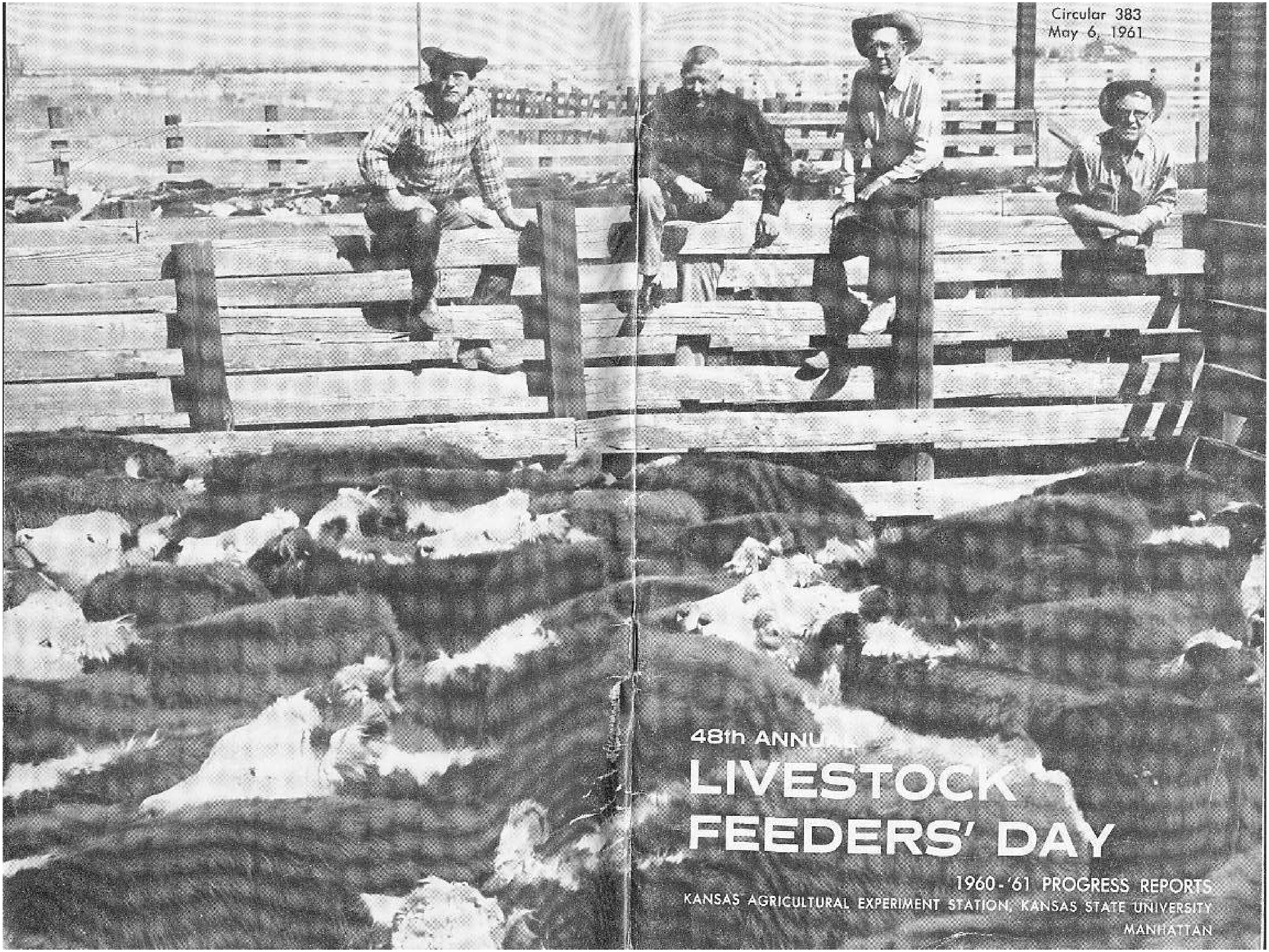
Circular 383
May 6, 1961



48th ANNUAL

LIVESTOCK FEEDERS' DAY

1960-'61 PROGRESS REPORTS

KANSAS AGRICULTURAL EXPERIMENT STATION, KANSAS STATE UNIVERSITY

MANHATTAN

CONTENTS

48th Annual Livestock Feeders' Day

KANSAS STATE UNIVERSITY
MANHATTAN, KANSAS

Saturday, May 6, 1961

8:00 to 10:00 a.m.—Experimental Livestock on Exhibit—Animal Husbandry Arena

10:00 a.m.—Arena

Presiding—Gene Sundgren, Salina, Kansas, President, Kansas Livestock Association

Reviews of Experiments—Animal Husbandry Staff

- Grazing and Grass Management
- Pasture Burning, Deferred and Season-long Grazing
- Bonemeal, Copper, Cobalt, and Aureomycin for Steers on Pasture
- Salt-protein Blocks vs. Salt-protein Mixtures for Calves on Winter Pasture
- Forage vs. Grain Sorghum Silage (cattle)
- Vitamin A and Aureomycin for Wintering Calves
- Enzyme Preparations for Calves on Wintering Rations
- Dehydrated Alfalfa vs. Vitamin A with and without Aureomycin
- Artificially Dried Grain for Cattle
- Comparative Value of Four Varieties of Forage Sorghum Silage for Wintering Calves
- Tranquilizers for Controlling Shipping Fever and Shrink in Stocker Calves
- The Value of Concrete Lots and Shelter for Wintering Steers
- Trace Minerals for Fattening Catttle
- Pelleting Forage Sorghums
- The Garden City Branch Station Lamb Feeding Tests
- The Colby Branch Station Sheep Project
- Breeding for Improved Lamb Production
- Specific Pathogen-free Swine
- Production Tested Boars
- Soaking Whole Sorghum Grain for Finishing Pigs in Drylot
- The Effects of Various Milling Processes on Sorghum Grain for Finishing Pigs in Drylot
- Iron and Quality Pork
- Quality in Lamb Carcasses

12:00 m. —Lunch—Arena

12:45 p.m.—Awards to Beef Production Contest Winners—Room 107, W. H. Atzenweiler, Agricultural Commissioner, Kansas City Chamber of Commerce; and Extension Animal Husbandmen

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KANSAS STATE UNIVERSITY
AGRICULTURAL EXPERIMENT STATION
MANHATTAN
GLENN H. BECK, Director

1:15 p.m.—Beef Making in the San Joaquin Valley—

Harvey McDougal, Feedlot Operator, Collinsville, California

Utilizing Forages and Roughages in Kansas and the Southwest—Panel Members

By Cow Herds in the Flint Hills—Floyd Mills, Ranch Operator, Sedan, Kansas

By Cow Herds in Western Pastures—Mel Harper, Ranch Operator, Sitka, Kansas

By Steers from the Range—George Andrews, Ranch Operator, Kanopolis, Kansas

By Heifers from the Range—Fred Winzeler, Ranch Operator, Lamont, Kansas

In Feedlots—Harvey McDougal, California, and Girdner Crofoot, Feedlot Operator, Cottonwood Falls, Kansas

Selling Cattle Fed Bulky vs. Highly Concentrated Rations—Willard Olander, National Livestock Company, Kansas City Market

Buying Cattle Fed Bulky vs. Concentrated Rations—Russell Halberg, Armour and Company, St. Joseph, Missouri

Questions and Discussion

3:00 p.m.—Adjournment

6:30 p.m.—Kansas State Union—Banquet for visiting stockmen and ladies—Block and Bridle Club

Honoring: Henry Rogler
Bill House
James Reid (deceased)

FOR THE LADIES

Friday, May 5, 1961

6:30 p.m.—Dinner, Gillett Hotel—Kansas Cow Belles and all visiting ladies (make reservations with Mrs. C. G. Elling, 701 Elling Drive, Manhattan)

Saturday, May 6, 1961

9:30 a.m.—Coffee, Animal Industries Building—by Animal Husbandry Ladies

10:30 a.m.—Program and Demonstrations

12:00 m. —Lunch, Animal Husbandry Arena

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

COVER PHOTO: Calves used in grazing and feeding tests by the animal husbandry department being loaded at Alpine, Texas, for shipment to Kansas, October, 1960. This is the third consecutive year that calves have been purchased for the experiments from the Jeff Ranch, Fort Davis, Texas. Photo courtesy Henry Elder, manager, Texas Hereford Association, Fort Worth.

Beef Cattle

Trace-mineral Salt for Steers on an All-roughage Ration (Concrete and Shelter vs. Dirt and No Shelter) (Project 430).

M. M. McCartor, B. A. Koch, E. F. Smith, and D. Richardson

Previous data collected at this station seem to indicate that supplementary dietary trace minerals may be of value under certain feeding regimes. This trial also was designed to obtain further information on the value of shelter and concrete in feeding lots.

Experimental Procedure

The steers used in this study had been used in various pasture trials during the summer of 1960. After those trials were completed, the steers were fed an all-roughage maintenance ration until they were allotted to this study December 14, 1960.

The cattle were divided into four groups of 10 animals each as follows:

Lot 1. Plain salt (on concrete and with shelter available).
Lot 2. Trace-mineral salt (on concrete and with shelter available).
Lot 3. Trace-mineral salt (dirt lot—no shelter).
Lot 4. Plain salt (dirt lot—no shelter).

The cattle were held off feed and water for 15 hours prior to being on and off test. Throughout the wintering period silage was fed in the morning and hay, in the afternoon. All animals had free-choice access to the designated salt and also to a mixture of that salt and bonemeal. Water was always available from heated automatic waterers.

Observations

Trace mineral salt apparently had no effect on average daily gain or feed efficiency of steers being wintered on an all-roughage ration.

Table 1

Trace-mineral salt* for steers on an all-roughage ration (concrete and shelter vs. dirt and no shelter).

December 14, 1960, to March 17, 1961—93 days.

	Concrete lot + shelter		Dirt lot, no shelter	
Treatment	Plain salt	T-M salt	T-M salt	Plain salt
Number steers per lot	10	10	10	10
Av. initial wt., lbs.	714	719	736	741
Av. final wt., lbs.	849	857	846	846
Av. total gain, lbs.	135	138	110	105
Av. daily gain, lbs.	1.45	1.48	1.18	1.13
Standard error of mean	±0.11	±0.11	±0.09	±0.12
Av. daily ration, lbs.:				
Sorghum silage	26.0	26.0	26.0	26.0
Alfalfa hay	11.8	11.9	11.5	11.9
T-M salt		.027	.027	
T-M salt + bonemeal		.155	.139	
Plain salt				
Plain salt + bonemeal	.129			.118
Av. feed per cwt. gain, lbs.:				
Sorghum silage	1779	1755	2204	2298
Alfalfa hay	808	804	974	1053
Av. feed cost per cwt. gain	$11.98	11.62	14.61	15.56

* Commercial trace-mineral salt containing not less than .150% manganese; .010% cobalt; .033% copper; .005% zinc; .007% iodine; .125% iron.

Steers fed on concrete and with shelter available gained significantly faster than those fed on dirt and without shelter. The average feed requirement per hundredweight gain was much higher for cattle on dirt and without shelter.

It should be pointed out that weather conditions were relatively mild and precipitation was almost zero during the time that this trial was in progress.

Cobalt Bullets or Cobalt-fortified Soybean Oil Meal for Heifers on a Finishing Ration (Project 430).

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

Experimental Procedure

Twenty-seven head of Hereford heifers of good to choice quality were used in this trial. They previously had been used to study various winter treatments. Treatments were as follows:

Control lot. Cracked sorghum grain and alfalfa hay fed twice a day; soybean oil meal fed once a day.

Cobalt-bullet lot. Each heifer given a cobalt bullet at beginning of the feeding period; fed the same as the control lot.

Cobalt "fed" lot. Daily allowance of supplemental cobalt carried in soybean oil meal; fed the same as the control lot.

During the first 17 days of the trial, each heifer received 10 pounds of silage per day mixed with the grain to help bring to full feed. Heifers in the cobalt "fed" lot received 0.75 mg. of supplemental cobalt per head per day in their soybean oil meal during the first 90 days. During the last 80 days, the supplemental cobalt was increased to 1.50 mgs. per head per day.

Observations

The heifers receiving cobalt bullets did not show significant improvement in average daily gain, feed efficiency, or carcass grade compared with the controls, but feed cost per hundredweight of gain was slightly lower and average carcass grade was slightly higher for the "cobalt" heifers.

Heifers receiving cobalt in their protein supplement each day gained an average of 0.3 pound more per day than controls, and feed cost per hundredweight gain was considerably lower. Average carcass grade was also considerably higher than that of the control group. Statistically, increase in average daily gain over that of the control group was highly significant.

In this particular test, the cobalt in the protein supplement apparently was more effective than that supplied by a cobalt bullet.

Table 2

Cobalt bullets or cobalt-fortified soybean oil meal for heifers on a finishing ration.

May 25, 1960, to November 11, 1960—170 days.

Treatment	Control	Cobalt bullet	Cobalt in SBOM[1]
Heifers per lot	9	9	8[2]
Av. initial wt., lbs.	637	634	636
Av. final wt., lbs.	926	926	976
Av. total gain, lbs.	289	292	340
Av. daily gain, lbs.	1.70	1.72	2.00
Standard error of mean	±0.07	±0.13	±0.05
Av. daily ration, lbs.:			
Sorghum grain	14.42	14.08	15.75
Soybean oil meal	1.00	1.00	1.00
Alfalfa hay	4.87	4.84	4.97
Salt	0.052	0.052	0.044
Salt and bonemeal	0.072	0.082	0.068
Av. feed per cwt. gain, lbs.:			
Sorghum grain	848.2	818.6	787.5
Soybean oil meal	58.8	58.1	50.0
Alfalfa hay	286.5	281.4	248.5
Feed cost per cwt. gain[3]	$19.31	$18.71	$17.61
Carcass grades, USDA:			
Av. choice	1	1	1
Low choice		2	2
High good	3	2	3
Av. good	4	2	2
Low good	1	2	
Av. USDA carcass grade[4]	11.56	11.78	12.25
Av. marbling score[5]	7.11	7.56	6.75

1. Each pound of soybean oil meal contained 0.75 mg. of cobalt added as $CoSO_4 \cdot 7H_2O$ for the first 90 days. During the last 80 days each pound of soybean meal contained 1.50 mgs. of cobalt.

2. One heifer died 10-8-60 (pneumonia).

Table 2 (Continued)

3. Feed prices listed on inside of back cover.

4. Average grade determined as follows: Av. choice, 14; low choice, 13; high good, 12; av. good, 11; low good, 10.

5. Visual marbling score: Modest, 6; small amount, 7; slight amount, 8; moderate amount, 9.

Studies on Shipping Fever and Shipping Shrink in Cattle.

F. W. Boren, H. D. Anthony, D. C. Kelley, D. L. Nelson, E. F. Smith, and S. Wearden

This is the second year in which an attempt was made to determine some basic facts related to shipping fever and shipping shrink in weaned stocker calves.

As in the previous years, the calves used in this study were from Jeff Ranch, Fort Davis, Texas. They were gathered early October 21, 1960, weaned from the cows, loaded into trucks, and transported 50 miles to loading pens in Alpine, Texas.

Fifty head of heifer calves were randomly selected from a group of 85 heifers. They were then randomly assigned to two groups as follows: (1) Control calves injected intramuscularly with sterile saline; (2) each calf injected with 2.5 cc of a commercial tranquilizer which contained 50 mgs. of ethylisobutrazine (2-ethyl - 3-dimethyl lamino - 2-propyl)- 10 phenothiazine hydrochloride per cc.

The two groups of calves were weighed, combined, and loaded into one cattle car and shipped to Manhattan, Kansas. On arrival they were separated into two groups, irrespective of treatment, and placed in two lots. Subsequently, seven additional examinations, including temperature, two nasal swabs, blood samples, and body weights, were made for each animal. All calves were observed daily for symptoms of shipping fever.

Observations

The transit shrink for four carloads of stocker calves is shown in Table 3. Shrink varied from 5 to 9% for the calves in cars 1, 2, and 3. Car 4 contained the experimental group of calves. The average shrink of these calves was 6%, with the tranquilized calves shrinking 5% and the control calves 7%. All the calves in the shipment, 195 head, received the same transit treatment. The difference in shrink is not significant.

Shipping fever did not occur in any of the calves during the experiment. However, symptoms of respiratory complexes did occur in approximately the same number in both the treated and control groups. These were treated with injections of penicillin and streptomycin, with a high degree of success.

It required about 21 days for the control group of calves to regain their initial pay weight of 428 pounds. The tranquilized group did not regain their pay weight, 443 pounds, during the course of the experiment, which was 27 days.

Red blood count, packed cell volume, and body temperatures of the control group of calves remained higher for the entire experimental period.

Table 3

Transit shrink of stocker calves.

Car No.	No. head	Sex	Transit shrink, %
1	45	Steers	7
2	50	Steers	5
3	50	Mixed	9
4[1]	50	Heifers	6
	25T[2]	Heifers	5
	25C[3]	Heifers	7

1. Car 4 was the experimental group.
2. Calves injected with tranquilizer.
3. Calves injected with saline solution.

Adapting Roughages Varying in Quality and Curing Processes to the Nutrition of Beef Cattle, 1960-61 (Project 370).

Comparative Value of Four Varieties of Forage Sorghum Silage for Wintering Weaned Beef Calves. A Progress Report.

