INFLUENCE OF BREEDING AND ENERGY CONTENT OF THE RATION ON PORK CARCASSES

By

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INTRODUCTION

Fat is a major item affecting the market value of the hog carcass. Consequently the low price of lard and fat cuts has reduced the value of overfat hogs. At the present time considerable emphasis is being placed on the production of a meat type hog which yields a maximum of high quality pork with a minimum of excess fat. Consumer preference for leaner cuts of pork and the reduced consumer demand for lard is arousing considerable interest in this problem.

One possible method of producing meat type hogs is to limit the feed intake during some stage of the fattening period, thereby reducing the rate of gain and limiting the amount of fat deposition.

A second method of developing meat type hogs is through breeding. This requires the identification of the best individuals and lines for producing hogs with a high percentage of the preferred carcass cuts without sacrificing rate and efficiency of gain.

This experiment was undertaken to gain information on the effect of the two methods, separately and in combination, on the cost of production and carcass merit.

REVIEW OF LITERATURE

Numerous studies have been published which are of value in attempting to find an economical method of producing leaner type hogs. Considerable work has been reported on the relationship of type to economical pork production and carcass yield, and the effect of rate of gain and the animal's slaughter weight on the various carcass components. Within recent years many reports on this problem have been devoted to the effects of breeding and restrictive feeding methods on carcass desirability.

Scott (1927) reported a study on 648 lard type hogs classified into three type groups. The percentage of wholesale cuts did not differ greatly among these groups but the long-bodied, more upstanding hogs produced the highest percentage of lean cuts (ham, loin, and Boston butt). The short-bodied hogs yielded the highest percentage of sides and fat cuts (fat back, clear plate, and dry salt butts). Condition as measured by depth of fat was a factor of considerable importance in determining the percentage of wholesale cuts. As hogs increased in degree of fatness the percentage of lean and bony cuts decreased and the percentage of fat cuts increased.

A study was made by Carroll and co-workers (1929) on the effect of type on economy of gain. Their study involved 316 pigs classified as very chuffy, chuffy, intermediate, rangy, and very rangy. The intermediate type tended to make somewhat more rapid and more economical gains. Bull and Longwell (1929) analyzed the carcass data on 189 of these hogs. They concluded that, from the butchers standpoint, the intermediate type was also the most desirable. The carcasses from the rangy type were satisfactory if the pigs were self-fed. Very chuffy pigs tended to be too fat and the very rangy pigs yielded carcasses lacking in firmness and containing too much bone.

Bull and others (1935) classified 58 hogs into four different types and found no significant differences in rate and economy of gain or in dressing percentage. They concluded that none of the types of animals included in the study met the pork market demand of the day. The intermediate type most nearly approached the ideal but pigs with the quality and plumpness of the intermediate type, the length of the rangy type and the early maturity of the chuffy type would be ideal.

Zeller (1940) reported further on the relation of type to economy of swine production. In this study 672 Poland China hogs comprizing three type groups were used. The intermediate type hogs made the fastest and most economical gains. Zeller concluded that the intermediate type best suited the market demands. Flexibility in time of marketing this type increased its value.

Hankins (1940) studied the effect of type on the carcass components using small, medium, and large type Poland China hogs. In one study the different types were killed when a uniform degree of finish was reached. The small type averaged 150, the medium type 223, and the large type 262 pounds when killed. The dressing percentage of the large type was 2 to 3 per cent higher than the other two types. The difference in yield of wholesale cuts was small and in favor of the large type. In the other study the three types were all slaughtered at about 225 pounds. The dressing percentage of the small type was significantly higher than the other two groups although the large type yielded the highest percentage of lean cuts. However, the large type carcasses were inferior as they tended to be soft.

Study of the relation of rate of gain and slaughter weight to carcass conformation and components has produced useful information in the problem of how to produce leaner carcasses.

Scott (1930) observed that as the pig develops the depth of backfat and percentage of fat cuts (jowl and shoulder fat) increase and the percentage of Boston butt and bony cuts (neckbones, spare ribs, and shank) decrease. Gilts yielded a slightly higher percentage of lean cuts than barrows.

Crampton (1940) studied the effects of early growth rate on leanness of carcass in 247 bacon pigs. The pigs were allowed to govern their own feed intake so gains were in no way controlled. Variation in gains was typical of those found in any non-inbred group of this size. The average daily gain from 60 days of age to 200 pounds was 1.10 pounds with a standard deviation of 0.14 of a pound. From these data he concluded there was no relationship between rate of gain and carcass leanness or length of carcass. Leanness was not related to length but gains were related to feed intake.

In a study of growth rate and carcass quality on 75 bacon pigs, Donald (1940) concluded that it would be unwise to make detailed predictions of the relation between growth and carcass quality. However, he observed that fast growth rates after weaning and thick backfat seem to be associated.

