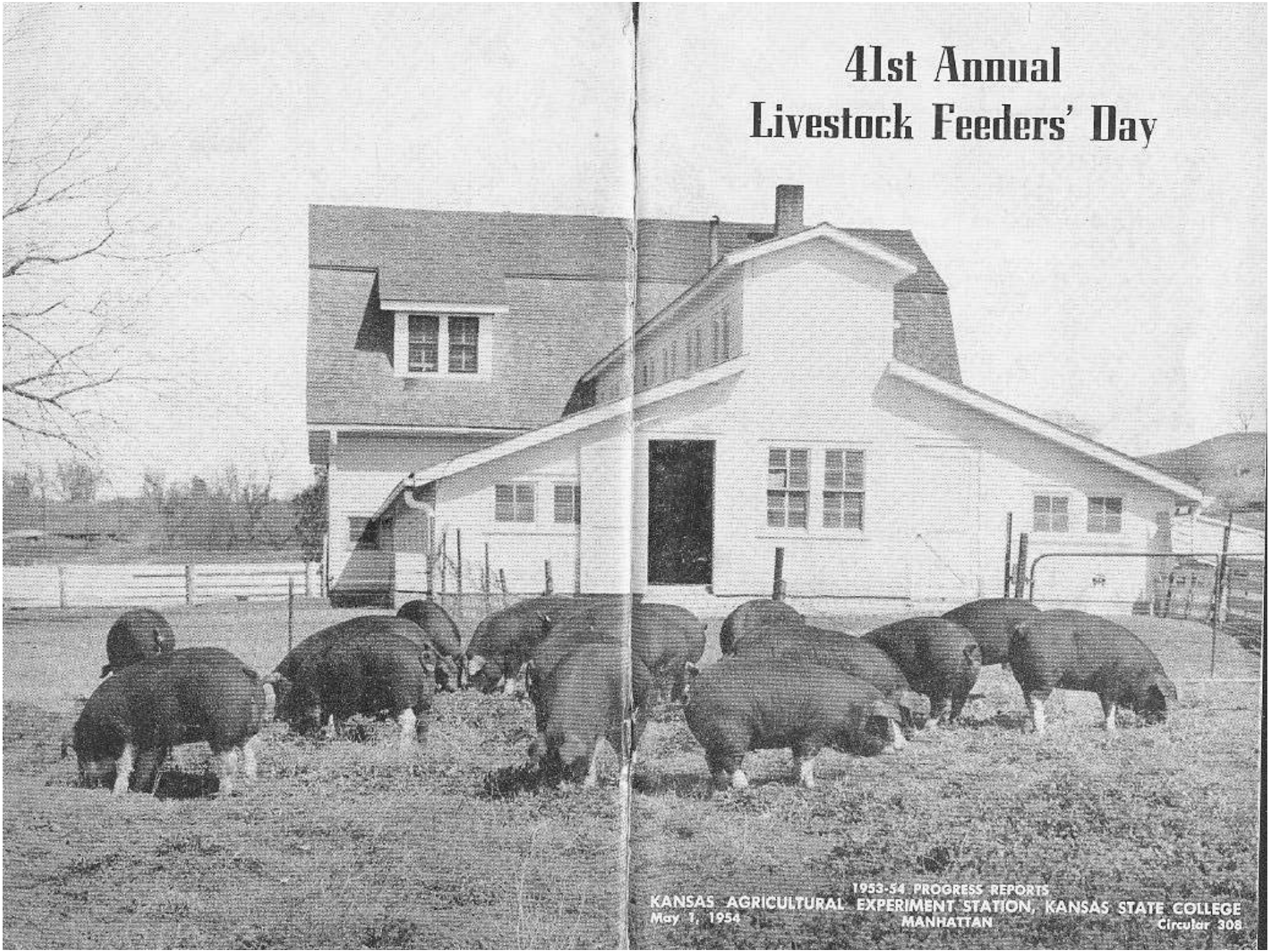
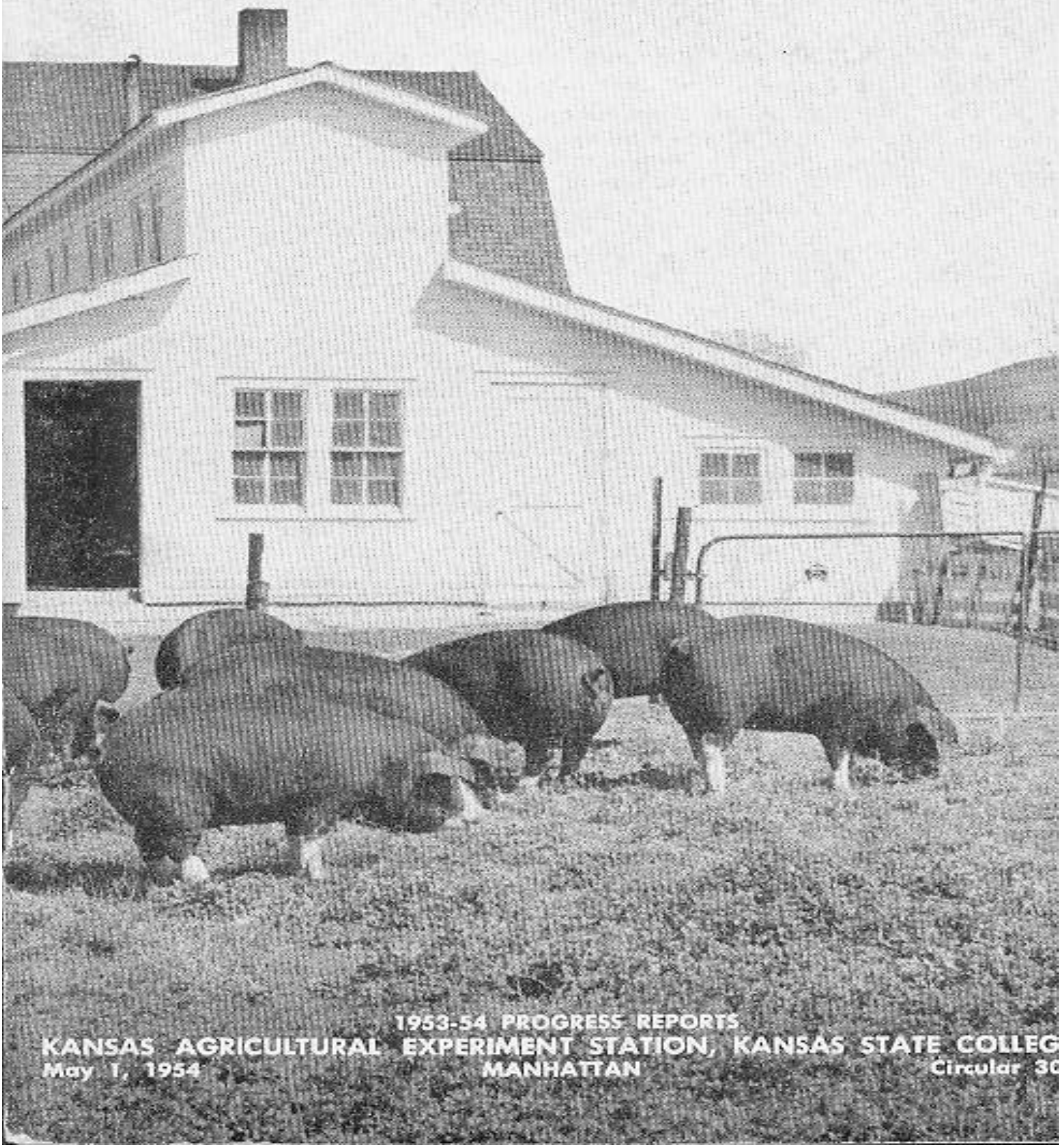


41st Annual Livestock Feeders' Day

1953-54 PROGRESS REPORTS

KANSAS AGRICULTURAL EXPERIMENT STATION, KANSAS STATE COLLEGE
MANHATTAN
May 1, 1954 Circular 308

41st Annual Livestock Feeders' Day



1953-54 PROGRESS REPORTS

KANSAS AGRICULTURAL EXPERIMENT STATION, KANSAS STATE COLLEG
May 1, 1954 MANHATTAN Circular 30

41st Annual Livestock Feeders' Day

Kansas State College

Manhattan

SATURDAY, MAY 1, 1954

9:30 a.m.—Inspection of livestock—Barns and feedlots.

10:00 a.m.—Announcements—Animal Husbandry staff.

Results of Experiments:

Cattle—Experimental feedlots.

Hogs—Hog Barn.

Sheep—Sheep Barn.

11:30 a.m.—Lunch—Field House.

Afternoon Program—Field House

1:30 p.m.—Announcements and Special Features.

Welcome—President James A. McCain, Kansas State College.

Presiding—J. W. Birney, Bucklin, Kan. President, Kansas Livestock Association.

Current Problems Confronting Stockmen—Macky McAlpine, Ranchman, Redwing, Colo.

Presentation of Beef Cattle Production Contest Winners—W. H. Atzenweiler, Agricultural Commissioner, Kansas City, Mo., Chamber of Commerce.

Question and Answer Panel.

FOR THE LADIES

Friday, April 30

7:00 p.m.—Dutch Treat Dinner—Gillett Hotel.

Kansas Cow Belles and Visiting Ladies—in charge of Mrs. Orville Burtis, Manhattan, Kan.

Saturday, May 1

10:00 a.m.—Coffee Hour—Calvin Lounge, Home Ec. Bldg.

11:30 a.m.—Lunch—Field House.

Afternoon Program—Engineering Lecture Room (Across street from Field House)

Presiding—Mrs. Earl Kielhorn, Cambridge, President, Kansas Cow Belles.

Demonstration of Model Meal Featuring Meat—Miss Rita Campbell, National Livestock and Meat Board, Chicago, Ill.

Animal Husbandry Investigations

1953-54 PROGRESS REPORTS*

41st Annual
LIVESTOCK FEEDERS' DAY

Kansas Agricultural Experiment Station, Manhattan

KANSAS STATE COLLEGE
OF
AGRICULTURE AND APPLIED SCIENCE

ARTHUR D. WEBER, Director

* Contribution No. 202, Department of Animal Husbandry. 8M—5-54

Contents

BEEF CATTLE

	PAGE
Wintering and Grazing Steer Calves	3
Wintering and Grazing Yearling Steers	6
Wintering, Grazing, and Fattening Steer Calves	9
Wintering, Grazing, and Fattening Heifers	12
A Comparison of Alfalfa Silage and Alfalfa Hay for Wintering Heifer Calves	15
Fattening Heifers on Milo Grain and Sorghum Silage	16
Ratio of Roughage to Concentrate for Fattening Heifers	18
A Comparison of Prairie Hay and Corn Cobs; a Special Supplement vs. Milo Grain and Cottonseed Meal	20
Value of Ammoniated Molasses in Beef Cattle Wintering Rations	22
The Effect of Grazing Systems on Livestock and Vegetation	24
Improvement of Beef Cattle Through Breeding Methods	29
Dwarfism in Beef Cattle	34

SHEEP

Feedlot Fattening Experiments with Lambs	39
The Relationship of Physical Balance and Energy Value in Sheep Rations	43
The Effect of Different Hormone Treatments upon the Breeding and Lambing Performance of Ewes	44
The Effect of Cottonseed Meal and Soybean Oilmeal Fed Separately and Together upon the Digestibility of a Ration Fed to Lambs	46
Adaptability of Breeds of Rams and Breed-Types of Range Ewes to Market Lamb Production in Kansas	47
Physical Balance in Lamb Fattening Rations, Pelleted and Unpelleted Rations for Creep-fed Lambs	49

SWINE

Swine Feeding Investigations	50

Col. W. A. Harris	57

Beef Cattle

Wintering and Grazing Steer Calves

Methods of Wintering Steer Calves That Are To Be Grazed a Full Season and Sold Off Grass, 1952-53.

PROJECT 253-1

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

This project is concerned with different methods of wintering, different supplements, and level of wintering for steer calves that are to be sold as stocker or feeder yearlings after the summer grazing season. After the different winter treatments, the calves are all grazed together from May 1 until the close of the test at midsummer or fall. The effect of the different winter treatments was measured by the combined winter and summer performance of the steers.

The following comparisons were made:

1. Wintering in drylot compared wtih wintering on dry bluestem pasture.
2. Level of protein feeding on dry bluestem pasture.
3. The value of a grain and protein combination fed on dry bluestem pasture.

Experimental Procedure

Four lots of 10 Hereford steer calves per lot were used in the study. The calves were part of 220 purchased from the Brite Ranch at Marfa, Texas. They cost 29 cents a pound delivered to Manhattan November 3, 1952. From the date received until they were placed on test December 18, 1952, they were fed prairie hay and 1 pound of soybean pellets per head daily.

All lots were wintered on dry bluestem pasture except Lot 1 wintered in a drylot. The calves on pasture were rotated every 15 days to equalize any differences due to pasture. The pastures in which the steers grazed were stocked at a normal rate during the 1952 summer season; sufficient grass remained for winter grazing. The winter stocking rate ranged from 4 to 13 acres per steer, varying with the different sizes of pasture.

Observations

1. The steers made good gains under all methods of winter feeding. The winter was mild except for three snowstorms; one the latter part of November covered the grass about three weeks. The summer was dry but plenty of grass was available.
2. It was more economical to winter on dry grass than in the drylot on prairie hay, on the basis of the gains and feed prices reported in this test.
3. Replacing 1 pound of protein with 1 pound of grain had little effect on yearly gain but lowered the cost of production.
4. When winter feeding of concentrates on dry grass was raised from 1 pound per head daily to 2 pounds, gains were increased appreciably. This increased gain paid for the additional 1 pound of corn fed per head daily in Lot 3 but not for the additional 1 pound of soybean pellets fed in Lot 4.
5. There is some indication from other tests that, had this study continued until October, the feeding of 1 pound of corn in Lot 3 would not have been profitable on a gain basis.

Table 1.—Wintering and Grazing Steer Calves.

Phase 1—Wintering—December 18, 1952, to May 4, 1953—137 days.[1]

Lot number	1	2	3	4
Number steers per lot	10	10	10	10
Place of wintering	Drylot	Bluestem pasture	Bluestem pasture	Bluestem pasture
Initial wt. of steer	417	416	416	417
Final wt. of steer	550	516	535	545
Gain per steer	133	100	119	128
Daily gain per steer	.97	.73	.87	.93
Daily ration per steer:[1]				
Soybean pellets	1.00	1.01	1.02	2.02
Prairie hay	13.36	1.83[2]	1.72[2]	1.72[2]
Corn			1.00	
Mineral[3]	Yes	Yes	Yes	Yes
Salt	Yes	Yes	Yes	Yes
Dry bluestem pasture	No	Yes	Yes	Yes
Feed required for 100 lbs. gain:				
Soybean pellets	94.73	123.00	103.36	190.62
Prairie hay	1265.41	231.00	174.50	162.23
Corn			103.36	
Dry bluestem pasture			Free choice	
Feed cost per cwt. gain[4]	$20.31	$10.73	$11.98	$13.08
Feed cost per steer	27.01	10.73	14.26	16.74

Phase 2—Grazing—May 4 to July 30, 1953—87 days.

Initial wt. of steer	550	516	535	545
Final wt. per steer	727	691	717	721
Gain per steer	167	175	182	176
Daily gain per steer	1.92	2.01	2.09	2.02
Cost per 100 lbs. pasture gain	$ 9.58	$ 9.14	$ 8.79	$ 9.09

Summary of Phases 1 and 2
December 18, 1952, to July 30, 1953—224 days.

Initial wt. per steer	417	416	416	417
Final wt. per steer	727	691	717	721
Gain per steer	310	275	301	304
Daily gain per steer	1.38	1.23	1.34	1.36
Feed cost per 100 lbs. gain	$ 13.87	$ 9.72	$ 10.05	$ 10.77
Feed cost per steer	43.01	26.73	30.26	32.74

1. The wintering ration for Lot 1 was discontinued April 23 for Lots 2, 3, and 4 on April 18; the final weight for the winter period was taken May 4.
2. Prairie hay was fed to Lots 2, 3, and 4, only when snow covered the grass.
3. Mineral was two parts steamed bonemeal to one part salt.
4. Feed prices: corn, $1.60 per bushel; soybean pellets, $95 per ton; prairie hay, $25 per ton; dry bluestem pasture, $.50 per head per month; summer bluestem pasture, $16 for season.

Wintering and Grazing Steer Calves

Effect of Feeding Yearling Steers on Bluestem Pasture 2 Pounds of Corn or Soybean Pellets During the Latter Part of the Grazing Season, 1953.

PROJECT 253-1

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

The nutritive value of bluestem pasture usually declines rapidly after midsummer. This test is an attempt to maintain a high rate of gain after midsummer with small amounts of concentrate feed.

Experimental Procedure

Thirty-six head of good quality yearling Hereford steers were used in this test. They had been grazing together on bluestem pasture previous to the test. The steers were divided into three lots of 12 steers each, in a manner to equalize any difference due to previous winter treatments. They were grazed on bluestem pasture and received the following treatment from August 6, 1953, to October 23, 1953.

Lot 1—No supplement.
Lot 2—Two pounds of soybean pellets per head daily.
Lot 3—Two pounds of corn per head daily.

The steers were rotated on the pastures every 15 days to equalize any differences that might be due to pastures.

Observations

1. Both supplements increased the gain slightly but not enough to pay for the supplement.
2. Apparently there was no great lack of protein in the grass, since the corn increased the gain slightly more than the soybean pellets.
3. As evaluated by a committee of animal husbandmen, the steers fed soybean pellets did not show so much bloom as those fed no supplement or those fed 2 pounds of corn.

Table 2.—Effects of Feeding a Protein Supplement During the Latter Part of the Grazing Season to Yearling Steers on Bluestem Pasture.

August 6-October 23, 1953—78 days.

Lot number	1	2	3
Number steers per lot	12	12	12
Management	No supplement	2 pounds soybean pellets	2 pounds corn
Initial wt. per steer	703	705	710
Final wt. per steer	811	823	835
Gain per steer	108	118	125
Daily gain per steer	1.38	1.51	1.60
Gain in wt. contributed to feeding soybean pellets or corn	0	10	17
Total soybean pellets or corn fed per steer—lbs.:			
Soybeans		156	
Corn			156
Gain per steer by periods:			
August 6-September 3	50	58	40
September 3-October 2	42	35	62
October 2-October 23	16	25	23
Total gain August 6-October 23	108	118	125

Wintering and Grazing Yearling Steers

The Most Efficient Level of Winter Protein Feeding for Yearling Steers Wintered and Summer Grazed on Bluestem Pasture, 1952-53.

PROJECT 253-4

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

Yearling steers have been successfully wintered at this station on dry bluestem pasture for the past five winters by feeding 1½ to 2 pounds of cottonseed or soybean oilmeal per head daily. The objective of this test is to determine if the level of winter protein feeding may be reduced without affecting the yearly performance of the steers.

