	86	128.9

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

Table 12

Cumulative % 4- and 5-year-old ewes lambing by periods after first lamb birth, October 21, 1963.

Lot no.	Days after October 21				
	10	20	30	40	90
1	4.3	29.8	80.9	97.9	100
2	8.2	46.9	87.8	91.8	95.9
3	2.0	11.8	66.7	90.2	95.7
4	4.3	25.5	66.0	91.5	95.7
5	6.4	17.0	78.7	93.6	97.9
6	6.0	20.0	70.0	86.0	94.0

Table 13
Gains and lambing performance of yearling ewes fed six flushing rations, May 14 to June 18, 1963—34 days.

Lot no.	No. of ewes	Av. total gain per ewe, lbs.	No. ewes lambing	No. total lambs	No. sets of twins	% lamb crop[1]
1	25	6.98	25	26	1	104.0
2	25	8.37	22	23	1	92.0
3	25	7.52	23	24	1	96.0
4	25	10.37	20	20	0	80.0
5	25	11.04	24	25	1	100.0
6	25	9.02	19	20	1	80.0
Total	150	8.74	133	138	5	92.0

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

Table 14
Cumulative % yearling ewes lambing by periods after first lamb birth, October 21, 1963.

Lot no.	Days after October 21				
	10	20	30	40	90
1	4.0	12.0	56.0	64.0	96.0
2	12.0	24.0	60.0	72.0	88.0
3	8.0	8.0	32.0	68.0	88.0
4	.....	8.0	32.0	52.0	80.0
5	.....	20.0	68.0	76.0	96.0
6	4.0	8.0	40.0	40.0	76.0

Table 15
Flock lambing records 1959-1962.

Year	No. ewes	% ewes lambing	% lamb crop born	% lamb loss prior to 10 days of age	% lamb loss after 10 days of age	% lamb crop marketed
1959[1]	151	96.7	109.3	4.8	4.2	99.3
1960[1]	350	94.6	109.4	3.7	2.6	102.6
1961	340	95.3	118.4	3.0	2.5	112.1
1962	324	96.0	124.7	3.7	6.9	111.4
Total Average	1165	95.4	116.3	3.6	4.1	107.4

1. All ewes lambing in 1959 were yearlings and approximately 200 ewes lambing in 1960 were yearlings.

Lamb Feeding Tests (1963-64)

Procedure: To determine the value of various rations and the practice of early weaning, ewes and lambs were divided into eight lots on the basis of lamb age and type of lamb birth (single or twin). A 7- to 10-day adjustment period was allowed, following lamb birth, before ewes and lambs were placed into respective lots. Lambs were docked and castrated during the adjustment period. All lamb creep rations were self-fed.

Following are the 1963-64 treatments:

Lot no.	Daily ewe ration	Lamb creep ration and treatment
5	Standard ration[1]	Standard ration[2]
2	Rye pasture + standard ration when weather demands	Rye pasture + standard ration
7	Standard ration	Ground sorghum grain + 5% salt, alfalfa hay
8	Standard ration	Ground sorghum grain + 1.5% ground limestone, alfalfa hay
4	Standard ration	Ground mixed ration of 45% sorghum grain and 55% alfalfa hay
6	Standard ration	Ground mixed ration of 35% sorghum grain, 10% soybean oil meal and 55% alfalfa hay
1	Standard ration until lambs are weaned, then maintenance ration[3]	Lambs weaned 8-10 weeks of age, ground mixed ration of 45% sorghum grain and 55% alfalfa hay
3	Standard ration until lambs are weaned, then maintenance ration[3]	Lambs weaned 8-10 weeks of age, pelleted ration of 45% sorghum grain and 55% alfalfa hay

Results of the above test in progress will be reported in the 1964 Annual Report.

1. Ewe standard ration: 1 lb. whole sorghum grain, 1¾ lbs. alfalfa hay and full feed of sorghum silage.
2. Lamb standard creep ration: whole sorghum grain and alfalfa hay in separate feeders.
3. Ewe maintenance ration: 1 lb. alfalfa hay and 6 lbs. sorghum silage.

Garden City Branch Kansas Agricultural Experiment Station, Garden City, Kansas. Lamb Feeding Experiments, 1963-1964.[*]

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

Lambs and Pretest Treatment

Delivery of 602 fine-wool feeder lambs was accepted at Menard, Texas, October 16, 1963. They were sorted from 700 lambs and averaged 67.3 lbs. each with a 3% shrink. Purchase price was $16.25 per cwt. Immediately 197 were injected (intramuscular) with ½ cc. of an emulsified solution supplying 250,000 I.U. of vitamin A, 37,500 I.U. vitamin D_3 and 25 I.U. of vitamin E. All lambs were shorn (average fleece, 3.7 lbs.) and then shipped to Garden City on a triple-deck truck. They arrived at the Experiment Station at 8 a.m. October 18, having lost approximately 4 lbs. per lamb in transit. Lambs were weighed on arrival, divided into pens of approximately 50 head each and fed about 40 lbs. of medium-quality ground alfalfa hay and 45 to 60 pounds of green chopped grain sorghum stubble per lot until October 22 when they were moved to buffalo pasture. November 4 they were placed in dry lot and fed alfalfa hay and chopped sorghum stubble ration until started on test.

Experimental Procedure

November 8, lambs were weighed, implanted with 3 mgs. stilbestrol lotted with equal numbers of vitamin-injected lambs (17 in each lot) and started on test rations.

Following are treatments for the 11 lots:

Lot no.	Treatment	How fed
1	Standard ration of whole sorghum grain, .75 lb. chopped alfalfa hay, .10 lb. 41% cottonseed meal and sorghum silage.	Hand
2	Standard ration plus an additional .10 lb. cottonseed meal.	Hand
5	Standard ration plus Terramycin.	Hand
7	Sorghum silage replaced by corn silage in standard ration.	Hand

[*] Contribution No. 391, Department of Animal Husbandry, Kansas State University, Kansas Agricultural Experiment Station, and No. 71, Garden City Branch Agricultural Experiment Station.

Lot no.	Treatment	How fed
3	Mixture of 65% sun-cured alfalfa pellets and 35% whole sorghum grain.	Self
8	Mixture of 65% dehydrated alfalfa pellets and 35% whole sorghum grain.	Self
4	Complete pelleted ration consisting of 65% sun-cured alfalfa hay and 35% sorghum grain.	Self
6	Complete pelleted ration, watered from unheated water trough.	Self
9	Ground mixed ration consisting of 65% sun-cured alfalfa hay and 35% sorghum grain.	Self
10	High concentrate ground mixed ration of sun-cured alfalfa hay, sorghum grain, and 41% cottonseed meal.	Self
11	Alfalfa pasture.	

Hand-fed lots were fed equal amounts of sorghum grain, alfalfa hay and cottonseed meal (Lot 5 received a higher level), and all the silage they would clean up. Salt was available in all lots, and all lots except six were watered by automatic electrically heated waterers.

The same source of alfalfa hay was used in all self-fed rations containing sun-cured alfalfa.

The 65% roughage and 35% sorghum grain ratio was fed from the start of the test in Lots 3, 4, 6, 8, and 9. Lambs fed the high-concentrate ration were started on 65% alfalfa and 35% sorghum grain. Each 15 days the percentage of alfalfa was lowered by 10% and the sorghum grain increased by 10% until at the end of 45 days lambs were eating 35% alfalfa and 65% sorghum grain. At 60 days the ration was changed to 20% alfalfa, 75% sorghum grain and 5% cottonseed meal and after 90 days, to 10% alfalfa, 80% sorghum grain and 10% cottonseed meal.

Death losses from enterotoxemia were high in Lots 1 and 5 the first 10 days on test. Heavy grain content of sorghum silage may have contributed to losses. Grain was fed at the start of the test, November 8, at the rate of 15 lbs. per lot (50 lambs) both morning and evening. The rate was increased to 20 lbs. each feeding by November 14. It was reduced to 15 lbs. November 18, and discontinued thereafter until November 25. It was originally planned for lambs in Lot 1 to water from a heated waterer and those in Lot 5 from an unheated waterer. However, because of high death losses, one half of the lambs in Lots 1 and 5 were vaccinated November 22 with 5 cc. clostridium perfringens type D bacterin, and Lot 5 was changed to a heated water source and also fed Terramycin at 80 mgs. per lamb per day for three days, then at 40 mgs. per lamb per day.

Final lamb weights were taken February 21 after 105 days on test.

Feed prices and processing charges used in computing cost gains costs:

Alfalfa hay	$24.00 per ton
Alfalfa pellets	31.00 per ton
Dehydrated alfalfa pellets	43.00 per ton
Sorghum silage	6.50 per ton
Corn silage	7.00 per ton
41% cottonseed meal	74.00 per ton
65% alfalfa, 35% sorghum grain pellets	34.15 per ton
Sorghum grain	1.65 per cwt.
Salt	1.10 per cwt.
Terramycin crumbles (2 gms./lb.)	21.50 per cwt.

Chopping hay	2.00 per ton
Grinding hay	4.00 per ton
Grinding and pelleting	7.00 per ton
Grinding sorghum grain	2.00 per ton
Alfalfa pasture	.01 per lamb per day

Table 16

Hand fed rations and alfalfa pasture for fattening lambs, November 8, 1963, to February 21, 1964—105 days.

Lot no.	1	2	5	7	11
Treatment	Standard sorghum silage[3]	Standard sorghum silage + additional C.S.M.	Standard sorghum silage + Terramycin[3]	Corn silage	Alfalfa pasture[2]
No. lambs	42	46	43	45	47
Av. initial wt., lbs.	63.1	62.5	63.1	62.8	62.5
Av. final wt., lbs.	111.4	112.5	110.0	112.8	107.4
Av. total gain, lbs.	48.3	50.0	46.9	50.0	44.9
Av. daily gain, lbs.	.460	.476	.446	.477	.428
Vitamin injection[3]	.439	.490	.432	.462	.426
No vitamin	.470	.469	.454	.484	.429
Daily feed per lamb, lbs.:					
Whole sorghum grain	.94	.94	.94	.94	.....
Sorghum silage	4.78	4.59	4.31	.....	.....
Corn silage	.....	.....	.....	5.35	.....
Alfalfa hay	.72	.72	.72	.72	.10
41% C.S.M.	.10	.20	.10	.10	.....
Salt	.027	.026	.018	.028	.017
Feed per cwt. gain, lbs.:					
Whole sorghum grain	204.3	197.5	210.8	197.1	.....
Sorghum silage	1039.1	964.3	966.4	.....	.....
Corn silage	.....	.....	.....	1121.6	.....
Alfalfa hay	156.5	151.3	161.4	150.9	23.4
41% C.S.M.	21.7	42.0	22.4	21.0	.....
Salt	5.9	5.5	4.0	5.9	4.0
Av. feed cost per cwt. gain[4]	$9.64	$9.97	$10.41	$9.97	$2.66
Av. feed cost per lamb	$4.66	$4.98	$4.88	$4.98	$1.19

1. Half the lambs in each lot vaccinated with 5 cc. clostridium perfringens type D bacterin November 22.
2. Alfalfa hay fed only when snow covered pasture.
3. Seventeen lambs in each lot received vitamin injection.
4. Does not include cost of vitamins or stilbestrol implants.

Table 17
Self-fed rations for fattening lambs, November 8, 1963, to February 21, 1964—105 days.

Lot no.	3	8	4	6	9	10
Treatment	Sun-cured alf. pellets + whole sorghum grain	Dehy. alf. pellets + whole sorghum grain	Pelleted ration	Pelleted ration, unheated water	Ground mixed ration	High-concentrate, ground mixed ration
No. lambs	39	38	42	45	42	36
Av. initial wt., lbs.	62.4	62.6	62.2	61.8	62.4	63.5
Av. final wt., lbs.	117.9	119.0	109.6	113.3	109.3	107.9
Av. total gain, lbs.	55.6	56.4	47.4	51.5	46.9	44.4
Av. daily gain, lbs.	.529	.537	.452	.490	.446	.423
Vitamin injection[1]	.547	.532	.421	.481	.447	.380
No vitamin	.521	.540	.466	.496	.446	.442
Daily feed per lamb, lbs.:						
Complete pellets	....	....	3.5	3.65	....	....
Sorghum grain	1.17	1.28	....	....	1.23	1.84
Alfalfa pellets	2.17	....	....	....	....	....
Dehy. alfalfa pellets	....	2.38	....	....	....	....
Alfalfa hay	....	....	....	....	2.39	1.07
41% C.S.M.	....	....	....	....	....	.08
Salt	.021	.021	.021	.030	.031	.021
Feed per cwt. gain, lbs.:						
Complete pellets	....	....	775.5	744.9	....	....
Sorghum grain	221.2	238.4	....	....	275.8	435.0
Alfalfa pellets	410.2	....	....	....	....	....
Dehy. alfalfa pellets	....	443.2	....	....	....	....
Alfalfa hay	....	....	....	....	535.9	252.9
41% C.S.M.	....	....	....	....	....	18.9
Salt	4.0	3.9	4.6	6.1	7.0	5.0
Av. feed cost per cwt. gain[2]	$10.05	$13.50	$13.44	$12.92	$12.41	$11.91
Av. feed cost per lamb[2]	$ 5.59	$ 7.61	$ 6.37	$ 6.65	$ 5.82	$ 5.29

1. Seventeen lambs in each lot received vitamin injection.
2. Does not include cost of vitamins or stilbestrol implants.

Observations

Eighty-four lambs on test died during the 105-day feeding period. Deaths in each lot can be obtained by subtracting the number remaining from 50. Although early death losses were highest in Lots 1 and 5, losses soon became serious in almost all other lots. Many lambs, particularly in self-fed Lots 3, 4, 6, 8, 9 and 10, slipped large amounts of wool. Some lambs became almost completely bare. This condition made them vulnerable to cold, windy weather December 11 until early January, and losses were quite high. Cause of death was diagnosed as enterotoxemia in all lambs posted, with the following exceptions: on alfalfa pasture (Lot 11) one lamb died from impaction complicated by tapeworms, lung and kidney damage, and two lambs were killed by dogs; one lamb in Lot 8 died from urinary calculi.

Only one vaccinated and one nonvaccinated lamb in Lot 1, and one nonvaccinated lamb in Lot 5 died after November 22, when half the lambs in those lots were vaccinated for enterotoxemia and Lot 5 was placed on Terramycin. It is, therefore, impossible to say that either treatment was beneficial. Terramycin did not improve gains but it did increase feed cost. Vaccinated lambs gained .46 lb. per lamb per day and nonvaccinated lambs, .45 lb. per lamb per day.

Surviving lambs made fast and efficient gains in all lots. Hand-fed lambs receiving silage rations gained approximately as fast as self-fed lambs and in general made cheaper gains.

Feeding an additional .10 lb. of cottonseed meal to lambs in Lot 2 on the standard sorghum silage ration did not materially improve gains but increased cost of gains slightly.

Lambs fed corn silage in Lot 7 ate considerably more silage than those in Lot 1. However, this did not result in much improvement in gain, and feed cost was higher.

This is the second year alfalfa pasture has produced fast, very cheap lamb gains. There were also fewer death losses attributed to the ration. Even though lambs grazed on alfalfa pasture made good gains, they were not so fat as drylot lambs at the end of the test, so they were placed on the complete pelleted ration fed Lots 4 and 6 after final weights were taken.

Among the self-fed lots, lambs in Lots 3 and 8 fed the mixed sun-cured or dehydrated alfalfa pellets and whole sorghum grain made the fastest, most efficient gains. In those two lots sun-cured alfalfa pellets produced cheaper gains than did dehydrated alfalfa pellets. More efficient, but costlier gains were made by lambs fed a pelleted ration (Lot 4) containing the same ratio of hay and grain as in the ground, mixed ration fed Lot 9. Usually pelleting a ration containing a high level of roughage (65% in this instance) improves gain; however, that was not so this year.

Lambs having access to heated water gained no faster nor any more efficiently than those drinking from an unheated trough.