McMeekan (1940) slaughtered Large White pigs at birth, 4, 8, 16, 20, 24, and 28 weeks of age to determine the order and rate at which the various carcass components developed under two planes of nutrition. He found the growth of body proportions exhibited a well-defined anterior-posterior gradient.

The major body tissues showed a marked differential growth behavior. Development of body tissues was in the order of skeleton, muscle, and fat. The bone and skin components developed at a relatively constant rate. Lean tissue developed rapidly, starting early and increasing slightly with rate of growth throughout the entire 28 weeks. The fat content of the carcass remained low from birth to about the sixteenth week. Then fat was deposited at an increasing rate until the fat portion equaled the lean portion at about 26 weeks. The body organs and offal showed the most development at birth.

An inadequate ration affected development of loin, depth of body, and hindquarter more severely than head, neck, leg, and body length. With a limited supply of nutrients the development of bone and muscle was penalized less than the development of fat tissue.

A measure and count of muscle fibers from tissue cross sections indicated that muscle growth was primarily the result of an increase in size of the individual muscle fibers. The size of muscle fibers was found to be directly related to the plane of nutrition. He found no evidence of any increase in number of muscle fibers after the birth of the pig.

Loeffel and co-workers (1943) slaughtered pigs at weights of 150, 175, 200, 225, 250, 300, and 400 pounds. The dressing percentage increased 10 per cent and the backfat thickness increased from 0.69 to 2.44 inches from the 150 to the 400 pound group. The carcass of a 150-pound pig contained 32 per cent fat and 51 per cent lean while the carcass of a 400-pound pig contained 55 per cent fat and 34 per cent lean.

Dickerson and workers (1943) collected data on 278 Poland China pigs slaughtered at an average weight of 225 pounds to determine the relationship between carcass conformation and value of the live hog. External conformation indicated differences in fat thickness and in length of bone and muscle rather than in thickness of muscle. Width at pelvic region and plumpness of ham were the only external measurements indicative of muscle thickness. The deeper carcasses yielded more ham and shoulder, while wider carcasses yielded more belly and fat. Carcasses with plumper hams yielded more ham, belly, and loin. According to this work the most valuable carcasses would be those that are wider, deeper, and plumper in the ham. The area of loin cross section was a more accurate measure of muscling than area of lean in the ham cross section.

Hankins and Ellis (1945) slaughtered 64 intermediate type hogs ranging in weight from 167 to 254 pounds to determine the effect of live weight on the yield of the carcass components. As the live weight increased the weight of ham, shoulder, belly, and backfat increased proportionally. The loin also increased in weight but at a slower rate. The percentage of protein in the carcass decreased as live weight increased. In general, the loin contained the highest proportion of lean meat and the head the lowest, while the ham, shoulder, and bacon were intermediate. Five 175-pound hogs yielded about as much lean as four 250-pound hogs.

One of the first production studies made on hogs of different breeds was undertaken by Hogan and others (1925). Of the eight Large Yorkshires and eight Poland Chinas used in this experiment, one of each was slaughtered at the following weights: 100, 150, 200, 250, and 300 pounds. Carcass studies did not indicate any great differences between the breeds. However the Yorkshire consistently yielded the heavier loin and the Poland China produced the larger percentage of bacon.

The dressing percentage increased 12 per cent as the slaughter weight increased from 100 to 300 pounds. As the hogs gained in weight the shoulder and sparerib made up a smaller percentage of the carcass. The ham and head showed a similar but smaller decrease in proportion but the bacon and loin gained in relative size as the carcass became heavier. The economy of gain and rate of gain was approximately the same for both types, but the carcass data indicated the lard type hogs reached their most desirable market weight at an earlier age.

In a comparison of meat yields of Danish Landrace hogs with Poland Chinas and Durocs, Hankins and Hiner (1937) reported the Danish Landrace carcasses had heavier loins than the two American breeds. The hams from the Danish Landrace and Poland China carcasses were heavier than those from Durocs. No differences were noted in yields of bellies, picnics, and Boston butts. The Danish Landrace hogs produced the highest percentage of lean cuts without a decrease in percentage of belly. The loin eye measurement indicated the Danish Landrace hogs produced the leanest carcasses. The Duroc hogs had the highest dressing percentage.

Dickerson and co-workers (1946) in studying hybrid vigor in single crosses between inbred lines of Poland Chinas, noted the crosses exceeded the inbreds by 12 per cent in weight at 56 days and 21 per cent at 154 days. In total litter weight at 154 days they exceeded the inbreds by 72 per cent. The average daily gain of the linecrosses exceeded the inbreds by .14 of a pound from 84 days to final weight of 225 pounds. Although crosses grew more rapidly, the feed requirements per 100 pounds gain was practically the same for both groups during this period. Slaughter data showed a trend for the crosses to have a lower dressing percentage, less fat, and plumper hams than the inbred lines.

