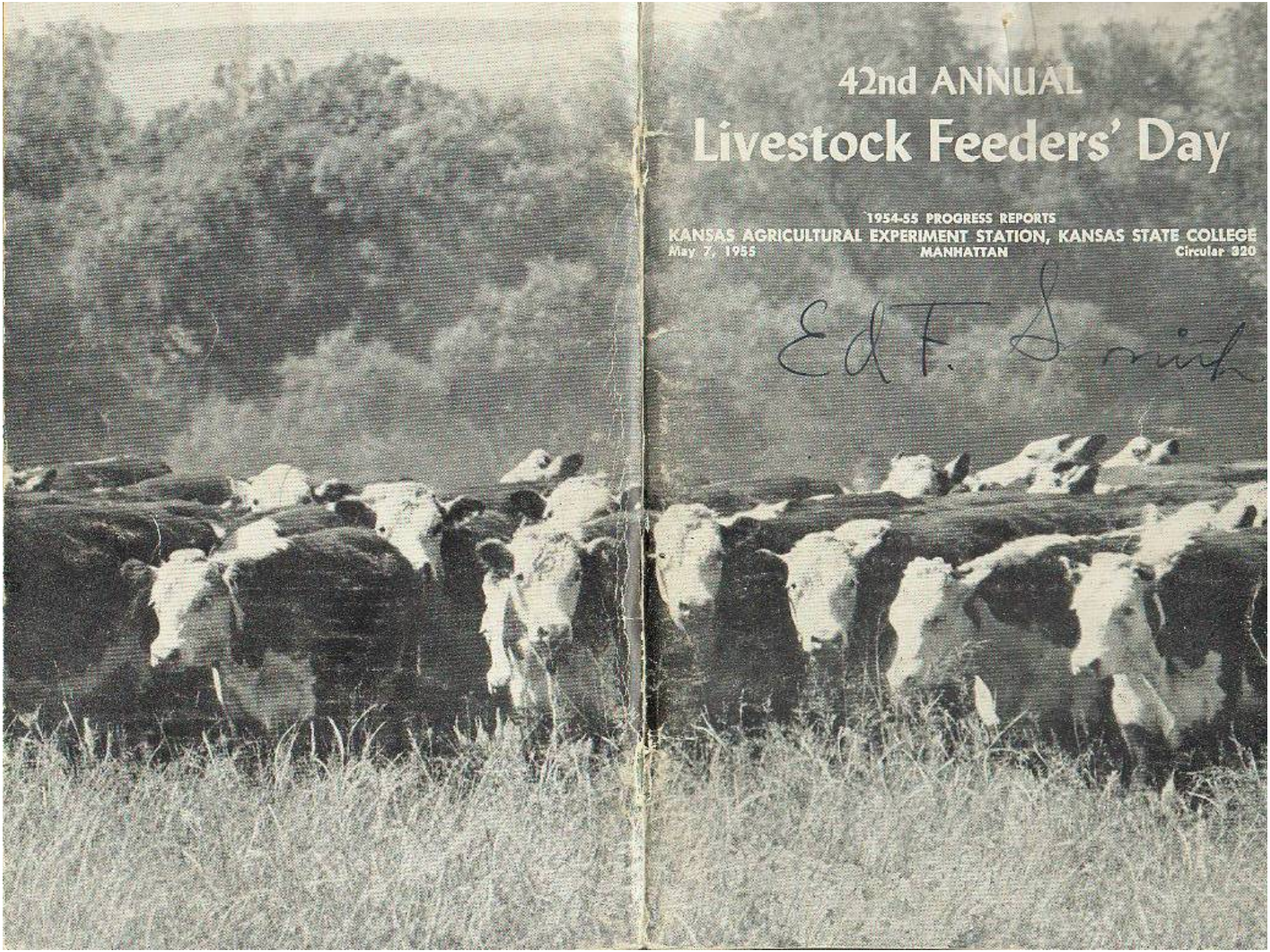

42nd ANNUAL
Livestock Feeders' Day

1954-55 PROGRESS REPORTS

KANSAS AGRICULTURAL EXPERIMENT STATION, KANSAS STATE COLLEGE

May 7, 1955 MANHATTAN Circular 320

Ed F. Smith

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42nd Annual Livestock Feeders' Day

Kansas State College

Manhattan

SATURDAY, MAY 7, 1955

9:30 a.m.—Inspection of Livestock—Barns and Feedlots. Breeding and Experimental Herds of Cattle, Sheep and Hogs.

11:30 a.m.—Lunch—Livestock Judging Pavilion (In case of rain, lunch will be served in the Fieldhouse.)

Afternoon Program—Livestock Judging Pavilion

1:30 p.m.—Presiding—Geo. F. Andrews, Kanopolis, Kansas, President, Kansas Livestock Association.

Presentation—Beef Production Awards—
W. H. Atzenweiler, Agricultural Commissioner, Chamber of Commerce, Kansas City, Missouri.

Guest Speaker—John H. Knox, Head, Department of Animal Husbandry, New Mexico A & M College.

Reports of Livestock Feeding and Breeding Tests—
Staff, Animal Husbandry Department.

Question and Answer Panel.

FOR THE LADIES

Friday, May 6, 1955

6:30 p.m.—Dutch Treat Dinner—Gillett Hotel.
Kansas Cow Belles and Visiting Ladies (Make reservations with Mrs. Orville Burtis, Manhattan, Kansas.)

Saturday, May 7, 1955

10:00 a.m.—Get Acquainted Meeting and Refreshments—
Calvin Lounge, Home Economics Building.

11:30 a.m.—Lunch—Livestock Judging Pavilion.
(Fieldhouse in case of rain.)

Afternoon Program

Presiding—Mrs. Geo. F. Andrews, Kanopolis, Kansas, President, Kansas Cow Belles.

Program—Home Economics and Animal Husbandry Staffs, Kansas State College.

Animal Husbandry Investigations

1954-55 PROGRESS REPORTS*

42nd Annual
LIVESTOCK FEEDERS' DAY

Kansas Agricultural Experiment Station, Manhattan

KANSAS STATE COLLEGE
OF
AGRICULTURE AND APPLIED SCIENCE

ARTHUR D. WEBER, Director

* Contribution No. 205, Department of Animal Husbandry. 8M—5-55

Contents

Chemical Analyses of Feeds Used in Feeding Trials, 1954-55

	% Moisture	% Protein	% Ether extract	% Crude fiber	% N-free extract	% Ash	% Phosphorus
Corn	10.19	10.75	4.00	2.15	71.22	1.69	0.34
Milo grain	8.71	9.44	3.04	1.54	75.64	1.63	
Milo grain	7.90	13.00	3.62	1.89	71.73	1.86	
Alfalfa hay	5.40	13.06	1.78	33.88	37.66	8.22	
Alfalfa hay	5.07	16.50	1.69	29.16	37.91	9.67	
Soybean meal	7.60	43.60	5.65	5.71	31.70	5.78	0.56
Sorghum stover	52.50	2.17	.88	10.37	31.04	3.04	0.10
Prairie hay	5.22	5.88	2.46	32.35	46.91	7.18	
Corn cobs	8.57	2.31	.45	33.86	52.92	1.59	
Special cattle supplement	11.27	34.13	1.97	4.91	35.61	12.11	
Alfalfa silage	64.70	5.69	.98	11.34	13.56	3.73	
Atlas sorgo silage	65.09	2.77	.88	8.00	20.70	2.65	

Feed Prices Used in Beef Cattle Tests, 1953-1954

Milo grain, cwt.	$ 2.50
Soybean meal, ton	84.00
Soybean cake, ton	86.00
Special cattle supplement, ton	92.70
Sorghum silage, ton	8.00
Alfalfa hay, ton	25.00
Alfalfa silage, ton	8.00
Corn cobs, ton	14.00
Prairie hay, ton	20.00
Corn, bushel	1.60
Salt, ton	15.00
Mineral (2 parts steamed bone meal, 1 part salt), ton	80.00
Dry grass pasture, calves per head per month	.50
Dry grass pasture, yearlings per head per month	.75

Sheep

Lamb Feeding Experiments

Feedlot and Pasture Fattening Tests with Feeder Lambs. Studies Carried On by the Department of Animal Husbandry and the Garden City Branch Experiment Station.

PROJECT 111 GC

T. Donald Bell and A. B. Erhart

The tests this year compared whole milo with ground milo grain fed with a standard roughage ration of ground sorghum stover, protein supplement, and supplemental salt and limestone. The roughage comparisons included (1) all sorghum stover, (2) sorghum stover and alfalfa hay, and (3) beet top silage and alfalfa hay. One lot of lambs received the sorghum stover-alfalfa hay-milo grain ration as pellets.

One lot on the standard ration received 6 milligram pellet implants of stilbestrol at the beginning of the feeding period; another lot on the standard ration received estradiol-progesterone (Synovex) pellet implants at the start of the tests; and another lot of lambs was given 2 milligrams of stilbestrol daily in the standard ration.

Two lots of lambs were run on irrigated milo pasture with supplemental alfalfa hay during the early part of the grazing period. Additional grain was provided after approximately 50 days, and one lot was brought into the dry lot for finishing after 63 days on pasture. Another lot of lambs was grazed on irrigated wheat pasture for 63 days and brought in (because of snow) to be finshed in the dry lot.

Lambs

The lambs for this year's tests were obtained from Wyoming, and included primarily white-face, crossbred lambs, with a smaller number of black-face crossbreds. They weighed 68.1 pounds at the loading point in Wyoming. The average weight off the cars in Garden City was 61.2. They were started on tests about 30 days later, weighing approximately 73 pounds.

Feed Prices

Milo grain	$ 2.00 per cwt.
Grinding	.10 per cwt.
Cottonseed meal	80.00 per ton
Alfalfa hay	30.00 per ton
Straw	7.00 per ton
Ground sorghum stover	15.00 per ton
Sorghum silage	8.00 per ton
Beet top silage	8.00 per ton
Pellets (32.7% dehydrated Axtell, 19.2% alfalfa, 48.1% milo)	41.14 per ton
Wheat pasture (14 acres used 63 days)	.50 per head per month
Sorghum stubble, 30 acres	.50 per acre
Salt	.90 per cwt.
Calcium	1.00 per cwt.

Table 1.—Feedlot tests.

Lot number	1	2	3	4
	Beet top silage	Axtell stover	Stilbestrol in feed	Stilbestrol implants
Ration fed	Whole milo, alfalfa hay, salt, limestone	Whole milo, C.S.M., salt, limestone	Axtell stover, whole milo, C.S.M., salt, limestone	Axtell stover, whole milo C.S.M., salt, limestone
Number of lambs per lot	50	50	50	50
Number of days on feed	105	105	105	105
Initial wt. per lamb	73.0	73.9	73.6	73.5
Final wt. per lamb	109.7	101.6	107.4	107.0
Total gain per lamb	36.7	27.7	33.8	33.5
Daily gain per lamb	.35	.26	.32	.32
Feed per lamb daily:				
Milo grain	1.21	1.21	1.21	1.21
Alfalfa hay	.51			
Axtell stover		2.40	2.47	2.51
Beet top silage	5.12			
Cottonseed meal		.20	.20	.20
Salt		.022	.026	.022
Limestone		.015	.015	.015
Feed per cwt. gain:				
Milo grain	345	457	375	379
Alfalfa hay	146			
Axtell stover		909	770	786
Beet top silage	1463			
Cottonseed meal		76	63	62
Salt	6.3	8.4	8.3	6.9
Limestone		5.7	4.7	4.7
Feed cost per cwt. gain	$ 15.00	$ 19.12	$ 15.91	$ 16.08
Feed cost per lamb	$ 5.50	5.29	5.38	5.39
Initial cost per lamb	$ 13.52	13.69	13.63	13.61
Number of lambs lost	0	0	0	0
Cost of lamb loss	0	0	0	0
Total cost	$ 19.02	18.98	19.01	19.00
Final cost per cwt.	$ 17.33	18.68	17.70	17.76
Average fleece wt., lbs.	7.2	6.5	6.4	6.7

Table 2.—Feedlot tests.

Lot number	5	6	7	8
	Estradiol-progesterone implants	Ground milo	Pelleted ration	Non-pelleted ration
Ration fed	Whole milo, Axtell stover, C.S.M., salt, limestone	Axtell stover, C.S.M., salt, limestone	Milo-Axtell stover, alfalfa hay pellets, straw, salt	Whole milo, Axtell stover, alfalfa hay, salt
Number of lambs per lot	50	50	50	50
Number of days on feed	105	105	105	105
Initial wt. per lamb	72.6	73.3	73.6	72.4
Final wt. per lamb	107.1	101.8	105.0	101.2

Table 2 (Continued).

Total gain per lamb	34.5	28.5	31.4	28.8
Daily gain per lamb	.33	.27	.30	.27
Feed per lamb daily:				
Milo grain	1.21	1.21		1.21
Alfalfa hay			.068	.50
Axtell stover	2.46	2.33	.381	1.85
Straw			.243	
Pellets			2.39	
Cottonseed meal	.20	.20		
Salt	.025	.022	.028	.023
Limestone	.015	.015		
Feed per cwt. gain:				
Milo grain	367.9	443.22		440.83
Alfalfa hay			22.64	182.52
Axtell stover	748.9	853.5	127.2	677.44
Straw			81.09	
Pellets			798.94	
Cottonseed meal	60.9	73.3		
Salt	7.77	8.058	9.41	8.48
Limestone	4.57	5.49		
Feed cost per cwt. gain	$ 15.54	$ 18.77	$ 18.03	$ 16.72
Feed cost per lamb	$ 5.36	5.35	5.66	4.81
Initial cost per lamb	$ 13.44	13.58	13.63	13.40
Number of lambs lost	0	1	0	0
Cost of lamb loss	0	.32	0	0
Total cost	$ 18.80	19.25	19.29	18.21
Final cost per cwt.	$ 17.65	18.91	18.37	17.99
Average fleece wt., lbs.	6.2	6.6	6.5	6.5

Table 3.—Pasture tests.

Lot number	9	10	11
Ration fed	Milo stubble + alfalfa hay + milo, salt	Milo stubble + alfalfa hay + milo (63 days) Drylot—sorghum silage, alfalfa hay and milo (42 days)	Wheat pasture (63 days) Drylot—sorghum silage, alfalfa hay and milo (42 days)
Number of lambs per lot	50	50	50
Number of days on feed	105	105	105
Pasture	105	63	63
Drylot		42	42
Initial wt. per lamb	73.0	72.6	71.8
Final wt. per lamb	89.8	96.3	108.4
Total gain per lamb	16.8	23.7	36.3
Daily gain per lamb	.16	.23	.35
Pasture		.14	.40
Drylot		.36	.29

Table 3 (Continued).

Feed per lamb daily (in addition to pasture):			
Milo grain	.57	.57	.49
Alfalfa hay	.51	.51	.20
Axtell stover	.14		
Sorghum silage		1.80	1.65
Salt	.012	.015	.022
Feed per cwt. gain:			
Milo grain	366.45	254.0	142.3
Alfalfa hay	326.9	228.0	57.2
Axtell stover	89.0		
Sorghum silage		801.0	472.8
Salt	7.75	6.8	6.3
Feed cost per cwt. gain	$ 14.16	$ 12.28	$ 8.54
Feed cost per lamb	$ 2.38	2.91	3.10
Initial cost per lamb	$ 13.52	13.44	13.30
Number of lambs lost	1	0	0
Cost of lamb loss	.28	0	0
Total cost	$ 15.90	16.35	16.40
Final cost per cwt.	$ 17.70	16.98	15.13
Average fleece wt., lbs.	6.3	6.0	7.7

Observations

The lambs receiving ground milo gained a little faster and slightly more economically than the lambs receiving whole milo. In similar tests through previous years an advantage was shown in grinding the milo in two of the years, while no advantage was shown the other year.

Beet top silage produced the largest and most economical gains, using current prices, of any of the feedlot rations in this year's tests. In the 1953-54 tests the beet top silage ration produced larger gains than any of the other rations, but at the prices charged, it was not the most economical. Because of the interest in shrinkage and yield of the silage-fed lambs, this information was obtained when the lambs were marketed in Wichita. The silage-fed lambs shrank 7.45 percent going to market and yielded 53 percent when slaughtered. The lambs fed the standard or control ration shrank 9.35 percent going from Garden City to Wichita, and had average carcass yields of 50 percent based on the purchase weight at Wichita.

The pelleted ration, as in previous years, produced faster gains with more efficient use of feed nutrients than the non-pelleted ration. The gains, however, were more expensive with the pelleted ration because of its cost.

Including ½ pound of alfalfa hay as a part of the roughage produced slightly larger and considerably cheaper gains than when sorghum stover was the only roughage.

This was the first test with irrigated wheat pasture. It clearly demonstrated its worth, producing as high a rate of gain as the best drylot group. The final cost per hundred for the lambs fed wheat pasture was $1.85 less than the cost of any other group either on pasture or in dry lot.

Sorghum stubble produced economical gains, but the gains were small. This was particularly true with lambs that remained on sorghum stubble the entire feeding period.

The lambs given hormones—either as implants at the beginning of the tests or daily in the feed—gained more rapidly than lambs on a similar ration with no hormone treatment. In previous tests with stilbestrol implants and with stilbestrol-progesterone implants, the hormone-treated lambs shrank more going to market and produced lower grading and lower yielding carcasses than lambs fed similar rations without hormones. Further information concerning the use of hormones in lamb feeding is presented below.

The lambs were shown at the close of the experimental feeding period. Wool production for the various lots is shown in the bottom line of each table. The lots making larger gains generally produced larger and heavier fleeces.

A comparative appraisal was made by a commission firm representative following shearing. He considered the lot receiving the beet top silage, the lot receiving the 6 mg. implants of stilbestrol, and the lot of lambs receiving the pelleted ration the best lambs, with the wheat pasture lambs almost as good. He ranked the remaining lots lower and thought they probably would sell in about the same price range. Other observers at the Feeders' Day program thought the sorghum-pasture lambs and the lambs receiving "Synovex" implants were of lower finish and quality.

Only two lambs were lost in the tests this year, both from "over-eating disease."

Appreciation is expressed to Eli Lilly Company, Indianapolis, Ind., for the stilbestrol pre-mix fed; to Norden Laboratories, Lincoln, Neb., for the stilbestrol pellets; and to Syntex Animal Products Company, Kansas City, Mo., for the estradiol-progesterone (Synovex) pellets.

Use of Hormones

PROJECT 111 GC

T. Donald Bell, Walter H. Smith, A. B. Erhart, A. W. Gardner, D. L. Mackintosh, and Ralph Soule

In the lamb-feeding tests at the Garden City Branch Station during the 1953-54 feeding season, one lot of 48 lambs was given stilbestrol implants of varying sizes at the beginning of the feeding period. Another lot of 48 lambs was given stilbestrol-progesterone implants at two different dosage levels at the beginning of the feeding period. The performance of these lambs was compared with those in another group of 48 receiving a similar ration of ground sorghum fodder, sorghum grain, protein supplement, and limestone—but no hormone treatment. The preliminary results of the feedlot studies were presented in the 41st Annual Livestock Feeders' Day report of May 1, 1954. Additional feedlot, slaughter, and carcass data were obtained from these lambs and are presented in Table 4.

At the conclusion of the feeding tests the spring of 1954, three lambs from the control lot, three lambs that had received 15 mg. stilbestrol implants, and three lambs that had received 12 mg. of stilbestrol and 120 mg. of progesterone in pellet implants at the beginning of the tests were brought to Manhattan for detailed carcass studies. The information from these studies is presented in Tables 5, 6, and 7.

Table 4.—Feedlot performance, shrinkage to market, and carcass grades and yields of lambs receiving hormone implants and of lambs receiving a similar ration with no hormone treatment.

	Stilbestrol implants				Stilbestrol-progesterone implants[1]			Controls
	6 mg.	12 mg.	15 mg.	Total	2 pellets	1 pellets	Total	No treatment
Number of lambs	17	16	15	48	25	23	48	48
Daily rate of gain	.31	.34	.34	.33	.33	.34	.33	.25
Shrink to market, %[2]				9.3			9.3	9.3
Carcass yield, %				46.5			46.1	50.0
Carcass wt., lbs.				44.2			44.3	43.7
Carcass grades[3]								
Choice								5
Good				12			11	31
Utility				31			28	10
Cull				2			5	1
Average		High utility				Utility		Good

1. Each pellet contained 3 mg. stilbestrol and 20 mg. progesterone.
2. Shrinkage figured on loss of weight while trucking from Garden City to Wichita.
3. A representative portion of the lambs was used for detailed carcass studies and was not taken to Wichita.

