Studies with Beef Cattle, Sheep and Swine

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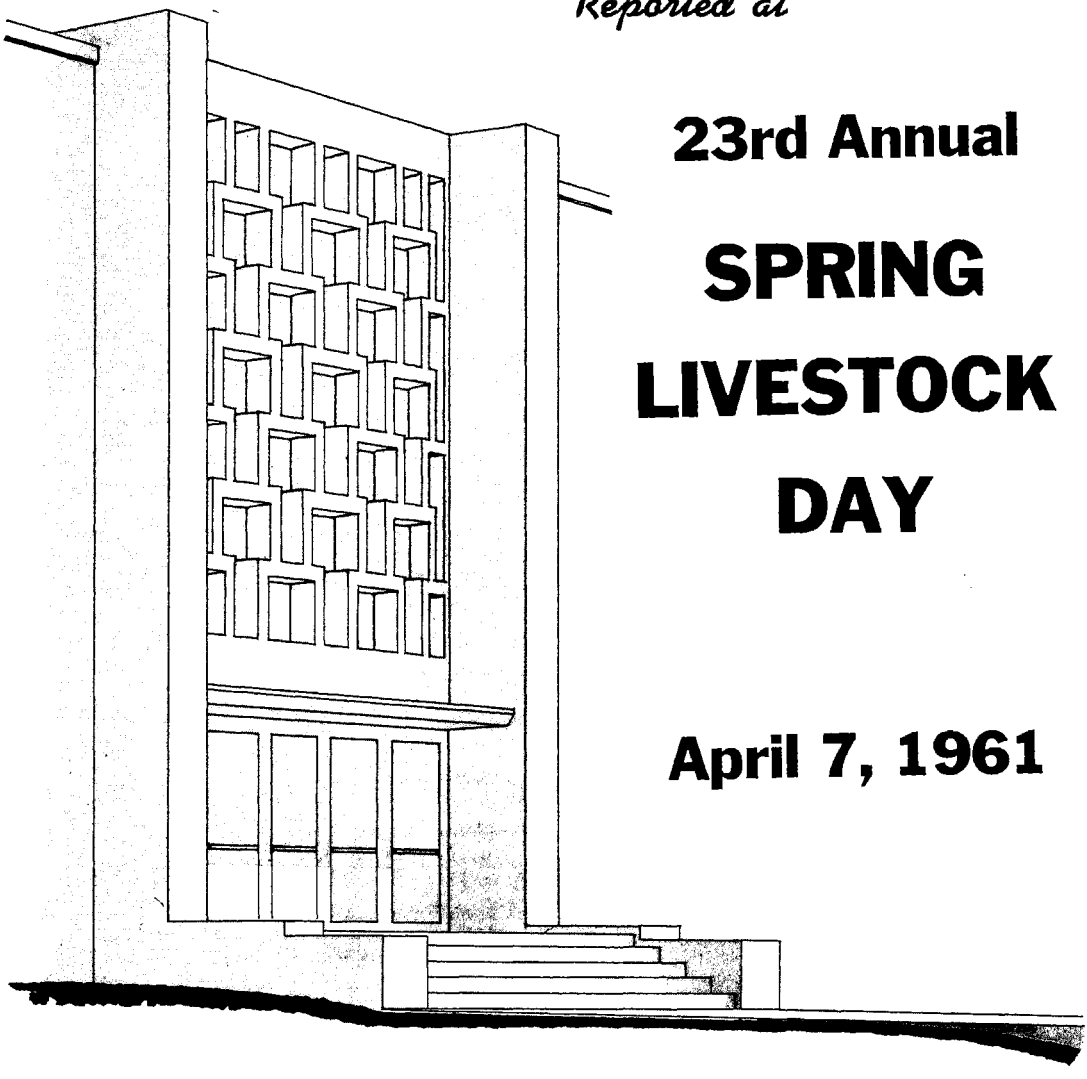

University of Missouri

AGRICULTURAL EXPERIMENT STATION

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CONTENTS

PRE-WEANING, FATTENING AND CARCASS PERFORMANCE OF SIX SIRE GROUPS OF HEREFORDS

B. J. Greiman, J. E. Comfort, & J. F. Lasley

The cattle in this experiment were studied for differences in preweaning performance, feed-lot performance, and various carcass characteristics as influenced by their sires. The influences of a growth stimulating hormone implant and the sex of cattle were also investigated.

Two groups of cattle have been studied thus far: 21 steers and 26 heifers that were calved during the fall of 1958, and 100 steer and heifer calves that were calved during the fall of 1959. All of the calves were born in the Weldon Spring Research Center grade Hereford herd and were sired by purebred Hereford bulls. Calves were allowed to nurse their mothers until the month of June after the fall in which they were born.

After being weaned, the calves were hauled to Columbia and placed in a dry lot where their feed-lot performance was measured. Both 1958 and 1959 groups were fed the same. After they were on full feed, some corn and cob meal was before them at all times. They were also fed 1 1/2 pounds of soybean oil meal per head per day and restricted to 2 pounds of alfalfa hay per day. Free choice of a mineral mixture composed of three parts salt to one part steamed bone meal was provided. Total feed consumption records by lots were kept during the feeding period.

Half of the first group were implanted with Synovex (a growth stimulating hormone) and reimplanted after 5 1/2 months on feed. The first group remained in the feed lot until they reached an approximate shrunk weight of 900 pounds for steers and 800 pounds for heifers. Records are incomplete on the second group.

BIRTH WEIGHTS OF THE CALVES BY SIRE GROUPS

Sire	1958	1959
1	73.8#	61.5#
2	67.3#	69.7#
3	67.2#	67.7#
4	73.7#	69.7#

After weights had been corrected for sex of calf, there was a 6.6 pound difference in sire groups for the 1958 calves and an 8.2 pound difference in the 1959 calves. Sires 3 and 4 were the same bulls in both groups of cattle and there was very little difference between the birth weights of their calves for the two years. Bulls influence the birth weights of their calves, and these data indicate that the same bull tends to produce calves similar in average birth weight year after year.

Weaning weights of the calves by sire group, corrected for age of calf to 210 days, age of dam, and sex of calf, follow:

WEANING WEIGHTS OF CALVES BY SIRE GROUPS

Sire	1958	1959
1	287	285
2	306	300
3	294	307
4	316	307

The weaning weights of the 1958 calves show a 29 pound difference between high and low sire groups. Note that sire 1 had the heaviest calves at birth but the lightest calves at weaning. The 1959 calves showed a 22 pound difference in weaning weight by sire groups. Sires 3 and 4, the repeat bulls, show differences of 14 and 9 pounds, respectively, in their two groups of calves. Thus, it can be seen that different sires influenced the weaning weights of their calves more in one particular year than did the same sires in different years.

SUBJECTIVE CONFORMATION WEANING SCORES OF THE CALVES

Sire	1958	1959
1	7.08	9.25
2	7.08	9.19
3	7.40	8.88
4	7.77	9.12

SUBJECTIVE CONDITION WEANING SCORES OF THE CALVES

Sire	1958	1959
1	5.83	7.46
2	5.92	7.38
3	6.00	7.61
4	6.23	7.41

These scores are based on a 15 point scale with 8 corresponding to average good, 9 to high good, 10 to low choice, etc.

There was little difference between sire groups in either conformation or condition scores within any one year. However, the 1959 calves were given higher scores on both conformation and condition than were the 1958 calves by the same group of three judges. Wintering conditions for the cow herd at Weldon Spring were more favorable in 1959-60 than in 1958-59. Thus, the second group of calves was fleshier at the time of scoring. It would seem from these data that the higher the condition score given a calf, the higher its conformation score is likely to be.

Subjective conformation and condition scores given the 1958 cattle at three different times in their life span:

CONFORMATION SCORES

Sires	Weaning Score	After Five Months in Feed Lot Score	Final Score
1	7.08	8.9	9.2
2	7.08	9.6	10.5
3	7.40	9.1	9.9
4	7.77	9.6	10.3

CONDITION SCORES

Sires	Weaning Score	After Five Months in Feed Lot Score	Final Score
1	5.83	5.8	8.8
2	5.92	6.5	9.9
3	6.00	6.0	9.7
4	6.23	6.4	9.4

These data also indicate that as condition score increases so does conformation. Note that while the sire groups were quite close at weaning time in both subjective scores, some spread appeared during the feeding period and quite pronounced differences were shown in the final scorings.

RATE OF GAIN FOR 1958 CATTLE BY SIRE, SEX, AND IMPLANT

	Steers		Heifers		
Sires	Implant	Nonimplant	Implant	Nonimplant	Av. by Sires
1	1.81	1.75	1.86	1.89	1.84
2	2.16	2.02	2.14	1.83	2.02
3	2.21	2.02	1.87	1.77	1.97
4	2.16	2.03	1.92	1.82	
Average	2.14	1.95	1.92	1.82	

There was about a 10% difference in rate of gain between the high gaining sire group of cattle and the low gaining group. Steers outgained heifers by about 10%. Increase in rate of gain from the Synovex implant was nearly 10% for the steers and 5% for the heifers. The offspring of sire 1 showed almost no increase in rate of gain due to implants, whereas those of sire 2 had about a 12% increase in steers and heifers combined. Thus, it would seem that there could be a difference in the effect of Synovex implant on gaining ability of cattle of different genetic makeup. Another observation to note is the fact that sire 1's progeny, the lowest gaining group, also received the lowest final subjective live animal conformation and condition scores, while the progeny of sire 2 gained the fastest and were given the highest final subjective conformation and condition scores.