Bratzler (1947) obtained cut-outs at a packing plant on 478 carcasses representing 17 breeds and breed crosses. The number of carcasses per breed or cross varied from 5 to 61. The percentage of primal cuts varied from 46.7 per cent for the Chester x Hampshire cross to 49.4 per cent for the Hampshires. The Berkshires and Chester Whites seemed to be heavier in the shoulder than the other 15 breeds and breed crosses.

Winters and others (1948) gathered carcass data from 708 carcasses representing three breeds, crosses between these breeds, many inbred lines, and crosses between these lines. They concluded that carcasses from crossed lines were distinctly superior to carcasses from parental inbred lines or the three unidentified breeds used as a check. The carcasses from crosses of lines belonging to different breeds were superior to those within the Poland China breed. The feed lot performance was also in favor of the breed crosses.

They obtained superior carcasses from pigs that made very rapid gains. They concluded that slow growth due to genetic or environmental influences was not necessary for the production of superior carcasses.

When 741 carcasses representing 50 breeding groups were studied by Sierk (1949), significant differences were found between breeding groups for five primal cuts, degree of fatness, and carcass measurements. When the Minnesota No. 1 line was used in crosses, the carcasses were longer and produced a larger quantity of high quality bacon. Minnesota No. 2 line increased the yield of loin and reduced the fat content while Poland China lines increased the proportion of ham when used in crosses. The lowest yield of five primal cuts came from some inbred Poland China lines and the Poland China, Duroc, and Chester White outbreds. The fattest carcasses were from the Duroc and Chester White outbred groups.

Interest in the effect of restricted feeding methods for the economical production of leaner type carcasses has increased since lard does not command the price it formerly did. Ellis and Zeller (1934) found that the restriction of the feed to growing pigs to approximately three-fourths and one-half full feed generally resulted in a decrease in the quantity of feed required to produce a unit of gain. When corn and supplement were fed at levels of 4, 3, and 2 pounds per hundred pounds live weight, the average daily gains from 65 to 200 pounds were 1.14, 1.03, and .77 pounds, respectively. The pigs on the high feed level required 34 per cent more feed than the pigs on the low feed level. When a wheat ration with supplement was used in the same manner, the average daily gains were 1.26, .95, and .62 pounds, respectively. The corn and supplement ration proved more economical per unit of gain in the restricted groups than the wheat and supplement ration. The carcasses of the hogs on the most restricted feeding level yielded the highest percentage of lean cuts.

In a paired feeding experiment Mansfield and Trehane (1935) reported that restricted pigs required 9 per cent less feed per 100 pounds gain than the unrestricted pigs. The restricted pigs were limited to three-fourths of the feed of the non-restricted pigs from 65 to 100 pounds. From 100 pounds to slaughter weight they were restricted to two-thirds. The non-restricted group of pigs made an average daily gain of 1.55 pounds. The restricted group gained 1.19 pounds a day and required 29 days longer to reach a slaughter weight of 200 pounds. Fifty-five per cent of the carcasses from the restricted group graded A or B while only 10 per cent of non-restricted group made the same grades. The gilts graded higher than the barrows.

Shorrock (1940) found some advantage in the restricted feeding method if not carried to such a degree that it was no longer economically feasible. He divided pigs into three groups so that the reduction in feed of the restricted groups became progressively more severe as the pigs increased in weight. At 115 pounds the medium and low level groups were getting 95 and 90 per cent as much feed as the high group. At 165 pounds these two groups were only getting 85 and 70 per cent of the feed of the high group. He observed that pigs on the restricted rations consumed less feed per unit of gain and the carcasses contained a smaller proportion of fat.

McMeekan (1940a) and McMeekan and Hammond (1940) designed the following type of experiment to determine the effect of restricted rations on growth curves and carcasses:

Lot	Designation	Birth to 16 weeks	16 weeks to slaughter
1	HH	Full-fed	Full-fed
2	HL	Full-fed	Restricted
3	LH	Restricted	Full-fed
4	LL	Restricted	Restricted

Inbred Large White pigs were started on this experiment at birth. The ration for the restricted lots was quantitively reduced to about one-half the intake of the full-fed lots.

A few pigs from each lot were slaughtered at 16 weeks of age. The full-fed pigs averaged 113 pounds whereas the restricted pigs only weighed 37 pounds at this age. The full-fed and restricted groups had averaged 40 and 20 pounds, respectively, at eight weeks of age. A comparison of the carcasses from these 16 week old pigs showed that the restricted ration had penalized fat deposition most, lean development next, and skeletal growth least.