The high-concentrate mixed ration fed Lot 10 produced somewhat slower gains than other self-fed rations but overall performance was quite satisfactory. Average ratio of ingredients in this ration over the entire feeding period was 61.5% sorghum grain, 35.8% alfalfa and 2.7% cottonseed meal.

Injecting lambs with the mixture of A, D, and E vitamins did not improve gains. Lambs receiving the injection gained .456 lb. per day and those not treated gained .473 lb. per day.

Acknowledgments

Stilbestrol implants were supplied by Charles Pfizer and Company, Inc., Terre Haute, Ind.

Dehydrated alfalfa pellets were furnished by Archer-Daniels-Midland Company, Holcomb, Kans., and National Alfalfa Dehydrating and Milling Company, Garden City, Kans.

Sun-cured alfalfa pellets and meal fed to self-fed lots were supplied by Garden City Coop. Equity Exchange, Garden City, Kans.

Swine

Table 18
Composition of rations used in swine trials.

Ration no.	35-A[2]	47-A	61	67[3]	49-A
Ground sorghum grain, lbs.	1550	1450	1600	1466	....
Meat scraps (50% C.P.), lbs.	....	....	100	....	400
Soybean oil meal (44% C.P.), lbs.	400	345	192	400	1164
Dehydrated alfalfa meal (17% C.P.), lbs.	....	150	100	100	250
Dicalcium phosphate, lbs.	20	20	....	20	....
Steamed bonemeal, lbs.	....	....	....	....	50
Limestone, lbs.	20	20	....	20	50
Salt, lbs.	10	10	8	10	50
Trace mineral premix (5% Zn), lbs.	1	1	....	1	5
Vitamin A, I.U.	3,000,000	2,000,000	800,000	....	....
Vitamin D, I.U.	300,000	300,000	....	300,000	....
B-complex vitamin premix, lbs.[1]	0.5	0.5	0.5	0.5	1.5
Chlortetracycline (Aureomycin), gms.	10.8	10.8	10.0	....	50.0
Tylan (Tylosin), gms.	....	....	....	10.0	....
Vitamin B_{12}, mgs.	10.8	10.8	10.0	10.0	50.0

1. Contains 8.0 gms. riboflavin; 14.7 gms. D-pantothenic acid; 24.0 gms. niacin; and 80.0 gms. choline chloride per lb.

2. **35-B** contains 25 lbs. Peter Hand F.W. Premix per ton; **35-C** contains 2.5 lbs. of Mycostatin-20 per ton; **35-D** contains 10 gms. of Tylosin per ton; **35-E** contains 10 gms. of Tylosin plus 1 lb. of Mycostatin-20 per ton; **35-F** is ration 61 with Tylosin replacing Aureomycin; **35-G** contains 5 lbs. of Aureo S-P-250 premix per ton and **35-H** contains 30 lbs. of Vigofac per ton (the additive replaced grain in every case).

3. **67-A** contains 1.2% $NaNO_3$ per ton; **67-B** contains 4.0% urea per ton; **67-C** contains 4% NaCl per ton; **67-D** contains 4% K_2SO_4 per ton and **67-E** contains 4.0% $NaNO_3$ per ton. (The additive replaced sorghum grain in every case.)

NOTE: The Department of Animal Husbandry acknowledges the following donors of the products listed:

The Calcium Carbonate Company, Carthage, Mo., "CCC" trace mineral premix; Chas. Pfizer & Co., Inc., Brooklyn, N.Y., Vigofac-6—unidentified growth factors; E. R. Squibb & Sons, New York, N.Y., Mycostatin-20 (Squibb nystatin); Peter Hand Foundation, Chicago, Ill., F.W. Pig (with trace minerals and antibiotics plus octaferm); American Cyanamid Co., Princeton, N.J., (1) Aureomycin, (2) ASP-250; Eli Lilly & Co., Indianapolis, Ind., Tylan (Tylosin tartrate).

Additives in Growing-Finishing Rations (Project 110).

B. A. Koch and D. W. Loeppke

Specific additives are successfully incorporated into swine rations. Each year new ones are approved and each year the efficacy of the older ones is questioned. Recent feeding trial comparisons at this station are summarized here.

I. Aureomycin vs. Tylosin

The broad-spectrum antibiotic Aureomycin (chlortetracycline) is an older additive. Tylosin is one of the more recently approved broad-spectrum antibiotics.

Experimental Procedure

Pigs used were both barrows and gilts. They included Durocs, Poland Chinas, and crossbreds. Each weighed nearly 100 pounds going on test. Prior to the test the pigs had been together on brome-alfalfa pasture.

They were fed and housed on concrete and had access to an electrically heated automatic waterer. Pigs in each pen also had access to a three-hole fence-line self-feeder.

Ration formulations (pelleted) are listed in Table 18. Pigs were taken off test individually as they reached market weight.

Observations

Table 19 summarizes performance data of the pigs. Average daily gains were essentially the same in the two lots. Feed efficiency was better for pigs supplemented with Tylosin in this test.

Table 19
Aureomycin vs. Tylosin for growing-finishing pigs. (Feeding period began September 28, 1963)

Ration no.[1]	S-35-F	S-61
Additive	Tylosin	Aureomycin
No. of pigs	10	8
Av. on-test wt., lbs.	110	114
Av. off-test wt., lbs.	193	212
Av. daily gain, lbs.	1.81	1.85
Standard error	±.06	±.08
Av. feed efficiency, lbs.	3.26	3.56

1. See Table 18 for ration formulation.

II. Aureomycin, F.W. Premix, and Aureomycin + Mycostatin Compared.

This trial was part of a swine-ulcer study with the College of Veterinary Medicine. Dr. William Griffing made all ulcer observations. Previous work by Dr. Griffing and others had suggested the possibility that a fungus, Candida albicans, was involved in the ulcer syndrome. The antifungal agent, Mycostatin, was included as an additive. Only performance data are reported here. Details of the ulcer study will be reported elsewhere by Dr. Griffing.

Experimental Procedure

Poland China, Duroc, and crossbred barrows and gilts were assigned to one of three groups of 18 each as uniformly as possible. Each group was then divided into two groups of four each and two groups of five each. Each group of four or five was housed and fed in a 6- x 18-foot pen, half of which was under roof.

All rations were pelleted and self-fed. The pigs were watered in

troughs three times per day. A measured amount of the fungus, Candida albicans, was added to the drinking water of half the pigs six times during the test period.

Observations

Table 20 summarizes performance data of the pigs. There was no difference in performance between control pigs and pigs that received the fungus, Candida albicans. Ulcer incidence was low in all groups. There were no ulcers in groups that received F.W. Premix as the feed additive. Groups receiving the various feed additives performed very similarly.

Table 20
Aureomycin, F.W. Premix, and Aureomycin + Mycostatin compared, March 2, 1963, to June 9, 1963—99 days.

Ration no.[1]	S-35-A	S-35-B	S-35-C
Additive	Aureomycin	F.W. Premix	Aureomycin + Mycostatin
No. of pigs	18	18	18
Av. on-test wt., lbs.	53	56	57
Av. off-test wt., lbs.	227	230	232
Av. daily gain, lbs.	1.75	1.75	1.76
Standard error	±.06	±.04	±.04
Av. feed efficiency, lbs.	3.16	3.25	3.21
Ulcers (at slaughter)	3	0	4

1. See Table 18 for ration formulation.

III. Aureomycin, F.W. Premix, Tylosin, ASP-250, and Vigofac Compared.

This feeding trial was designed to compare Aureomycin, one of the older antibiotics, with two sources of unidentified growth factors and with two newer antibiotics.

Experimental Procedure

Fifty feeder pigs, 10 Poland Chinas, 10 Durocs, and 30 crossbreds, both barrows and gilts, were divided by breed and sex into five groups. All pigs had been previously vaccinated for cholera and erysipelas and wormed with piperazine.

The pigs were fed and housed on concrete where each pig had 18 square feet of floor space. Each group of 10 pigs had access to an electrically heated automatic waterer and a three-hole fence-line self-feeder. Prior to going on test all pigs had been on alfalfa-brome pasture. Pigs were taken off test individually as they reached market weight.

All rations were formulated from the same lot of sorghum grain. Ration composition is shown in Table 18. All rations were pelleted.

Observations

Table 21 summarizes performance data of the pigs. Average daily gains in the various lots were not significantly different. Pigs receiving F.W. Premix or ASP-250 made the highest average daily gain with the best feed efficiency. Pigs receiving Tylosin required somewhat more feed per pound of gain than those receiving other additives.

Table 21
Aureomycin, F.W. Premix, Tylosin, ASP-250, and Vigofac compared. (Feeding period began November 29, 1963)

Ration no.[1]	35-A	35-B	35-D	35-G	35-H
Additive	Aureomycin	F.W. Premix	Tylosin	ASP-250	Vigofac
No. pigs	10	10	10[2]	10[3]	10
Av. on-test wt., lbs.	62	64	59	62	58
Av. off-test wt., lbs.	196	198	192	192	192
Av. daily gain, lbs.	1.63	1.70	1.53	1.68	1.53
Standard error	±0.09	±0.08	±0.06	±0.06	±0.07
Av. feed efficiency, lbs.	3.28	3.13	3.51	3.25	3.18

1. See Table 18 for ration formulation.
2. One pig died from a perforated ulcer.
3. One pig removed to hospital (blocked intestine).

IV. Aureomycin, Tylosin, and ASP-250 Compared (Progress Report).

These three additives are being critically compared in a factorial study, with performance of Poland Chinas, Durocs, and crossbreds also being measured.

Experimental Procedure

Seventy-two feeder pigs, 24 Poland Chinas, 24 Durocs, and 24 crossbreds, both barrows and gilts, were divided by breed and weight into 18 groups of four pigs each. Each group is housed and fed in a pen 6 x 18 feet, half of which is under roof. Each group has access to a two-hole self-feeder and each group is watered in a trough three times per day. Prior to being put on test the pigs had been weaned at four weeks and grown under complete confinement conditions.

Twenty-four pigs, eight of each breeding, receive their respective additive in a complete pelleted ration. Ration formulations are listed in Table 18. All rations are made from the same lot of sorghum grain. Pigs that received ASP-250 the first 28 days will receive either Tylosin or Aureomycin for the rest of the feeding period.

Observations

Pigs receiving ASP-250 made the greatest average daily gain during the first 28 days. They also appear more thrifty. Pigs receiving Aureomycin and Tylosin made similar gains. Both were somewhat lower than the ASP-250 gains.

Poland Chinas weighed somewhat less than Durocs or crossbreds when they went on test. They gained at a slower rate than the others during the first 28 days on test.

Table 22 (progress report)
Aureomycin, Tylosin, and ASP-250 compared using Poland China, Duroc, and crossbred pigs. (Feeding period began February 25, 1964)

	Ration no.	Additive	No. pigs	Av. on test wt.	28 day wt.	Av. D. gain
Aureomycin	35-A	Aureomycin	24	48	84	1.30
Tylosin	35-D	Tylosin	24	50	88	1.32
ASP-250	35-G	ASP-250	24	51	93	1.48
Poland China	.....	.....	24	42	77	1.25
Duroc	.....	.....	24	53	93	1.43
Crossbred	.....	.....	24	54	95	1.46

General Observations Concerning Additives

All trials reported here were conducted under somewhat ideal conditions. Pens were always cleaned and disinfected before pigs went into them. All pigs were from the same background and were approximately the same age and size when they went on test. Pigs were always fed in small groups. Care and management were at a rather high level.

A zero additive or control was not included in any of the above trials. The Aureomycin-fed group was considered as a control, since Aureomycin has been fed at low levels at this station for a number of years.

Under actual field conditions any or all of the additives may perform differently. One should not plan to substitute an additive for good management, good sanitation procedures, or good housing. With field conditions where it is virtually impossible to maintain ideal conditions, the proper additive may help improve animal performance. That every additive increases feed costs must be considered when evaluating additive response under any set of conditions.

Dietary $NaNO_2$, NaCl, K_2SO_4 or Urea for Growing-finishing Pigs (Project 311).

B. A. Koch and D. B. Parrish[1]

Nitrates are known to harm animals when ingested under certain conditions. Previous work here indicated that a high level of dietary nitrate might interfere with carotene conversion to vitamin A. This trial attempted to determine whether such interference does exist and also whether other dietary additives might interfere in carotene conversion.

Experimental Procedure

Twenty-four weanling pigs, 12 Duroc and 12 three-way crossbreds, six barrows and six gilts from each breed, were divided into six treatment groups of four pigs each. Each group was further divided so each pen contained one Duroc and one crossbred pig and one gilt and one barrow.

The pigs had been vaccinated for cholera and erysipelas before going on test. They also had been wormed with liquid piperazine. They had access to a heated automatic waterer and a two-hole self-feeder. Each ration was freshly mixed and pelleted every two or three weeks. Composition of the rations is listed in Table 18.

Observations

Results are reported here primarily to show that growing-finishing pigs can tolerate rather high levels of these materials without serious effects. None of the additives had an apparent effect on the blood serum vitamin A level. Pigs consuming 4 percent urea in their diet made the highest average daily gain.

1. Department of Biochemistry, K.S.U.

Table 23

Dietary $NaNO_2$, NaCl, K_2SO_4 and urea for growing-finishing pigs. (Feeding period started December 10, 1963, and ended February 27 or March 3, 1964.)

Treatment[2]	Control	+1.3% $NaNO_2$	+4% $NaNO_2$	+4% NaCl	+1% K_2SO_4	+1% urea
Ration No.	67	67-A	67-E	67-C	67-D	67-B
No. of pigs	3[3]	4	4	3[3]	4	4
Av. on-test wt., lbs.	82	87	87	76	93	85
Av. off-test wt., lbs.	207	221	201	190	226	224
Av. daily gain, lbs.	1.50	1.63	1.39	1.39	1.58	1.68
Standard error	±.05	±.20	±.13	±.16	±.22	±.02
Feed efficiency, lbs.	3.94	3.83	4.01	4.14	3.80	3.78
Serum vitamin A, units per 100 ml. (at slaughter)	38.2	37.2	40.9	33.5	34.8	35.2

1. The additive replaced sorghum grain in the ration.
2. One pig died in each group. Cause of death was not related to the ration being fed.

Limited Feeding for Growing-finishing Swine (Project 110).

B. A. Koch

Limiting daily feed intake during the last half of the growing-finishing period is a possible way to improve carcass characteristics of market pigs.

A review of limited feeding trials conducted here and elsewhere leads to these conclusions regarding limited feeding:

1. It reduces growth rate.
2. Reduces excess backfat but its effect on meaty hogs is questionable.
3. Requires 10 to 30 days extra feeding.
4. Requires feeding in small groups.
5. May or may not improve feed efficiency.
6. May produce a softer carcass.

The study reported below compared limited feeding with full feeding, and dry feeding with wet feeding.

Experimental Procedure

Thirty-two growing pigs (Poland Chinas, Durocs, and crossbreds), both barrows and gilts, that averaged nearly 100 pounds, were divided into eight groups of four pigs each. Each group of four pigs was housed and fed in a 6- x 16-foot pen, half of which was under roof. All pigs were watered in a trough three times a day. Four groups ate ad libitum from two-hole self-feeders and four groups were hand fed twice a day. All rations were pelleted. Two of the hand-fed groups ate off the floor. An equal amount of feed was soaked in water and fed to the other two groups in a trough twice each day. Feed was limited to 4 pounds per pig per day until the pigs weighed approximately 150 pounds, then it was increased to 5 pounds per pig per day. Feed was increased to 6 pounds per day when pigs weighed approximately 180 pounds. It was held at that level until they went to market. The four hand-fed groups and two of the self-fed groups were fed ration 35-D (See Table 24). The other two self-fed groups received ration 35-E (See Table 24).

Performance of the various groups is summarized by feeding method in Table 24.

Observations

Self-fed pigs gained considerably faster than limit-fed pigs. Limit-fed pigs made more efficient use of feed than self-fed pigs. Carcass differences were very slight at slaughter.

There was no difference in performance of pigs limit-fed dry on the floor and those limit-fed gruel in a trough. Teeth were checked and there was no evidence of excessive wear from eating off the floor.

Table 24
Self-feeding compared with limited feeding of growing-finishing pigs.