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

The production of sorghum silage in Kansas has, during the past 20 years, grown from an insignificant source of farm income to one of major proportions. The total value of sorghums produced for silage and forage is about $40 million. Each year silage accounts for about two thirds of this total, or about $26 million. As more acres are retired from production of price-support crops, sorghum acreage is expected to increase still more.

Presently, there are 30 to 50 different forage sorghum varieties from which a farmer must choose. These varieties of forage sorghum have similar to widely different agronomic characteristics.

It is the object of this test to obtain data to help farmers select the sorghum varieties best suited to their livestock enterprises.

Four varieties of forage sorghum, widely different in agronomic characteristics, were used in this pilot test. They were:

1. DeKalb FS-1a: High grain producer; dry stalk; nonsweet; 76-77 days to reach 50% bloom.
2. Lindsey 115-F: Low-to-medium grain producer; juicy stalk; semi-sweet; late maturing.
3. Early Hegari: High grain producer; juicy stalk; nonsweet; 75-77 days to reach 50% bloom.
4. Axtell: Standard variety; low-to-medium grain producer; juicy stalk; sweet; 74 days to reach 50% bloom.

These four varieties were ensiled in upright silos when the grain reached the medium to hard dough stage.

Forty head of choice-quality heifer calves from the Jeff Ranch, Fort Davis, Texas, were used in this experiment. They were allotted, 10 head per lot, on the basis of weight, and fed silage free choice plus 1.25 lbs. of soybean meal. Dicalcium phosphate and salt were fed as a source of calcium, phosphorus, and salt. This feeding regime was such that it allowed a full expression of the production potential of the silage.

Results and Observations

The results of this experiment are reported in Table 4. Early Hegari produced the most gain, followed by DeKalb, with Lindsey and Axtell producing the least gain. The two high grain-yielding varieties, Early Hegari and DeKalb, produced more gain, 0.20 and 0.11 pound per animal per day, respectively, than the two low to medium grain-yielding varieties, Lindsey and Axtell. The latter two produced the same gains for the winter period. Statistical analysis of the data showed the differences in gain to be nonsignificant.

Daily ration, feed required per cwt. gain, and feed cost per cwt. gain show differences among lots, but valid conclusions are difficult to make from only one year's results. It is apparent that greater numbers of cattle are needed to detect statistically significant differences if they exist.

Table 4

Comparative value of four varieties of forage sorghum silage for wintering weaned beef calves.

December 1, 1960, to March 27, 1961—116 days.

Lot number	13	14	15	16
Number heifers per lot	10	10	10	10
Silage variety fed	DeKalb FS1a	Lindsey 115F	Early Hegari	Axtell
Initial wt. per heifer, lbs.	464	454	462	465
Final wt. per heifer, lbs.	654	634	665	645
Av. gain per heifer, lbs.	190	180	203	180
Av. daily gain per heifer, lbs.	1.64	1.55	1.75	1.55
Av. daily ration, lbs.:				
Silage	37.7	38.2	39.6	33.3
Soybean meal	1.25	1.25	1.25	1.25
Lbs. feed per cwt. gain:				
Silage	2300	2463	2265	2143
Soybean meal	76	81	71	81
Total feed required per cwt. gain, lbs.	2376	2544	2336	2224
Feed cost per cwt. gain	$9.23	9.87	9.17	8.95

Adapting Roughages Varying in Quality and Curing Processes to the Nutrition of Beef Cattle, 1960-61 (Project 370).

Performance of Yearling Beef Heifers Fed Various Ratios of Sorghum Grain to Dehydrated Alfalfa in Pellet Form.

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

This is the first year of an experiment designed to investigate the value of a complete pelleted ration for fattening cattle. Since Kansas has an abundance of sorghum grain and alfalfa, the 1960 study was designed to study the performance of yearling heifers fed various ratios of sorghum grain to dehydrated alfalfa in pellet form. Dehydrated alfalfa served as a source of roughage and protein.

The feeds used in this study were grown locally and the pellets made by the University's feed technology technicians—3/8 inch in diameter.

Fifty head of about 660-pound choice-quality Hereford heifers were used. They were allotted 10 head per lot on the basis of prior treatment and the lots randomly assigned to the various concentrate:roughage ratio pellets. The heifers were rapidly brought up to a full feed of pellets and, when on full feed, pellets were kept before them all the time. No other concentrates or roughages were fed. The pellets made up the sole source of concentrates and roughages received during the fattening period. At the end of the 135-day fattening period the heifers were sold on a grade and yield basis.

The indicated ratios of sorghum grain to dehydrated alfalfa in pellet form were compared.

Chemical analyses of the pellets also are indicated:

Lot number	Sorghum grain	Dehy. alfalfa	Protein	Ether extract	Crude fiber	Moisture	Ash	N.F.E.	Carbo-hydrates
	%	%							
1	90	10	10.13	3.32	4.03	9.88	2.36	70.28	75.31
2	70	30	11.56	3.32	7.62	8.97	3.51	65.02	72.64
3	50	50	12.75	3.52	13.05	8.61	5.15	56.92	69.97
4	30	70	15.63	3.57	15.80	7.72	6.81	50.47	66.27
5	10	90	16.59	3.61	20.57	7.23	7.52	46.32	66.89

Observations

The heifers in all lots went on full feed without difficulty and in about 20 days all lots were being fed pellets ad lib, with their average daily pellet consumption being within ½ to 1 pound of the average daily consumption for the entire 135-day fattening period. All the cattle stayed on feed very well; however, bloat was experienced in some lots. Practically all of the heifers in lots 1 and 2 getting 90:10 and 70:30 ratios of sorghum grain to dehydrated alfalfa, respectively, experienced some degree of bloat almost every day. The most bloat occurred from 9 to 10 a.m. and from 5 to 7 p.m. The heifers in lots 3, 4, and 5 rarely bloated, with lots 4 and 5 having no bloat at all. From our observations, the frequency of bloat decreased as the amount of dehydrated alfalfa increased from 30 to 90 percent of the total ration.

The heifers in all lots were restless, especially those in lots 1, 2, and 3. Those in lots 4 and 5 appeared more content and were observed to ruminate frequently. Without exception, all heifers indicated a desire for fiber by chewing and eating the board fences.

The feedlot performance and carcass data are presented in Table 5. The data presented reveal the following:

1. The average daily gain made by the different lots of heifers was not significantly different.
2. Daily pellet consumption per head increased as the dehydrated alfalfa increased, with the heifers in lot 5 eating about 3 pounds of pellets more per head daily.
3. Lot 1 required less feed per pound of gain followed by lots 3, 4, 2, and 5.
4. Lot 1 made the most economical gain.
5. The high cost of gain made in lots 2, 3, 4, and 5 over lot 1 was due not only to the increased feed consumption but mainly to the higher cost of the pelleted feed containing the higher percentages of dehydrated alfalfa.
6. Carcass grade scores of lots 1 and 2 are not significantly different. However, lot 1 graded significantly higher than lot 4, highly significantly higher than lot 3, and highly significantly higher than lots 4 and 5.
7. These data indicate that as the roughage portion (dehydrated alfalfa) of this all-pellet fattening ration was increased the following occurred:
   (a) Average daily gain did not change significantly.
   (b) Average daily feed consumption increased markedly.
   (c) Feed required per cwt. gain increased.
   (d) Carcass grade decreased significantly.
8. The quality of carcass fat was not affected by the level of dehydrated alfalfa in the fattening ration. The carcass fat of the cattle from all lots was very firm and the desirable white to creamy-white.

Table 5

Performance of yearling beef heifers fed various ratios of sorghum grain to dehydrated alfalfa in pellet form. A progress report.

May 17, 1960, to September 30, 1960—135-day fattening period.

Lot number	1	2	3	4	5
Number heifers per lot	9	10	9	10	10
Sorghum grain: Dehydrated alfalfa ratio	90:10	70:30	50:50	30:70	10:90
Av. initial wt., lbs.	670	655	659	653	666
Av. final wt., lbs.	908	879	920	909	899
Av. gain per heifer, lbs.	238	224	261	256	233
Av. daily gain per heifer, lbs.	1.76	1.66	1.93	1.89	1.73
Av. daily ration per heifer, lbs:					
Sorghum grain	13.91	11.81	8.76	5.32	1.86
Dehydrated alfalfa	1.55	5.06	8.77	12.40	16.75
Lbs. pellets consumed daily, total	15.46	16.87	17.53	17.72	18.61
Lbs. feed per cwt. gain:					
Sorghum grain	789.20	711.56	453.44	280.27	107.85
Dehydrated alfalfa	87.69	304.95	453.45	653.98	970.69
Total lbs. feed per cwt. gain	876.89	1016.51	906.89	934.25	1078.54
Feed cost per cwt. gain[1]	$18.41	22.87	21.31	22.89	28.07
Carcass data grades, USDA:[2]					
Av. choice	1	2	2	..	..
Low choice	2	5	1	..	..
High good	2	1	1	3	..
Av. good	3	2	..	2	3
Low good	1	..	3	4	5
High standard	..	..	2	1	2
Av. carcass grade[4]	17.9	18.7	17.1	16.7	16.1
Value per head on carcass grade-yield basis[3]	196.50	192.54	189.20	177.64	172.38

1. Pellet price on last page of bulletin.
2. Av. choice = 20; low choice = 19; high good = 18; av. good = 17; low good = 16; high standard = 15.
3. Choice grade carcasses = $38 per cwt.; good grade carcasses = $35.50; standard = $32.
4. Grade significance: $P < 0.05$ = 17.9 over 16.7; 18.7 over 17.1.
   $P < 0.01$ = 17.9 over 16.1; 18.7 over 16.7 and 16.1.

Experimental Grubicide Application Methods to Control Cattle Grubs.

F. W. Knapp and Miles McKee

During the past year a new grubicide application method has been tested for use in controlling cattle grubs. Called the pour-on method, it consists of pouring a small amount of a special formulation of a systemic grubicide along the back line of an animal before grubs appear in the back.

Three experimental systemic compounds tested were Bayer 29493, Co-

Ral, and Dylox, also called Dipterex.[1] These compounds were in mineral oil as a 2 percent suspension except Dylox was an 8 percent suspension.

The animals used were the University's purebred cow and calf herd, ranging in age from 1 to 15 years. They were divided into six groups and treated as follows:

Group 1. 15 head, 250 cc of B-29493 per head October 11, 1960.
Group 2. 15 head, untreated controls for group 1.
Group 3. 29 head, 250 cc of Dylox per head November 1, 1960.
Group 4. 25 head, untreated controls for group 2.
Group 5. 14 head, 250 cc of Co-Ral per head October 11, 1960.
Group 6. 14 head, untreated controls for group 5.

A pint jar with a 250-cc mark was used to apply insecticides to animals' backs. After treatment the animals were grouped as necessary for the convenience of the herdsman.

Not all animals in each group were available for grub counts due to consignment for shows and sales. Past experiments indicated that most grubs are encysted in backs by February; therefore, only one count was made February 1, 1961.

Table 6
The value of a pour-on grubicide application for grub control.

Group	Treatment	No. animals treated	No. animals checked for grubs	No. animals infested	Total grubs found	Av. grubs per head	% grub reduction
1	B-29493	15	11	3	3	0.3	90
2	untreated	15	15	7	45	3.0	
3	Dylox	29	11	0	0	0	100
4	untreated	25	25	12	76	3.0	
5	Co-Ral	14	10	10	313	31.3	24.6
6	untreated	14	8	8	332	41.5	

Results and Discussion

All three pour-ons in mineral oil were quite viscous the day of application due to cool weather and viscocity of the oil used. Newer formulations are less viscous and more easily applied.

No ill effects to the animals were noted nor was there any damage to the hair coat at the site of application. Treated animals could easily be distinguished from untreated by the residue of mineral oil along back lines.

The control of grubs by the B-29493 and Dylox treatments was 90 and 100 percent, respectively, and considered very effective. The Co-Ral treatment, however, gave only 24.6 percent control. Other workers using Co-Ral in a less viscous carrier have reported effective control.

Conclusions

The application of a grubicide by a pour-on method requires less time, labor, and equipment than either bolus or spray treatment. Another advantage over the spray method is that the pour-on treatments can be applied under adverse weather conditions. This work is still experimental and will require more testing before complete approval.

1. Bayer 29493 (0, 0 - dimethyl 0 - 4 - (methylthio) -m- tolyl phosphorothioate)
Co-Ral (0, 0 diethyl 0 - 3 - chloro - 4 - methyl - 2 -oxo-2H-1- benzopyran-7yl phosphorothioate)
Dylox (0, 0 - dimethyl- 2, 2, 2- trichloro -1- hydroxyethyl phosphate)
Insecticides were furnished by the Chemagro Corporation, Kansas City, Mo.

A Comparison of Salt-protein Blocks and Salt-protein Loose Mixtures for Steer Calves on Winter Bluestem Pasture, 1959-60 (Project 253-1).

E. F. Smith, F. W. Boren, and B. A. Koch

Salt-meal mixtures, with enough salt to limit protein intake, have been used for some time to supply protein on a self-service basis to range cattle. By pressing the salt-protein mixture into block form there is the possibility of limiting intake mechanically and thereby reducing the salt content of the mixture, which would be desirable.

The following experimental treatments were compared:

Pastures 7A and 13. Salt and soybean meal mixture.
Pastures 7B and 15. Salt and soybean meal in block form.

The mixtures or blocks listed above were kept before the steers throughout the winter period. Molasses was included as a binding agent in the blocks, so it was also included in the mixtures. Bonemeal was included in both blocks and mixtures as a source of phosphorus.

The bluestem pastures, each containing 60 acres, had sufficient dry grass for the cattle.

The 40 steer calves, 10 per pasture, used in the experiment were Good to Choice grade Herefords from near Fort Davis, Texas, and were assigned on a random weight basis to their treatments.

Observations

Salt content in both blocks and loose mixtures was varied in attempting to maintain consumption of the supplemental feed at the same level for all lots. Salt content of the blocks varied from 0 to 20 percent and that of the loose mixtures from 10 to 22 percent. Consumption was easier to regulate with the salt-protein mixture because the ratio could be changed easily. By the end of the first two weeks the cattle on both blocks and mixture were consuming 20 percent salt. Salt required to limit intake ranged between 0.43 pound and 0.48 pound per steer daily. The blocks contributed very little toward lowering salt consumption. The performance of the steers was about the same under both treatments.

Table 7
A comparison of salt-protein blocks and salt-protein mixtures.
December 8, 1959, to April 27, 1960.

Pasture number	7A	13	7B	15
Treatment	Mixture	Mixture	Block	Block
Number of steers	10	10	10	10
Initial weight, lbs.	455	459	456	451
Daily gain per steer	0.23	0.27	0.11	0.18
Daily ration per steer, self-fed, lbs.:				
Soybean meal	1.64	1.67	1.74	1.68
Salt	0.48	0.48	0.44	0.43
Bonemeal	0.08	0.08	0.12	0.12
Molasses	0.06	0.06	0.12	0.12
Total	2.26	2.29	2.42	2.35
Bluestem pasture	(free choice)		(free choice)	

The Value of Diethylstilbestrol Implants[1] and Implants Plus an Antibiotic[2] for Wintering Steer Calves, 1960-61 (Project 253-6).

C. L. Drake, E. F. Smith, B. A. Koch, D. Richardson, and F. W. Boren

Thirty-four good-to-choice Hereford steer calves from near Alpine, Texas, were randomly assigned (Snedecor's[3] randomization table) to three treatments:

Lot 19. Control.
Lot 20. Each steer implanted with 24 mgs. of diethylstilbestrol in the right ear.
Lot 21. Each steer implanted with 24 mgs. of diethylstilbestrol in the right ear and fed 70 mgs. of Aureomycin daily, mixed with sorghum grain.

Each animal in each lot received daily 5 lbs. of sorghum grain, 4 lbs. of alfalfa hay, and prairie hay free choice. They will be grazed and fattened during the summer and fall of 1961. Some will be reimplanted with diethylstilbestrol to collect more information on its use in a wintering, grazing, and fattening program.

Observations

Weight gains were not significantly affected by either stilbestrol implants or Aureomycin; however, the combination treatment administered to lot 21 apparently reduced the feed required per 100 lbs. of gain compared with the controls (lot 19).

Table 8

The value of diethylstilbestrol implants with and without chlortetracycline (aureomycin) for wintering steer calves.

December 2, 1960, to March 24, 1961—112 days.

Treatment	Control	Stilbestrol implant	Stilbestrol implant and Aureomycin
Lot number	19	20	21
Number of steers	14	10	10
Initial wt. per steer, lbs.	536	521	520
Daily gain per steer	0.95	1.01	1.08
Standard error of mean	.06	.04	.08
Daily ration per steer, lbs.:			
Sorghum grain	5.0	5.0	5.0
Alfalfa hay	4.0	4.0	4.0
Prairie hay	8.7	8.0	8.1
Salt (free choice)	....	....	....
Stilbestrol implant, 24 mgs.	No	Yes	Yes
Aureomycin, 70 mgs. per head daily	No	No	Yes
Feed per cwt. gain, lbs.:			
Sorghum grain	523	493	457
Alfalfa hay	418	395	370
Prairie hay	927	791	748

A Comparison of Feeding Hay to Steers on Bluestem Pasture and in Drylot, 1960-61 (Project 253-2).

C. L. Drake, E. F. Smith, F. W. Boren, and B. A. Koch

This study was designed to compare winter bluestem pasture with drylot as a place to winter calves. The same ration, alfalfa and prairie hay, was fed to both groups.