The pigs on the low plane of nutrition throughout the feeding period (LL) required 327 days to reach 200 pounds. This group produced the leanest carcasses but the lean was not well developed. The group that was on the low plane to 16 weeks of age then full-fed to 200 pounds (LH) had the most fat in the carcass.

The group that was full-fed throughout the experiment (HH) required 165 days to reach 200 pounds. This group produced the second fattest carcasses. McMeekan stated that the most desirable carcasses came from the group of pigs that was full-fed to 16 weeks of age and then restricted on feed intake until they reached 200 pounds (HL). These HL carcasses were second to the LL group in leanness but the lean was of more desirable quality.

Although the (HL) and the (LH) groups were fed to reach 200 pounds at the same age (211 days), the (LH) group were much fatter. McMeekan concluded that the pig tends to develop more lean than fat to 16 weeks of age and more fat than lean after that age. He concluded that the nutritional environment has a directive and controlling force in the development of the animal's body.

Winters and co-workers (1949) designed an experiment somewhat similar to that of McMeekan and Hammond's (1940) to determine the effect of different levels of feed intake on economy of production and carcass quality. Eighty weanling pigs of the Poland China, Duroc, and Chester White breeds were assigned to four lots and fed on pasture as indicated below:

Lot	Designation	Treatment
1	HH	Self-fed through the experiment
2	HL	Self-fed until 125 pounds and then feed restricted to 3 per cent of body weight
3	LH	Feed restricted to 3 per cent of body weight until 125 pounds then self-fed
4	LL	Restricted to 3 per cent of body weight throughout experiment

The pigs on the LL ration produced the leanest carcasses though there was a tendency for them to lack firmness. This group required the least feed per 100 pounds gain. The HH carcasses were the fattest and yielded the lowest percentage of primal cuts. HL and LH carcasses were essentially the same in fatness and yield.

No breed differences were observed in the yield of five primal cuts on different levels of feeding. The Poland China consistently produced less fat than either the Durocs or Chester Whites regardless of the feeding method.

Winters concluded that animals should be bred for maximum capacity for gain and efficient feed utilization and then carcass quality may be improved by modifying generally accepted feeding practices.

Brugman (1950) developed two lines of pigs from genetically similar foundation animals. One line was selected for performance on full feed and the other line for performance on 70 per cent of full feed up to 150 pounds. Both lines were full-fed from 150 to 220 pounds. The F_1 low plane line required 56 days longer than the F_1 high plane line to reach 150 pounds. The F_2 low plane line required 67 days longer than the F_2 high plane line to reach 150 pounds. The low plane line yielded a significantly higher percentage of the five trimmed primal cuts and a lower percentage of fat.

Smith and co-workers (1950) studied the effect of pasture on rate of gain, economy of gain, and on carcass merit of pigs full-fed, 80 per cent and 60 per cent full-fed. In the spring of 1949 the four groups (full-fed dry lot, full-fed on pasture, 80 per cent full-fed on pasture, and 60 per cent full-fed on pasture) made average daily gains of 1.56, 1.62, 1.40, and 1.18 pounds and the feed requirements per 100 pounds gain were 432, 373, 340, and 314 pounds, respectively. The 1950 data showed similar results.

Carcass data revealed that the backfat thickness of the full-fed pigs was greater than the limited-fed pigs. Although there were a larger number of excessively fat carcasses in the full-fed groups, these groups graded slightly higher. The carcasses from the 60 per cent full-fed group lacked quality while the carcasses of the 80 per cent full-fed group were acceptable.

Gregory and Dickerson (1950) studied the effects of breeding and plane of nutrition on the economical production of leaner type carcasses. Two inbred lines from the Poland China breed, one line from the Hampshire breed, crosses of these lines, outbred Durocs, and topcrosses of the inbred lines on outbred Durocs were used in this experiment. One-half of the pigs were restricted to a feed intake of 80 per cent of the full-fed group. The limited-fed pigs gained from .1 to .2 of a pound less per day but required only 93 per cent as much feed per 100 pounds gain as compared to the full-fed pigs. The linecross pigs when limited to the same level of intake as pigs of the parental lines showed a superiority in rate and economy of gain. Full-fed crosses when compared with full-fed parental lines showed a greater advantage in rate of gain and less in economy of gain. The topcross pigs did not show any marked advantage over the outbred Durocs in rate and economy of gain.

Carcass characteristics of linecross pigs tended to be an average of the inbreds of parental lines. The outbred Durocs produced the poorest carcasses but topcrosses were comparable to the inbred lines in carcass desirability. The limited-fed pigs dressed one to two per cent less, produced less fat, and yielded primal cuts of higher quality in comparison to the full-fed pigs. However, the feeding level had little influence on yield of loin equivalent when adjustment was made for quality.