Table 5.—Slaughter and carcass information secured from lambs receiving hormone implants at the beginning of the feeding period, and from lambs receiving a similar ration but given no hormone implants.

	Lambs given 15 mg. stilbestrol implants (Av. of 3 lambs)	Lambs given stil.-prog. implants* (Av. of 3 lambs)	Lambs given no hormone (Av. of 3 lambs)
Live wt., lbs.	90.5	93.0	88.0
Dressed wt., lbs.	43.3	46.3	45.0
Chilled wt., lbs.	42.2	45.0	43.5
Difference in hot and chilled wt., lbs.	1.1	1.3	1.5
Dressing percentages			
Based on cold wt.	47.0	48.1	50.0
Based on hot wt.	48.2	50.0	52.0
Shorn pelt wt., lbs.	13.2	13.0	11.1
Weight of organs, gms.			
Liver	645.0	662.0	552.0
Spleen	63.0	59.0	71.0
Kidney	108.0	105.0	96.0
Heart	146.0	150.0	131.0
Blood wt., lbs.	3.7	3.7	3.5
P.H. of liver	6.0	6.1	6.0
P.H. of spleen	6.2	6.2	6.1
Rib cut percentages:			
Eye	17.9	18.0	*18.1
Other lean	34.4	34.0	30.0
Fat	22.5	23.0	28.0
Bone	25.3	26.0	24.0
Carcass grades	Low good	Low good	Good

* Lambs were given 4 pellets containing a total of 12 mg. stilbestrol and 120 mg. progesterone.

Table 6.—Cooking and palatability data for legs of lamb from lambs receiving hormone implants and those receiving no implants.[1]

	Lambs given 15 mg. stilbestrol implants (Av. of 3 legs)	Lambs given stil.-prog. implants[2] (Av. of 3 legs)	No hormone controls (Av. of 3 legs)
Volatile loss, %	16.1	18.6	17.7
Drip loss, %	5.5	4.4	5.6
Total loss, %	21.7	23.1	23.3
Desirability scores[3]			
Aroma	5.9	5.9	6.0
Lean	5.8	6.4	6.4
Fat	5.7	5.0	5.5

Table 6 (Continued).

Tenderness score[2]	6.0	5.8	6.1
Shear value, lbs.	10.9	16.9	16.0
Juiciness score[2]	5.1	6.1	5.5
Press fluid yield M1/25g.	7.9	8.1	8.0
Comments	Soft, with little fat		

1. This work was done by The Home Economics Department of the Kansas Agricultural Experiment Station.
2. Maximum score, 7.

Table 7.—Chemical analyses of meat from hormone-treated and untreated lambs.

	Moisture %	Ash %	Ether extract %	Total nitrogen %
Lambs given 15 mg. stilbestrol implants:				
Rib eye	73.92	1.04	4.31	3.33
Other lean	65.20	.96	16.21	2.99
Fat	17.19			
Lambs given stilbestrol-progesterone implants:				
Rib eye	74.07	1.05	4.11	3.29
Other lean	65.74	.96	14.94	3.07
Fat	22.62			
Controls—no hormones:				
Rib eye	73.01	1.04	5.18	3.35
Other lean	60.72	.96	17.64	3.17
Fat	16.11			

Tables 8 and 9 show the comparative measurements of the urogenital systems of lambs receiving the hormone implants, and those that received no implants. They were recovered at the time of slaughter in the Wichita packing plant in the 1954 studies, and in the 1955 tests were taken from the 40 lambs brought to Manhattan for detailed carcass studies.

In the 1954-55 tests at Garden City, four lots of 50 lambs each were fed basal rations of ground sorghum stover, sorghum grain, cottonseed meal, salt, and limestone. The lambs in one lot received pellet implants containing 6 mg. stilbestrol at the beginning of the test; those in another lot received pellet implants of estradiol and progesterone containing 10 mg. of estradiol and 250 mg. of progesterone; those in another lot were fed 2 mg. of stilbestrol per head daily in their feed; and those in the control lot were given no hormones.

Following the Lamb Feeders' Day at Garden City March 5, 1955, 10 lambs from the control lot and 10 from each of the three hormone-treated lots were brought to Manhattan to secure additional information. The detailed study of the carcasses of these lambs is being made jointly by the Departments of Animal Husbandry, Chemistry, and Home Economics. Results of their studies will be made at a later date.

The shrink in bringing these lambs from Garden City to Manhattan is shown in Table 10, together with the carcass grades of the four groups of lambs. Measurements of the urogenital system from these lambs are shown in Table 8.

Table 8.—Comparative size of organs of the urogenital systems of wether lambs given hormones and of untreated lambs.

	Number of lambs	Seminal vesicles		Bladder		Ampullae diameter	Urethra and prostate diameter	Cowper's glands, diameter
		Length	Width	Length	Width			
		mm	mm	mm	mm	mm	mm	mm
1954								
No hormone	20	12.4	8.0	38.0	23.2	3.3	10.8	9.4
Stil. implants:								
6 mg.	6	20.1	12.3	48.0	25.0	4.4	18.1	11.7
12 mg.	6	23.6	15.2	43.0	29.3	6.1	18.1	19.5
15 mg.	7	24.8	16.9	41.8	29.8	7.0	16.0	16.6
Stil.-prog. implants:								
2 pellets	13	23.4	15.7	45.8	27.0	6.6	16.3	15.8
4 pellets	9	25.8	17.0	46.1	27.4	7.0	17.7	18.9
1955								
No hormone	10	16.0	7.4	43.5	23.4	3.4	13.7	8.6
6 mg. stil. implants	8	21.2	11.9	47.5	29.5	5.3	16.1	13.5
Stil. in feed (2 mg. daily)	10	26.4	13.3	50.1	29.6	5.7	18.3	14.2
Estradiol prog. pellet implants (10 mg. estradiol 250 mg. prog.)	10	25.6	15.4	62.8	35.8	6.6	21.3	19.6

Table 9.—Comparative size of organs of the urogenital systems of ewe lambs given hormone implants and those receiving no implants.

	Number of lambs	Diameter of cervix mm	Ovaries: Length mm	Ovaries: Width mm	Diameter of largest follicle mm	Bladder: Length mm	Bladder: Width mm	Diameter of body of uterus mm
1954								
No hormone	21	12.3	14.7	11.2	5.2	40.5	25.0	15.1
6 mg. stil. pellet implants	9	11.7	14.2	10.8	5.2	49.0	28.5	14.4
12 mg. stil. pellet implants	8	14.1	17.0	13.1	5.2	45.5	27.5	16.6
15 mg. stil. pellet implants	9	15.1	18.0	12.0	3.3	49.1	29.0	18.4
Stil. and prog. implants:								
2 pellets	12	13.6	16.0	10.4	2.3	45.8	26.6	14.8
4 pellets	12	14.8	14.6	10.9	2.7	42.9	28.0	14.9

Table 10.—Shrink in transit and carcass grades of hormone-treated lambs and untreated lambs.

Treatment	Number of lambs	% Shrink—Garden City to Manhattan	Carcass grades*					
			C	C–	G+	G	G–	U+
Controls—no treatment	10	4.67		4	6			
6 mg. stilbestrol implants ..	10	4.54	2	4	4			
Estradiol-progesterone implants	10	5.75			4	5		1
Stilbestrol in the feed (2 mg. daily)	10	5.11		3	3	4		

* C = choice, G = good, U = utility.

Observations

In the 1953-54 tests, feeder lambs given either stilbestrol implants or stilbestrol-progesterone implants made larger gains in the feed lot than lambs receiving a similar ration, but receiving no hormone treatment. The hormone-treated lambs, however, yielded between 3.5 and 4.0 percent less than the controls when slaughtered, and the hormone lambs graded nearly a full grade less than the untreated lambs.

The untreated lambs and those receiving the 6 mg. stilbestrol implants in the 1954-55 tests were graded higher on foot than either the lambs receiving stilbestrol in their feed, or those receiving the estradiol-progesterone pellet implants. The lambs receiving the hormones carried their tails higher and some swelling was evident in their rectal region. The swellings were particularly evident in lambs receiving the estradiol-progesterone implants, and some lambs were showing considerable discomfort at the end of the 105-day feeding period.

Based on a sample of 10 lambs from each of the four groups, shrinkage in transit was less on the untreated lambs and those receiving the 6 mg. stilbestrol implants. These lambs also had higher grading carcasses. The estradiol-progesterone treated lambs graded the lowest and had watery, slimy carcasses that failed to harden in the cooler.

Detailed slaughter and carcass studies of hormone-implanted lambs and untreated lambs in the 1953-54 tests showed that the untreated lambs yielded and graded higher with a larger proportion of fat and a lower proportion of bone than the lambs receiving the hormone implants. The hormone-treated lambs had larger livers, kidneys, and hearts and had a greater blood weight than the control lambs.

Cooking and palatability tests did not indicate any consistent differences in cooking losses, palatability, tenderness, or juiciness between the control and treated lambs.

A chemical analysis of the rib eyes, other lean, and fat from rib cuts showed that the hormone-treated lambs had a higher percentage of moisture in all three portions, and had a lower percentage of ether extract or fat.

The hormones, either as implants or given in the feed, have increased the size of the organs of the urogenital systems of wether lambs. Previous work showed that the stimulated growth of the Cowper's glands and of the prostate and urethra may block the urethral passage and cause lethal complications.

The increase in size of the organs is generally associated with the size of the dosage. Inclusion of progesterone in the pellet implant does not prevent the growth stimulation. Differences in the urogenital systems of female lambs given the hormones in the feed or as implants are not so apparent as those shown by the wether lambs. The bladders of the treated ewe lambs are larger than those from untreated lambs. Larger pellet implants of stilbestrol and the implants containing both stilbestrol and progesterone apparently inhibited follicle development in the ovaries.

The Relationship of Physical Balance in the Utilization of Pelleted and Non-pelleted Rations for Lambs.

PROJECT 236

T. Donald Bell, Draytford Richardson, R. F. Cox, J. W. Needham, and Russell John

This project was designed to study the difference between pelleted and non-pelleted rations of different concentrations. Many commercial lamb feeders are pelleting the entire ration and believe it is superior to the same ration hand-fed. At the present time, the extra cost of pelleting varies from $8-$12 per ton. This test and others are designed to determine whether there is enough additional gain in weight and feed efficiency to warrant the use of pelleted rations, and to determine the most desirable ratio of roughage to concentrate.

Experimental Procedure

Seventy-nine black-faced feeder lambs were used in this study. The lambs were purchased at the Kansas City stock yards and weighed approximately 75 pounds each when purchased. The lambs arrived at the Kansas State College station in early October and were placed in dry lot on arrival. They were fed prairie hay three days and then changed to alfalfa hay. Small amounts of cracked corn were added until the lambs were approximately on full feed. The top 16 lambs by weight were separated and used for digestibility trials corresponding to the same rations used for the feeding tests. The lambs in the remaining group were weighed and lotted randomly into four lots of 10 lambs each and four lots of five lambs each. The four lots, in which the pellets were to be fed, were changed to pellets and for the first few days a limited amount of alfalfa hay was provided. The trial began November 2 and continued 86 days. The rations fed to the lots were as follows:

Lot 1—Pelleted ration (65 percent dehydrated alfalfa hay and 35 percent corn).
Lot 2—Pelleted ration (55 percent dehydrated alfalfa hay and 45 percent corn).
Lot 3—Sixty-five percent chopped alfalfa hay and 35 percent cracked corn.
Lot 4—Fifty-five percent chopped alfalfa hay and 45 percent cracked corn.
Lot 5—Same as Lot 1, individually self-fed.
Lot 6—Same as Lot 2, individually self-fed.
Lot 7—Same as Lot 3, individually self-fed.
Lot 8—Same as Lot 4, individually self-fed.

Lots 1, 2, 3, and 4 received the same amount of total digestible nutrients daily until the latter part of the feeding period, when Lot 2 went off feed and had to have the volume of feed lowered. At this time, Lot 1 was eating all the pellets they would clean up so they were left on the same quantity of feed, but Lots 3 and 4 were raised to a higher level of feed intake.

The alfalfa hay used in this trial was harvested from the same area for the pelleted and non-pelleted feeds. For the pelleted rations, the alfalfa hay was taken from the field as it was cut and then dehydrated. The hay for the unpelleted rations was cured in the field, baled, and then chopped. The corn for all rations was taken from the same bulk at the Manhattan elevator.

The individually fed lambs (lots 5, 6, 7, and 8) were placed in separate feeding pens two hours night and morning. Small self-feeders were used for each lamb. The lambs fed as a group (Lots 1, 2, 3, and 4) were hand-fed twice daily. Water and salt were before the lambs at all times.

Table 11.—Feedlot performance of lambs fed pelleted and non-pelleted rations of varying concentrations.

Lot number	1	2	3	4	5	6	7	8
Ration fed	Pellet, 35% corn, 65% dehydrated alfalfa	Pellet, 45% corn, 55% dehydrated alfalfa	35% cracked corn, 65% chopped hay	45% cracked corn, 55% chopped hay	Same as Lot 1 self-fed	Same as Lot 2 self-fed	Same as Lot 3 self-fed	Same as Lot 4 self-fed
Number lambs per lot	9	9	9	8	5	5	4	5
Days on feed	86	86	86	86	86	86	86	86
Initial wt. per lamb	81.6	81.8	83.9	83.4	83	83	82.5	81.6
Final wt. per lamb	111.5	101.4	108.2	109.6	111.8	107.0	96	101.6
Total gain per lamb	30.3	19.6	24.3	26.2	28.8	24.0	13.5	20.0
Daily gain per lamb	.352	.228	.283	.306	.335	.279	.159	.233
Feed per lamb daily, total	2.92	2.51	3.02	2.93	2.76	2.51	2.51	2.75
Pellet	2.92	2.51			2.76	2.51		
Cracked corn			1.05	1.32			.88	1.24
Chopped hay			1.97	1.61			1.63	1.51
Feed per 100 lbs. gain, total	829	1100.4	1070.0	962.5	824.2	901.0	1600.6	1182.0
Pellet	829	1100.4			824.2	901.0		
Cracked corn			374.0	432.8			560.2	531.9
Chopped hay			696.0	529.7			1040.4	650.1
Feed cost per cwt. gain	$19.14	$26.41	$17.98	$17.71	$19.02	$21.62	$26.89	$21.75
Feed cost per lamb	$ 5.80	$ 5.18	$ 4.30	$ 4.64	$ 5.48	$ 5.19	$ 3.63	$ 4.35
Live market grade	5.11	6.20	5.73	6.05	5.06	5.20	5.02	5.60
Number lambs died				1			1	
Number lambs removed	1	1	1	1				

Table 12.—Chemical composition of feeds used.

Description	Protein	Ether extract	Crude fiber	Moisture	Ash	N.F.E.	C.H.O.
Pellet (55% alfalfa hay) (45% corn)	15.19	4.07	12.15	7.75	7.20	53.64	65.79
Pellet (65% alfalfa hay) (35% corn)	15.00	3.84	14.86	7.35	7.94	51.01	65.87
Corn	10.75	4.00	2.15	10.19	1.69	71.22	73.37
Hay	13.06	1.78	33.88	5.40	8.22	37.66	71.54

Individual weights were taken at the beginning of the trial, every two weeks during the test, and at the end of the test. The lambs were graded by three college staff members and the results are found in Table 11. The grades were given a numerical value and are as follows:

Top choice 4	Top good 7
Middle choice 5	Middle good 8
Low choice 6	Low good 9

Average daily gain, feed intake, feed consumed per 100 pounds gain, and financial results are shown in Table 11. Chemical analyses of all feedstuffs are shown in Table 12 on page 16.

The results of the digestion trials and balance studies are shown in Table 13.

Table 13.—Digestion and balance studies with lambs receiving pelleted and non-pelleted rations of varying concentrations.

Lot number	A	B	C	D
Ration fed	65% chopped alfalfa 35% cracked corn	55% chopped alfalfa 45% cracked corn	Pellet 35% corn 65% dehy. alfalfa	Pellet 45% corn 55% dehy. alfalfa
Number of lambs	16	16	15	16
% T.D.N.	62.12	65.75	61.52	67.54
Digestion coefficients:				
Protein	62.03	65.84	66.37	71.76
Ether extract	50.53	63.65	62.07	77.60
Crude fiber	52.18	50.52	25.77	27.47
N.F.E.	80.35	83.32	83.06	86.25
% nitrogen retained	0.19	2.20	15.56	26.26

Results and Discussion

With one exception, the lambs given pelleted rations of similar concentration and similar feeding management made larger and more efficient gains than lambs given the unpelleted rations. This exception was in Lot 2, which went off feed several times; therefore, their gains were lower and less efficient than the gains of group-fed lambs on a similar but unpelleted ration.

Pelleted rations made up of 65 percent alfalfa hay and 35 percent corn gave better results when fed either individually or in groups than did pelleted rations containing 55 percent alfalfa and 45 percent corn; however, unpelleted rations containing 55 percent alfalfa and 45 percent corn produced larger and more efficient gains than the unpelleted rations containing the higher percentage of alfalfa hay.

Despite this greater efficiency of gain obtained by feeding the pellets, the cost of gain was considerably higher when the pellets were fed because of the high cost of pelleting.

There was only one-third of an average grade difference between the highest and lowest grading lots, and this difference is probably not significant.

Two lambs were lost during the trial, one from enterotoxemia and the other from an undetermined cause. Four lambs were removed from the test because of abnormal results which may or may not have been a result of this experiment.

The protein of the pelleted ration was more efficiently digested and the percentage of nitrogen retained was greater than from the unpelleted rations. The fat and ether extract portions were also more efficiently utilized in the pelleted ration than in the unpelleted rations. The fiber, however, was much less completely digested when the pelleted rations were fed, and consequently there was little difference in the amount of total digestible nutrients in the pelleted and non-pelleted rations.

Adaptability of Breeds of Rams and Breed-Types of Range Ewes to Market Lamb Production in Kansas.

PROJECT 347

T. Donald Bell, Lewis A. Holland, and A. W. Gardner

Western ewes of the three predominant types (Texas ewes or fine wools, Blackface crossbreds, and Northwestern Whiteface crossbreds) commonly found in Kansas were obtained as ewe lambs in the fall of 1951 and bred to Hampshire, Suffolk, Shropshire, and Southdown rams two seasons. A different set of yearling rams has been used each year, and the ewes are being rotated so that no ewes are bred to the same breed of ram each year. Lamb production and wool production records are being obtained from the different types of ewes, and lamb production figures are being obtained for the four sire groups.

Results

Lamb production figures for the 1953-54 lamb crop are presented in Table 14 and the preliminary lambing data and lamb production for 1954-55 are shown in Table 16 on page 19.

Table 14.—Lamb production by ewes of different types and from sires of different breeds in 1954.

Ewe types	Number ewes bred	Number lambs weaned	% lambs weaned	Average weaning weight	Pounds lamb weaned per ewe bred
Finewools	50	44	88	93	82
Northwest Whiteface	42	38	93	86	78
Northwest Blackface	52	47	90	87	79
Sire groups					
Hampshire	36	35	97	90	88
Suffolk	35	28	80	95	76
Southdown	37	32	86	89	77
Shropshire	36	34	94	82	78

The lambs were separated by sire groups following lambing and the ewes in each group were fed similar rations consisting of approximately 6 pounds of sorghum silage, 1½ pounds of alfalfa hay, and 1½ pounds of grain per head daily.

The lambs in each group were creep-fed and a record was kept of the concentrates eaten. The creep concentrate mixture was made up of 1 part oats, 2 parts milo, 1 part corn, 1 part bran, 1 part dehydrated alfalfa pellets (including 35 percent corn), and ½ part soybean oil meal. The gains and feed consumption of the different groups of lambs are shown in Table 15.

Table 15.—Feed consumption and rate of gain of lambs of different breeding—March 3, 1955, to March 29, 1955.