RATE OF GAIN FOR 1959 CATTLE BY SIRE GROUPS

Sire 1	Sire 2	Sire 3	Sire 4
1.85	1.91	1.84	1.90

Less than 4% difference in rate of gain exists thus far in the feed lot test for the cattle born in 1959. While the progeny of sires 3 and 4, the repeat bulls, are about 7% and 3% lower, respectively, in rate of gain this year, the 1959 steers were not implanted with a growth stimulating hormone and were carrying a higher degree of condition when they started on the feed lot test.

Feed Efficiency

Steers were more efficient than heifers in the 1958 group, requiring 0.6 of a pound less feed per pound of gain.

AVERAGE SUBCUTANEOUS FAT THICKNESS (IN MM) MEASURED OVER THE 12TH LEFT AND RIGHT RIBS

Sire 1	Sire 2	Sire 3	Sire 4
12.43	18.15	18.95	14.88

Steers		Heifers	
Implant	Nonimplant	Implant	Nonimplant
16.15	16.91	15.85	15.60

There was a 36% difference in fat thickness between sire groups with the progeny of sire 1, the slow gainers, being the thinnest. Sire 2's calves, the fastest gaining cattle, were one of the groups carrying the most subcutaneous fat. Little

difference was found in amount of subcutaneous fat between the implanted and nonimplanted cattle, whether they were steers or heifers.

ACTUAL CARCASS GRADE

Sire 1	Sire 2	Sire 3	Sire 4
9.25	9.58	10.00	8.23

Steers		Heifers	
Implant	Nonimplant	Implant	Nonimplant
8.7	10.1	8.5	9.5

There was a difference of almost 2/3 of a grade between different sires' calves and the sires' progeny, those with the most subcutaneous fat tending to grade higher. These data point out that implantation of Synovex lowered carcass grade in steers about 1/2 of a grade and in heifers about 1/3 of a grade even though there was little difference in subcutaneous fat between implanted and nonimplanted cattle.

AREA OF RIBEYE (IN SQUARE INCHES)

Sire 1	Sire 2	Sire 3	Sire 4
9.40	9.68	9.39	10.45

Steers		Heifers	
Implant	Nonimplant	Implant	Nonimplant
10.18	10.10	9.59	9.36

Area of ribeye was more than 11% larger for the group of cattle sired by bull 4 than for those sired by bull 3 or 1. Note that sire 3's calves had the most subcutaneous fat, the highest carcass grade, and also the smallest ribeye area. Implant treatment did not seem to affect area of ribeye to any great extent.

PERCENT LEAN CUTS

Sire 1	Sire 2	Sire 3	Sire 4
61.07	59.33	58.86	61.02

Steers		Heifers	
Implant	Nonimplant	Implant	Nonimplant
61.18	59.68	60.72	59.27

The difference in percent lean cuts by sire groups amounted to more than 2% between the low and high groups of animals. The thinner sire groups of cattle produced the most lean and the fatter groups the least lean meat. Area of ribeye and percent lean cuts within a particular sire group did not follow as closely as one might expect. The implant cattle (both steers and heifers) had about 1 1/2% more lean cuts than did the nonimplant animals.

TENDERNESS OF THE 12TH RIB CUT AS MEASURED BY THE WARNER-BRATZLER SHEAR TEST

Sire 1	Sire 2	Sire 3	Sire 4
18.36	15.89	17.10	16.64

Steers		Heifers	
Implant	Nonimplant	Implant	Nonimplant
17.33	18.37	14.97	16.66

This tenderness study shows Sire 2's progeny to be about 17% more tender than those of Sire 1. This could possibly be explained by the fact that the cattle sired by bull 2 were faster gainers and thus were slaughtered at a younger age. There was a slight difference in tenderness in favor of the implanted cattle but this also could be due to the fact that the implanted cattle gained faster than those not implanted and thus were slaughtered at a younger age. The meat from the heifers was more tender than that from the steers.

SUMMARY:

1. Sires influenced preweaning performance, feed lot performance, and various carcass characteristics in their progeny.
2. Synovex implantation increased rate of gain, increased percentage of lean cuts, and possibly increased tenderness and area of ribeye, but lowered carcass grade in both steers and heifers.
3. Steers gained faster and more efficiently than heifers.
4. The higher the subjective condition score of an animal, the higher the subjective conformation score placed on it. (Projects 198-396-397)

USE OF ULTRASONICS TO MEASURE RIBEYE AREA OF LIVE CATTLE

H. B. Hedrick, M. A. Alexander, W. E. Meyer

An ultrasonic method is being developed to measure the ribeye area in live animals. The principle of the ultrasonic method involves sending high frequency sound waves through the tissue of the live animal at selected locations. When the sound waves stike the boundary between two layers of tissue of different density, some of the energy is reflected (bounced back).

The reflecting boundaries of different density in the animal are: between fat layers, between fat and lean, between muscles, and between lean and bone. The time taken for a pulse to travel through a given thickness of tissue and return to the source, after reflection at the boundary of tissue layers, depends on the thickness of tissue and the velocity of sound in it. High frequency sound waves are transmitted from a crystal in the transducer and, after reflection from tissue boundaries, are then received on the same crystal, amplified and displayed on the oscilloscope.

A Sonoray instrument (Branson Instruments, Inc.) equipped with a transducer which sends out sound waves at the rate of one million per second was used in this study. The curvature of the animals' back at the 12-13th rib was traced as a base line and values obtained with the ultrasonic instrument were plotted from it. Figure 1 illustrates the measurement compared with an actual tracing taken from the carcass.

The small differences between actual tracings and the ultrasonic method are shown in the table. Increased accuracy in measuring ribeyes with the ultrasonic equipment in Group II and III compared to Group I is attributed to more skillful use

of equipment and greater knowledge of anatomical differences. There were no significant differences between the area of ribeye determined by ultrasonic measurements compared to area by actual tracing. Results from these preliminary studies indicate the area of ribeye determined from the live animal by the ultrasonic method is a reliable and accurate measurement.

Comparison of Area of Ribeye Calculated From Ribeye Tracings and Area of Ribeye Calculated From Ultrasonic Measurements

Number Animals	Left Tracing Sq. In. Average	Left Ultrasonic Sq. In. Average	Range In Difference Sq. In.	Accuracy[1] Sq. In.
		Group I		
47	9.44	9.58	.01-3.17	±.60
		Group II		
Number Animals	Right Tracing Sq. In. Average	Right Ultrasonic Sq. In. Average	Range In Difference Sq. In.	Accuracy[1] Sq. In.
28	11.37	11.38	.06-1.57	±.37
		Group III		
Number Animals	Right Tracing Sq. In. Average	Right Ultrasonic Sq. In. Average	Range In Difference Sq. In.	Accuracy[1] Sq. In.
71	10.39	10.41	.00-1.69	±.33
Number Animals	Left Tracing Sq. In. Average	Left Ultrasonic Sq. In. Average	Range In Difference Sq. In.	Accuracy[1] Sq. In.
71	10.09	10.35	.02-1.66	±.33

[1]Sixty-eight percent of the time the difference between the area as measured by ultrasonics and that of tracings did not exceed the amount indicated or was less than the amount indicated.