1. Diethylstilbestrol implants (Stimplants) were furnished by Chas. Pfizer and Co., Inc., Terre Haute, Ind.

2. Chlortetracycline (Aureomycin) was furnished by the American Cyanamid Co., Pearl River, N.Y.

3. George W. Snedecor. Statistical Methods. Iowa State University Press, Ames, Iowa (1959).

The following experimental treatments were used:

Pasture 8. Fourteen steers wintered in a 139-acre bluestem pasture from December 2, 1960, to March 24, 1961, and fed 4 pounds of alfalfa hay per head daily. Prairie hay and salt were offered free choice.

Lot 22. Fourteen steers wintered in a drylot 50 x 120 feet, without shelter and fed the same as those in pasture 8.

Observations

The results of this test are shown in Table 9. The steers in drylot consumed 2 pounds more prairie hay per head daily and gained slightly more than those wintered on bluestem pasture; however, the difference in gain was not statistically significant.

These steers will be grazed together this summer to determine the influence of different regimes on summer grazing gains.

Table 9

A comparison of feeding hay to steers in drylot and on bluestem pasture.

December 2, 1960, to March 24, 1961—112 days.

Lot number	22	8
Number of steers per lot	14	14
Feeding area	Drylot	Bluestem pasture
Initial wt. per steer, lbs.	490	512
Daily gain per steer	0.41	0.32
Standard error of mean	.03	.03
Daily ration per steer, lbs.:		
Alfalfa hay	4.0	4.0
Prairie hay	10.2	8.3
Salt (free choice)	....	....
Bluestem pasture	No	Yes

Different Methods of Managing Bluestem Pastures, 1960 (Projects 253-3 and 253-5).

E. F. Smith, K. L. Anderson, B. A. Koch, 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 11 years of the study is included.

Experimental Procedure

Two-year-old Hereford steers with an average USDA feeder grade of high good were used to stock the pastures in 1960. They had been purchased as calves from near Fort Davis, Texas, and were used in this experiment in 1959 as yearlings. During the winter of 1959-60, prior to this grazing trial, they were fed sorghum silage and alfalfa hay in drylot until about March 1 when they were moved to a bluestem pasture where they were fed alfalfa hay until the grazing season started.

The experimental treatment for each pasture was:

Pasture 1. Moderate stocking rate, 3.7 acres per steer.
Pasture 2. Overstocked, 2.6 acres per steer.
Pasture 3. Understocked, 5.4 acres per steer.
Pastures 4, 5, and 6. Deferred grazing at the moderate stocking rate, 3.7 acres per steer. All steers were grazed on pastures 4 and 6 from May 4 to July 6. They were then moved to pasture 5 where they remained until September 8. From this date until September 29 they were allowed to graze in all three pastures.
Pasture 9. Burned April 7, 1960, moderate rate of stocking.
Pasture 10. Burned April 7, 1960, moderate rate of stocking.
Pasture 11. Burned May 4, 1960, moderate rate of stocking.

Pastures 9 and 10 were burned on the same date due to snow cover which prevented burning pasture 9 at its regular earlier date. In the experimental plan pasture 9 is an early-spring-burned pasture which is usually burned in March.

Observations

Results are presented in Tables 10 and 11.

Burning and overstocking have reduced the forage produced on these pastures. Only about 75 percent of the early-spring-burned and mid-spring-burned pasture was burned due to lack of forage. The soil was moist under the grass, since it had rained two days prior to the April 7 burning. The late-spring-burned pasture (burned May 4) burned only in spotty areas and along the fence rows due to new growth of grass and lack of old grass.

Steer gains appear to be increased by burning treatments, especially late spring burning, and lowered by overstocking and deferred grazing.

Plant census counts, forage yields and disappearance obtained in 1960 are shown. Disappearance is a measure of removal, and census counts made annually give a measure of population change that shows range condition. Under the treatments, pasture 2 (close grazing) and pasture 9 (early spring burning) have deteriorated in yield, vigor, and range condition. Pastures 3, 4, 5, and 6 have improved.

Table 10

A comparison of different methods of managing bluestem pastures.
May 4, 1960, to September 29, 1960.

Pasture number	1	2	3	4, 5, 6	9	10	11
Management	Moderately stocked	Over-stocked	Under-stocked	Deferred	Early-spring-burned	Mid-spring-burned	Late-spring-burned
Number of steers per pasture	16	23	11	48	12	12	12
Acres in pasture	60	60	60	3—60[1]	44	44	44
Acres per head	3.7	2.6	5.4	3.7	3.7	3.7	3.7
Initial wt. per steer, lbs.	746	735	730	750	750	749	749
Final wt. per steer, lbs.	1014	977	985	985	1049	1038	1063
Gain per steer, lbs.	267	242	255	235	299	289	314
Daily gain per steer, lbs.	1.82	1.65	1.73	1.60	2.03	1.97	2.14
Gain per acre, lbs.	72	93	47	64	81	78	85

1. Three 60-acre pastures.

Table 11

Yearly account of cattle gains under different methods of grazing pastures: 11-year summary, 1950-1960. Average gain per steer in pounds for the summer season of approximately 150 days.

Pasture number	1	2	3	4, 5, 6	9	10	11
Management	Normally 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
Average	238	222	235	205	247	265	270

Table 12

Forage yields, disappearance of forage, botanical composition, and range condition of bluestem pastures under different management practices, 1960.

Pasture number	1	2	3	4, 5, 6	9	10	11
Yields of vegetation in pounds of air-dry forage per acre, 1960							
Range site:							
Ordinary upland							
Forage	4799	4522	5838	5548	2756	3940	4438
Weeds	287	472	300	239	344	324	152
Mulch	1415	1914	1742	1848			
Limestone breaks							
Forage	3540	2676	4526	3901	2458	2892	2873
Weeds	284	287	185	137	293	132	157
Mulch	1329	648	1310	1784			
Disappearance of vegetation in pounds of air-dry forage per acre, 1960							
Ordinary upland							
Forage	2109	2957	2383	2836	1186	1288	2397
Weeds	49	315	71	38	110	106	
Mulch		1103	133	295			
Limestone breaks							
Forage	1598	1512	1576	1295	1058	1423	1134
Weeds	81	102	62	47	95		91
Mulch	295	161		397			
Botanical composition and range condition, 1960							
Ordinary upland							
% decreasers[1]	58	37	38	55	42	69	65
% increasers[2]	23	35	35	26	24	14	20
% range condition	70	47	50	65	54	83	77
Limestone breaks							
% decreasers	48	42	62	65	59	68	77
% increasers	25	36	16	21	19	20	16
% range condition	69	68	78	86	81	90	92

1. In these pastures big bluestem and little bluestem and Indiangrass are the most abundant; they decrease under heavy grazing pressure.
2. Increasers include the gramas, buffalograss, bluegrass, and others that increase under grazing pressure.

The Value of Supplemental Copper, Cobalt, Copper and Cobalt, and Aureomycin[1] for Steers on Bluestem Pasture.

E. F. Smith, D. Richardson, W. S. Tsien, C. L. Drake

It has been tentatively reported, on the basis of chemical analyses, that some of the dominant species growing in bluestem pastures were inadequate in cobalt content and borderline in copper content for proper nutrition of cattle. Other work such as that of Glendening (Mineral Content of Certain Cattle Feeds Used in North Central Kansas, Journal of Animal Science, Volume 11) indicates adequate copper and cobalt content of bluestem pasture grasses.

This study was undertaken to evaluate the desirability of supplying these two trace minerals alone and in combination to steers grazing bluestem pastures.

Under a grant from the American Cyanamid Company, aureomycin (chlortetracycline) was fed to one lot to evaluate this antibiotic under grazing conditions.

Experimental Procedure

Fifty good to choice yearling Hereford steers were allotted into five lots of 10 steers each on the basis of prior treatment. They were purchased as calves the previous fall near Fort Davis, Texas, and were grazed on bluestem pastures the winter prior to this study. They were fed, in addition to the grass, soybean meal and small quantities of molasses and bonemeal.

In this study, the steers received only grass and their mineral or antibiotic treatment.

Each group was in a 60-acre bluestem pasture except the antibiotic group, which was in a 120-acre pasture with 10 other steers.

Copper carbonate was mixed with the salt to supply about 25 mgs. of copper per steer daily, about one half the requirement. The copper lot

Table 13

The value of supplemental copper, cobalt, copper and cobalt, and aureomycin for steers on bluestem pasture.

May 21, 1960, to October 21, 1960—153 days.

Pasture number	13	7A	15	7B	8
Treatment	Control	Copper[1]	Cobalt[2]	Copper[1] and cobalt[2]	Aureomycin[3]
Number steers	10	10	10	10	10
Initial wt. per steer, lbs.	509	516	515	512	507
Daily gain per steer*	1.54	1.61	1.47	1.44	1.70
Daily ration per steer:					
Salt, self-service, lb.	0.083	0.062	0.084	0.068	0.080
Copper, mgs.[1]		22.0		24.0	
Cobalt, mg.[2]			0.38	0.30	
Chlortetracycline, mgs.[3]					80.0
Bluestem pasture	Ad libitum				

* Least significant mean difference: P<.05 = 0.15 lb.; P<.01 = 0.20 lb.

1. Copper was fed in the form of copper carbonate mixed with salt, 714 mgs. of copper sulfate to 1 lb. of salt.

2. Cobalt was fed in the form of cobalt sulfate mixed with the salt, 21 mgs. of cobalt sulfate to 1 lb. of salt.

3. The source of aureomycin (chlortetracycline) was Aurofac 10 mixed with the salt, about 1 lb. of Aurofac 10 to 10 lbs. of salt.

1. Trade name of American Cyanamid Company for chlortetracycline.

actually consumed 22 mgs. and the copper-cobalt lot 24 mgs. due to variation in salt consumption.

Cobalt sulfate was mixed with the salt to supply about one half the requirement, 0.3 mg. per steer daily, the cobalt lot actually consumed 0.38 mg., and the copper-cobalt lot 0.3 mg. per steer daily. It was planned to supply chlortetracycline at the rate of 70 mgs. per steer daily; they received 80 mgs.

Observations

Neither copper, cobalt nor the combination of copper and cobalt produced a significant difference in gain compared with the control lot. The group fed copper gained significantly more than those fed copper and cobalt. Aureomycin increased steer gains 0.16 pound per steer daily over the control lot, which was significant at the 5 percent level.

The Value of Chlortetracycline[1] for Steers on Winter Bluestem Pasture, 1961 (Project 5-663).

E. F. Smith and B. A. Koch[2]

Forty Hereford steers were divided into two groups of 20 each on the basis of weight. Each group was pastured in a 160-acre bluestem pasture on the Pringle Ranch near Rose, Kansas. Both groups were fed protein blocks and chlortetracycline was included in the blocks for one group, to supply about 70 mgs. per steer daily. The blocks were composed primarily of soybean meal with 10% salt to limit intake. They were kept before the animals continuously during the first half of the trial but during the latter half were rationed to keep consumption of both groups at about the same level.

As shown in Table 14, the steers receiving chlortetracycline gained significantly more than the control group. The protein blocks were readily consumed and those containing chlortetracycline seemed to be the more palatable.

Table 14

The value of chlortetracycline for steers on winter bluestem pasture, January 27 to April 7, 1961—70 days.

	Control	Chlortetracycline[1]
Number of steers	20	20
Initial weight, lbs.	493	493
Daily gain	0.07	0.36*
Daily feed consumption:		
Protein blocks[2]	2.36	2.48
Winter bluestem pasture	160 acres	160 acres

* Significantly higher at the 5% level.

1. Aureomycin supplied by American Cyanamid Co., Pearl River, N.Y.

2. Protein blocks supplied by Harvest Brand, Inc., Pittsburg, Kansas.

1. Chlortetracycline (Aureomycin) was supplied by the American Cyanamid Co., Pearl River, N.Y.

2. Pringle Ranch, Rose, Kansas; P. R. Zimmer, American Cyanamid Co., Pearl River, N.Y.; and M. A. Hoelscher, Harvest Brand, Inc., Pittsburg, Kansas, were cooperators in the experiment.

The Value of Diethylstilbestrol Implants[1] and Aureomycin[2] for Steer Calves on a Wintering, Grazing, and Fattening Program, 1959-60 (Project 253-6).

E. F. Smith, B. A. Koch, F. W. Boren, and C. L. Drake

This is the third trial in a series designed to study the use of stilbestrol implants combined with aureomycin for steers on growing and fattening rations. The others are reported in circulars 371 and 378 from this station.

The good-to-choice Hereford steer calves used in this test came from near Fort Davis, Texas, and were assigned to treatment on a random-weight basis.

The animals under all treatments received the same basic ration.

The experimental treatment was as follows:

Lot 19. Control group of steer calves implanted with 24 mgs. of stilbestrol August 10, 1960.

Lot 21. Ten steer calves implanted with 24 mgs. of stilbestrol May 10, 1960.

Lot 20. Twelve steer calves, all implanted with 24 mgs. of stilbestrol December 1, 1959; four reimplanted with 24 mgs. of stilbestrol May 10, 1960, and four others reimplanted August 10, 1960, leaving only four with the original fall implant. See Table 16 for gains of different implant groups.

Lot 22. Twelve steer calves received the same treatment as lot 20 plus 70 mgs. of aureomycin per head daily.

Observations

Results of this test are reported in Tables 15 and 16.

In Table 15, a 24-mg. stilbestrol implant increased steer gain 0.12 pound per steer daily for the winter period (compare the average gain of lots 19 and 21 with that of lot 20 which received the implant). Aureomycin fed in lot 22 increased gain 0.25 pound per head daily compared with lot 20 and also increased feed efficiency. A 24-mg. implant administered May 10 to steers in lot 21 increased pasture gain 0.25 pound as compared with nonimplanted steers in lot 19. However, aureomycin fed with salt in lot 22 reduced summer gain 0.25 pound per steer daily.

During the fattening period beginning in August, steers implanted in May gained at about the same rate as those implanted in August. However, steers implanted in August were slightly more efficient. Aureomycin fed to lot 22 during this period increased gains over lot 20 by 0.34 pound per steer daily.

In summary of the three phases, wintering, grazing, and fattening, the steers implanted in August gained about the same as those implanted in May. Their carcasses graded slightly higher but their dressing percentage tended to be lower. Aureomycin increased steer gains in lot 22 0.16 pound over the steers in lot 20 and also improved dressing percentages and carcass grades slightly.

From the results shown in Table 16, it appears desirable to reimplant fall-implanted steers when they are placed on a fattening ration in August rather than to implant only in the fall or in the fall and spring.

1. The diethylstilbestrol implants were supplied by Chas. Pfizer and Co., Inc., Terre Haute, Ind.

2. The aureomycin (chlortetracycline) was supplied by the American Cyanamid Company, Pearl River, N.Y.

Table 15

The value of diethylstilbestrol implants and aureomycin for steer calves on a wintering, grazing, and fattening program.

Wintering, December 1, 1959, to May 10, 1960—162 days.

Lot number	19	21	20	22
Treatment	Control—Stilbestrol implant Aug. 10, 1960	Stilbestrol implant May 10, 1960	Stilbestrol implant Dec. 1, 1959[1]	Stilbestrol implant Dec. 1, 1959[1] and Aureomycin
Number steers	10	10	12	12
Initial wt. per steer	520	520	524	523
Daily gain per steer, lbs.	1.44	1.38	1.53	1.78
Standard error of mean	0.06	0.07	0.06	0.07
Daily ration per steer, lbs.:				
Sorghum grain	4.97	4.97	4.97	4.97
Soybean meal	.99	.99	.99	.99
Sorghum silage	29.83	29.83	31.17	33.31
Salt	.08	.08	.14	.12
Bonemeal	.02	.02	.03	.02
Stilbestrol implants, 24 mgs.[1]	No	No	Yes	Yes
Aureomycin, 70 mgs. per head daily				Yes
Feed per cwt. gain, lbs.:				
Sorghum grain	345	359	325	279
Soybean meal	69	72	65	56
Sorghum silage	2074	2157	2036	1866
Feed costs per cwt. gain[2]	$19.31	$20.10	$18.66	$16.57
Phase II—Grazing, May 11 to August 2, 1960—83 days.				
Initial wt. per steer	753	744	772	812
Daily gain per steer, lb.	.63	.88	.78	.53
Standard error of mean	0.12	0.09	0.10	0.07
Stilbestrol implants, 24 mgs.	No	Yes	See Footnote No. 1	
Aureomycin, 70 mgs. per steer daily	No	No	No	Yes
Phase III—Fattening, August 2, 1960, to November 12, 1960—102 days.				
Initial wt. per steer	805	817	837	856
Daily gain per steer, lbs.	2.66	2.60	2.37	2.71
Standard error of mean	0.10	0.20	0.13	0.14
Daily ration per steer, lbs.:				
Ground corn, self-fed	13.42	14.27	14.08	15.43
Soybean meal	1.51	1.51	1.51	1.51
Ground limestone	.07	.07	.07	.07
Salt	.05	.06	.03	.05
Prairie hay	6.29	6.32	6.41	6.45
Alfalfa hay	2.05	1.56	2.04	2.04
Stilbestrol implants, 24 mgs.	Yes	Implanted May 10	See Footnote No. 1	
Aureomycin, 70 mgs. per head daily	No	No	No	Yes
Feed per cwt. gain:				
Ground corn	505	549	593	570
Soybean meal	57	58	64	56
Prairie hay	237	243	270	239
Alfalfa hay	77	60	86	76
Feed costs per cwt. gain[2]	$15.57	$16.51	$18.06	$16.95

1. All steers in lots 20 and 22 were implanted with 24 mgs. of diethylstilbestrol December 1, 1959; four from each lot were reimplanted May 10, 1960, with 24 mgs. and four other animals from each lot were reimplanted August 10, 1960. See Table 16 for gains by phases of each implanted group.