Sire group	Number of lambs	Daily concentrate consumption in creeps, lbs.	Average daily gain, lb.	Gain per pound of creep feed consumed
Hampshire	45	1.62	.72	.395
Suffolk	44	1.95	.70	.334
Southdown	10	1.73	.55	.313
Shropshire	40	1.32	.64	.482
Ewe group				
Finewools	49		.61	
Northwest Whiteface	34		.76	
Northwest Blackface	56		.74	

Table 16.—1955 lambing data and lamb production from ewes of different types and from sires of different breeds.

Ewe types	Number ewes bred	Average lambing date	Birth weight: Singles	Birth weight: Twins	% lambs born	Number of lambs alive 3-29-55	Average weights 3-29-55
Finewools	50	11-30-54	10.7	8.3	106	49	82.6
Northwest Whiteface	41	1-3-55	11.7	9.8	90	35	67.9
Northwest Blackface	50	1-6-55	10.5	9.6	116	58	64.0
Sire groups							
Hampshire	35	12-24-54	10.3	9.4	132	46	66.1
Suffolk	35	12-18-54	11.5	9.0	131	46	80.0
Southdown	35	12-10-54	9.4	7.9	28	10	74.3
Shropshire	36	12-30-54	11.4	9.5	122	40	66.8

Table 17 gives the average body weights following lambing in 1955 and the grease wool production for 1955.

Table 17.—Body weights of and wool production from ewes of different types.

	1955 grease wool production, pounds per head	Body weight in pounds per head following lambing, 1954-55
Finewools	10.68	129
Northwest Whiteface	12.07	157
Northwest Blackface	9.05	166

Discussion and Conclusions

The Texas ewes have bred and lambed earlier than the other two types of ewes in the three years that the tests have been conducted. The difference was greatest in the 1954-55 tests when the fine-wool ewes had an average lambing date more than a month earlier than the other two groups. Because of earlier lambing dates, lambs from fine-wool ewes reach market weights earlier than lambs from the other groups. This early lambing characteristic of fine-wool ewes is of considerable practical importance in the fall lambing program that is popular in Kansas.

The Whiteface crossbred ewes generally produced the heaviest fleeces, followed by the Finewools. There have been no consistent differences among the three types of ewes in lambing or weaning percentages. Lambs from Blackface crossbred ewes have graded a little higher when slaughtered than the other two groups.

Lambing and weaning data for the lambs sired by Hampshire, Suffolk, Southdown, and Shropshire rams have not been consistent. Additional information is needed before any definite conclusions can be drawn. The limited information indicates that Hampshire- and Suffolk-sired lambs gain faster than Southdown- or Shropshire-sired lambs. Shropshire-sired lambs, however, have put on gains with less feed than lambs in the other sire groups. The carcasses of Southdown-sired lambs graded highest in 1954 but were no better than those of Hampshire-sired lambs in 1953. Lambing and weaning percentages have varied in the previous tests with no consistent advantage shown by Hampshire-, Suffolk-, Shropshire-, or Southdown-sired groups. The Southdown ram failed to settle a large proportion of the ewes allotted to him the fall of 1954.

Swine

Swine Feeding Investigations

The Comparative Value of Greenleaf Sudangrass and Common Sudangrass as Pasture for Fattening Spring Pigs.

PROJECT 110, Test 1

C. E. Aubel

This experiment in the summer of 1954 used spring pigs on pasture. It was to compare the quality of the two varieties of sudangrass.

Two lots were fed shelled corn and a mixed animal and plant protein supplement composed of 5 parts tankage, 4 parts soybean meal, and 1 part cottonseed meal. Both were self-fed, free choice. Lot 1 was pastured on Greenleaf sudangrass; Lot 2, on Common sudangrass.

The pastures were the same quality and stand. Both furnished ample green forage throughout the test. It was necessary to clip the pastures during the summer to get rid of headed-out stalks and provide good, leafy forage. Both stood the dry weather equally well and were relished equally by the pigs, as well as could be determined by observations.

Results of the experiment are given in Table 18.

Table 18.—Comparative value of Greenleaf sudangrass and Common sudangrass as forage for fattening spring pigs.

(June 12, 1954-September 9, 1954—89 days)

Ration fed	Shelled corn and protein mixed supplt.	
	Greenleaf sudangrass pasture	Common sudangrass pasture
Lot number	1	2
No. pigs in lot	10	9
Av. initial wt. per pig, lbs.	54.70	58.11
Av. final wt. per pig, lbs.	185.80	192.55
Av. total gain per pig, lbs.	131.10	134.44
Av. daily gain per pig, lbs.	1.47	1.51
Av. daily ration per pig:		
Shelled corn, lbs.	3.94	4.33
Protein supplt., lb.	.60	.50
Feed per 100 lbs. gain per pig:		
Shelled corn, lbs.	267.50	286.78
Protein supplt., lbs.	40.80	33.47

Observations

1. The pigs on the Greenleaf sudangrass made about the same daily gains as those on the Common sudangrass.

2. The pigs on the Greenleaf sudangrass required 19 pounds of corn less per 100 pounds gain than those on Common sudangrass. They, however, consumed 7 more pounds protein supplement per 100 pounds gain than the pigs pasturing on Common sudangrass.

3. It appeared that either variety of sudangrass is a satisfactory forage for fattening spring pigs.

The Maximum Value of Alfalfa Meal in Protein Supplements for Pigs on Pasture.

PROJECT 110, Test II

C. E. Aubel

Pastures for swine are often poor, inadequate, or unavailable in Kansas. There is a growing appreciation of the value of alfalfa hay or meal in the rations of all swine and brood sows as well as pigs being fed for market. This test was to secure information on the maximum quantity of alfalfa meal that could be used in protein supplement mixtures for pigs on summer pastures and the quantity of alfalfa meal that could be substituted for pasture.

In this test three lots of pigs on sudangrass pasture were self-fed shelled corn and a mixed protein supplement, with varying quantities of alfalfa meal. One group was fed in the dry lot with a large quantity of alfalfa meal in the protein supplement, to ascertain whether or not alfalfa meal thus fed could replace green pasture.

Lot 1 received no alfalfa meal, but a mixed protein supplement of 5 parts tankage, 4 parts soybean meal, and 1 part cottonseed meal.

Lot 2 received 4 parts tankage, 4 parts soybean meal, 1 part cottonseed meal, and 1 part alfalfa meal.

Lot 3 received 4 parts tankage, 4 parts soybean meal, and 2 parts alfalfa meal.

Lot 4, in the dry lot, received 4 parts tankage, 4 parts soybean meal, and 3 parts alfalfa meal.

Results are shown in Table 19.

Table 19.—The maximum value of alfalfa meal in protein supplements for pigs on pasture.

(June 12, 1954-September 9, 1954—89 days)

	Shelled corn, sudangrass pasture, mixed protein supplt.			Shelled corn, mixed protein supplt. in dry lot
Ration fed	5 parts tankage, 4 parts S.B.M., 1 part C.S.M.	4 parts tankage, 4 parts S.B.M., 1 part alf. meal, 1 part C.S.M.	4 parts tankage, 4 parts S.B.M., 2 parts alf. meal	4 parts tankage, 4 parts S.B.M., 3 parts alf. meal
Lot number	1	2	3	4
No. pigs in lot	9	10	10	8
Av. initial wt. per pig, lbs.	58.11	55.40	55.50	56.12
Av. final wt. per pig, lbs.	192.55	195.00	188.10	199.37
Av. total gain per pig, lbs.	134.44	139.60	132.60	143.25
Av. daily gain per pig, lbs.	1.51	1.56	1.49	1.60
Av. daily ration per pig:				
Shelled corn, lbs.	4.33	4.19	4.01	4.50
Protein supplt., lb.	.50	.72	.65	.77
Feed per 100 lbs. gain per pig:				
Shelled corn, lbs.	286.78	267.55	269.68	280.10
Protein supplt., lbs.	33.47	46.20	43.96	47.99

Observations

1. The Lot 2 pigs receiving the mixed protein supplement of 4 parts tankage, 4 parts soybean meal, 1 part cottonseed meal, and 1 part alfalfa meal made the best gains of pigs on pasture. Lot 3 pigs receiv-

ing 2 parts alfalfa meal made about the same gains as the Lot 1 pigs that received no alfalfa meal. Best gains of all were made by Lot 4, pigs in the dry lot that received the largest amount of alfalfa meal. They gained 1.60 pounds per day. The pigs in this lot also consumed daily more feed than the others and required more feed per 100 pounds gain. Thus the gains were more expensive in dry lot than on pasture.

3. The test indicates that the quantity of alfalfa meal that can be fed to pigs on pasture, without affecting their gains, is limited. However, economical gains can be produced using large quantities of alfalfa meal.

Varying Amounts of Alfalfa Meal in the Rations of Spring Pigs and in Dry Lot.

PROJECT 110, Test III

C. E. Aubel

Summer of 1954 test with spring pigs was to get information on the maximum use of alfalfa meal in protein supplemental mixtures for pigs in the dry lot.

Four lots of pigs were self-fed shelled corn and a mixed protein supplement.

Lot 1 pigs were fed sudangrass pasture and self-fed a protein supplement of 4 parts tankage, 4 parts soybean meal, 1 part cottonseed meal, and 1 part alfalfa meal.

Lot 2 received the same protein supplement as Lot 1 for 38 days or until the pigs weighed 100 pounds. They were then removed from the pasture and put into a dry lot and fed a protein supplement of equal parts tankage and alfalfa meal until the close of the experiment, when they weighed 197 pounds.

Lot 3 was fed in the dry lot the entire feeding period on a protein mixture of 4 parts tankage, 4 parts soybean meal, and 3 parts alfalfa meal.

Lot 4 was fed in the dry lot the entire feeding period with an increased alfalfa meal allowance, a protein supplement mixture of 5 parts tankage, and 5 parts alfalfa meal.

Results are given in Table 20.

Table 20.—Varying amounts of alfalfa meal in the rations of spring pigs in the dry lot.

(June 12, 1954-September 9, 1954—89 days)

	Shelled corn, sudangrass past., mixed prot. supplt.		Shelled corn, mixed prot. supplt. in dry lot		
	4 parts tankage, 4 parts S.B.M., 1 part C.S.M., 1 part alf. meal	4 parts tankage, 4 parts S.B.M., 1 part C.S.M., 1 part alf. meal	5 parts tankage, 5 parts alf. meal	4 parts tankage, 4 parts S.B.M., 3 parts alf. meal	5 parts tankage, 5 parts alf. meal
Lot number	1	2	2	3	4
		(June 12-July 20—38 days)	(July 20-Sept. 9—51 days)		
No. pigs in lot	10	10	10	8	9
Av. initial wt. per pig, lbs.	55.40	56.60	99.50	56.12	57.22
Av. final wt. per pig, lbs.	195.00	99.50	196.88	199.37	179.44

Table 20 (Continued).

Av. total gain per pig, lbs.	139.60	42.90	97.38	143.25	122.22
Total gain, Lot 2—entire period		140,28			
Av. daily gain per pig, lbs.	1.56	1.12	1.90	1.60	1.37
Av. daily gain per pig, lbs., Lot 2—entire period		1.57			
Av. daily ration per pig:					
Shelled corn, lbs.	4.19	3.15	4.98	4.50	4.17
Protein supplt., lb.	.72	.39	.75	.77	.74
Feed per 100 lbs. gain per pig:					
Shelled corn, lbs.	267.55	279.72	261.24	280.10	303.64
Protein supplt., lbs.	46.20	34.96	39.43	47.99	51.73
Feed per 100 lbs. gain per pig: (Lot 2) for entire period					
Shelled corn, lbs.		266.89			
Protein supplt., lbs.		38.06			

Observations

In this experiment Lot 1 pigs on pasture the entire feeding period and Lot 2 pigs on pasture only about one-half the feeding period (then placed in the dry lot) made about the same gains. They gained 1.56 and 1.57 pounds daily for the period with almost exactly the same feed per 100 pounds gain, except that the pigs in dry lot one-half the time (on increased alfalfa meal) consumed 8 pounds less protein supplement than the pasture-grazed pigs.

The daily gains of those on dry lot one-half time were about the same as Lot 3 (fed the entire time in dry lot with 3 parts alfalfa meal). Lot 3 pigs used 23 pounds more feed per 100 pounds gain than Lot 2 pigs.

The Lot 4 pigs made the poorest showing of all with a daily gain of 1.37 pounds, and they had a rather high requirement of feed per 100 pounds gain.

Conclusion

Results indicate thus far that when the allowance of alfalfa meal in a ration is too high, efficiency decreases. But a ration of proper quantities of alfalfa meal, fed in the dry lot, will be as efficient as pasture and a smaller quantity of alfalfa meal.

More tests are needed to verify these observations.

The Comparative Value of Corn and Whole and Ground Milo as Swine-Fattening Feeds.

PROJECT 110, Test IV

C. E. Aubel

Sorghum grains are grown extensively in parts of Kansas for hog feed. In previous feeding tests with hogs at this station, some sorghum

grains have given excellent results compared with corn. In 1950 Westland and Midland milos gave 12 percent greater daily gain than corn. The economy in feed per 100 pounds gain was about 5 percent better from sorghum grain than from corn. Because corn has been more difficult to produce in Kansas, while sorghum grains have increased in popularity, it was thought advisable to compare sorghum grain with corn again.

Four lots of pigs were self-fed in dry lot. All lots received a mixed animal and plant protein supplement of 4 parts tankage, 4 parts soybean meal, 1 part linseed meal, and 1 part alfalfa meal. The milo was an unidentified variety, straight elevator run. Lot 1 received shelled corn; Lot 2, whole milo; Lot 3, coarsely ground milo from a burr mill; Lot 4, ground milo. The protein supplement mixture for this lot contained aureomycin supplied as Aurofac at the rate of 27 pounds per ton.

Table 21 gives the results.

Table 21.—Comparative value of corn and milo as swine-fattening feeds.

Ration fed, 91 days	Shelled corn, protein mixed supplt., min. mix.	Whole milo, protein mixed supplt., min. mix.	Burr mill ground milo, protein mixed supplt., min. mix.	Ground milo, protein mixed supplt., 27 lbs. Aurofac per ton min. mix.
Lot number	1	2	3	4
Number pigs in lot	10	10	9	9
Av. initial wt. per pig, lbs.	51.90	51.70	53.11	52.55
Av. final wt. per pig, lbs.	202.90	219.20	223.22	224.32
Av. total gain per pig, lbs.	151.00	162.50	170.11	171.77
Av. daily gain per pig, lbs.	1.65	1.78	1.86	1.88
Av. daily ration per pig:				
Grain, lbs.	5.40	6.26	6.42	6.34
Protein mix, lb.	.89	.90	.91	.92
Lbs. feed per 100 lbs. gain per pig:				
Grain	325.82	350.89	339.64	323.42
Protein mix	54.17	50.76	48.85	48.77
Mineral mix	.08	.07	.06	.06

Observations

1. Whole milo produced about 8 percent greater gains in pigs than was produced by corn.
2. Daily gains of pigs fed ground milo were about 12 percent greater than daily gains of pigs fed corn.
3. Ground milo was more efficient than whole milo.
4. Adding aureomycin to the ration reduced the amount of feed required per 100 pounds gain.
5. Milo was palatable. Each lot fed milo consumed more of it daily than the amount of corn consumed daily by the corn-fed lot.
6. Milo was a satisfactory grain in all respects and was better than corn, in these tests, for fattening pigs.

Some Studies on Breeding Market Pigs by Crossing Duroc with Beltsville No. 1 for Meat-type Hogs.

PROJECT 242

C. E. Aubel

Much discussion in Kansas has concerned the desirability of crossbreeding inbred breeds (so-called hybrids) with other breeds for meat-

type hogs. Consequently, a Beltsville No. 1 (Poland x Landrace origin) was secured and matings planned with a Duroc. The test was to study vigor and size of the litter produced and ultimate performance in the feedlot of the litter compared with performance of purebred Duroc pigs raised under comparable conditions.

In the winter of 1953-54, six purebred Duroc sows were mated to a Duroc boar, and six Duroc sows were mated to a Beltsville No. 1 boar.

Results are given in Table 22.

Table 22.—Some studies on breeding market pigs by crossing Durocs with a Beltsville No. 1 boar for meat-type hogs.

Farrowing Data—Spring, 1954

	Purebred Duroc	Beltsville No. 1 x Duroc
Lot number	1	2
Number sows farrowed	6	6
Av. number pigs/litter	9.0	9.1
Av. birth wt. of pigs	2.1	2.4
Av. strong pigs/litter	6.1	7.6
Av. weak pigs/litter	2.5	.8
Av. born dead/litter	.3	.5
Av. 5-day wt. pigs in litter	3.3	3.6
Av. 56-day wt. pigs in litter	21.9	21.8
Av. pigs weaned/litter	7.2	6.4

From the pigs farrowed, 25 purebred Duroc pigs and 23 crossbred Beltsville No. 1 x Duroc pigs were selected to be fed for market. They were self-fed in separate groups on corn, tankage, and sudangrass pasture. Their initial weights were 34.63 pounds, purebred Durocs; 36.52 pounds, crossbreds. The following data show the results of this feeding test.

Table 23.—Some studies on breeding market pigs by crossing.

(June 9, 1954, to October 5, 1954—118 days)

	Shelled corn, tankage (self-fed on sudangrass)	
	Purebred Duroc	Beltsville No. 1 x Duroc
Lot number	1	2
Number pigs in lot	25	23
Av. birth wt. of pigs, lbs.	2.1	2.4
Av. 56-day wt. of pigs, lbs.	21.9	21.8
Av. initial wt. on feed, lbs.	34.63	36.52
Av. final wt. on feed, lbs.	188.12	188.26
Av. total gain/pig, lbs.	153.49	151.74
Av. daily gain/pig, lbs.	1.30	1.28
Feed/day/pig:		
Shelled corn, lbs.	3.47	3.40
Tankage, lb.	.80	.70
Feed for 100 lbs. gain/pig:		
Shelled corn, lbs.	258.08	265.18
Tankage, lbs.	57.35	54.44

Observations

The purebred pigs gained 153 pounds with 315.43 pounds of feed for 100 pounds gain, while the crossbred pigs gained 151.74 pounds with 319.62 pounds of feed for 100 pounds gain.

The Comparative Value of New Corn (1954 Crop) and Old Corn (Government Stored 1948-49) for Fattening Fall Pigs in Dry Lot.

PROJECT 110

C. E. Aubel

Numerous inquiries to the Department of Animal Husbandry in recent months concerning the probable value for hog feed of corn stored several years under government supervision prompted this test.

This experiment was initiated and conducted during the winter of 1954-55, starting with fall-farrowed pigs weighing about 55 pounds.

Three lots totaling 25 pigs were fed. Lot 1 was self-fed **shelled** old corn that had been government stored since 1948-49. Lot 2 was self-fed the same corn **ground**, and Lot 3 was the control group self-fed shelled new corn. All lots were self-fed free choice a mixed animal and plant protein supplement of 4 parts tankage, 4 parts soybean meal, 1 part cottonseed meal, and 1 part alfalfa meal, in dry lot.

Results are shown in Table 24.

Table 24.—Comparative value of new corn (1954 crop) and old corn (government stored 1948-49) self-fed for fattening fall pigs in dry lot.

(December 7, 1954, to March 15, 1955—98 days)

Ration fed	Shelled old corn	Ground old corn	Shelled new corn
	——Prot. supplt. mixed, self-fed——, 4 parts tankage, 4 parts soybean meal, 1 part cottonseed meal, and 1 part alfalfa meal		
Lot number	1	2	3
Number of pigs in lot	8	8	9
Av. initial wt. per pig, lbs.	55.25	55.25	53.88
Av. final wt. per pig, lbs.	204.75	204.62	205.88
Av. total gain per pig, lbs.	149.50	149.37	152.00
Av. daily gain per pig, lbs.	1.52	1.52	1.55
Av. daily ration per pig:			
Corn, lbs.	4.75	5.12	5.49
Protein supplt., lbs.	1.01	1.14	.95
Lbs. feed per 100 lbs. gain:			
Corn	311.87	349.14	354.53
Protein supplt.	66.47	74.89	61.40

Observations

1. There was little difference among lots in daily gains throughout the 98-day feeding period. Lot 1 on old shelled corn gained 1.52 pounds. Lot 2 on old ground corn made the same gain, and Lot 3 on the new shelled corn gained 1.55 pounds.