Method	Self-fed	Limited—Dry	Limited—Wet	Self-fed
Ration no.[1]	35-D	35-D	35-D	35-E
No. of pigs	8	8	8	8
Av. on-test wt., lbs.	110	108	112	111
Av. off-test wt., lbs.	212	204	205	209
Av. daily gain, lbs.	1.73	1.50	1.46	1.71
Standard error	±.07	±.06	±.05	±.10
Av. feed eff., lbs.	3.10	3.05	3.15	3.31
U.S.D.A. carcass grades:				
U.S. Choice No. 1	7	6	7	7
U.S. Medium	1	2	1	1

1. See Table 18 for ration formulation.

Slotted Floors for Swine

B. A. Koch

Slotted floors in all phases of swine production are being widely investigated. Confining pigs on a slotted floor is not a new idea. However, we need to know more about how best to use slotted floors.

Experimental Procedure

A 12- by 20-foot portable unit with a partially slotted floor is being used here to study pig performance. The unit consists of 96 square feet of solid floor (under roof) and 144 square feet of commercial slotted floor (uncovered).

Twenty-six head of Durocs, Polands, and crossbreds averaging 62 pounds were started on test February 23, 1963. The pigs had access to two three-hole, fence-line self-feeders and a kerosene-heated, 80-gallon waterer (all on the slotted floor). They ate a complete pelleted ration (ration 35-A, Table 24).

Observations

Performance data are summarized in Table 25. The pigs were self-fed 72 days. Pigs preferred to eat from the feeder parallel with the slots. All manure fell through the slotted floor. No labor was used for cleaning. Pigs stayed clean. Feet and legs were no more unsound than one would expect on concrete floors. Wasted feed was held to a minimum by careful adjustment of feeders. Wasted feed was lost because it fell through the floor. Manure accumulated beneath the floor with a minimum of odor. After the pigs were removed, the unit was moved. Manure was then loaded with a power scoop.

Table 25
Performance of pigs on portable slotted floor, February 23, 1963, to May 6, 1963—72 days.

No. of pigs	26
Av. on-test wt., lbs.	62.4
Av. off-test wt., lbs.	196.1
Av. daily gain, lbs.	1.86
Standard error	±.03
Av. feed efficiency, lbs.	3.05
Av. age off test, days	155

Processing Sorghum Grain for Growing-finishing Pigs.

B. A. Koch and C. W. Deyoe[1]

Sorghum grain can be processed several ways for growing-finishing swine. Trials conducted in cooperation with the Department of Flour and Feed Milling Industries were designed to determine the preparation pigs preferred and how the pigs performed when limited to one preparation.

Experimental Procedure

Six different preparations of R.S. 610 hybrid grain sorghum were offered 10 pigs during a 118-day feeding period. Pigs ate the preparation of their choice. Feeders were moved every third day to minimize position effects.

The pigs had access to an electrically heated, automatic waterer. They ate protein supplement 49-A (see Table 18) free choice from a seventh

1. Department of Flour and Feed Milling Industries, K.S.U.

self-feeder. The waterer and all feeders were under roof in an open-front shed. Each pig had approximately 30 square feet of floor area, two thirds of which was under roof.

The six preparations were (1) whole grain; (2) dry rolled grain; (3) dry rolled and pelleted grain; (4) steam rolled grain; (5) steam conditioned, rolled grain and (6) fine ground grain.

At the same time five groups of pigs were each given only one preparation throughout the growing-finishing period. Preparations used were the same as the first three above, a complete ration in meal form and a complete ration in pellet form. The pigs eating preparations (1), (2), and (3) ate protein supplement 49-A (see Table 18) free choice. The complete rations were 80 percent dry rolled sorghum grain and 20 percent protein supplement 49-A.

These pigs were housed in 7- x 28-foot pens with 16 feet under the roof of an open-front building. Water was available from automatic, electrically heated waterers. Each pen contained a three-hole, fence-line feeder. Pigs eating free choice had supplement available at one feeder opening and grain at the other two. Pigs eating a complete ration had the ration available at all three openings.

Observations

Results of the preference study are summarized in Table 26. The pigs definitely preferred whole grain or dry rolled pelleted grain over all other preparations, with no definite preference between the two preparations. They consumed very little of any of the other preparations.

Results of the performance part of the study are summarized in Table 27. Average daily gains of pigs eating various preparations did not differ significantly. The amount of grain required to produce 100 pounds of gain differed among the three groups on grain and supplement free

Table 26
Consumption of various sorghum grain preparations during a 118-day preference trial.

Preparation	Total lbs.	Days	Lbs. per day
Whole grain	2213	118	18.75
Dry rolled	7	118	0.06
Rolled and pelleted	2298	118	19.47
Steam rolled	8	118	0.07
Steam conditioned, rolled	12	118	0.10
Fine ground	9	118	0.07

Table 27
Performance of pigs limited to one sorghum grain preparation.

Ration preparation	No. of pigs	Av. gain, lbs. per day	Grain + supplement, lbs. per 100 lbs. gain	Feed cost 100 lbs. gain[1]
Whole grain	10	1.43 ± .04[2]	310 + 55	$8.12
Dry rolled	10	1.50 ± .07	285 + 58	7.82
Rolled and pelleted	10	1.41 ± .10	273 + 56	7.51
Complete ration (meal)[3]	10	1.48 ± .08	298 + 72	8.95
Complete ration (pelleted)[3]	10	1.53 ± .06	246 + 62	7.95

1. Ingredient and processing costs: sorghum grain, $1.77 per cwt.; protein supplement, $4.79 per cwt.; rolled grain, 20 cents per cwt.; pelleting, 10 cents per cwt.
2. Standard error of mean.
3. 80% dry rolled grain + 20% protein supplement.

choice. However, supplement intakes were very similar for the three groups. Pigs eating a complete ration were forced to eat a particular ratio of grain and supplement. Pigs eating a complete pelleted ration were much more efficient gainers than those eating a complete meal ration.

Kansas Swine Improvement Association Testing Station

B. A. Koch and W. A. Moyer

Eleven Kansas swine producers had 27 pens of barrows and gilts on test during the summer of 1963. It was necessary to send most of the pigs to Maurer-Neuer Meat Packers in Arkansas City for slaughter because our refrigeration facilities failed. Some carcass data were lost. Table 28 summarizes performance and carcass data collected.

Two litter-mate pigs were fed in each pen. The pigs received ration S-35-A (Table 18) throughout the testing period. Average testing cost per pig was $29; average return per carcass, $32. Sixteen of the 54 pigs that started on test met certification requirements.

Nine Kansas producers had 14 pens of barrows and gilts on test during the fall and winter of 1963-64. Another producer had a pen of 15 animals on test under the rules of the Superior Meat Sire (SMS) program. Tables 29 and 30 summarize performance and carcass data collected.

Two litter-mate pigs were fed in each pen as before. The pigs received rations S-35-D (Table 18). Average testing cost per pig was $35; average return per carcass, $32. Ten of the 20 pigs in the 14 test pens and 9 of those in the SMS pen met or exceeded purebred breed association certification standards.

Table 28
Kansas Swine Testing Station—Summer 1963.

Breeder	Sex[4]	B[5]	Age at 200 lbs. (days)	A.D.G., lbs.	Feed eff., lbs.	Lgth., in.	B.F., in.	L.E., sq. in.	% L.C.	Index
PRODUCTION DATA[1]						**CARCASS DATA[2]**				
Vern Albrecht	B	D	142	1.82	287	29.0	1.33	4.16	54.4	.....
Smith Center	B	D	Died on test							
Vern Albrecht	B	D	148	1.91	302	29.0	1.73	3.43	50.5	.....
Smith Center	B	D	149	2.00		29.0	1.70	3.72	50.3	.....
Balthrop Farm	G	H	184	1.16	283	30.0	0.97	4.67	57.7	96.70
Wichita	B	H	155	1.71		30.5	1.07	5.42	56.6	.....
(32) Balthrop Farm	G	H	Died on test							
Wichita	B	H	158	1.60	284	29.5	1.33	4.40	57.2	.....
J. V. Cundiff	G	S	148	1.76	316	Lost in transit				
Talmage	B	S	160	1.67		29.5	1.30	4.12	56.9	.....
J. V. Cundiff	G	S	147	1.97	276	30.5	1.16	3.71	55.7	.....
Talmage	B	S	158	1.74		29.0	1.20	4.00	55.7	.....
Animal Husbandry	G	D	158	1.85	289	29.5	1.23	3.37	51.9	.....
KSU, Manhattan	B	D	134	2.07		29.0	1.67	2.91	50.6	.....
Animal Husbandry	G	PC	188	1.25	309	28.8	1.08	4.05	56.0	86.5
KSU, Manhattan	B	PC	164	1.83		Lost in transit				
John Musick, Jr.	B	H	160	1.80	288	Lost in transit				
Route #5, Lawrence	B	H	184	1.50		30.5	0.93	4.13	59.5	.....
John Musick, Jr.	B	H	174	1.50	313	30.0	1.17	4.60	55.1	.....
Route #5, Lawrence	G	H	183	1.51		30.5	1.03	4.50	57.8	.....
John Musick, Jr.	G	H	161	1.64	309	Lost in transit				
Route #5, Lawrence	B	H	172	1.52		29.0	1.17	5.02	56.5	.....
O'Bryan Ranch	G	H	174	1.61	329	31.0	0.83	4.44	59.8	.....
Hiattville	G	H	Died on test							
O'Bryan Ranch	G	H	150	1.89	273	30.5	0.90	4.82	55.9	.....
Hiattville	G	H	157	1.75		Lost in transit				
O'Bryan Ranch	G	H	196	1.06	328	29.1	0.95	4.68	60.7	99.8
Hiattville	B	H	147	1.68		30.0	1.20	4.41	56.6	.....
Sandy Knoll Farm	G	D	148	1.94	273	Lost in transit				
Leon L. Dunn, St. John	B	D	162	1.57		29.0	1.17	3.40	54.9	.....
Melvin Shipley	B	H	169	1.44	284	Lost in transit				
Esbon	B	H	154	1.75		Lost in transit				
Melvin Shipley	B	H	171	1.48	318	Lost in transit				
Esbon	G	H	170	1.53		Lost in transit				
Wilbur Talkington	B	D	148	1.94	283	28.0	1.40	3.87	53.0	74.7
Matfield Green	B	D	147	2.02		28.6	1.18	3.70	53.3	68.0
Wilbur Talkington	G	D	140	1.60	285	29.5	1.10	4.12	57.6	.....
Matfield Green	B	D	150	1.87		30.0	1.40	4.03	56.3	.....
Loren Thiele	G	H	191	1.37	317	30.9	1.22	5.04	56.9	101.4
Route #2, Norton	B	H	189	1.55		29.5	1.27	4.97	55.1	.....
Loren Thiele	B	H	202	1.64	296	30.0	1.23	4.95	57.5	.....
Route #2, Norton	B	H	218	1.32		29.3	1.12	4.29	56.5	93.9
Neill Walker	B	Y	128	2.00	250	30.5	1.53	4.71	57.0	.....
McPherson	B	Y	130	2.08		29.5	1.40	4.34	56.9	.....
(33) Neill Walker	G	Y	166	1.56	284	30.5	1.37	4.61	57.1	.....
McPherson	B	Y	136	2.14		29.5	1.30	4.45	54.6	.....
Neill Walker	G	Y	139	1.87	267	30.5	1.50	5.36	56.5	.....
McPherson	B	Y	137	1.92		31.0	1.63	4.40	52.1	.....
Neill Walker	G	Y	154	1.64	286	Lost in transit				
McPherson	B	Y	148	1.82		Lost in transit				
Neill Walker	G	Y	151	1.86	262	31.0	1.35	5.47	55.4	101.7[3]
McPherson	B	Y	137	2.08		30.0	1.33	4.03	55.2	.....
Neill Walker	B	Y	136	2.20	250	30.5	1.63	4.57	53.3	85.7
McPherson	B	Y	136	2.05		31.1	1.48	4.49	55.1	93.9

1. B = Breed; A.D.G. = average daily gain; feed efficiency = an average for two pigs fed together.

2. Lgth. = carcass length; B.F. = average carcass backfat; L.E. = loin eye area; % lean cuts on carcass weight basis; Index = index according to 1962 National Barrow Show Index (a pig with 5.0 sq. in. of loin eye and 15% of live weight in trimmed ham indexes 100.0).

3. Highest indexing carcass that meets or exceeds all certification requirements.

4. Sex — B = barrow; G = gilt.

5. B = breed; D = Duroc; H = Hampshire; S = Spot; PC = Poland China; Y = Yorkshire.

Table 29
Kansas Swine Testing Station—Winter 1963.

Breeder	Sex[4]	B[5]	PRODUCTION DATA[1] Age at 200 lbs. (days)	A.D.G., lbs.	Feed eff., lbs.	CARCASS DATA[2] Lgth., in.	B.F., in.	L.E., sq. in.	% L.C.	Index
Dale S. Galle & Son	G	X	163	1.53	335	29.5	1.42	4.26	49.2	81
Moundridge	B	X	143	1.96		30.0	1.65	3.88	48.5	79
Dale S. Galle & Son	G	D	144	1.83	333	29.0	1.67	3.72	50.9	81
Moundridge	B	D	142	1.93		29.1	1.48	3.18	48.6	68
Wilbur Talkington	G	D	146	1.71	354	28.0	1.53	3.53	48.4	78
Matfield Green	B	D	180	1.19		27.3	1.21	4.11	55.9	92
Neill Walker	G	Y	160	1.51	356	29.5	1.40	4.04	50.2	71
McPherson	G	Y	148	1.65		29.8	1.20	4.41	52.5	88
Wallace Wolf	B	Y	139	2.16	291	30.1	1.52	3.64	51.9	73
South Haven	B	Y	144	2.07		29.1	1.58	4.37	52.0	82
Wallace Wolf	B	Y	155	1.88	329	27.8	1.43	4.83	52.8	83
South Haven	B	Y	180	1.56		28.9	1.28	3.80	56.3	92
Velsa Hall	B	Y	143	2.10	288	29.4	1.50	4.44	52.4	79
South Haven	B	Y	147	1.70		28.7	1.33	4.88	54.8	94
Neill Walker	G	Y	Died on test							
McPherson	B	Y	Died on test							
Loren Thiele	G	H	170	1.51	314	29.5	1.10	4.19	57.6	107
Norton	B	H	159	1.73		28.8	1.15	4.26	54.2	88
Loren Thiele	B	H	165	1.58	306	29.1	.98	5.20	59.4	122[3]
Norton	G	H	161	1.68		29.7	1.32	5.32	57.5	108
Melvin Shipley	B	H	159	1.75	320	28.9	1.49	4.13	53.6	83
Esbon	B	H	160	1.80		27.7	1.30	4.97	55.9	111
Kansas State Univ.	B	PC	165	1.51	304	27.5	1.17	5.45	59.7	123
Manhattan	B	PC	160	1.51		28.2	1.13	4.64	53.6	93
Kansas State Univ.	B	D	162	1.48	361	27.9	1.48	3.50	49.9	68
Manhattan	B	D	163	1.66		28.4	.97	3.78	54.0	88
Joe O'Bryan	B	H	135	2.05	329	29.4	1.28	4.36	51.9	83
Hiattville	G	H	169	1.52		29.0	1.15	4.25	55.8	94
	Average		156	1.71	325	28.9	1.34	4.27	53.4	89

1. B = Breed; A.D.G. = average daily gain; feed efficiency = an average for two pigs fed together.

2. Lgth. = carcass length; B.F. = average carcass backfat; L.E. = loin eye area; % L.C. = percent lean cuts on carcass weight basis; Index = index according to 1963 National Barrow Show Index (a pig with 5.0 sq. in. of loin eye and 15% of live weight in trimmed ham indexes 100.0).

3. Highest indexing carcass that meets or exceeds all certification requirements.

4. Sex — B = barrow; G = gilt.

5. B = breed; X = crossbred; D = Duroc; Y = Yorkshire; H = Hampshire; PC = Poland China.

Table 30
Superior Meat Sire Test Pen—Winter 1963.