2. Feed prices may be found on inside back cover.

Summary of Phases I, II, and III, December 1, 1959, to November 12, 1960—347 days.

Final wt. per steer	1076	1082	1079	1132
Daily gain per steer, all phases	1.60	1.62	1.60	1.76
Standard error of mean	0.03	0.07	0.05	0.05
Feed cost per steer	$ 102.08	$ 103.67	$ 105.79	$ 109.77
Feed cost per cwt. gain	$ 18.36	$ 18.45	$ 19.06	$ 18.02
Sale price per cwt., live wt., based on carcass value[3]	$ 21.94	$ 20.46	$ 21.60	$ 23.18
Return or loss per steer above feed cost and initial steer cost at 35¢ per lb.	$ −46.70	$ −54.09	$ −56.82	$ −42.81
Dressing %	61.73	59.58	60.95	61.92
Av. carcass grade, USDA[4]	16.10	17.00	15.75	16.50
Av. marbling score[5]	8.00	7.50	8.17	7.75

3. Sale price per cwt. was based on the following carcass values per cwt.: Choice, $39.50; good, $37; standard, $35.

4. The USDA grade, high standard, was assigned a numerical grade of 15; low good, 16; average good, 17.

5. Degree of marbling: a score of 7 indicates small amount; 8 indicates slight amount, and 9 indicates traces only. The higher the score, the less marbling.

Table 16

The effect of implanting steers with diethylstilbestrol at different times during a wintering, grazing, and fattening program.

	Number of steers per treatment	Winter gain, lbs., Dec. '59 to May '60, 162 days	Summer gain, lbs., May '60 to Aug. '60, 83 days	Fattening gain, lbs., Aug. '60 to Nov. '60, 102 days	Total gain, lbs., Dec. '59 to Nov. '60, 347 days	Average carcass grade[2]
Implanted in December, 1959, with 24 mgs.	8[1]	275	53	235	563	16.25
Implanted in December, 1959, and May, 1960, with 24 mgs. each time	8[1]	252	68	245	565	16.25
Implanted in December, 1959, and August, 1960, with 24 mgs. each time	8[1]	278	42	298	618	15.87

1. Half of the steers in each implant group were from lot 20 and half from lot 22 from Table 15.

2. The USDA grade high standard was assigned a numerical score of 15, low good, 16.

Improvement of Beef Cattle Through Breeding Methods (Project 286).

W. H. Smith and J. D. Wheat

The purebred Shorthorn cattle breeding project was continued during 1960 according to the breeding program adopted when the study was initiated in 1949. Two inbred lines were established and have been continued. The Wernacre Premier line is now in the fourth generation of inbreeding and the Mercury line, in the third generation. The bulls, Wernacre's Premier and Gregg Farm's Hoarfrost, were used as foundation sires to establish these two lines, respectively.

This experiment was initiated to study the inheritance of production traits in beef cattle, to evaluate the effects of inbreeding in cattle, and to explore the feasibility of using inbred lines of beef cattle for the breeding improvement of their production traits. No extensive line crossing has been attempted to date because of the limited number of breeding

Table 17
Summary of the 1959 Shorthorn calves.

Tattoo number	Coefficient of inbreeding	Birth weight	Weaning weight	Weaning score	Days fed	Initial weight	Final weight	Total gain	Average daily gain	Final score	Pounds corn per cwt. gain	Pounds alfalfa per cwt. gain
Mercury Line—Bulls												
923	19.14	51	335	2−	182	324	675	351	1.93	2−	567	288
931	17.38	59	345	2	182	350	700	350	1.92	2+	464	240
941	13.67	67	317	2	182	322	736	414	2.27	2	402	202
945	16.41	59	285	2+	182	285	554	269	1.48	2−	409	379
949	18.75	67	352	2	182	360	745	385	2.12	2+	409	201
955	16.80	62	305	2−	182	320	710	390	2.14	2	417	209
959	13.67	50	240	2+	182	247	555	308	1.69	2	407	198
961	18.75	76	275	3	182	285	540	255	1.40	3+	449	247
969	13.48	74	367	1−	182	422	839	417	2.29	2+	410	211
977	14.46	81	365	2	182	397	830	433	2.38	2	356	193
991	6.44	70	253	3+	182	275	655	380	2.09	3	372	193
997	15.72	70	322	1−	182	348	780	432	2.37	1−	381	190
Average	15.39	66	314	2	182	328	693	365	2.01	2	420	230
Heifers												
921	16.41	57	325	2+	182	327	582	255	1.40	1−	392	416
927	19.24	57	283	2−	182	294	540	246	1.35	2	449	407
929	17.58	56	352	2−	182	358	602	244	1.34	2	432	393
937	17.77	60	330	2	182	332	622	290	1.59	1−	414	379
947	19.14	67	342	2	182	353	610	257	1.41	1−	434	405
953	19.24	64	350	2−	182	345	600	255	1.40	2	445	408
971	15.63	60	340	2+	182	351	665	314	1.73	1−	342	344
983	18.75	65	350	2	182	378	670	292	1.60	2−	377	349
Average	17.97	61	334	2	182	342	611	269	1.48	2+	411	388
Wernacre Premier Line—Bulls												
965	18.00	75	326	3	182	330	750	420	2.31	3+	456	222
973	18.93	72	430	2−	182	458	930	478	2.63	2+	392	188
975	30.12	65	398	3−	182	411	770	359	1.97	3	451	223
979	22.45	75	437	2−	182	465	1020	555	3.05	2−	314	186
985	24.80	75	340	2−	182	380	828	448	2.46	2−	374	190
Average	28.58	72	386	3+	182	409	860	452	2.48	2−	397	202
Heifers												
957	31.44	73	324	3	182	337	602	265	1.46	3	387	392
967	20.11	72	265	3−	182	275	602	327	1.80	3+	339	306
981	29.87	80	305	3+	182	333	645	312	1.71	2	356	327
987	14.84	58	287	2−	182	303	598	295	1.62	3+	381	346
Average	24.07	71	295	3	182	312	612	300	1.65	3+	366	343
Line-Cross Heifers												
925	....	61	325	1−	182	332	655	323	1.77	1	384	353
933	....	56	365	2	182	400	640	240	1.32	1−	448	417
951	....	72	303	2	182	307	572	265	1.46	2	302	340
Average	....	63	331	2+	182	346	622	276	1.52	1−	378	370

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

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

The weight of each cow and the weight of each calf are taken immediately after the time of calving. Summer pasture breeding is practiced and the calves are born in the spring of each year. The calves are not creep fed during the suckling period. Calves are weaned, weighed, and scored for type when they are approximately 6 months old. After a short preliminary adjustment period following weaning, they are placed on individual feeding trials or record-of-performance tests for a 182-day period. Weight gain and feed consumption records are maintained on each calf. The calves are scored for type again as yearlings on completion of their feeding trials.

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

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

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

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

Artificially Dried Corn in Cattle Rations.

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

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

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

Experimental Procedure

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

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

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

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

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

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

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

Results and Discussion

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

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

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

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

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

Table 18

The value of artificially dried corn in beef cattle rations.

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

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

Table 18 (Continued)

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

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

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

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

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

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

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

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

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

Experimental Procedure

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

Results and Discussion

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

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

Table 19

Enzymes in beef cattle fattening rations.

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

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

* Not including enzymes.

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

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

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

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

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

rot which appeared to be of equal severity and distribution among lots. Differences in average daily gains appear to be large: however, statistical analysis showed that the differences were not significant. Animals in lot 2 were always slow to clean up their feed. Apparently the amylase depressed the appetite. Those in lot 3 ate well at first but tended to have less desire for feed after about midway in the feeding period. There were no significant differences in carcass characteristics. The rumen fluid did not show any differences in concentration of volatile fatty acids or percentage distribution of acetic, propionic, and butyric acids.

Cobalt Bullets for Beef Cattle[1]

D. Richardson, E. F. Smith, J. R. Brethour, B. A. Koch, W. S. Tsien, F. W. Boren, and B. D. Carmack

Cobalt is a trace mineral element which is essential to the health and well-being of animals. If it is deficient in the ration, it should be supplied. A cobalt bullet, which is placed in the rumen, was developed in Australia for sheep and cattle on cobalt-deficient pastures or rations. These cobalt bullets were found to be effective in preventing cobalt deficiency. Cobalt bullets are now available in this country. The bullet is composed of 90% cobalt oxide and 10% binding agent. The weight is 20 grams for cattle and 5 grams for sheep. The bullet is placed in the rumen with a balling gun. Since it is heavy, it remains in the rumen and allows cobalt to become available to the animal. Bullets were recovered at slaughter in some of these tests after over 300 days.

Table 20
Results with cobalt bullets in beef cattle.

	Control	Cobalt bullet in rumen
Number animals	15	15
Number days	215	215
Av. daily gain, lbs.	1.54	1.66
Ration: Sorghum silage, alfalfa hay, soybean oil meal, and corn.		
Number animals	15	15
Number days	215	215
Av. daily gain, lbs.	1.49	1.74*
Ration: Same as above except no alfalfa hay.		
Number animals	20	20
Number days	140	140
Av. daily gain, lbs.	1.75	1.67
Ration: Sorghum silage, alfalfa hay, soybean oil meal, and 2 to 4 pounds sorghum grain.		
Number animals	18	20
Number days	158	158
Av. daily gain, lbs.	1.70	1.72
Ration: Sorghum silage, alfalfa hay, soybean oil meal, and sorghum grain.		
Bluestem pasture (Manhattan)		
Number animals	66	61
Number days (May 4-Sept. 29)	147	147
Av. daily gain, lbs.	1.84	1.86
Fort Hays pastures (Blackwell switchgrass, Caucasian bluestem, Western wheatgrass, and native mixture).		
Number animals	60	59
Number days (May 3-Sept. 30)	150	150
Av. daily gain, lb.	0.88	0.87

* Significantly higher gain.

1. We wish to thank Nicholas International Ltd., Toronto, Ontario, Canada, for supplying the cobalt bullets and partial support in these studies.

The results reported in Table 20 were obtained on feedlot and grazing tests conducted at Manhattan and Fort Hays. One half of the animals on each test received a cobalt bullet and the others did not. Feed and pasture samples were analyzed for cobalt content.

A significant difference in gain was produced in only one test. This was with corn in a fattening ration and without alfalfa. No significant difference was obtained when alfalfa was in the ration, when sorghum grain was fed, or when animals were on pasture.

It is generally agreed that 0.1 part per million (PPM) cobalt in forage is sufficient for cattle. If this is correct, both rations or pastures used supply sufficient cobalt. Cobalt content of feeds and pasture is shown in Table 21.

Table 21
Cobalt analysis of feedstuffs.

Ingredient	Cobalt content on dry matter basis PPM
Manhattan	
Corn	0.21
Corn	0.25
Corn	0.20
Sorghum grain	0.15
Pelleted sorghum grain	0.17
Soybean oil meal	0.15
Soybean oil meal	0.18
Steamed bonemeal	0.12
Common salt	0.10
Alfalfa hay	0.59
Dehydrated alfalfa pellets	0.58
Grain sorghum silage	0.18
Dehydrated grain sorghum pellets	0.21
Atlas sorghum silage	0.17
Big bluestem, ungrazed tops	0.09
Big bluestem, whole plant	0.08
Little bluestem, ungrazed tops	0.13
Little bluestem, whole plant	0.14
Fort Hays	
Blackwell switchgrass	0.12
Blue grama	0.14
Buffalograss	0.11
Caucasian bluestem	0.14
Western ragweed	0.50
Western wheatgrass	0.14

The Value of Added Enzyme Preparations to Beef Steer Calf Wintering Ration[1] (Project 5-662).

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

This is our second test to determine the value of various enzyme preparations added to beef cattle rations. Amylase acts on carbohydrates; protease, on proteins; and cellulase, on cellulose. The previous test involved amylase and a combination of amylase and protease. This test involved a combination of amylase and protease and also this combination plus cellulase. Since a high roughage ration was used, it was thought that cellulase might be of some value. One lot received a combination of all the enzyme preparations on alternate 28 days, that is, the enzymes were fed for 28 days and removed from the ration for the next 28 days. The daily ration and type of enzyme preparation for each lot are shown in Table 22.

Results and Discussion

Results of this test are shown in Table 22. Feeding the enzyme preparations on alternate 28-day periods was of no value in this test. There was a tendency for all lots receiving enzyme preparations to consume less silage and the gains were slightly less; however, there were no significant differences. It is believed that enzyme preparations can be useful in livestock rations but much more work is necessary to determine how they should be used. This test is being continued with the animals receiving a fattening ration. Lot 10 will receive a protease preparation instead of the combination. All lots will receive stilbestrol.

Table 22

Added enzyme preparations in beef cattle wintering rations.

December 9, 1960, to March 31, 1961—112 days.

Lot number	7	8	9	10
Added enzyme preparation	None	Amylase + protease	Amylase + protease + cellulase	Same as 9, fed 28 alternate days
Number animals per lot	11	11	11	11
Av. initial wt., lbs.	541	540	542	541
Av. final wt., lbs.	752	746	743	736
Av. daily gain per steer, lbs.	1.89	1.84	1.80	1.74
Av. daily ration, lbs.:				
Sorghum silage	34.7	34.0	33.9	32.0
Alfalfa hay	1.0	1.0	1.0	1.0
Soybean oil meal	1.0	1.0	1.0	1.0
Sorghum grain	5.0	5.0	5.0	5.0
Av. feed per cwt. gain, lbs.:				
Sorghum silage	1780	1848	1887	1841
Alfalfa hay	53	54.3	55.6	57.6
Soybean oil meal	53	54.3	55.6	57.6
Sorghum grain	265	271	278	288
Feed cost per cwt. gain (Does not include cost of enzymes)	$12.26	12.61	12.92	13.04

1. Appreciation is expressed to Rohm & Haas Company, Philadelphia, Pennsylvania, for partial support and enzyme preparations used in this test.

The Value of Grain Sorghum Harvested as Silage and as Dehydrated Pellets (Project 567).

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

In many instances, sorghum grain contains so much moisture at harvest time that it cannot be stored without artificial drying. Sometimes there is danger of losing immature grain because of early frost. This is the second test to study the value of the entire grain sorghum plant harvested as silage and as dehydrated pellets.

Experimental Procedure

RS610 was the hybrid sorghum used. It produced about 85 bushels of grain or approximately 9 tons of silage per acre. The crop was harvested while the leaves were still green and the grain was in the late dough stage. Part was stored as silage and part as dehydrated pellets. Twenty of the heaviest steer calves were divided into two lots of 10 each. All animals received soybean oil meal and dehydrated alfalfa pellets during the wintering period of 168 days. Silage was fed to one lot and the dehydrated pellets to the other. Both were fed free choice.

The silage was used up at the end of 168 days; the ration was then changed to forage type silage and then to alfalfa hay. Rolled grain was added to both lots. A mixture of steamed bonemeal and salt and salt alone was available at all times.

Results and Discussion

Results of the test are shown in Table 23. The intake of dry matter was approximately the same for each lot during the first phase of the test. There was no significant difference in rate of gain or feed efficiency. The cost per pound of gain was higher for the lot receiving the dehydrated pellets.

There was no difference in rate of gain after grain was added to the ration; however, neither lot gained as well as should be expected. Animals on the pelleted ration were never observed to regurgitate and chew their cud after a few days on the ration. There seemed to be a wide variation in response of individual animals to the pelleted ration. This is indicated by the great variation in carcass grade. It is believed that a small amount of normal roughage would have greatly improved performance of the animals in lot 6.

Table 23

Grain sorghum silage vs. dehydrated grain sorghum pellets in steer rations.

Wintering phase, December 3, 1959, to May 19, 1960—168 days.

Lot number	5	6
Number steers per lot	10	10
Av. initial wt., lbs.	561	562
Av. final wt., lbs.	835	841
Av. daily gain per steer, lbs.	1.63	1.66
Av. daily ration, lbs.:		
Grain sorghum silage	37.1	..
Dehydrated grain sorghum pellets	..	13.1
Dehydrated alfalfa pellets	1.0	1.0
Soybean oil meal	1.0	1.0
Feed per cwt. gain, lbs.:		
Grain sorghum silage	2277	..
Dehydrated grain sorghum pellets	..	791
Dehydrated alfalfa pellets	61	60
Soybean oil meal	61	60
Feed cost per cwt. gain	$15.01	19.39

Table 23 (Continued)

Fattening phase[1]—157 days.