2. Daily consumption of the grain indicated that the new corn was a little more palatable. **Ground** old corn was consumed at 5.12 pounds per day compared with 4.75 pounds per day for the shelled old corn. There was a little difference in the protein supplement consumed daily. This might indicate that the old corn was harder than the new corn, and thus not relished.

3. For 100 pounds gain, Lot 1 required 311 pounds of shelled old corn and 66 pounds of protein supplement. Lot 2 required 349 pounds of ground old corn and 74 pounds of supplement. Lot 3 required 354 pounds of new corn and 61 pounds of supplement. All three lots of pigs made excellent use of their corn in making gains. The shelled old corn lot was a little more efficient, although, as noted above, they consumed less feed daily.

It may be concluded from this experiment that old government-stored corn may be expected to produce pork in the feed lot as efficiently as a new crop, when both have similar quality.

The Maximum Use of Alfalfa Meal in Protein Supplemental Mixtures for Fattening Fall Pigs in the Dry Lot.

PROJECT 110

C. E. Aubel

This experiment was designed to secure information on maximum use of alfalfa meal in protein supplemental mixtures for pigs in dry lot. The experiment on next page reports similar information from pigs on alfalfa pasture.

In this 1954-55 test four lots of fall-farrowed pigs were self-fed corn in dry lot. Each lot received different amounts of alfalfa meal in protein supplements. Lot 1 received an animal plant protein mixed supplement of 4 parts tankage, 4 parts soybean meal, 1 part cottonseed meal, and 1 part alfalfa meal. Lot 2 received one of 4 parts tankage, 4 parts soybean meal, and 2 parts alfalfa meal. Lot 3 received one of 4 parts tankage, 4 parts soybean meal, and 3 parts alfalfa meal; and Lot 4 received one of equal parts tankage and alfalfa meal.

Results are given in Table 25.

Table 25.—Maximum use of alfalfa meal in protein supplemental mixtures for fattening fall pigs in the dry lot.

(December 7, 1954, to March 15, 1955—98 days)

	Shelled corn, self-fed			
Protein mixed supplement fed	4 parts tankage, 4 parts S.B.M., 1 part C.S.M., 1 part alf. meal	4 parts tankage, 4 parts S.B.M., 2 parts alf. meal	4 parts tankage, 4 parts S.B.M., 3 parts alf. meal	5 parts tankage, 5 parts alf. meal
Lot number	1	2	3	4
Number pigs in lot	9	9	9	9
Av. initial wt. per pig	53.88	55.36	53.11	52.77
Av. final wt. per pig	205.88	208.37	198.33	203.66
Av. total gain per pig	152.00	153.01	145.22	150.89
Av. daily gain per pig	1.55	1.56	1.47	1.53
Av. daily ration per pig:				
Corn	5.49	5.13	4.75	5.76
Protein supplement	.95	.88	.78	.70
Feed per 100 lbs. gain per pig:				
Corn	354.53	369.66	373.94	374.44
Protein supplement	61.40	56.77	53.58	46.02

Observations

1. Daily gains varied little. Lot 3 had the smallest daily gain—1.47 pounds per day. Other daily gains were: Lot 1, 1.55 pounds; Lot 2,

1.56 pounds; and Lot 4, 1.53 pounds. This indicates that the rations were efficient.

2. Lot 4 pigs consumed the most corn and the least supplement. This probably was because the high percentage of alfalfa meal in the supplement made them prefer shelled corn. The Lot 1 pigs consumed both the most corn and the most supplement daily. The extra consumption of corn required more protein to balance it nutritionally.

3. Most efficient utilization of corn was in Lot 1, the lot that ate the most each day. Lot 1 required more protein supplement per 100 pounds gain. There was little difference in the corn requirements among the other three lots. Lot 4 used the least protein supplement.

4. Results of this test indicate that increased amounts of alfalfa meal in the ration of pigs being fattened in dry lot are desirable and tend to produce more profitable gains.

Metabolism of Carotenoid Pigments and Vitamin A in Swine

Relative Value of Vitamin A and Carotenoids of Alfalfa Meal and of Corn in Supplying Vitamin A Requirements of Swine for Reproduction.

PROJECT 311

D. B. Parrish and C. E. Aubel

Swine commonly obtain vitamin A from feed in the form of the provitamins—carotene and cryptoxanthin—of alfalfa and yellow corn. Swine are able to convert these provitamins to vitamin A, probably in their intestinal walls. Some commercial swine feeds contain true vitamin A, especially feeds recommended for young pigs.

Nearly all the information available on the relative effectiveness of the forms of provitamin A in natural feedstuffs to supply vitamin A requirements of swine was obtained on young growing pigs. The requirements for, and metabolism of, vitamin A may differ in growing pigs and sows. A study of this problem, therefore, was undertaken.

Duroc gilts were placed in dry lot late in the fall. Feeding of experimental rations was begun one month before the gilts were bred. The experimental diets were composed of white corn, soybean oil meal, brewer's yeast, skimmilk powder, iodized salt, bone meal, limestone, and vitamins. The amount of various vitamin A supplements that each gilt received daily is shown for the various experiments in Tables 26, 27, and 28.

The amounts of supplement given were such that the vitamin A intake would be near marginal levels so that if differences in the values of the supplements existed they would likely show up. The experiments continued varying lengths of time after farrowing. Since only a limited number of comparisons could be made at any one time, the studies were continued several years, using essentially the same experimental conditions each time, but varying the supplemental sources of vitamin A. Each test was made twice. The criteria used for judging relative effectiveness of the various sources of vitamin A were: vitamin A levels in blood serum and colostrum of the gilts at farrowing and vitamin A levels in blood serum and livers of new-born pigs. Other analyses and observations made varied somewhat from one study to another.

In the first trial, vitamin A or carotene was added to the diet so each gilt received 6500 units of vitamin A activity daily. In the second trial the work was repeated but the supplemental provitamin A was fed at 7100 units daily. In each trial, the results were compared with those obtained on another lot of gilts fed the common yellow corn-tankage diet, plus leafy alfalfa hay, **ad lib.** The data from Trials 1 and 2 are presented in Table 26.

In Trials 3 and 4, the relative vitamin A values of carotene in oil and

Table 26.—Concentrations of vitamin A in blood serum and colostrum of gilts at time of farrowing and in blood serum and livers of new-born and 4-day-old pigs.

Trial	1			2		
Lot[1]	1	2	3	1	2	3
Ration supplement	Check[2]	Vitamin A	Carotene	Check	Vitamin A	Carotene
Vitamin A in gilt's blood serum, μg./100 ml.	17.7	20.0	10.3	19.2	16.2	7.2
Vitamin A in colostrum, μg./100 ml.	221	191	103	162	196	123
Vitamin A in new-born pig's blood serum, μg./100 ml.	12.5	11.9	6.7	13.7	12.6	5.1
Vitamin A in 4-day-old pig's blood serum, μg./100 ml.	33.4	30.5	17.7	36.4	26.6[3]	14.5
Vitamin A in new-born pig's liver, μg./g.	10.7	6.8	1.6	10.8	8.9	1.1
μg./liver	373	211	45	363	288	14.9
Vitamin A in 4-day-old pig's liver, μg./g.	18.9	18.3	3.8	20.9	14.7[3]	3.9
μg./liver	821	808	163	798	594[3]	189

1. Five animals per lot, except that Lot 3 contained only 4 animals by farrowing time in each trial.
2. A practical yellow corn-tankage ration, plus good leafy alfalfa hay fed free choice.
3. One gilt refused to care for her pigs; only 4 pigs available at this stage.

Table 27.—Concentrations of vitamin A in blood serum and colostrum of gilts at time of farrowing and in blood serum and livers of new-born pigs.

Trial	3			4		
Lot[1]	1	2	3	1	2	3
Source vit. A	Car. oil	Car. oil	Dehy. alf.	Car. oil	Car. oil	Dehy. alf.
Units vit. A fed daily	23,000	7,800	7,800	20,000	6,500	6,500
Sow's serum, μg./100 ml.	13.9	12.2	18.3	19.7	11.5	19.3
Colostrum, μg./100 ml.	174	128	177	125	117	160
New-born pig's serum, μg./100 ml.	11.1	7.4	9.2	11.7	6.3	11.0
New-born pig's liver, μg./gm.	7.3	3.1	4.6	3.9	0.8	3.2
μg./liver	240	92	187	96	29	99

1. Five gilts per lot.

carotene in dehydrated alfalfa were compared. Since the results of Trials 1 and 2 indicated that carotene-in-oil was about ⅓ to ½ less effective than vitamin A-in-oil, depending on the criteria used, carotene was given at two levels, one about three times higher than the other, as a further check on their relative effectiveness. Results are presented in Table 27. In these trials, data were not obtained on 4-day-old pigs, since in Trials 1 and 2 the trends at 4 days of age were similar to those at farrowing.

In Trials 5 and 6, comparisons were made of the relative vitamin A activity of carotene and cryptoxanthin of alfalfa and of yellow corn fed at 6500 units daily. When yellow corn was used, the required amount was substituted for an equal amount of white corn in the diet. The calculation of vitamin A potency was based on the crude carotene and crude cryptoxanthin contents as determined by separation of the non-saponifiable yellow pigments on an alumina chromatographic column, using 4 percent acetone in hexane for elution of carotene and 12 percent acetone in hexane for elution of crude cryptoxanthin. The latter was assigned 50 percent of the vitamin A value of carotene, which constituted the relative vitamin A activities found in rat experiments. The results are given in Table 28.

Table 28.—Concentrations of vitamin A in blood serum and colostrum of gilts at time of farrowing and in blood serum and livers of new-born pigs.

Trial	5		6	
Lot[1]	1	2	1	2
Source vit. A	Alfalfa	Yellow corn	Alfalfa	Yellow corn
Units vit. A fed daily	6,500	6,500	6,500	6,500
Sow's serum, μg./100 ml.	11.6	15.7	10.9	10.7
Colostrum, μg./100 ml.	96	120	92	86
New-born pig's serum, μg./100 ml.	7.8	6.7	4.4	5.5
New-born pig's liver, μg./gm.	1.4	0.8	0.29	0.25
μg./liver	43	31	10.5	8.2

1. Six gilts per lot

Observations

1. Vitamin A concentrations in blood serum of vitamin A supplemented (6500 units daily) fed gilts at time of farrowing, in their colostrum, and in the blood serum and livers of their new-born and 4-day-old pigs were similar to those in the same materials from animals of the check lot in which the gilts were fed the common yellow corn-tankage ration supplemented with alfalfa hay, free choice. On an equal unit basis, carotene was much less effective than vitamin A as a vitamin A feed supplement for gilts during gestation.

2. Vitamin A concentrations in blood serum of gilts decreased as farrowing approached and increased again during the days immediately following farrowing.

3. Crystalline carotene-in-oil fed at either 6500 or 7800 units daily was much less effective as a vitamin A source for gilts during gestation than was carotene or dehydrated alfalfa. When carotene-in-oil was fed at 20,000-23,000 units daily, it appeared to be about as effective as 6500-7800 units of carotene in alfalfa.

4. The provitamin A of alfalfa meal and of yellow corn fed at 6500 units daily were of similar value for supplying vitamin A requirements of gilts during gestation.

Effects of Bacitracin Pellets Implanted Subcutaneously in Pigs[1]

PROJECT 513

Melvin J. Swenson, Ralph G. Buckner, Dennis D. Goetsch, C. E. Aubel, and G. K. L. Underbjerg

Forty-seven new-born pigs from six gilts were randomized to three groups. The pigs in Group I were untreated and served as controls. Each pig in Group II was implanted subcutaneously, posterior to the right ear, with a bacitracin pellet 36 hours after birth. The pigs in Group III were implanted with a slow-absorbing, zinc-aluminum-bacitracin pellet in a similar manner. All pellets each contained 1,000 units of bacitracin.

Blood samples were taken from the anterior vena cava 36 hours after birth and at 1, 2, 3, 4, 5, 6, 7, and 8 weeks of age. At each bleeding time the pigs were weighed.

Results

The growth of the nursing pigs was not altered by the implanted antibiotic pellets as shown in Table 29.

From the standpoint of the blood picture, the values were not altered by the bacitracin pellets. Clinical cases of nutritional anemia were not observed. As a rule, such cases are seen when the pigs are 2 to 3 weeks of age. There was evidence, however, of subclinical anemia occurring at 2 to 3 weeks of age in all groups. This finding was revealed by studying the red blood cells and hemoglobin. At 4 weeks of age, the blood values had returned to normal.

Conclusions

1. Bacitracin pellets implanted subcutaneously in new-born pigs did not alter the weekly growth rate in 35 pigs as compared with 16 untreated pigs.
2. The blood picture was not affected by the implanted bacitracin pellets.

Table 29.—Effect on the weight of pigs when implanted with bacitracin pellets shortly after birth.

Group	No. pigs in group	36 hours	Age, weeks 1	2	3	4	5	6	7	8
			Average weight, pounds							
I, Cont.	16	2.7	4.7	7.8	10.0	11.7	14.4	17.6	21.3	25.6
II, Imp.	15	2.6	4.9	7.8	9.9	11.8	14.6	18.4	20.6	26.0
III, Imp.	16	2.7	4.5	7.6	9.8	11.4	14.2	17.2	20.6	24.6
Av.		2.6	4.7	7.7	9.9	11.6	14.4	17.8	20.8	25.4

Levels of Aureomycin and the Comparative Value of Dehydrated Alfalfa and Elodea canadensis Meals in Swine-fattening Rations.*

PROJECT 361

D. Richardson

The amount of antibiotic generally recommended in swine-fattening rations is 5 mg. per pound of total feed consumed. Some workers have felt that higher levels might produce more rapid and economical gains. One purpose of this test was to compare results with 5 and 20 mg. of aureomycin per pound of complete feed.

1. This project was supported by a grant-in-aid from Commercial Solvents Corporation, Terre Haute, Ind.

* The dehydrated Elodea canadensis meal was supplied by A. J. Stephens, Basswood Gardens, Kansas City, Mo., and the Aurofac 2A by Ralph Elliot, Lederle Laboratories, Pearl River, N.Y.

Elodea canadensis is a plant which grows in fresh-water lakes and ponds. Upon dehydration and grinding, it looks about the same as dehydrated alfalfa meal. The second purpose of this experiment was to compare the value of dehydrated alfalfa and Elodea canadensis meals in swine-fattening rations. Table 30 gives the chemical analysis of the Elodea canadensis meal used.

Experimental Procedure

Sixteen weanling pigs were divided as equally as possible into lots of four pigs each on the basis of weight, sex, and breed. The pigs were fed a complete ration, shown in Table 31. It contained about 18 percent protein and was fed till the pigs reached approximately 75 pounds body weight. The protein level of the ration was 15 percent from 75 to approximately 125 pounds body weight. It was then lowered to 12 percent protein for the remainder of the experiment. Adjustments in protein were made by adding corn and removing part of the tankage and soybean meal. Aureomycin was added in the form of Aurofac 2A. Elodea canadensis was substituted for equal amounts of alfalfa meal. Water was available at all times.

Results and Discussion

The results of the experiment are shown in Table 32. There was a difference in rate of gain of 0.08 pound in favor of the 20-milligram level of aureomycin, and essentially no difference in feed efficiency. There was 0.18 pound difference in daily gain in favor of the Elodea canadensis over alfalfa meal; however, there was no difference in feed efficiency.

It should be pointed out that Lot 1 pigs obviously did not do so well as they should have. Therefore, the differences observed are probably greater than they should be. The data indicate that: (1) there is no economic advantage to feeding high levels of aureomycin to fattening pigs; (2) Elodea canadensis is equal or superior to alfalfa meal in pig fattening rations when fed at levels used in this experiment.

Table 30.—Chemical analysis of dehydrated Elodea canadensis.

	%
Moisture	9.38
Crude protein	12.31
Ether extract	1.69
Crude fiber	15.00
Nitrogen-free extract	41.27
Ash	20.35
Calcium	3.72
Phosphorus	0.20
Carotene	48.0 mg. per lb.

Table 31.—Composition of experimental ration.

Ingredient	%
Yellow corn	73.5
Soybean oil meal	12.0
Tankage, 60% protein	10.0
Dehydrated alfalfa meal*	3.0
Steamed bone meal	0.5
Ground limestone	0.5
Salt	0.5
	100.0

*Lots 2 and 4 received dehydrated Elodea canadensis meal instead of alfalfa meal.

Table 32.—Pig-fattening results on (1) levels of aureomycin, (2) comparative value of dehydrated alfalfa and Elodea canadensis meals.
(November 16, 1954, to March 4, 1955—108 days)

	5 mg. aureomycin per pound feed			20 mg. aureomycin per pound feed	
	Alfalfa meal	Elodea canadensis		Alfalfa meal	Elodea canadensis
Lot number	1	2		3	4*
Number pigs per lot	4	4		4	4
Av. initial wt. per pig, lbs.	39	37		37	38
Av. gain per pig, lbs.	155	194		183	171
Av. final wt. per pig, lbs.	194	231		220	209
Av. daily gain per pig, lbs.	1.44	1.80		1.69	1.70
Av. daily feed per pig, lbs.	5.6	6.9		6.4	6.6
Av. feed per 100 lbs. gain, lbs.	389	382		377	386
Av. daily gain all pigs on 5 mg. aureomycin, lbs.			1.62		
Av. daily gain all pigs on 20 mg. aureomycin, lbs.			1.70		
Av. daily gain all pigs on alfalfa meal, lbs.			1.57		
Av. daily gain all pigs on Elodea canadensis, lbs.			1.75		

* 1 pig slaughtered at 180 lbs.

Antibiotics for Growing-Fattening Swine

PROJECT 361*

D. Richardson, R. P. Soule, Jr., and C. E. Aubel

Certain antibiotics are generally considered to be desirable and economically practical in growing-fattening rations of swine. In most cases, there has been an increase in rate of gain and some increase in feed efficiency.

This experiment was designed to study, with littermates, the effect of aureomycin and terramycin upon rate of growth feed efficiency, digestibility of feed, and nitrogen balance. This report gives a summary of four feedlot and three metabolism trials. Carcass data on these pigs are reported under Project 217.

Experimental Procedure

Duroc Jersey and Poland China littermates of the same sex were used in each trial; however, males were used in trials 1 and 3, and females in trials 2 and 4. The pigs were selected for uniformity as much as possible and allotted at random into three groups. Group 1 was assigned the basal ration; group 2, basal plus 10 mg. of Aureomycin HC1 per pound of feed, and group 3, basal plus 10 mg. of Terramycin HC1 per pound of feed. Aureomycin HC1 was supplied from Aurofac 2A and Terramycin HC1 from Bi-Con TM5. All pigs in trials 1 and 2 were treated with sodium fluoride to remove worms. Pigs in trials 3 and 4 were not treated. A complete ration was used and the pigs were individually self-fed. The ration contained 18 per-

* This project was partially supported by Lederle Laboratories, Pearl River, N.Y.

cent protein until the pigs reached approximately 75 pounds body weight. It was then lowered to 15 percent protein until the pigs reached 125 pounds body weight. The protein was reduced to 12 percent for the remainder of the feeding period. Table 33 shows the composition of the basal ration. The pigs were slaughtered at approximately 225 pounds for carcass studies.

At approximately 100 pounds, each pig was placed in a metabolism crate for seven days to collect urine and feces for digestion and nitrogen balance studies. The pigs were self-fed while in the crates.

Table 33.—Basal ration.

Ingredient	% fed to 75 lbs.	% fed from 75 to 125 lbs.	% fed from 125 to 225 lbs.
Yellow corn	73.5	80.5	87.5
Soybean oil meal	12.0	8.0	5.0
Tankage	10.0	7.0	4.0
Dehydrated alfalfa meal	3.0	3.0	2.0
Steamed bone meal	0.5	0.5	0.5
Ground limestone	0.5	0.5	0.5
Salt	0.5	0.5	0.5
Total	100.0	100.0	100.0
% protein	18.0	15.0	12.0

Results

Table 34 gives the results of each trial and a summary of all trials on growth rate, feed efficiency, and the number of roundworms found at time of slaughter. Results of the metabolism studies are shown in Table 35. The antibiotics had no significant influence upon the digestibility of the feed or the nitrogen retained.