Breeder	Sex[3]	B[4]	PRODUCTION DATA Age at 200 lbs. (days)	A.D.G., lbs.	Feed eff., lbs.	Lgth., in.	B.F., in.	L.E., sq. in.
Balthrop Farm[1]	B	H	168	1.56	314	29.0	1.33	4.38
Wichita	G	H	176	1.36		29.5	1.33	4.47
	B	H	168	1.53		29.5	1.47	4.66
	B	H	165	1.56	314	29.0	1.60	4.72
	G	H	509	.38[2]		......	......	......
	B	H	169	1.50		29.0	1.50	3.80
	B	H	177	1.31	314	28.0	1.03	3.82
	G	H	167	1.43		29.0	1.16	5.07
	G	H	165	1.44		29.0	1.06	4.82
	G	H	161	1.54	314	29.0	1.37	4.76
	B	H	167	1.39		29.5	1.34	4.22
	B	H	153	1.65		30.0	1.57	3.95
	B	H	172	1.40	314	29.5	1.07	3.84
	B	H	166	1.46		30.0	1.40	3.83
	G	H	174	1.43		29.5	1.17	4.05
	Average		168	1.47	314	29.2	1.31	4.31

1. Sire of pigs—Arnold 942651.
2. Data not used to calculate average.
3. Sex — B = barrow; G = gilt.
4. B = breed; H = Hampshire.

Beef Cattle

Vitamin A and Dehydrated Alfalfa Fed Individually and in Combination with and without Aureomycin in a Steer Fattening Ration (Project 567).

D. Richardson and E. F. Smith

This was the second test to compare dehydrated alfalfa as a source of vitamin A with pre-formed vitamin A, fed individually and in combination with and without Aureomycin. Two-year-old Hereford steers from two previous bluestem pasture-grazing tests were used in this test. They were from the same group as the yearlings used in the previous test. After the grazing test was completed, the steers were assigned to six lots of nine animals each on the basis of weight and uniformity. Supplements supplied the same amount of protein, calcium and phosphorus in each lot. Vitamin A value of carotene figuring dehydrated alfalfa at 400 I.U. per milligram of carotene gave 10,000 to 12,000 I.U. of vitamin A per head daily for animals receiving dehydrated alfalfa. Pre-formed vitamin A was added to the supplement at the rate of 15,000 I.U. per head daily. Assay of the supplements indicated approximately 30 percent loss. Aureomycin was fed at the rate of 70 mgs. per head daily. After the steers were on full feed, silage was limited to 20 pounds per head daily. The carotene content of the silage averaged about 2 mgs. per pound. All the sorghum grain was fed that the steers would clean up.

Results and Observations

The results are shown in Table 31. In general, the results agree with those of the previous test.

1. There were no differences in performance between animals fed dehydrated alfalfa and those fed pre-formed vitamin A.
2. A combination of pre-formed vitamin A and carotene was no better than either alone. Thus, it is indicated that a ration containing sufficient pro-vitamin A (carotene) is not benefited by adding pre-formed vitamin A.
3. Animals receiving a combination of added carotene, vitamin A and Aureomycin gained significantly faster than other lots in both tests; however, this was the only Aureomycin lot that gained faster. No explanation seems apparent.
4. No deficiency symptoms or difference in appearance was observed that could be attributed to vitamin A.
5. Again, liver storage of vitamin A was highest in animals fed pre-formed vitamin A, with greater variations within treatments than between treatments.
6. There was no real relationship between liver vitamin A storage and rate of gain, but animals with less liver storage tended to gain fastest.
7. There were no significant differences in percentage shrink to market, dressing percentage, carcass grades or carcass characteristics.

(38)

Table 31

Results of feeding vitamin A and dehydrated alfalfa individually and in combination with and without Aureomycin. December 9, 1962, to May 11, 1963—154 days.

Lot no.	7	8	9	10	11	12
No. steers per lot	9	9	9	9	9	9
Av. initial wt., lbs.	862	860	860	856	862	857
Av. final wt., lbs.	1253	1242	1246	1256	1245	1283
Av. daily gain, lbs.	2.54	2.51	2.51	2.59	2.49	2.76
Av. daily ration, lbs.:						
Sorghum silage	22.8	21.9	22.7	22.3	22.1	22.2
Sorghum grain	18.6	17.9	18.5	18.1	17.6	18.9
Supplement	1.5	1.5	2.0	2.0	2.0	2.0
Dehydrated alfalfa[1]	No	No	Yes	Yes	Yes	Yes
Vitamin A[2]	Yes	Yes	Yes	No	Yes	Yes
Aureomycin	No	Yes	No	No	No	Yes
Feed per cwt. gain, lbs.:						
Sorghum silage	897.7	873.3	905.3	860.0	889.3	802.0
Sorghum grain	732.2	712.7	738.8	696.6	708.0	685.4
Supplement	59.1	59.8	79.8	77.1	80.3	72.4
Feed cost per cwt. gain	19.57	$19.38	$20.32	$19.52	$19.73	$18.97
In transit shrink, %	2.44	1.80	2.10	1.68	1.74	1.78
Overnight shrink, %	2.13	1.90	2.10	2.21	2.37	2.03
Total shrink, %	4.57	3.70	4.20	3.89	4.11	3.81
Av. hot carcass wt., lbs.	769.7	768.8	774.6	767.8	758.9	794.0
Dressing %, feedlot wt.	61.4	61.9	62.2	61.2	61.0	61.9
Estimated kidney knob, % carcass	2.9	2.4	2.9	2.7	2.6	3.1
Average finish:						
Fat thickness, 12th rib, in.	0.73	0.72	0.66	0.58	0.59	0.70
Distribution[3]	3.2	3.0	3.4	3.7	3.8	3.2
Degree marbling[4]	6.0	5.2	5.8	5.4	6.9	6.2
Degree firmness[5]	2.2	1.8	2.2	2.3	3.2	3.9
Fat color[6]	2.0	2.2	2.3	2.1	2.6	2.2
Lean color[7]	2.4	2.3	2.7	2.7	2.7	2.7
Av. carcass grade:						
Lot prime	..	..	..	1	..	..
Top choice	1	1	..	1	..	..
Av. choice	..	5	3	1	..	..
Low choice	4	2	2	3	2	5
Top good	4	1	2	3	5	..
Av. good	..	..	2	..	..	3
Low good	..	..	..	..	2	1
Av. liver wt., lbs.	12.1	12.1	12.4	12.3	12.6	12.5
Av. vitamin A per gram liver, I.U.	25.0	26.0	18.8	16.9	36.5	25.3
Av. carotene per gram liver, meg.	1.66	1.69	2.43	2.15	1.86	1.70

(39)

1. 0.50 lb. per head daily included in supplement. Carotene figured at 1 mg. = 400 I.U. vitamin A.
2. 15,000 I.U. per head daily.
3. 2 = uniform, 3 = moderately uniform, 4 = modestly uniform.
4. 5 = moderate amount, 6 = modest amount, 7 = small amount.
5. 1 = very firm, 2 = firm, 3 = moderately firm.
6. 1 = white, 2 = creamy white, 3 = creamy, 4 = slightly yellow.
7. 1 = light cherry red or dark pink, 2 = slightly dark cherry red or dark pink, 3 = moderately dark cherry red.

Level of Vitamin A in Beef Steer Rations: Wintering Phase. Progress Report (Project 567).

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

Sixty Hereford steer calves were divided into six equal lots. Sorghum silage ad lib. and 1 pound of soybean oil meal per head daily were fed to all lots. Half of the animals (Lots 7, 8, and 9) received 8 pounds of sorghum grain per head daily; the other half (Lots 10, 11, and 12), 4 pounds per head daily. This phase of the test was to measure performance on two levels of grain and prepare the animals for the fattening phase. At the beginning of the fattening phase, the animals were reallotted to six lots of 10 with five animals from the 8-pound level of grain and five from the 4-pound level. Objectives of the fattening phase are to study:

1. 0, 15,000 and 30,000 units of added vitamin A per head daily added to a basal sorghum silage, sorghum grain and supplement ration.
2. Performance with 10 or 20 pounds of silage in ration.
3. Level of wintering ration on subsequent performance.

Results are shown in Table 32.

Table 32

Level of sorghum grain in steer calf wintering ration results, November 12, 1963, to March 6, 1964—115 days.

Lot no.	7	8	9	10	11	12
No. steers per lot	10	10	10	10	10	10
Av. initial wt., lbs.	489.5	486.0	486.5	487.0	487.0	487.5
Av. final wt., lbs.	751.5	745.0	763.0	730.5	737.0	732.0
Av. daily gain, lbs.	2.28	2.25	2.40	2.12	2.17	2.13
Av. daily ration, lbs.:						
Sorghum silage	24.2	24.3	24.3	29.8	29.7	29.7
Sorghum grain	7.9	7.9	7.9	4.0	4.0	4.0
Soybean oil meal	1.0	1.0	1.0	1.0	1.0	1.0
Feed per cwt. gain, lbs.:						
Sorghum silage	1063.0	1077.0	1010.0	1405.0	1368.0	1399.0
Sorghum grain	344.3	348.3	326.2	188.9	184.0	188.1
Soybean oil meal	43.9	44.4	41.6	47.2	46.0	47.0
Feed cost per cwt. gain	$11.97	$12.12	$11.35	$10.28	$10.02	$10.24

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

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

It is generally thought that performance of cattle may differ in various parts of the state due to location, soil, climate, rainfall and/or feed produced. This project is an attempt to determine whether such differences exist and, if so, to measure them.

Forty-eight Hereford steer calves from the same herd and averaging 448 pounds were divided as uniformly as possible into four lots of 12 animals. One lot was assigned to each of four locations: Colby, Garden City, Manhattan, and Mound Valley. Uniform size concrete lots with sheds are being used at each location. The animals were subdivided into two groups of six animals. The wintering ration consisted of locally grown sorghum silage fed to limit of appetite and 5 pounds of locally grown second cutting of 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 entire test. Analyses of the feeds used are shown in Table 34.

Results and Observations

Results of the first test are shown in Table 33. Satisfactory and economical performance was obtained at all locations. There were differences in the performance of animals at the various locations in both the wintering and fattening phases; however, one test is not sufficient to determine whether the differences were real. The test will be repeated several times.

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

Table 33
Feedlot results for wintering phase, November 21, 1962, to March 19, 1963—118 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.	448	448	449	448	449	449	449	448
Av. final wt., lbs.	585.8	567.5	588.3	584.8	581.7	592.5	611	611
Av. daily gain, lbs.	1.17	1.01	1.18	1.16	1.12	1.21	1.37	1.38
Av. daily ration, lbs.:								
Sorghum silage	24	24	22	22	23	23	30	29
Alfalfa hay	5	5	5	5	5	5	5	5
Feed per cwt. gain, lbs.:								
Sorghum silage	2,082	2,376	1,853	1,873	2,045	1,895	2,187	2,135
Alfalfa hay	418	490	422	430	445	412	365	363
Dry matter per cwt. gain, lbs.:								
Sorghum silage	618	706	584	590	644	597	538	525
Alfalfa hay	397	465	401	408	423	391	347	345
Total dry matter per cwt. gain, lbs.	1,015	1,171	985	998	1,067	988	885	870
Feed cost per cwt. gain[1]	$11.99	$13.85	$11.30	$11.47	$12.21	$11.31	$11.67	$11.48
Feedlot results for fattening phase, March 19 to September 28, 1963—193 days.								
Initial wt. per steer, lbs.	585.8	567.5	588.3	584.8	581.7	592.5	611	611
Final wt. per steer, lbs.	1,024	965.5	1,026	1,035	995	977.5	945	906
Av. daily gain, lbs.	2.27	2.06	2.27	2.33	2.19	1.99	1.73	1.53
Av. daily ration, lbs.:								
Alfalfa hay	4.6	4.6	4.5	4.4	5.0	5.0	4.5	4.1
Sorghum grain	17.1	16.5	16.9	16.8	15.4	16.0	14.7	13.2
Feed per cwt. gain, lbs.:								
Alfalfa hay	202.2	223.4	197.0	190.4	231.9	249.6	261.9	270.0
Sorghum grain	751.7	800.9	745.8	718.5	720.4	802.0	850.2	862.9
Feed cost per cwt. gain[1]	$16.06	$17.21	$15.88	$15.31	$15.87	$17.56	$18.57	$18.91
Shrink to market, %	5.5	4.2	4.7	3.1	3.9	3.2	4.5	3.8
Av. hot carcass wt. less 2%	602.2	574.8	608.3	610.7	583.6	583.1	546	525
Dressing %, feedlot wt.	58.8	59.5	59.3	59	58.7	59.7	57.8	57.9
Dressing %, selling wt.	62.2	62.1	62.2	61.9	61	61.7	60.5	60.2
Av. finish:								
Fat thickness, 12th rib, in.	.59	.74	.56	.53	.46	.56	.49	.40
Distribution[2]	3.0	3.0	3.2	3.3	3.2	3.2	2.3	3.7
Size rib eye, sq. in.	10.04	9.67	10.64	10.27	10.36	10.12	10.19	9.26
Degree marbling[3]	5.8	6.0	6.5	6.8	6.7	6.2	5.5	6.7
Degree firmness[4]	3.7	4.2	4.3	4.7	4.5	4.2	3.7	4.0
Fat color[5]	2.7	2.7	3.3	2.8	2.5	2.8	2.7	3.2
Lean color[6]	2.5	2.0	3.2	2.5	2.7	2.7	2.7	3.2
Av. carcass grade:								
Av. prime	..	..	..	..	..	..	1	..
Top choice	..	..	..	..	..	..	..	..
Av. choice	1	1	..	..	..	2	2	..
Low choice	5	3	5	3	4	2	1	1
Top good	..	2	1	2	2	1	1	2
Av. good	..	..	..	..	..	..	1	1
Low good	..	..	..	1	..	1	..	2
Liver wt., lbs.	10.02	10.11	10.48	10.55	10.15	9.69	8.80	8.77
Vitamin A per gram liver, I.U.	155.7	189.1	238.0	151.7	55.4	66.7	59.9	52.6
Carotene per gram liver, mcg.	4.7	5.1	5.9	6.1	4.2	4.2	3.3	3.6

1. Silage, $6.50 per ton; alfalfa hay, $25 per ton; sorghum grain, $1.80 per cwt.
2. 2 = uniform, 3 = moderately uniform, 4 = modestly uniform.
3. 5 = moderate, 6 = modest, 7 = small amount.
4. 3 = moderately, 4 = modestly firm, 5 = slightly firm.
5. 1 = white, 2 = creamy white, 3 = creamy, 4 = slightly yellow.
6. 1 = light cherry red or dark pink, 2 = slightly dark cherry red, 3 = moderately dark cherry red, 4 = slightly dark red.

Table 34
Feedstuff analyses.

	Moisture, %	Dry matter, %	Protein, %	Ash, %	Crude fiber, %	Ether extract, %	N.F.E., %	Carotene, mgs./lb.
Colby:								
Sorghum silage	71.80	28.20	1.82	2.61	5.07	0.84	17.86	8
Alfalfa hay	5.00	95.00	15.50	6.41	33.32	1.40	38.37	14
Sorghum grain	11.99	88.01	8.19	2.86	4.07	5.10	67.79	....
Garden City:								
Sorghum silage	68.56	31.44	1.33	2.00	3.17	0.48	24.46	1
Alfalfa hay	5.00	95.00	14.28	9.19	29.97	1.62	39.94	38
Sorghum grain	9.90	90.10	7.35	2.79	2.34	5.20	72.42	....
Manhattan:								
Sorghum silage	68.49	31.51	1.95	1.54	7.38	0.75	19.89	2
Alfalfa hay	5.00	95.00	11.98	3.11	35.67	1.19	43.05	10
Sorghum grain	10.65	89.35	8.14	2.58	3.48	4.50	70.65	....
Mound Valley:								
Sorghum silage	75.96	24.04	1.80	1.61	3.95	0.39	16.29	2
Alfalfa hay	5.00	95.00	13.67	5.79	31.01	1.41	43.12	7
Sorghum grain	7.99	92.01	7.73	2.23	3.41	4.40	74.24	....