Av. initial wt., lbs.	830.5	841
Av. final wt., lbs.	1078	1094
Av. daily gain per steer, lbs.	1.57	1.61
Av. daily ration, lbs.:		
Forage sorghum silage[2]	4.5	..
Dehydrated grain sorghum pellets	..	5.6
Alfalfa hay	3.2	..
Dehydrated alfalfa pellets	..	1.1
Soybean oil meal	1.0	1.0
Sorghum grain	15.9	9.1
Feed per cwt. gain, lbs.:		
Forage sorghum silage	287	..
Dehydrated grain sorghum pellets	..	345
Alfalfa hay	204	..
Dehydrated alfalfa pellets	..	69
Soybean oil meal	63	63
Sorghum grain	1000	564
Feed cost per cwt. gain	$22.26	20.67
% shrink	4.2	3.9
Dressing %, feedlot wt.	61.8	60.3
Dressing %, pay wt.	64.2	62.7
Av. hot carcass wt.	671.4	667.7
Av. chilled carcass wt.	662.9	660.2
Av. % cooler shrink	1.3	1.1
Av. finish:		
Thickness[3]	3.9	3.7
Distribution[4]	3.4	3.3
Av. degree of marbling[5]	5.1	6.0
Av. size of ribeye[6]	4.1	4.8
Av. degree of firmness[7]	2.7	3.4
Carcass grades:		
Av. prime	1	..
Top choice	1	1
Av. choice	3	3
Low choice	3	2
Top good	1	1
Av. good	..	1
Low good	..	1
Av. carcass value (prime 43.0¢) (choice 41.5¢) (good 39.0¢)	$275.55	268.63

1. One steer lost in each lot from urinary calculi.
2. Silage fed only first 42 days.
3. Based on 2, thick; 3, moderate; 4, modest.
4. Based on 2, uniform; 3, moderately uniform; 4, modestly uniform.
5. Based on 4, slightly abundant; 5, moderate; 6, modest; 7, small amount.
6. Based on 3, moderately large; 4, modestly large; 5, slightly small.
7. Based on 2, firm; 3, moderately firm; 4, modestly firm; 5, slightly firm.

Grain Sorghum Silage vs. Forage Sorghum Silage; Dehydrated Alfalfa vs. Vitamin A, and the Value of Aureomycin in Cattle Rations (Project 567).

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

Two types of sorghum silage were used in this test. They were (1) DeKalb forage type which produced approximately 100 bushels of grain and 20 tons of silage per acre; and (2) RS610 grain type which produced

approximately 75 bushels of grain and 10 tons of silage per acre. Forty Hereford heifer calves were divided into four lots of 10 each. Three lots received the grain sorghum silage and one the forage silage plus 2 pounds of grain. This was an attempt to keep the grain intake equal in all lots; however, since the forage sorghum produced so much grain, this lot may have received slightly more grain than the others. Dehydrated alfalfa as a source of vitamin A was compared with vitamin A and with vitamin A plus Aureomycin. The average daily ration for each lot is shown in Table 24.

Results and Discussion

The test had to be terminated at 77 days when the supply of grain sorghum silage was exhausted. Results are shown in Table 24.

There were no significant differences in rate of gain between animals receiving the forage- and grain-type silage. A combination of vitamin A and Aureomycin produced larger gains than dehydrated alfalfa or vitamin A; however, those receiving dehydrated alfalfa made larger gains than those receiving vitamin A without Aureomycin.

The higher feed costs for grain-type silage are due to a charge of $10 per ton compared with $6 for the forage type. These and previous results indicate that a high grain-yielding forage-type sorghum may be the most desirable for ensilage.

Table 24

Grain- vs. forage-type sorghum silage; dehydrated alfalfa vs. vitamin A, and the value of Aureomycin in cattle rations.

December 9, 1960, to February 24, 1961—77 days.

Lot number	3	4	5	6
Number heifers per lot	10	10	10	10
Av. initial wt., lbs.	518.5	518.5	518	519
Av. final wt., lbs.	656	648	635.5	656
Av. daily gain per animal, lbs.	1.79	1.68	1.53	1.78
Av. daily ration, lbs.:				
DeKalb forage sorghum silage	31.8	..	..	..
RS610 grain sorghum silage	..	31.1	31.4	34.6
Soybean oil meal	1.0	1.0	1.0	1.0
Dehydrated alfalfa pellets	.5	.5	..	..
Sorghum grain	2.0	..	..	..
Vitamin A, I.U.	..	..	10000.0	10000.0
Aureomycin, mg.	..	..	..	72
Feed per cwt. gain, lbs.:				
DeKalb forage sorghum silage	1782	..	..	..
RS610 grain sorghum silage	..	1849	2057	1943
Soybean oil meal	56	59	66	56
Dehydrated alfalfa pellets	28	30	..	..
Sorghum grain	112	..	..	..
Feed cost per cwt. gain (Does not include cost of vitamin A and Aureomycin)	$9.94	12.04	12.57	11.65

Rolled vs. Finely Ground Pelleted Sorghum Grain in Cattle Rations (Project 567).

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

In previous tests where grain intake was held at the same level, finely ground pelleted sorghum grain has produced larger and more efficient gains than rolled sorghum grain. This test was conducted to study the value of the two methods of grain preparation when the rest of the ration was held at a constant level and the grain fed according to the amount the animals would consume.

Experimental Procedure

Twenty heavy steer calves were divided into two lots of 10 each. They were fed the same ration throughout the wintering and fattening phases. The only difference was the method of grain preparation. The rations and daily consumption are shown in Table 25.

Results and Discussion

Results are shown in Table 25. There were no significant differences in wintering or fattening gains or carcasses. Animals receiving the pelleted grain were more efficient; however, the increased cost of pelleting caused the cost of gain to be nearly the same. Increased feed efficiency for pelleted grain has been observed in previous feedlot and digestion studies; however, pelleting tends to decrease the daily intake of grain.

Table 25

Rolled vs. finely ground pelleted sorghum grain in steer rations.

Wintering phase, December 3, 1959, to April 21, 1960—140 days.

Lot number	3	4
Number steers per lot	10	10
Av. initial wt., lbs.	560	562
Av. final wt., lbs.	794.5	818
Av. daily gain per steer, lbs.	1.68	1.83
Av. daily ration, lbs.:		
Sorghum silage	29.5	28.8
Alfalfa hay	1.3	1.3
Soybean oil meal	1.0	1.0
Rolled sorghum grain	4.0	..
Pelleted sorghum grain	..	4.0
Feed per cwt. gain, lbs.:		
Sorghum silage	1763	1574
Alfalfa hay	75	68
Soybean oil meal	60	55
Rolled sorghum grain	239	..
Pelleted sorghum grain	..	219
Feed cost per cwt. gain	$12.18	11.36
Fattening phase—158 days.		
Av. initial wt., lbs.	794.5	818
Av. final wt., lbs.	1087.5	1099
Av. daily gain per steer, lbs.	1.86	1.77
Av. daily ration, lbs.:		
Sorghum silage[1]	5.6	5.5
Alfalfa hay	2.6	2.7
Soybean oil meal	1.0	1.0
Rolled sorghum grain	16.7	..
Pelleted sorghum grain	..	14.4
Feed per cwt. gain, lbs.:		
Sorghum silage	305	311
Alfalfa hay	143	151
Soybean oil meal	54	56
Rolled sorghum grain	899	..
Pelleted sorghum grain	..	807
Feed cost per cwt. gain	$19.73	19.47

1. Silage fed only first 72 days.

Table 25 (Continued)

Summary, Wintering and fattening—298 days.

Av. total gain, lbs.	527.5	537.0
Av. daily gain	1.77	1.80
% shrink	3.7	4.3
Dressing %, feedlot wt.	61.6	61.3
Dressing %, pay wt.	64.0	64.1
Av. hot carcass wt.	678.6	681.9
Av. chilled carcass wt.	670.2	674.2
Av. % cooler shrink	1.2	1.1
Av. finish:		
Thickness[2]	3.8	3.8
Distribution[3]	3.3	3.4
Av. degree of marbling[4]	5.7	6.0
Av. size ribeye[5]	4.0	4.2
Av. degree firmness[6]	2.6	2.8
Carcass grades:		
Av. choice	3	3
Low choice	7	4
Top good	..	2
Av. good	..	1
Av. carcass value: (choice, 41.5¢) (good, 39.0¢)	$278.13	274.74

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

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

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

5. Based on visual est.: 3, moderately large; 4, modestly large; 5, slightly small.

6. Based on 1, very firm; 2, firm; 3, moderately firm; 4, modestly firm.

Swine

The Value of Soaking Whole Sorghum Grain for Finishing Fall Pigs in Drylot (Project 110).

C. E. Aubel

Two lots of pigs were self-fed, free choice, whole sorghum grain and a mixed protein supplement. Each lot contained 10 pigs. In one lot, the whole sorghum grain was fed dry; in the other, it was automatically fed into water warmed enough to prevent freezing.

The protein supplement fed both lots consisted of 4 parts tankage, 4 parts soybean meal, 1 part cottonseed meal, and 1 part alfalfa meal. To each ton of supplement was added 27 pounds of antibiotic Aurofac[1] (Aureomycin) and one half pound of zinc oxide.

The results are listed in Table 26.

Table 26

Feeding whole sorghum grain dry and soaked for finishing fall pigs in drylot.[1]

December 17, 1960, to March 18, 1961—91 days.

Item	Soaked whole grain sorghum	Whole dry sorghum grain
Lot number	1	2
Number pigs in lot	10	10
Av. initial wt. per pig, lbs.	48.50	49.70
Av. final wt. per pig, lbs.	178.60	178.90
Av. total gain per pig, lbs.	130.10	129.20
Av. daily gain per pig, lbs.	1.42	1.41
Av. daily ration per pig, lbs.:		
Sorghum grain	4.84	4.75
Protein supplement	.75	.71
Lbs. feed per cwt. gain per pig:		
Sorghum grain	339.20	334.75
Protein supplement	53.03	50.69

1. Both lots received the same protein supplement.

Observations

From these results it is concluded there was no advantage in soaking sorghum grain for pigs. Gains and feed efficiency were very much the same.

The Effect of Various Milling Processes on Sorghum Grain When Used for Finishing Fall Pigs in Drylot (Project 110-2).

C. E. Aubel

Grain sorghums are being grown extensively in many parts of the High Plains. Sorghum grain previously has given excellent results compared with corn in feeding tests with swine at this station.

New ways of processing grain may improve the efficiency of the grains for feeding and thus provide more profit in hog raising.

1. Registered trademark American Cyanamid Company for Aureomycin.

Table 27

The comparative value of sorghum grain prepared by different milling processes for finishing fall pigs in drylot.[1]

December 17, 1960, to March 18, 1961—91 days.

	RATION FED					
	Sorghum grain					
Item	Whole	Steam rolled	Fine ground	Fine ground, pelleted	Dry rolled	Steam rolled, delayed crimp
Lot number	1	2	3	4	5	6
Number pigs per lot	10	10	10	9	10	10
Av. initial wt. per pig, lbs.	49.70	47.30	48.30	49.30	48.70	48.10
Av. final wt. per pig, lbs.	178.90	185.50	184.50	171.11	164.50	183.50
Av. total gain per pig, lbs.	129.20	138.20	136.20	121.81	115.80	135.40
Av. daily gain per pig, lbs.	1.41	1.51	1.49	1.33	1.26	1.48
Av. daily ration per pig, lbs.:						
Sorghum grain	4.75	4.63	4.41	3.52	3.84	4.74*
Protein supplement	.71	.75	.73	.71	.74	.79
Lbs. feed per cwt. gain per pig:						
Sorghum grain	334.75	305.35	295.15	292.80	301.38	319.05
Protein supplement	50.69	49.92	39.19	59.29	58.72	53.17

1. All lots received the same protein mix supplement.

* In addition to the figures given, the pigs in lot 2 rooted out of their feeder and wasted an estimated 300 pounds of steam rolled sorghum grain. The pigs in lot 6 rooted out an estimated 2,300 pounds of steam rolled, delayed crimp sorghum grain.

Six lots were self-fed, free choice, in drylot. All lots received a mixed animal and plant protein supplement of 4 parts tankage, 4 parts soybean meal, 1 part cottonseed meal, and 1 part alfalfa meal. Each ton of mixed protein supplement also contained 27 pounds of Aurofac[1] and ½ pound of zinc oxide. The ration for each lot varied only in the method of processing.

Lot 1. Whole sorghum grain.
Lot 2. Steam rolled sorghum grain.
Lot 3. Fine ground sorghum grain.
Lot 4. Fine ground and pelleted sorghum grain.
Lot 5. Dry rolled sorghum grain.
Lot 6. Steamed sorghum grain, rolled and crimped four hours later.

The sorghum grain was steamed at 90 pounds pressure and at 180°F. Results are presented in Table 27.

Observations

The pigs in lot 5, which were fed the dry rolled sorghum grain, made the lowest daily gains in this experiment. Those in lot 4 receiving the fine ground pelleted sorghum grain made the next lowest daily gains. Daily ration figures indicate that both lots consumed less feed daily and both had a low feed conversion figure.

Lots 2, 3, and 6 made an excellent showing both in daily gains and in feed conversion. The pigs in lot 6 wasted an estimated 2,300 pounds of steam rolled, delayed crimp sorghum grain. Those in lot 2 wasted about 300 pounds. This is an enormous waste. In processing the feeds in these lots the grain was steamed and put under heat of 180° to 200°F. It is possible this destroyed or changed the food nutrients of these feeds, or made the feed unpalatable. Perhaps enzymes were affected.

A test is now under way to get at the meaning of these wastes. In lot 4, where the grain was pelleted, a poor response was made by the pigs in both daily gains and daily feed consumption (palatability). In pelleting, heat also develops, to about the temperature used in processing the grains for lots 2 and 6.

Effects of Fat and of Pelleting on Utilization of Vitamin A in Pig Feeds (Project 311).

D. B. Parrish and C. E. Aubel

Two tests were made. The first test was to determine effect pelleting feed has on utilization of vitamin A activity supplied by yellow corn. The second test was made on the effect that adding fat has on utilization of vitamin A activity supplied by carotene.

In each test 16 growing pigs were paired by litter, sex, and weight; divided into two test groups; and fed two pigs per pen. The pigs were started at 25-40 pounds each and continued on experiment until the average gain was about 145 pounds. The pigs were from gilts fed limited quantities of vitamin A during gestation. No vitamin A was added to the feed of either mother or pigs during nursing or during feeding before the pigs went on experiment.

In Test 1 a good growing ration was used in which vitamin A activity was supplied by new-crop yellow corn at a level of approximately 400 units per pound of feed. The feed for both groups was the same, except that fed one group was pelleted. Level of feeding to pigs of each pen was limited to the intake of the lowest of the paired-pen groups.

In Test 2 the feed contained 500 units vitamin A activity, supplied by high-quality alfalfa meal. Feed for one group contained 5% added stabilized animal fat, but both feeds were made approximately the same in energy, protein, calcium, and phosphorus by using beet pulp and adjusting quantities of grains and protein sources. Both feeds were pelleted and given free choice.

In these tests vitamin A activity was calculated as follows: 1 microgram of carotene was equivalent to 1.6 units of vitamin A activity and 1 microgram cryptoxanthin to 0.8 unit. Thus, on a weight basis, vitamin A activity was about 30% of the N.R.C. requirement in Test 1 and 40% of it in Test 2.

1. Registered trademark American Cyanamid Company for Aureomycin.

Results of the two tests are in Table 28.

Observations

Pelleting feed containing yellow corn as the vitamin A source had little effect on average gain or on utilization of vitamin A, as judged by serum vitamin A levels, but feed conversion was improved somewhat.

Addition of 5% fat to the diet had little effect on gains (if weight of the ill pig is eliminated), but feed conversion was improved, and utilization of vitamin A, as judged by serum vitamin A levels, was affected adversely.

Although only low levels of vitamin A were fed, pigs grew well, gaining about 1.5 pounds per day in Test 1 and 1.3 pounds per day in Test 2. Small quantities of vitamin A were found in the blood serum of all groups of pigs, and pigs appeared normal, except for the one that was ill during the early part of the test.

Table 28
Effects of fat and of pelleting on utilization of vitamin A in pig feeds.

Ration	No. pigs	Days on test	Av. wt. start, lbs.	Av. wt. finish, lbs.	Gain, lbs.	Feed conversion ratio	Serum vitamin A, units/100 ml. Start	Finish
Test 1								
Mash	8	95	39	181	142	3.70	12.6	23.3
Pellets	8	95	39	186	147	3.55	15.4	25.3
Test 2								
Normal	8	108	31	165*	134	3.20	13.6	24.9
5% fat	8	108	31	177	146	3.05	13.6	17.7

* One pig ill first month with respiratory condition; average weight 174 pounds with this pig's weight eliminated.

Kansas Swine Improvement Association Testing Station

The Kansas Swine Testing Station, in its third year of operation, continues to function under supervision of the animal husbandry department staff. All expenses involved in testing are paid by breeders or producers who have pigs on test.

Production data on boars and barrows are collected while the animals are growing from 60 to 200 pounds body weight. All animals receive the same pelleted ration during the growing period. Boars meeting station requirements are auctioned in March or August. Barrows are slaughtered in the meats laboratory of the Animal Industries building where carcass information is collected.

Table 29 summarizes data collected during the 1960 summer test and the 1960-61 winter test. The basic ration, fed until the boars weigh 200 pounds and come off test, is listed in Table 30. They are then fed a 15% alfalfa ration until sale time. The barrows are taken off test at approximately 210 pounds body weight and shrunk over night before slaughter.

For further information about the swine testing program contact your county agent, the Kansas Swine Improvement Association, the Extension Service, or the Department of Animal Husbandry.

Table 29
Swine testing results (1960-61).