Lasley and Tribble (1951) fed duplicate lots of Duroc pigs on pasture and drylot at the following levels: full-fed throughout the experiment (HH), full-fed to 125 pounds and then limited-fed (HL), and limited-fed throughout the experiment so they would gain 75 per cent as fast as the full-fed groups (LL). The HL pigs required 9 days longer and the LL pigs required 33 days longer than the HH pigs to reach the average slaughter weight of 214 pounds. The LL group made the least economical gains. The net returns per pig above feed cost was $1.07 less for the HL pigs and $3.37 less for the LL pigs in comparison to the HH group.

Carcass data revealed that the LL group pigs produced the highest scoring carcasses. Although pigs of this group had a lower dressing percentage, their carcasses were longer, had less backfat, and showed more ham and loin muscle area. Carcasses of the HL group were almost equal in quality to the LL group.

From these data Lasley and Tribble concluded that the disadvantage of full-feeding and limited-feeding was overcome in part by limited-feeding after 125 pounds. When this procedure was followed the production costs were slightly higher than for the full-fed pigs and the carcass quality was about equal to that of the limited-fed pigs.

OBJECTIVES OF THE EXPERIMENT

This experiment was designed:

1. To determine the effect of restricted energy intake during the latter part of the fattening period on rate of gain, feed consumption per 100 pounds of gain, and carcass merit.
2. To compare the feed lot performance and carcass merit of hogs of different breeding when fed on two levels of energy intake.
3. To compare the carcass merit of barrows and gilts of different breeding when fed on two levels of energy intake.

EXPERIMENTAL PROCEDURE

The 48 pigs (26 barrows and 22 gilts) used in this experiment were from the Swine Breeding Project of the Oklahoma Agricultural Experiment Station in cooperation with the Regional Swine Breeding Laboratory. During October and November, 1950, a sample of four pigs from each of 12 litters representing seven breeding groups were started on this experiment after weaning. The Duroc line T, Duroc line crosses T x 3 and (T x 3) x (C x S), Duroc line T x Landrace-Poland, and Minnesota No. 1 x Landrace-Poland breeding groups were represented by two litters each. The outbred Duroc x Landrace-Poland and the Landrace-Poland breeding groups were represented by one litter each.

At the beginning of the experiment each litter was divided into two lots of equal weight with a barrow and gilt in each lot wherever possible. At this time one lot from each litter was chosen at random to be placed on a low energy ration at 140 pounds weight.

From weaning to an estimated weight of 75 pounds all pigs were self fed ration 1 as shown in Table 1. From 75 to 140 pounds all pigs were self fed ration 2. From 140 pounds to slaughter weight the pigs in the odd numbered lots were self fed the high energy ration 3a which contained approximately 1.52 therms per pound. These lots were designated as the "high-high" treatment. The pigs in the even numbered lots were designated as the "high-low" treatment and were self fed the low energy ration 3b which contained approximately 1.43 therms per pound.

In order to reduce the energy content of the low energy ration (3b) and still use self feeders, ground prairie hay was substituted for 23 per cent of the corn. The protein supplement of the low energy ration (3b) was increased 3 per cent so this ration would have approximately the

TABLE 1

Percentage Composition, Chemical Analysis, and Cost* of Rations

Rations	1	2	3a	3b
When Fed	Weaning—75 lbs.	75—140 lbs.	140—225 lbs.	140—225 lbs.
Contents				
Corn	75.00	80.00	88.00	65.00
Ground prairie hay	——	——	——	20.00
Tankage	4.86	3.88	2.33	2.91
Soybean meal	7.28	5.83	3.50	4.37
Cottonseed meal	4.86	3.88	2.33	2.91
Alfalfa meal	4.86	3.88	2.33	2.91
Trace mineralized salt	0.73	0.58	0.35	0.44
Bone meal	0.73	0.58	0.35	0.44
Limestone	0.73	0.58	0.35	0.44
Lederle APF	0.97	0.78	0.47	0.58
Chemical Analysis				
Water	11.49	12.67	12.15	10.70
Ash	5.63	4.92	4.36	5.65
Protein	16.13	13.98	12.97	12.54
Fat	2.20	2.07	2.42	2.26
Fiber	3.67	2.98	2.61	7.88
Nitrogen-Free-Extract	60.88	63.38	65.49	61.06
Calcium	0.880	0.695	0.615	0.750
Phosphorus	0.473	0.473	0.436	0.393
Energy Content per lb. of ration (therms)	1.49	1.49	1.52	1.43
Cost per 100 lbs. of ration	$3.49	$3.31	$3.02	$2.70

* Feed prices (per ton) unless otherwise stated.

Corn (bu.)	$ 1.45	Alfalfa meal	$ 52.50
Ground prairie hay	9.00	Trace mineralized salt	37.00
Tankage	115.00	Bone meal	80.00
Soybean meal	75.00	Limestone	14.00
Cottonseed meal	77.50	Lederle APF	790.00

same percentage of protein as the high energy ration (3a). Both rations were adequate in calcium and phosphorus.