Table 34.—Average growth and feed efficiency results with aureomycin and terramycin in swine-fattening rations using individually fed littermates.

	Number of pigs	Average initial weight	Average final weight	Average total days	Average daily gain	Feed per cwt. gain	Total requirement at slaughter
			Trial No. 1—Nov. 11, 1952-April 9, 1953				
Basal	4	30.5	224.3	140.5	1.38	383	53
Basal + 10 mg. aureomycin	4	30.3	224.0	121.3	1.60	364	34
Basal + 10 mg. terramycin	4	31.8	222.0	147.8	1.29	391	128
			Trial No. 2—May 9-Sept. 26, 1953				
Basal	5	41.0	236.0	127.0	1.54	341	81
Basal + 10 mg. aureomycin	4*	43.0	239.0	106.0	1.85	331	52
Basal + 10 mg. terramycin	4*	43.0	233.0	121.0	1.57	349	58
			Trial No. 3—Nov. 14, 1953-March 6, 1954				
Basal	4	43.5	230.0	108.5	1.72	389	11
Basal + 10 mg. aureomycin	4	43.3	226.3	98.0	1.87	362	37
Basal + 10 mg. terramycin	4	44.0	224.8	103.3	1.75	360	87
			Trial No. 4—May 15-Oct. 8, 1954				
Basal	5	31.0	228.0	122.2	1.61	320	77
Basal + 10 mg. aureomycin	5	32.4	228.6	117.0	1.68	348	100
Basal + 10 mg. terramycin	5	32.6	228.6	118.2	1.66	335	83
			Summary of all trials				
Basal	18	36.4	229.8	124.5	1.55	355.0	221
Basal + 10 mg. aureomycin	17	36.9	229.3	110.9	1.73	350.9	223
Basal + 10 mg. terramycin	17	37.5	227.2	122.3	1.55	357.2	356

*1 pig died from heat.

Table 35.—Average digestion coefficients, percent total digestible nutrients, and percent nitrogen retention with aureomycin and terramycin in swine-fattening rations using littermates.

	Number of pigs	Av. wt. into crate	Av. gain in crate	Av. percent apparent digestibility				% total dig. nutr.	% nitrogen retention
				Crude protein	Ether extract	Crude fiber	N-free extract		
Trial number 1									
Basal	4	100.0	7.2	84.3	77.8	58.3	92.6	79.8	50.0
Basal + 10 mg. aureomycin	4	104.0	6.2	81.8	79.7	59.0	91.4	79.4	38.6
Basal + 10 mg. terramycin	4	97.3	6.5	83.9	76.9	51.7	92.1	79.2	46.4
Trial number 3*									
Basal	5	122.8	7.6	77.8	78.8	56.7	90.0	77.8	37.8
Basal + 10 mg. aureomycin	5	118.6	7.0	81.6	82.1	52.2	91.2	79.6	38.0
Basal + 10 mg. terramycin	5	121.6	8.0	79.8	84.9	51.7	89.9	78.9	34.7
Trial number 4									
Basal	5	102.8	3.0	79.4	75.2	47.5	91.4	79.6	44.8
Basal + 10 mg. aureomycin	5	99.2	4.8	79.5	74.1	51.3	90.9	79.2	44.2
Basal + 10 mg. terramycin	5	99.8	3.6	78.1	70.3	41.6	90.7	78.0	43.5
Summary of all trials									
Basal	14	109.1	5.9	80.1	77.5	54.4	91.1	78.9	43.3
Basal + 10 mg. aureomycin	14	107.5	6.0	81.0	79.0	51.3	91.2	79.4	40.1
Basal + 10 mg. terramycin	14	106.9	6.0	80.3	78.4	48.9	90.7	78.7	40.1

* Metabolism studies were not conducted during Trial 2 because of heat.

The Effect of Antibiotics on Swine Carcasses, 1952-1954.

PROJECT, PURNELL 217

R. P. Soule, Jr., D. L. Mackintosh, D. Richardson, and C. E. Aubel

A number of antibiotics have been incorporated in swine rations during the past several years. Experimental workers at other experiment stations have reported that the stimulation in increased rate of gain is due to the increase in fat.

This experiment was conducted to measure any differences in fat on carcasses from hogs fed antibiotics.

Experimental Procedure

The two antibiotics fed in these four trials were Aureomycin and Terramycin HCl at the level of 10 mg. per pound of total ration. Lot 1 pigs were the controls receiving the basal ration; Lot 2, basal plus 10 mg. of Aureomycin HCl per pound of total feed; Lot 3, basal plus 10 mg. of Terramycin HCl per pound of total feed. Fifty-two pigs were used in the four trials carried out from November 1952 to October 1954.

The pigs were slaughtered at the college laboratory when they reached approximately 225 pounds. The stomach and intestinal contents were weighed and subtracted from the live slaughter weight to determine the net body weight.

All carcasses were weighed after 48 hours chill at 34°F. The length of body was measured from the anterior portion of the first rib to the anterior portion of the aitch bone. The back fat is the average of the three measurements—opposite the first rib, last rib, and last lumbar vertebra. The primal cuts are the skinned ham, trimmed loin, N.Y. style shoulder, and the trimmed belly. The lean cuts are the skinned ham, trimmed loin, and N.Y. style shoulder. The primal and lean-cut yields were based on net body weight and chilled carcass weight. The carcasses were graded, using the average back fat thickness and length as criteria for grades. These grades are based on the official U.S. Standards for Grades of Pork Carcasses, which are choice 1, 2, 3; medium; and cull.

Observations

1. The aureomycin-fed pigs produced a thicker back fat than either the controls or terramycin-fed pigs.
2. The terramycin-fed pigs had less back fat than either the controls or aureomycin-fed pigs.
3. The total fat trim was slightly more from the aureomycin-fed pigs.
4. The aureomycin-fed pigs had a slightly higher dressing percentage than the controls.
5. The terramycin-group pigs fell within the Choice No. 1 grade, while the controls and aureomycin-fed pigs fell within the Choice No. 2 grade; see summary of Table 37.

Table 30.—Average slaughter and carcass data results with antibiotics fed in swine rations.

	Live wt.[1]	Chilled carcass wt.	Dressing %[2]	Length of body[3] (inches)	Back fat thickness[4] (inches)	Total wt. primal cuts[5]	Total wt. lean cuts[6]
			Trial No. 1—November 11, 1952-April 9, 1953				
Basal	208	160	76.53	28.66	1.86	100.6	74.9
Basal + 10 mg. aureomycin HCl	207	163	78.50	28.27	2.04	100.1	74.8
Basal + 10 mg. terramycin HCl	208	157	75.48	28.84	1.64	100.6	75.8
			Trial No. 2—May 9-September 26, 1953				
Basal	221	173	77.91	29.30	1.70	113.2	87.2
Basal + 10 mg. aureomycin HCl	228	176	76.91	29.60	1.80	112.8	84.8
Basal + 10 mg. terramycin HCl	222	173	77.73	29.06	1.62	110.5	83.1
			Trial No. 3—November 14, 1953-March 6, 1954				
Basal	216	168	78.04	28.66	1.92	106.3	81.3
Basal + 10 mg. aureomycin HCl	216	170	78.96	28.06	1.96	107.2	80.4
Basal + 10 mg. terramycin HCl	213	165	77.34	28.21	1.94	104.4	78.4
			Trial No. 4—May 15-October 8, 1954				
Basal	214	168	78.65	29.13	1.76	100.7	77.1
Basal + 10 mg. aureomycin HCl	215	172	79.89	29.29	1.79	102.9	78.9
Basal + 10 mg. terramycin HCl	217	170	78.36	29.61	1.67	103.8	81.0
			Summary of the four trials				
Basal	215	167	77.78	28.94	1.81	105.2	80.1
Basal + 10 mg. aureomycin HCl	217	170	78.57	28.81	1.90	105.8	79.7
Basal + 10 mg. terramycin HCl	215	166	77.23	28.93	1.72	104.8	79.6

1. Live weight based on net body weight.
2. Dressing percentage based on chilled carcass weight divided by net body weight.
3. Length of body measured anterior to the first rib to the anterior of the aitch bone.
4. Back fat thickness measured opposite first rib, last rib, and last lumbar vertebra and averaged.
5. Primal cuts are the N.Y. style shoulder, trimmed loin, trimmed belly, and skinned ham.
6. Lean cuts are N.Y. style shoulder, trimmed loin, and skinned ham.

Table 37.—Average slaughter and carcass data results with antibiotics fed in swine rations.

	Primal cut yield % (net body wt.)	Lean cut yield % (net body wt.)	Primal cut yield[1] (%)	Lean cut yield[1] (%)	Total fat trim (lbs.)	Grade[3]
Trial No. 1—November 11, 1952-April 9, 1953						
Basal	48.19	35.89	62.98	46.90	33.9	Ch.No.2
Basal + 10 mg. aureomycin HCl	48.37	36.13	61.61	46.03	35.5	Ch.No.2
Basal + 10 mg. terramycin HCl	48.40	36.45	64.10	48.29	33.9	Ch.No.1
Trial No. 2—May 9-September 26, 1953						
Basal	51.10	39.38	65.55	50.50	32.9	Ch.No.1
Basal + 10 mg. aureomycin HCl	49.40	37.10	64.18	48.20	38.4	Ch.No.1
Basal + 10 mg. terramycin HCl	49.70	37.38	63.95	48.10	36.5	Ch.No.1
Trial No. 3—November 14, 1953-March 6, 1954						
Basal	49.31	37.71	63.18	48.32	39.4	Ch.No.2
Basal + 10 mg. aureomycin HCl	49.70	37.30	62.95	47.24	41.6	Ch.No.2
Basal + 10 mg. terramycin HCl	48.92	36.74	63.26	47.50	40.4	Ch.No.2
Trial No. 4—May 15-October 8, 1954						
Basal	47.04	36.02	59.81	45.80	38.8	Ch.No.1
Basal + 10 mg. aureomycin HCl	47.80	36.90	59.84	45.90	39.5	Ch.No.1
Basal + 10 mg. terramycin HCl	47.78	37.31	60.98	47.61	36.4	Ch.No.1
Summary of the four trials						
Basal	48.91	37.25	62.88	47.88	36.3	Ch.No.2
Basal + 10 mg. aureomycin HCl	48.82	36.86	62.15	46.84	38.8	Ch.No.2
Basal + 10 mg. terramycin HCl	48.70	36.97	63.07	47.88	36.8	Ch.No.1

1. Based on chilled carcass weight.
2. Based on net body weight.
3. Grade based on the official U.S. Standards for Grades of Pork Carcasses.

Beef Cattle

Ratio of Roughage to Concentrate for Fattening Heifers, 1954.

PROJECT 222

D. Richardson, F. H. Baker, E. F. Smith, and R. F. Cox

This is the third test in an experiment planned to secure information on the effects of different levels of roughage on average daily gain, feed required per unit of gain, carcass quality, and digestibility of the ration. Kansas normally produces a large quantity of roughage. It is desirable to have information concerning the maximum amount of roughage that can be used in fattening rations, consistent with maximum and economical gains.

Experimental Procedure

Fifty Hereford heifers were divided into five lots as equally as possible on the basis of weight, size, conformation, and previous treatment. The heifers were wintered, 10 per lot, as calves on the following rations: (1) alfalfa hay and 3 pounds of corn; (2) Atlas sorghum silage, 2 pounds milo grain, and 1 pound cottonseed meal; (3) Atlas sorghum silage and 3 pounds special supplement; (4) prairie hay, 2.6 pounds milo grain, and 1 pound cottonseed meal; (5) corn cobs, 2.25 pounds milo grain, and 1.5 pounds cottonseed meal. Two heifers from each lot on the above wintering rations were allotted to each of the five lots in this experiment. That gave a total of 10 animals per lot.

The feeds used were good quality, chopped alfalfa hay, coarsely cracked milo grain, and corn. One lot of animals received corn so that a comparison of milo grain and corn could be made. Water, salt, and ground limestone were provided free choice at all times.

After starting the animals on feed, the grain was increased until each lot was on the ration indicated as follows:

Lot 1—1 pound of alfalfa hay to 1 pound milo grain.

Lot 2—1 pound of alfalfa hay to 3 pounds milo grain.

Lot 3—1 pound of alfalfa hay to 3 pounds corn.

Lot 4—1 pound of alfalfa hay to 5 pounds milo grain.

Lot 5—Changing ratio, started at 2 pounds alfalfa hay to 1 pound milo grain. Each succeeding 28 days the grain was increased until the ratio was 1 pound hay to 4 pounds grain at the end of the test.

Eleven yearling steers were used to determine the digestibility of the ration when alfalfa hay and milo grain were fed at ratios of 1 to 1, 1 to 3, and 1 to 5. The steers were fed in stanchions, and canvas collection bags were used to collect the feces.

Results and Discussion

Table 38 gives a summary of the results obtained in the feedlot test. Corn produced better results than milo grain in this test; however, the reverse was true in a previous test. Lot 1 animals on equal parts of hay and grain made satisfactory gains but not so good as animals on a more concentrated ration. The gains were economical but the question arises as to the possibility of getting animals to average choice grade on this ration; and, if so, how long it would take.

Table 39 shows the average daily gains of animals based upon their wintering ration.

Table 40 gives the average percentage digestion of the various nutrients and the percent of total digestible nutrients on ratios of 1 to 1, 1 to 3, and 1 to 5 of hay and grain, respectively.

In general, best results have been obtained in the feedlot on the ratio of 1 part hay to 3 parts concentrates or 25 percent roughage. These digestion results agree with the feedlot tests.

Table 38.—Ratio of roughage to concentrates for fattening heifers.
(May 7-October 8, 1954—154 days)

Lot number	1	2	3	4	5
Ratio of roughage to concentrate	1 hay 1 milo	1 hay 3 milo	1 hay 3 corn	1 hay 5 milo	Changing ratio
Number heifers per lot	10	10	10	10	10
Av. initial wt., lbs.	518	512	511	515	518
Av. gain per heifer, lbs.	289	303	349	330	315
Av. daily gain per heifer, lbs.	1.88	1.97	2.27	2.14	2.04
Total feed per head, lbs.:					
Milo grain	1588	2183		2348	2002
Corn			2108		
Alfalfa hay	1657	950	925	771	1153
Av. daily feed per head, lbs.:					
Milo grain	10.3	14.2		15.2	13.0
Corn			13.7		
Alfalfa hay	10.7	6.2	6.0	5.0	7.5
Lbs. feed per 100 lbs. gain:					
Milo grain	549	720		711	635
Corn			604		
Alfalfa hay	573	313	265	234	368
Days to reach ratio	18	39	39	55	
Feed cost per 100 lbs. gain*	$21.10	$23.29	$19.92	$22.25	$21.46
% shrink to market	1.63	2.29	2.25	2.46	2.16
Av. dressing % (including cooler shrink)	59.8	60.9	61.8	61.0	60.0
Carcass grades:					
High choice				1	
Av. choice		2	4	3	2
Low choice	3	4	4	5	5
Top good	5	3	2	1	1
Av. good	1	1			2
Low good	1				
Marbling:					
Moderate		1	1		
Modest			6	6	4
Small	1	3	1	3	1
Slight	9	6	2	1	5

* Alfalfa hay per ton, $20; milo grain per cwt., $2.80; and corn per bu., $1.60.

Table 39.—Average daily gain per head based upon wintering rations with 10 animals per lot.

Previous treatment	Prairie hay, 2.6 milo, 1 C.S.M.	Corn cobs, 2.25 milo, 1.5 C.S.M.	Atlas sorgo silage, 3 special suppl.	Atlas sorgo silage, 2.0 milo, 1.0 C.S.M.	Alfalfa hay, 3.0 corn
Av. daily gain during 154-day fattening period	2.03	2.12	2.04	1.92	2.18

Table 40.—Average digestion coefficients of 11 yearling steers on different ratios of roughage to concentrate.

Ratio of alfalfa hay to milo grain	% Apparent Digestibility of: Crude protein	Ether extract	Crude fiber	N-free extract	% total dig. nutr.
1 to 1	64.6	50.8	51.7	75.0	61.7
1 to 3	66.1	64.0	57.5	79.6	69.0
1 to 5	63.2	62.3	49.2	78.9	68.5

Grinding and Pelleting Complete Rations for Fattening Beef Heifers, 1954.

PROJECT 222

F. H. Baker, E. F. Smith, D. Richardson, and R. F. Cox

Pelleted rations for fattening sheep have been studied rather extensively at several experiment stations. The results indicate that the feed efficiency and rate of gain of sheep fed pelleted rations are superior to those of similar sheep fed non-pelleted rations. A limited amount of data from other stations suggests that cattle may react similarly to pelleted rations. This experiment was designed to study the effect of both fine grinding and pelleting of rations on the fattening performance of beef heifers.

Procedure

Thirty light yearling heifers of good to choice quality were used. The heifers were purchased the fall of 1953, used in wintering tests until May 1, 1954, and grazed on native grass pasture during May and June. Assignment of the cattle to lots for this experiment was made on the basis of weight, feeder grade, and winter treatment.

The rations for the experiment were corn, 60 percent; cottonseed meal, 5 percent; molasses, 10 percent; and alfalfa hay, 25 percent. In starting the cattle on feed, this basic mixture was fed twice daily to all lots, and alfalfa hay was fed free choice. After the first month of the test the only hay fed to the cattle was that contained in the mixed ration. The cattle in all lots were self-fed the complete ration after the first month of the test. The rations for the various lots were prepared in the following manner:

Lot 1—Coarsely cracked corn, cottonsed meal, and molasses were mixed together by a commercial feed mixer. The alfalfa hay was chopped as coarsely as possible in a forage chopper and mixed with the other portion of the ration as it was fed to the cattle.

Lot 2—The entire ration was ground as finely as possible and mixed by a commercial feed mixer.

Lot 3—This ration was ground and mixed as the ration for Lot 2, and then made into pellets 3/8 inch in diameter.

It is recognized that these rations in the quantities consumed by the heifers provide more protein than is normally fed to fattening cattle. The cottonseed meal was included in the mixture to insure that the daily protein intake would be adequate for maximum gains, even though

the total feed intake might be low in some of the lots. It is likewise recognized that 10 percent molasses may not be necessary for maximum gains; however, it was included in these rations to control the dustiness of the finely ground feeds.

Observations

1. The cattle fed the coarsely cracked corn and chopped hay (Lot 1) made significantly faster gains than the cattle fed the finely ground or the pelleted rations. Likewise, the cattle of Lot 1 had higher carcass grades, dressing percentages, and marbling scores than the cattle of the other two lots.
2. Despite their lower rate of gain, the feed efficiency of the cattle fed the pelleted ration was as high as that of the cattle fed the coarsely cracked corn and chopped hay.
3. It was apparent that the low feed consumption certainly contributed to the lower gains of the cattle fed the finely ground and pelleted rations.
4. The absence of rumination (cud-chewing) was quite evident among the heifers of Lots 2 and 3, which were fed the finely ground and the pelleted rations, respectively. In the later stages of the test the heifers of both Lots 2 and 3 exhibited a strong desire for coarse roughage. They chewed vigorously on the wooden fences and ate every sprig of bedding that was placed in their pen.

Table 41.—A study of the preparation of rations for fattening heifers.
(July 3-October 23, 1954—112 days)

Lot number	1	2	3
Management	Chopped hay and coarsely ground grain ration	Finely ground ration	Pelleted ration
Number heifers per lot	10	10	10
Initial wt.	590	590	592
Final wt.	869	797	811
Gain per heifer	279	207	219
Daily gain per heifer	2.49	1.85	1.96
Daily ration per heifer, lbs.:			
Corn	11.88	9.28	9.14
Cottonseed meal	.98	.77	.76
Molasses	1.96	1.55	1.52
Alfalfa hay	6.62	5.53	5.48
Salt	.01	.02	.03
Lbs. feed required per cwt. of gain:			
Corn	474.84	502.15	467.65
Cottonseed meal	39.57	41.84	38.97
Molasses	79.14	83.69	77.94
Alfalfa hay	265.66	302.71	280.01
Salt	.43	1.21	1.78
Feed cost per cwt. gain	$22.77	$24.42	$23.57
Initial cost of heifer @ $18.00	$106.20	$106.20	$106.56
Feed cost per heifer	$63.53	$50.55	$51.62
Heifer cost plus feed cost	$169.73	$156.75	$158.18
Market wt., lbs.	844	780	795
Necessary selling price per cwt.	$20.11	$20.10	$19.90
Selling price per cwt.	$23.50	$22.50	$22.50
Dressing %	60.9	59.5	59.1
Carcass grades:			
Choice	6	2	1
Good	4	8	9

Table 41 (Continued).