	BOARS	
	Summer, 1960	Winter, 1960-61
Number on test	54 (19 herds)	52 (16 herds)
Av. daily gain, lbs.	1.84 (2.43-1.51)	1.76 (2.22-1.50)
Av. backfat, in.	1.11 (1.43-0.72)	1.09 (1.42-0.68)
Av. efficiency, lbs.	2.64 (2.98-2.34)	2.87 (3.07-2.65)
Av. age at 200 lbs., days	147 (123-174)	156 (129-185)
Cost to breeder	$52	$58
Av. sale price	$172 ($330-$90)	$199 ($340-$65)
	BARROWS	
	Summer, 1960	Winter, 1960-61
Number on test	27 (19 herds)	27 (16 herds)
Av. initial wt., lbs.	56	58
Av. slaughter wt., lbs.	200	200
Av. daily gain, lbs.	1.71 (2.05-1.55)	1.67 (2.13-1.23)
Av. daily ration, lbs.	5.5	5.18
Av. feed per lb. gain, lbs.	3.20	3.10
Av. daily feed costs	$0.16	$0.15
Av. feed cost per lb. gain	$0.09	$0.09
Av. age at 200 lbs., days	153 (132-173)	166 (129-195)
Av. backfat, in.	1.53 (1.81-1.15)	1.56 (1.73-1.30)
Av. loin eye, sq. in.	3.95 (4.74-2.84)	3.93 (4.95-3.06)
Av. % lean cuts	48.1 (52.5-43.6)	48.8 (53.0-43.3)
USDA No. 1	17	16
USDA No. 2	10	11

Table 30
Kansas swine testing ration.
(Prepared in University feed mill)

	Pounds
Sorghum grain	1,544
50% tankage	60
44% soybean oil meal	200
60% fish meal	40
17% dehydrated alfalfa meal	60
Cane molasses	50
Iodized salt	10
Dicalcium phosphate	15
Calcium carbonate	8
Trace minerals (5% zinc)	1
B-complex vitamins (Merck 58-A)	2
	Grams
Vitamin A (10,000 I.U. per gram)	200
Vitamin D (3,000 I.U. per gram)	100
	Pounds
Vitamin E (20,000 I.U. per lb.)	1
Aurofac 1.8-1.8	5
Arsanilic acid (Pro-Gen)	1
DL-Methonine	2
Lyamine (20% lysine)	2

Approximate analysis: 16% crude protein; 0.75% calcium; 0.62% phosphorus.

Sheep

Corn, Sorghum Grain, Wheat, Rye, and Barley as Concentrates in Complete Pelleted Rations Compared with a Standard Nonpelleted Sorghum Grain and Alfalfa Hay Ration for Self-feeding Fattening Lambs (Project 236).

C. S. Menzies, D. Richardson, and R. F. Cox

Previous experiments at this station have shown that lambs fed complete pelleted rations make faster, more efficient gains than lambs fed similar nonpelleted rations, and that optimum results are obtained when pelleted rations contain around 30 to 40 percent concentrates. This test was designed to study various grains in complete pelleted rations compared with a standard nonpelleted ration.

Experimental Procedure

Finewool-type mixed ewe and wether feeder lambs were used. Lambs were received October 15. They were shorn and drenched with a commercial fine particle-size phenothiazine drench. November 12, lambs were weighed, ear tagged, divided into six lots of 24 lambs each (144 total), and self-fed the following rations.

Lot 1. 35% sorghum grain and 65% alfalfa hay, pelleted.
Lot 2. 35% corn and 65% alfalfa hay, pelleted.
Lot 3. Mixed nonpelleted ration of 45% ground sorghum grain and 55% chopped alfalfa hay.
Lot 4. 35% wheat and 65% alfalfa hay, pelleted.
Lot 5. 35% rye and 65% alfalfa hay, pelleted.
Lot 6. 35% barley and 65% alfalfa hay, pelleted.

Lambs in each lot, except 3, were fed 10 pounds of chopped alfalfa hay every other day in addition to pelleted rations. Stock salt was supplied free choice. All lambs were implanted with 3 mgs. stilbestrol[1] at start of test.

Brown first-cutting alfalfa hay was used. Hay used in pelleted rations was ground through a ¼-inch screen and the hay fed to lot 3 was chopped. The sorghum grain, corn, wheat, barley, and rye were purchased in bulk. Rye used was a mixture of rye varieties but was of good quality.

Feed prices and processing charges used in determining feed cost per cwt. gain were: sorghum grain, $1.25 per cwt.; wheat, $1.71 per bu.; rye, $0.80 per bu.; shelled yellow corn, $0.90 per bu.; barley, $0.70 per bu.; baled alfalfa hay, $15 per ton; grinding hay, $5 per ton; chopping hay, $3 per ton; grinding grain for lot 3, $5 per ton; grinding grain, mixing and pelleting rations, $4 per ton. With these prices and charges, feed costs per ton for each lot were as follows: Lot 1, $25.75; Lot 2, $28.27; Lot 3, $22.20; Lot 4, $36.95; Lot 5, $27.01; and Lot 6, $27.22. These are bulk prices, as cost of bags is not included. This would increase feed price for each lot by $2 to $3 per ton.

Results and Discussion

Results are shown in Table 31. Chemical analyses of feeds used are given in Table 32.

Lambs fed the mixed, nonpelleted ration in lot 3 ate less feed and made slower, less efficient but cheaper gains than lambs fed pelleted rations.

There was little difference in rate of gain between lambs fed different pelleted rations. However, lambs fed the sorghum grain-alfalfa pellets consumed more feed and made slightly faster gains. In nonpelleted rations wheat, rye, and barley are generally worth 10 to 15 percent less for fattening lambs than corn or sorghum grain. Wheat and corn pro-

1. Three mgs. stilbestrol implants furnished by Chas. Pfizer and Company, Inc., Terre Haute, Indiana.

Table 32

Chemical analyses of feeds fed in pelleted ration study.

	% Protein N x 6.25	% Ether extract	% Crude fiber	% Moisture	% Ash	% N-Free extract	% Carbohydrate
Alfalfa hay	14.13	1.99	32.77	5.56	8.61	36.94	69.71
Sorghum grain	9.06	3.46	2.10	7.05	1.68	77.05	79.15
Lot 1. Sorghum grain-Alfalfa pellets	13.94	2.35	20.14	5.67	7.89	50.01	70.15
Lot 2. Corn-Alfalfa pellets	12.88	2.72	21.55	5.62	6.63	50.60	72.15
Lot 4. Wheat-Alfalfa pellets	13.94	2.08	21.10	5.71	6.45	50.72	71.82
Lot 5. Rye-Alfalfa pellets	14.13	2.02	21.12	5.48	6.64	50.61	71.73
Lot 6. Barley-Alfalfa pellets	14.25	2.15	22.42	5.66	7.33	48.19	70.61

Table 31

Corn, sorghum grain, wheat, rye, and barley in complete pelleted rations vs. a standard nonpelleted ration for self-feeding fattening lambs.

November 12, 1960, to February 6, 1961—86 days.

Lot number	1	2	3	4	5	6
Ration fed	Pelleted: 35% sorg. grain, 65% alf. hay	Pelleted: 35% corn, 65% alf. hay	Nonpelleted: 45% ground sorg. grain, 55% chopped alf. hay	Pelleted: 35% wheat, 65% alf. hay	Pelleted: 35% rye, 65% alf. hay	Pelleted: 35% barley, 65% alf. hay
Number lambs per lot[1]	24	19	24	24	24	23
Initial wt. per lamb, lbs.	61.8	60.2	60.7	59.9	61.6	61.8
Final wt. per lamb, lbs.	107.8	102.4	96.0	103.8	105.7	103.2
Total gain per lamb, lbs.	46.0	42.2	35.3	43.9	44.1	41.4
Av. daily gain per lamb, lbs.	.535	.491	.410	.51	.513	.481
Pounds feed per lamb daily:						
Pelleted ration	4.06	3.49		3.58	3.78	3.59
Chopped alfalfa hay	.16	.18	1.89	.16	.16	.17
Ground sorghum grain			1.60			
Total feed per lamb daily	4.22	3.67	3.49	3.74	3.94	3.76
Pounds feed per cwt. gain	788.7	747.4	851.2	733.3	768.0	781.7
Feed cost per cwt. gain	$10.17	10.54	9.42	15.42	10.50	10.63
Number lambs not marketed[2]	2	2	5	3	2	3
Av. % yield[3]	48.0	46.5	47.1	47.9	46.6	47.1
Av. USDA carcass grade[4]	10.7	9.6	9.7	9.8	10.5	10.7

1. Four lambs in lot 2 died during test from enterotoxemia and one lamb from lot 2 and one from lot 6 were removed soon after the test began.
2. Lambs weighing less than 85 lbs. at market time were not sold.
3. Based on hot dressed carcass weight and individual lamb weight at Manhattan just prior to shipment.
4. Based on prime, 14; choice, 11; good, 8; utility, 5; and cull, 2.

duced the most efficient gains. However, because of the high price of wheat, cost per cwt. gain was high for lambs in lot 4.

Lambs in lot 3 fed the nonpelleted ration went off feed several times during the test. Several foundered from overeating but no death loss occurred in this lot. For some reason four lambs fed the corn-alfalfa pellets in lot 2 died from overeating after about 60 days on test.

Because of the nonuniform beginning weights, there were several lambs in each lot that did not reach market weight and finish by the end of the test. The largest number of lambs not sold came from lot 3 fed the nonpelleted ration.

There was about ½ USDA carcass grade variation among lots and about 1.5 percent variation in yield among lots.

Heritabilities, Genetic, and Phenotypic Correlations Between Carcass and Live Animal Traits in Sheep (Project 347).

Carl Menzies, Myron Hillman, John D. Wheat, D. L. Mackintosh, and R. A. Merkel

This is a contributing project to the North Central-50 Regional Sheep Breeding Project. The Kansas State project was initiated in the spring of 1959 to determine relationships between various carcass measurements and live animal traits, to estimate heritability of these traits, and to determine how findings may be applied to selection and breeding of meat-type lambs.

Experimental Procedure

Ewes and lambs were handled practically the same in 1960-61 as in 1959-60. Procedure followed in handling ewes and rams and lambs during the 1959-60 season was outlined in Kansas Circular 378. Ewes were the same ones used in 1959-60. Ten different yearling Hampshire rams were obtained from various Kansas breeders. Rams were scored for various characteristics by a group of department members, weighed, and probed for fat thickness and loin eye depth at the second lumbar vertebra at the end of the breeding season. Each ram was randomly assigned to a group of 10 ewes. Breeding season was June 6 to September 1, 1960.

Lambs were weighed at birth and have been weighed every two to three weeks since. They are self-fed a pelleted creep ration consisting of 10% poor-quality field-cured alfalfa, 35% dehydrated alfalfa, 45% ground sorghum grain, 7.5% molasses and 2.5% soybean oil meal plus 10 mgs. of Aureomycin per pound of pellets. Ewes are fed all the sorghum silage they will eat plus 1 lb. of sorghum grain and about 2 lbs. of alfalfa hay per head daily. Salt is available free choice. Lambs suckle ewes until slaughtered.

When lambs weigh between 95 and 100 lbs. they are sheared, probed for fat thickness and loin eye depth at the 2nd lumbar vertebra and 20 body measurements are taken. Lambs are slaughtered at the meats laboratory. Various measurements and scores are obtained on the carcasses. Each hotel rack is separated physically. Percentage of ether extract is obtained on a section of the loin eye and intercostal muscle. Each loin is sent to the Home Economics Department where Warner-Bratzler tenderness scores, total cooking losses, press fluid, and panel scores on tenderness, flavor, and juiciness are obtained.

Results and Discussion

See report on page 59 for a brief description of some of the carcass information obtained on lambs slaughtered in 1959-60.

A portion of the data obtained during 1959-60 is reported in Table 33. There were considerable differences in ram type score and weight, and between performance and carcass characteristics of the 10 lamb groups. Gain data were not corrected for sex or type of birth (single or twin) and have not been statistically analyzed.

The Southdown ram used in 1959-60 served as a clean-up ram after the Hampshire rams had been removed and the ewe groups turned to-

Table 33

1959-60 data on one Southdown and nine Hampshire rams and their lambs.

	Hampshire rams									Southdown ram
Ram number	2	3	4	5	6	7	8	9	10	1
Ram type score[1]	81.5	90.7	77.8	76.0	79.7	74.0	86.6	82.3	90.5	
Wt. of ram, June 1, 1959	159	206	166	158	153	166	171	174	195	
Total number of lambs	8	8	9	9	6	8	10	9	10	10
Av. birth wt., lbs.[2]	9.6	8.38	9.54	9.87	9.18	10.20	8.96	10.03	8.6	9.10
Av. slaughter wt., lbs.[3]	86.2	87.5	86.9	86.3	85.8	88.0	85.4	86.8	86.2	78.0
Av. age at slaughter	127	148	153.7	147	149	137.3	148.8	132.3	157.6	136.9
Av. daily gain, lbs.[2,4]	.708	.615	.593	.598	.595	.645	.543	.670	.576	.546
Av. rib eye area, 12th rib, sq. in.	2.13	2.23	2.20	2.23	2.30	2.22	2.24	2.05	2.06	1.96
Av. rib eye area per cwt. carcass, sq. in.	4.33	4.48	4.38	4.50	4.67	4.53	4.62	4.24	4.13	4.94
Av. fat thickness, 12th rib, in.	.26	.28	.28	.32	.28	.28	.27	.34	.28	.18
Av. marbling score[5]	5.37	6.0	5.77	5.44	6.0	5.37	6.30	5.11	6.40	5.70
Av. USDA carcass grade[6]	13.0	13.9	14.3	14.4	14.5	13.4	14.2	13.6	14.1	13.8
Av. dressing %[7]	50.8	51.4	50.0	51.6	51.1	50.4	50.6	49.9	51.2	47.5
Av. % leg	29.4	29.4	31.0	29.5	30.3	30.3	30.5	30.6	30.7	31.2
Av. % loin	11.8	11.1	11.5	11.6	12.2	11.0	11.1	11.5	10.0	10.3
Av. % rack	11.6	11.5	11.4	12.4	10.9	11.2	11.3	11.8	11.4	10.6
Av. % breast	17.5	17.6	17.7	18.5	18.1	18.3	17.7	17.0	17.8	19.1
Av. % shoulder	24.7	25.4	24.7	23.8	24.7	25.3	25.1	25.2	25.8	25.0

1. Average general type score, with perfect score being 100.
2. Not corrected for sex or type of birth.
3. Shorn weight taken just before slaughter after lambs had stood over night without feed and water.
4. Based on unshorn weight.
5. Higher score means more marbling.
6. Carcasses graded by USDA grader: Prime, 14; choice, 11; good, 8; etc.
7. Based on shorn slaughter weight and chilled dressed carcass weight.

Table 34
Preliminary 1960-61 data on ten yearling Hampshire rams and their lambs as of March 9, 1961.

Ram number	1	2	3	4	5	6	7	8	9	10
Ram type score[1]	80	78.8	71.6	92.1	78.8	82.3	86.8	86.8	78.3	60.0
Wt. of ram, lbs. 9-2-60	198	161	163	270	189	229	224	222	170	147
Ram probe fat depth at 2nd lumbar, in.	.30	.40	.40	.35	.30	.40	.30	.20	.30	.20
Ram probe loin eye depth at 2nd lumbar, in.	1.75	1.60	1.40	2.15	1.60	1.50	1.90	2.10	1.70	1.20
Ram loin eye depth per cwt., in.	.92	.99	.85	.92	.84	.65	.84	.94	1.00	.816
Total number of lambs	12	11	13	10	10	8	7	12	11	10
Number twin lambs	6	4	6	4	2	2	2	6	4	2
Av. birth wt., lbs.[2]	10.8	9.2	9.0	10.7	9.9	10.6	10.4	9.6	10.0	8.9
Av. daily gain, lbs.[2]	.786	.762	.801	.819	.773	.785	.756	.823	.755	.761

1. Average general type score, with perfect score, equals 100.
2. Not corrected for sex or type of birth.

gether. Preliminary data on rams used in 1960-61 and on their lambs are reported in Table 34. There was considerable variation among rams in regard to type score, weight, probe, fat depth, and probe loin eye depth. Lamb birth weight and gain differ; however, these have not been corrected for type of birth or sex.

A more complete report on the 1960-61 lambs will be made in the 1962 Feeders' Day Report.

Effects of Exercise and Cooling on Reproductive Efficiency of Ewes Bred During Summer Months (Project 441).

H. G. Spies, C. S. Menzies, W. H. Smith, and S. P. Scott

Failure of ewes to conceive during summer is one of the biggest problems affecting the early spring lamb producer. Workers at other stations have reported that 90° F. temperatures lowered reproductive performance. This study was designed to determine the effects of forced exercise and temperature on reproductive performance of ewes.

Experimental Procedure

Forty-eight five- to six-year-old western ewes of Rambouillet breeding were sheared, drenched, and grazed on brome pasture plus ½ pound of grain per head daily until they were placed in either an air-conditoned room or a control pen. Each group was fed equal quantities of grain and hay during the treatment period. Twenty-four were maintained under a confined, but otherwise normal, outdoor environment and 24 were placed in a temperature-controlled room (60-64° F.) on the seventh day of the first detected estrous cycle until day 3 or 25 of pregnancy. Twelve ewes of each group were exercised on a mechanical exerciser for 30 minutes each day from day 10 of the first detected estrous cycle until day 3 or 20 of pregnancy. Exercised ewes walked about 1.4 miles each day. Two Hampshire rams were used to breed each ewe, on the second detected estrus (first estrus of the experimental period). Rams were kept in a cooled room prior to and throughout the breeding season. Twenty-four ewes (6 exercised and cooled, 6 exercised and not cooled, 6 not exercised and not cooled, and 6 not exercised and cooled) were slaughtered at day 3 of gestation, and 24 ewes given similar treatments were allowed to lamb.