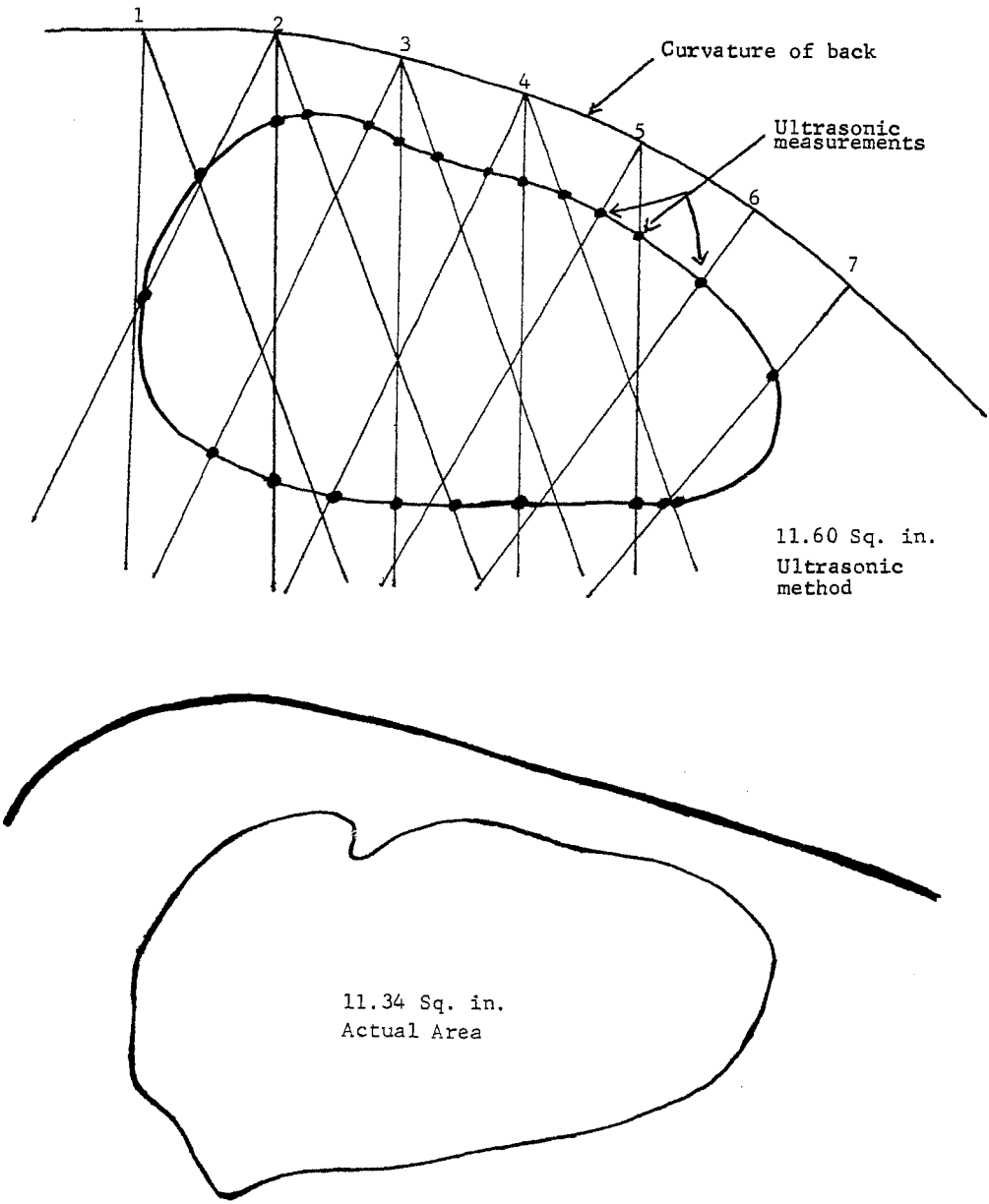


Figure 1. Comparison of an ultrasonically determined ribeye area of a live beef animal with an actual tracing from the same location of its carcass.

COMPARISON OF A LIQUID SUPPLEMENT (MOREA) WITH SOYBEAN MEAL IN WINTERING AND FATTENING BEEF CATTLE RATIONS

G. B. Thompson

This feeding trial was conducted to compare the value of a liquid mixture of urea, molasses, phosphoric acid, ethanol, and various minerals (Morea) with soybean meal as a supplement in wintering and fattening rations for beef calves and yearlings.

Twenty-four 600 pound good to choice Hereford calves were fed a full feed of corn silage once a day during the wintering period. (February 12 to May 14, 1960 - 90 days). Half of the calves received 2 pounds of soybean oil meal per head daily; the other group received the liquid supplement (Morea) free choice. The cattle fed the soybean meal were provided an equal mixture of salt and bone meal free choice. The cattle receiving the liquid supplement were provided the following minerals free choice: salt, limestone, sodium phosphate, magnesium sulfate and potassium sulfate.

During the wintering phase the cattle were fed at the University South Farms in two small pastures without shelter. Water was supplied in a manure - insulated tank without heat.

Summary of Results - Wintering Phase
February 12 - May 14, 1960 (90 days)

	Morea	Soybean Meal
Number of Steers	12	12
Starting Weight (lbs)	594	599
Final Weight (lbs)	669	700
Gain per steer (lbs)	75.5	101.
Average Daily Gain (lbs)	0.81	1.08
Average Daily Ration		
Corn Silage (lbs)	43.1	43.5
Morea (lbs)	3.4	------
Soybean Meal (lbs)	-------	2.0
Feed per 100# gain		
Corn Silage	6497	4708
Morea	500	------
Soybean Meal	-------	218.6

The fattening phase was started May 14. Half of the cattle wintered on each type of supplement were switched to the other for the fattening period. The cattle were fed increasing amounts of ground ear corn twice daily and were on full feed in two weeks. Mineral supplements were the same as in the wintering period. The liquid supplement was provided free choice. The cattle fed soybean meal received 1 1/2 pounds per head daily throughout the fattening phase.

Summary of Results - Fattening Phase:
May 14 - October 31 (154-167 days)

	Morea	Soybean Meal
Number of Steers	12	12
Starting Weight (lbs)	666	663
Final Weight (lbs)	970	994

(continued on next page)

Gain per steer (lbs)	304	330
Average daily gain (lbs)	1.89	2.05
Average Daily Ration		
Ground ear corn	17.4	16.7
Hay (orchard grass)	0.82	1.02
Supplement	1.19	1.50
Feed per 100 lb. gain		
Ground ear corn	931	812
Hay	43.2	49.5
Supplement	62.6	72.3

The cattle were slaughtered at the University of Missouri Meats Laboratory. The carcasses were graded according to USDA standards.

Summary Carcass Data:

	Morea	Soybean Meal
Dressing percentage	57.6	57.6
Marbling Score	Modest	Small
Conformation Grade	Low Choice	High Good
Carcass Grade	Low Choice	Average Good
Back Fat (milimeters)	18.5	20.2

Observations:

1. Feeding two pounds of soybean meal per head daily to good and choice 600 pound feeder calves receiving a full feed of corn silage produced 1/4 pound per head daily greater gain and required 1800 pounds less silage per hundred pounds gain than free choice consumption of 3.4 pounds of the liquid supplement (Morea).

2. Consumption of the liquid supplement (Morea) ranged from 1 to 6 pounds per head daily with higher consumption during severe cold weather and during snow storms during the wintering period.

3. Poor performance resulted with both supplements during the wintering phase due to very unfavorable weather conditions.

4. Silage consumption was equal with the two supplements during the wintering phase.

5. Steers fed 1 1/2 pounds of soybean meal per head daily made similar gains (2.01 vs 1.89 pounds per head daily) to those of steers that ate 1.19 pounds of the liquid supplement (Morea). However, 120 pounds less ear corn was required per hundred weight gain with the soybean supplement during the fattening phase.

6. There were no differences in dressing percentages or loin eye areas of steers fed the two supplements.

7. Steers fed the liquid supplement (Morea) produced carcasses that were 2/3 of a grade higher than carcasses of steers fed soybean meal.

8. Highest marbling scores and carcass grades were produced with steers fed the liquid supplement (Morea) during both the wintering and fattening periods, although the supplement fed during the fattening period had the greatest effect on the carcass characteristics studied. (Project 237)

WINTER FEEDING FOR QUALITY BEEF PRODUCTION

G. B. Thompson, R. L. Preston, and H. B. Hedrick

Demand for beef without excessive fat covering requires that feeding practices be re-evaluated to determine their effects on carcasses. This experiment was a study of the effects of energy and protein levels in winter rations on the carcasses of beef calves.

Four rations were fed to provide the following amounts of total digestible nutrients (TDN) and crude protein (CP) per head daily during the wintering period.

	TDN (lbs)	CP (lbs)
1. High energy-low protein	9.5	1.0
2. High energy-high protein	9.5	1.6
3. Low energy-high protein	7.0	1.6
4. Low energy-low protein	7.0	1.0

The energy (TDN) levels fed represent 100% of the wintering requirement for 1 pound per head daily gain and 100% of the fattening requirement. The protein levels fed represent 75% of the crude protein requirement for wintering and 100% of the fattening requirement.

Half of the cattle fed each of the four rations were implanted with 24 miligrams of diethystilbestrol (DES) at the beginning of the wintering phase. These same cattle were re-implanted with 36 miligrams of DES at the beginning of the fattening phase.

Summary of Results: Wintering Phase:
December 19, 1959 - May 14, 1960 (145 Days)

	Ration			
	HE[1]-LP	HE[2]-HP	LE[3]-HP	LE[4]-LP
Number of Steers	12	12	12	12
Initial weight (lbs)	477.4	476.3	465.8	480.1
Gain per steer (lbs)	231.3	277.2	208.2	182.8
Average Daily Gain (lbs)	1.60	1.91	1.44	1.26
Gain Response to DES[1]	-0.7%	+3.3%	+10.7%	-1.9%
Daily Ration				
Ground Ear Corn (lbs)	7.1			
Ground Shelled Corn (lbs)	2.1	7.92	.5	2.3
Corn Silage (lbs)	14.4	15.0	29.3	29.3
Soybean meal (lbs)	.30	1.49	3.15	.76
Salt and Bonemeal (lbs)	.25	.25	.28	.27
Feed per 100 lbs. gain				
Ground ear corn	442.8			
Shelled corn	130.6	414.1	36.5	184.3
Corn silage	902.4	783.2	2039.4	2341.6
Soybean meal	18.6	77.6	219.4	60.2
TDN per pound gain	6.27	5.33	5.68	6.22

[1]DES - 24 mg. Diethylstilbestrol implant

Fattening Phase

The plan of the experiment was to fatten all cattle on a standard fattening ration. The average daily ration consisted of a full feed of ground ear corn, 1 1/2 pounds of soybean meal, free choice orchard grass hay and a mineral mixture of equal parts salt and bone meal.

Eight steers, two from each treatment, were slaughtered weekly. The average combined wintering and fattening gain of each group of eight steers was 500 pounds at slaughter.