Data for average daily gains and feed consumption per 100 pounds gain were collected for both periods of the experiment, i.e., from weaning to 140 pounds and from 140 pounds to 225 pounds. A summary of the performance of the different breeding groups on the high-high and high-low treatments throughout the experiment is given in Table 2.

When the pigs weighed 219 to 238 pounds (average weight was 226.7 pounds), they were taken off feed for 20 to 24 hours and then slaughtered in the college meat laboratory. The average shrunk weight of all hogs was 215.9 ($\sigma = 4.38$) pounds. Carcasses were prepared packer style with head off and leaf fat removed. After chilling for about 56 hours, the carcasses were air and water weighed (Brown and others 1951) and carcass measurements were made. The carcasses were then chilled for three more days and cut to obtain lean measurements and cut out percentages. All measurements (except loin lean area) were obtained from both halves of the carcass and the average used in the analysis. The entire carcass was cut and trimmed (Whiteman 1951) to obtain the individual percentages of primal cuts.

The following measurements and evaluations were studied:

Dressing Percentage	$\frac{\text{Chilled carcass weight}}{\text{Shrunk live weight}} \times 100$
Specific gravity	$\frac{\text{Carcass weight in air}}{\text{Carcass weight in air} - \text{Carcass weight in water}}$
Carcass length	Measured from the anterior edge of the aitch bone to the anterior edge of the first rib.
Backfat	The reported mean is the average of three measurements which were taken opposite the first and last ribs and the sixth lumbar vertebra.

TABLE 2

Summary of Feed Lot Data

Breed	Crossbred						Landrace-Poland	
Line	T x Landrace-Poland		Outbred Duroc x Landrace-Poland		Minn. No. 1 x Landrace-Poland			
Treatment	HH	HL	HH	HL	HH	HL	HH	HL
No. of Pigs	4	4	2	2	4	4	2	2
First period (Weaning-140 lbs.)								
Av. initial wt.	39.0	39.0	50.5	52.5	33.0	33.0	35.5	32.0
Av. final wt.	142.2	140.2	140.5	140.5	138.7	141.0	150.5	140.5
Av. total gain	103.2	101.2	90.0	88.0	105.7	108.0	115.0	108.5
Av. no. days in period	75.0	65.0	58.0	59.0	76.5	75.5	80.0	87.0
Av. daily gain	1.38	1.56	1.55	1.49	1.38	1.43	1.44	1.25
Av. feed per cwt. gain	363	305	307	307	306	293	324	317
Av. energy consumed per pound gain (therms)	5.40	4.55	4.57	4.58	4.53	4.35	4.82	4.71
Av. feed cost per cwt. gain	$12.27	10.32	10.29	10.32	10.32	9.90	11.34	10.75
Second period (140 lbs.-225 lbs.)								
Av. initial wt.	142.2	140.2	140.5	140.5	138.7	141.0	150.5	140.5
Av. final wt.	228.7	225.5	222.5	227.5	227.0	224.5	228.0	227.0
Av. total gain	86.5	85.3	82.0	87.0	88.2	83.5	77.5	86.5
Av. no. days in period	39.2	56.2	35.5	66.0	46.7	59.2	51.5	65.5
Av. daily gain	2.21	1.52	2.31	1.32	1.89	1.41	1.50	1.32
Av. feed per cwt. gain	376	578	360	593	393	561	482	566
Av. energy consumed per pound gain (therms)	5.77	8.26	5.48	8.48	5.94	8.00	7.34	8.09
Av. feed cost per cwt. gain	$11.36	15.62	10.87	16.03	11.86	15.14	14.56	15.29
Both periods (Weaning-225 lbs.)								
Av. total gain	189.7	186.5	172.0	175.0	194.0	191.5	192.5	195.0
Av. no. days in period	114.2	121.2	93.5	125.0	123.2	134.7	131.5	152.5
Av. daily gain	1.66	1.54	1.84	1.40	1.57	1.42	1.46	1.28
Av. feed per cwt. gain	368	430	332	449	349.5	410	388	427
Av. energy consumed per pound gain (therms)	5.57	6.24	5.00	6.52	5.17	5.94	5.84	6.21
Av. feed cost per cwt. gain	$11.84	12.39	10.57	13.16	10.98	12.20	12.64	12.76

TABLE 2 (cont.)