Twenty head of good quality Hereford yearling steers, 10 head to a lot, were used in this study. They originated in southeastern Colorado and were purchased as calves in the fall of 1951 for 42 cents a pound. They were used in summer grazing tests on bluestem pasture in 1952. From November 1 until December 31, 1952, when this test started, they were on bluestem pasture supplemented with 1 pound of soybean pellets. 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 in which the steers were grazed were of such size as to vary the stocking rate from 6 to 19 acres per head. All pastures used in the winter had sufficient grass remaining on them for winter use, although they were stocked at a normal rate for the summer of 1952.

In addition to dry winter bluestem pasture, the following amounts of protein were fed:

Lot 1—1 pound of soybean pellets per head daily.

Lot 2—2 pounds of soybean pellets per head daily.

The steers were grazed together during the summer of 1953 after the different winter treatments.

Observation

1. On the basis of the combined winter and summer gain, the most effective level of protein supplement was 1 pound of soybean pellets per head daily. It took 124 pounds of pellets to produce an additional 15 pounds of gain in Lot 2.

Table 3.—Wintering and Grazing Yearling Steers.

Phase 1—Wintering—December 31, 1952-May 4,[1] 1953—124 days.

Lot number	1	2
No. of steers per lot	10	10
Management	Fed 1 lb. soybean pellets	Fed 2 lbs. soybean pellets
Initial wt. per steer	718	720
Final wt. per steer	784	832
Gain per steer	66	112
Daily gain per steer	.53	.90
Daily ration per steer:		
Soybean pellets[1]	1.00	2.02
Prairie hay[2]	1.39	1.39
Minerals[3]	.22	.20

Salt	.06	.05
Dry bluestem pasture	Free choice	Free choice
Feed cost per steer[4]	$11.31	$16.36
Phase 2—Summer Grazing—May 4, 1953-August 3, 1953—91 days.		
Initial wt. per steer	784	832
Final wt. per steer	1003	1020
Gain per steer	219	188
Daily gain per steer	2.41	2.07
Summary of Phases 1 and 2		
Initial wt. per steer	718	720
Final wt. per steer	1003	1020
Gain per steer	285	300
Daily gain per steer	1.33	1.40
Total feed cost per steer	$27.31	$32.36
Feed cost per cwt. gain	$ 9.60	$10.78

1. Soybean pellets were discontinued April 18, 1953.
2. Prairie hay was fed only when snow covered the grass.
3. Minerals were 2 parts steamed bonemeal and 1 part salt.
4. Feed prices: Soybean pellets, $95 a ton; prairie hay, $25 a ton; minerals, $5 cwt.; salt, $12 a ton.

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, 1953.

PROJECT 253-4

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

The nutritive value of bluestem pasture usually begins to decline rapidly after midsummer. This test is concerned with the effect of feeding a protein supplement after midsummer on cattle gains and condition.

Three years of this work have been summarized in Circular 297.

Experimental Procedure

Twenty head of good quality two-year-old Hereford steers were used in this test. They were wintered on dry bluestem pasture and then grazed together until August 5, when this test started.

The steers were divided into two uniform lots and grazed on bluestem pasture with the following treatment from August 5, 1953, to October 23, 1953:

Lot 1—No supplement.
Lot 2—Two pounds of soybean pellets per head daily.

Observations

1. The 38 pounds of beef produced in Lot 2 as a result of feeding two pounds of soybean pellets per head daily was just enough to pay for the 158 pounds of pellets required to produce this additional gain.

2. Lot 2, fed soybean pellets, appeared fleshier as judged by a committee of animal husbandmen.

Table 4.—Effect of Feeding a Protein Supplement During the Latter Part of the Grazing Season to Two-Year-Old Steers on Bluestem Pasture, 1953.

August 5-October 23, 1953—79 days.

Lot number	1	2
Steers in lot	10	10
Management	No soybean pellets fed	Fed two pounds soybean pellets per head daily
Initial wt. per steer	1014	1009
Final wt. per steer	1079	1112
Gain per steer	65	103
Daily gain per steer	.82	1.30
Gain in wt. contributed to soybean pellets	0	38
Total soybean pellets fed per steer, lbs.	0	158
Gain per steer by periods:		
Aug. 5-Sept. 3	51	38
Sept. 3-Oct. 2	16	52
Oct. 2-Oct. 23	−2	13

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

This is a progress report covering only the wintering phase of this test. One other test has been completed for 1952-53, and is reported in this publication (page 6). The purpose of this experiment is to determine which is the more profitable method of wintering on dry bluestem pasture for yearling steers, feeding 1 or 2 pounds of cottonseed cake per head daily.

The results are to be measured by the combined winter and summer gains and the condition of the cattle.

The steers will be grazed together during the summer of 1954 and will be sold off grass as feeder steers in the fall.

Experimental Procedure

Twenty head of good quality Hereford yearling steers were used in this study. They were purchased from the Brite Ranch at Marfa, Texas, in the fall of 1952 as calves for 28 cents a pound. They were used in summer grazing tests on bluestem pasture in 1953. This test started at the close of the summer grazing season on October 26, 1953, and extended to April 1, 1954. During this test the steers were moved from pasture to pasture every 15 days to minimize any differences due to pastures.

During March one-half of the steers in each lot had access to molasses-sprayed grass in a pilot test to find out if this method of feeding might have some possibilities. The pastures in which the

steers were grazed were of such size as to vary the stocking rate from 6 to 19 acres per head. All pastures used in this winter test had sufficient grass remaining for winter use. They were lightly stocked during the summer of 1952.

Observations

1. The winter was mild, dry, open, and favorable for wintering on dry grass. The additional pound of cottonseed cake fed per head daily to Lot 19 increased the winter gain enough to pay for its use. However, this may not be true by the end of summer.

The results of the level of protein feeding studied here can best be evaluated at the close of the summer grazing season in 1954 and will be reported at next year's livestock feeders' day.

Table 5.—Wintering and Grazing Yearling Steers.

Phase 1—Wintering, October 26, 1953, to April 1, 1954—158 days.

Lot number	18	19
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	743	743
Final wt. per steer	838	872
Gain per steer	95	129
Daily gain per steer	.61	.83
Daily ration per steer, lbs.:		
Cottonseed cake	1.00	2.00
Mineral (bonemeal and salt)	.16	.12
Salt	Free choice	Free choice
Dry bluestem pasture	Free choice	Free choice
Feed cost per steer[1]	$11.47	$17.13

1. Feed prices may be found on page 27 of this publication.

Wintering, Grazing, and Fattening Steer Calves

1. The value of trace minerals in a wintering and fattening ration.[1]
2. Self-feeding grain in drylot vs. self-feeding on bluestem pasture, 1952-53.

PROJECT 253-6

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

This is the second trial of this experiment; the first is reported in Kansas Agricultural Experiment Station Circular 297. The steers were all wintered, grazed and then full fed. One objective of the test was to find out the value of trace minerals, copper, cobalt, iron, manganese, iodine, and zinc on the performance of steers on a wintering and a fattening ration. Another objective was to compare self-feeding grain on grass to self-feeding grain in drylot for steers on the deferred full-feeding program. The system of production called deferred full-feeding uses good-quality steer calves and consists of three phases: (1) producing 225-250 pounds of gain during the winter; (2) grazing 90 days without grain; and (3) full feeding 100 days in the drylot.

1. The trace mineral premix used in this study was furnished by the Calcium Carbonate Company of Chicago, Ill.

Experimental Procedure

Thirty head of good quality Hereford steer calves, 10 head to a lot, were used in the study. They were the lightest calves of a shipment of 220 steer calves from the Brite Ranch at Marfa, Texas. They cost 29 cents a pound delivered to Manhattan, Kan., November 3, 1952.

They were fed prairie hay and 1 pound of soybean pellets until they were started on test December 19, 1952. All weights are full weights taken about 7:00 a.m. before feeding, except the initial and final weights of the full-feeding period, which were taken after an overnight stand in drylot.

The trace minerals were fed as a trace mineral premix added to the soybean oilmeal to furnish the following amounts in milligrams per head daily in the wintering and fattening ration, respectively: manganese 25.0, 56.3; iodine .87, 1.97; cobalt .55, 1.25; iron 20.5, 46.13; copper 1.62, 3.55; and zinc 1.52, 3.42.

The system of management for each lot follows:

Lot 1—wintered on Atlas sorgo silage, prairie hay, 5 pounds of ground grain, and 1 pound of 41 percent protein concentrate per head daily, free access to mineral (bonemeal-salt mix) and salt; bluestem pasture May 1 to August 1; self-fed grain on bluestem pasture after August 1 to choice grade.

Lot 2—wintered on Atlas sorgo silage, prairie hay, 5 pounds of grain, and 1 pound of protein concentrate per head daily, free access to mineral (bonemeal and salt mixture) and salt; grazed on bluestem pasture May 1 to August 1; self-fed grain in drylot after August 1 to choice grade. During the winter and full-feeding phase they received trace minerals.

Lot 3—wintered on Atlas sorgo silage, prairie hay, 5 pounds of grain, and 1 pound of protein concentrate per head daily; free access to mineral (bonemeal and salt mixture) and salt; grazed on bluestem pasture, May 1 to August 1; self-fed grain in drylot from August 1 until they graded choice.

Observations

1. The addition of trace minerals to the wintering ration failed to produce a favorable response. The winter gains in all lots were exceptionally good. On this type of ration a gain of about 1½ pounds per head daily has been obtained in the past compared with about 2 pounds in this test for both the trace mineral and check lots.

2. Self-feeding grain on grass to Lot 1 produced just as large a gain with slightly less grain and a lower feed cost as self-feeding grain in drylot to Lot 3. This lower feed cost enabled Lot 1 to show a greater return per steer above initial cost, plus feed cost.

3. The trace minerals fed to Lot 2 during the full-feeding phase increased the gain .58 of a pound daily over Lot 3 fed no trace mineral. This increase was most notable during the last 30 days of the test. Lot 2 fed trace minerals ate more grain (all lots were self-fed grain), utilized it more efficiently, and produced higher grading carcasses than Lot 3 fed no trace minerals. Lot 2 also made a slightly greater return per steer over initial cost, plus feed cost.

Table 6.—Wintering Steer Calves.

Phase 1—December 19, 1952-May 4, 1953—136 days.

Lot number	1	2	3
Number steers in lot	10	10	10
Management	Standard ration	Standard ration plus trace mineral	Standard ration
Initial wt. per steer	360	361	357
Final wt. per steer	639	644	641

Gain per steer	279	283	284
Daily gain per steer	2.05	2.08	2.09
Daily ration per steer:			
Soybean pellets	1.00	1.00	1.00
Corn	5.07	5.07	5.07
Sorghum silage	19.56	19.26	19.15
Prairie hay	1.72	2.07	2.23
Mineral[1]	.08	.09	.10
Salt	.07	.05	.05
Trace minerals[2]	No	Yes	No
Feed cost per cwt. gain[3]	$15.27	$15.19	$15.26
Feed cost per steer	42.60	42.98	43.34

Phase 2—Grazing—May 4, 1953-July 31, 1953—88 days.

Initial wt. per steer	639	644	641
Final wt. per steer	751	727	738
Gain per steer	112	83	97
Daily gain per steer	1.27	.94	1.10

Phase 3—Full Feeding—July 31, 1953-November 7, 1953—99 days

Management	Self-fed grain on grass	Self-fed grain in drylot plus trace-mins.	Self-fed grain in drylot
Initial wt. per steer	751	727	738
Final wt. per steer	994	1026	980
Gain per steer	243	299	242
Daily gain per steer	2.45	3.02	2.44
Daily ration per steer, lbs.:			
Soybean pellets	1.44	1.46	1.44
Corn	13.72	15.88	14.09
Prairie hay		4.62	4.88
Ground limestone	.10	.10	.09
Salt	Free choice	.08	.09
Trace minerals[2]	No	Yes	No
Feed per cwt. gain, lbs.:			
Soybean pellets	58.85	48.41	58.88
Corn	558.84	525.25	576.61
Prairie hay		153.14	166.81
Ground limestone	4.01	3.30	3.84
Salt	Free choice	2.57	3.72
Cost of feed per cwt. gain[3]	$18.65	$19.10	$21.23
Total feed cost this phase	45.32	57.10	51.37

Summary of Phases 1, 2, and 3

Total gain per steer (all phases)	644	665	623
Daily gain per steer (all phases)	1.99	2.06	1.93

Feed cost per cwt. gain (all phases)	$16.13	$17.72	$17.77
Total cost of feed per steer	103.92	116.08	110.71
Initial cost per steer at 29 cwt.	104.40	104.69	103.53
Feed cost + steer cost	208.32	220.77	214.24
Selling price per cwt. at market	22.00	22.00	22.00
Selling price per steer	218.68	225.72	215.60
Return per steer above initial cost + feed cost	10.36	4.95	1.36
Percentage wt. change in shipping to market	—1.00	+1.00	—1.00
Dressing percentage	60.0	60.7	60.6
Carcass grades, US[4]:			
Choice+			
Choice		1	
Choice—	2	3	1
Good+	1	3	2
Good	3	2	4
Good—	3		3
Commercial+	1	1	

1. Mineral was 2 parts steamed bonemeal to 1 part salt.
2. The trace minerals were fed as a trace mineral premix added to the soybean oilmeal to furnish the following amounts in milligrams per head daily in the wintering and fattening ration, respectively: manganese 25.0, 56.3; iodine .87, 1.97; cobalt .55, 1.25; iron 20.5, 46.13; copper 1.62, 3.65; zinc 1.52, 3.42.
3. Feed prices: corn $1.60 per bu.; soybean pellets $95 a ton; sorghum silage $10 a ton; prairie hay $25 a ton; mineral $5 cwt.; salt $12 a ton; bluestem pasture $16 per head.
4. The carcasses were graded the following day as follows: Lot 1—1 commercial, 7 good and 2 choice; Lot 2—1 commercial, 5 good and 4 choice; and Lots 3-9 good and 1 choice.

Wintering, Grazing, and Fattening Heifers, 1952-53

PROJECT 253-2

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

This test was to compare different methods of wintering heifer calves that are going to be full fed grain after a short summer grazing period. Lot 1 was wintered on dry bluestem pasture. Lot 2 was wintered in drylot. It was planned to winter Lot 3 on brome pasture but lack of moisture and bromegrass growth made it necessary to move the heifers in Lot 3 into drylot January 1.

Experimental Procedure

Thirty good quality Hereford heifer calves, 10 head to a lot, were used in the study. They cost 29 cents a pound delivered to Manhattan, Kansas, September 15, 1952. They originated in the Sterling City, Texas, area. From delivery date until November 15, 1952, they were fed prairie hay and 1 pound of soybean oilmeal pellets per head daily. The system of management for each lot follows:

Lot 1—wintered on dry bluestem pasture supplemented with 1½ to 2 pounds of concentrate feed per head daily, grazed on bluestem pasture May 1 to July 15, full fed in drylot 100 days.

Lot 2—wintered on Atlas sorgo silage, prairie hay, 1 pound of soy-

bean pellets, and 2 pounds of corn per head daily; grazed on bluestem pasture May 1 to July 15; full fed in drylot 100 days.

Lot 3—wintered on brome pasture until January 1, then moved to drylot. In drylot they were fed sorghum silage, prairie hay, and 1 pound of soybean pellets per head daily. From April 9, 1953, to July 14, 1953, they were grazed on brome pasture; starting July 14 they were full fed grain 100 days in drylot.

Observations

1. The winter of 1952-53 in general was mild and favorable for wintering on dry grass as demonstrated by the gain made by Lot 1 at a low feed cost. There were three snowstorms; one the latter part of November left snow covering the grass three weeks.

2. The heifers in Lots 2 and 3 made favorable winter gains. Lot 2 was showing considerable "fleshing" at the close of the winter period. This probably affected the summer gain to some extent, lowering it to .64 pound per head daily.

3. The heifers were self-fed grain during the fattening period and all lots made good gains. Lot 2 continued gaining at a lower rate than the other two lots, probably due to the additional finish they appeared to be carrying.

4. Lot 2, wintered at the highest level, sold for more than the other two lots and produced the highest grading carcasses.

5. Lot 3 wintered at a slightly lower level than Lot 2, made about the same gain, and had about the same dressing percentage. They lost a little more money than Lot 2, primarily because of a lower selling price.

6. Lot 1 wintered in dry bluestem produced the lowest total gain, selling price, dressing percentage, and carcass grade. However, in money lost they ranked favorably, along with Lot 2, largely because of lower feed costs.

Table 7.—Wintering, Grazing, Fattening Heifers.

Phase 1—Wintering 1952-53

Lot number	1	2	3
Place of wintering	Bluestem pasture	Drylot	Drylot and brome pasture
No. heifers per lot	10	10	10
Number of days in phase	170	170	145
Initial wt. per heifer	443	445	446
Final wt. per heifer	588	714	625
Gain per heifer	145	269	179
Daily gain per heifer	.85	1.58	1.24
Feed per head daily:			
Soybean pellets	1.16	1.00	1.00
Corn	.30	1.94	
Prairie hay	1.85	5.35	6.45
Sorghum silage		21.47	17.76
Mineral	.04	.06	.18
Salt	.04	.05	.09
Cost of feed per cwt. gain	10.37	17.65	17.15
Feed cost per heifer	18.05	47.52	34.86

Phase 2—Grazing

Lot number	1	2	3
Place and time of grazing	Bluestem pasture May 4-July 14, 1953	Bluestem pasture May 4-July 14, 1953	Brome pasture April 9 to July 14, 1953
Number of days grazed	71	71	96
Initial wt. per heifer	588	714	625
Final wt. per heifer	717	759	749
Gain per heifer	129	45	124
Daily gain per heifer	1.82	.64	1.29

Phase 3—Full Feeding
July 14, 1953, to October 22, 1953—100 days.

Lot number	1	2	3
Initial wt. per heifer	717	759	749
Final wt. per heifer	949	970	970
Gain per heifer	232	211	221
Daily gain per heifer	2.32	2.11	2.21
Feed per head daily:			
Ground corn	14.48	13.67	13.97
Soybean oilmeal pellets	1.49	1.47	1.48
Prairie hay	5.68	5.35	6.19
Ground limestone	.10	.09	.09
Salt	.07	.06	.07
Feed per cwt. gained:			
Ground corn	624.35	648.82	632.13
Soybean pellets	64.11	69.78	67.30
Prairie hay	245.00	253.40	280.00
Ground limestone	4.22	4.60	4.43
Salt	3.02	2.80	3.53
Feed cost per cwt. gain	23.64	24.71	24.45
Total feed cost this phase	54.81	52.09	54.01

Summary of Phases 1, 2, and 3

Lot number	1	2	3
Total gain per heifer all phases	506	525	524
Daily gain per heifer all phases	1.48	1.54	1.54
Feed cost per cwt. gain	17.56	22.02	20.01
Total cost of feed per heifer	88.84	115.59	104.85
Initial cost per heifer	128.47	129.05	129.36
Feed cost and heifer cost	217.31	244.64	234.21
Selling price per cwt. at market	22.00	24.25	23.00
Selling price per heifer	208.34	236.20	221.49
Loss per heifer	8.97	8.44	12.72
Percentage shrink in shipping to market	.20	.40	.40

Dressing percentage	58.9	61.9	61.6
Carcass grades, U.S.:			
Prime		1	
Prime—		1	
Choice+		2	1
Choice		1	
Choice—	4	4	5
Good+	2	1	2
Good	2		2
Good—	2		

1. Wintering period for Lots 1 and 2 was November 15, 1952, to May 4, 1953, 170 days; Lot 3, November 15 to April 9—145 days.
2. Feed prices were corn $1.60 a bu.; soybean pellets $95 a ton; prairie hay $25 a ton; sorghum silage $10 a ton; mineral $5 a hundred and salt $12 a ton.
3. Mineral was two parts steamed bonemeal, one part salt.
4. Fed only when snow covered the grass.