Marbling score:			
Moderate	1		
Modest	5	1	
Small	1	5	4
Slight	2	4	4
Traces	1		2

Feed prices: corn, $2.70 per cwt.; cottonseed meal, $80 per ton; alfalfa hay, $22 per ton; molasses, $2 per cwt.; salt, $15 per ton; mixing feed, $4 per ton; pelleting, $2 per ton; grinding, $5 per ton.

Fundamental Nutrition Studies of Sorghum Roughages and Grains.

A Comparison of Rolled, Coarsely Ground, and Finely Ground Milo Grain for Fattening Yearling Heifers, 1954.

PROJECT 222

F. H. Baker, E. F. Smith, R. F. Cox, and D. Richardson

Thirty light yearling Hereford heifers were used in this experiment. The heifers were purchased in the fall of 1953, used in wintering tests until May 1, 1954, and grazed on native grass pasture from May 1 to July 1, 1954. In allotting the heifers for this test, consideration was given to weight, feeder grade, and previous treatment.

The rolled milo was dry rolled and appeared satisfactory upon emergence from the roller; however, after sacking and when finally fed, it was in small particles and somewhat powdered. The coarsely ground or cracked milo was the product of a burr mill. A hammer mill was used to prepare the finely ground milo, which was ground to a coarse, mealy mixture.

The heifers were hand-fed twice daily, according to appetite, until they were on full feed (35 days). During the remainder of the experiment, 5 pounds of alfalfa hay was fed once daily and the grain was self-fed. Fresh water and salt were available at all times.

Observations

1. The daily consumption of finely ground milo by the heifers in Lot 1 was slightly lower than consumption of coarsely ground and rolled milo by heifers of Lots 2 and 3, respectively. The heifers in Lots 1 and 3 used the feed more efficiently than did the heifers of Lot 2.
2. The gains of the heifers fed finely ground milo and of those fed rolled milo were materially higher than those of the heifers fed coarsely ground milo.
3. The selling price, dressing percentage, marbling scores, and carcass grades of the heifers fed coarsely ground milo were slightly lower than either those fed finely ground or rolled milo.

Table 42.—A comparison of rolled, coarsely ground, and finely ground milo grain for fattening heifers.

(July 3-October 23, 1954—112 days)

Lot number	1	2	3
Management	Finely ground milo	Coarsely ground milo	Rolled milo
Number heifers per lot	10	10	10
Initial wt. per heifer, lbs.	592	588	590
Final wt. per heifer, lbs.	848	818	853

Table 42 (Continued).

Market wt.	827	802	830
Gain per heifer, lbs.	256	230	263
Daily gain per heifer, lbs.	2.29	2.05	2.35
Daily ration per heifer, lbs.:			
Milo	12.74	13.59	13.68
Alfalfa hay	6.34	6.25	6.52
Salt	.03	.03	.02
Feed required per 100 lbs. gain, lbs.:			
Milo	557.19	661.61	582.78
Alfalfa hay	277.58	304.26	277.57
Salt	1.17	1.30	1.03
Cost of feed per 100 lbs. gain	$ 17.55	$ 20.56	$ 18.21
Initial cost of heifer @ $18 cwt.	106.56	105.84	106.20
Feed cost per heifer	44.93	47.29	47.89
Heifer cost plus feed cost	151.49	153.13	154.09
Necessary selling price per cwt.	18.32	19.09	18.56
Selling price per cwt.	23.50	22.50	23.50
Dressing %	60.9	60.2	60.7
Carcass grades:			
Choice	2	1	2
Choice—	5	4	3
Good+	3	2	3
Good		3	2
Marbling:			
Moderate	1		
Modest	1	1	2
Small	6	4	5
Slight	2	4	3
Traces		1	

Feed prices: Milo, $2.60 per cwt.; alfalfa hay, $22 per ton; salt, $15 per ton.

The Value of Ammoniated Hydrol in Beef Cattle Wintering Rations, 1954-55.

PROJECT 537*

D. Richardson, F. H. Baker, and R. F. Cox

Ruminant animals are capable of utilizing many nonprotein nitrogen compounds, when properly fed, as a substitute for protein. Certain of these products are now being used in livestock feeds as a substitute for protein. Natural proteins are desired in livestock rations and usually produce better results. However, with our increasing population and its demand for meat, the supply of natural protein feedstuffs may become a limiting factor in livestock production. We should learn more about proper methods of production of protein substitutes and their utilization as a feed ingredient by ruminants.

In previous experiments at this and other stations, poor results were obtained with ammoniated blackstrap molasses. It is believed that the process of ammoniation was primarily at fault. This experiment was planned to evaluate ammoniated hydrol (corn molasses) as a partial

* This project was partially supported by Clinton Foods, Inc., Clinton, Iowa.

substitute for protein in the wintering ration of beef calves. This product was made by a different process from the one used previously.

Experimental Procedure

Twenty Hereford heifer calves were divided as equally as possible on the basis of size, weight, and type into two lots of 10 animals each. Atlas sorghum silage was used as the roughage and the amount fed was adjusted to the amount the animals would clean up daily. The remainder of the ration was kept the same throughout the experiment. The ration at the beginning of the experiment is shown in Table 43. The concentrate part of the ration was mixed with the silage. A mineral mixture of two parts steamed bone meal and one part salt and salt alone were fed free choice. Water was available at all times.

Table 43.—Daily ration used at the beginning of the experiment (pounds).

Lot	Atlas sorghum silage	Milo grain	Soybean oil meal	Ammoniated hydrol*
8 Control	20	2.0	1.0	
4 One-half protein concentrate as protein equivalent from ammoniated hydrol	20	0.9	0.6	2.00

* Contained 11.55 percent protein equivalent.

Results and Discussion

The results of this experiment are shown in Table 44. The average daily gain of the animals receiving ammoniated hydrol was satisfactory; however, it was not so good as the gain of the control animals. For some unknown reason the animals fed ammoniated hydrol did not eat as much silage as the control animals the first 84 days; however, they ate as much during the remainder of the experiment. Blood serum phosphorus taken February 15 showed an average of 9.74 mg. percent for the controls, and 9.91 mg. percent for those receiving ammoniated hydrol. These are normal values.

No craziness (as in animals fed ammoniated molasses in previous tests here) or other ill effects were observed during the entire feeding period. Further studies are being conducted on the blood of animals and digestibility of the ammoniated hydrol.

Table 44.—Results of feeding ammoniated hydrol in the wintering ration of beef heifer calves.

(Nov. 15, 1954, to April 4, 1955—140 days)

Lot	8 (Control)	4 (One-half protein concentrate as protein equivalent from ammoniated hydrol)
Number heifers per lot	10	10
Number days on trial	140	140
Av. initial wt. of heifers, lbs.	430	431
Av. final wt. of heifers, lbs.	647	619.3
Av. gain per heifer, lbs.	217	188.7
Av. daily gain per heifer, lbs.	1.55	1.35
Av. daily ration per heifer, lbs.:		
Sorghum silage	29.46	26.93
Ground milo grain	2.00	1.05
Soybean oil meal	1.00	0.63

Table 44 (Continued).

Ammoniated hydrol		1.77*
Steamed bone meal and salt mix	0.12	.13
Salt	0.10	.05
Feed per 100 lbs. gain, lbs.:		
Sorghum silage	1900	1998
Ground milo grain	129	77.7
Soybean oil meal	64.5	46.4
Ammoniated hydrol		131.4
Steamed bone meal and salt mix	7.4	9.3
Salt	6.1	3.4

* There was a two-week period in which ammoniated hydrol was not fed.

Sources of Phosphorus for Wintering Beef Heifer Calves on Dry Bluestem Pasture

PROJECT 536*

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

Roughages generally provide more calcium than phosphorus. There is usually sufficient calcium in a high roughage ration but additional phosphorus is needed. Present ingredients used to supply phosphorus also supply calcium in as great or greater quantities. It would be desirable to have an ingredient to supply phosphorus without having to add other elements not needed in the ration. This experiment was planned to determine whether or not phosphoric acid could be used as a source of phosphorus and, if so, the efficiency of utilization.

Experimental Procedure

Forty head of choice-quality Hereford heifer calves were divided into four lots of 10 animals each on the basis of weight and type. Each animal was branded with an individual number and lot number. All animals grazed together on dry bluestem grass and were divided each day to receive their respective supplemental feed. Prairie hay was fed when snow covered the grass. The prairie hay averaged 1.67 pounds per head daily for the entire time of the experiment. Water and salt were available at all times. The supplement fed per head daily was as follows:

Lot 1—1.5 pounds soybean meal and 0.2 pound blackstrap molasses.

Lot 2—1.5 pounds soybean meal, 0.2 pound blackstrap molasses, and 8 grams of phosphorus from steamed bone meal.

Lot 3—1.5 pounds soybean meal, 0.2 pound blackstrap molasses, and 8 grams of phosphorus from phosphoric acid.

Lot 4—1.5 pounds soybean meal, 0.2 pound blackstrap molasses, and 4 grams of phosphorus from phosphoric acid.

The phosphoric acid was mixed with the blackstrap molasses and then added to the soybean meal in the mixer. The ingredients were mixed in a mechanical mixer. The supplement was fed as a meal in bunks.

Weights were taken every 28 days. Blood serum phosphorus was determined to measure phosphorus utilization. These animals will continue on grass until sometime in July. After the grazing season, they will be placed in dry lot and fed to grade choice.

Results

Growth results are presented in Table 45. The gains were not so

* This project was in cooperation with Westvaco Mineral Products Division, Food Machinery and Chemical Corporation, New York 17, N.Y.

good as might be expected; however, it should be pointed out that the calves were in fleshy condition at the beginning of the experiment and the grass was covered by snow a good part of the time.

Blood samples were taken to determine the serum phosphorus levels. The dates taken and average results of these tests are shown in Table 46. It required two days to collect the blood because of laboratory facilities. It is obvious, as shown by the figures for November 16 and 17, that some error was made on one of the days of the first collection. One-half of the animals were bled on each of the two days for the other tests to equalize any error that might be made.

Observations

1. The supplements containing phosphoric acid were highly palatable. They seemed to be more palatable than the other supplements.
2. No harmful or ill effects of any kind were observed.
3. There was a definite lowering of serum phosphorus in Lot 1 which did not receive any supplemental phosphorus.
4. The serum phosphorus levels of Lots 2, 3, and 4 remained practically the same throughout the test. The values in these lots are considered normal.
5. Weight gains and serum phosphorus levels indicate that 4 grams of additional phosphorus are as efficient as 8 grams.

Table 45.—Sources of phosphorus for beef heifer calves on dry bluestem pasture.

(Nov. 17, 1954-April 6, 1955—140 days)

Lot	1	2	3	4
Added phosphorus	None	8 grams from steamed bone meal	8 grams from phosphoric acid	4 grams from phosphoric acid
Number heifers per lot	10	10	10	10
Av. initial wt., lbs.	515.5	517.0	515.5	516.5
Av. final wt., lbs.	560.0	566.7	561.0	574.0
Av. gain, lbs.	44.5	49.7	45.5	57.5
Av. daily gain, lbs.	.32	.36	.33	.41

Table 46.—Average serum phosphorus levels.*

Lot	1	2	3	4
November 16 and 17	8.93	8.53	10.51	10.36
February 16 and 17	6.12	8.61	8.79	8.42
March 22 and 23	6.83	9.55	10.08	9.44

* Figures are expressed as milligrams percent.

The Performance of Phenothiazine-treated Cattle.

PROJECT 370

W. A. Moyer, F. H. Baker, D. S. Folse, E. F. Smith, and R. F. Cox

Cattlemen, in recent years, have become interested in internal parasites and their control. A large number of cattle, particularly replacement calves and yearlings, move into Kansas from the Southwest each year. The level of parasitism of these cattle and the possible effect of control measures pose as questions in the minds of many cattlemen. These experiments were designed to study the level of parasitism in feeder calves and the effect of phenothiazine treatment.

Experimental Procedure

The first experiment was conducted during the winter of 1953-54 with 60 heifer calves. The heifers were raised near Snyder, Texas, and delivered to Manhattan December 1, 1953. The heifers were assigned December 17, 1953, as lots of 10 to a series of wintering experiments. The level of parasitism was established during the last two weeks of December. Fecal samples were collected and E.P.G. (egg per gram) counts were made on the composite fecal samples from each lot. Five heifers in each lot were treated with 60 grams (two 30-gram boluses) of phenothazine on January 14, 1954.

A second experiment using this same procedure was conducted during the winter of 1954-55, with 70 steer calves that originated in Barber county, Kansas.

The results of the two experiments are shown in Table 47.

Table 47.—Effect of phenothiazine treatment on the gains of young beef cattle fed wintering rations.

	1953-54		1954-55	
Year	Treated	Non-treated	Treated	Non-treated
Length of experiment, days	137	137	140	140
Number of cattle	30*	30*	35**	35**
Av. initial wt., lbs.	310	312	454	456
Av. final wt., lbs.	491	487	718	721
Av. total gain, lbs.	181	175	264	265
Av. daily gain, lbs.	1.31	1.27	1.88	1.89

* Heifers.
** Steers.

Observations

Beef calves used in this experiment were typical of replacement calves used on many farms and ranches of Kansas. The average initial E.P.G. count of the heifers used in the first test was 156 as compared to 17 for the steers used in the second test. An E.P.G. count of 300 to 500 is considered to be detrimental or harmful to the animal.

The weight gains of the phenothiazine-treated heifers in the first test were 6 pounds more per head than those of the non-treated heifers, whereas in the second test the treated steers gained 1 pound less than the non-treated steers. The difference in gain was not statistically significant in either test.

Phenothiazine treatment of beef calves in Kansas is unwarranted unless the degree of parasitism is higher than it was in the cattle used in these experiments.

The Value of Stilbestrol* in Beef Cattle Rations, Wintering Phase.

PROJECT 370

D. Richardson, F. H. Baker, D. L. Good, and R. F. Cox

Stilbestrol has been recognized as a growth-stimulating factor in beef cattle-fattening rations. It is a synthetic compound that has a hormone-like effect when taken into the body.

This experiment was designed to determine the value of stilbestrol (1) in the wintering ration of beef calves, (2) during grazing, (3) when animals return to the feed lot after grazing, (4) effect of removing stilbestrol from the animals while grazing, (5) effect from long-time continuous feeding, (6) effect upon digestibility of feed, and (7) car-

* Stilbestrol (shortened name for diethylstilbestrol) premix was supplied by the Eli Lilly Company, Indianapolis 6, Ind.

cass grade. This report gives information on the wintering phase (1) and the digestibility (6) studies.

Experimental Procedure

Forty Hereford steer calves averaging about 450 pounds were divided as equally as possible into four lots of 10 animals each. Two lots served as controls and the other two lots received 10 mg. of stilbestrol per head daily in the soybean meal. Ten Hereford heifer calves averaging about 335 pounds were divided as equally as possible into two lots of five animals each. One served as control and the other received 10 mg. of stilbestrol per head daily in the soybean meal. Atlas sorghum silage was used as the roughage in all lots and the animals received all they would clean up each day. The concentrate part of the ration consisted of 1 pound of soybean meal and 4 pounds of ground milo grain for all lots. A mineral mixture of 2 parts steamed bone meal and 1 part salt and salt were fed free choice. Water was available at all times.

Eleven yearling Hereford steers were used in the digestion study. The ration used was chopped alfalfa hay and cracked milo grain fed at a ratio of 1 part hay to 3 parts grain. The study was made with all steers and then repeated with stilbestrol. Thus, each animal served as his own control. The stilbestrol was fed at the rate of 10 mg. per head daily. The steers were fed in stanchions, and canvas collection bags were used to collect the feces for chemical analyses.

Results and Discussion

Feed lot results for the steers are shown in Table 48, and for the heifers in Table 49. Note that there is a little variation between lots; however, there are no significant differences. Table 50 gives a summary of the digestion study. There was a consistent lowering of digestibility when stilbestrol was added to the ration. These differences are statistically significant. The economic or practical significance of these findings cannot be stated at this time. However, with increased gains on fattening rations and apparently lowered digestibility of the feed, further investigations seem to be warranted.

Many animals, both steers and heifers, developed high tailheads and weak backs in the region of the loin. Here again, the practical significance of these results is not known at this time.

Table 48.—Results with and without stilbestrol in the wintering ration of beef steer calves.

(Nov. 16, 1954-April 5, 1955—140 days)

Lot number	10	15	11*	12*
Number steers per lot	10	10	10	10
Av. initial wt., lbs.	454	457	456	455
Av. final wt., lbs.	723	714	723	729
Av. total gain, lbs.	269	257	267	274
Av. daily gain, lbs.	1.92	1.84	1.91	1.96
Av. daily ration, lbs.:				
Soybean meal	1.00	1.00	1.00	1.00
Ground milo	4.00	4.00	4.00	4.00
Atlas sorgo silage	29.05	29.04	28.94	29.05
Salt	.10	.11	.13	.13
Mineral (bone meal + salt)	.09	.10	.09	.09
Lbs. feed per 100 lbs. gain:				
Soybean meal	52.12	54.45	52.43	51.13
Ground milo	208.49	217.81	209.74	204.53
Atlas sorgo silage	1514.89	1581.09	1517.60	1485.57
Salt	5.14	5.72	6.62	6.87
Mineral	4.80	5.60	4.83	5.08
Feed cost per 100 lbs. gain	$13.38	$13.99	$13.86	$13.56

* Received 10 mg. of stilbestrol in soybean oil meal per head daily. Cost figured at .08c per mg. or .8c per head daily.

Table 49.—Results with stilbestrol in the wintering ration of beef heifer calves.

(Nov. 16, 1954-April 5, 1955—140 days)

Lot number	16	17*
Number heifers per lot	5	5
Av. initial wt., lbs.	336	338
Av. final wt., lbs.	577	592
Av. total gain, lbs.	241	254
Av. daily gain, lbs.	1.72	1.82
Av. daily ration, lbs.:		
Soybean meal	1.00	1.00
Ground milo	4.00	4.00
Atlas sorghum silage	22.57	22.54
Salt	.13	.11
Mineral (bone meal + salt)	.18	.18
Lbs. feed per 100 lbs. gain:		
Soybean meal	58.09	55.03
Ground milo	232.37	220.13
Atlas sorghum silage	1311.20	1240.17
Salt	7.72	5.90
Mineral (bone meal + salt)	10.79	10.22
Feed cost per 100 lbs. gain	$13.63	$13.33

* Received 10 mg. of stilbestrol per head daily. Cost figured at .08c per mg. or .8c per head daily.

The Use of Live Yeast Suspensions in Beef Cattle Rations.

PROJECT 370

F. H. Baker, D. Richardson, J. O. Harris, R. F. Cox, and O. M. Bowman

It has long been recognized that the rumen of cattle and sheep normally contains innumerable microorganisms which function in the fermentation of complex carbohydrates and the synthesis of nutrients beneficial to the host animal. However, the modern era of feed additives has resulted in a renewed interest in the feeding of live yeast to ruminants.

An experiment was initiated to study the value of two strains of yeast in wintering and fattening rations for beef cattle. This progress report is on a digestion study of a fattening ration and the wintering phase of an experiment that includes wintering, grazing, and fattening steer calves.

Procedure

Forty head of choice-quality steer calves were used in the wintering phase of this test. These calves were part of a shipment from the Lonker Ranch, Medicine Lodge, Kan. The steers were assigned to lots on the basis of weight and feeder grade.

The live yeast suspensions used in this experiment are **Torula utilis** and **Saccharomyces cerevisiae.** The yeast suspensions were prepared weekly and stored at the optimum temperature until fed. They were prepared to supply 3 billion live yeast cells per animal daily. The suspensions were mixed with ½ pint of water and sprinkled over the rations in the feed bunks each morning.

Results of this phase of the study are presented in Table 51.