Summary of Results - Fattening Phase: May 14, to October 31, 1960 (113 to 145 days)

Treatment During Wintering Phase	HE-LP	HE-HP	LE-HP	LE-LP
Number of Steers	12	12	12	12
Initial Weight (lbs)	709	754	674	663
Gain per steer (lbs)	257	273	267	281
Average daily gain (lbs)	2.01	2.13	2.08	2.19
Gain Response to DES[1]	+15.0%	+28.3%	+25.0%	+9.8%
Daily Ration				
Ground ear corn (lbs)	16.4	18.7	18.0	17.9
Soybean meal (lbs)	1.5	1.5	1.5	1.5
Hay (orchard grass) lbs	1.2	1.1	1.0	1.1
Feed per 100# gain				
Ground ear corn (lbs)	817	879	866	820
Soybean meal (lbs)	74.0	69.8	71.4	67.5
Hay (lbs)	60.7	51.0	48.8	51.3

[1]All cattle receiving a 24 mg. implant of diethylstilbestrol (DES) at the start of the start of the wintering period were reimplanted with 36 mg. DES at the start of the fattening phase.

Summary of Carcass Analysis:

Treatment During Wintering Phase	HE-LP	HE-HP	LE-HP	LE-LP
Chilled carcass weight (lbs)	571	622	551	548
Dressing per cent	59.1	60.6	58.6	58.1
Marbling Score[1]	4.83	4.92	4.33	3.92
Conformation score[2]	7.17	7.67	6.83	6.33
Carcass grade[2]	5.58	5.92	4.83	4.42
Loin eye area (sq. in.)	10.2	10.8	10.2	10.3
sq. in/cwt carcass weight	1.84	1.73	1.84	1.87
Back Fat (in.)	15.8	18.5	16.9	13.2

1. Marbling Score: Traces 3, Slight 4, Small 5, Modest 6, Moderate 7.
2. Conformation Score and Carcass Grade: Low good 4, Average good 5, High good 6, Low choice 7, Average choice 8, High choice 9.

Effects of Diethylstilbestrol Implants - Fattening Phase:

Implant Treatment	36 mg. DES	Controls
Number of Steers	24	24
Days on fattening ration	128	128
Initial Weight (lbs)	700	715
Gain (lbs)	294	246
Average Daily Gain (lbs)	2.29	1.92
Gain Response	19.3%	

Summary Carcass Results

Treatment	DES[1]	Controls
Carcass weight (lbs)	582	563
Dressing per cent	58.7	59.9
Loin Eye Area (sq. in.)	10.48	10.16
Loin Eye Area per cwt carcass	1.80	1.80
Back Fat (milimeters)	15.6	16.8
Marbling Score	4.33	4.67
Conformation Score	6.88	7.08
Carcass Grade	5.00	5.38

1. Steers were implanted with 24 miligrams of diethystilbestrol at the beginning of the wintering period and reimplanted with 36 mg. of DES at the start of the fattening period.

Summary:

1. Differences in the energy and protein levels in wintering rations for beef calves resulted in differences in the carcasses after a subsequent fattening period.

2. Winter gain increased with protein and energy levels of the wintering ration.

3. Marbling conformation score, and carcass grade increased with both the energy level and the protein level of the wintering ration, with energy level producing the greatest effect. However, protein level had the greatest effect in increasing outside fat cover.

4. Reimplanting with 36 mg at the start of the fattening period resulted in a 19.3% increase in the rate of gain over nonimplanted steers.

5. The gain response to 24 milligram diethylstilbestrol implants in the wintering phase was greatest on rations adequate in protein. Low protein rations, with low and adequate energy levels, produced a slightly negative hormone response.

6. Implanted steers had slightly larger loin eye areas; however, when expressed on basis of carcass weight there was no difference.

7. Implanted steers had 1.2 lower dressing percent than non-implanted steers.

8. This test indicates that adequate protein should be fed wintering calves, regardless of energy level, for most efficient gains. This is especially true if the cattle receive diethylstilbestrol.

9. Additional work is being conducted to refine these observations and develop improved feeding systems for carcass qualtiy. (Project 237)

RESULTS OF FEEDING YEARLING STEERS AT TWO PROTEIN LEVELS WITH FEED ADDITIVES

G. B. Thompson, G. Boswell, and J. E. Comfort

The objective of this experiment was to determine effects of different protein levels, with and without a goitrogenic hormone-like substance (Tapazole) on feed lot performance and carcass value of slaughter cattle. Two previous experiments were reported last year. In the first test, reducing the digestible protein content from 7.8 percent to 5.8 percent during the fattening period appeared inferior to a constant 6.8 percent digestible protein ration, especially during the last one-third of the trial. In Trial 2, reducing the digestible protein from 8.5 percent to 6.5 percent resulted in no advantage over a constant 7.5 percent digestible protein ration. Therefore, in the experiment reported here a constant 6.5 percent digestible protein ration was compared with a 7.5 percent one. Since the levels of "Tapazole" used in Trials 1 and 2 failed to significantly improve feed lot performance or carcass value, the levels were increased in Trial 3.

Thirty-two 780 pound yearling crossbred steers were fed for 112 days in Trial 3. Body weight, conformation, and fleshing were considered in dividing the cattle into four equal lots.

Design of Experiment

Lot	1	2	3	4
Percent digestible protein	6.5	6.5	7.5	7.5
Stilbestrol (mg/head daily)	10	10	10	10
Tapazole				
First 56 days	---	300	---	---
Last 56 days (mg/head daily)	---	300	---	600

Ration

The ration consisted of a full feed of ground white ear corn full fed. Silage was fed at the rate of 15 pounds per head daily the first 56 days, then reduced to 7 1/2 pounds per head daily for the next 28 days, and discontinued entirely the last four weeks. Soybean oil meal was fed to supply the protein levels indicated above. Premixes of diethylstilbestrol and tapazole were mixed in the soybean meal to supply the levels indicated. Salt and bone meal (equal parts) were provided free choice. Vitamin A supplement was included in the premixes to provide 5000 I. U.'s of vitamin A per head daily.

Results

Lot	1	2	3	4
No. of steers	8	8	8	8
Total 112 Days				
Gain/steer (lbs.)	380	328	342	370
ADG (lbs.)	3.39	2.93	3.05	3.30
Feed per 100 lbs. gain				
Concentrates (lbs.)	700	805	823	785
Corn silage (lbs.)	279	347	309	280
Carcass Data				
Dressing per cent	57.8	55.7	58.8	59.4
Marbling score[1]	5.63	4.75	6.00	5.25
Carcass grade[2]	8.75	8.50	9.75	9.38
Loin eye area (sq. in.)	11.08	10.64	11.84	12.39

[1]Marbling score - slight amount = 4
small amount = 5
modest amount=6

[2]Carcass grades - average good = 8
high good = 9
high choice = 10

1. The 7.5 percent digestible protein ration apparently improved marbling scores and loin eye areas, but failed to increase live weight gains or feed efficiency above that obtained from the 6.5 percent ration.

2. The feeding of 300 milligrams of Tapazole per head daily for the entire 112 day trial failed to improve carcass characteristics or feed lot performance.

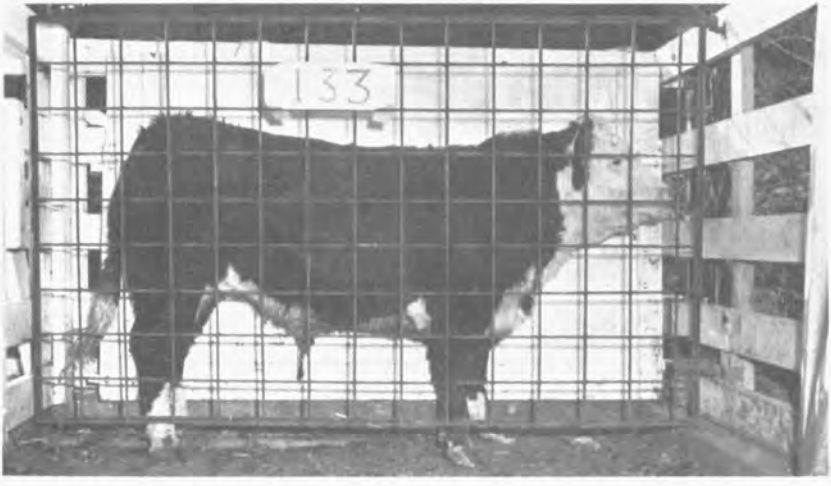
3. Feeding 600 milligrams of Tapazole per head daily the last 56 days of the trial did not improve carcass grade but resulted in more efficient gains and significantly increased rate of gain. (Project 237)

MISSOURI SWINE EVALUATION STATION

R. K. Leavitt

The purpose of a swine testing station is to locate strains of swine within the various breeds that will do an efficient job of production and at the same time yield a carcass of high quality that is acceptable to the consumer. This purpose can be accomplished with records that indicate:

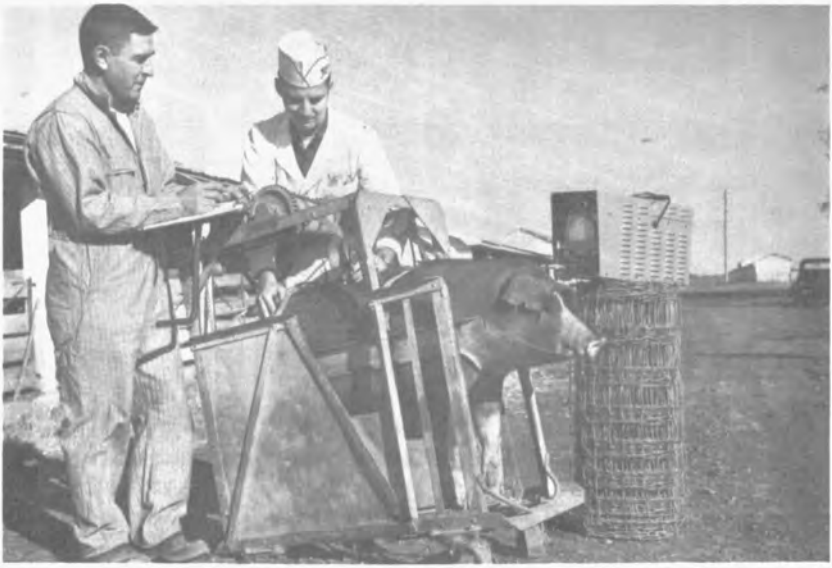
Heifer 161 by sire 1. She made a 1.58 pound per day gain and measured 1.72 square inches of ribeye per hundredweight and 60.5 percent lean cuts. (See first report.)



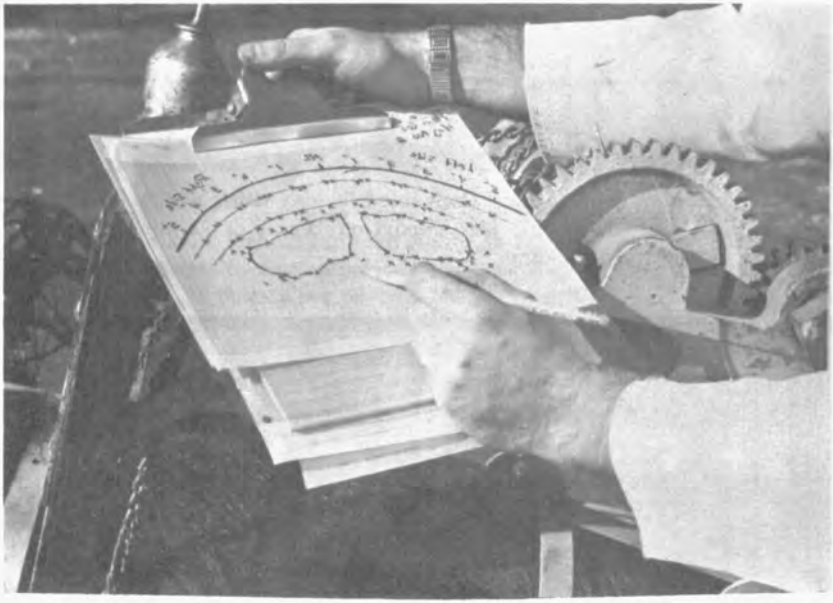
Steer 133 by sire 4 gained 2.23 pounds per day and measured 2.12 square inches of ribeye per hundredweight and 65.9 percent lean cuts. (See first report.)

Steers by sires 2 and 4 after 180 days of feeding. (See first report.)

Using Ultrasonics to measure ribeye area of a steer. (See second report.)



Method of restraining hog while it is being measured with high frequency sound.



Plotted high frequency sound readings illustrating the layers of fat and loin eye area. (See report on "High Frequency Sound Study on Swine.")

Ground corn cobs provide excellent dry bed for a sow and litter.

Duroc litter of 14 pigs at weaning. Converted 56-day litter weight--604 lbs. Sow received antibiotics at breeding. (See report on "Value of Feeding High Levels of Antibiotics to Sows at Breeding.")

Duroc sows in trial 8 (see report on "Effect of Feeding During Gestation on Sow Performance.") Two sows on right were fed normally; sow on left was limited-fed during gestation.

Rapid growth rate - over 1.7 pounds per day
Efficient feed utilization / less than 325 pounds/100 pounds gain
Low backfat - less than 1.4 inches
Prolificacy - 8 or more pigs per litter
Absence of inherited defects - swirls, ruptures, etc.
12 or more teats
Nursing ability - heavy weaning weight
Weigh 200 pounds in a minimum number of days
Good conformation, quality and soundness
Superior meat-type carcass

Some of these records apply to the entire litter and others to individuals in the litter. It is also a test of the sire's and dam's ability to produce litters and individuals that will perform at a maximum level.

Two factors affect performance: heritability and environment. Testing stations have a uniform environment during a given testing season, which will tend to eliminate environment as a factor and make it possible to compare litters and individuals on the basis of heritability.

A testing station is only one of many tools available to breeders. Other useful tools are: performance registry, certification, live animal and carcass shows, breed shows and on-the-farm-testing. Most purebred breeders are using some or all of these tools.

The Missouri Swine Evaluation Station is in its third year of operation with the fifth group of boars and barrows on test. The fifth test period was not finished when this went to print.

A total of 675 boars and 224 barrows have been tested in the three years. Of the 517 boars in the first four tests, 339 qualified.

The major cause of boars being disqualified in the first two test periods was backfat. The maximum standard for the station is 1.40 inches of backfat. The major cause of loss in the last three test periods was rate of gain. The maximum standard for rate of gain is 1.70 pounds per day. A few pens were disqualified because of a feed efficiency of over 325 pounds of feed per 100 pounds of gain which is the maximum permissible by station standards.

TABLE 1

	1st.	2nd	3rd	4th	5th
No. of pens	21	65	47	67	57
Lbs. feed/100 lbs. gain	308	305	287	304	300.3(*)
Avg. daily gain:					
boars	1.76	1.92	11.93	1.90	(1)
barrows	1.83	1.82	1.95	1.87	(1)
Backfat (in.)	1.30	1.25	1.14	1.21	(1)
Index	112	111	128	114	(1)

(*) 48 pens
(1) Not available

TABLE 2
CARCASS DATA AVERAGE - 4 TEST PERIODS

	No.	Ham	Picnic	B.B.	Loin	B.F.	Loin Area	Lgth.	% of C. Wt.	% of L. Wt.
1st	21	28.07	11.4	8.23	21.7	1.54	3.55	29.9	46.8	35.7
2nd	63	27.81	11.3	8.09	20.8	1.54	3.76	29.9	46.7	35.7
3rd	47	29.30	11.9	8.70	22.2	1.37	4.13	29.0	48.7	37.0
4th	93	27.70	11.7	8.20	21.7	1.39	3.75	29.5	47.5	35.9
Avg.		28.22	11.5	8.30	21.6	1.46	3.79	29.5	47.4	36.0

RESULTS OF A HIGH FREQUENCY SOUND STUDY ON SWINE

Steve E. Zobrisky and Wm. G. Moody

The use of HFS (high frequency sound) as a tool for measuring composition of live animals is relatively new, being still in the experimental stage. Therfore the real potential of HFS for making fast and accurate predictions of live animal meatiness has not as yet been satisfactorily explored.

This experiment was designed to test the accuracy and usefulness of HFS as a tool for predicting the fat thickness and the size and shape of the loin eye muscle of swine. The hair was clipped and motor oil applied to insure continuous sound transmission into the animal. Exact sites of measurement were marked. The back curvature was obtained with a heavy solder wire which was used as a guide for plotting the HFS readings. HFS measurements were interpreted as the depth of fat, lean, and bone. The plotted HFS measurements present the various fat layers and area of loin eye. These were later compared to actual tracings of the same variables from the untrimmed loin.

A. High Frequency Sound (HFS) vs. Loin Eye Area

The correlations in Table I not only indicate the high degree of association between the right and left loin eye area, but also that the HFS estimates were as accurate as the actual tracings in denoting this likeness.