A Comparison of Alfalfa Silage and Alfalfa Hay for Wintering Heifer Calves, 1953-54.

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

Introduction

Results of two years' trials previously indicated that alfalfa silage did not produce satisfactory winter gains on beef calves and that it was distinctly inferior to alfalfa hay fed free choice. This year's test was planned to study certain supplements when the dry matter intakes of hay and silage were held equal.

Experimental Procedure

Forty Texas Hereford heifer calves averaging 360 pounds each were divided into four lots of 10 head each. The feeding test was conducted from December 17, 1953, to April 8, 1954, or 113 days.

The alfalfa silage and hay were made from first-cutting feed in the same field, when it was approaching one-half bloom. One lot of silage was preserved with cornmeal at the rate of 150 pounds per ton of green forage. The other silage was made without preservative. Both silages were field-chopped and hauled immediately to the silos.

The first feeding plan was to add concentrates to the roughages at the same rate as the corn in the alfalfa-cornmeal silage. However, since consumption and gains of all the calves were so unsatisfactory at the end of 29 days of feeding, the plan was altered so that all groups were fed concentrates at the rate of 4 pounds per head daily, allowance being made in Lot 3 for the corn contained in the silage.

Table 8.—Alfalfa Silage and Hay for Wintering Heifer Calves.
(December 17, 1953-April 8, 1954—113 days)

Lot number	3	4	5	6
Number heifers per lot	10	10	10	10
Rations fed	Alfalfa-corn meal silage,[1] corn	Alfalfa silage, corn	Alfalfa silage, corn, cottonseed meal	Alfalfa hay, corn
Av. initial wt., lbs.	360	360	360	360

1. Contained .07 pound corn per pound of silage.

Av. final wt., lbs.	492	491	500	532
Av. gain, lbs.	132	131	140	172
Av. daily gain, lbs.	1.17	1.15	1.23	1.52
Av. daily ration, lbs.:				
Alfalfa silage	22.72[1]	22.12	22.13	
Alfalfa hay	.38[2]			7.18
Ground shelled corn	1.45	3.04	2.08	3.04
Cottonseed meal			.96	
Mineral[3]	.06	.07	.05	.06
Salt	.04	.04	.03	.04
Feed required per 100 lbs. gain, lbs.:				
Alfalfa silage	1943.98[1]	1912.65	1841.48	
Alfalfa hay	32.17			472.83
Ground shelled corn	123.69	263.50	173.34	200.35
Cottonseed meal			79.68	
Mineral[3]	5.00	5.98	4.12	3.85
Salt	3.48	3.45	2.65	2.62
Daily feed cost per head	$ .18	$ .18	$ .19	$ .18
Feed cost per 100 lbs. gain	15.29	15.48	15.50	11.81

1. Contained .07 pound corn per pound of silage.
2. Fed January 2 to January 13 only.
3. Composed of two parts steamed bonemeal and one part salt.

Observations

1. The greatest gains were produced by alfalfa hay plus 3.04 pounds of corn (Lot 6). These gains were statistically significant. Comparing Lot 6 with Lot 4, about 473 pounds of hay and 200 pounds of corn replaced 1913 pounds of silage and 264 pounds of corn in producing 100 pounds of winter gains. Likewise, the gains were distinctly more economical with the hay than with silage.

2. Gains and efficiency of gains on the cornmeal-preserved alfalfa silage and non-preserved silage plus corn were practically equal (Lots 3 and 4).

3. The substitution of .96 pound of cottonseed meal for an equal amount of ground shelled corn increased the average daily gains .08 pound but the difference was not statistically significant (Lots 4 and 5).

Fattening Heifers on Milo Grain and Sorghum Silage.

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

Milo grain and sorghum silage are extensively used in fattening rations for beef cattle in Kansas. A fattening ration composed of milo grain and sorghum silage contains sufficient protein to meet the recommended protein allowances of fattening beef cattle. It seems possible that the protein supplement fed with such a ration could be materially reduced if not completely eliminated.

Feedstuffs commonly used for fattening cattle in Kansas contain sufficient trace minerals to prevent deficiencies. However, numerous field reports suggest that the addition of trace minerals to a fattening ration may improve cattle gains.

An experiment has been initiated to study the protein and trace mineral needs of beef cattle fattened on milo grain and sorghum silage. Twenty Hereford heifers were divided into four lots of five heifers each. The heifers of Lot 14 are fed only sorghum silage, milo grain,

and 1/10 pound of ground limestone per head daily, while those in Lot 15 are fed the same ration plus a trace mineral mixture containing manganese, iodine, cobalt, copper, iron, and zinc. The heifers of Lots 16 and 17 are fed 1 pound of cottonseed meal in addition to the respective rations of Lots 14 and 15. The milo grain is being self-fed to the heifers, while the remainder of the ration is fed once daily.

No conclusion can be made at this time; however, the results to date indicate that cattle gains can be increased by adding protein to a milo grain-sorghum silage ration and that trace minerals are not beneficial in such a ration.

Wintering, Grazing, and Fattening Heifers; Wintering Heifer Calves To Be Fattened for the Fall Market, 1953-54.

PROJECT 253-2

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

This is a progress report on the wintering phase of this test. Following this phase, the heifers will be grazed together on bluestem until July 15, then full fed 100 days in drylot. The purpose of this test is to determine if heifers can be wintered on dry grass or a low plane of nutrition, grazed during the early summer, and produce satisfactory slaughter animals for the fall market after a short full-feeding period.

Experimental Procedure

Twenty good quality Hereford heifer calves, 10 head to a lot, were used in this study. They originated in the vicinity of Pueblo, Colo., and were delivered to Manhattan, Kan., for 18.5 cents a pound. About one week after arrival, they were branded and vaccinated. One week later, December 17, 1953, they were started on test.

The system of management planned for each lot follows:

Lot 7—wintered on dry bluestem pasture supplemented with 1 to 2 pounds of cottonseed cake per head daily; grazed on bluestem pasture May 1 to July 15; full fed in drylot 100 days.

Lot 8—Wintered in drylot on Atlas sorgo silage. 1 pound of cottonseed meal, and 2 pounds of milo grain per head daily; grazed on bluestem pasture May 1 to July 15; full fed in drylot 100 days.

A bonemeal and salt mixture was offered free choice to all lots.

Lot 8 was fed 1 pound of cottonseed cake per head daily all winter, except during March and the first part of April, when the cake was increased to 2 pounds per head daily.

Table 9.—Wintering Heifer Calves To Be Fattened for the Early Fall Market.

Phase 1—Wintering—December 17, 1953-April 7, 1954—112 days

Lot number	7	8
Place of wintering	Dry bluestem pasture	Drylot
Number of heifers per lot	10	10
Initial wt. per heifer	360	357
Final wt. per heifer	450	547
Gain per heifer	90	190
Daily gain per heifer	.80	1.70
Daily ration per heifer (av.):		
Cottonseed meal or pellets	1.32	1.00
Milo		2.00

Atlas sorgo silage		23.46
Dry bluestem	Free choice	
Mineral (salt, bonemeal)	Free choice	Free choice
Salt	Free choice	Free choice
Feed cost per heifer[1]	$8.55	$20.31
Feed cost per 100 lbs. gain[1]	9.50	10.69

1. Feed prices may be found on page 27 of this publication.

Observations

1. The winter was mild, open, dry, and favorable for wintering on dry grass.

2. The heifers in Lot 7 wintered on dry grass made a favorable gain at a rather low feed cost. They had sufficient dry grass to winter on, in pastures that were lightly stocked the previous season.

3. Exceptionally good gains were made by the heifers in Lot 8 and they show more "fleshing" than those in Lot 7.

Ratio of Roughage to Concentrate for Fattening Heifers, 1953.

PROJECT 222

D. Richardson, E. F. Smith, R. F. Cox, and E. K. Keating

Beef cattle are naturally large consumers of roughage. The relative cost of producing or purchasing roughages throughout Kansas is normally less than for grain and other concentrates. 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. This is the second trial in an experiment which was 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 selling price. This trial was planned also to determine the effect of previous wintering rations on fattening ability, the relative value of milo grain and corn for fattening, and effect on carcass quality.

Experimental Procedure

Fifty Hereford heifers were divided into five lots as equally as possible on the basis of weight, size, conformation, and previous treatment. These heifers were wintered as calves on the following rations: (1) alfalfa hay, (2) Atlas sorghum silage, 2 pounds of corn and 1 pound of soybean oilmeal pellets, (3) Atlas sorghum silage and 3 pounds of special supplement, (4) prairie hay, 4.9 pounds of corn and 1.25 pounds of soybean oilmeal pellets, (5) corn cobs, 4.9 pounds of corn and 1.9 pounds of soybean oilmeal pellets.

There were 10 animals on each of these rations. Each of the five lots in this experiment had two heifers from each of the five previous treatments.

A mixture of one-half alfalfa and one-half bromegrass hay which had been chopped to facilitate mixing was used as the roughage. Coarsely ground corn and milo grain were used as the concentrates except in Lots 2, 4, and 5, where soybean oilmeal was added to maintain the same level of protein in all lots. Chemical analyses of feeds used in this experiment are shown in Table No. 36 in the back of this circular. 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 following rations:

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

Lot 2—moving ratio started with 1 pound of corn to 1 pound of hay for first 28 days and each succeeding 28 days the corn was increased by 1 pound so that at the end of the feeding period the ratio was 4 pounds of corn to 1 pound of hay.
Lot 3—1 pound of corn to 1 pound of hay.
Lot 4—3 pounds of corn to 1 pound of hay.
Lot 5—5 pounds of corn to 1 pound of hay.

The feeding period was from May 14 to August 13, 1953. Table 10 gives a summary of the results. Table 10a gives the average daily gain of the 10 animals per lot when summarized on the basis of their wintering ration.

Table 10.—Ratio of Roughage to Concentrates for Fattening Heifers.
(May 14-August 13, 1953—91 days.)

Lot number	1	2	3	4	5
Ratio of roughage to concentrate	1 hay 3 milo	changing ratio	1 hay 1 corn	1 hay 3 corn	1 hay 5 corn
No. heifers per lot	10	10	10	10	10
Av. initial wt., lbs.	638	638	639	638	637
Av. daily gain per heifer, lbs.	2.27	1.77	1.83	1.97	2.34
Total days on feed	91	91	91	91	91
Total feed, lbs., per head:					
Milo grain	1561				
Corn		1092	1035	1263	1435
Hay	657	698	1045	663	507
Soybean oilmeal		16.9		23.5	36.8
Average daily feed per head, lbs.:					
Milo grain	17.1				
Corn		12	11.4	13.9	15.8
Hay	7.2	7.7	11.5	6.2	5.6
Soybean oilmeal		.19		.26	.40
Feed per 100 lbs. gain:					
Milo grain	754				
Corn		674	623	706	674
Hay	318	431	630	370	238
Soybean oilmeal		10.4		13.1	17.3
Feed cost per 100 lbs. gain*	$26.28	$26.79	$28.06	$26.82	$23.97
Selling price per 100 lbs.	21.00	19.50	20.50	21.00	22.00
Av. dressing percent (including cooler shrink)	59.4	58.0	58.3	58.8	60.0
Carcass grades:					
Low prime	1		1		
High choice					1
Av. choice		1		2	1

* Corn per bu., $1.60; milo grain per cwt., $2.80; soybean oilmeal per ton, $95; bromegrass hay per ton, $25; and alfalfa hay per ton, $40.

Low choice	4	2		3	4
High good	4	1	2	3	3
Av. good	1	3	4	2	1
Low good		3	2		
High commercial			1		
Marbling:					
Slightly abundant	1		1		
Moderate					1
Modest		1		3	
Small	5	3	2	2	5
Slight	4	2	3	1	2
Traces		4	4	4	1
Av. external finish (thickness in cm. between 12th and 13th rib)	1.48	.83	1.51	1.28	1.34

Table 10a.—Average Daily Gain Per Head Based Upon Wintering Rations with 10 Animals Per Lot.

Previous treatment	Alfalfa hay	Atlas sorghum silage, 3 lbs. corn, 1 lb. SBOM	Atlas sorghum silage, special supplt.	Prairie hay 4.9 lbs. corn, 1.25 lbs. SBOM	Corn cobs, 4.9 lbs. corn, 1.9 lbs. SBOM
Av. daily gain during 91-day fattening period	1.93	1.95	2.00	2.05	1.68

Observations

1. Considering the extremely hot weather, all lots made satisfactory gains; however, the gains in Lot 2 were not as good as expected.
2. Rate of gain, economy of gain, and carcass quality were highest in the lots receiving the greatest amount of concentrates in relation to roughage. This indicates that for short feeding periods, the amount of grain should be high in relation to roughage.
3. Animals receiving milo grain ate more, gained faster, and showed less digestive disturbances than animals receiving the same ratio of corn; however, there was essentially no difference in feed or total cost per 100 pounds of gain.
4. The overall carcass values were the same for milo grain and corn fed animals. The external finish between the 12th and 13th rib of the milo-grain fed heifers was greater; however, they showed a slight tendency for less finish over the forequarter and rounds.
5. Animals receiving corn cobs as the roughage in a wintering ration did not gain as well in the feedlot as those receiving alfalfa hay, Atlas sorghum silage, or prairie hay.

Adapting Roughages Varying in Quality and Curing Processes to the Nutrition of Beef Cattle: A Comparison of Prairie Hay and Corn Cobs; a Special Supplement vs. Milo Grain and Cottonseed Meal, 1953-54.

PROJECT 370

E. F. Smith, D. Richardson, F. H. Baker, R. B. Cathcart, R. F. Cox

This is the second test in an experiment designed to compare the

value of certain roughages and supplements in the wintering ration of beef calves.

Experimental Procedure

Forty good quality Hereford heifer calves were divided as equally as possible into four lots of 10 animals each. The heifers originated in the vicinity of Snyder, Texas. They were dehorned, vaccinated, and branded before starting the experiment.

The rations used in this experiment are shown in Table 11. An attempt was made to keep the protein and total digestible nutrients on an equal basis between the prairie hay and corn cob lots. The animals receiving corn cobs as their roughage were given 50,000 International Units of vitamin A per head daily. The 3 pounds of special supplement fed daily to Lot 12 was composed of 2.25 pounds cottonseed meal, .50 pound molasses, .18 pound steamed bonemeal, .06 pound salt, and .01 pound vitamin supplement (2250 international units of vitamin A and 400 international units of vitamin D per gram). All lots were fed once daily during the morning.

Observations

1. There was no difference in rate of gain, daily feed consumption, or cost per hundred pounds of gain between Lots 1 and 2.
2. Animals in Lot 12 receiving 3 pounds daily of the special supplement made .08 pound more daily gain than animals in Lot 13 receiving 2 pounds of milo grain and 1 pound of cottonseed meal daily. However, the cost per 100 pounds gain was higher for Lot 12 because of the cost of the special supplement.

Table 11.—A Comparison of Roughages and Supplements for Wintering Beef Heifer Calves.

December 17, 1953-April 8, 1954—113 days.

Lot number	1	2	12	13
No. heifers per lot	10	10	10	10
Treatment	Prairie hay, cottonseed meal, milo grain	Corn cobs, cottonseed meal, milo grain, vitamin A[1]	Atlas sorgo silage, special supplt.	Atlas sorgo silage, cottonseed meal, milo grain
Av. initial wt. per heifer	294	296	296	296
Av. final wt. per heifer	438	437	491	483
Av. gain per heifer	144	141	195	187
Av. daily gain per heifer	1.27	1.25	1.73	1.65
Av. daily feed consumed:				
Prairie hay	6.48			
Corn cobs		6.23		
Atlas sorgo silage			23.38	23.47
Milo grain	2.59	2.26		2.0
Cottonseed meal	.98	1.50		1.0
Special supplement			3.0	
Mineral (bonemeal, salt)	.06	.05	.06	.06
Salt	.04	.04	.03	.03
Feed per cwt. gain:				
Prairie hay	508.26			
Corn cobs		499.50		
Atlas sorgo silage			1355.13	1418.45

1. 50,000 IU vitamin A per head daily. Total cost $14.75 for Lot 2.

Milo grain	203.00	181.49		120.86
Cottonseed meal	77.22	120.21		60.43
Special supplement			173.85	
Mineral (bonemeal, salt)	4.58	3.97	3.49	3.64
Salt	3.06	2.84	1.54	1.60
Feed cost per cwt. gain	$13.72	$13.74[1]	$12.59	$11.08

1. 50,000 IU vitamin A per head daily. Total cost $14.75 for Lot 2.

The Value of Ammoniated Molasses in Beef Cattle Wintering Rations, 1953-54.

PROJECT 517

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

There are microorganisms present in the paunch of ruminants which can utilize ammonia from urea, ammoniated products, and other simple nitrogen-containing compounds. In order to do this, readily available energy, minerals, and probably other nutrients must be present at the same time for efficient utilization of inorganic nitrogen by the microorganisms.

The products used in this experiment were ammoniated molasses containing 15 percent and 33 percent protein equivalent. The 15 percent ammoniated molasses was made by simply adding anhydrous ammonia to bring the molasses to a 15 percent protein equivalent. The sucrose in the molasses was inverted and anhydrous ammonia added to bring the ammoniated invert molasses to 33 percent protein equivalent. Sulfuric acid was used to adjust the pH to 7. Theoretically, these products could serve as a substitute for part of the protein in ruminant rations. The purpose of this experiment was to determine the value and amount to use in the wintering ration of beef calves.

Experimental Procedure

Forty head of good quality Hereford heifer calves were purchased from near Pueblo, Colo. They were divided as equally as possible into four lots of 10 heifers each. The starting ration for each lot is shown in Table 12. These rations were calculated to contain the same protein equivalent and total digestible nutrients per lot. The amount of silage was increased as the experiment progressed and all lots received the same amount. All animals were fed the control ration about a week before starting the experiment. During the experiment, the animals were fed once daily during the morning. The concentrates and molasses were spread over the silage and mixed. Warm water was mixed with the molasses in cold weather to make handling and mixing easier. As a result of thorough mixing, no animal was able to eat more than its share of any ingredient. A mineral mixture of steamed bonemeal and salt was fed free choice. Water was available at all times.

Table 12.—Daily Rations Used at the Beginning of the Experiment (Pounds).