A digestion study was conducted to determine the influence of the two strains of yeast on the digestibility of a cattle-fattening ration composed of 3 parts milo grain and 1 part alfalfa hay. Eleven yearling Hereford steers weighing 700 pounds each were used in this study.

The results of this study are given in Table 52.

Table 50.—Results of digestion study with stilbestrol using 11 yearling Hereford steers and a ration of 1 part alfalfa hay to 3 parts milo grain.

Steer number	% Apparent Digestibility of: Crude protein		Ether extract		Crude fiber		N-free extract		% T.D.N.	
	Control	Treated*	Control	Treated*	Control	Treated*	Control	Treated*	Control	Treated*
1	65.6	60.3	70.0	54.1	57.3	53.4	77.9	79.9	68.3	67.4
2	70.2	58.1	65.4	55.0	60.9	49.6	86.7	79.2	74.5	66.5
3	70.1	66.3	70.7	64.9	65.8	51.7	82.2	83.7	72.4	71.1
4	68.2	57.4	72.5	64.0	60.7	58.6	77.5	72.7	68.9	63.1
5	61.3	53.2	63.7	46.4	55.1	50.4	75.6	63.7	65.6	55.2
6	61.4	50.5	55.4	54.2	55.4	50.1	77.1	66.2	66.0	57.0
7	66.1	52.7	62.6	51.7	58.2	50.9	83.2	67.4	71.3	58.0
8	67.2	56.6	60.5	50.1	56.9	50.4	80.3	62.8	69.4	55.2
9	67.2	60.0	69.0	59.1	54.7	52.2	81.3	80.3	70.4	67.9
10	66.2	57.3	65.1	62.3	51.3	50.8	77.0	70.2	66.9	61.0
11	62.3	57.5	50.7	46.6	56.2	53.9	75.5	76.8	64.9	64.7
Weighted Av.	66.1	57.3	64.0	55.0	57.5	51.3	79.6	73.2	69.0	62.6

* Received 10 mg. of stilbestrol per head daily.

Observations

1. The rate of gain and feed efficiency were essentially the same for the four lots of steers.

2. The digestibility of the rations, which included the yeast suspensions, was no higher than that of the control ration.

3. The fecal excreta of the yeast-fed steers in both the digestion stalls and the feed lots contained as much coarse grain as did that of the control steers. A more pungent fecal odor was observed among the yeast-fed steers during the digestion study.

Table 51.—Feeding live yeast cultures in wintering rations of steer calves.

(Nov. 16, 1954-April 5, 1955—140 days)

Experimental treatment	None	None	Torula utilis yeast	Saccharomyces cerevisiae yeast
Lot number	10	15	13	14
Number steers per lot	10	10	10	10
Av. initial wt., lbs.	454	457	454	456
Av. final wt., lbs.	723	714	712	713
Av. total gain, lbs.	269	257	258	257
Av. daily gain, lbs.	1.92	1.84	1.84	1.84
Av. daily ration, lbs.:				
Soybean meal	1.00	1.00	1.00	1.00
Ground milo	4.00	4.00	4.00	4.00
Atlas sorgo silage	29.05	29.04	28.93	29.04
Salt	.10	.11	.10	.12
Mineral	.09	.10	.10	.10
Lbs. feed per cwt. gain:				
Soybean meal	52.12	54.45	54.24	54.52
Milo	208.49	217.81	216.97	218.07
Atlas sorgo silage	1514.89	1581.09	1569.15	1582.94
Salt	5.14	5.72	5.58	6.31
Mineral	4.80	5.60	5.66	5.69
Feed cost per cwt. gain*	$13.38	$13.99	$13.93	$14.02

* Feed prices listed on page 3 of this publication.

Table 52.—Digestion coefficients for cattle fattening rations that contained live yeast suspension.

	Crude protein	Ether extract	Crude fiber	Nitrogen-free extract	Total digestible nutrients
Control	66.1	64.0	57.5	79.6	69.0
Torula utilis	66.31	60.38	52.54	80.82	68.49
Saccharomyces cerevisiae	58.34	54.60	57.45	75.98	65.17

Adapting Roughages Varying in Quality and Curing Processes to the Nutrition of Beef Cattle: Prairie Hay vs. Corn Cobs; A Special Supplement vs. Milo Grain and Soybean Meal, 1954-1955.

PROJECT 370

E. F. Smith, D. Richardson, F. H. Baker, and R. F. Cox

This is the third test in an experiment designed to compare the value of certain roughages and supplements in the wintering ration of beef calves. A three-year summary of this experiment is given in Table 54.

Experimental Procedure

Forty choice-quality Hereford heifers were divided as equally as possible into four lots of 10 animals each. The heifers originated in Barber county, Kansas. The rations used are shown in Table 53. An attempt was made to equalize the protein and total digestible nutrient intake between the lots receiving prairie hay and lots receiving corn cobs as roughages. The animals receiving corn cobs were given 50,000 International Units of vitamin A per head daily. The 3 pounds of special supplement fed daily to Lot 7 was composed of 2.25 pounds soybean meal, 0.50 pound molasses, 0.18 pound steamed bone meal, 0.06 pound salt, and 0.01 pound vitamin supplement (2,250 International Units of vitamin A and 400 International Units of vitamin D per gram). A mineral mixture of 1 part salt and 2 parts steamed bone meal and salt were fed free choice. Water was available at all times.

Results and Discussion

The results of this test are shown in Table 53. The animals receiving the special supplement gained faster than the control lot. There were no differences in the first two years' tests. It is believed that the difference in this test was due to chance. Even though animals on the special supplement gained faster, their cost per 100 pounds of gain was greater because of the higher cost of the supplement. The animals receiving corn cobs as the only roughage did not gain quite so well as those receiving prairie hay but their gains were more economical. This shows that corn cobs can be used as the only roughage when properly supplemented.

Table 53.—A comparison of roughages and supplements for wintering beef heifer calves.

(Nov. 15, 1954-April 4, 1955—140 days)

	Atlas sorghum silage, soybean meal, milo grain	Atlas sorghum silage, special supplement	Prairie hay, soybean meal, milo grain	Corn cobs, soybean meal, milo grain, vit. A*
Lot number	8	7	1	2
Number heifers per lot	10	10	10	10
Av. initial wt., lbs.	430	431	432	432
Av. final wt., lbs.	647	695	641	622
Av. total gain, lbs.	217	264	209	190
Av. daily gain, lbs.	1.55	1.89	1.50	1.36
Av. daily ration, lbs.:				
Soybean meal	1.00		1.00	1.50
Ground milo	2.00		3.00	2.50
Special supplement		3.00		
Atlas sorghum silage	29.46	29.54		
Prairie hay			11.46	
Corn cobs				8.56
Salt	.10	.11	.04	.07
Mineral (bone meal + salt)	.12	.11	.11	.07
Lbs. feed per 100 lbs. gain:				
Soybean meal	64.50		66.79	110.47
Ground milo	129.00		200.38	184.11
Special supplement		158.79		
Atlas sorghum silage	1900.00	1563.32		
Prairie hay			765.12	
Corn cobs				630.45
Salt	6.10	5.90	2.43	5.21
Mineral (bone meal + salt)	7.40	5.78	7.11	5.21
Feed cost per 100 lbs. gain	$13.77	$13.87	$15.56	$14.75

* 50,000 I.U. per head daily. Total cost of vitamin A, $18.20.

Table 54.—Three-year summary comparing roughages and supplements for wintering beef heifer calves.

Average 120 days

	Trial number	Atlas sorghum silage, 2 lbs. grain, 1 lb. S.B.M.	Atlas sorghum silage, 3 lbs. special supplt.	Prairie hay, grain, protein	Corn cobs, grain, protein
Av. initial wt., lbs.	1	424	419	419	419
	2	296	296	294	296
	3	430	431	432	432
	Av.	383.3	382.0	382.0	382.0
Av. final wt., lbs.	1	610	602	592	573
	2	483	491	438	437
	3	647	695	641	622
	Av.	580.0	596.0	557.0	544.0
Av. gain per heifer, lbs.	1	186	183	173	154
	2	187	195	144	141
	3	217	264	209	190
	Av.	196.7	214.0	175.3	161.7
Av. daily gain per heifer, lbs.	1	1.72	1.69	1.60	1.43
	2	1.65	1.73	1.27	1.25
	3	1.55	1.89	1.50	1.36
	Av.	1.64	1.77	1.46	1.35
Av. feed per 100 lbs. gain:					
Soybean meal, lbs.	1	58.1		77.5	133.1
	2	60.4		77.2	120.2
	3	64.5		66.8	110.5
	Av.	61.0		73.8	121.3
Grain, lbs.	1	116.1		228.3	210.4
	2	120.9		203.0	181.5
	3	129.0		200.4	184.1
	Av.	122.0		210.6	192.0
Special supplement, lbs.	1		177.0		
	2		173.8		
	3		158.8		
	Av.		169.9		
Atlas sorghum silage, lbs.	1	1763.4	1808.7		
	2	1418.4	1355.1		
	3	1900.0	1563.3		
	Av.	1693.9	1575.7		
Prairie hay, lbs.	1			611.8	
	2			508.3	
	3			765.1	
	Av.			628.4	
Corn cobs, lbs.	1				590.1
	2				499.5
	3				630.5
	Av.				573.4
Minerals (bone meal + salt), lbs.	1	6.1	6.2	8.1	5.2
	2	3.6	3.5	4.6	4.0
	3	7.4	5.8	7.1	5.2
	Av.	5.7	5.2	6.6	4.8

Table 54 (Continued).

Salt, lbs.	1	2.4	3.3	1.3	2.8
	2	1.6	1.9	3.1	2.8
	3	6.1	5.9	2.4	5.2
	Av.	3.4	3.7	2.3	3.6

Alfalfa Silage vs. Alfalfa Hay for Wintering Heifer Calves

PROJECT 370

F. H. Baker, D. Richardson, E. F. Smith, and R. F. Cox

Studies conducted at several experiment stations have demonstrated that alfalfa silage will not produce satisfactory gains for wintering young beef cattle, unless it is supplemented with grain or a protein concentrate. This experiment was designed to determine if a combination of alfalfa silage and hay would equal alfalfa hay as a roughage for wintering young beef heifers.

Experimental Procedure

Twenty choice-quality Hereford heifer calves, average weight of 438 pounds each, were used. The heifers were purchased as calves from the Lonker and the Hall-McNally ranches in Barber county, Kansas. Allotment of the heifers was based on weight, feeder grade, and origin.

The alfalfa hay and silage were harvested from the first-cutting growth on the Animal Husbandry farm. The silage was allowed to wilt from one to two hours in the harvesting process.

In the feeding trial, 3 pounds of alfalfa hay was fed to the cattle of Lot 3 to provide readily available protein and dry roughage. The heifers of Lot 3 were maintained at maximum consumption of alfalfa silage, whereas the heifers of Lot 6 were restricted to the same dry matter intake as Lot 3.

Observations

The rate of gain of the heifers fed alfalfa silage was significantly less than that of those fed alfalfa hay. Likewise, the cost of gains of the alfalfa hay-fed cattle was distinctly less.

Table 55.—Alfalfa silage versus alfalfa hay for wintering heifer calves.

(Nov. 15, 1954-April 4, 1955—140 days)

	3	6
Lot number	3	6
Number heifers per lot	10	10
Av. initial wt., lbs.	438	438
Av. final wt., lbs.	635	673
Av. total gain, lbs.	197	235
Av. daily gain, lbs.	1.41	1.68
Av. daily ration, lbs.:		
Ground milo	4.00	4.00
Alfalfa hay	3.00	11.95
Alfalfa silage	26.78	.....
Salt	.05	.04
Mineral	.11	.10

Table 55 (Continued).

Lbs. feed per 100 lbs. gain:		
Milo	284.55	238.50
Alfalfa hay	213.41	712.30
Alfalfa silage	1905.48	.....
Salt	3.56	2.30
Mineral[1]	7.57	5.75
Feed cost per 100 lbs. gain[2]	$17.31	$14.76

1. Mineral composed of 2 parts steamed bone meal and 1 part salt.
2. Feed prices listed on page 3.

Wintering and Grazing Steer Calves

Methods of Wintering Steer Calves That Are To Be Grazed a Full Season and Sold Off Grass, 1954-55.

PROJECT 253-1

F. H. Baker, R. F. Cox, E. F. Smith, D. L. Good, and G. L. Walker

This is a progress report of the wintering phase of the second trial of this experiment. The results of the first trial were reported in Kansas Agr. Exp. Sta. Cir. 308. The experiment is designed to study management methods, levels of feeding, and supplements for wintering steer calves that are to be sold as stocker or feeder yearlings. Results of the experiment are measured by the combined winter and summer performance of the steers.

The current test includes the following comparisons:

1. Wintering in dry lot compared with wintering on dry bluestem pasture.
2. Levels of protein feeding on dry bluestem pasture.
3. A combination of grain and protein concentrate compared with protein concentrate fed on dry bluestem pasture.

Experimental Procedure

Forty choice Hereford steer calves, purchased from the Lonker Ranch in Barber county, Kansas, were used in this experiment. The steers of Lot 1 were wintered in a dry lot at the experimental barn, while those of the other lots were wintered on dry bluestem pasture at the experimental range unit. The pastures had been stocked at a normal rate the previous summer; adequate grass remained for winter pasture. The calves of Lots 2, 3, and 4 were moved from pasture to pasture monthly to minimize any differences due to pasture.

The rations used in the test as well as the results are presented in Table 56.

Table 56.—Wintering and grazing steer calves.
(Nov. 10, 1954-April 6, 1955—147 days)

Lot number	1	2	3	4
Number of steers	10	10	10	10
Place of wintering	Dry lot	Bluestem pasture	Bluestem pasture	Bluestem pasture
Initial wt. of steer, lbs.	521	523	522	519
Final wt. of steer, lbs.	653	534	561	561
Gain per steer, lbs.	132	11	39	42
Daily gain per steer, lbs.	0.90	0.08	0.27	0.29

Table 56 (Continued).

Daily ration per steer, lbs.:				
Soybean pellets	1.00	1.00	1.00	2.00
Prairie hay	12.11	1.59	1.59	1.59
Corn			1.00	
Dry bluestem pasture		Free choice	Free choice	Free choice
Salt	Free choice	Free choice	Free choice	Free choice
Minerals	Free choice	Free choice	Free choice	Free choice
Feed cost per steer*	$24.11	$11.17	$14.99	$17.49

* Feed prices listed on page 3 of this publication.

Observations

1. The winter was rather severe for feeding cattle on pasture. This, along with the fleshy condition of the calves at the beginning of the winter, may be responsible for the low gains of all the steers wintered on pasture.

2. The condition of the calves at the end of the winter appears to be as good as in years when the gains were higher.

3. The steers wintered in dry lot made gains comparable to those of steers on the same ration in previous years.

Wintering, Grazing, and Fattening Heifers 1953-54.

PROJECT 253-2

F. H. Baker, E. F. Smith, and R. F. Cox

This experiment was designed to study the effect of different wintering management systems on the grazing and fattening performance of beef heifers. Since this report concerns the third trial of the series, a brief summary table of the three years' results and the current year's results in included in the report.

Experimental Procedure

Twenty choice-quality Hereford heifer calves were used in the study. They were delivered to Manhattan, December 1, 1953, at $18 per cwt., from the Pueblo, Colo., area. The system of management for each lot follows:

Lot 1—wintered on dry bluestem pasture with 1.31 pounds of cottonseed cake per head daily, grazed on bluestem pasture until July 2, full-fed in dry lot 112 days.

Lot 2—wintered on Atlas sorgo silage, 1 pound cottonseed meal, and 2 pounds ground milo per head daily, grazed on bluestem pasture until July 2, and full-fed in dry lot 112 days.

Observations

1. The winter of 1953-54 was mild and very favorable for wintering cattle on dry grass.

2. Although wintering heifers on dry bluestem pasture resulted in lower total gains, dressing percentages, carcass grades, and selling prices, they returned as much money above feed costs as did the heifers wintered in dry lot. This was due primarily to the higher grass gains the following summer and lower winter feed costs of the heifers wintered on bluestem pasture.

Table 57.—Wintering, grazing, and fattening heifers.

Phase 1—Wintering, 1953-54

	1	2
Lot number	1	2
Place wintered	Bluestem pasture	Dry lot
Number days in phase	111	140
Initial wt. of heifers, lbs.	360	357
Final wt. per heifer, lbs.	450	579
Gain per heifer, lbs.	90	222
Daily gain per heifer, lbs.	.81	1.59
Feed per head daily, lbs.:		
Cottonseed meal or cake	1.31	1.00
Milo	.....	2.00
Sorghum silage	.....	23.54
Dry bluestem pasture	Free choice	.....
Salt	.035	.05
Mineral	.035	.05
Feed cost per 100 lbs. gain*	$ 8.14	$ 11.85
Feed cost per heifer*	7.33	26.31

Phase 2—Grazing

Dates of grazing	April 6-July 2	May 5-July 2
Number days grazing	87	58
Initial wt. per heifer	450	579
Final wt. per heifer	602	620
Gain per heifer	152	41
Daily gain per heifer	1.75	.71

Phase 3—Full-Feeding, July 3, 1954-October 23, 1954—112 Days

Initial wt. per heifer, lbs.	596	614
Final wt. per heifer, lbs.	824	878
Gain per heifer, lbs.	228	264
Daily gain per heifer, lbs.	2.04	2.36
Feed per head daily, lbs.:		
Ground corn	12.52	13.50
Cottonseed meal	1.67	1.68
Prairie hay	6.05	5.29
Ground limestone	.13	.13
Salt	.03	.03
Lbs. feed per cwt. gain:		
Ground corn	614.82	572.77
Cottonseed meal	81.80	69.32
Prairie hay	297.41	224.39
Ground limestone	6.45	5.38
Salt	1.54	1.33
Feed cost per cwt. gain*	$ 24.03	$ 21.63
Total feed cost this phase*	54.78	56.58

Table 57 (Continued).

Summary—Phases 1, 2, and 3

Total gain per heifer all phases, lbs.	464	521
Daily gain per heifer all phases, lbs.	1.50	1.68
Feed cost per cwt. gain	$ 16.83	$ 20.32
Total feed cost per heifer	78.11	88.89
Initial cost per heifer	64.80	64.26
Feed cost and heifer cost	142.91	163.15
Selling price per cwt. at market	$ 22.50	$ 23.50
Selling price per heifer	177.08	197.17
Profit per heifer	34.17	34.02
% shrink in shipment to market	4.5	4.4
Dressing %	58.7	61.1
Carcass grades U.S.:		
Choice +		1
Choice		1
Choice —	1	4
Good +	5	4
Good	4	

* Feed prices: Sorghum silage, $8 ton; prairie hay, $20 ton; corn, $1.60 bu.; summer grazing, $16; winter grazing, $0.50 per month; cottonseed meal or cake, $75 ton; mineral, $4 cwt.; salt, $12 ton.

Table 58.—Wintering, grazing, and fattening heifers, three-year summary.

Management	Wintered on dry bluestem	Wintered in dry lot
Lot number	1	2
Number heifers per lot	10	10
Initial wt. av., lbs.	428	428
Winter gain av., lbs.	85	200
Grass gain av., lbs.	151	67
Feed-lot gain av., lbs.	249	250
Final wt. av., lbs.	913	945
Total gain, lbs.	485	517
Feed cost per cwt. gain[1]	19.79	22.77
Dressing %	59.1	61.1
Carcass grade		
Choice	5	9
Good	5	1
Selling price per cwt.	$ 24.67	$ 25.75

1. Based on average prices each of the three years.

Table 59.—Comparison of different methods of managing bluestem pasture, 1954.

Pasture number	1	2	3	4, 5, 6	7	8	9
Management	Normal stocked	Over-stocked	Under-stocked	Deferred rotated	Early-spring burned	Mid-spring burned	Late-spring burned
Number head per pasture	17	25	13	51	12	12	12
Acres in pasture	60	60	60	3-60*	44	44	44
Number acres per head	3.53	2.4	4.62	3.53	3.67	3.67	3.67
Initial wt. per steer, lbs.	456	456	462	456	463	454	457
Final wt. per steer, lbs.	717	693	698	670	733	725	763
Gain per steer, lbs.	261	237	236	214	270	271	306
Daily gain per steer, lbs.	1.65	1.50	1.49	1.35	1.71	1.72	1.94
Gain per acre, lbs.	73.94	98.75	51.08	60.62	73.57	73.84	83.38

*Three 60-acre pastures.