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 Bass, E. F. Smith, L. H. Harbers, D. C. Loper, and R. F. Cox

This is a progress report on the second 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 four areas of Kansas: Colby, Garden City, Manhattan, and Mound Valley. Forty-eight Hereford steer calves averaging 454 pounds each were divided into four groups of 12. One lot was assigned to each location. Sorghum silage from the same variety (FSIA) and second cutting of alfalfa plus plain salt were used in the wintering phase. Feedstuff analyses are shown in Table 34, and results of the wintering phase in Table 35. Silage has been removed from the ration and sorghum grain added. The animals will be fattened for slaughter.

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

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	2,389	2,233	1,360	1,534	1,656	1,760	1,658	1,858
Alfalfa hay	405	408	278	334	338	365	382	454
Total dry matter cwt. gain, lbs.	954	921	680	786	886	947	807	949
Feed cost cwt. gain*	$14.62	$14.03	$8.92	$10.31	$11.05	$11.60	$11.16	$13.11

* Silage, $8 per ton; alfalfa hay, $25 per ton.

Table 36
Feedstuff analyses.

	Moisture, %	Dry matter, %	Protein, %	Ash, %	Ether extract, %	Crude fiber, %	N.F.E., %	Carotene, mgs./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	45.00	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 grain	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	.....

Protein Synthesis in the Rumen from Single or Mixed Sources of Nitrogen (Project 596).

D. Richardson and Muhammad Akram

Opinion differs on the value of single or mixed sources of added protein in beef rations. This experiment was to determine the percentage total nitrogen and protein nitrogen present in rumen ingesta of steers fed a single source of nitrogen and combinations of two, three and four sources (% nitrogen × 6.25 = % protein). Four rumen-fistulated steers were used. Prairie hay served as the roughage; alfalfa hay, cottonseed oil meal, soybean oil meal and urea as sources of nitrogen. All feed ingredients were analyzed and equal amounts of added nitrogen were used in all cases. When mixed sources were used, each ingredient contributed an equal amount of nitrogen. Thus the rations fed were isonitrogenous. Where urea was fed, corn was added to make the rations isocaloric. The first test was conducted without grain (except 1 pound daily with urea). The second test was conducted with added grain. One steer died from "hardware disease" at the end of the first test. That left only three steers, so alfalfa hay was omitted in the second test.

Results

Results of the first test are shown in Table 37. There were significant differences in percent total nitrogen and protein nitrogen; however, the lowest amount was greater than is recommended. Thus, it is obvious that all sources of nitrogen were utilized by the microorganisms in amounts to make sufficient protein available for digestion. Significantly higher total nitrogen and protein nitrogen were available from soybean meal and cottonseed meal than from urea except when both soybean and cottonseed meal were fed. No combinations of sources produced significantly more total nitrogen and protein nitrogen in the rumen than soybean oil meal or cottonseed meal fed alone, except the soybean and cottonseed meal combination.

Results of the second test with grain added to the ration are shown in Table 38. Total nitrogen and protein nitrogen were not significantly different in the rumen of steers fed soybean oil meal or cottonseed meal or a combination of soybean oil meal and cottonseed meal. Steers fed soybean oil meal or cottonseed meal had significantly higher total nitrogen and protein nitrogen than any whose ration contained urea.

Those results show differences in the ability of sources of nitrogen to provide total and protein nitrogen in the rumen. The oilseed meals were best. Soybean oil meal or cottonseed meal fed individually was equal to or superior to combinations of sources of nitrogen in all but one case. Thus, so far as protein per se is concerned, mixed sources of nitrogen (protein) show no advantage in beef cattle rations.

Table 37

Average percentage total nitrogen and protein nitrogen of the rumen samples from the fistulated steers fed rations having different sources of additional nitrogen in varying combinations without added grain.

	Source of nitrogen							
	S	C	A	U	S + C	S + A	S + U	C + A
Average total nitrogen, % *	2.05	1.98	1.86	1.73	2.29	2.15	1.86	2.20
Average protein nitrogen, % *	1.90	1.86	1.72	1.62	2.07	1.92	1.76	1.96
Average protein nitrogen as percentage of total nitrogen, %	92.68	93.93	92.47	93.64	90.04	89.31	94.62	89.09

	C + U	A + U	S + C + A	S + A + U	S + C + U	C + A + U	S + C + A + U
Average total nitrogen, % *	1.88	1.88	2.03	1.74	1.93	1.81	1.94
Average protein nitrogen, % *	1.76	1.76	1.82	1.53	1.72	1.55	1.76
Average protein nitrogen as percentage of total nitrogen, %	93.62	93.62	89.66	87.93	89.12	85.63	90.72

A = Alfalfa hay. S = Soybean oil meal. * % nitrogen × 6.25 = % protein.
C = Cottonseed oil meal. U = Urea.

Table 38

Average percentage total nitrogen and protein nitrogen of the rumen samples from the fistulated steers fed rations having different sources of additional nitrogen in varying combinations with added grain.

	Source of nitrogen						
	Soybean oil meal	Cottonseed oil meal	Urea	Soybean oil meal + cottonseed oil meal	Soybean oil meal + urea	Cottonseed oil meal + urea	Soybean oil meal + cottonseed oil meal + urea
Average total nitrogen, % *	2.63	2.67	2.33	2.46	2.28	2.27	2.12
Average protein nitrogen, % *	2.25	2.39	2.01	2.09	1.95	1.93	1.77
Average protein nitrogen as a percentage of total nitrogen, %	85.55	89.51	86.22	84.95	85.52	85.05	83.49

* % nitrogen × 6.25 = % protein.

Level of Protein for Heifer Calves Wintered on Bluestem Pasture, 1963-64 (Project 253).

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

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

The heifers were rotated between pastures so any differences due to pastures were minimized. Dicalcium phosphate was fed to standardize phosphorus intake between groups.

The results are reported in Table 39.

The heifers receiving only sorghum grain lost weight during the winter, an average of 0.30 pound each daily. As the amount of soybean meal increased in the ration, performance improved. Heifers receiving 1 pound of soybean oil meal and 1 pound of sorghum grain per head daily gained 0.25 pound per head daily and where the soybean meal was increased to 1.7 pounds daily, gain increased slightly to an average of 0.35 pound per head daily.

These heifers will be bred during the summer to study the effect of the protein levels on reproductive performance.

Table 39

Level of protein for heifer calves wintered on bluestem pasture, December 6, 1963, to March 30, 1964—115 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., lbs.	433	424	436	427	426	438
Daily gain per head, lbs.	−0.35	−0.26	0.34	0.15	0.46	0.24
Daily ration, lbs.:						
Ground sorghum grain	2	2	1	1	0.3	0.3
Soybean oil meal	.....	.....	1	1	1.7	1.7
Dicalcium phosphate	0.1	0.1	0.075	0.075	0.05	0.05
Vitamin A, I.U.	15,000					
Bluestem pasture	Free choice					
Salt	Free choice					

1. Sorghum grain was fed early in the trial.

Dicalcium Phosphate and Vitamin A for Calves on Winter Bluestem Pasture, 1962-63 (Project 253-1).

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

The 40 steer calves, 10 per lot, used in this experiment were good-to-choice Herefords from near Fort Davis, Texas, assigned on a random-weight basis to their treatments. They were pastured together in a 190-acre bluestem pasture during the winter, penned three times weekly, divided into treatment groups and fed the experimental diets shown in Table 40. The lots receiving dicalcium phosphate (0.1 pound per steer daily) and vitamin A (10,000 I.U. daily) received it mixed with soybean meal.

During the summer grazing phase only salt was fed, free choice. Each group of steers was in a 60-acre bluestem pasture. The steers were rotated among pastures the first of each month to minimize pasture differences.

The treatments appeared to have little effect during the winter. Some differences in weight gain occurred during summer grazing, but probably not from treatment.

Table 40

Dicalcium phosphate and vitamin A for calves on winter bluestem pasture, winter grazing, December 8, 1962, to April 1, 1963—114 days.

Lot no.	12A	12B	12C	12D
Treatment	Control	Dicalcium phosphate	Vitamin A	Dicalcium phosphate and vitamin A
No. of steers	10	10	10	10
Initial wt. per steer, lbs.	372	378	375	382
Daily gain per steer, lbs.	0.30	0.23	0.23	0.23
Daily ration per steer, lbs.:				
Soybean 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. daily	.....	.....	Yes	Yes
Bluestem pasture	Free choice			
Salt	Free choice			
Summer grazing, April 1, 1963, to September 29, 1963—184 days.				
Initial wt., lbs.	406	404	401	408
Gain per steer, lbs.	242	273	272	241
Daily gain per steer, lbs.	1.32	1.48	1.48	1.31
Summary, December 8, 1962, to September 29, 1963—298 days.				
Final wt., lbs.	648	677	673	649
Gain per steer, lbs.	276	299	294	267
Daily gain per steer, lbs.	0.93	1.00	0.99	0.90

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

L. J. Theurer, E. F. Smith, D. Richardson, and F. W. Boren

The 40 heifer calves, 10 per lot, used in this experiment were good-to-choice Herefords from near Fort Davis, Texas, assigned on a random-weight basis to their treatments. They were pastured together in a 190-acre bluestem pasture, penned three times weekly, divided into treatment groups, and fed experimental rations shown in Table 41. Dicalcium phosphate (0.1 pound per heifer daily) and vitamin A (10,000 I.U. daily), when fed, was mixed with soybean meal.

The results (Table 41) indicate no apparent advantage to feeding dicalcium phosphate, vitamin A or a combination of the two.

Table 41

Dicalcium phosphate and vitamin A for calves on winter bluestem pasture, December 6, 1963, to April 3, 1964—120 days.

Lot no.	7	8	9	10
Item	Control	Dicalcium phosphate	Vitamin A	Dicalcium phosphate and vitamin A
No. of heifers	11	10	11	10
Initial wt., lbs.	437	434	428	437
Daily gain per heifer, lbs.	.36	.15	.17	.15
Daily ration per heifer, lbs.:				
Soybean 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. daily	.....	.....	Yes	Yes
Bluestem pasture	Free choice			
Salt	Free choice			

The Value of Supplemental Copper and Cobalt for Steers on Fattening Rations, 1963 (Project 253-4-6).

K. L. Gnadt, E. F. Smith, D. Richardson, F. W. Boren, J. E. Kramer, and L. Dunn

Cobalt is one of the more recent minerals discovered to be essential to ruminants. It is necessary for the synthesis of vitamin B_{12} in the rumen. Copper is necessary for hemoglobin formation, along with iron. Corn is considerably lower in copper and cobalt than sorghum grains, according to the National Research Council. Its requirement tables for beef cattle show that 2 to 4 mgs. of copper and .03 to .05 mg. of cobalt are required per pound of feed.

The 54 good-to-choice Hereford steers, 9 per lot, were assigned to treatment on a random-weight basis. Two steers were removed shortly after the test started because of urinary calculi and arthritis, one from each of Lots 18 and 21. All lots received silage for 30 days and rolled corn was gradually increased until full feed was reached. Each lot received a controlled amount of prairie hay and a soybean meal protein supplement fed at 1.5 pounds daily. It supplied 7,500 I.U. of vitamin A, 10 mgs. of stilbestrol, 70 mgs. Aureomycin, and 20 gms. of calcium. Cobalt sulfate was added to the supplement for three lots to provide .75 mg. cobalt daily per head. Cupric sulphate was fed to two lots to supply 49.5 mgs. copper daily. Excess copper was fed to two lots to supply 271.5 mgs. copper per head daily. Both copper treatments utilized the supplement as their carrier.

The results of the trial are reported in Table 42. Differences in daily gain and efficiency were not large. However, lots receiving cobalt (.75 mg. per head) or copper (49.5 mgs. per head) at the lower level or cobalt and copper combined at the lower level were somewhat superior. The two lots receiving excess copper (271.5 mgs. per head) responded the same as the control lot.

Table 42

Effect of supplemental copper and cobalt on fattening steers, June 17 to October 7, 1963—112 days.

Treatment	Control	Cobalt	Copper and cobalt	Copper	Cobalt, excess copper	Excess copper
Lot no.	18	19	20	21	22	23
No. steers per lot	8	9	9	8	9	9
Initial wt. per steer, lbs.	714	721	729	724	720	712
Total gain, lbs.	297	325	316	312	298	302
Daily gain per steer, lbs.	2.65	2.90	2.82	2.79	2.66	2.70
Daily ration per steer, lbs.:						
Corn	17.23	17.59	17.59	16.76	17.26	17.59
SBOM Supplement	1.49	1.48	1.49	1.49	1.49	1.49
Silage	3.47	3.52	3.52	3.60	3.55	3.52
Prairie hay	1.26	1.21	1.21	1.23	1.22	1.21
Feed cost per lb. gain, cents[1]	17.7	16.5	16.9	16.5	17.9	17.7
Lbs. feed per lb. gain	8.8	8.2	8.4	8.3	8.8	8.8
Carcass data:						
Average carcass wt., lbs.	603	633	619	619	607	598
Average dressing %	59.6	60.5	59.2	59.7	59.6	58.9
Average USDA grade[2]	15	14.7	14.9	14.3	14.4	13.9
Average yield grade[3]	3.75	3.4	3.2	3.6	3.4	3.5
Average marbling score[4]	7	7.4	7	7.1	7.6	8.1
Average rib eye, sq. in.	11.12	11.35	11.14	11.39	10.63	10.49

1. Feed prices can be found on inside back cover.
2. Average grade determined as follows: High choice, 18; average choice, 17; low choice, 16; high good, 15, etc.
3. Score from 1 to 6 on basis of yield, with 1 being the highest yield in closely trimmed boneless retail cuts.
4. Average marbling determined as follows: Moderately abundant, 3; slightly abundant, 4; moderate, 5; modest amount, 6; small amount, 7; slight amount, 8.

The Value of Dicalcium Phosphate, Vitamin A and Grinding Corn for Calves Fed Prairie Hay, 1963-64 (Projects 253-4-6).

E. F. Smith, D. Richardson, R. G. Curtis, and L. Dunn

The 60 good-to-choice grade Hereford calves used in this test came from near Fort Davis, Texas. They were assigned 10 to a lot on the basis of weight. All lots received all the prairie hay they would consume, about four pounds of corn each daily, and 1.25 pounds of soybean meal; where vitamin A (15,000 I.U. daily) and dicalcium phosphate (0.1 pound per head daily) were fed they were mixed with the soybean meal. In the lots fed ground corn it was ground medium coarse or between fine and coarse ground; the modulus of fineness was 4.34.

The phosphorus and carotene content of the feeds used is reported in the table on the inside back cover. The phosphorus intake of the basic ration without dicalcium phosphate was 11.8 grams daily per head and the carotene intake on the basic ration without vitamin A added was 80 mgs. of carotene from the prairie hay alone; these values exceed requirements published by the National Research Council.

The average daily gain for the three lots fed ground corn was 1.58 pounds; those fed whole corn gained 1.54 pounds; neither dicalcium phosphate nor vitamin A and dicalcium phosphate combined improved performance.

Table 43

The value of dicalcium phosphate, vitamin A, and grinding corn for calves fed prairie hay, November 27, 1963, to March 27, 1964—121 days.

Treatment	Ground grain	Whole grain	Ground grain + phosphorus	Whole grain + phosphorus	Ground grain, phosphorus + vitamin A	Whole grain, phosphorus + vitamin A
Lot no.	18	19	20	21	22	23
Heifers per lot	10	10	10	10	10	10
Initial wt., lbs.	369	365	368	362	361	364
Daily gain, lbs.	1.65	1.56	1.60	1.62	1.49	1.46
Daily ration per heifer, lbs.:						
Corn	3.88	3.88	3.88	3.88	3.88	3.88
Soybean meal	1.25	1.25	1.25	1.25	1.25	1.25
Prairie hay	9.10	9.03	9.36	9.14	9.32	9.20
Dicalcium phosphate	....	....	0.10	0.10	0.10	0.10
Vitamin A, 15,000 I.U. daily	....	....	....	....	Yes	Yes
Salt	Free choice					
Feed per lb. of gain, lbs.:						
Corn	2.35	2.49	2.43	2.40	2.60	2.66
Soybean meal	0.76	0.80	0.78	0.77	0.84	0.86
Prairie hay	5.52	5.79	5.85	5.64	6.26	6.30
Total feed per lb. of gain	8.63	9.08	9.16	8.91	11.05	11.17
Feed cost per lb. of gain[1]	$0.1371	$0.1420	$0.1465	$0.1411	$0.1582	$0.1581

1. Feed prices may be found on page 78.

Different Methods of Managing Bluestem Pasture, 1963 (Projects 253-3-5).