Lot	Atlas sorgo silage	Cottonseed meal	Milo grain	15% ammoniated molasses	33% ammoniated molasses
8	20	1.0	2.0		
9	20	.5	1.6	1.46	
10	20	.5	2.0		.7
11	20		2.0		1.37

Results and Discussion

The over-all results of the experiment are shown in Table 13; however, a better idea of the results may be obtained from Table 14 which gives the average daily gains by weigh periods.

Lot 8 animals gained satisfactorily throughout the experiment. The gains probably would have been better if more silage had been fed. These calves cleaned up their feed by late afternoon each day; however, the amount of silage fed daily was maintained at the same level in all lots.

On the eighth day after starting the experiment, some animals in all lots receiving ammoniated molasses were stimulated or affected in some way to make them act in a very crazy manner. An affected animal would start by weaving and winding among and around other animals in the lot. Then it would suddenly dash across the lot and into whatever might be in the way. Fences and even some posts were smashed. One animal broke out part of its teeth. No definite explanation can be given at this time for this peculiar behavior. The blood urea of affected animals was normal.

After stimulation occurred, the ammoniated molasses was removed from the ration for one week. Feeding was resumed and some animals were affected after again eating the ammoniated molasses for a week. About one-third of the animals receiving the ammoniated molasses were observed to be crazy. It is possible that more were affected. The percentage protein equivalent or amount did not seem to be a factor.

Daily gains (Table 14) and feed efficiency (Table 13) were adversely affected by the ammoniated molasses. There was no apparent difference in mineral consumption between lots. When ammoniated molasses was removed or the amount lowered in the ration, the daily gains increased. At the end of the experiment, animals in Lot 10 were beginning to show signs of being affected, even though they were receiving only .5 pound of ammoniated molasses per head per day. All animals receiving ammoniated molasses had excessive watery drainage from the eyes.

Conclusions

1. The forms of ammoniated molasses used in this experiment, as part or all of the protein concentrate, are not satisfactory in the wintering ration of beef calves from the standpoint of rate of gain or welfare of the animal.

2. Further basic research needs to be done to determine the cause or causes of the trouble experienced.

Table 13.—Results of Feeding Ammoniated Molasses in Wintering Rations of Beef Heifer Calves.

December 17, 1953-April 7, 1954—112 days.

Lot number	8	9	10	11
Number heifers per lot	10	10	10	10
Number days on trial	112	112	112	112
Av. initial wt. of heifers, lbs.	356.9	358.8	358.0	357.6
Av. final wt. of heifers, lbs.	546.5	490.5	490.0	503.0
Av. gain per heifer	189.6	131.7	132.0	145.4
Av. daily gain per heifer	1.69	1.18	1.18	1.30
Av. daily ration per heifer:				
Sorghum silage	23.21	23.12	23.21	22.46
Ground milo grain	2.0	1.7	2.0	2.0
Cottonseed meal (41%)	1.0	.65	.53	.66

Ammoniated molasses (15%)		.89[3]	.05[2]	.04[2]
Ammoniated molasses (33%)		.06[1]	.49	.47
Salt	ad lib	ad lib	ad lib	ad lib
Salt, steamed bonemeal	ad lib	ad lib	ad lib	ad lib
Total feed consumed (lbs.):				
Sorghum silage	26000	25900	26000	25150
Ground milo grain	2240	1904	2245	2254
Cottonseed meal	1120	730	590	738
Ammoniated molasses (15%)		1000	52[2]	42[2]
Ammoniated molasses (33%)		65[1]	547	530
Total gain (lbs.)	1896	1317	1320	1454
Feed per 100 lbs. gain:				
Sorghum silage	1371.3	1966.6	1969.7	1729.7
Ground milo grain	118.1	144.6	170.1	155.0
Cottonseed meal	59.1	55.4	44.7	50.7
Ammoniated molasses (15%)		75.9	3.9	2.9
Ammoniated molasses (33%)		4.9	41.4	36.4
Total feed per cwt. gain	1548.5	2247.4	2229.8	1974.7

1. Substituted due to delay in receiving 15 percent molasses.
2. Substituted due to delay in receiving 33 percent molasses.
3. No molasses fed the last 28 days of the trial.

Table 14.—Average Daily Gain by 28-Day Weigh Periods (Pounds).

Lot	8	9	10	11
1st 28-day period	1.84	1.11	.86	.40
2nd 28-day period	1.75	1.05	1.41[2]	1.57[1]
3rd 28-day period	1.66	1.11	1.48	1.84
4th 28-day period	1.51	1.43[3]	.96	1.37
Av. entire 112 days	1.69	1.18	1.18	1.30

1. 33 percent ammoniated molasses reduced to .33 pound and .75 pound cottonseed meal added at end of first 28-day period.
2. Amount of ammoniated molasses reduced from .7 pound to .5 pound per head daily.
3. Molasses removed completely because of stimulation. Animals put on control ration.

The Effect of Grazing Systems on Livestock and Vegetation

Comparison of Different Methods of Managing Bluestem Pastures, 1953.

PROJECTS 353-3 and 353-5

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

The objectives of this experiment are to determine the effects of different stocking rates, deferred grazing, and burning on livestock gains,

on productivity of pastures, and on the bluestem vegetation itself. In addition to the yearly report, a brief summary of the cattle gains for the past four years is included.

Experimental Procedure

Good quality Hereford yearling steers weighing approximately 565 pounds were used to stock the pastures. The method of management of each pasture was as follows:

Pasture 1—Normal rate of stocking, 3.75 acres per head.

Pasture 2—Overstocked, 2.74 acres per head.

Pasture 3—Understocked, 5.45 acres per head.

Pastures 4, 5, 6—Deferred and rotation grazing, 3.75 acres per head. All the steers were held in two pastures until June 30, then turned into the protected pasture until August 3. On that date they were placed on the better of the two pastures previously used, where they remained until August 10. After that they were allowed the run of all three pastures.

Pasture 7—Burned March 13, 1953; rate of stocking was 3.67 acres per head.

Pasture 8—Burned April 9, 1953; rate of stocking was 3.67 acres per head.

Pasture 9—Burned April 30, 1953; rate of stocking was 3.67 acres per head.

Observations

1. The largest gains were made by the steers in the late spring-burned, the understocked, the normal-stocked, and the mid spring-burned pastures.
2. The lowest gains were made by the steers in the overstocked, the deferred and rotated, and the early spring-burned pastures.
3. The season was dry. The overstocked, the early, and the mid spring-burned pastures were grazed closely.
4. 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 that tended to obscure the effects of heavy grazing. Despite the drought of 1952 and 1953, bluestem vegetation improved under light stocking and under deferred grazing, while rather severe depletion is developing under heavy stocking.

The chief criterion for evaluating pasture condition is the vegetative population. Under conservative use the major forage species, big bluestem, little bluestem, indiangrass, and switchgrass, are increasing while less valuable forage species like sideoats, grama, buffalograss, and blue-grama, as well as the weedy invaders, are decreasing. Opposite trends are noted in pastures stocked heavily and are beginning to occur under early and mid spring burning.

Table 15.—A Comparison of Different Methods of Managing Bluestem Pasture, 1953.

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	16	22	11	48	12	12	12
Acres in pasture	60	60	60	3-60*	44	44	44
Number acres per head	3.75	2.74	5.45	3.75	3.67	3.67	3.67
Initial wt. per steer	562	563[1]	564	567[1]	562	566	568
Final wt. per steer	788	757[1]	797	764[1]	767	783	802
Gain per steer	226	194	233	197	205	217	234
Daily gain per steer	1.60	1.37	1.64	1.39	1.45	1.54	1.66
Gain per acre	60.13	71.1	42.66	52.66	55.95	59.09	63.86

* Three 60-acre pastures.

1. One steer was removed from pasture 2 and one from pastures 4, 5, and 6 because of lump jaw. Another steer was substituted to maintain the correct stocking rate.

Table 16.—Yearly Account of Cattle Gains Under Different Methods of Grazing Pastures.

Four-Year Summary, 1950-1953.

Gain per Steer in Pounds for the Summer Season.

	Normal stocked	Over-stocked	Under-stocked	Deferred, rotation grazing
1950	221	210	214	205
1951	242	256	290	234
1952	246	209	228	197
1953	226	194	233	197
Average	234	217	241	208

Yearly Account of Cattle Gains on Burned and Nonburned Pastures.

	Not burned	Early spring burned	Mid spring burned	Late spring burned
1950	221	216	254	230
1951	253	243	265	254
1952	246	251	278	283
1953	226	205	217	234
Average	238	229	254	252

Feed Prices Used in Beef Cattle Tests, 1953-1954.

Milo grain, cwt.	$ 2.50
Cottonseed meal or cake, ton	75.00
Special supplement, ton	81.00
Alfalfa hay, ton	25.00
Alfalfa silage, ton	8.00
Sorghum silage, ton	8.00
Corn cobs, ton	14.00
Prairie hay, ton	22.00
Dry bluestem pasture, calves per head per month	.50
Dry bluestem pasture, yearlings per head per month	.75
Mineral (2 pounds bonemeal to 1 pound salt), cwt.	4.00
Salt, ton	15.00

Chemical Analysis of Feeds Used in Feeding Trials, 1952-1954.

Ingredient	Time of analysis	% Moisture	% Protein	% Ether extract	% Crude fiber	% N-free extract	% Ash	% Calcium	% Phosphorus	Mg carotene per pound
Corn	Winter,	11.58	9.19	4.20	1.90	71.68	1.45			
Soybean pellets	1952-53	9.60	45.56	4.66	4.81	29.66	5.71			
Special cattle supplt.	"	11.27	34.13	1.97	4.91	35.61	12.11			
Ground corn cobs	"	8.87	2.31	.45	33.86	52.92	1.59			
Prairie hay	"	5.22	5.88	2.46	32.35	46.91	7.18			1.94
Alfalfa hay	"	5.95	13.56	1.90	32.18	38.21	8.20			
Atlas sorgo silage	"	65.00	2.77	.88	8.00	20.70	2.65			
Nonwilted alfalfa silage	"	75.00	4.86	1.14	7.33	8.77	2.90			12.9
Wilted alfalfa silage	"	64.70	5.69	.98	11.34	13.56	3.73			1.9
Yellow corn	Summer,	9.45	9.06	4.32	4.03	71.64	1.50	.01	.30	1.2
Milo grain	1953	9.17	11.06	2.95	2.80	71.76	2.26	.04	.34	
Chopped alfalfa hay	"	7.69	16.19	2.01	25.71	39.22	9.18	1.57	.18	7.8
Brome hay (cut after harvesting seed)	"	6.98	8.88	2.12	32.77	41.93	7.32	.29	.13	2.2
Atlas sorgo stover	Winter,	52.50	2.17	.88	10.37	31.04	3.04	.12	.03	7.7
Dehydrated alfalfa pellets	1953-54	6.65	20.00	3.49	18.25	40.65	10.96	2.09	.27	58.0
Dehydrated alfalfa meal	"		20.00							64.0
Cottonseed meal	"	7.95	41.63	4.01	11.80	28.49	6.12	.16	1.14	
Soybean oilmeal	"	8.70	48.63	2.77	4.51	28.35	7.04	.33	.63	
Yellow corn	"	10.70	10.06	3.84	2.08	71.89	1.43	.01	.33	

The Improvement of Beef Cattle Through Breeding Methods

PROJECT 286

Walter H. Smith, Lewis A. Holland, and H. L. Ibsen

The purebred Shorthorn cattle breeding project proceeded according to plan during the last year. The project has been planned to facilitate the collection of production data that will be used to devise and test breeding procedures useful to cattlemen to improve beef cattle through breeding methods.

Pedigree barriers were established in the original College Shorthorn herd in 1950 and two inbred lines are being developed. College Premier 29th, 2368167, and Gregg Farm's Hoarfrost, 2492499, have been used as herd sires for this purpose and the inbred lines are designated as the Wernacre Premier and Mercury lines, respectively, for these two foundation sires. The inbreeding program in the Wernacre Premier line was initiated in 1949 by mating College Premier 29th to his half-sisters. These matings were continued during 1950, 1951, 1952, and 1953. A son of College Premier 29th, KSC Premier C 11th, was mated to the females produced in the Wernacre Premier line to extend the inbreeding into the second generation. Calves from these matings were produced in 1952 and 1953.

Calves sired by Gregg Farm's Hoarfrost in 1951, 1952, and 1953 were not inbred because the dams of these were not related to him. Inbreeding in the Mercury line was initiated in 1952 by mating the daughters of Gregg Farm's Hoarfrost to one of his sons, KSC Mercury. Calves from these matings were produced in 1953.

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 corn and 25 percent chopped alfalfa hay, and that for the heifers, 55 percent corn and 45 percent chopped alfalfa hay.

All steers are maintained on a fattening ration after completing the regular feeding trial and slaughtered in the College meats laboratory for detailed carcass studies.

The feeding trial data for the 1952 calf crop are summarized in Table 17, and a partial summary of the 1953 calf crop is presented in Table 18. The feeding trials for the 1953 calves have not been completed to date and the number of days of feeding is designated for each animal.

Table 17.—Summary of the 1952 Shorthorn Calves of the Wernacre Premier and Mercury Lines.

Tag number	Coefficient of inbreeding¹	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												
105	6.25	75	455	2	182	469	1024	555	3.05	2	366	226
184	14.06	88	514	2	182	530	1047	517	2.84	3+	369	232
2	23.44	64	400	3+	182	473	961	488	2.68	3	359	240
Av.	14.58	76	456	2−	182	491	1011	520	2.86	3+	364	233
Steers												
37	14.06	78	386	2	182	403	820	417	2.29	3	380	241
7	12.50	91	365	2−	182	380	732	342	1.88	3	417	270
72	6.64	67	336	3+	182	371	790	419	2.30	3	352	204
Av.	11.07	79	362	2−	182	385	777	393	2.16	3	383	238
Heifers												
49	15.62	67	357	3	182	367	565	198	1.09	3+	343	429
39	15.62	75	363	2	182	398	656	258	1.42	2−	473	516
10	18.75	65	392	2−	182	410	682	272	1.49	2−	374	353
154	6.25	56	295	3+	182	347	643	296	1.63	2	386	345
14	27.73	55	301	2−	182	406	782	376	2.07	3	332	303
108	19.73	55	270	3	182	346	727	381	2.09	3+	354	320
23	22.27	57	329	3+	182	361	687	326	1.79	3+	331	301
56	23.44	65	295	3+	182	338	681	343	1.88	3+	328	297
Av.	18.67	62	325	3+	182	372	678	306	1.68	3+	365	358

Table 17 (Cont.)

Mercury Line

Bulls

61	0	64	366	1-	182	400	801	401	2.20	1-	285	281
9	0	84	434	2	182	448	969	521	2.86	2+	322	192
4	0	69	391	2+	182	411	824	413	2.27	1-	289	289
90	0	71	430	2	182	440	930	490	2.69	2+	366	236
Av.	0	72	405	2+	182	425	881	456	2.50	2+	316	350

Steers

68	0	62	335	3+	182	360	757	397	2.18	3	392	249

Heifers

82	0	66	353	1-	182	378	629	251	1.38	1-	397	382
180	0	68	380	1	182	401	618	217	1.19	1	359	350
92	0	68	363	2+	182	376	579	203	1.12	2	401	472
58	0	57	342	2	182	360	678	318	1.75	3+	413	384
79	0	59	311	2+	182	330	638	308	1.69	2	394	370
Av.	0	64	350	2+	182	369	628	259	1.43	2	393	392

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

Table 18.—Partial Summary of the 1953 Shorthorn Calves of the Wernacre Premier and Mercury Lines.

Tag number	Coefficient of inbreeding	Birth weight	Weaning weight	Weaning score	Initial weight	Weight on 4-5-54	Days on trial	Daily gain during trial
Wernacre Premier Line								
Bulls								
82	27.73	60	275	3	397	532	119	1.97
Steers								
9	15.62	61	435	2–	470	515	182	1.90
760	14.06	79	425	3	450	832	161	2.37
10	6.25	83	425	2	418	835	182	2.29
Av.	11.98	74	428	3+	446	837		2.19
Heifers								
92	15.62	71	360	2	393	675	182	1.55
39	14.06	72	370	2	393	713	182	1.76
43	14.06	70	290	3–	318	650	182	1.82
79	7.80	70	320	2–	335	486	119	1.27
14	0.00	64	300	3+	307	500	119	1.62
Av.	10.30	69	328	3+	349	605		1.60
Mercury Line								
Bulls								
58	0.00	73	390	1–	435	752	140	2.26
184	0.00	75	369	2+	425	776	140	2.51
61	14.06	52	215	3–	230	370	119	1.18
68	14.06	65	285	3+	304	490	119	1.56
Av.	7.03	66	315	2–	349	597		1.88

Table 18 (Cont.)

Steers								
154	0.00	69	390	2+	421	780	161	2.23
56	0.00	78	400	2	426	814	161	2.41
18	0.00	63	410	1–	426	820	161	2.45
Av.		70	400	2+	424	805		2.36
Heifers								
180	0.00	84	355	2–	356	610	161	1.58
23	0.00	85	375	2+	435	694	140	1.85
108	0.00	68	415	2+	405	660	140	1.82
2	0.00	67	370	2–	380	645	140	1.89
90	15.62	56	270	3+	305	540	140	1.68
22	0.00	68	325	3+	344	580	119	1.98
Av.	2.60	71	352	2–	371	623		1.81

Dwarfism in Beef Cattle

Walter H. Smith and Lewis A. Holland

During recent years there have been several scientific and numerous breeders' reports on dwarfism in the Angus, Hereford, and Shorthorn breeds of beef cattle. These have described what appear to be several different kinds of dwarfism, only two of which are apparently associated with recognizable types of cattle. Many of the scientific publications have discussed the mode of inheritance as well as the description of the kind of dwarfism considered. The general problem is complex and research pertaining to most phases of it is as yet in the preliminary stages; however, there are some important facts known at this time which should be understood by breeders who are attempting remedial measures to suppress incidence of dwarfism in breeding herds.

The Kansas Experiment Station has not conducted a formal research project on dwarfism. The authors have observed several kinds of dwarfs in the three major British beef breeds and have presented this discussion of the most troublesome kind in Hereford cattle. Some of the information contained herein includes discussions of preliminary experimental findings reported by research workers. These are indicated as such and are not intended to be considered conclusive at this time. A more detailed discussion of several types of dwarfism in Hereford, Angus, and Shorthorn cattle is being prepared by the authors and will be provided by the Animal Husbandry Department upon request after it is completed, which should be by June 1, 1954.

Reports by breeders indicate that dwarfs have been produced occasionally in some herds of conventional[1] Herefords for many years. The first technical report on the description and mode of inheritance of this type of dwarfism was made by a group of research workers of the South Dakota Experiment Station in 1950.