Summary of Feed Lot Data

Breed Line Treatment	Duroc T HH	 HL	 T x 3 HH	 HL	 (Tx3)x(CxS) HH	 HL	Averages for Treatments HH	 HL
No. of Pigs	4	4	4	4	4	4	24	24
First Period (Weaning-140 lbs.)								
Av. initial wt.	34.2	33.5	31.0	32.0	35.7	36.2	36.0	36.1
Av. final wt.	139.2	138.7	141.7	143.5	141.7	139.7	141.5	140.6
Av. total gain	105.0	105.2	110.7	111.5	106.0	103.5	105.5	104.5
Av. no. days in period	69.5	72.5	67.0	66.0	64.0	64.0	70.2	69.3
Av. daily gain	1.51	1.45	1.65	1.69	1.66	1.62	1.50	1.51
Av. feed per cwt. gain	320	323	311	343	319	309	322	314
Av. energy consumed per pound gain (therms)	4.75	4.81	4.64	5.11	4.74	4.60	4.79	4.69
Av. feed cost per cwt. gain	$10.80	10.93	10.57	11.66	10.76	10.44	10.92	10.63
Second period (140 lbs.-225 lbs.)								
Av. initial wt.	139.2	138.8	141.7	143.5	141.7	139.7	141.5	140.6
Av. final wt.	227.2	224.0	225.0	229.2	230.7	226.2	227.3	226.1
Av. total gain	88.0	85.2	83.2	85.7	89.0	86.5	85.8	85.5
Av. no. days in period	48.5	65.0	38.7	64.2	43.5	63.7	43.4	62.4
Av. daily gain	1.81	1.31	2.15	1.33	2.05	1.36	1.96	1.38
Av. feed per cwt. gain	420	552	412	566	388	629	407	577
Av. energy consumed per pound gain (therms)	6.41	7.90	6.28	8.07	5.91	8.98	6.11	8.25
Av. feed cost per cwt. gain	$12.70	14.90	12.46	15.30	11.72	16.99	12.14	15.60
Both periods (Weaning-225 lbs.)								
Av. total gain	193.0	190.5	194.0	197.2	195.0	190.0	191.3	190.0
Av. no. days in period	118.0	137.5	105.7	130.2	107.5	127.7	113.6	131.7
Av. daily gain	1.64	1.39	1.84	1.51	1.81	1.49	1.68	1.45
Av. feed per cwt. gain	366	425	355	440	350	455	357	433
Av. energy consumed per pound gain (therms)	5.51	6.20	5.34	6.40	5.28	6.30	5.38	6.29
Av. feed cost per cwt. gain	$11.66	12.71	11.38	13.24	11.20	13.43	11.45	12.86

Loin lean area	Product of the two dimensions of the loin eye muscle exposed when the loin was bisected between the last two ribs.
Ham lean area	Product of the two dimensions of the lean exposed at the butt when the ham was severed from the side.
Percentages of each of the four primal cuts	Weight of the cut expressed as a percentage of the shrunk live weight.

The hams were skinned about two-thirds of the way to the shank and the fat was trimmed to one-fourth inch in thickness. The loins were trimmed as close as possible without damaging the lean. The shoulders were trimmed New York style with most of the external fat removed about one-half to two-thirds of the way to the shank. Bellies were squared and trimmed as large as possible. The lower end was trimmed to the teat line and the loin edge straightened to form a rectangle. The forward end of the belly coincided with the cut to remove the shoulder at the third rib. The posterior end was cut as long as possible after removing the ham at a line perpendicular to the long axis of the ham and half way between the aitch bone and sixth lumbar vertebra.

Analysis of variance (Snedecor 1946) was used to test mean differences for rate of gain and feed per 100 pounds of gain. The mean squares for differences between lots within breeding and ration was used in the F-test to determine the significance of differences due to breeding and ration for the entire experiment. For the carcass data a split plot analysis of variance was used to test mean differences. Two lots were represented by two barrows rather than a barrow and gilt. For the purpose of analyzing the 12 carcass items one barrow from each of these lots was selected at random and his carcass measurements were corrected to a gilt equivalent basis. The correction factors were computed from intralitter barrow and gilt differences from carcass data similar to that used in this experiment. The mean square for litter differences within breeding was used in the F-test to determine the significance of differences due to breeding. At the beginning of the experiment six orthogonal comparisons were planned for analyzing all data if significant differences were found among breeding groups. The mean square of the error term in the subplot was used in the F-test to determine the significant differences due to ration, sex, and interactions.

RESULTS

Lush (1931) and Miranda and others (1946) showed that variations in initial weights of pigs influence the rate and efficiency of gain. Covariance analysis revealed that the small variations in initial weight in these data had no significant influence on rate and efficiency of gain. Therefore differences in initial weight were ignored in the analysis of variance.