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

This experiment was designed 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 14 years is included.

Experimental Procedure

Two-year-old Hereford steers with an average U.S.D.A. feeder grade of about high good were used in 1963. They were purchased as calves near Fort Davis, Texas, and received prairie and alfalfa hay in dry lot during the winter each year. They were used in this study during the summers of 1962 and 1963. They were assigned to pastures on a random-weight basis.

The experimental treatment for each pasture was:

Pasture 1—Moderate stocking rate, 4 acres per steer.

Pasture 2—Overstocked, 2.7 acres per steer.

Pasture 3—Understocked, 6 acres per steer.

Pastures 4, 5, 6—Deferred grazing and burning, moderate stocking rate, 4 acres per steer. The steers were grazed on pastures 4 and 6 from May 7 to July 1. They were then moved to pasture 5 where they remained until September 2, when they were grazed in all three pastures until September 28, close of the trial. Deferred pasture 5 was burned April 25.

Pasture 9—Burned March 14, 1963, moderate rate of stocking.

Pasture 10—Burned April 8, 1963, moderate rate of stocking.

Pasture 11—Burned April 25, 1963, moderate rate of stocking.

The steers were gathered about 3 p.m., held over night without feed or water and weighed the following morning about 8 o'clock. Starting and final weights were obtained after putting all steers together and weighing them in random order.

Observations

Results are reported in Tables 44, 45, 46, and 47.

Compared with pasture 1, which was moderately stocked and not burned, gains were reduced by overstocking, deferring and burning, and early spring burning. Steer gain was greatest on the late-spring burned pasture. There was not much grass to burn on the early-spring burned pasture, the ground was wet, a good wind was available but only about one third of the pasture burned. Forage was also lacking on the mid-spring burned pasture. Although there was a strong wind and it was dry, only the slopes burned, about one half to two thirds of the pasture. Some green vegetation on the late burned pasture (April 25) seemed to aid the fire; about three fourths of this pasture burned. The deferred pasture had a good cover of vegetation and nearly a complete burn was obtained. It was burned in an attempt to improve steer weight gains which have been low under deferred grazing.

Table 44

A comparison of different methods of managing bluestem pastures, May 7, 1963, to September 28, 1963—144 days.

Pasture no.	1	2	3	4, 5, 6	9	10	11
Management	Moderately stocked	Over-stocked	Under-stocked	Deferred and late spring burned*	Early-spring burned	Mid-spring burned	Late-spring burned
No. of steers per pasture	15	22	10	45	11	11	11
Acres in pasture	60	60	60	3-60**	44	44	44
Acres per head	4	2.7	6	4	4	4	4
Initial wt. per steer	730	730	730	736	740	750	750
Gain per steer	202	180	195	170	187	200	233
Daily gain per steer	1.40	1.25	1.35	1.18	1.30	1.38	1.62
Gain per acre	51	65	32	43	47	50	

* Deferred pasture no. 5 was late-spring burned.

** Three 60-acre pastures.

Table 45

Yearly account of summer gains (pounds per steer) under different methods of grazing pastures; 14-year summary, 1950-63, 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	187	200	233
Average	236	215	230	199	239	255	261

Table 46

Per acre production and disappearance of forage, weeds, and mulch, Donaldson pastures, near Manhattan, Kans., 1963.

Range site		Pasture number 1 (lbs./A.)	2 (lbs./A.)	3 (lbs./A.)	Av. of 4 & 6 (lbs./A.)	5 (lbs./A.)	9[1] (lbs./A.)	10[1] (lbs./A.)	11[1] (lbs./A.)
		Production							
OU	Forage	3402	2167	3688	3573	2604	1268	1711	2079
	Weeds	150	247	183	304	104	194	152	130
	Mulch	2657	2350	2623	3257	540	.....	.....	.....
LB	Forage	2291	1276	3746	3238	1881	1272	1122	1332
	Weeds	262	302	157	169	77	251	168	112
	Mulch	1973	1030	2934	2723	701	.....	.....	.....
		Disappearance (index of amount grazed)							
OU	Forage	1977	1790	1629	1536	1521	721	811	961
	Weeds	77	148	29	105	99	93	60	53
	Mulch	744	855	66	697	97	....	....	....
LB	Forage	693	1074	1193	1334	977	467	370	578
	Weeds	97	183	73	89	15	42	130	93
	Mulch	772	485	tr	574	251	....	.....	....
		Remainder (amount left ungrazed at end of season)							
OU	Forage	1425	377	2059	2037	1083	574	900	1118
	Weeds	73	99	154	199	14	101	92	77
	Mulch	1913	1495	2557	2560	443	.....	....	....
LB	Forage	1598	202	2553	1904	904	805	752	578
	Weeds	165	119	84	100	62	209	38	19
	Mulch	1251	545	2934	2149	450	.....	.....	.....

1, No mulch in pastures 9, 10, and 11, burned annually, and very little in 5, burned in 1963 before deferment.

Table 47
Grass decreasers and grass increasers given as percent of total vegetation and estimated range condition in percent of "original" vegetation.

Range site		Pasture number 1 (%)	2 (%)	3 (%)	4 & 6 Av. (%)	5[1] (%)	9[2] (%)	10[2] (%)	11[2] (%)
OU	Grass decreasers ..	47	33	38	48	56	42	71	72
	Grass increasers ..	33	39	40	36	29	30	15	14
	Range condition ..	62	48	51	62	72	55	86	85
LB	Grass decreasers ..	62	44	56	62	62	47	68	82
	Grass increasers ..	26	32	30	23	24	27	18	15
	Range condition ..	80	65	75	79	81	68	88	97

1. Burned late spring, 1962, before deferment.
2. Burned annually, early, mid-, and late spring, respectively.

The Effects of Feeding Different Levels of Dicalcium Phosphate to Heifers on Bluestem Pasture (Project 253-2).

C. L. Drake, E. F. Smith, H. G. Spies, D. Richardson, and D. L. Good

This trial was designed to study effects of low to high levels of calcium and phosphorus supplements on heifers grazing bluestem pasture.

February 18, 1961, 40 Hereford heifer calves, weighing about 400 pounds each, were randomly divided into four groups and turned into a 140-acre pasture. Each morning the heifers were gathered, divided into four lots and fed the experimental rations shown in Table 49. The chemical analysis is presented in Table 48.

Starting October 5, 1961, the heifers were gathered and fed three times weekly instead of each day; however, the same quantity was fed per week. The heifers were given about 5 pounds of prairie hay per day when snow covered the grass and protein supplement was fed only during winter months. A trace-mineralized vitamin A salt mixture[1] was available at all times and heated water was available during the winter.

Blood samples were obtained at five different intervals during the study and analyzed for calcium and phosphorus. The average for each lot is shown in the following table.

Blood Calcium and Phosphorus Values[1]
(Blood values in mgs. per 100 mls. blood)

Lots		Calcium	Phosphorus
1	(No mineral supplement)	10.33	5.87
2	(Low mineral supplement)	9.95	6.86
3	(Average mineral supplement)	9.92	6.95
4	(High mineral supplement)	9.76	7.50

1. Each value is the average of five samples.

There were no differences between lots in blood calcium; however, there were differences due to season. Highest values were obtained in February, June and August of 1962 while lower values were in December, 1962, and March, 1963. There were significant differences in blood phosphorus between lots and season. Blood phosphorus levels

1. Commercial mixture containing 10% manganese; 10% iron; 14% max.-12% min., calcium; 1% copper; 5% zinc; .30% iodine; .10% cobalt. Two pounds of this mixture were added to 97 pounds of salt containing one pound of vitamin A (10,000 I.U. per gm.).

increased as the supplemental phosphorus increased and blood levels were highest during winter months.

There were no significant differences in hematocrit values between lots.

Average daily gain was not influenced by mineral supplementation; however, there were seasonal differences. In general, the gains were positive from May through October and negative from November through April; however, this depended somewhat on climatic conditions. Average daily gain is shown in Table 49.

The heifers were bred as short two-year-olds in the summer of 1962 and calved in the spring of 1963. Two purebred Hereford bulls with marking harnesses were used and an attempt was made to record the breeding date or dates of each heifer. The heifers were pregnancy checked by rectal palpation for 12 weeks during the breeding season.

There were no significant correlations between blood calcium or blood phosphorus levels and reproductive phenomena. The following table shows the effects of mineral supplementation on reproductive performance.

Effects of Calcium and Phosphorus Supplementation on Reproductive Performance.

	Lots 1	2	3	4
Mineral supplement	None	Low	Average	High
Heifers per treatment	10	10	10	10
Services per conception[1]	1.5	1.5	2.4	2.3
Heifers never conceiving[2]	2	0	2	3
Embryonic death loss[3]	4[4]	1	0	2
Percent calf crop	60	90	80	50[3]
Birth weight	69	63	65	64

1. Calculated on heifers known to have conceived as detected by rectal palpation.
2. Based on 35- to 40-day rectal palpation and failure to calve. Two heifers in Lot 1 and one in Lot 4 failed to ovulate throughout breeding season.
3. One calf was born dead in this group and is not included in this figure.
4. One heifer resorbed two embryos.

Table 48
Chemical analysis of the experimental ration.

Feedstuff	Protein, %	Calcium, %	Phosphorus, %
Corn gluten meal	43.63	0.05	0.98
Dried molasses	6.25	0.73	0.16
Dicalcium phosphate	0.00	22.33	20.56
Bluestem grass	4.72	0.43	0.09

Table 49
Experimental rations and average daily gain per head.[2]

	Av. daily gain 4-15-61 9-25-61	Av. daily gain[1] 4-15-62 9-15-62	Av. daily gain 9-25-61 4-15-62	Av. daily gain 9-15-62 3-15-63
Ration				
Lot 1 (No mineral supplement) 1 lb. dried molasses	1.42	1.70	−0.32	−0.0
Lot 2 (Low mineral supplement) 1 lb. dried molasses 27.1 gms. dicalcium phosphate	1.44	1.65	−0.44	−0.10
Lot 3 (Average mineral supplement) 1 lb. dried molasses 54.1 gms. dicalcium phosphate	1.42	1.73	−0.48	−0.01
Lot 4 (High mineral supplement) 1 lb. dried molasses 81.1 gms. dicalcium phosphate	1.42	1.70	−0.53	−0.01

1. Heifers were pregnant during this period.
2. One pound of 41% corn gluten meal per head was fed daily during winter.

Supplying moderate amounts of dicalcium phosphate seemed to enhance reproductive performance. Failure to ovulate and increased early embryonic mortality accounted for the poorer reproductive performance in the no-supplemental and high-level lots. Low and average mineral supplementation gave the highest calf crop percentages, while birth weight was not affected. Too few animals were involved to draw definite conclusions before more work is completed.

The Effects of Adding Protein to Dry-rolled Sorghum Grain Fattening Rations (Project 370).

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

Previous work (Bulletins 447 and 460) indicated sorghum grain fattening rations supplemented with 0.5 pound per head daily of soybean oil meal produced less efficient gains but carcasses about equal to those from heifers fed 1 pound of soybean oil meal per head daily. With each increase of 0.5 pound of protein (0.5 lb.-1.5 lbs.) came an increase in average daily gain and an increase in feed efficiency.

This experiment repeated a part of the previous experiment with the following modifications for a 140-day fattening period.

Lots 8 and 13—One half pound of soybean oil meal per head daily.

Lots 9 and 14—One pound of soybean oil meal per head daily.

Lots 10 and 15—One and one half pounds of soybean oil meal per head daily.

Lots 11 and 16—One half pound of soybean oil meal per head daily for the first 28 days, then increasing one half pound each 28 days for the 140 days.

Lots 12 and 17—Two and one half pounds of soybean oil meal per head daily for the first 28 days, then decreasing one half pound each 28 days for 140 days.

The heifers used in this experiment were good-to-choice Herefords from near Fort Davis, Texas, and were assigned on a random-weight basis to their treatments.

The amount of feed was increased gradually until they were on full feed. Half the ration was fed twice a day; any remaining feed was weighed back.

The sorghum grain used in the experiment contained an average of 10 percent protein.

Observations

Data collected in Trial 1 appear in Table 50. Average daily gain increased 0.13 and 0.07 pound, respectively, as daily soybean meal intake increased from 0.5 to 1.5 pounds. A daily intake of 1.5 pounds of protein fed in an increasing or decreasing manner resulted in an increased gain of 0.07 and 0.02 pound, respectively, compared with the half-pound level.

Feed efficiency increased as the protein intake increased from 0.5 to 1.5 pounds. A slight increase over the half-pound level was noted when 1.5 pounds of protein were fed in an increasing manner; however, 1.5

Table 50
Trial 1: Effects of adding protein to dry-rolled sorghum grain fattening rations, April 19, 1963, to September 6, 1963—140 days.

Lot no.	13	14	15	16	17
Protein feeding: Lbs. per head daily	.5	1	1.5	0.5 first 28 days plus 0.5 increase each 28 days	2.5 per day decreasing 0.5 each 28 days
No. heifers per lot	10	10	10	10	10
Av. initial wt., lbs.	650	656	648	650	650
Total gain, lbs.	200	218	210	210	203
Av. final wt., lbs.	850	874	858	860	853
Av. daily gain, lbs.	1.43	1.56	1.50	1.50	1.45
Av. daily ration, lbs.:[2]					
Sorghum grain	14.7	14.7	13.7	13.6	13.9
Soybean oil meal	.5	1.01	1.51	1.52	1.48
Sorghum silage	15.0	14.9	14.1	14.0	13.9
Prairie hay[3]	.82	.82	.82	.82	.82
Feed required per cwt. gain, lbs.:					
Sorghum grain	1031	942	912	904	957
Soybean oil meal	35	65	101	101	103
Sorghum silage	1048	958	940	933	960
Prairie hay	58	53	55	55	57
Total	2172	2018	2008	1993	2076
Feed cost per cwt. gain:[2]					
Sorghum grain	$19.59	$17.90	$17.33	$17.16	$18.18
Soybean oil meal	1.56	2.93	4.55	4.55	4.59
Sorghum silage	3.40	3.11	3.06	3.03	3.12
Prairie hay	.55	.50	.52	.52	.54
Total	$25.10	$24.44	$25.46	$25.26	$26.43
Carcass data					
Av. area rib eye, sq. in.	10.76	10.83	10.73	11.82	11.57
Av. fat thickness, 12th rib, in.	.89	.98	.92	.88	.88
Av. carcass grade:					
Prime	1				
Prime −		1			
Choice +		1	1	2	1
Choice	6	1	2	2	2
Choice −	3	6	4	6	4
Good +		1	3		2
Good					
Good −					1

1. Each animal received 0.1 lb. dicalcium phosphate and 10,000 I.U. vitamin A daily. Salt fed free choice; none of these included in feed costs.
2. Feed costs on page 78.
3. Prairie hay fed from August 15 to end of period; silage supply exhausted.

pounds of protein fed in a decreasing manner resulted in a feed efficiency between that of 0.5 and 1.0 constantly fed.

Table 51 shows data collected from Trial 2 with the same objectives. Feeding methods were the same.

Average daily gain was increased when the daily soybean meal intake increased from 0.5 to 1.5 pounds per head. Increasing the soybean meal intake every 28 days did not affect the average daily gain; however, decreasing the average daily protein intake every 28 days decreased average daily gain compared with that of the constant 1.5-pound level.

Table 51

Trial 2: Effects of adding protein to dry-rolled sorghum grain fattening rations, May 20, 1963, to October 10, 1963—143 days.