TABLE 1. CORRELATION BETWEEN RIGHT AND LEFT LOIN EYE AREA AT THE 10th RIB N=69

Measurements	r^2*
Actual tracings	90%
HFS estimate	83%

* an "r^2" of 100% indicates perfect association

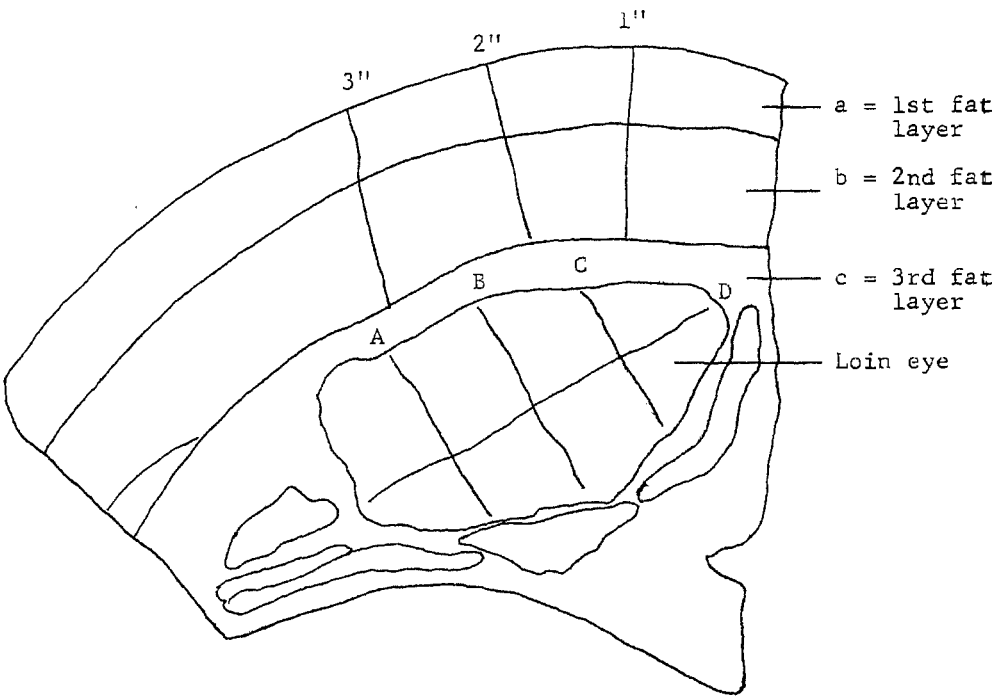
The HFS estimates of the 10th rib loin eye area on the right and left side can be used to predict the actual loin eye area at the second, 10th and last rib. The tracings and HFS predicted areas of the 10th rib loin eye area for the right and left sides were very closely associated. (Probability of chance occurrence less than 1 in a thousand.) One should notice that although it isn't practical to estimate, by HFS, the second rib loin area, this measurement as well as the last rib loin area are reliable for predicting the 10th rib loin area.

Measurements A, B, C and D, shown in the drawing, were individually associated with the HFS estimates and actual loin eye areas at the 10th rib. Depth measurements A and C were significantly associated with the estimated and actual 10th rib loin eye area. Depth measurement B was correlated only at the 5% level. The length measurement D was more highly associated with the loin eye area than any of the width measurements.

Summary A:

These results indicate that there was very little difference in loin eye area of the right and left side. By utilizing both sides (right and left side of the hog), we acquired twice the amount of information and also test the repeatability of the HFS technique.

MEASUREMENTS OBTAINED ON THE PORK LOINS



These results strongly suggest that HFS is a reliable tool for measuring loin eye area. Our average error in measuring these loin eyes was 0.3 square inch, or better than 90% accuracy. For back fat thickness, the average error was less than 0.15 inch.

B. HFS vs. Fat Layers and Total Backfat Thickness

The associations between several indices of meatiness and the backfat thickness one, two, and three inches from the midline (illustrated in the drawing) at the tenth rib were highly significant. Each of the single measurements was approximately equally associated with several indices of meatiness in swine. This strongly indicates that any one of these measurements can be used to predict the average backfat thickness, yield of ham, four lean cuts or total trim fat.

Each of the three fat layer thicknesses (illustrated in Figure 3) was significantly associated with the averages of the backfat thickness, yield of ham, four lean cuts and total trim fat. The second fat layer (b) was consistently more highly associated with all of the meatiness indices than the first layer (a) or third fat layer (c). The consistency of magnitude of the correlations involving the second fat layer (b) suggest many implications regarding fat development. Possibly, here is a measure on a live animal which is directly associated with inter- and intra-muscular fat development. The associations between the second fat layer thickness and the yield of ham, four lean cuts, and trim fat approximated those with total fat depth.

Summary B:

These results indicate that HFS can also be used to measure total backfat thickness and possibly more important, the thickness of the individual layers of backfat. The strong association of each of these fat layers with the average fatback thickness, the percent of ham, four lean cuts and total trim fat gives us another live hog and carcass index which may prove to be of greater value in swine appraisal than average backfat thickness. (Project 384)

CARCASS CHARACTERISTICS AND CONSUMER ACCEPTANCE OF LIGHT WEIGHT HOGS

S. E. Zobrisky, Hugh Leach, V. J. Rhodes and H. D. Naumann

The main purpose of this study was to determine acceptability of cuts from light weight hogs. This study is only one of several steps essential to the evaluation of slaughter at light weights for increased meatiness in swine. A study is also being made of the economy of production and slaughter at light weights.

One hundred and thirty meat type hogs were purchased from three commercial herds of good, meat type breeding. These hogs were divided into three weight lots. The lots consisted of 30 hogs of approximately 125 pounds, 40 hogs of 166 pounds and 60 hogs of 205 pounds live weight.

Data from 130 hogs indicate that the greatest percentage increase of the lean cuts (ham, loin, picnic and Boston Butt) and bone cuts (neck bone and spare ribs) occurred during the 125-165 pound live weight interval. Conversely, the greatest percentage increase in fat cuts (carcass trim fat, backfat, leaf fat and belly) occurred during the 165-205 pound live weight interval.

Length of ham appeared to be directly associated with the increase in lean cuts; length of ham increased 2 times more during the 125-165 pound interval than during the 165-205 pound live weight interval. Circumference of ham, depth of body, and width of body and shoulder were more closely associated with gain in live weight than with yield of lean or fat cuts. Backfat thickness paralleled the increase in weight of fat cuts. The cured cuts from the lighter weight hogs lost a slightly greater percentage of their weight during the smoking process than similar cuts from the heavier hogs.

TABLE 1--AVERAGE WEIGHT AND YIELD OF THE PRIMAL CUTS

Weight	125		165		205	
	%	Lbs.	%	Lbs.	%	Lbs.
Ham (tr.)	19.7	18.2	19.5	24.3	18.5	28.5
Picnic	8.7	8.0	8.3	10.3	7.7	11.9
Boston Butt	6.4	5.6	6.2	7.7	5.5	8.5
Loin	14.7	13.5	15.6	19.7	14.8	22.6
Four Lean Cuts	49.2	45.3	50.2	62.0	46.1	71.5

Cuts from these hogs were eaten and evaluated by 240 families in two Missouri cities. Each family evaluated cuts from a 205 pound hog and matching cuts from one of the lighter hogs. Families evaluated cuts as to general acceptance, leanness, tenderness, and size. Data are presented in Tables 2 and 3.

TABLE 2--ACCEPTABILITY ARE SCORES* BY WEIGHT GROUPS

Live Weight	Chops	Loin Roasts	Bacon	Ham Slices
125 lbs.	2.07	1.95	3.02	2.03
165 lbs.	2.03	1.86	3.04	2.19
205 lbs.	2.00	2.22	3.17	2.15

*1 - Like Extremely to 9 - Dislike Extremely

Conclusions

Slaughter at live weights as light as 125 pounds does not present any palatability problems as judged by this sample of consumers.

Cuts from 165 pound hogs might be more readily accepted than those from 125 pound hogs because the former differ less in size from conventional cuts. However, acceptance of size as such cannot be determined accurately except by merchandising experiments.

The percentage of lean cuts decreases with an increase in slaughter weight.

Detailed results of this study are published in Missouri Research Bulletin 739.

(Project 348)

EFFECTS OF CERTAIN VITAMINS AND MINERALS ON STABILITY OF CURED HAM PIGMENTS

Milton E. Bailey and Richard W. Frame

The livestock producer has a major interest in the degree of consumer acceptance of meat and meat products processed from his animals. Attractive, stable processed meats, displayed in appropriate environments will increase consumer demand for these products and will eventually increase sales of livestock. A major problem at the meat retail level is the discoloration by fluorescent light of the red-pink "cured ham pigments." Ham slices discolored under these conditions are not acceptable to consumers and are usually used in the formulation of less-expensive processed meats. These decreases in profits are then felt by all concerned in meat production.

This report involves a study of the influence of certain vitamins and minerals on the light-stability of "cured ham pigments" (nitric oxide myoglobin). These include ascorbic acid (vitamin C), nicotinamide (anti-pellegra vitamin), and inorganic phosphates. In the past, there has been considerable difference of opinion as to the effectiveness of vitamin C in production and stabilization of nitric oxide myoglobin in the presence of regular curing mixtures.

Results from recent studies indicate that vitamin C not only shortens the time necessary to cure hams with regular curing salts to 5 days, but that the "cured ham pigments" formed by this accelerated process are more stable to fluorescent light irradiation than non-treated hams. The addition of pyridoxamine in the presence of vitamin C further stabilizes these pigments; even better protection is obtained by using orthophosphate buffer at low acidity.

In one study where 40 ratings were made by a sensory color panel of ham slices from cured hams treated with and without vitamin C, there were 38 preferences for vitamin C-treated slices and only 2 preferences for non-treated slices. There were 158 preferences for slices from hams treated with orthophosphates at low acidity and 37 preferences for slices treated at higher acidity.

Another group of comparisons were made between nicotinamide-treated samples and non-treated samples. Of 160 ratings during light-irradiation, 144 preferred treatment with nicotinamide while there were 46 preferences for non-treated samples. Results from a subsequent study indicated that slices from hams treated with nicotinamide and vitamin C were more stable to light-irradiation than slices from hams treated with vitamin C alone.

After 286 observations of slices exposed to fluorescent light during 96 hours, there was a decided and significant preference for nicotinamide-treated hams.