1. Description

Dwarf calves produced by conventional Herefords are generally born alive and survive during the suckling period and variable periods of time following weaning, although some breeders believe that still-births and early calfhood death losses are more prevalent in dwarf than normal calves. Most cattlemen who have observed dwarf calves can recognize dwarfs at the time of birth because dwarf calves possess a blocky appearance, shorter than normal cannon bones, bulging foreheads, and protruding lower jaws. Dwarf calves have been mistaken for outstanding prospects in many instances. Some are born with contracted flexor tendons of the forelegs and are unable to stand naturally and most show evidence of incoordination as indicated by a somewhat staggering gait. The condition is variable, some being more extreme than others, and as yet no one has discovered a criterion for the positive identification of dwarfs at the time of birth.[2] The dwarf condition becomes more pronounced at three to four months of age because these calves fail to grow normally and most develop distended paunches as a result of chronic bloat. Nearly all dwarfs that have been permitted to live have died prior to two years of age, presumably because of bloat. Because of its usual causation of death at an early age, dwarfism is often referred to as a sub-lethal character. Its primary detrimental effect is that of lowering reproductive efficiency. Survivability in dwarfs is variable and some have lived long enough to reproduce under experimental conditions.

Post mortem examinations have revealed no gross abnormalities although many reports describe dwarfs as hydrocephalic because the lateral ventricles of the brain possess more than a normal amount of fluid.

1. Conventional Herefords are those which are not of the distinct "compact" type.
2. X-rays of lumbar (loin) vertebrae are being used by some research workers.

2. Physiological Cause of Dwarfism

Research workers have made several attempts to determine the physiological cause of growth failure in dwarfs. Some breeders have believed that nutritional deficiencies may be responsible although none of the experimental findings to date substantiate this assumption. The Oklahoma research workers found that the blood mineral content of cows suckling dwarf calves was the same as cows suckling normal calves. Dwarfism occurs in herds where normal calves are produced and there have been several reports of fraternal twins in which one calf was a dwarf and the other normal. Other evidence indicates a hereditary basis, so there is considerable proof that dwarfism is not caused by a nutritional deficiency.

Research workers generally agree that dwarfism is due to an endocrine malfunction that is conditioned by heredity. Most studies of this aspect of dwarfism have entailed assays of dwarf pituitaries for thyrotrophic and growth hormones. These investigations were made to determine whether or not it would be possible to identify dwarf producing cattle by means of hormone assays and to explore the usefulness of hormonal therapy for inducing a growth response in dwarf calves. Endocrine assays have been made at the California, Oklahoma, and Purdue Experiment Stations. To date no gross abnormalities of the endocrine glands have been found to be consistently associated with the dwarf condition and hormonal therapy has not resulted in a skeletal or muscular growth response in the dwarf. Work is being continued on these studies at some stations; however, no endocrinological techniques useful for detection of dwarf producing cattle or correction of the dwarf condition have been devised to date.

3. Inheritance of Dwarfism in Conventional Herefords

Research workers at the South Dakota, Iowa, California, and Arizona Experiment Stations have reported that dwarfism in conventional Herefords is transmitted as a single recessive gene. The character is not associated with sex because it occurs in both bulls and heifers with equal frequency. Observations by other research workers substantiate the assumption that dwarfism is transmitted in this manner. Cattle are of three kinds in regard to this type of dwarfism: normal non-carriers, normal carriers, and dwarfs. The inheritance is best explained by using the symbols **d** to represent the dwarf hereditary factor or gene, and **D** to represent the gene for normal growth. Since an animal must receive a unit of inheritance from each of its parents, it possesses two genes. Non-carriers are **DD**, carriers **Dd**, and dwarfs are **dd**. The **Dd** individuals are normal and cannot be distinguished from **DD** animals on the basis of their appearance because the **D** gene is dominant or "overshadows" **d** when the two are present in the same individual. Dwarfs must be **dd**, which means that each parent has to contribute a **d** gene to that type of individual; therefore, both parents of the dwarf are carriers of the **d** gene and are equally responsible for a dwarf calf.

Six mating types are possible for a pair of genes such as **D** and **d**. These may be summarized as follows:

	Mating types or parents	Offspring	
		Genetic composition*	Appearance*
1.	DD x DD	All DD	All normal
2.	DD x Dd	½ DD and ½ Dd	All normal
3.	Dd x Dd	¼ DD; ½ Dd; ¼ dd	¼ dwarfs
4.	DD x dd	All Dd	All normal
5.	Dd x dd	½ Dd and ½ dd	½ dwarfs
6.	dd x dd	All dd	All dwarfs

* All ratios represent average expected values.

Only the first three mating types normally occur under natural breeding conditions because the last three involve dwarfs and are not likely to occur in non-experimental herds.

Some breeders have questioned this explanation of the inheritance of

dwarfism on the basis of observations in herds in which more than 25 percent of the calves produced in a single calf crop were dwarfs and others have believed that some carrier bulls tend to sire more dwarf calves than others. These exceptions have undoubtedly been due to chance deviations which are likely to occur in genetic ratios involving small numbers of offspring and variations in the proportions of carrier and non-carrier cows to which carrier bulls have been mated.

Practically all reports on dwarfism in conventional Herefords indicate that the frequency of occurrence of dwarf calves has increased during recent years. The gene which causes dwarfism is perpetuated in the breed by carrier animals and because both parents of a dwarf must be carriers, the percentage of carrier animals must have increased in breeding herds.

Breeders believe that inbreeding and linebreeding might have caused this increase in the percentage of carrier animals. These and other breeding plans do not create new genes but have a definite influence on the distribution of those present in a population. Many breeders have attributed the increase in the percentage of carriers as having been due to chance on the basis of the assumption that some of the outstanding sires in the breed were carriers by chance and that due to the fact that their close relatives, primarily sons, were used extensively in the breed, the dwarf gene was spread and its frequency increased in the breed. There is no doubt that some of the outstanding sires in the breed were carriers which has been instrumental in causing some increase in the frequency of the dwarfism gene; however, population geneticists generally assume that to have increased the frequency of this gene to its present level, breeders must have unknowingly practiced some preference for carrier animals in the selection of breeding stock.

There is no conclusive evidence to prove this assumption but if it is true, it means that breeders must be selecting carriers on the basis of their desirability in regard to one or more physical characteristics emphasized in type standards. Some breeders believe that nearly all outstanding individuals are carriers and others have not recognized any association between these two factors. There are many reports by breeders which indicate that animals of so-called "old-fashioned" type as well as "modern" type produce dwarf calves. This aspect of the dwarfism problem in conventional Herefords has received consideration by research workers but as yet no one has devised a method by which carrier and non-carrier animals can be differentiated on the basis of visual appearance. Additional information is required before conclusions can be made and breeders should not discriminate against a particular type on the basis of the assumption that it is definitely associated with preference for carrier animals in breeding selections. Body measurements of normal calves produced from known carrier matings are included as part of the study of dwarfism being conducted at the Iowa Experiment Station and decisive facts will be established as the result of this and other research work.

4. Identification of Carriers

The control of dwarfism depends upon the identification and disposal of carrier animals in breeding herds. The authors believe that the only technique that possesses proved reliability to identify carrier animals is the breeding test. Breeding tests are costly because test herds must be maintained and these also necessitate delays in breeding programs.

Carriers are identified when a cow produces or a bull sires a dwarf calf. The dwarf gene is perpetuated and transmitted in the breed by normal carriers, and since dwarf females will usually not reproduce, it is necessary to use known carrier cows for the establishment of test herds. Each cow must have produced at least one dwarf calf to be considered a known carrier.

Breeding tests are designed to determine whether or not prospective herd sires are carriers of the dwarf gene. A bull is a carrier if he sires a dwarf calf when mated to carrier cows. Since approximately one-

fourth of the calves from carrier matings are dwarfs, a carrier bull may be mated to carrier cows to produce a few calves which by chance are all normal. In other instances a carrier bull may sire a dwarf as the result of a first service to a carrier cow. Because chance may cause pronounced deviations from expected genetic ratios, with only a few calves in breeding tests, it is necessary to use a test which is adequate to permit reliable decisions. The following table shows the percentage of carrier bulls which would be expected not to sire dwarf calves when mated to carrier cows for various numbers of progeny in test matings.

Number of calves from known carrier cows	Percent of carrier bulls which would sire no dwarfs
1	75
2	56
4	32
8	10
10	6
12	3
14	2
16	1

It is evident that the reliability of a breeding test increases with the number of calves produced. Prospective herd sires must sire 15 or more calves, all of which are normal, from carrier cows before they may be classified as non-carriers with a high degree of confidence. On the average there is about one chance in 100 of misclassifying a carrier for a non-carrier on the basis of 16 progeny, all of which are normal, from carrier cows.

Still-births and questionable pedigrees of calves produced by test herds may result in wrong decisions. Hand breeding is necessary for the avoidance of pedigree errors under most conditions. Approximately 20 carrier cows are required to test a questionable bull in a single year because not all cows used are likely to produce calves in that length of time. Normal calves from a test herd should not be used as replacements in regular breeding herds even though their sires are apparently non-carriers because approximately one-half of these will be carriers because of their dams which may transmit the dwarf gene to them.

Many breeders are not aware of the limitations of a method of controlling dwarfism which is useful for the determination of only whether or not sires are carriers or non-carriers of the dwarf gene. In herds in which only non-carrier bulls are used the dwarf gene may yet be possessed by many females although these may not have produced dwarf calves. Carrier females transmit the dwarf gene to their offspring sired by a non-carrier as well as to those by a carrier bull. Dwarf calves are not produced by the use of a non-carrier bull but a breeder may be assured that some carrier calves will be produced in a herd if part of the cows are known carriers or possibly if some of the close relatives of the cow herd are known carriers.

The continued use of non-carrier bulls is an effective method of controlling dwarfism because it eliminates the occurrence of dwarfs and reduces the percentage of carriers in the females produced each generation. The average generation interval is approximately five years in beef cattle, so many years would be required to reduce the frequency of the dwarf gene to a level which is negligible for all practical purposes in breeding considerations. Even under these circumstances, the technique for the identification of non-carrier bulls would need to be continued because of the possibility of selection preference for carriers over non-carriers.

During the last five years several experimental studies have been initiated to detect possible measureable differences between carrier and non-carrier bulls. The research on endocrine functions and blood composition has been previously mentioned. Other studies have in-

cluded head shape which is obtained by means of the profilometer,[3] length and diameter of the cannon bone, bone structure using X-ray, and cellular antigens of blood. Some of the preliminary studies have shown promise, but none of the techniques devised from these investigations for differentiating between carrier and non-carrier cattle has been adequately tested at present to justify recommendation to breeders.

Bone measurement and X-ray studies are still in progress at the Iowa Experiment Station and the blood antigen studies are being continued at the Ohio Station. All techniques are necessarily being checked with breeding tests which require much time and large experimental breeding herds.

Some herds and blood lines are claimed to be free from the dwarf gene. If this is true breeders can avoid dwarfism by using bulls from "carrier-free" families. Caution must be advised in the selection of sires on this basis because the dwarf gene may be present in these families or lines but at such a low frequency that no dwarf calves have as yet been produced. Pedigree errors may cause the dwarf gene to be introduced into families which were free or at least considered to be free from the dwarf gene.

Pedigree penalties may lead to complete discrimination against certain families although many individuals in carrier lines are non-carriers. If selection against dwarfism is carried to the extreme on a pedigree basis, breeders may lower the performance of beef herds in other traits associated with efficient production in beef cattle.

The disposal of animals closely related to dwarfs facilitates the disposal of carrier individuals from breeding herds. Even though there are many limitations to pedigree studies, the studies should be used to "screen" breeding herd replacements, particularly prospective sires to be placed on breeding tests. In many instances pedigree studies have been the only method of controlling dwarfism that has been available for adoption by breeders.

5. Summary

One type of dwarfism in Hereford cattle has been considered in this discussion and the primary aspects of the general problem that have been subjected to experimental study have been reviewed. Breeders should be aware of the following conclusions, which appear justifiable at this time.

1. Dwarfism in conventional Herefords is transmitted as a single, autosomal recessive gene.
2. The increase in the frequency of occurrence of dwarf calves suggests that carriers are being preferred over non-carriers in breeding selections although the reason has not been determined.
3. At present the only reliable technique for the identification of non-carrier sires is the progeny test.
4. Pedigree studies may be useful for controlling dwarfism.
5. It is not advisable to place all selection preference on freedom from dwarfism and to disregard many other traits which are also important in efficient beef cattle production.

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3. The profilometer is an instrument developed by the California research workers to obtain the median profile contour of cattle heads.

Sheep

Feedlot Fattening Experiments with Lambs, 1953-54

T. Donald Bell and A. B. Erhart*

The tests this year compared whole milo with steam-rolled milo, and ground milo when fed with a standard roughage ration of ground sorghum fodder (little grain), plus a protein supplement and supplemental salt and limestone. The roughage comparisons included: (1) all sorghum fodder, (2) sorghum fodder and alfalfa hay, (3) sorghum silage and alfalfa hay, (4) sorghum silage and sorghum fodder, and (5) beet top silage and alfalfa hay. One lot of lambs received the standard ration of fodder, milo grain, and protein in pellets containing all three ingredients.

The value of antibiotics was checked in one lot and the value of stilbestrol implants and progesterone-stilbestrol implants was checked in two other lots.

Lambs

The lambs for this year's tests were secured from New Mexico and included a large proportion of white-face fine wool lambs and a smaller number of black-face crossbred lambs, with a larger number of ewe lambs than usual. They entered the feeding tests weighing approximately 67 pounds.

Feed Prices

Milo grain	$ 2.10 per cwt.
Grinding	.10 per cwt.
Steam rolling	.15 per cwt.
Cottonseed meal	80.00 per ton
Alfalfa hay	30.00 per ton
Ground sorghum fodder	11.00 per ton
Beet top silage	8.00 per ton
Sorghum silage	8.00 per ton
Pellets—60% dehydrated sorghum fodder, 35.3% milo grain, 4.7% cottonseed meal	41.50 per ton

Table 10.—Feedlot Tests.

First Feeding Period—November 10, 1953, to February 23, 1954.

Lot number	1	2	3	4
Number of lambs per lot	48	48	48	48
Ration fed	Beet top silage, milo, alfalfa hay, protein, salt, limestone	Stilbestrol implants, Axtell fodder, milo, protein, salt, limestone	Sorghum silage, milo, alfalfa hay, protein, salt, limestone	Milo (steam rolled), Axtell fodder, protein, salt, limestone
Number of days on feed	105	105	105	105
Initial wt. per lamb	67.2	66.8	68.5	65.8

* Appreciation is expressed to the Cudahy Packing Company of Wichita for providing the carcass data from these experimental lambs.

Table 19 (Continued).

Final wt. per lamb	105.4	100.8	100.6	92.1
Total gain per lamb	38.2	34.0	32.1	26.3
Daily gain per lamb	.36	.33	.31	.25
Feed per lamb daily:				
Milo grain	1.13	1.13	1.13	1.03
Alfalfa hay	.50		.50	
Axtell fodder		2.62		2.05
Beet top silage	5.51			
Sorghum silage			3.61	
Cottonseed meal	.20	.20	.20	.20
Salt-limestone	.018	.035	.029	.043
Feed cost per cwt. gain	$16.89	$14.26	$17.61	$17.04
Number of lambs lost	0	0	0	0

Feeding Period Following Shearing—February 23, 1954, to April 1, 1954.

Number of days on feed	37	37	37	37
Number of lambs lost	1	0	0	0
Number of lambs finishing tests	47	48	48	48
Av. initial wt.	105.5	101.0	100.6	92.1
Av. final wt.	111.5	106.7	103.9	98.9
Av. fleece wt.	7.3	6.9	7.6	7.5
Total gain per lamb plus fleece wt.	13.4	12.6	10.9	14.3
Daily gain per lamb	.36	.34	.29	.39
Feed cost per cwt. gain	$18.10	$15.81	$17.47	$13.83
Total gain—both periods	51.6	46.6	43.0	40.6
Av. daily gain—both periods	.36	.33	.30	.29

Table 20.—Feedlot Tests.

First Feeding Period—November 10, 1953, to February 23, 1954.

Lot number	5	6	7	8
Ration fed	Stilbestrol and progesterone implants, milo, Axtell fodder, protein, salt, limestone	Ground milo, Axtell fodder, protein, salt, limestone	Axtell fodder, alfalfa hay, milo, protein, salt, limestone	Sorghum silage, Axtell fodder, milo, protein, salt, limestone
Number of lambs per lot	48	48	48	48
Number of days on feed	105	105	105	105
Initial wt. per lamb	66.4	65.9	65.7	66.8
Final wt. per lamb	100.6	95.4	97.7	92.7
Total gain per lamb	34.2	29.5	32.0	25.9
Daily gain per lamb	.33	.28	.30	.25
Feed per lamb daily:				
Milo grain	1.13	1.13	1.13	1.13
Alfalfa hay			.50	
Axtell fodder	2.46	2.32	1.90	.50

Table 20 (Continued).

Beet top silage				3.06
Sorghum silage				
Cottonseed meal	.20	.20	.20	.20
Salt-limestone	.042	.042	.037	.037
Feed cost per cwt. gain	$14.04	$16.44	$16.40	$19.26
Number of lambs lost	0	0	0	0
Feeding Period Following Shearing—February 23, 1954, to April 1, 1954.				
Number of days on feed	37	37	37	37
Number of lambs lost	0	1	0	4
Number of lambs finishing tests	48	47	48	44
Av. initial wt.	100.6	95.8	97.7	93.6
Av. final wt.	106.5	99.7	101.4	93.9
Av. fleece wt.	7.2	7.8	7.6	7.5
Total gain per lamb plus fleece wt.	13.1	11.7	13.2	7.7
Daily gain per lamb	.35	.32	.36	.21
Feed cost per cwt. gain	14.80	15.86	15.01	26.29
Total gain—both periods	47.3	41.2	45.2	33.6
Av. daily gain—both periods	.33	.29	.32	.24

Table 21.—Feedlot Tests.

First Feeding Period—November 10, 1953, to February 23, 1954

Lot number	9	10	11
Ration fed	Antibiotics, milo, Axtell fodder, protein, salt, limestone	Standard, milo, Axtell fodder, protein, salt, limestone	Pelleted ration, milo, Axtell fodder, protein, salt, limestone
Number of lambs per lot	48	48	48
Number of days on feed	105	105	105
Initial wt. per lamb	66.8	66.5	66.9
Final wt. per lamb	93.7	93.1	98.7
Total gain per lamb	26.9	26.3	31.8
Daily gain per lamb	.26	.25	.30
Feed per lamb daily:			
Milo grain	1.13	1.11	
Axtell fodder	2.25	2.14	.58
Cottonseed meal	.20	.20	.019
Pellets			2.59
Salt-limestone	.037	.033	.037
Feed cost per cwt. gain	$17.30	$17.20	$28.74
Number of lambs lost	0	0	0
Feeding Period Following Shearing—February 23, 1954, to April 1, 1954.			
Number of days on feed	37	37	37
Number of lambs lost	1	0	2

Table 21 (Continued).