Results and Discussion

Summer temperature, although mild in 1960 (average temperature 77° F. with a range of 48-99° F.) appeared to be detrimental to reproductive efficiency of western ewes. The number of normally cleaved ova at the third day of gestation was lower in noncooled ewes than in cooled ewes (57% vs. 80%). Also the number of ewes returning to heat following breeding and the number of services per conception was higher in the noncooled ewes (50% vs. 0% and 1.8% vs. 1.0%, respectively; see Table 35). Body temperature and respiration rate were used as indicators of physiological stress. Average body temperature and respiration rate of cooled ewes were 102.4° F. and 33.4 respirations per minute compared with 102.5° F. and 64.8 respirations per minute, for the noncooled ewes. Although these differences are not so great as some workers have reported, they were significant. Forced exercise resulted in significantly lower numbers of normal ova at three days postbreeding compared with nonexercise (57% vs. 80%; Table 35). However, since there were no differences in the number of ewes returning to heat between exercised and nonexercised groups (17% compared with 17%; Table 35), the effect of 30 minutes of exercise daily on reproductive efficiency may be questioned. More study is needed before definite conclusions are drawn. The exercised ewes were placed under some physiological stress as indicated by comparisons of body temperature and respiration rate. Exercise caused an average increase of 1.6° F. in body temperature and 79 respirations per minute. Ewes' body temperature and respiration rate returned to normal within one day.

Table 35

The effects of cooling and exercising on fertilization and conception rate.

Treatment group[1]	Fertilization rate %	Ewes returning to heat %	Services per conception for 24 ewes lambing
Cooled	80	0	1.0
Noncooled	57[2]	50[2]	1.8[2]
Exercised	57[3]	17	1.4
Nonexercised	80	17	1.4

1. Each of the four treatment groups contained 12 ewes.
2. Significantly different from the cooled ewes.
3. Significantly lower than the nonexercised group.

Garden City Lamb Feeding Experiments, 1960-61 (Project G.C. 111).

Carl Menzies and A. B. Erhart

Lambs

The 600 head of Rambouillet wether feeder lambs used in these tests were received at Menard, Texas, October 10, 1960. They were sorted from 1100 wether lambs raised by Page Brothers of El Dorado, Texas. Average purchase weight was 75.1 pounds. Purchase price was $14.50 per cwt. The lambs were sheared at Menard, averaging 3.9 pounds of wool that sold for 41½¢ per pound. Lambs weighed 62.7 pounds off trucks at Garden City October 12. Total trucking cost was $482.40.

General Procedure

During the pre-test period, chopped alfalfa hay and sorghum silage were fed. All lambs were drenched with 7 cc. of trivermol October 31. Lambs were weighed, ear tagged, implanted with 3 mgs. stilbestrol, lotted, and started on test November 1. Final weights were taken January 28, 1961, after 88 days on test.

Comparisons of sorghum, corn, and grain sorghum silages were made between lots 2, 3, 10, 11, and 12. Lambs were fed all the silage they would consume. Lambs in lot 10 did not receive additional grain above that supplied in the silage. Those in lots 11 and 12 were fed sorghum grain after 60 days on test.

The grain sorghum silage was made from sorghum hybrid RS610 grown on winter-irrigated land. It produced about 5 tons of silage per acre with 50 bus. of grain. Forage sorghum silage consisted of two hybrids grown on winter-irrigated land. They made about 7½ tons per acre which contained 45 to 50 bus. of grain. The corn silage was hybrid 904W grown under full irrigation. It produced 21 tons per acre with an estimated yield of 80 bus. of grain per acre.

Whole sorghum grain, whole barley, ground pelleted sorghum grain, ground pelleted barley, or a mixture of ½ barley and ½ sorghum grain was fed as carbonaceous concentrates in lots 2, 9, 5, 6, and 8 respectively. All 5 lots received equal levels of grain, protein supplement, and alfalfa hay. Lambs were fed all the sorghum silage they would consume.

Lambs in lot 1 were self-fed a complete pelleted ration of 35% sorghum grain and 65% alfalfa hay. A mixed self-fed ration consisting of a whole sorghum grain and dehydrated alfalfa pellets was fed to lot 7. A ration of 25% grain and 75% alfalfa pellets was fed at the start of the test. The grain was gradually increased over about a 50-day period to a ration of 45% grain and 55% alfalfa pellets. Alfalfa straw was supplied free choice to lots 1 and 7.

One half pound dehydrated alfalfa pellets was substituted for ¾ pound alfalfa hay in lot 4.

Lambs in lot 13 were grazed on volunteer wheat pasture.

One half the lambs in each lot were given a 5-gm. cobalt bullet each that contained 90% cobalt oxide.

Table 36

Sorghum, corn, and grain sorghum silages compared for fattening lambs.

Lot number	2	3	10	11	12
Treatment	Sorghum silage	Corn silage	Grain sorghum silage, no sorghum grain	Grain sorghum silage, sorghum grain after 60 days on test	Corn silage, sorghum grain after 60 days on test
Number of lambs	44	43	44	44	43
Days on feed	88	88	88	88	88
Av. initial wt., lbs.	72.9	74.0	72.5	72.1	72.7
Av. final wt., lbs.	109.0	113.5	104.3	107.7	102.0
Av. total gain, lbs.	36.1	39.5	31.8	35.6	29.3
Av. daily gain, lb.:	.410	.449	.361	.404	.333
No cobalt	.391	.455	.364	.415	.327
Cobalt	.430	.443	.357	.395	.339
Daily feed per lamb, lbs.:					
Whole sorghum grain	1.31	1.31	....	.40[3]	.40[3]
Alfalfa hay	.74	.74	.74	.74	.74
Forage sorghum silage	3.81	....	....	....	....
Grain sorghum silage	....	....	5.32	5.11	....
Corn silage	....	4.43	....	....	5.39
Cottonseed meal	.10	.10	.10	.10	.10
Salt	.020	.022	.024	.017	.015
Av. lbs. feed per cwt. gain:					
Whole sorghum grain	319.3	291.5	....	98.3	119.2
Alfalfa hay	180.7	165.0	205.3	183.4	222.5
Forage sorghum silage	928.5	....	....	....	....
Grain sorghum silage	....	....	1472.3	1264.3	....
Corn silage	....	986.0	....	....	1617.7
Cottonseed meal	24.4	22.3	27.7	24.8	30.0
Salt	4.8	4.9	6.6	4.2	4.5
Av. feed cost per cwt. gain[1]	$10.25	$10.10	$10.75	$10.56	$11.23
Av. feed cost per lamb[1]	$ 3.70	$ 3.99	$ 3.42	$ 3.76	$ 3.29
Cost per lamb start of test	$10.69	$10.85	$10.63	$10.57	$10.66
Av. total cost per lamb[1,2]	$14.39	$14.84	$14.05	$14.33	$13.95
Av. total cost per cwt.[1,2]	$13.20	$13.07	$13.47	$13.31	$13.68

1. Includes cost of stilbestrol implant @ 9¢ but does not include cost of drench or cobalt bullets.
2. Does not include cost of lamb loss.
3. Grain consumption given as an average over the 88-day test, but no grain was feed for first 60 days.

Table 37

Rations of whole sorghum grain, whole barley, pelleted sorghum grain, pelleted barley, and a mixture of ½ sorghum grain with ½ barley compared with lambs.

Lot number	2	9	5	6	8
Treatment	Whole sorghum grain	Whole barley	Pelleted sorghum grain	Pelleted barley	½ whole sorghum grain ½ whole barley
Number lambs	44	43	44	44	43
Days on feed	88	88	88	88	88
Av. initial wt., lbs.	72.9	73.1	74.1	73.6	73.4
Av. final wt., lbs.	109.0	109.5	115.7	114.8	112.9
Av. total gain, lbs.	36.1	36.4	41.6	41.2	39.5
Av. daily gain, lb.	.410	.414	.473	.468	.449
No cobalt	.391	.421	.479	.470	.465
Cobalt	.430	.408	.467	.467	.433
Daily feed per lamb, lbs.:					
Whole sorghum grain	1.31	....	....	....	.65
Pelleted sorghum grain	....	....	1.31	....	....
Whole barley grain	....	1.31	....	....	.65
Pelleted barley grain	....	....	....	1.31	....
Alfalfa hay	.74	.74	.74	.74	.74
Forage sorghum silage	3.81	3.27	3.39	3.41	3.78
Cottonseed meal	.10	.10	.10	.10	.10
Salt	.020	.021	.018	.013	.021
Av. lbs. feed per cwt. gain:					
Whole sorghum grain	319.3	....	....	....	145.6
Pelleted sorghum grain	....	....	276.7	....	....
Whole barley grain	....	316.2	....	....	145.6
Pelleted barley grain	....	316.2	....	....	145.6
Pelleted barley grain	....	....	....	279.7	....
Alfalfa hay	180.7	179.0	156.7	158.3	165.0
Forage sorghum silage	928.5	788.9	717.1	729.0	841.2
Cottonseed meal	24.4	24.2	21.1	21.4	22.3
Salt	4.8	5.1	3.8	2.8	4.7
Av. feed cost per cwt. gain[1]	$10.25	$10.49	$ 9.40	$10.19	$ 9.70
Av. feed cost per lamb[1]	$ 3.70	$ 3.82	$ 3.91	$ 4.20	$ 3.83
Cost per lamb start of test	$10.69	$10.72	$10.86	$10.79	$10.76
Av. total cost per lamb[1,2]	$14.39	$14.54	$14.77	$14.99	$14.59
Av. total cost per cwt.[1,2]	$13.20	$13.28	$12.77	$13.06	$12.92

1. Includes cost of stilbestrol implant @ 9¢ but does not include cost of drench or cobalt bullets.

2. Does not include cost of lamb loss.

Feed Prices

35% sorghum grain, 65% alfalfa hay pellets	$34.00 per ton
Whole sorghum grain	1.25 per cwt.
Pelleted sorghum grain	1.55 per cwt.
Whole barley grain	1.50 per cwt.
Pelleted barley grain	1.80 per cwt.
Dehydrated alfalfa pellets	40.00 per ton
Alfalfa hay	20.00 per ton
Alfalfa straw	$ 5.00 per ton
Forage sorghum silage	7.00 per ton
Grain sorghum silage	10.00 per ton
Corn silage	7.50 per ton
Cottonseed meal	74.00 per ton
Salt	1.05 per cwt.
Wheat pasture	1¢ per head per day

Table 38

Self-fed complete pelleted ration, self-fed whole sorghum grain and dehydrated alfalfa pellets, and dehydrated alfalfa pellets compared with Texas lambs.

Lot number	1	7	4	2
Treatment	Self-fed complete pellet	Self-fed mixed ration of whole sorg. grain and dehy. alf. pellets	Stand. ration with dehy. alf. pellets	Stand. ration with alfalfa hay
Number lambs	44	44	44	44
Days on feed	88	88	88	88
Av. initial wt., lbs.	73.6	73.6	74.3	72.9
Av. final wt., lbs.	127.6	123.4	108.7	109.0
Av. total gain, lbs.	54.0	49.8	34.4	36.1
Av. daily gain, lb.	.614	.566	.391	.410
No cobalt	.608	.556	.393	.391
Cobalt	.619	.577	.388	.430
Daily feed per lamb, lbs.:				
Complete pellet	3.92	....	....	....
Whole sorghum grain	....	1.36	1.31	1.31
Alfalfa pellets	....	2.56	.49	....
Alfalfa hay	....	....	....	.74
Forage sorghum silage	....	....	4.17	3.81
Cottonseed meal	....	....	.10	.10
Salt	.024	.018	.028	.020
Alfalfa straw	.24	.22	....	....
Av. lbs. feed per cwt. gain:				
Complete pellet	638.1	....	....	....
Whole sorghum grain	....	240.3	334.8	319.3
Alfalfa pellets	....	451.8	126.3	....
Alfalfa hay	....	....	....	180.7
Forage sorghum silage	....	....	1067.0	928.5
Cottonseed meal	....	....	25.6	24.4
Salt	3.9	3.2	7.2	4.8
Alfalfa straw	39.1	38.5	....	....
Av. feed cost per cwt. gain[1]	$11.17	$12.35	$11.72	$10.25
Av. feed cost per lamb[1]	$ 6.03	$ 6.15	$ 4.03	$ 3.70
Cost per lamb start of test	$10.79	$10.79	$10.89	$10.69
Av. total cost per lamb[1,2]	$16.82	$16.94	$14.92	$14.39
Av. total cost per cwt.[1,2]	$13.18	$13.73	$13.73	$13.20

1. Includes cost of stilbestrol implant @ 9¢ but does not include cost of drench or cobalt bullets.

2. Does not include cost of lamb loss.

Table 39
Data from wheat pasture and cobalt tests with lambs.

	13	All lots	
	Wheat pasture	Cobalt bullets	No cobalt bullets
Number lambs	44	283	285
Days on feed	88	88	88
Av. initial wt., lbs.	71.4	72.9	73.4
Av. final wt., lbs.	108.6	111.9	112.4
Av. total gain, lbs.	37.2	39.0	39.0
Av. daily gain, lb.	.423	.443	.443
No cobalt	.413		
Cobalt	.433		
Daily feed per lamb, lb.:			
Wheat pasture	free choice		
Salt	.014		
Av. lbs. feed per cwt. gain:			
Salt	3.3		
Av. feed cost per cwt. gain[1]	$ 2.63		
Av. feed cost per lamb[1]	$ .98		
Cost per lamb start of test	$10.47		
Av. total cost per lamb[1]	$11.45		
Av. total cost per cwt.[1]	$10.54		

1. Includes cost of stilbestrol implant @ 9¢ but not cost of drench or cobalt bullets.

Observations

Lambs in lot 3 consumed about .5 pound more corn silage per lamb per day than those fed sorghum silage in lot 2. Because of this, slightly faster and cheaper gains were made by lambs fed corn silage. These results agree with those obtained in the 1959-60 test.

A ration of alfalfa hay, cottonseed meal, and free-choice grain sorghum silage produced satisfactory but slower and slightly more expensive gains than a ration of alfalfa hay, cottonseed meal, forage sorghum silage, and sorghum grain. Supplementing the grain sorghum silage ration with sorghum grain for the last 28 days of the 88-day period increased rate of gain. Lambs in lot 12 that were fed a corn silage ration supplemented with grain for the last 28 days of the test gained more slowly, less efficiently, and produced more expensive gains than lambs on the other silage rations.

Whole barley was equal to whole sorghum grain in this test. However, sorghum grain produced cheaper gains using current feed prices. Grinding and then pelleting sorghum grain or barley increased rate of gain, improved feed efficiency, and slightly reduced feed cost per cwt. gain. Lambs fed a grain mixture of ½ whole sorghum grain and ½ whole barley produced cheaper and slightly faster gains than lambs fed whole sorghum grain or whole barley.

Lambs in lot 1 fed a complete pelleted ration gained faster and more efficiently than lambs fed other drylot rations. The feed cost per cwt. gain was higher than for most of the other rations. However, because of the large total gain per lamb, and since the gain cost less per cwt. than the purchase price of the lamb, the total cost per cwt. was in line with other lots that produced slower but cheaper gains. A mixed self-fed ration of whole sorghum grain and dehydrated alfalfa pellets fed in lot 7 produced less efficient gains than the complete pelleted ration. However, lambs fed the mixed ration gained faster and more efficiently than lambs fed other rations. Replacing .75 pound of alfalfa hay with .5 pound dehydrated alfalfa pellets in lot 4 did not affect rate or efficiency of gain. However, replacing the alfalfa hay in lot 4 or the alfalfa hay and silage in lot 7 with dehydrated alfalfa pellets resulted in a higher feed cost per cwt. gain.

Wheat pasture produced as rapid gains as most rations at the lowest

feed cost per cwt. gain. One light snow fell during the test but it interfered only slightly with grazing.

Lambs treated with a 5-gm. cobalt bullet gained no faster than those given no supplemental cobalt.

Two lambs died prior to the start of the test. Four lambs, one from lots 3, 8, 9, and 12 respectively, died from enterotoxemia during the test period.

Charles Pfizer and Co., Inc., Terre Haute, Indiana, furnished the stilbestrol implants; Wm. Cooper and Nephews, Inc., Chicago, Illinois, supplied the cobalt bullets; and Trivermol drench was furnished by Jen-Sal Laboratories, Kansas City, Missouri. The dehydrated alfalfa pellets were supplied by Archer-Daniels Midland Company and National Dehydrating and Milling Company.

Investigations of Milk-fat Lamb Production Practices for Western Kansas (Project 584).

Carl Menzies and Evans Banbury

This sheep project was initiated in the spring of 1959 as a new research project at the Colby Branch Experiment Station in cooperation with the Department of Animal Husbandry, Kansas State University.

One hundred fifty-one finewool yearling ewes were purchased from near Del Rio, Texas, May 4, 1959. An additional 200 similar yearling ewes were purchased from the same area May 13, 1960. These ewes are handled in a typical Kansas early lambing program. The ewes are bred to purebred Hampshire rams and all lambs are sold in the spring as milk-fat lambs.

Over-all objectives of this project are to determine the productive and economic value of various management practices, types of pastures, feeds, feed additives, and combinations of these to maintain a commercial ewe flock and to produce milk-fat lambs for a spring market under western Kansas conditions.

Ewe Flushing Test—Spring 1959

One hundred fifty-one yearling ewes were divided into three lots and fed the following rations for 40 days (May 14-June 23).