In other studies, ham slices were treated with regular pickle, ascorbate, nicotinamide and orthophosphates in various combinations to determine if decrease in acidity of the pickle by the orthophosphates in the presence of the other additives would affect light-stability of the nitric oxide myoglobin. Five hundred and sixteen observations were made of slices from these hams during irradiation with 50 foot-candles of fluorescent light. Seventy-one percent of the preferences were in favor of the orthophosphate treatment of low acidity.

PREFERENCES DURING STORAGE FOR HAM SLICES TREATED WITH ORTHOPHOSPHATE BUFFER

Treatment	Observations	Percentage preference for low acidity treatment
Pickle	39	80
Pickle + Ascorbate	189	67
Pickle + Isoascorbate	129	69
Pickle + Ascorbate + Nicotinamide	99	78
Pickle + Ascorbate + Niacin	99	76
Overall	516	71

(Project 432)

LIVE HOG AND CARCASS RELATIONSHIPS BETWEEN BOAR, BARROW AND GILT LITTERMATES

Steve E. Zobrisky and Wm. G. Moody

This report is part of a study of the relationship of certain live hog and carcass characteristics between littermate pigs. The experiment outline is shown in Table I. All of the pigs in group I and the barrows from group II were slaughtered when they individually attained 205 pounds, ± 3, live weight. Management, slaughtering, processing and measurement procedures were standardized.

TABLE 1
EXPERIMENTAL OUTLINE

	Group I	
Littermates	1 barrow 1 boar 1 gilt	33 litters 99 pigs
	Group II	
Littermates	1 barrow 2 boars 1 boar, half-sib.	112 litters 448 pigs

TABLE 2
AVERAGE GROWTH DATA FROM LITTERMATES IN GROUP I

Growth Data	Boars N=33 Ave. $\bar{X}$	Gilts N=33 Avg. $\bar{X}$	Barrows* N=33 Ave. $\bar{X}$
Farrowing Wt.	3.3	3.2	3.4
Slaughter Age	166.9	171.9	170.1
Slaughter Wt.	193.7	194.3	196.3

*Castrated at 56 days of age.

Table 2 illustrates the small differences in the average weight of the littermates when farrowed and slaughtered. Slaughter weight was controlled by time of slaughter.

There was also little difference in average slaughter age of the littermates. The boars gained slightly more per day than the barrows and the barrows slightly more than the gilts. These differences were not significant.

The association between backfat thickness, percent carcass trim fat, and percent ham fat from the littermates was not strong.

Backfat thickness of the gilts was significantly associated with the backfat thickness of their littermate boars and barrows. Percent ham trim fat was significantly associated only between the gilts and barrows, whereas the percent carcass trim fat was not associated between the littermates. None of the fat measurements between boar and barrow littermates were significantly associated. Tentatively, backfat thickness appeared to be more useful than carcass trim fat or ham trim fat as an average index of fatness between littermates.

The associations between actual yields and measurements (of littermates) indicative of the quantity of muscular development were greater than in the case of fat development. These results indicate that relationships between carcass characteristics of littermates do exist. These relationships are best illustrated by the significant associations between measures that might be termed "absolute entities." The separable ham tissues, bone, and muscle, and also the loin eye areas, each represent "absolute single entities." These characteristics are correlated between littermates. However, the percentages of 4 lean cuts are not highly correlated between littermates. The percentage of 4 lean cuts represents what might be called a non-absolute entity since it is made up of fat, lean, and bone. The amount of fat in these cuts is most variable. The same can be said for backfat thickness as compared to carcass fat. Backfat thickness is a positive measurement and is significantly correlated between littermates, whereas, carcass trim fat is quite variable--the amount depending not only on trimming error but where the fat is in relation to muscle and bone.

The barrows increased in yield of 4 lean cuts per unit increase in loin eye area slightly more than boars or gilts. There was no significant difference between the rates of increase. It is doubtful if this would hold true on a separable muscle basis since the barrows were fatter than the boars and gilts.

The increase in carcass trim fat per unit increase in backfat thickness indicates no difference between littermate boars and gilts in this respect. However, the increase in carcass trim fat per unit increase in backfat thickness was twice as great for the littermate barrows as for the boars and gilts. This illustrates why gilts cut out better than barrows, even though both may have the same backfat thickness. The likeness of the regression coefficients between the boar and gilt littermates lends support to the theory that gilts are more representative of boars than are barrows.

Our last comparison was between backfat measurements of boar and barrow littermates and half-sib boars of the same breed and approximate age. (sib = brother or sister; half-sib = half-brother or half-sister) These pigs were reared in lots of 4. Only the barrows were slaughtered. The backfat measurements from the littermate boars and barrows were all significantly correlated

whereas those from half-sib boars were not. The associations were of small magnitude, but were consistent.

In summary, backfat measurements and carcass yields appear more highly associated between littermate boars and gilts and between barrows and gilts than between boars and barrows. There appears to be no significant difference in the increase in percentage of 4 lean cuts per increase in loin eye area between littermates. Per unit increase in backfat thickness, barrows increased in carcass trim fat more than boars and gilts. Boars and gilts appear to increase in fat yield similarly (approximately the same amount per given increase in backfat thickness).

Backfat probes of littermate barrows and boars were significantly correlated. These same measurements between half-sib boars were not significantly correlated. (Project 397)

EFFECT OF LEVEL OF FEEDING DURING GESTATION ON SOW PERFORMANCE

B. T. Dean and L. F. Tribble

Performance of the sow is one of the most important items affecting the swine producer's profits. The nutrition of the sow during various phases of the reproductive cycle has a great effect on her performance. It has been observed that sows which are fed too liberally during gestation do not perform well at farrowing and during lactation.

The objectives of this study are to observe the effects of level of feeding during gestation on sow performance. Fatness of the sows at various stages is being measured with a backfat probe.

Eight trials have been completed studying the effect of limiting the energy intake during gestation on the reproductive performance of sows and gilts. A total of 123 sows and gilts have been used in these trials.

Typical rations are shown in the table.

			Supplement pounds	Corn pounds
Normal	Gilts	Pasture	1 1/4	4-5
		Dry Lot	1 1/4	5
	Sows	Pasture	3/4 - 11	4
		Dry Lot	1 1 1/4	5
Limited	Gilts	Pasture	1 1/4	2-3
		Dry Lot	1 1/4	2-3
	Sows	Pasture	3/4 - 1	2
		Dry Lot	1 - 1 1/4	2-3

Slight variations were made in the rations such as elimination of some vitamins when good pasture was available. Shelled corn plus the protein supplement was fed during gestation in all but two trials and in these trials a complete mixed ration similar to the complete mixed lactation ration was fed. The feeding program during during gestation was as follows:

All sows and gilts were treated in the same manner from the 109th day of gestation until the pigs were weaned. They were farrowed in a central farrowing house with farrowing crates. They were let out of the farrowing crate twice daily and fed from a self-feeder. The sows and litters were moved to pasture when the pigs were 10-14 days of age. A creep feed was offered to the pigs while on pasture. All animals were probed at breeding and again at farrowing and at weaning in order to more accurately measure the changes in condition.

Results:

Gilts fed a limited amount of corn have farrowed more pigs and weaned more pigs per litter than gilts fed a normal ration of corn. Both groups received the same amount of protein supplement. Birth weights and weaning weights per pig have favored the group fed normally. Gilts fed the limited ration farrowed 9.5% more pigs and weaned 16% more pigs than the normally fed group. The trials with the sows followed the same pattern as with the gilts except there was no difference in the number of pigs farrowed per litter. Limited fed sows weaned 15% more pigs per litter than did normally fed sows. This difference was not statistically significant. In Trial 8, an intermediate group was included and this group farrowed fewer pigs but weaned a higher percentageof the pigs farrowed than either the normal or limited fed sows.

Normally fed sows and gilts gained approximately 1 pound per head per day during the gestation while the limited fed groups gained a little less than three-fourths of a pound per head per day. The normally fed group gained in condition as indicated by the backfat probe while the limited fed group just maintained or lost condition. The trend in condition was usually reversed during lactation with the normally fed group losing while the limited fed group gained condition.

When the weight gains of the gilts during the gestation period are compared with the number of pigs farrowed and weaned, the optimum weight gains appear between 80 and 99 pounds. These data indicate that a feeding program intermediate between the averages for the two experimental treatments would be most desirable.

The normally fed sows and gilts consumed more feed during gestation but less feed during lactation than the sows and gilts in the limited fed group. When the amounts of feed consumed during gestation and lactation are combined, the limited fed group consumed about 150 pounds less feed per head.

Correlations between various traits studied with gilts show that the gains the first month of the gestation period and for the entire gestation period were not significantly correlated with the number of pigs farrowed. The change in the backfat thickness was significantly correlated with number of pigs farrowed indicating that as backfat increased, the number of pigs farrowed decreased. None of these appeared to have any effect on the number of pigs weaned.