Number of lambs finishing tests	47	48	46
Av. initial wt.	93.9	93.1	99.6
Av. final wt.	98.3	95.3	100.5
Av. fleece wt.	6.9	7.4	7.7
Total gain per lamb plus fleece wt.	11.3	9.6	8.6
Daily gain per lamb	.30	.26	.23
Feed cost per cwt. gain	$16.14	$17.29	$31.87
Total gain both periods	38.2	35.9	40.4
Av. daily gains for both periods	.28	.25	.28

Observations

The lambs were shorn late in February and early in March. Stormy and cold weather during the shearing period may have affected the later shorn ones more than those shorn earlier. Because of the difficulty in securing representative weights before Lamb Feeders' Day at Garden City March 20, tests were summarized as of February 23 and the data presented in the Garden City Lamb Feeders' Day bulletin. This information on the initial feeding period of 105 days is shown in the first portions of Tables 19, 20, and 21. Information on the feeding period following February 23 is presented in the second portions of the same tables. Total gain and average daily gain for the entire feeding period of 142 days are shown on the last two lines of each table.

No lambs died during the initial feeding period but nine died during the second period. Six died from exposure; two, with enterotoxemia; and one, with urinary calculi.

Largest gains over the entire feeding period were made by lambs receiving the beet top silage, followed by those receiving stilbestrol and stilbestrol-progesterone implants.

As in past years the carcass yields and grades of the hormone-treated lambs this year were much lower than the yields and grades of lambs receiving the same rations but receiving no hormones. The carcass grades and yields for the two hormone-treated lots and the control lot are shown below. Abnormal development of the accessory reproductive glands was found in the hormone-treated lambs again this year.

Treatment groups	Yield	Carcass grades			
		Choice	Good	Utility	Good
Controls	50.07%	5	31	10	1
Stilbestrol treated	46.5 %		11	28	5
Stilbestrol and Progesterone treated	46.10%		12	31	2

The lambs on the steam-rolled milo went off feed several times during the early part of the test but gained rapidly during the second feeding period. Gains of .29 pound per head daily were made by the lambs receiving steam-rolled and ground milo compared with .25 pound by lambs receiving the unground milo.

When sorghum silage replaced a portion of the sorghum fodder, the rates of gain were slightly reduced and the cost of gain increased. The gains also were slightly lower when sorghum silage replaced the sorghum fodder fed with alfalfa hay as roughage. The cost per pound of gain increased when the silage was fed. In previous years, silage has generally produced slightly larger gains, but at higher costs than roughage entirely of sorghum stover. In this year's tests, fodder was used instead of stover. While the grain content of the fodder was low, it still may have been enough to cause some variation in results from previous years.

Alfalfa hay replacing part of the sorghum fodder or all of the fodder

when fed with silage increased the rate of gain. The gains were also a little cheaper when alfalfa hay was fed as part of the roughage.

Lambs receiving antibiotics made slightly larger gains than lambs on the same ration without antibiotics. The lambs receiving the completely pelleted ration also gained a little more than lambs receiving the unpelleted ration, but the cost of the pelleting processes made the cost of gains much higher for lambs receiving pellets.

The Relationship of Physical Balance and Energy Value in Sheep Rations, Summer, 1953.

PROJECT 236

T. Donald Bell, Draytford Richardson, J. S. Hughes, and D. B. Parrish*

Lamb-fattening rations varying in proportions of roughage to concentrates have been studied in this project for several years. Experimental evidence shows that a ratio of 55 percent roughage and 45 percent concentrates has been most efficient in the utilization of feed nutrients. In recent years much interest has been shown by feeders in rations that are ground, mixed, and the entire ration put into a pellet.

Objects of the 1953 studies:

1. To determine if a ration of corn and alfalfa hay would produce larger and more economical gains when fed as pellets than when the hay was fed long and the corn was unground.
2. To determine if certain proportions of roughages to concentrates were more desirable than others in the completely pelleted ration.

Table 22.—Physical Balance in Lamb Fattening Studies.
Pelleting Trials, June 27-August 24, 1953

	Lot 1 Pellets Corn 45% Hay 55%	Lot 2 Whole corn 45% Long hay 65%	Lot 3 Pellets Corn 35% Hay 65%	Lot 4 Whole corn 35% Long hay 65%
Number of lambs per lot	10	10	10	9
Initial wt. per lamb	70.5	71.6	71.1	70.1
Final wt. per lamb	95.2	92.0	93.0	89.0
Total gain per lamb	24.7	20.4	21.9	18.9
Average daily gain	.36	.30	.33	.27
Pounds of feed daily per lamb	2.6	2.6	2.6	2.6
Feed per cwt. gain	716	867	807	971
Feed cost per cwt. gain*	17.80	16.34	18.94	17.04
Initial cost of lamb at $17 per cwt.	11.98	12.17	12.09	12.03
Total cost of lambs and feed	16.38	15.51	16.23	15.12
Final cost per cwt.	17.21	16.79	17.46	17.01
Return over cost per lamb—selling price, $21.50 cwt.	4.09	4.27	3.76	3.99

* Corn, $1.60 per bushel; Alfalfa hay, $25 per ton; Cost of pellet preparation (hauling, grinding, and pelleting), $12 per ton.

* Grateful acknowledgement is given to Morris Johnson, graduate student in animal husbandry, for his help in summarizing these data.

Plan of Feeding

Lot 1—Pelleted ration (pellets of 55 percent alfalfa hay and 45 percent corn).

Lot 2—Long alfalfa hay, 55 percent, whole corn, 45 percent.

Lot 3—Pelleted ration (pellets of 65 percent alfalfa hay and 35 percent corn).

Lot 4—Long alfalfa hay, 65 percent and whole corn, 35 percent.

Summary

Results of the tests are summarized in the accompanying table and indicate:

1. The pelleted rations produced larger average daily gains (.06 of a pound more per lamb in each pelleted lot) than the same ration fed as long hay and whole corn.
2. About 150-160 pounds less feed was required to put on 100 pounds of gain with pelleted rations than with unpelleted rations.
3. Despite 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.
4. A ratio of 55 percent roughage and 45 percent concentrates produced greater and more efficient gains than the 65-35 ratio in both the pelleted and unpelleted rations.

The Effect of Different Hormone Treatments upon the Breeding and Lambing Performance of Ewes.

PROJECT 347

T. Donald Bell, Walter H. Smith, and Morris Johnson

Glowing reports of the successful use of hormones in producing earlier and more uniform lamb crops have periodically appeared in the press. Unfortunately, experimental tests and further use of the hormone preparations in commercial flocks have failed to show that they can be expected to produce beneficial results regularly and uniformly. Some tests have indicated that the hormones may actually interfere with normal reproductive activities.

In 1951 and 1952 experimental work at the University of Wisconsin and at the University of Kentucky indicated that a combination of two hormones—progesterone and the gonadotrophic hormone from pregnant mare serum (often called P.M.S.)—would cause ewes to breed and conceive during their normally quiet breeding period. Because of these encouraging results, field tests with three commercial flocks near Manhattan were undertaken during the spring and summer of 1953. A commercial estrogenic material, E.C.P., had been receiving a great deal of publicity, and tests with this material were made in the College Rambouillet flock during the spring and summer of 1953.

Experimental Procedure

Approximately 350 ewes, largely of western origin, were included in three outlying experimental flocks. Approximately one-third of each flock received a series of five injections of progesterone* (30 mg. each) at three-day intervals and an injection of 500 IU of P.M.S. material, either "Gonaden"** or "Gonadogen," three days following the last injection of progesterone. One group of ewes in the larger flock received only four injections of progesterone before receiving their P.M.S. injection.

* The progesterone, as well as the "Gonadogen" and "E. C. P.," was supplied by the Upjohn Company, Kalamazoo, Mich.

** The "Gonaden" was supplied by the Cutter Laboratories of Berkeley, Calif.

Approximately one-third of the ewes in each flock received a single injection of P.M.S. material, either "Gonaden" or "Gonadogen," while one-third of each flock remained untreated and served as controls.

Care was taken to randomly distribute the ewes into the three groups according to age, stage of lactation, and breed type. The ewes were paint branded for individual identification and rams equipped with marking harnesses were turned in with the ewes following the final hormone injection.

Eighteen mixed age Rambouillet ewes were injected with one mg. of the estrogenic material, "E.C.P.," and their subsequent breeding and lambing performance compared with 18 similar aged untreated ewes.

Results

Apparently, between 60 and 80 percent of the ewes receiving the series of progesterone injections, followed by an injection of P.M.S. material, came into heat and bred within eight to 10 days following the last injection. About 40 to 50 percent of the ewes receiving the single injection of "Gonaden" or "Gonadogen" were bred within eight to 10 days following treatment, while virtually none of the untreated ewes came into heat.

Of the 18 College ewes treated with E.C.P., 16 came into heat within one to three days and remained in heat from two and one-half to 72 days. During the same period five of the 18 ewes serving as controls came into heat with estrual periods ranging from 28 to 40 hours.

Lambing Results

Since lambing performance was similar in the three outlying experimental flocks, the lambing information has been grouped and summarized in Table 23.

Table 23.—Percentage of Treated and Untreated Ewes Lambing by Indicated Dates.

	Oct. 15	Oct. 30	Nov. 15	Nov. 30	Dec. 15	Dec. 30	Jan. 15
Progesterone and P.M.S.	0	5	28	32	53	66	81
P.M.S. alone ..	0	0	8	28	53	65	80
Untreated controls	1	2	8	34	52	69	81

Table 24.—Percentage of Untreated Ewes and Ewes Receiving E.C.P. Lambing by Indicated Dates.

	Dec. 1	Dec. 15	Dec. 30	Jan. 15	Jan. 30	Feb. 15
Untreated	0	13	16	50	86	94
E.C.P. treated	0	0	14	36	79	83

Discussion

It may be seen from Table 23 that the progesterone-P.M.S. therapy did encourage somewhat earlier lambing, since 28 percent of the progesterone-P.M.S. treated ewes had lambed by November 15 compared with 8 percent of the untreated controls. However, by November 30, more control ewes had lambed than had the treated groups. Rate of lambing then remained similar in the treated and untreated groups for the remainder of the lambing period. It is not known why a higher percentage of the treated ewes that bred following lambing did not conceive. It is possible that the fertility of the rams was low during the

early part of the breeding season and it is also possible that the artificially induced estrus or heat was not accompanied by conditions necessary for successful conception.

In Table 24 it may be seen that the untreated ewes lambed a little earlier than the ones receiving the estrogenic material, "E.C.P." Three ewes failed to lamb in the treated group compared with one in the controlled group.

These tests further indicate the difficulty in securing earlier and more uniform lamb crops by use of hormones.

The Effect of Cottonseed Meal and Soybean Oilmeal Fed Separately and Together upon the Digestibility of a Ration Fed to Lambs, 1953.

D. Richardson

There is a variation in the digestibility of protein in the various concentrates fed to livestock. It has been shown that the digestibility of nutrients in a ration with a mixture of protein concentrates is closely related to the proportion of the various protein sources in the ration. However, opinions differ on the effect of single and mixed proteins upon the digestibility of protein and other nutrients in the ration of cattle and sheep. This preliminary study was to evaluate further the nutritive value of single and mixed protein concentrates in the lambs' ration.

Hampshire, Shropshire, and Rambouillet wether lambs that averaged about 100 pounds each were used. Sorghum stover, ground in a hammer mill, was used as the roughage. In addition to the stover, each lamb received a daily ration of 1 pound of yellow corn, 1/10 pound of dehydrated alfalfa pellets, 1/10 pound of ground limestone, and ¼ pound of cottonseed meal, or its equivalent in protein from soybean meal or a mixture of ½ each cottonseed meal and soybean meal.

The results of this preliminary study are shown in Table 25.

Table 25.—The Effect of Cottonseed Meal and Soybean Oilmeal Fed Separately and Together Upon the Digestibility of a Ration Fed to Lambs.

	Percent apparent digestibility of—				Percent total dig. nutr.
	Crude protein	Ether ext.	Crude fiber	N-free ext.	
Lamb	Cottonseed meal as protein supplement				
2	52.31	72.43	34.07	79.60	44.87
3	52.97	73.99	28.91	81.52	49.02
6	55.41	75.12	40.63	82.74	47.15
8	58.37	77.29	42.26	81.10	48.75
Average	54.76	74.69	36.77	81.23	47.32
Lamb	Soybean oilmeal as protein supplement				
1	66.11	73.09	45.55	83.71	49.74
4	60.69	70.30	38.20	81.77	46.87
7	66.12	74.47	50.87	84.07	48.72
Average	63.81	72.11	43.24	82.94	48.34
Lamb	Cottonseed meal plus soybean oilmeal as protein supplement				
2B	64.76	69.38	45.27	82.64	47.85
3B	57.23	73.33	31.79	80.72	47.14
6B	66.63	78.44	56.38	84.05	49.91
8B	58.95	76.19	45.44	76.63	45.10
Average	61.92	74.35	45.16	81.01	47.50

Observations

1. The digestibility of protein and total nutrients was lowest when cottonseed meal was used in the ration.

2. The digestibility of protein and total nutrients was highest when soybean oilmeal was used in the ration.

3. The digestibility of protein and total nutrients in the ration using a mixture of cottonseed meal and soybean oilmeal was greater than for cottonseed meal alone but less than for soybean oilmeal alone. This agrees with previous work with cattle and sheep at other experiment stations.

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

PROJECT 347

T. Donald Bell and Lewis Holland*

Western ewes of the three predominant types (Texas ewes or fine wools, Blackface crossbreds, and Northwestern Whiteface crossbreds) commonly found in Kansas were secured 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 the same ewes are not 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 1952-53 lamb crop are presented in Table 26.

Table 26.—Lamb production by ewes of different types and from sires of different breeds in 1953.

Ewe types	No. ewes bred	No. lambs weaned	% lambs weaned	Av. weaning weight	Lbs. lamb weaned per ewe bred
Finewools	43	40	93	87	81
Northwest Whiteface	45	39	87	84	73
Northwest Blackface	52	49	94	81	76
Sire groups					
Hampshire	35	31	88	92	81
Suffolk	35	36	103	91	94
Southdown	35	28	80	82	65
Shropshire	35	33	94	70	66

* Much assistance in collecting and summarizing the data for this experiment was given by Arthur W. Gardner, a graduate student in animal husbandry.

Table 27 gives the lambing performance and production of the three types of ewes for 1954.

Table 27.—Lambing Data and Lamb Production from Ewes of Different Types and from Sires of Different Breeds, 1954.

Ewe types	No. ewes bred	Av. lambing date	Av. birth weight	No. lambs alive April 13, 1954	Av. weight April 13, 1954
Finewools	51	12/18/53	11.1	45	82.6
Northwest Whiteface	42	1/11/54	10.7	38	71.8
Northwest Blackface	52	1/1/54	10.5	49	73.1
Single groups					
Hampshire	36	12/18/53	11.4	35	80.2
Suffolk	36	1/23/54	10.8	30	80.3
Southdown	37	1/14/54	11.0	32	79.2
Shropshire	36	1/7/54	10.7	35	67.8

Table 28 gives the average body weights following lambing in 1954 and the grease wool production for 1953.

Table 28.—Body Weights of and Wool Production from Ewes of Different Types.

	1953 grease wool production lbs.	Body weight in lbs. following lambing, 1953-54
Finewools	11.7	132
Northwest Whiteface	13.7	152
Northwest Blackface	10.7	158

The Rambouillet or finewool ewes have lambed the earliest both years of the test; their lambs have been heavier at weaning time in 1953 and their lambs were heavier on April 13, 1954, because of their age. The Northwest Whitefaces have lambed the latest both years of the test.

Lambs sired by Hampshire and Suffolk rams were heavier at weaning time than the Southdown and Shropshire-sired lambs and they produced more pounds of lamb per ewe bred in the 1953 tests. April 13, 1954, there was little difference in the weights of lambs sired by Hampshire, Suffolk, or Southdown rams. The Shropshire lambs were lighter but there were more twins in the Shropshire-sired group than in the Suffolk- or Southdown-sired groups.

The Northwest Whiteface ewes have sheared more wool than either of the other types of ewes both years of the tests. The finewool ewes have ranked second in wool production, although the Blackfaces sheared only 1 pound less in 1953.

Conclusion

1. The tests so far indicate fairly clearly that the finewool ewes will lamb earlier than the other two types and that the Whiteface crossbreds will shear the most wool. While there is some indication that some breeds of rams will produce more pounds of lambs, the figures are too limited and variable for definite conclusion; tests need to be repeated several years to give a reliable indication.

Physical Balance in Lamb Fattening Rations. Pelleted and Unpelleted Rations for Creep-fed Lambs, Spring 1954.

T. Donald Bell, Draytford Richardson, J. S. Hughes, Donald Parrish*

While information is becoming available concerning the pelleting of complete rations for fattening lambs, no studies have been made using pelleted rations for creep-fed lambs still nursing their mothers. To secure information on the merits of such a practice, lambs in the College experimental breeding trials were used for such tests. The lambs with their mothers were separated into four groups sired by Hampshire, Suffolk, Southdown, and Shropshire rams, respectively. Each sire group was then divided as nearly equally as possible into two groups—one fed the pelleted ration and one, the unpelleted ration. The pellets were 25 percent ground alfalfa hay, 68 percent sorghum grain, and 7 percent cottonseed meal and were fed free choice in the creeps. A mixture of ground alfalfa hay from the same source as that in the pellets, whole milo, and cottonseed meal in the same percentages as in the pellets was fed free choice in the creeps of the lambs receiving the unpelleted rations. In addition, some long alfalfa hay was provided in the creeps of all lots. The ewes in all lots were fed the same ration which consisted of approximately 1½ pounds of alfalfa hay, 4 pounds of corn silage, and 1 pound of mixed grain (milo, bran, and cottonseed meal) per head daily.

Table 29 shows the response of the different lots of lambs during the feeding period from March 2, 1954, to April 13, 1954.

Table 29.—Comparative Performance of Creep-Fed Lambs Receiving Pelleted and Unpelleted Rations.
March 2-April 13, 1954.

	No. lambs	Pellets or grain mixture consumed daily per lamb	Alfalfa eaten in creep daily per lamb	Av. daily gain per lamb	Creep feed cost per 100 lbs. gain
Hampshire-sired lambs:					
Pelleted creep ration	15	1.5	.23	.72	$6.90
Unpelleted ration	14	1.6	.24	.63	6.31
Suffolk-sired lambs:					
Pelleted ration	16	1.6	.22	.78	6.78
Unpelleted ration	14	1.7	.24	.72	5.82
Southdown-sired lambs:					
Pelleted ration	15	1.6	.23	.60	7.78
Unpelleted ration	16	1.5	.21	.57	6.46
Shropshire-sired lambs:					
Pelleted ration	16	1.3	.20	.66	6.29
Unpelleted ration	16	1.2	.18	.60	4.73

The pellets increased the rate and efficiency of gain in the creep-fed rations, but when the $12 a ton cost of pelleting is included in the feed costs, gains of lambs on the pelleted rations were all more expensive than gains of those fed unpelleted rations. These results are consistent with results obtained in several tests with feeder lambs where rate and efficiency of gain were increased with pelleted rations, but extremely high costs of pelleting made costs of gains of lambs receiving pellets higher than gains from unpelleted feeds.

* Recognition is given to Morris Johnson and Wendell Gardner, graduate students in animal husbandry, for their help in collecting and summarizing these data.

Swine

Swine Feeding Investigations

EXPERIMENT I

The Effect of Varying Amounts of Antibiotics (Aureomycin-B_{12} Supplement) in the Protein Supplement for Swine on Sudan Pasture.