Table 60.—Yearly account of cattle gains under different methods of grazing pastures.

Five-year summary, 1950-1954

Gain per steer in pounds for the summer season of approximately 150 days.

Pasture number	1	2	3	4, 5, 6	7	8	9
	Normal stocked	Over-stocked	Under-stocked	Deferred rotation grazing	Early-spring burned	Mid-spring burned	Late-spring burned
1950	221	210	214	205	216	254	230
1951	242	256	290	234	343	365	254
1952	246	209	228	197	251	278	283
1953	226	194	233	197	305	217	234
1954	261	237	236	214	270	271	306
Average	239	221	240	209	237	257	263

The Effect of Grazing Systems on Livestock and Vegetation

Comparison of Different Methods of Managing Bluestem Pastures, 1954.

PROJECTS 253-3 and 253-5

E. F. Smith, K. L. Anderson, and F. H. Baker

This experiment is to determine effects of different stocking rates, deferred grazing, and burning on livestock gains, productivity of pastures, and range condition as determined by plant population changes. In addition to the yearly report, a brief summary of the cattle gains for the first 5 years of this test is included.

Experimental Procedure

Good-quality Hereford yearling steers weighing about 460 pounds were used to stock the pastures. The method of management of each pasture was:

Pasture 1—Normal rate of stocking, 3.5 acres per head.
Pasture 2—Overstocked, 2.4 acres per head.
Pasture 3—Understocked, 4.6 acres per head.
Pastures 4, 5, 6—Deferred and rotation grazing, 3.5 acres per head. All steers were held in two pastures until July 1, then turned in to the protected pasture until it seemed advisable to allow them the run of all three pastures.
Pasture 7—Burned February 23, 1954; rate of stocking, 3.67 acres per head.
Pasture 8—Burned April 10, 1954; rate of stocking, 3.67 acres per head.
Pasture 9—Burned April 24, 1954; rate of stocking, 3.67 acres per head.

Observations

1. The cattle grazing in all the pastures made satisfactory gains. However, greatest gains were made by steers in the late-spring burned pasture, and least gains by steers in pastures handled in the deferred and rotation grazing system.

2. June and July were very hot and dry, which reduced the growth of grass and lowered cattle gains. However, several August rains resulted in satisfactory regrowth of grass.

3. Effects of the various stocking treatments on the vegetation did not become apparent until 1952. Before that, the better than average moisture conditions resulted in better than average growth of forage. This tended to obscure the effects of heavy grazing. Despite the drought of the past three years, bluestem vegetation, as measured by vegetative population counts, improved under light stocking and under deferred grazing, while rather severe depletion developed under heavy stocking.

Chief criterion for evaluating range condition is the vegetative population. Under conservative use the major forage species, big bluestem, little bluestem, Indiangrass, and switchgrass, are increasing while less productive forage species and weedy invaders are decreasing. Opposite trends are noted in the pastures stocked heavily and are beginning to be evident in early- and mid-spring burned pastures.

Wintering and Grazing Yearling Steers

The Most Efficient Level of Winter Protein Feeding for Yearling Steers Wintered and Summer Grazed on Bluestem Pasture, 1953-54.

PROJECT 253-4

E. F. Smith, F. H. Baker, R. F. Cox, and L. A. Holland

Experiments conducted at this station during the past five years have demonstrated that yearling steers can be successfully wintered

on dry bluestem pasture with 1½ to 2 pounds of cottonseed or soybean oil meal or cake per head daily. The experiment reported here is the second of a series of tests designed to determine if the level of winter protein feeding may be reduced without affecting the yearly performance of the steers. Results of the first trial indicated that yearling steers wintered and grazed on bluestem pasture made more economical annual gains when they received a winter ration of 1 pound of soybean cake daily than when fed 2 pounds of soybean cake daily.

Procedure

Twenty head of good-quality Hereford yearling steers, 10 per lot, were used. They were purchased as steer calves in the fall of 1953 from the Brite Ranch at Marfa, Texas, and used in summer grazing tests on bluestem pasture in 1953. During the winter phase of this test the steers were moved from pasture to pasture every 15 days to minimize any differences due to pastures. The winter pastures the steers were grazed in had been stocked at normal rate during summer, but had sufficient grass remaining to provide ample winter grazing.

In addition to dry bluestem pasture, the steers were fed in the following manner during the winter:

Lot 1—1 pound of cottonseed cake per head daily.
Lot 2—2 pounds of cottonseed cake per head daily.
The steers of both lots were grazed together during the summer of 1954.

Observation

The steers wintered on 1 pound of cake per head daily made 7 pounds more annual gain than those fed 2 pounds of cake per head daily during the winter.

Table 61.—Wintering and grazing yearling steers.

Phase 1—Wintering, October 26, 1953-April 1, 1954—158 days		
Lot number	1	2
Number of steers per lot	10	10
Method of feeding	1 lb. cottonseed cake daily on dry grass	2 lbs. cottonseed cake daily on dry grass
Initial wt. per steer, lbs.	743	743
Final wt. per steer, lbs.	838	872
Gain per steer, lbs.	95	129
Daily gain per steer, lbs.	.61	.83
Daily ration per steer, lbs.:		
Cottonseed cake	1.00	2.00
Mineral (bone meal and salt)	.16	.12
Salt	Free choice	Free choice
Dry bluestem pasture	Free choice	Free choice
Feed cost per steer*	$11.47	$17.13
Phase 2—Grazing, April 1-August 4, 1954—122 days		
Initial wt. per steer, lbs.	838	872
Final wt. per steer, lbs.	1091	1084
Gain per steer, lbs.	253	212
Daily gain per steer, lbs.	2.07	1.74
Cost per 100 lbs. pasture gain*	$6.32	$7.55
Summary Phases 1 and 2		
Initial wt. per steer, lbs.	743	743
Final wt. per steer, lbs.	1091	1084

Table 61 (Continued).

Gain per steer, lbs.	348	341
Total feed cost per steer*	$27.47	$33.13
Feed cost per cwt. gain*	$ 7.89	$ 9.72

* Feed prices: Cottonseed cake, $75 per ton; mineral (2 lbs. bone meal to 1 lb. salt), $4 per cwt.; salt, $0.75 per cwt.; winter pasture, $0.75 per month; summer grazing, $16.

Wintering and Grazing Yearling Steers

The Most Efficient Level of Winter Protein Feeding for Yearling Steers Wintered and Grazed on Bluestem Pasture, 1954-55.

PROJECT 253-4

F. H. Baker, R. F. Cox, E. F. Smith, and L. A. Holland

This is a progress report of the wintering phase of the third trial of this experiment. The results of the first trial were reported in Kansas Agr. Expt. Sta. Cir. 308, and the second trial on page 63 of this publication. This experiment was conducted to determine if 1 pound or 2 pounds of soybean cake per head daily is the more profitable method to winter yearling steers on bluestem pasture. The results are to be measured by the combined winter and summer gains and the condition of the cattle.

Experimental Procedure

Twenty good-quality Hereford yearling steers were used in this test. They were purchased as steer calves in the fall of 1953 from the Joyce Ranch near Carlsbad, N.M. During the summer of 1953 the steers were used in pasture management experiments. The current test was initiated November 10, 1954, and continued to April 6, 1955. To minimize differences due to pastures, the steers were moved monthly from pasture to pasture.

Observations

1. The weather was quite severe for wintering cattle on dry grass pasture. This is reflected in the gains of both lots of steers. Compared with the two previous experiments, the gains were reduced about 50 percent.

2. The winter gains of the steers fed 2 pounds of cake were significantly higher than those of the lot fed 1 pound of cake. However, the economical and practical significance of the results cannot be determined until the end of the summer grazing phase of the test.

Table 62.—Wintering and grazing yearling steers.

Phase 1—Wintering Nov. 10, 1954-April 6, 1955—147 days

Lot number	1	2
Method of feeding	1 lb. soybean cake daily on dry grass	2 lbs. soybean cake daily on dry grass
Number steers per lot	10	10
Initial wt. per steer, lbs.	601	597
Final wt. per steer, lbs.	633	663
Gain per steer, lbs.	32	66
Daily gain per steer, lbs.	0.22	0.45

Table 62 (Continued).

Daily ration per steer, lbs.:		
Soybean cake	1.00	2.00
Prairie hay*	1.83	1.83
Dry bluestem pasture	Free choice	Free choice
Salt	Free choice	Free choice
Mineral (bone meal and salt)	Free choice	Free choice
Feed cost per steer	$11.22	$17.24

* Fed only when snow covered the grass.

Wintering and Grazing Yearling Steers

Effect of Feeding a Protein Supplement During the Latter Part of the Grazing Season to Two-year-old Steers on Bluestem Pasture, 1954.

PROJECT 253-4

F. H. Baker, E. F. Smith, R. F. Cox, and D. L. Good

The nutritive value of bluestem pasture decreases materially after midsummer. Lower protein as well as certain other nutrients is known to be involved in the reduced value of the grass. This experiment was designed to determine the effect of feeding protein supplement after midsummer on cattle gains and condition.

Experimental Procedure

Twenty head of good quality two-year-old Hereford steers were used. They were wintered and summered on bluestem pasture until August 4, when this test was initiated.

The steers were divided into two uniform lots and grazed on bluestem pasture with the following treatment from August 4, 1954, to October 15, 1954:

Lot 1—No supplement.

Lot 2—2 pounds of cottonseed cake per head daily.

Observations

1. The 21 pounds of beef produced in Lot 2 as a result of protein supplementation was not enough to pay for the 144 pounds of cake required to produce this additional gain.

2. The cattle fed cake appeared fleshier, as judged by a committee of animal husbandmen.

Table 63.—Effect of feeding a protein supplement during the latter part of the grazing season to two-year-old steers on bluestem pasture, 1954.

(Aug. 4-Oct. 15, 1954—72 days)

Lot number	1	2
Number steers in lot	10	10
Cottonseed cake fed per steer daily, lbs.	0	2
Initial wt. per steer, lbs.	1087	1087
Final wt. per steer, lbs.	1183	1204
Gain per steer, lbs.	96	117
Daily gain per steer, lbs.	1.33	1.63
Gain in wt. contributed to cottonseed cake, lbs.	0	21
Total cottonseed cake fed per steer, lbs.	0	144

Table 63 (Continued).

Gain per steer by periods:		
Aug. 4-Sept. 3	35	23
Sept. 3-Oct. 2	42	71
Oct. 2-Oct. 23	19	23

Wintering, Grazing, and Fattening Steer Calves

1. The Value of Trace Minerals in a Wintering and Fattening Ration.[1] 2. Self-feeding Grain in Dry Lot Versus Self-feeding on Bluestem pasture.

PROJECT 253-6

F. H. Baker, E. F. Smith, C. S. Menzies, and R. F. Cox

This is a progress report of the wintering phase of the third trial of this experiment. Following this phase the steers will be grazed on bluestem pasture 90 days and then full-fed grain 100 days. One objective of the test is to determine the value of trace minerals (copper, cobalt, iron, manganese, iodine, and zinc) on the performance of steers in a wintering and a fattening ration. A second objective is to compare self-feeding grain in dry lot to self-feeding grain on grass during the full-feeding phase of the deferred full-feeding program.

Experimental Procedure

Thirty choice Hereford steer calves, 10 head to a lot, are being used. Eight steers of each lot were obtained in a shipment from the Lonker Ranch near Medicine Lodge, Kan. The remaining two steers of each lot were obtained from the Currie Ranch near Westmoreland, Kan. The system of management planned for each lot of steers follows:

Lot 15—Wintered on sorghum silage, 4 pounds of grain, and 1 pound of 41 percent protein concentrate per head daily, free access to mineral (bone meal and salt) and salt; bluestem pasture May 1 to August 1; self-fed grain on bluestem pasture after August 1 to choice grade.

Lot 10—Wintered on sorghum silage, 4 pounds of grain, and 1 pound of protein concentrate per head daily, free access to mineral (bone meal and salt) and salt; grazed on bluestem pasture May 1 to August 1; self-fed grain in dry lot after August 1 to choice grade.

Lot 9—Wintered on sorghum silage, 4 pounds of grain, and 1 pound of protein concentrate per head daily; free access to mineral (bone meal and salt) and salt; grazed on bluestem pasture, May 1 to August 1; self-fed grain in dry lot from August 1 until they grade choice. Trace minerals are being supplied to this lot of steers during the wintering and fattening phases of the test.

Observations

No differences due to treatment were apparent among the lots. The difference in gain between Lots 15 and 10, handled identically, demonstrates the variability in cattle gains.

Table 64.—The value of trace minerals in a wintering ration for steer calves.

Management	Standard ration	Standard ration	Trace minerals[1]
Lot number	15	10	9
Number of steers per lot	10	10	10
Av. initial wt., lbs.	457	454	456

1. The trace mineral premix used was supplied by the Calcium Carbonate Corporation, Chicago, Ill.

Table 64 (Continued).

Av. final wt., lbs.	714	723	725
Av. total gain, lbs.	257	269	269
Av. daily gain, lbs.	1.84	1.92	1.92
Av. daily ration, lbs.:			
Soybean meal	1.00	1.00	1.00
Ground milo	4.00	4.00	4.00
Atlas sorgo silage	29.04	29.05	28.92
Salt	.11	.10	.10
Mineral	.10	.09	.11
Feed per cwt. gain:			
Soybean meal	54.45	52.12	52.12
Milo	217.81	208.49	208.49
Atlas sorgo silage	1581.09	1514.89	1507.44
Salt	5.72	5.14	5.32
Mineral[2]	5.60	4.80	5.54
Feed cost per cwt. gain[3]	$13.99	$13.38	$13.38

1. The trace minerals were fed as a trace mineral premix added to the soybean meal to furnish the following amounts in milligrams per head: manganese, 25.0; iodine, 0.87; cobalt, 0.55; iron, 20.5; copper, 1.62; zinc, 1.52.

2. Mineral was 2 parts steamed bone meal to 1 part salt.

3. Feed prices listed on page 3 of this publication.

Improvement of Beef Cattle Through Breeding

PROJECT 286

Walter H. Smith and Lewis A. Holland

The purebred Shorthorn cattle breeding project, established to study the inheritance of physical characteristics, effectiveness of selection, and effects of inbreeding, was continued according to plan last year. Two inbred lines have been established by the use of the two herd sires—College Premier 29th 2368167 and Gregg Farm's Hoarfrost 2492499. They are referred to as the Wernacre Premier and the Mercury lines, respectively. The Wernacre Premier line is in the second generation of inbreeding and the Mercury line has entered the first generation of inbreeding.

The calves of the Wernacre Premier line for 1953 were sired by College Premier 29th and those for 1954 were sired by College Premier 29th and one of his inbred sons, KSC Premier C 11th. College Premier 29th was sold in 1954 and KSC Premier 11th is now being used as the senior herd sire in the Wernacre Premier line.

The non-inbred calves in the Mercury line for 1953 and 1954 were sired by Gregg Farm's Hoarfrost. The inbred calves for these two years were sired by one of his sons, KSC Mercury. Gregg Farm's Hoarfrost died in the spring of 1955 and one of his sons, KSC Mercury 4th, is being used as the senior herd sire in the Mercury line. The 1955 Mercury calves were sired by this bull.

The females in the project are pasture-bred to calve in the spring of each year. The calves are not creep-fed during the suckling period while the cows are on grass. All calves are weaned at 182 days of age and placed on individual feeding trials for 182 days after a three-week adjustment period following weaning.

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

The feeding trial data for the 1953 calf crop are summarized in Table 65, and a partial summary of the 1953 calf crop is presented in Table 66. The feeding trials for the 1953 calves have not been completed to date. The number of days of feeding is designated for each animal.

Table 65.—Summary of the 1953 Shorthorn calves of the Wernacre Premier and Mercury lines.

Tag number	Coefficient of inbreeding[1]	Birth weight	Weaning weight	Weaning score	Days fed	Initial weight	Final weight	Total gain	Average daily gain	Final score	Pounds corn per 100 pounds gain	Pounds alfalfa per 100 pounds gain
Wernacre Premier Line												
Bulls												
82	27.73	60	275	3	182	297	737	440	2.42	3−	361	176
Steers												
9	15.62	61	435	2−	182	470	815	345	1.90	3	452	225
760	14.06	79	425	3	182	450	857	407	2.24	4+	413	210
10	6.25	83	425	2	182	418	835	417	2.29	2	438	224
Av.	11.98	74	428	3+	182	446	836	390	2.14	3	434	220
Heifers												
92	15.62	71	360	2	182	393	675	282	1.55	3+	360	339
39	14.06	72	370	2	182	393	713	320	1.76	3	359	338
49	14.06	70	290	3−	182	318	650	332	1.82	3	316	292
79	7.80	70	320	2−	182	335	591	256	1.41	3	375	344
14	.....	64	300	3+	182	307	590	283	1.55	3	359	332
Av.	10.30	69	328	3+	182	349	644	293	1.62	3	354	329

Table 65 (Continued).

Mercury Line

Bulls

38	.....	73	390	1–	182	435	862	367	2.01	2–	495	349
184	.....	75	369	2+	182	425	895	470	2.58	2+	369	179
61	14.06	52	215	3–	182	230	535	305	1.68	2	389	189
68	14.06	65	285	3+	182	304	703	499	2.74	2	220	131
Av.	7.03	66	315	2–	182	349	734	410	2.25	2	368	187

Steers

154	.....	69	390	2+	182	421	810	389	2.14	3	446	211
56	.....	78	400	3	182	426	845	419	2.30	3–	419	199
18	.....	63	410	1–	182	426	849	423	2.32	3	424	199
Av.	.....	70	400	2+	182	424	835	410	2.25	3	430	203

Heifers

180	.....	84	355	2–	182	356	650	294	1.62	3+	364	333
23	.....	83	375	2+	182	435	770	335	1.84	1	404	358
108	.....	68	415	2+	182	405	733	328	1.80	1	419	372
2	.....	67	370	2–	182	380	720	340	1.87	2+	372	329
90	15.62	55	270	3+	182	305	600	295	1.62	3	351	312
22	.....	68	325	3+	182	344	669	325	1.79	3	240	357
Av.	2.60	71	352	2–	182	371	690	320	1.76	2	358	544

1. The coefficient of inbreeding means the percentage of inbreeding. Individuals from full brother-sister matings are 25 percent inbred. Individuals produced from mating half-brothers and sisters are 12.5 percent inbred.

Table 66.—Partial summary of the 1954 Shorthorn calves of the Wernacre Premier and Mercury lines.

Tag number	Coefficient of inbreeding	Birth weight	Weaning weight	Weaning score	Initial weight	Weight on 4-4-55	Days on trial	Daily gain during trial
				Wernacre Premier Line[1]				
				Steers				
82	15.62	75	401	3	416	759	168	2.04
9	23.44	82	380	3-	388	806	168	2.49
103	14.06	82	445	3+	449	791	168	2.04
18	23.44	58	351	3	443	835	182	2.13
68	19.73	66	370	3	462	792	170	1.94
Av.	19.26	73	389	3	432	797	.....	2.13
				Heifers				
10	14.06	75	332	3-	335	480	168	.86

1. No bulls were fed from this group of calves.

Table 66 (Continued).

Mercury Line

Bulls

30	.....	61	430	1	413	865	168	2.69
79	.....	65	402	1–	400	790	154	2.53
61	25.00	69	382	2	350	510	84	1.90
Av.	8.33	65	405	1–	388	722	.....	2.37

Steers

14	.....	61	435	2+	424	774	154	2.27
180	3.12	72	365	2–	361	635	140	1.96
23	12.50	69	331	2–	341	660	140	2.28
Av.	5.21	67	379	2	375	690	.....	2.17

Heifers

105	.....	70	372	1–	435	715	168	1.67
58	14.06	67	315	2	313	528	140	1.54
22	3.12	64	320	2	314	570	140	1.83
90	12.50	67	331	2	350	600	140	1.79
134	7.81	53	305	2–	285	416	84	1.56
56	12.50	48	261	3+	255	380	84	1.49
760	.....	56	261	2–	268	410	84	1.69
Av.	7.14	61	309	2	317	517	.....	1.65

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