RATIONS FOR SOWS AND GILTS

	Creep Ration	Gestation Supplement	Lactation
Corn	59.4	--	79
Rolled Oats	7.5	--	--
Soybean oil meal	23.2	62.66	15
Meat and Bone	2.5	31.00	5
Alfalfa Meal	2.5	--	--
Dried Whey	2.5	--	--
Salt	0.5[1]	2.0	0.5
Limestone	0.5	1.0	0.2
Bonemeal	0.5	2.0	--
Vitamin A & D[2]	0.2	--	0.1
Vitamin A[3]	--	0.14	--
B-Vitamins[4]	0.2	0.6	0.1
B_{12} Supp. [5]	0.2	0.6	0.1
Antibiotics[6]	0.3	--	--

1. Contained 1 pound zinc oxide per 100 pounds of salt
2. Contained 2250 IU of A and 400 IU of D per gram
3. Contained 10,000 IU of A per gram
4. Contained 2-4-9-10 grams per pound of riboflavin, pantathenic acid, nicotinic acid, and choline respectively.
5. Contained 9 milligrams of Vitamin B_{12} per pound.
6. Contained 10 grams tetracycline antibiotic per pound.

Summary:

1. Under the conditions of these experiments where adequate quantities of protein, vitamins, and minerals were fed, reducing gains during gestation to two-thirds to three-fourths of normally recommended gains by limiting the corn (energy) intake was beneficial to reproduction for both sows and gilts in terms of number of pigs farrowed and weaned per litter.

2. Between 80 and 100 pounds appears to be the optimum weight gain for gilts during gestation. Gilts were well grown and in good condition at breeding.

3. Up to 150 pounds of feed, mostly corn, was saved by limiting the feed during gestation and preventing the sows from becoming too fat.

4. On the average, both limited fed sows and gilts weaned a higher percentage of the pigs farrowed than those fed normal levels of feed. Limited fed sows and gilts farrowed more easily and had fewer stillborn pigs than those fed normally.

VALUE OF FEEDING HIGH LEVELS OF ANTIBIOTICS TO SOWS AT BREEDING

B. T. Dean and L. F. Tribble

Four trials have been conducted studying the effect of feeding high levels of antibiotics at breeding on reproductive performance of sows and gilts. Three trials were conducted using aged sows and one trial with gilts.

In all trials antibiotics were fed at the level of 0.54 gms per head per day. In trial I the antibiotics were fed commencing one week prior to the start of the breeding season and were fed for a three-week period. In trial 2 they were fed commencing the day the sows weaned their pigs and were fed for a two-week period. In trials 3 and 4 the antibiotics were fed commencing the day of breeding and were fed for a 10-day period.

The antibiotic oxytetracycline (terramycin) was used in two trials and chlortetracycline (aureomycin) was used in two trials.

RESULTS

In all trials, sows and gilts which received antibiotics farrowed and weaned larger litters. When all trials are combined, 1.74 more pigs per litter (18.8%) were farrowed and 36.5% more pigs were weaned by sows receiving antibiotics, compared to those not receiving antibiotics. Birth weights tended to favor those which did not receive antibiotics, which is probably a reflection on the size of litter farrowed. Weaning weights were also generally in favor of those that did not receive antibiotics and which weaned smaller litters.

CONCLUSIONS

Feeding antibiotics at a level of 1/2 gram per day for a 10-day to two-week period, commencing three to five days prior to the start of the breeding season, is suggested from these results. (Project 355)

PROTEIN SUPPLEMENTS FOR GROWING-FINISHING SWINE IN DRY LOT AND ON PASTURE

L. F. Tribble

Objective was to test various combinations of soybean oil meal and meat and bone scraps in protein supplements to be fed free choice with corn to growing-fattening hogs in dry lot and on red clover pasture.

Purebred Duroc and Hampshire pigs were divided as equally as possible into six lots of 10 pigs each. Pigs were fed from three-hole self-feeders with two holes for shelled corn and one hole for supplement. Water was available at all times.

Three lots of pigs were fed on concrete while the other three lots were on red clover pasture. The clover was excellent at the beginning of the trial but due to hot, dry weather, was rather poor at the end of the trial. The trial started June 7 and was completed August 29, 1960.

The supplement containing 3 parts soybean oil meal to 1 part of meat and bone scraps fed on pasture was as follows: soybean oil meal 72%, meat and bone 23.9%, salt 2%, limestone 1.4%, antibiotics 0.7%. The same rations were fed in dry lot except that vitamins were added.

All supplements were satisfactory on pasture as the pigs on pasture gained about the same on the various supplements. The consumption of supplement was not excessive in any of the lots. Pigs on the supplement containing equal parts of soybean oil meal and meat and bone scraps ate less supplement than pigs on supplements containing more soybean oil meal. These pigs also gained a little slower than pigs on the other supplement on pasture, 1.35 pounds per head per day, compared to 1.4 pounds for those fed 2 and 3 parts of soybean oil meal.

In dry lot the supplement containing three parts of soybean oil meal and one part meat and bone scraps was best as pigs fed this supplement made faster (1.5 pounds per head per day) and more efficient gains than pigs on other supplements.

The supplement containing equal parts soybean oil meal and meat and bone scraps was unsatisfactory for pigs in dry lot. Pigs on this supplement gained only 1.1 pounds per head per day in dry lot.

SUMMARY:

Protein supplements composed of mixtures of either three or two parts of soybean oil meal and one part of meat and bone scraps make satisfactory protein supplements to be fed free choice with shelled corn for growing-fattening pigs on pasture or dry lot. This mixture must be properly supplemented with vitamins minerals and antibiotics. (Project 141)

SHELLED CORN VERSUS A HIGHLY PALATABLE PELLETED CREEP RATION FOR SUCKLING LAMBS

C. V. Ross and Melvin R. Karr

Previous work reported in 1958 and 1959 indicated that suckling lambs preferred certain feed ingredients and mixtures of ingredients. A pelleted mixture composed of 60% corn, 30% soybean oil meal and 10% wheat bran was the most acceptable of the several formulas. The work was continued in the spring of 1960, with the objective of determining the practical significance of creep rations formulated for palatability.

Thirty-six purebred ewes and their forty-six lambs were divided as equally as possible into two groups of 22 and 24 lambs each, based on body weight, birth date, twins or singles, and thrift of lambs.

The ewes and lambs were kept in similar dry lots during the period from March 4 to April 8. Then they grazed similar rye pastures until May 26. The two groups of ewes and lambs were rotated on the pastures weekly to minimize differences due to forage. The lambs were given free access to the feed which was placed in similar shallow grain troughs inside the creeps. Shelled corn was used as the basal creep ration. The experimental ration was composed of 60% ground shelled corn, 30% soybean oil meal and 10% wheat bran.

Response of Suckling Lambs Fed Shelled Corn in a Creep Compared to Similar Lambs Fed a Highly Palatable Pelleted Ration

	Lot I Shelled Corn	Lot II Mixed Ration
No. of days on test	82.2	80.0
No. of lambs	24	22
Avg. initial wt. (lbs.)	23.0	23.8
Avg. final wt. (lbs.)	64.7	72.9
Avg. Daily gain (lbs.)		
All lambs	.510	.614
Singles	.586	.700
Twins	.467	.552
Feed Consumption/lamb/day (lbs.)	.35	.80
Avg. final live grade	5.2	6.04

1. Grades were assigned numberical values as follows:

Medium choice	8	Medium good	5
Low choice	7	Low good	4
High good	6		

OBSERVATIONS:

1. The lambs on the special formula consumed 2.28 times more feed than those on shelled corn and they gained 20% faster.

2. They had more bloom and graded higher at the end of the test than those on shelled corn. The gains were significant.

3. Differences between lots were greater before ewes and lambs were turned on pasture.

4. Lambs on the mixed ration were consuming approximately 1.25 pounds of pellets daily when they were put on pasture. Feed consumption decreased radically and never returned to the level observed in dry lot. Feed consumption by lambs on shelled corn never at any time approached that of lambs on the pelleted ration, but they were apparently much less affected by being placed on pasture. (Project 142)

CURRENT PROJECTS IN ANIMAL HUSBANDRY

Beef Cattle
- Improvement of Beef Cattle Through Breeding
- Rations for Fattening Cattle
- Production of Feeder Calves
- Beef Cattle Testing Station

Swine
- Performance Testing of Swine
- Method of Selection and Breeding for Swine Improvement
- Protein Nutrition of Swine
- Factors Affecting Sow Performance
- Evaluation of Some Economic Traits of Swine

Sheep
- Some Factors Affecting Productivity of Ewes
- Reproduction of Sheep
- Lamb Fattening
- Performance Testing of Swine

Nutrition
- Ruminant Digestion
- Mineral Balance
- Roughage Changes

Breeding
- Endocrine Secretions in Reproductive Physiology of Farm Animals
- Anatomy of Reproduction

Meats
- Meat Tenderness
- Tolerances of Meat Storage
- Meat Acceptability
- Improving the Objective Identification of Swine
- Economic and Technological Problems in Marketing Pork and Beef
- Objective Indices of Meatiness

AVAILABLE PUBLICATIONS

B610 Feeding Livestock

B618 Improving Livestock Through Breeding

B627 Fattening Two Year Old Steers

B628 Winter Rations for Feeder Calves

B641 Corn Substitutes for Fattening Cattle

B646 Fattening Comparisons - Steers vs. Heifers

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E731 Profitable Pork Production in Missouri

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Folder 19 Concrete Barnyard Pavement and Feeding Floors

Folder 24 Here's Help for You on Grain Storage

Folder 33 Restoring Drought Pastures

Folder 36 Housing for Calves

C248 The Value of Manure

Memo: Feeding, Processing and Handling for Beef Cattle