PROJECT 110

FINAL REPORT

C. E. Aubel

In recent years the use of antibiotics in swine nutrition has received much attention. Research has shown that different vitamin B_{12} antibiotic supplements stimulate gains.

Antibiotics have been shown to be effective in stimulating rate of gain as much as 18 percent and improving the feed efficiency up to 10 percent when fed in the rations of swine. Not so conclusive evidence has been obtained, however, to show that mere inclusion of an antibiotic in a feed insures the improvement in the well-doing of the pig, unless the antibiotic is fed in adequate amounts, which is from 5.0-7.5 mg. per pound of total feed.

Most swine feeders self-feed grain and a supplement, with the latter containing the protein, vitamins and minerals. The ratio of corn to protein supplement consumed becomes wider as the pigs mature; therefore, the amount of antibiotic furnished daily by a protein supplement fed free choice with corn will be different from the amount supplied by feeding an antibiotic in a complete ration. Usually pigs will eat daily a fairly constant amount of a protein supplement throughout the feeding period, but the amount of grain they eat increases in proportion to weight of the pigs.

This experiment was designed to determine the optimum level of antibiotic in the protein supplement for growing and fattening pigs. Aurofac, the aureomycin-B_{12} supplement produced by Lederle Laboratories, New York, was used as the source of antibiotic. This contained approximately 1.8 mg. of vitamin B_{12} and 1.8 grams aureomycin hydrochloride per pound.

The problem in feeding the antibiotic in this manner was to determine how much antibiotic supplement to put in a ton of protein supplement to supply 5 mg. per pound of total feed consumed, as recommended from nutrition studies with swine. If one assumes that pigs eat their feed at a ratio of 1 pound of protein supplement to 3.5 pounds of grain, then 27 pounds of Aurofac per ton of supplement would supply approximately 5 mg. of aureomycin hydrochloride per pound of feed consumed.

Five lots of 10 pigs each were started on sudangrass pasture at a weight of about 56 pounds. They were fed free choice on shelled corn and a protein supplement of 4 parts tankage, 4 parts soybean meal, 1 part cottonseed meal, and 1 part alfalfa meal. The protein supplement had a protein content of about 50 percent. A mineral mixture also was supplied, made of equal parts ground limestone, steamed bonemeal and salt.

The following levels of Aurofac were added to the protein supplement:

Lot 1—no Aurofac
Lot 2—15 pounds per ton
Lot 3—25 pounds per ton

Lot 4—35 pounds per ton
Lot 5—45 pounds per ton

The following table gives a summary of the results of this experiment.

Table 30.—The Effect of Varying Amounts of Antibiotics (Aureomycin-B_{12} Supplement) in the Protein Supplement on Weanling Pigs on Sudangrass Pasture.

Ration fed	Shelled corn, sudangrass pasture, min. mix (Self-fed)				
	Protein mixed supplt.	Protein mixed supplt. 15 lbs. aureo-B_{12} to 1 ton	Protein mixed supplt. 25 lbs. aureo-B_{12} to 1 ton	Protein mixed supplt. 35 lbs. aureo-B_{12} to 1 ton	Protein mixed supplt. 45 lbs. aureo-B_{12} to 1 ton
Lot number	1	2	3	4	5
No. pigs in lot	10	10	10	9	10
Av. initial wt. per pig	57.70	56.40	63.90	56.00	57.85
Av. final wt. per pig	194.00	195.30	209.50	201.90	205.50
Av. total gain per pig	136.30	136.90	145.60	145.90	147.65
Av. daily gain per pig	1.49	1.50	1.60	1.60	1.62
Av. daily ration per pig:					
Corn	4.07	4.31	4.01	4.12	4.54
Protein supplt.	1.05	1.00	1.22	1.00	1.06
Feed consumed per 100 lbs. gain:					
Corn	272.19	287.07	251.03	256.34	280.39
Protein supplt.	70.35	66.76	76.51	63.26	65.35
Mineral mix	.14	.27	.12	.12	.17
Feed cost per 100 lbs. gain	$11.32	$11.78	$11.27	$10.75	$11.86

Feed prices charged: Shelled corn, $1.68 per bu.; mixed protein supplements in Lot 1, $90 per ton; mixed protein supplements with Aurofac in Lot 2, $95.25, Lot 3, $98.75, Lot 4, $102.25, and Lot 5, $105.75 per ton; Aurofac, 35c per lb.; mineral mixture, 3c per lb.

Observations

1. Feeding Aurofac at 15 pounds per ton of protein supplement produced no better response with the pigs than no antibiotic.
2. If the antibiotic were fed at near the recommended level or more, daily gains were increased and the efficiency of the feed was increased, except in Lot 5 where 45 pounds of antibiotic to the ton were fed. The amount of feed required per 100 pounds gain in this lot was about the same as when no antibiotic was fed and only slightly more than required by those getting nearer the recommended allowance.
3. The pigs receiving 25 pounds of Aurofac per ton of protein supplement consumed less corn and more protein supplement per 100 pounds gain than any other lot.
4. This experiment indicates that feeding the Aurofac mixed in the protein supplement and self-fed free choice with grain is a practical way to administer the antibiotic to growing fattening pigs.
5. About 25-35 pounds of Aurofac per ton of mixed protein supplement appear to be the correct amount. This amount is consistent with the amount recommended in a complete or total feed (5 mg. per pound of feed).

EXPERIMENT II—Summer 1953

The Effect of Antibiotics, Aureomycin-B_{12} Supplement, Terramycin and Vitamin B_2 Pre-mix in the Protein Supplement for Weanling Pigs on Sudan Pasture.

C. E. Aubel

Previous experiments have shown the effect of varying amounts of aureomycin-B_{12} supplement in the protein supplement for weanling pigs. The optimum amount has been between 25 and 35 pounds of Aurofac to a ton of mixed protein supplement. This supplies approximately 5 mg. of aureomycin per pound of total feed consumed, the amount usually recommended from nutrition studies.

This experiment was designed to get information on another antibiotic, terramycin, and on the feeding of a vitamin B_2 Pre-Mix supplement.

Four lots of pigs were fed. Lot 1 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. Lot 2 received a similar protein supplement with aureomycin added (as Aurofac) at the rate of 27 pounds to a ton. Lot 3 had a similar protein supplement with terramycin added as TM5 at the rate of 5 pounds per ton and Aurofac at the rate of 14 pounds per ton. These combined antibiotics provided the 5 mg. per pound of total feed usually recommended. Lot 4 received a similar protein supplement, with Aurofac added at the rate of 25 pounds per ton and a vitamin B_2 supplement containing riboflavin, niacin, pantothenic acid, choline chloride, and folic acid (Lederle's C-49) at the rate of 12 pounds per ton of supplement.

Table 31 gives the results of this experiment.

Table 31.—The Effect of Antibiotics, Aureomycin-B_{12} Supplement, Terramycin, and Vitamin B_2 Premixture in the Protein Supplement for Fattening Swine on Sudangrass Pasture.

(May 21, 1953-August 25, 1953—96 days)

Ration fed	Shelled corn, sudangrass pasture, mineral mixture			
	Protein mixed supplt.	Protein mixed supplt. 27 lbs. aureo-B_{12} per ton	Protein mixed supplt. 14 lbs. aureo-B_{12}, 5 lbs. TM5 per ton	Protein mixed supplt. 27 lbs. aureo-B_{12}, 12 lbs. C-49 per ton
Lot number	1	2	3	4
No. pigs in lot	10	10	10	10
Av. initial wt. per pig	40.80	41.20	39.90	41.70
Av. final wt. per pig	191.10	196.80	182.40	184.40
Av. total gain per pig	150.30	155.60	142.50	142.70
Av. daily gain per pig	1.56	1.62	1.48	1.48
Av. daily ration per pig:				
Shelled corn	3.94	4.40	3.87	3.81
Protein supplt.	.87	.85	.81	.91
Feed per 100 lbs. gain per pig:				
Shelled corn	251.82	271.85	261.05	256.83
Protein supplt.	55.88	52.69	55.08	61.45
Mineral mix	.12	.11	.09	.08

Prot. supplt.	.87	1.44	.91	1.11
Feed per 100 lbs. gain per pig:				
Sh. corn	251.82	217.59		
Gr. milo			339.64	344.33
Prot. supplt.	55.88	93.01	48.85	64.07
Minerals	.12	.12	.06	.07

When the pigs were on forage, there was little difference between the pigs not on a high-fat level and those that received extra fat in their protein supplement. The rate of gain was the similar and the feed consumption was practically the same. However, the fat-consuming pigs ate less corn than did the other lot.

Daily gains of the fat-fed pigs in the winter were somewhat less (about 6 percent) than gains of pigs not fed fats. Feed consumption was more fat-supplement consumed and a little more corn, than with the lot not getting surplus amounts of fat.

Observations

1. This experiment indicates that pigs may use extra amounts of fat in their rations if the price is low enough compared with corn to justify the cost of the extra handling and mixing.

2. It is thought that 10 or 15 percent of the ration could be fat and that that much could be fed mixed with ground corn, as well as in tankage, subsequently used in mixed protein supplements.

COL. W. A. HARRIS

by

C. W. McCampbell

William Alexander Harris, brilliant soldier, distinguished engineer, resolute legislator and master Shorthorn breeder born near Luray, Va., October 29, 1841, graduated from Columbia College (now George Washington University), Washington, D.C., in 1859, spent six months as a civil engineer on a preliminary inter-ocean canal survey in Central America, then entered Virginia Military Institute at Lexington, Va.

Virginia seceded in April 1861. The senior class of Virginia Military Institute, of which Colonel Harris was a member, was graduated immediately and all entered the Confederate Army under the leadership of one of their instructors, later to gain fame as "Stonewall" Jackson.

Splendid personal, mental, and physical endowments marked Colonel Harris early for leadership and his rise in the army was rapid. When the war ended, he had attained the rank of Colonel though only 24 years of age.

The war left the Harris fortune wrecked, so late in 1865 he came west. His personality, training, and experience secured for him employment as a civil engineer with the Kansas Pacific Railway (now the Union Pacific). His first assignment was to supervise construction of the Leavenworth to Lawrence branch.

This assignment was completed in 1866. Harris was then appointed resident engineer for the Kansas Pacific with headquarters in Wyandotte, Kan. (now Kansas City, Kan.). He remained until 1868 when he was appointed land agent for the Kansas Pacific and moved his headquarters to Lawrence, Kan.

Colonel Harris "had inherited love of country life and pastoral pursuits" and while on a Kansas Pacific right-of-way inspection trip, he was tremendously impressed with the lay of the land and apparent fertility of the Kansas river valley at a point some 25 miles west of Kansas City. He was completely captivated by the beauty of the landscape as viewed from a knoll about ½ mile north of the present town of Linwood, Kan. This knoll provided a view for considerable distance to the north, the east, and the south.

He walked over this area, noted its location in his memorandum book, and commented that some day he would build a home on that knoll. Approximately three years later a part of his dream became a reality, for one finds in the records that a deed dated June 9, 1868, transferred the ownership of the southwest quarter of Section 14 Township 12 Range 21 from Thomas L. Price to William A. Harris. The knoll where he hoped some day to build a home is located on this tract. Other land adjoining and nearby, making a total of 2946.47 acres, was included in this transaction.

Colonel Harris continued as land agent for the Kansas Pacific for several years but during this period, he also operated his farm at Linwood and developed quite a large herd of high grade beef cattle.

He resigned as land agent for the Kansas Pacific in 1876 so he could devote his entire attention to his farm and livestock but the house he had envisioned as a home was not completed until 1884 when the family moved from Lawrence to the new home. The Harris home, the most pretentious in the area, was usually referred to by persons of that community as "The Mansion," not in a spirit of derision but rather in one of community pride.

Built on the knoll as planned, the house has twelve spacious rooms, four large fireplaces each faced with beautiful imported tile and a most imposing carved walnut stairway leading to the second floor from a wide deep hall. The area around the house was beautifully landscaped

Observations

1. Feeding whole milo produced about 8 percent greater gains in pigs than produced by feeding corn.
2. The daily gains of the pigs receiving ground milo were about 12 percent greater than those of pigs fed corn.
3. Ground milo was more efficient than whole milo.
4. Adding aureomycin to the ration did not materially offset the daily gains but did reduce the amount of feed required per 100 pounds gain.
5. The 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 for fattening pigs in this experiment.

EXPERIMENT V—Summer and Winter 1953-54.

The Value of Animal Fats in Hog Fattening Rations.

C. E. Aubel and D. Richardson

The surplus of animal fats is a problem. A major part of this fat is considered unfit for human consumption. In the past, one of the greatest uses for it has been in soaps. Detergents have largely destroyed this market. Increased use of vegetable oils instead of animal fats has further reduced the market.

Fats contain 2.25 times as much energy as carbohydrates. The addition of fat to swine rations should increase their energy content and consequently decrease the feed required to produce 100 pounds of pork.

To get information on this theory or subject, two experiments were conducted last summer and winter with an inedible animal fat added to the ration of growing fattening pigs. In these experiments an animal tankage that analyzed 27 percent fat was used in an animal and vegetable protein supplement. This supplement contained 4 parts high-fat tankage, 4 parts soybean meal, 1 part linseed meal, and 1 part alfalfa meal. This supplement then analyzed 10.65 percent fat. This was self-fed to pigs free choice with corn in one experiment and milo in another. The pigs during summer experiment were on green forage, whereas the pigs during the winter experiment were in the drylot.

A summary of the results follows:

Table 34.—The Value of Animal Fats in Hog Fattening Rations.

	Summer 1953 (May 21, 1953 - August 25, 1953) 96 days on sudangrass pasture —Shelled corn self-fed—		Winter 1954 (December 14, 1953 - March 15, 1954) 91 days on drylot —Ground milo self-fed—	
Ration fed	Protein mixed suppl't. plus mineral mix.	Protein mixed suppl't. plus animal fat plus mineral mix.	Protein mixed suppl't. plus mineral mix.	Protein mixed suppl't. plus animal fat plus mineral mix.
Lot number	1	2	3	4
No. pigs in lot	10	10	9	8
Av. initial wt. per pig	40.80	39.70	53.11	55.00
Av. final wt. per pig	191.10	188.60	223.22	214.00
Av. total gain per pig	150.30	148.90	170.11	159.00
Av. daily gain per pig	1.56	1.55	1.86	1.74
Av. daily ration per pig:				
Sh. corn	3.94	3.37		
Gr. milo			6.42	6.01

Prot. supplt.	.87	1.44	.91	1.11
Feed per 100 lbs. gain per pig:				
Sh. corn	251.82	217.59		
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Built on the knoll as planned, the house has twelve spacious rooms, four large fireplaces each faced with beautiful imported tile and a most imposing carved walnut stairway leading to the second floor from a wide deep hall. The area around the house was beautifully landscaped

but all that remains of this landscaping is a few stately pines. The house still stands sturdy and solid but badly neglected.

This home, in its earlier years, exemplified the hospitality of the Old South transferred to a beautiful spot in Kansas and this hospitality was probably enjoyed by more distinguished persons than any other Kansas home of its time and by more persons from the more humble walks of life.

Harris recognized an opportunity for service to the livestock industry, to satisfy a desire to produce the best in livestock, and to profit financially by establishing a herd of purebred beef cattle. Since he was already an admirer of Shorthorns, the most popular of all breeds of cattle at that time, it is only natural that he established a Shorthorn herd.

A serious start was made with the purchase of three purebred heifers (Nuxumbie Queen 2d, Auvergne Rose, and Queen of the Roses) and the purebred bull Duke of Bayfield 38295 from Hamilton Brothers of Mt. Sterling, Ky., at a sale they held in Kansas City, Mo., May 23, 1879.

Two more purebred heifers—Rose Fairholm of Lawrence and Rose of Bayfield—were purchased in October, 1879, from H. C. Ireland of Mooresville, Mo., and in the fall of 1879 he also purchased the young purebred cow Grace Greenwood with heifer calf at side from M. E. Chanslor of Kearney, Mo. Then in June, 1880, he purchased two purebred heifers—Betty Grey Fourth and Myrtle Fifth—from E. A. Potts of Whitehall, Ill. The first purebred Shorthorn registered as bred by Harris was a heifer born at Linwood Farm. The dam was Muxumbie Queen 2d, the sire Duke of Bayfield 38295, the date April 2, 1880, and the name Nuxie V. 27p553. Thus began a herd of purebred Shorthorn cattle that was destined to become recognized as one of the greatest in this or any other country.

Early in 1881, Colonel Harris had purchased the young bull Goldendrop of Hillhurst 39120 bred by W. E. Simms of Paris, Ky. This bull carried two top crosses of Bates blood but his granddam represented the best in the "new" type Shorthorn blood lines and Goldendrop of Hillhurst possessed decidedly more compactness of form and thickness of flesh than Bates-bred cattle usually possessed.

Colonel Harris decided in 1881 to concentrate on the production of purebreds and sold 300 grade Shorthorn cattle and 1135 acres of land.

The more the Master of Linwood studied the problem of beef cattle type the more he became convinced that his cows, all representatives of Bates blood lines, and even Goldendrop of Hillhurst did not possess the type, thickness of flesh, and early maturity that was needed to produce the best quality of beef most economically, so early in 1882 he went to Kentucky, then considered the center of the best in Shorthorns in this country, with the hope of finding the kind of cattle he had in mind.

He spent several days inspecting the best known herds in that area without finding his type of cattle. Everywhere he went, he found that the Bates craze dominated breeding operations. One evening, while a guest in the A. L. Hamilton home near Lexington, Ky., he saw a pamphlet entitled "Catalogue of Shorthorn Cattle, the Property of Messrs. Cruickshank and Sittyton, Aberdeenshire, Scotland," and asked his friend Sanders if he had seen any of these cattle; also how they differed from the cattle they had seen in Kentucky. Sanders' description of those he had seen excited keen interest in Colonel Harris. When they parted, the Colonel asked Sanders to wire him if he located any good young cattle of Cruickshank-breeding that could be bought.

A short time later James H. Kissinger of Clarksville, Mo., held a sale of imported Cruickshank-bred cattle at Kansas City, Mo. Colonel Harris was on hand early. He was convinced that here was the type of Shorthorn that would "correct the growing tendency toward lightness of flesh and loss of feeding quality."

The individual that appealed most to him was a young red bull which Kissinger had selected for use in his own herd. Succumbing to the Colonel's exceptional persuasive powers, Kissinger consented to in-

clude this bull in the sale with the understanding that Colonel Harris would make sure that the youngster brought at least $1000. This bull, Baron Victor 42824, calved November 9, 1880, went to Colonel Harris for $1100. May 3, 1882, is a memorable date in Shorthorn history because it placed a master sire in the hands of a master breeder. This combination more than any other factor revolutionized Shorthorn type in America. Three Cruickshank-bred heifers (Victoria 63rd at $530; Violet Bud at $450; and Victoria 69th at $390) also were purchased in this sale. These purchases mark the beginning of the second phase of the career of Colonel Harris as a breeder of purebred Shorthorn cattle and his success during the next 10 years has never been surpassed by any breeder of Shorthorn cattle in any country.