Lot no.	8	9	10	11	12
Protein feeding:					
Lbs. per head daily ..	0.5	1.0	1.5	0.5 first 28 days plus 0.5 each 28 days	2.5 per day decreasing 0.5 each 28 days
No. heifers per lot	10	10	10	9[3]	10
Av. initial wt., lbs.	588	588	584	586	597
Total gain, lbs.	227	246	278	278	244
Av. final wt., lbs.	815	834	862	864	841
Av. daily gain, lbs.	1.59	1.72	1.94	1.94	1.71
Av. daily ration, lbs.:[1]					
Sorghum grain	13.65	13.60	13.32	13.21	13.04
Soybean oil meal	0.5	1.00	1.50	1.44	1.61
Silage	9.97	9.94	9.60	9.88	9.16
Prairie hay[4]	1.99	1.99	1.99	1.99	1.99
Feed required per cwt. gain, lbs.:					
Sorghum grain	860	793	685	680	764
Soybean oil meal	31	58	77	68	94
Silage	628	578	494	508	537
Prairie hay	126	116	103	103	117
Total	1645	1545	1359	1359	1512
Feed cost per cwt. gain:[2]					
Sorghum grain	$16.34	$15.07	$13.02	$12.92	$14.52
Soybean oil meal	1.40	2.61	3.47	3.06	4.23
Silage	2.04	1.88	1.61	1.65	1.75
Prairie hay	1.20	1.10	0.98	0.98	1.11
Total	$20.98	$20.66	$19.08	$18.61	$21.61
Carcass data					
Av. area rib eye, sq. in.	9.73	9.53	9.61	9.81	8.78
Av. fat thickness, 12th rib, in.	.56	.67	.69	.67	.59
Av. carcass grade:					
Prime = 1				1	
Choice + = 2				1	1
Choice = 5		1	1	2	1
Choice − = 7	4	2	1		2
Good + = 11	2	3	4	3	3
Good = 13	3	4	4	2	2
Good − = 1	1				1

1. Each animal supplemented with 0.1 lb. dicalcium phosphate and 10,000 I.U. vitamin A daily. Salt fed free choice; none of these included in feed costs.
2. Feed costs on page 78.
3. One animal died of pneumonia September 8, 1963.
4. Prairie hay fed from August 15 to end of period; silage supply exhausted.

Feed efficiency increased as average daily protein intake increased from 0.5 to 1.5 pounds. Increasing the average soybean oil meal intake each 28 days did not affect feed efficiency; decreasing the average daily protein intake each 28 days decreased feed efficiency.

Cane Molasses in Rations of Growing Beef Calves. The Value of Winter Shelter for Feedlot Calves, 1963-64 (Project 370).

E. F. Smith, D. Richardson, C. W. Deyoe, F. W. Boren, and R. G. Curtis

Choice grade Hereford steer calves in this test came from near Alden, Kansas, and were assigned to treatments on a random-weight basis.

All lots received the same experimental diet except 10 percent molasses was substituted for grain in the self-fed mixture for two lots. Small adjustments were made to equalize protein and energy intake between molasses and no-molasses lots. The composition of the roughage-concentrate mixture is listed in Table 52; it consisted primarily of ground rice

Table 52

1. The use of cane molasses in rations for growing beef calves. 2. The value of winter shelter for calves, December 17, 1963, to March 21, 1964 —95 days.

Treatment	Molasses 10%		No molasses	
	Shed	No shed	Shed	No shed
Lot no.	17	15	16	14
Steers per lot	10	10	10	10
Initial wt., lbs.	479	482	480	481
Daily gain, lbs.	2.77	2.69	2.51	2.13
Daily ration per steer, lbs.:				
Roughage-concentrate mixture	16.68	17.54	15.85	14.94
Alfalfa wafers	3.83	3.83	3.83	3.87
Prairie hay	1.76	1.64	1.61	1.80
Salt	Free choice			
Feed per lb. of gain:				
Roughage-concentrate mixture	6.02	6.52	6.31	7.01
Prairie hay	.64	.61	.64	.85
Alfalfa wafers	1.39	1.42	1.53	1.82
Feed cost per lb. of gain[1]	$0.1496	$0.1598	$0.1477	$0.1676
Composition of roughage-concentrate mixture, %:				
Ground sorghum grain	40.4		49.0	
Ground rice hulls	42.0		45.0	
Cane molasses	10.0		.....	
Soybean meal	4.6		3.0	
Urea	1.0		1.0	
Dicalcium phosphate	1.0		1.0	
Premix (supplying about 70 mgs. Aureomycin and 10 mgs. stilbestrol per steer daily)	1.0		1.0	

1. Feed prices used on page 78.

hulls, ground sorghum grain, additives and other nutrients, including additional protein. Ground rice hulls were used because it was thought they might be unpalatable and molasses might show more effect. The basal diet was finely ground and dusty. Molasses reduced the amount of fine material where it was included. The average chemical composition of the no-molasses mixture was 10.2 percent protein, 1.9 percent fat, and 17.8 percent fiber; the molasses mixture was 10.7 percent protein, 1.9 percent fat, and 17.4 percent fiber. In addition to the roughage-concentrate mixture, which was before the animals at all times, nearly 4 pounds of alfalfa wafers were fed per head daily and a small amount of prairie hay.

One of the lots receiving molasses and one on the no-molasses treatment were in pens with the shed shelter fenced off.

The concrete pens were 30 × 48 feet, with a 15- × 30-foot dirt-floor shed open to the south. The shed was about 7 feet high at the rear, 12 feet high in front.

Some calves in all lots bloated. One calf in Lot 17 died of bloat the first 10 days and was replaced. A calf in Lot 16 was stuck with a trocar to relieve bloat.

Calves fed the roughage - concentrate mixture with 10 percent cane molasses consumed an average of 1.71 pounds more of the mixture and gained 0.41 pound more per head daily. Their feed efficiency was slightly improved.

Shelter furnished by the sheds seemed to be of some benefit. In the comparison of shed and no shed with molasses in the ration some favorable effect was noted. The lot with shelter gained considerably more and required less feed to produce a pound of gain in the other comparison.

These trials will be completed in about 40 days.

The Value of Wheat Shorts in Coarse and Fine Ground Concentrate Mixtures for Fattening Heifers.

E. F. Smith, D. Richardson, and J. E. Kramer

Twenty-four yearling Hereford heifers with a USDA Feeder Grade of about High Good were divided on the basis of prior treatment and on a random-weight basis into four groups of six heifers each.

The experimental diet is listed in Table 53. Two lots of six each received wheat shorts to increase the protein content of the corn base ration to 10.5 percent protein, two lots received soybean oil meal in their mixture to raise the protein content to the same level. One lot fed wheat shorts and one lot fed soybean meal received their concentrate mixture fine ground; in the other wheat shorts and soybean meal lots, the mixture was fed in a medium-coarse ground form. The cattle were fed twice daily for about 60 days and then self-fed the latter part of the trial. No roughage was fed about the last 30 days of the trial.

The two sources of protein produced about the same result as did the two methods of grain preparation.

Table 53

The value of wheat shorts in coarse and fine ground concentrate mixtures for fattening heifers, June 10, 1963, to October 11, 1963—123 days.

Treatment	Wheat shorts		Soybean meal	
	Fine ground	Coarse ground	Fine ground	Coarse ground
Composition of concentrate mixture, %:				
Wheat shorts	25.0	25.0		
Soybean meal			5.0	5.0
Ground corn, 3/32" screen	73.0		93.0	
Ground corn, ¼" screen		73.0		93.0
Ground limestone and trace minerals[1]	1.0	1.0	1.0	1.0
Vitamin A premix (supplied 600 I.U. per lb. feed)	1.0	1.0	1.0	1.0
Cost of concentrate mixture per ton delivered	$48.70	$48.70	$50.30	$50.30
Lot no.	1	2	3	4
Heifers per lot	6	6	6	6
Av. initial wt., lbs.	696	697	702	702
Av. daily gain, lbs.	2.33	2.37	2.19	2.53
Feed consumption per head daily, lbs.:				
Concentrate mixture	17.6	18.4	17.6	17.6
Sorghum silage	5.7	5.7	5.7	5.7
Prairie hay	1.5	1.5	1.5	1.5
Feed required to produce a lb. of gain (air-dry basis), lbs.	8.8	9.0	8.8	8.1
Carcass weight, lbs.	613	606	598	613
Dressing %	62.1	61.3	61.6	60.5
Carcass grades:				
High choice		1		2
Choice	1	4		2
Low choice	2	1	6	2
High good	3			
Marbling estimate[2]	7.3	6.2	6.8	6.3
Carcass yield estimate[3]	3.0	3.2	2.8	2.8

1. Trace minerals supplied by adding 1 pound of trace mineral premix (Calcium Carbonate Company) per ton of feed.

2. Marbling—the lower the score, the greater the degree of marbling; 6 is modest amount, 7 is small amount, scored from 1 to 10 (10 being practically devoid).

3. Carcass yield—the lower the score, the higher the yield; carcasses scored from 1 to 6.

The Effect of Partial Wilting on the Feeding Value of Forage Sorghum Silage, 1963-64 (Project 623).

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

The object of this experiment was to evaluate forage sorghum (cut at the same physiological stage of maturity) ensiled with varying moisture contents. All forage was cut during two days but ensiled at three different times: immediately after cutting; after drying in the field about 24 hours; and after drying in the field about 48 hours.

The forage was cut at a satisfactory silage stage, when the few seed heads present were approaching maturity and when the entire plant was about 30 percent dry matter.

A Hesston three-row, 500 windrower and a Gehl forage harvester with pick-up attachment were used to cut, then to pick the material up, head first. The harvester was set to cut the forage to half-inch lengths but most of it was longer.

Silage was stored in upright concrete stave silos 12 feet in diameter and 25 feet high. They may have been too small for best preservation of the drier forage. Spoilage was greatest in the forage dried 24 hours; least in that cut and ensiled immediately.

DeKalb FS1A sorghum was grown on the Animal Husbandry farm. Production was about 7 tons, lightly seeded, leafy forage per acre. Rainfall recorded for the year was about 18 inches, 14 inches less than normal.

Two trials are included in this report. In one the heifers were group fed; in the other they were individually fed. The calves used in both trials were good-to-choice Herefords from near Fort Davis, Texas, assigned to experimental diets on a random-weight basis, within each trial.

Some variation in gain between treatments occurred, but it likely could not be assigned to the experimental diets. The amount of forage required to produce a pound of live-weight gain was lowest for the calves fed forage ensiled immediately after cutting (30 percent dry matter), and increased with drying time. The quality of forage stored and storage conditions confounded results.

Table 54
The effect of partial wilting on the feeding value of forage sorghum silage.

	Trial 1 (Steers fed Nov. 27, '63, to March 18, '64—111 days)			Trial 2 (Individually fed Dec. 12, '63, to March 18, '64—96 days)		
	Regular silage cut and ensiled immediately	Wilted 24 hours	Wilted 48 hours	Regular silage cut and ensiled immediately	Wilted approx. 24 hours	Wilted approx. 48 hours
Group	5	4	6	1	2	3
No. heifers per group	10	10	10	4	4	4
Initial wt. per heifer, lbs.	432	435	430	284	282	285
Daily gain per heifer, lbs.	1.44	1.44	1.33	1.36	1.32	1.46
Av. daily ration, as-fed basis, lbs.:						
Silage—DeKalb FS1A	36.8	33.2	30.6	23.6	18.3	21.3
Soybean oil meal	1.25	1.25	1.35	1.25	1.25	1.25
Dicalcium phosphate	0.10	0.10	0.10	0.10	0.10	0.10
Salt	Free choice			Free choice		
% dry matter in silage	29	38	40	29	38	40
Forage dry matter consumed per head daily, lbs.	10.67	12.61	12.24	6.84	6.95	8.52
Forage dry matter per lb. of gain, lbs.	7.41	8.76	9.95	5.03	5.27	5.84

The Value of Feedlot Lighting, 1963-64.

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

The favorable results of previous tests* of the value of beef feedlot lighting justified further studies. Faster and more efficient gains were obtained under lighted conditions in two years of farm testing.

Two tests are reported here, one using heifer calves on a silage ration and the other with steer calves self-fed a roughage-concentrate mixture. The heifer calves were good to choice Herefords from near Fort Davis, Texas; steer calves were choice Herefords from near Alden, Kansas. All animals were assigned to treatment on a random-weight basis.

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 lot in which they were mounted.

On the silage ration the two lots were located about 80 feet apart. Where the roughage-concentrate mixture was self-fed the two lots were about 100 feet apart.

*"Beef Feedlot Lighting" by K. E. Robertson and R. I. Lipper, Report of Progress No. 90, Department of Agricultural Engineering, Kansas Agricultural Experiment Station, February, 1964.

Table 55
The value of lights for feedlot calves.

Treatment	Silage ration		Roughage-concentrate mixture self-fed	
	Lights	No lights	Lights	No lights
Duration of study	Nov. 27, 1963-Mar. 17, 1964—111 days		Dec. 17, 1963-Mar. 21, 1964—95 days	
Lot no.	3	6	13	17
No. of animals per lot	10	10	10	10
Initial wt. per animal, lbs.	430	430	483	479
Daily gain per animal	1.46	1.23	2.72	2.77
Av. daily ration, as-fed basis, lbs.:				
Sorghum silage	30.89	30.60		
Soybean meal	1.25	1.25		
Dicalcium phosphate	0.10	0.10		
Roughage-concentrate-molasses mixture[1]			17.44	16.68
Alfalfa wafers			3.79	3.83
Prairie hay			1.73	1.76
Salt	Free choice			
Feed per lb. of gain, lbs.:				
Sorghum silage	21.16	24.88		
Soybean meal	0.86	1.02		
Roughage-concentrate mixture			6.41	6.02
Alfalfa wafers			1.39	1.38
Prairie hay			.64	.64
Feed cost per lb. of gain[2]	$0.1125	$0.1327	$0.1573	$0.1496

1. The roughage-concentrate mixture on a percentage basis consisted of: Ground rice hulls, 42; ground sorghum grain, 40.4; molasses, 10; soybean meal, 4.6; urea, 1; dicalcium phosphate, 1; Aureomycin and stilbestrol premix, 1 (Supplied about 70 mgs. Aureomycin and 10 mgs. stilbestrol per steer daily).

2. Feed prices given on page 78.

On the silage tests the lighted lot gained slightly more than the non-lighted lot with no increase in feed intake, for more efficient gains. Where the roughage-concentrate mixture was self-fed, lighting seemed to have no effect. The last two lots will be on test 45 more days. Both trials were short, so the results should be interpreted as progress reports only.

Improving Beef Cattle Through Breeding Methods (Project 286).

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

The purebred Shorthorn beef cattle breeding project was continued during 1963 without modification. Inbreeding was continued in the two separate lines, which have remained closed to outside breeding since the study was initiated in 1949. The inbreeding plan has been basically to continue successive generations of half-sibbing in both lines. The Wernacre Premier line is in its fifth generation and the Mercury line, its fourth generation of inbreeding.

This project was initiated to study the inheritance of production traits in beef cattle, to evaluate the effects of inbreeding in beef cattle, and to explore the feasibility of using inbred lines of beef cattle to improve production traits.

Extensive individual animal production data have been collected on all cattle produced in the project since its start. No extensive line crossing has been attempted to date because of the relatively low levels of inbreeding and the limited number of breeding animals in the project.

The 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 of each year. The mature cows are wintered on dry native grass. The calves are not creep fed during the suckling period. All calves are weaned, weighed, and scored for conformation when they are approximately six months old and the standardized weaning age for weaning weight correction is 180 days. They are placed on individual feeding trials for record-of-performance tests for 182 days shortly after they are weaned. Body weight gain and feed consumption records are maintained on all calves during the feeding period. The calves are scored for conformation as yearlings when they complete the prescribed feeding test.

The full-feed ration for the bulls consists of 75 percent cracked corn and 25 percent chopped alfalfa hay; that for the heifers, 55 percent cracked corn and 45 percent chopped alfalfa hay. All calves are fed twice daily from individual feeders.

Production data for the 1962 calves are summarized in Table 56. The 1963 calves had not completed their feeding test at the time of this report. Thirty-four calves of the 1963 calf crop are being fed.