Lot 1. Rye pasture and/or chopped green cereal crops. Rye pasture was grazed May 14 to May 27; from May 27 to June 13 chopped green wheat forage was fed in addition to rye pasture; and from June 13 to June 23 a ration of chopped green wheat forage and sorghum silage was fed. In addition to the rye pasture, 131 pounds of chopped wheat forage and 12 pounds of silage were fed per ewe during the flushing period. Both the rye and wheat had advanced to the soft-dough stage by the end of the flushing period.

Lot 2. Drylot. A ration of ¾ pound whole sorghum grain, 1¼ pounds alfalfa hay, and free-choice sorghum silage (4.7 pounds average consumption) was fed per ewe per day.

Lot 3. Buffalograss pasture. Ewes were grazed on 80 acres of very good buffalograss pasture.

Six yearling Hampshire rams were used to breed the ewes. Breeding season started May 25, about two weeks after ewes were placed on the different flushing rations. The six rams were divided into three pairs and were turned with the ewe groups each night and removed each morning. Each pair of rams was rotated to a different ewe lot twice a week. At the end of the flushing period, June 23, all ewes were turned together and grazed on buffalograss pasture. All six rams were turned with the entire flock each night until the end of the breeding season, September 1.

Results and Discussion

Ewe Gains Made During 40-day Flushing Period

Lot No.	No. ewes	Av. initial wt. May 14, lbs.	Av. final wt. June 23, lbs.	Total gain, lbs.	Av. daily gain, lbs.
1	50	94.5	109.6	15.1	.38
2	50	92.1	108.6	16.5	.41
3	51	93.2	113.4	20.2	.51

Ewe Lambing Performance[1]

Lot No.	No. ewes	Total No. lambs	No. single lambs	No. twin lambs	Percent ewes Lambing	Percent lamb crop
1	50	51	43	8	94	102
2	50	49	49	0	98	98
3	51	65	35	30	98	127.5

1. Includes all lambs born regardless of health at birth.

Cumulative Percentage Ewes Lambing by Periods After First Lamb Birth, October 19, 1959

Lot No.	Days after October 19				
	10	20	30	40	100
1	22.0	52.0	68.0	82.0	94.0
2	16.0	46.0	80.0	90.0	98.0
3	19.6	58.8	92.2	92.2	98.0

Ewes in lot 3, flushed on buffalograss pasture, made the largest gains during the flushing period. These ewes also produced more twins and a larger percentage of them lambed within the first month of lambing season. Low percentage of ewes lambing in lot 1 between the 20th and 30th days of the lambing season can be related to the June 2 to June 23 flushing period when rye pasture and green chopped wheat were maturing from bloom into soft-dough stages.

Ewes bred during the flushing period should have lambed within the first 30 to 35 days of the lambing season. Over-all lambing performance of all ewes was very good for yearling ewes.

Ewe Pre-lambing Treatment Test—Fall 1959

The 151 yearling ewes used in the spring flushing test were divided into three lots September 23 and fed the following until lambing or November 5, whichever came first. Ewes were fed the different pre-lambing rations for 30 to 40 days.

Lot 4. Fifty ewes were grazed on good buffalograss pasture plus ¼ pound sorghum grain per ewe daily.

Lot 5. Fifty ewes were grazed on lush rye pasture plus ¼ pound of sorghum grain per ewe daily.

Lot 6. Fifty-one ewes were grazed on good buffalograss pasture plus ¼ pound of 41% protein soybean oil meal pellets per ewe daily.

Results and Discussion

Ewes in lot 5, grazed on rye pasture plus ¼ pound grain, produced single lambs that weighed an average of 0.9 and 0.8 pound more at birth than lambs in lots 4 or 6, respectively. Twin lambs from lot 5 weighed an average of 2.6 and 2.5 pounds more at birth than lambs from lots 4 or 6, respectively. Results show that the difference between lots in birth weights narrowed as lambing season progressed, and as length of time when ewes were removed from the different pre-lambing rations and date of lambing increased.

Average Lamb Birth Weights, Lbs.

Lot No.	First 10 lambs	First 20 lambs	First 30 lambs	First 40 lambs	All single lambs	Twin lambs
4	10.2	10.3	10.2	10.0	10.1 (41 lambs)	5.9 (9 sets)
5	12.1	11.5	11.6	11.1	11.0 (42 lambs)	8.5 (4 sets)
6	10.1	9.8	9.7	10.2	10.2 (44 lambs)	6.0 (5 sets)

Lamb Feeding Tests—Winter 1959-60

Ewes and lambs were divided into three lots according to prior ewe treatment, date of lamb birth, and type of birth (single or twin).

Ewes and lambs were given one week to adjust after lamb birth before being placed in their respective lots. Lambs were docked with rubber bands when two to three days of age and castrated with a knife when around six days of age.

Lot 7. Ewes and lambs were grazed on rye pasture until December 22. Lambs had access to creep of whole sorghum grain and alfalfa hay. From December 22 to market this lot was handled the same as lot 9.

Lot 8. Ewes and lambs were grazed on rye pasture until December 22. Creep was not provided lambs in this lot. From December 22 to market, this lot was handled the same as lot 9.

Lot 9. Ewes in this lot were fed a daily ration of 1 pound whole sorghum grain, 1 to 1¼ pounds of alfalfa hay and all the sorghum silage they would consume (average consumption, 6.9 pounds). Ewes were fed this ration until lambs were marketed. Lambs had access to a creep of whole sorghum grain and alfalfa hay.

Results and Discussion

The following table shows lamb gains during the time when lots 7 and 8 were on rye pasture.

Lamb Gains from Birth to December 22

Lot No.	No. lambs	Av. lamb age Dec. 22, days	Av. lamb wt. Dec. 22, lbs.	Av. lamb gain, lbs.	Av. daily gain, lbs.
7	47	47.8	40.4	30.6	.64
8	48	47.3	39.7	29.8	.63
9	46	46.3	33.6	23.8	.51

Lambs in lot 7 that had access to a creep and those in lot 8 that did not have a creep, gained the same while on rye pasture. Both these lots made faster gains during this period than lambs in lot 9 that had access to a creep in the drylot.

The 1626 and 1633 ewe grazing days on rye pasture, in lots 7 and 8, respectively, each replaced around ¾ ton of sorghum grain, ¾ ton alfalfa hay, and slightly over 5 tons of sorghum silage fed to lot 9 during the same period. Lambs in the drylot ate about ⅓ pound of grain per day during this period. Grain consumption for lot 7 could not be figured accurately because of heavy bird feeding. Hay consumption by lambs during this period averaged less than 1/10 pound per day.

Summary of lamb gains from birth to market follows.

Lamb Gains from Birth to Sale Date

Lot No.	No. of lambs	Av. market wt., lbs.	Av. total gain	Av. age at market, days	Av. daily gain, lbs.
7	46	99.3	89.4	163.6	.55
8	48	99.7	89.7	169.6	.53
9	49	97.1	87.5	171.5	.51

Lambs in lots 7 and 8 made slower gains in the drylot than they did on rye pasture. Several lambs in each of these lots were born after lambs had been taken off rye pasture. The lambs born prior to December 2 that were placed on rye pasture reached market weight in 15 and 9 days less time in lots 7 and 8, respectively, than lambs of similar age in lot 9.

Seven cases of urinary calculi (2 died) occurred in lot 9, and one lamb in each of lots 7 and 8 developed urinary calculi.

One-half the lambs in lots 7, 8, and 9 were given 3 cc. of enterotoxemia antitoxin containing a minimum of 4,500 antitoxin units, on December 5. Lambs ranged from 10 to 48 days of age when treated. Bacterin was later given these same lambs when the youngest lamb was 2 months old.

Daily gains were similar for vaccinated and nonvaccinated lambs. One lamb died from a reaction when given the bacterin and one antitoxin-treated lamb died about one month after treatment. No lamb loss from enterotoxemia occurred after December 5 among the nonvaccinated lambs.

Lambs were marketed in periodic shipments. All lambs not already sold were weaned on April 25, 1960. All lambs were sold by June 11, 1960.

Ewe Flushing Test—Spring 1960

One hundred fifty two-year-old ewes were divided into two groups on April 25, 1960, and fed different rations until May 12, a 17-day period. One group was given a low-energy ration of 2 pounds alfalfa hay per ewe per day. The other group was fed a normal ration of 2 pounds alfalfa hay, 3 pounds sorghum silage, and ¼ pound sorghum grain per ewe per day. May 13 each of these groups was divided into six lots along with 200 yearling ewes. These six lots were fed the following flushing rations for a 40-day period:

Lot 1. Drylot—¾ pound whole wheat, 1¼ pounds alfalfa hay, and free-choice sorghum silage.

Lot 2. Drylot—¾ pound whole sorghum grain, 1¼ pounds alfalfa hay, and free-choice sorghum silage.

Lot 3. Cereal crop pasture plus ½ pound whole sorghum grain.

Lot 4. Cereal crop pasture.

Lot 5. Buffalograss pasture plus ½ pound whole sorghum grain.

Lot 6. Buffalograss pasture.

A pair of Hampshire rams was turned with each lot at night from May 28 to June 30, 1960. Rams were rotated to a new ewe group twice each week. On June 22, the end of the flushing period, all six lots were turned together and grazed during the day on buffalograss pasture. All 12 rams were turned with ewes each night until September 1.

Results and Discussion

The following table gives results of pre-flushing two-year-old ewes and flushing treatment on weight gain of two-year-old and yearling ewes.

Effect of Pre-flushing and/or Flushing Treatment on Weight Gain or Loss.

	Two-year-old ewes			Two-year-old and yearling ewes	
	No. of ewes	Av. pre-flushing wt. loss per ewe, lbs.	Av. flushing gain per ewe, lbs.	No. of ewes	Av. flushing gain per ewe, lbs.
Lot 1				58	16.7
Low-energy ration	13	−11.9	20.9		
Normal ration	12	− 8.1	20.1		
Lot 2				59	16.0
Low-energy ration	13	−11.3	21.4		
Normal ration	12	− 7.3	16.8		
Lot 3				58	12.8
Low-energy ration	13	−12.9	12.1		
Normal ration	12	− 7.3	12.4		
Lot 4				58	10.6
Low-energy ration	12	−12.5	9.1		
Normal ration	13	− 6.3	6.6		
Lot 5				58	16.2
Low-energy ration	12	−11.8	18.2		
Normal ration	13	− 9.4	17.3		
Lot 6				59	14.6
Low-energy ration	12	−11.9	15.0		
Normal ration	13	− 8.2	12.4		
All lots					
Low-energy ration	75	−12.0	16.2		
Normal ration	75	− 7.8	14.2		

Ewes on the low-energy pre-flushing ration lost an average of 4.2 pounds more than ewes fed the normal ration, but gained an average of 2 pounds more than the normal-fed ewes during the flushing period. Gain response to flushing by yearling ewes is not shown separately but is included with the two-year-old ewes in the right-hand column of the preceding table.

The table below gives lambing performance of two-year-old ewes fed two different pre-flushing rations.

Two-year-old Ewe Lambing Performance.

Pre-flushing treatment	No. ewes	No. ewes lambed	Total lambs	No. single lambs	No. twin lambs	% lamb crop
Low energy	75	74	98	50	48	131
Normal	75	73	92	54	38	124

There was no over-all difference in cumulative percentage of ewes lambing in a given length of time between the two groups. About 90% of these two-year-old ewes lambed within the first 30 days of lambing season. Lambing data are not given separately for two-year-old and yearling ewes for the six different flushing lots. The table below gives the combined performance.

Lambing Performance for Two-year-old and Yearling Ewes.[1]

Lot No.	No. of ewes	No. ewes lambed	Total lambs	No. single lambs	No. twin lambs	% lamb crop
1	58	53	59	47	12	101.7
2	59	58	65	51	14	110.2
3	58	54	70	38	32	120.7
4	58	53	59	47	12	101.7
5	58	56	63	49	14	108.6
6	59	57	67	47	20	113.6

1. Includes all lambs born regardless of health of lamb at birth.

Cumulative Percentage Ewes Lambing by Periods After First Lamb Birth—October 22, 1960.

	Days after October 22				
Lot No.	10	20	30	40	100
1	15.5	36.2	82.8	89.7	91.4
2	18.6	40.7	84.8	91.5	98.3
3	20.7	46.6	81.0	82.8	93.1
4	10.3	22.4	69.0	81.0	91.4
5	31.0	55.2	84.5	91.4	96.6
6	17.0	33.9	81.4	84.8	96.6

Ewes in lot 8 had more twins and produced more lambs. Five ewes in each of lots 1 and 4 failed to lamb. This may not be due to treatment. There was little difference in cumulative percentage of ewes lambing after the first 40 days of lambing season. Ewes in lot 4 were behind other lots during the early part of the lambing season.

Ewe Pre-lambing Treatment Test—Fall 1960

The 350 ewes were divided into three lots according to age and prior treatment September 27, 1960, and fed according to the following plan until October 31 or lambing, whichever came first.

Lot No.	No. ewes	
7	117	Buffalograss pasture plus ¼ pound whole grain sorghum grain.
8	117	Buffalograss pasture plus ¾ pound whole sorghum grain.
9	116	Rye pasture plus ¼ pound whole sorghum grain.

Results and Discussion

Ewes grazed on rye pasture, lot 9, produced both single and twin lambs that were heavier at birth than ewes in lot 7 or 8. As in 1959 the difference narrowed as lambing season progressed and pre-lambing treatment became farther removed from date of lambing. Ewes fed ¾ pound or ¼ pound sorghum grain on buffalograss pasture produced lambs that weighed about the same at birth.

Average Lamb Birth Weights, Lbs.

Lot No.	First 10 lambs 10-26-60	First 30 lambs 11-8-60	First 60 lambs 11-15-60	All single lambs	Twin lambs
7	8.6	9.5	9.8	10.1 (86 lambs)	7.7 (23 sets)
8	9.2	9.6	9.9	10.2 (93 lambs)	8.3 (15 sets)
9	10.1	10.4	10.5	10.6 (100 lambs)	8.5 (14 sets)

Meat

The Relation of Packaging Material to the Keeping Quality of Frozen Pork (Project 424).

D. L. Mackintosh, R. A. Merkel, J. L. Hall, Dorothy L. Harrison, L. Anderson

With the increasing number of home storage units, information regarding packaging material and storge life of meat is in constant demand. This project was designed, a number of years ago, to acquire information that might aid in answering these inquiries. Many wrapping materials have been tested and the general conclusion, at this time, is that there are now available many good wrapping materials which can be procured in commercial rolls or home-package size and that there is no need to use inferior materials such as parchment paper or wax papers.

During the past year, a vacuum pack and two different weights of polyethylene papers were tested, using pork sausage as the storage material. There was less than 1% loss in weight after 300 days of storage at 0° F., though the vacuum pack showed practically no loss. In each case, the sausage was no longer acceptable to the palatability committee after seven months, though the vacuum pack was in a little better condition than the others. Since antioxidants are now available and their use in the storage of fresh pork appears to increase the storage life, an antioxidant is being used this year in connection with a good wrapping material and a poor wrapping material. This phase is under observation at this time.

The Relation of Feathering and Overflow Fat of Lamb Carcasses to the Grade of the Lamb, Degree of Marbling, and Market Value of the Lamb (Project 580).

D. L. Mackintosh, R. A. Merkel, and C. S. Menzies

This project was undertaken in the spring of 1960 in an endeavor to determine the relationship, if any, of internal fats, overflow, and feathering to the degree of marbling in the *longissimus dorsi* muscle (eye muscle), the grade of the carcass; and the relationship of marbling to the palatability of meat.

Eighty-eight lambs of known breeding were slaughtered in the station laboratory during March, April, and May, 1960. They were the product of a sheep breeding experiment in progress at this station so that the history of each lamb was known. The lambs were slaughtered at about 95 lbs. and slaughter and carcass data recorded. All observations regarding carcass grade were made by a representative of the Federal Grading Service. Data on the palatability of the lambs are not yet available and the observations have not been treated statistically. The following general observations have been made. All carcasses graded within the range of high choice and high prime, feathering from 5 to 9, overflow from 4 to 8, flank fat from 4 to 7, estimated marbling 4 to 7, and actual marbling from 4 to 8, all on a basis of a standard ranging from 1 to 11.

Chemical analyses of the intercostal muscle for fat, as a measure of feathering, ranged from 19% to 30%; the overflow fat, separated mechanically, ranged from 20 to 101 grams, with over 50% falling between 33 and 50 grams. Chemical analyses of the eye muscle ranged from 2% to 7% fat, with about 50% of the lambs falling between 3.5% and 5% fat. Other observations include area of the eye muscle, thickness of fat over the eye muscle, and color of the flank muscle.

The project is being continued and should yield valuable information regarding the indices of finish to marbling, to grade of the carcass, and to palatability of the meat. It will also make valuable carcass data available to the sheep breeding project (No. 347).

Feed Prices—1960-61

Cracked corn, cwt.	$ 2.15
Rolled sorghum grain, cwt.	1.75
Sorghum grain pellets, cwt.	1.90
Soybean oil meal, cwt.	3.45
Sorghum silage, ton	5.75
Grain sorghum silage, ton	10.00
Dehydrated grain sorghum pellets, ton	40.00
Dehydrated alfalfa pellets, ton	50.00
Alfalfa hay, ton	17.00
Prairie hay, ton	14.00
Salt, cwt.	.90
Sorghum grain-dehydrated alfalfa pellets	
90:10	$ 2.10 cwt.
70:30	2.25 cwt.
50:50	2.35 cwt.
30:70	2.45 cwt.
10:90	2.60 cwt.