The first crop of calves by Baron Victor satisfied the Master of Linwood that he was on the right track. He took immediate steps to increase his stock of breeding females of Scotch, particularly Cruickshank, blood lines. "Expense was not spared in the purchase of the best individuals with which Cruickshank could be induced to part . . . Lot after lot of broad ribbed, compactly built, wonderfully matured yearlings and two-year-olds came from Cruickshank to Harris . . . . and as the seasons came and passed, under the masterful guidance of the owner, Linwood came to be the home of the best herd of Shorthorns on the American continent—the mecca toward which the most progressive breeders directed their steps in quest of bulls to head their herds."

Colonel Harris recognized that Cruickshank and a few contemporary Scotch breeders had been revolutionizing Shorthorn type but he was not a pedigree fanatic following blindly a new fashion in Shorthorn breeding. His chief concern was a good beef producing type of Shorthorn, and some of the best cattle produced by Colonel Harris carried one or more Bates crosses somewhere in their ancestry.

Colonel Harris was confronted with the difficult problem of maintaining a sequence of acceptable herd sires.

The sires, other than Baron Victor, that contributed most to the fame of the Linwood herd were Thistle Top, Craven Knight, Baron Lavender 2d, Spartan Hero, and Galahad.

Thistle Top 83876, calved March 30, 1885, bred by Cruickshank, was imported by J. I. Davidson of Canada and loaned to Kansas State College in May 1886, to use in place of Highland Chief, also bred by Cruickshank and purchased by Kansas State College from Davidson in January 1886, but had the misfortune to break a leg on the way to Manhattan and was destroyed. Thistle Top remained at Kansas State College until March 1887 when he was sold to Colonel Harris who used him extensively in 1887-1888 and 1889.

Craven Knight 96923, calved February 16, 1887, bred by Cruickshank, imported by Luther Adams of Iowa, was purchased by Colonel Harris in 1888 and used as his chief herd bull in 1889-1890. He is referred to in Sanders' History of Shorthorn Cattle as "probably the handsomest Cruickshank bull ever seen in the Western states." His first calves did not seem to develop quite so rapidly as Colonel Harris desired, so Craven Knight was traded to Kansas State College in 1891 for the Cruickshank-bred bull Royal Pirate, purchased from Colonel Harris in 1890. Contrary to early indications the sons and daughters of Craven Knight developed into grand individuals and in January 1894 Craven Knight, then in his seventh year, was returned to Linwood in exchange for his excellent son Golden Knight 108086, bred by Colonel Harris and used extensively by him in 1892 and 1893. Evidently something happened to Craven Knight soon after his return to Linwood, for no calves were ever registered as sired by him after he left Kansas State College. He was included in the dispersal sale in 1896 but the catalogue contains a statement that "he is not now capable of serving a cow." J. H. Potts and Son of Jacksonville, Ill., decided to gamble on him and got him for a bid of $65. This was a losing gamble and Craven Knight finally went to the shambles. It was generally

agreed that had Craven Knight remained at Linwood he would have at least equaled the record of Baron Victor as a sire.

Baron Lavender 2d 72610, calved October 9, 1885, by Baron Victor, bred by Colonel Harris and sold as a youngster, developed into a magnificent individual. Sanders referred to him in 1916 as "the peer of any bull of the breed yet produced on this side of the Atlantic." Despite limited opportunity during his early years he proved himself a really outstanding sire and came back to Linwood late in 1890 as a five-year-old. He was used as extensively as possible in 1891. This proved to be his last year of service, another untimely ending of the services of a great sire at Linwood.

Spartan Hero 77932, calved March 23, 1883, bred by Cruickshank was leased for the year 1892 from M. E. Jones of Williamsville, Ill. Despite the fact that he was then nine years old, this proved fortunate for, when mated with the splendid cows at Linwood, he proved a great sire. Some of his get were the best ever produced at Linwood. Space permits mention of only one—Royal Hero 113611, calved in December 1892. Among his notable winnings in the show ring was the "Championship of America" award at the Illinois State Fair as a seven-year-old in 1899. Incidentally a daughter of Royal Hero was the grand champion female at this same show.

Galahad 103259, calved October 3, 1889, bred by Colonel Harris, was sold to a Marshall county breeder as a youngster. He demonstrated unusual ability as a sire and Colonel Harris brought him back to Linwood Farm early in 1894 where he was used extensively that year and the next. He made a splendid record at Linwood Farm, one of his great sons being Gallant Knight 124468, calved May 13, 1896, that brought fame to the Tomson herd then at Dover, now at Wakarusa, Kan. Galahad, included in the dispersal sale of 1896, was purchased by H. C. Duncan of Osbourn, Mo.

Early in 1892, Colonel Harris went to Great Britain in search of one or more outstanding proved sires or sire prospects but found none that owners would sell. He then decided to depend upon sires of his own breeding except if by chance he could purchase or lease better sires. The three bulls of his own breeding that he retained and used extensively were: Golden Pirate 103411 by imported Royal Pirate; Golden Knight 108086 by imported Craven Knight; Golden Lord 119422 by Lord Mayor, also bred by Harris. They all belonged to his famous Golden Drop family. Golden Knight and Golden Lord were both out of Norton's Golden Drop, the foundress of the Linwood Golden Drop family, and Golden Pirate was out of one of her daughters. These three sires rendered excellent service; however, they shared Linwood honors with Spartan Hero (leased for a year) and Baron Lavender 2d and Galahad, both bred by Colonel Harris, sold as youngsters and repurchased as mature proved sires.

Forty bulls other than those mentioned were tested as sires at Linwood from 1882 to 1896 inclusive. Six were bred by Cruickshank, thirty by Colonel Harris and four by other American breeders. Several were sold before their real value was known. Most of the others were good sires but not quite up to the Harris standard.

A bull thought by all to be a great prospect as a sire and leased by Colonel Harris in 1887 proved to be a decided disappointment. This was Cupbearer 91223, calved November 3, 1884, bred by the famous Scotch breeder William Duthie and imported by Luther Adams of Iowa from whom Colonel Harris leased him. This splendidly bred bull compiled a show ring record that has seldom been approached in this country. His crowning victory was winning the "Champion of America" award at the Illinois State Fair in 1889. A wonderful individual but a disappointment as a sire.

Colonel Harris was just as discriminating in selecting females in his herd. Only the best were acceptable. Volumes could be written about the remarkable females in this herd but only brief mention of two is possible here.

1. Norton's Golden Drop V20p10636, calved September 21, 1880, bred by C. W. Norton of Iowa and purchased by Colonel Harris in 1882. This cow's dam represented straight Scotch breeding but her sire represented straight Bates breeding. Colonel Harris was an enthusiastic believer in Scotch-type Shorthorns as the best but in this instance he did not allow a Bates cross to obscure the individual excellence of this heifer which was described as "strongbacked, heavy quartered and deep bodied with a feminine head and neck . . ." She was the foundress of the Linwood Golden Drop family and one authority has stated that "the Linwood Golden Drops, with their beautiful finish, their wealth of flesh, substance and character, constituted in the opinion of our best judges, the most superb family of Shorthorn cattle of their time in the United States."

Ten calves were registered as the produce of Norton's Golden Drop, all produced at Linwood Farm, the last at the age of 14 years. Six were heifers and four bulls. The heifers were not only outstanding individuals but also wonderful producers. Two of the bulls were sold as youngsters. The other two, Golden Knight and Golden Lord (her last calf), were used extensively in the home herd.

2. Princess Alice V36P-628, calved December 21, 1886, bred by William Duthie, imported by Luther Adams of Iowa in 1887 and purchased by Colonel Harris in 1889. She was champion female at several state fairs as a yearling, the only year she was shown.

She produced two heifers before starting her remarkable career as a producer of outstanding bulls, one before coming to Linwood Farm and one at Linwood Farm early in 1890 not long after her arrival there. Both were described as "paragons of Shorthorn excellence" but the first was exported to Mexico and the second proved to be a non-breeder.

Bred to Craven Knight, she produced in 1891 the roan Young Marshall 110705, winner of first prize at the Columbian Exposition at Chicago in 1893, for L. W. Brown and Son of Illinois. Later he became the sire of some of the best show cattle seen on the American circuit from 1895 to 1910.

Bred to Craven Knight, she produced in January 1892 the roan Prince Royal 113305, a bull of fine promise that was sold for service in the good herd of Thomas H. Masten of Kansas City.

Bred to Spartan Hero, she produced in December 1892 the great roan Royal Hero whose record has been referred to previously.

Bred to Golden Knight (a son of Craven Knight), she produced in 1893 Royal Knight 117203, which rendered excellent service in the splendid herd of C. S. Hanna, Howard, Kan. Unfortunately he was accidentally drowned at the end of two years' service in the Hanna herd.

Bred to Galahad, she produced in 1894 the heifer Alice of Forest Grove and a short time later was sold at a long price to Col. T. S. Moberly of Kentucky. In other hands, she produced in 1895 the good bull Alice's Prince 122593 and finished her breeding career in 1897 by producing the bull Prince Armour 127794, a leading state fair winner. Princess Alice was truly a remarkable producer.

Most of the remarkable Harris herd was dispersed at the farm May 6, 1896. When the sale was about to start, Colonel Harris said: "I retained a few old cows not in condition and I trust some day I shall have another herd of the grandest and best breed of cattle on earth." This hope was never realized except for the few Shorthorns bred until the farm was sold in 1901.

The dispersal sale was held at the depth of the worst depression this country ever has experienced but the sale indicated high esteem for the herd and its owner. Buyers were present from every section of the country and the average, which seems ridiculously low at the present time, was the highest for several previous and following years. While the Harris sale averaged only $205, the Browndale Farm sale of pure-bred Shorthorns held the same week averaged a mere $91, yet the Browndale Farm herd was older, well-known throughout the country,

had been a leading winner at the Columbian Exposition in 1893 and the sale cattle were a carefully selected, well-fitted lot.

Why did Colonel Harris disperse his herd, particularly at the time he did? The depression of the '90s with its problems and low prices for purebred livestock of all kinds was a factor, but the principal reason was his reluctantly "responding to the urgent appeal of both industry and agriculture of his adopted state to accept the nomination as U.S. Representative-at-large in 1892 and U.S. Senator in 1896" and the inevitable neglect of some of the important details of management that could not be carried out from Washington, D.C.

He was not a candidate for nomination in either instance. In fact he did not know he had been nominated for Representative-at-large until, returning from a visit to the leading Shorthorn herds of Great Britain, he was notified by telegram.

When he had read the telegram he turned to his friend Sanders and said: "Why did this have to come to me just as I was returning home from this splendid trip, my mind fairly filled with new ideas, hopes and plans for the future of my home, my farm, my herd?" Accepting this call to duty was in reality the beginning of the end of the glory of Linwood Farm.

Connelley in his "Kansas and Kansans" states that the People's Party convention in session June 5, 1892, at Wichita, in which Colonel Harris was nominated Representative-at-large, "was a very enthusiastic one and a very dramatic incident occurred when Fred J. Close, a Union soldier who had lost an arm in the (Civil) War, in a brief and eloquent address placed the name of Col. W. A. Harris, an ex-Confederate, in nomination. The Assembly went wild and the nomination was made unanimous by a rising vote. Men stood on chairs and tables and cheered themselves hoarse. . . ." The Democratic Convention endorsed the state and elector ticket of the People's Party, the entire ticket was elected and Colonel Harris went to Washington, D.C.

He was defeated for re-election to Congress in 1894, returned home March 3, 1895, in the fall of 1896 was elected to the State Senate and in January 1897 elected U.S. Senator by the Kansas legislature, returned to Lawrence, Kan., to live in 1903.

Colonel Harris was recognized as a leader in both the House of Representatives and the Senate. Almost single handedly he brought about a settlement of the Union Pacific debt to the United States said to have saved the government $50 million. Theodore Roosevelt made no secret of his admiration of Colonel Harris, and consulted him frequently on matters of state. He desired greatly to appoint Colonel Harris a member of the Isthmian Canal Commission but the appointment was blocked by Senator-Elect Long, even though the entire remainder of the Kansas delegation in Congress favored the appointment.

One of Colonel Harris' achievements in Congress of special interest to this state was securing the Fort Hays Military Reservation for Kansas. This reservation was abandoned while Colonel Harris was serving as Congressman-at-large and he introduced a bill to have this land ceded to Kansas. The bill passed both houses but failed to receive the signature of President Cleveland. The Secretary of the Interior then decided to sell the land at public auction but Colonel Harris prevailed upon him not to sell it. When Colonel Harris returned to Congress as United States Senator, he found no plans for the disposal of this land and again introduced a bill, this time in the Senate, providing that this reservation be given to Kansas for educational and agricultural experimental purposes. Eventually it passed both houses and was signed by President McKinley. This land was allotted to the Hays Branch of the Kansas Agricultural Experiment Station of Kansas State College and Fort Hays Kansas State College.

Colonel Harris was one of the most appealing and convincing speakers in or out of Congress. Two incidents bearing on this point will be cited.

1. On May 19, 1900, the U.S. Senate accepted from the Grand Army

of the Republic a statue of General Grant. Reports of this event agreed that "the most eloquent and impressive speech on this occasion was made by Colonel W. A. Harris, a former Confederate Army Officer. It was a masterpiece."

2. Just a short time before his death, he was called upon to speak at a banquet given in Chicago for the Boston Association of Commerce together with the governors of Massachusetts and Rhode Island. A report of this meeting states that "Colonel Harris delivered an address of such power and appeal that at its close the men from the East rose to their feet and cheered him to the echo."

It is most fitting that his last public address should have been given before the Shorthorn Breeders of America assembled in annual meeting in Chicago December 1, 1909, just three weeks before his sudden death. It is also fitting that he should have been a member of the Board of Regents of Kansas State College at the time of his death.

His unexpected death of a heart attack in Chicago December 21, 1909, brought a deluge of tributes from many parts of the country. It is not possible to reproduce here even one in its entirety but parts of one that appeared in the Topeka State Journal, typical in thought of all, follow: "Not only does Kansas lose one of its ablest citizens but the same is also true of the nation. Although quiet of mien, unassuming, unostentatious to a degree, his was a personality of extreme force that accomplished things in whatever field of activity his labors or his duties carried him" and "He was an honest upright man, of wonderful capabilities, faithful and undeviating to his friends, and to his principles, a loyal and sincere citizen, a genuine Christian gentleman. Of any man no more can be said."

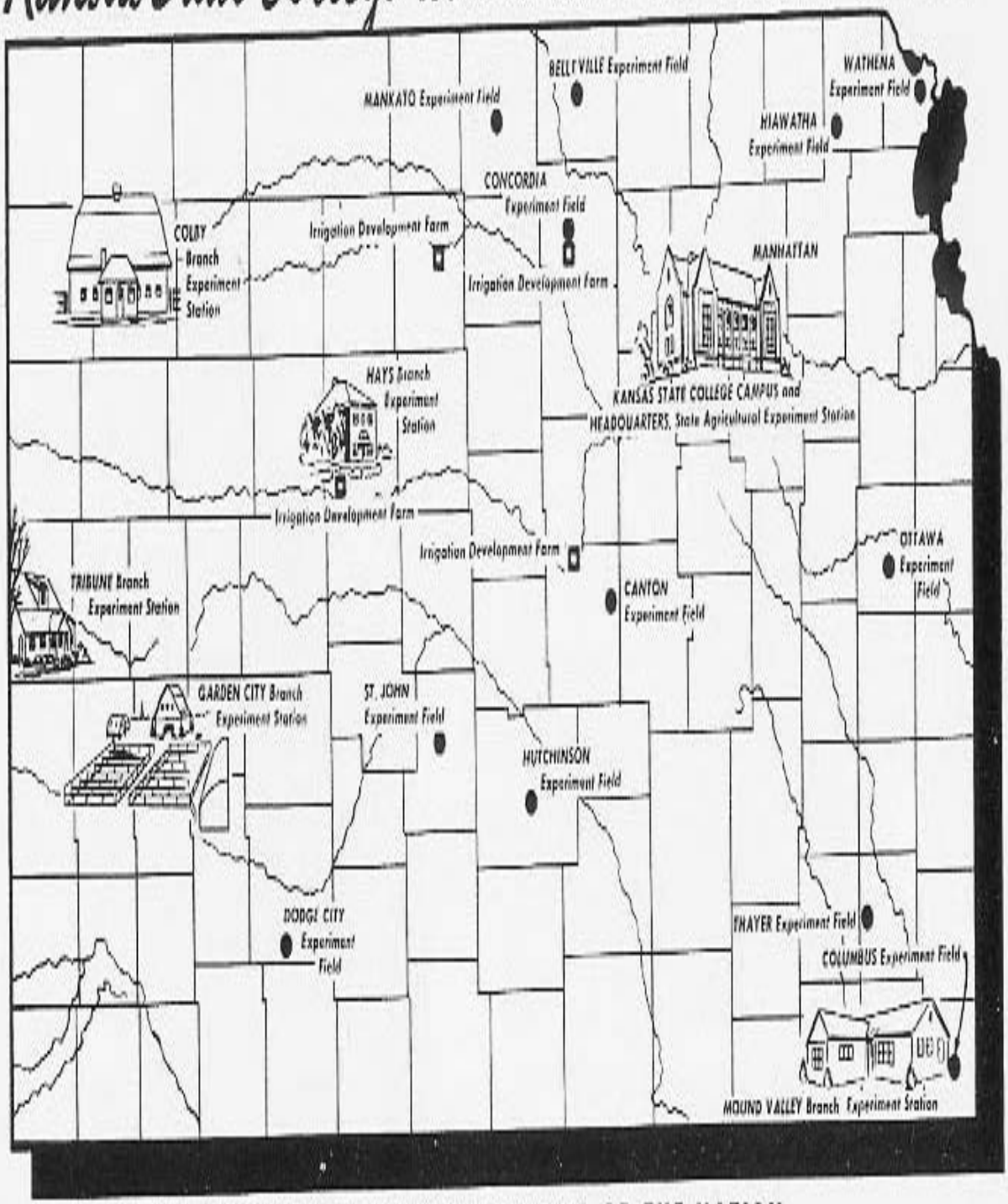
He was buried at Lawrence, Kan., and the respect and admiration which he commanded in this, his home community, is evidenced by the fact that every place of business in Lawrence was closed for his funeral despite the fact that it occurred on the busiest shopping day of the year. Left to mourn his death were his wife, two sons, and three daughters.

A statue of Colonel Harris by Carlo Romanelli, placed on the campus of Kansas State College by friends throughout the country, was dedicated October 28, 1911. Many distinguished persons were present and the tributes paid Colonel Harris were most impressive. Perhaps the most beautiful was delivered by his close friend, Captain J. G. Waters of Topeka, which near the close included this sentence: "He was the man I would like to be."

The wording on the plate of this statue is simple but significant.

WILLIAM ALEXANDER HARRIS
1841-1909
Soldier and Statesman
A Modern Farmer and Breeder
A Resolute Legislator Without Reproach
A Notable Example of American Manhood

Kansas State College AGRICULTURAL EXPERIMENT STATION



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