Table 56
Summary of the 1961 Shorthorn calves from indicated inbred lines.

Tag no.	Coefficient of inbreeding	Birth weight	Weaning weight	Weaning score	Days fed	Initial weight	Final weight	Total gain	Av. daily gain	Final score	Lbs. corn per cwt. gain	Lbs. alf. per cwt. gain
					Mercury Line, Bulls							
6	17.19	57	315	2—	182	330	751	421	2.31	2	436	223
91	15.63	43	274	2—	182	310	662	352	1.93	3	482	273
189	15.63	55	353	2	182	385	830	445	2.45	2+	442	245
8	12.50	70	415	2	182	418	840	422	2.32	2—	469	227
131	6.25	70	375	1—	182	403	900	497	2.73	2+	367	162
68	20.31	56	348	2—	182	362	824	462	2.54	2—	387	209
4	15.63	72	360	2+	182	385	875	490	2.69	1	378	205
5	12.81	60	300	2—	182	335	810	475	2.61	2—	448	220
7	18.75	60	350	2	182	360	805	445	2.45	2—	436	239
119	7.81	77	370	2—	182	415	951	536	2.95	1—	326	213
52	9.38	67	305	2	182	350	850	500	2.75	1—	415	211
87	9.38	82	310	2	182	310	819	509	2.80	2	396	191
31	17.74	57	386	2	172	418	810	392	2.23	2—	492	276
19	9.38	76	380	2—	172	445	860	415	2.36	2	563	278
12	9.84	73	353	2+	182	372	883	511	2.81	1	401	207
Average	13.22	65	346	2	.....	373	831	458	2.53	2+	429	225
					Heifers							
10	15.63	65	355	2+	176	415	775	360	2.05	1—	442	389
56	18.75	59	345	2+	182	357	712	355	1.95	1	370	406
(1)	18.75	65	320	2	182	357	720	363	1.99	1—	379	342
3	14.74	65	340	2	182	358	730	372	2.04	2	397	403
82	17.19	60	290	2+	182	320	655	335	1.84	2+	354	394
71	9.38	50	328	2—	182	368	705	337	1.85	2	427	332
21	7.18	75	353	2—	182	380	755	375	2.06	1	388	357
2	7.81	70	332	2+	182	351	703	352	1.93	1—	429	386
72	15.73	62	315	3	182	325	600	275	1.51	3+	451	407
9	15.92	60	255	3—	182	264	455	191	1.05	4	455	429
114	7.81	65	320	2—	182	335	590	255	1.40	2	449	408
81(a)	15.63	62	250	2	182	275	635	360	1.98	2	333	361
1	19.99	72	308	2	176	370	710	340	1.93	2—	432	382
36	15.92	71	401	1—	176	472	785	313	1.78	1	527	466
Average	14.32	64	322	2	.....	353	681	327	1.81	2+	417	390
					Wernacre Premier Line, Bulls							
191	33.05	61	320	3—	182	362	840	478	2.36	3—	417	219
14	29.81	80	425	3	182	473	955	482	2.65	3+	480	227
Average	31.43	71	373	3	.....	418	898	480	2.51	3	449	223
					Heifers							
13	28.27	68	345	3+	182	385	670	285	1.57	2—	447	407
15	34.05	65	300	2—	182	337	645	308	1.69	2—	425	357
81(b)	30.25	66	300	2—	176	373	705	332	1.89	2—	434	404
Average	30.86	66	315	2—	.....	365	673	308	1.72	2—	435	389

Meat

Influence of Breeding and Length of Feeding Period on Carcass Characteristics and Palatability of Beef.[1]

D. L. Mackintosh, D. H. Kropf, D. L. Harrison, E. R. Moore, and G. Ahlschwede

Sixty-four steer calves owned by Martin K. Eby and sired by the same bull were selected randomly from the 1962 fall calf crop. The calves were randomly selected and sorted into eight groups and placed in the feedlot. The first group was shipped to Kansas City for slaughter. Fifty-six days later Lot 2 was shipped and each 28 days thereafter eight steers were slaughtered for dressing and carcass data.

Muscle measurements were made at 14 points, with marbling evaluated subjectively at each location and samples taken for chemical analyses. Data are being analyzed. Early information indicates gradual decrease with time in the yield of primal cuts and an increase in dressing percentage; normal daily gain 2.3 pounds; gradual increase in carcass grade, first choice carcass after 112 days on feed, all choice after 224 days on feed. Muscle area increased gradually but at a decreasing rate, and an increase in marbling was evident.

Other observations will become apparent with data analyses.

A second phase of this project involves 24 calves of the same breeding, which were grazed during the summer of 1963, then wintered. At the end of the wintering period, eight head will be slaughtered and the balance summered on grass. At the end of the grazing season (August) eight head will be slaughtered and the balance placed on full feed for 140 days, then slaughtered.

1. Supported in part by a grant from the American Angus Association.

Influence of Sire on Quality of Beef.

D. L. Mackintosh, D. H. Kropf, D. L. Good, J. D. Wheat, John Teagarden, and Dorothy L. Harrison

Seventy head of fed Hereford steers, sired by four different bulls, were slaughtered in Kansas City and the rib cut from 40 (10 for each sire) returned to Manhattan for detailed analysis. Cooking data are now available on the ribs and are being prepared for the Statistical Laboratory, along with other data. All steers graded Choice on foot, but only three graded Choice in the carcass due to lack of marbling. The following table gives gross measure of the observations.

	Sire 1	Sire 2	Sire 3	Sire 4
Av. slaughter grade	12.7	11.9	11.8	12.0
Av. carcass grade	8.45	8.2	8.0	8.7
Av. marbling	11.8	10.2	10.6	11.6

Final distribution of the carcass grades was: Low Choice, 3; High Good, 4; Average Good, 13; Low Good, 46; High Standard, 4.

Palatability data not yet available.

Factors Related to Grade "A" Maturity Lambs.

D. L. Mackintosh, D. L. Harrison, D. H. Kropf, R. A. Merkel,[1] and J. C. Forrest[2]

Work on this phase of the lamb project was completed in the spring of 1963 and data for four years' work are involved. A total of 311 spring lambs were slaughtered. Slaughter, carcass, and palatability data for the four years have been tabulated and are now in the Statistical Laboratory for analysis. Earlier observations indicated that the subjective measurements of quality in grading lamb carcasses correlate highly with quality of the flesh. Conformation, fat streaking of the flank steak, fat streaking of the other flank muscles, quantity of external fat, color of lean in the flank steak, overflow fat and kidney and pelvic fat were all significantly related to carcass grade. Marbling and percentage fat in the longissimus dorsi muscle were both significantly related to grade. Percentage of fat in the longissimus dorsi was more consistently related. Marbling was observed to be the best indicator of quality as evaluated by a taste panel.

1. Now at Michigan State University.
2. Now at University of Wisconsin.

The Relationship of Certain Physical and Chemical Factors to Cooking and Sensory Evaluations of Beef.

David R. Moe, D. H. Kropf, D. L. Mackintosh, Dorothy L. Harrison, and Lois Anderson

A group of 32 wholesale beef ribs, from cattle of known history, ranging in grade from high standard to high good, were used. A **longissimus dorsi** (rib eye muscle) sample was removed at the 12th rib and used to obtain color, pH, water-holding capacity and cooking data. Another **longissimus dorsi** sample from the 9-10-11th rib cut was chemically analyzed for protein, moisture and ether extract and buttons (spinous process-distal portion) were removed for penetrometer readings and calcium determinations. The 6-7-8th rib section was roasted, and cooking data (cooking time and losses), sensory evaluations by a subjective panel and objective measures were obtained by personnel of the Department of Foods and Nutrition. Correlation coefficients were calculated between various factors.

Age in days, carcass grade, muscle pH and muscle moisture to protein ratios of raw or cooked samples were not good indicators of eating qualities. A lighter color tended to be associated with more desirable flavor ($r = .360$),* greater juiciness ($r = .448$)** and higher initial tenderness scores ($r = .353$).* Water-holding capacity as measured by the centrifuge method was significantly related to shear value (tenderness) ($r = .466$),** panel tenderness ($r = .589$),** and panel juiciness ($r = -.441$).* Water-holding capacity measured by either the press or weight method was not significantly related to sensory data.

Shear value was a good indicator of sensory tenderness as shown by a correlation of $-.703$.**

Penetrometer readings or calcium content of "button" samples was not closely related to age of animal at slaughter or to carcass grade.

* Significant at 5% level of probability.
** Highly significant at 1% level of probability.

The Effect of Level of Dietary Iron on Pork Muscle Characteristics (Project 524-D).

D. H. Kropf, D. L. Mackintosh, J. L. Hall, Dorothy L. Harrison, Mercedes Hunsader, and George A. Ahlschwede

Muscle color is an important factor affecting shoppers' choice of prepackaged meats from self-service display cases. The effect of several levels of dietary iron and of two levels of a chelating agent on pork muscle characteristics was studied.

Procedure

Barrows and gilts (20 of each), averaging 40.5 pounds and representing Duroc, Poland and Duroc-Poland cross breeding, were divided into five lots so that sex and breed were equally represented in all lots. The following rations were fed:

Lot 1—Control: Sorghum grain (milo), 790 lbs.; soybean oil meal, 95 lbs.; meat scraps, 50 lbs.; alfalfa meal, 50 lbs.; iodized salt, 5 lbs.; vitamin A, 400,000 I.U.; B complex vitamins (Merck 58-A), 0.5 lb.; Aurofac 1.8-1.8, 5 lbs.; $MnSO_4.H_2O$, 100 gms.

Lot 2—Control ration plus 0.1% Na_2Ca EDTA (ethylenediaminetetraacetate) ration.

Lot 3—Control ration plus 0.5% Na_2Ca EDTA.

Lot 4—Low iron ration consisting of: Ground corn, 675 lbs.; dried skim milk, 305 lbs.; ground limestone, 5 lbs.; iodized salt, 5 lbs.; vitamin A, B complex vitamins, Aurofac and $MnSO_4.H_2O$ at same levels as above.

Lot 5—Control ration plus 2786.8 gms. $FeSO_4.7\ H_2O$ and 209 gms. $CuSO_4$ per 1,000 lbs. ration.

EDTA chelating agent was added to rations of Lots 2 and 3. This additive may affect iron utilization and thus affect muscle quality. The low iron ration contained about one half the recommended allowance. A high level of iron and copper was added to Lot 5 ration. Rations were pelleted and fed free choice to pigs in concrete-floored feeding pens. Water was softened, so essentially no iron was available from it. Animals were individually taken off feed at 200 pounds live weight and slaughtered after being held 24 hours. Blood hemoglobin was determined on blood taken at slaughter and liver and spleen weights were taken. After a 24-hour chill, carcasses were cut by standard methods. Muscle color intensity was determined on the longissimus dorsi (loin eye) muscle, psoas major (tenderloin), and biceps femoris (a ham muscle). Muscle pH, myoglobin, moisture, total nitrogen and ash were determined on the above three muscles plus the semimembranosus and rectus femoris (2 ham muscles).

Results

Pigs receiving the ration containing added iron and copper gained faster than controls or those receiving EDTA. Pigs on the low iron ration gained faster than those receiving 0.5% EDTA and showed the highest feed efficiency. Liver and spleen weights were not significantly affected by treatment, perhaps because variation was high between individuals within lots. Blood hemoglobin was reduced by ration EDTA and increased by added iron and copper. Pigs receiving high levels of iron and copper (Lot 5) showed darker muscles and higher concentration of the muscle pigment, myoglobin. No significant treatment differences were demonstrated in moisture, total nitrogen or ash content of the muscles. Added iron and copper seemed to cause a desirable color in pork muscle.

The Effect of Processing Pork Carcasses Prior to Rigor Mortis upon Muscle and Fat Quality.

P. D. Weiner, D. H. Kropf, D. L. Mackintosh, and B. A. Koch

The effect of processing pork carcasses before rigor mortis was studied in 21 market-weight swine. The left side of each carcass served as a control and was chilled for 48 hours at 32-36°F. before being cut and processed by regular methods. The right sides (treated) were cut and processed within one hour of bleeding. Right hams were pumped with a 65° mixed pickle and cooled with iced pickle. Right loins were either placed in a chill room or in a blast freezer after being cut. Roasts removed from the hams and chops from the loins were cooked in a rotary oven. Selected fatback samples were rendered and lard samples analyzed for iodine number and free fatty acid value over 21 and 18 weeks, respectively, to determine whether treatment affected lard stability with storage at 70°F. Treated hams had significantly lower total cooking losses and drip losses than control hams. Muscles from the treated hams and from loins removed before rigor mortis and chilled were significantly tenderer as tested by shear force values of cooked samples. However, opposite results were noted for loins removed before rigor mortis and frozen. The frozen loins were less tender and had significantly higher expressible moisture than controls. Loin treatment had no significant effect on cooking losses, ether extract or total moisture. Treatment had no significant influence on fat stability as tested by iodine number or free fatty acid number after storage up to 21 weeks at 70°F.

Table 57
Prices of feeds used in beef cattle experiments, 1963-1964.

Sorghum grain, ground	$	1.90 cwt.
Corn, ground		2.15 cwt.
Corn		2.05 cwt.
Soybean meal		90.00 ton
Protein supplement (each 1.5 lbs. supplies 70 mgs. Aureomycin, 10 mgs. stilbestrol and 7,500 I.U. vitamin A)		110.00 ton
Protein supplement (each 1.25 lbs. supplies 15,000 I.U. vitamin A)		92.50 ton
Dicalcium phosphate		5.80 cwt.
Salt		20.00 ton
Prairie hay		19.00 ton
Sorghum silage		6.50 ton
Alfalfa wafers		35.00 ton
Alfalfa hay		25.00 ton
Rice hulls, ground		20.00 ton
Rice hulls—concentrate mixture		36.40 ton
Rice hulls—concentrate-molasses mixture		39.60 ton

Table 58
Chemical analysis of feeds used in beef cattle experiments.

Description	Protein (N x 6.25), %	Ether extract, %	Crude fiber, %	Moisture, %	Ash, %	N-free extract, %	Calcium, %	Phosphorus, %	Carotene, mgs./100 gms. (dry basis)
Prairie hay	5.25	2.29	31.24	7.13	7.48	46.61	0.49	0.12	1.94
Alfalfa wafers	15.94	1.62	25.42	8.62	10.49	37.91	1.90	0.22	0.33
Sorghum silage, ensiled immediately after cutting	3.06	0.76	7.34	68.62	2.96	17.26	.....	.....	0.42
Sorghum silage, wilted 24 hours	3.74	1.01	8.80	63.21	3.37	19.87	.....	.....	1.48
Sorghum silage, wilted 48 hours	3.89	0.79	9.56	59.82	4.47	21.47	.....	.....	1.82
Ground rice hulls, concentrate mixture	11.06	1.64	18.71	9.71	12.84	46.04	0.38	0.44	.....
Ground rice hulls, concentrate-molasses mixture	10.75	1.54	18.06	9.97	13.27	46.41	0.39	0.43	.....
Whole corn	9.94	3.78	2.15	11.55	1.45	71.13	0.01	0.32	.....
Ground corn	10.13	2.96	2.07	11.98	1.52	71.34	0.01	0.30	.....
Sorghum grain (Animal Husbandry elevator)	10.00	2.90	2.27	11.65	1.90	71.28	0.04	0.33	.....
Sorghum grain (Fed at Exp. Barn)	10.38	3.11	1.65	12.08	1.33	71.25	0.02	0.32	.....
Sorghum grain (Fed at pasture)	10.25	3.04	1.96	11.69	1.57	71.49	0.02	0.30	.....
Soybean meal (Fed at barn)	46.56	2.41	5.15	9.28	6.09	30.41	0.27	0.64	.....
Soybean meal (Fed at pasture)	45.69	1.50	5.02	10.59	6.01	31.19	0.28	0.66	.....
Ground rice hulls	1.50	0.40	40.20	7.71	23.36	26.83	0.10	0.08	.....
Dicalcium phosphate	.....	.....	.....	.....	.....	.....	21.20	18.75	.....