TABLE 3

Mean Squares of Average Daily Gain and Feed per 100 Pounds Gain for Both Periods

Source	d.f.	Average Daily Gain	Feed per 100 lbs. Gain
Treatment	1	.3725**	34,503**
Breeding	(6)	.0314*	321
Durocs vs Crossbreds and LP	1	.0376	------
T vs Line Crosses	1	.0610*	------
T x 3 vs (T x 3) x (C x S)	1	.0010	------
Durocs x LP vs Minn. No. 1 x LP and LP	1	.0631*	------
T x LP vs Outbred Duroc x LP	1	.0005	------
Minn. No. 1 x LP vs Landrace-Poland	1	.0252	------
Treatment x Breeding	6	.0089	501
Error (W/in Breeding and Treatment)	10	.0091	552

* Significant at .05 level
** Significant at .01 level

The rate of gain and feed consumption per 100 pounds gain for the entire experiment were statistically analyzed as shown in Table 3. Although non-Duroc (crossbred and Landrace-Poland) breeding groups consumed slightly less feed per 100 pounds gain than the Duroc groups, the differences were not significant. The Minnesota No. 1 x Landrace-Poland pigs made the most efficient gains while the Landrace-Polands made the least efficient gains (Table 4). There was a highly significant difference

TABLE 4

Pounds of Feed Required Per 100 Pounds Gain by Breeding Groups and Treatments

	Ration						Averages for Breeding Groups		
	High-High			High-Low					
Breeding	1st Period	2nd Period	Both Periods	1st Period	2nd Period	Both Periods	1st Period	2nd Period	Both Periods
T	320	420	366	323	552	425	321	485	395
T x 3	311	412	355	343	566	440	327	490	397
(T x 3) x (C x S)	319	388	350	309	629	455	314	506	402
T x Landrace-Poland	363	376	368	305	578	430	334	477	400
Outbred Duroc x L.-Poland	307	360	332	307	593	449	307	480	391
Minn. No. 1 x L.-Poland	306	392	344	293	560	410	298	472	376
Landrace-Poland	324	482	388	317	566	427	320	526	407
Average for Ration	322	407	357	314	577	433	317	491	395

TABLE 5

Average Daily Gain in Pounds by Breeding Groups and Treatments

	Ration						Averages for Breeding Groups		
	High-High			High-Low					
	1st Period	2nd Period	Both Periods	1st Period	2nd Period	Both Periods	1st Period	2nd Period	Both Periods
T	1.51	1.81	1.64	1.45	1.32	1.39	1.48	1.53	1.50
T x 3	1.65	2.15	1.84	1.69	1.33	1.51	1.67	1.64	1.66
(T x 3) x (C x S)	1.66	2.06	1.81	1.62	1.36	1.49	1.64	1.64	1.64
T x Landrace-Poland	1.38	2.21	1.66	1.56	1.52	1.54	1.46	1.80	1.60
Outbred Duroc x L.-Poland	1.55	2.31	1.84	1.49	1.32	1.40	1.52	1.67	1.59
Minn. No. 1 x L.-Poland	1.38	1.93	1.58	1.43	1.42	1.42	1.41	1.62	1.49
Landrace-Poland	1.44	1.50	1.46	1.25	1.32	1.28	1.34	1.40	1.36
Average for Ration	1.50	1.96	1.68	1.51	1.38	1.45	1.49	1.61	1.54

between the high-high and the high-low treatments in feed required per 100 pounds gain. The high-high pigs required 76 pounds less feed per 100 pounds gain than the high-low pigs. There was probably not this much actual difference in efficiency of feed utilization because of the excessive amount of feed wastage by the high-low pigs during the second period when they were fed the unpalatable prairie hay ration.

Significant differences due to breeding were found for average daily gains as indicated in Table 3. The orthogonal comparisons indicated these comparisons to be significant: (1) line cross Durocs outgained the Duroc line T by 0.18 of a pound per day and (2) Duroc x Landrace-Poland crossbreds outgained the Minnesota No. 1 x Landrace-Poland crossbreds and the Landrace-Poland line by 0.11 of a pound per day. In general, the line crosses, with the exception of the Minnesota No. 1 x Landrace-Poland cross, made the fastest gains (Table 5). The pigs of Duroc breeding outgained the Landrace-Poland and crossbred pigs 0.16 of a pound per day during the first period and 0.07 of a pound per day for both periods, although the Landrace-Poland and crossbred pigs outgained the Durocs 0.04 of a pound per day during the second period.

During the first period, when all pigs were fed the same rations, the high-high and the high-low pigs made comparable average daily gains. However, the high-low pigs required 18 additional days to reach market weight because of the reduced rate of gain during the second period. This reduction in rate of gain on the low energy ration is shown graphically in Figure 1. During the second period the high-low pigs gained 69 per cent as fast as the high-high pigs. Treatment differences in rate of gain over the entire experiment were highly significant (Table 3). The high-high pigs gained 1.68 pounds per day as compared to 1.45 pounds per day for the high-low pigs (Table 5).

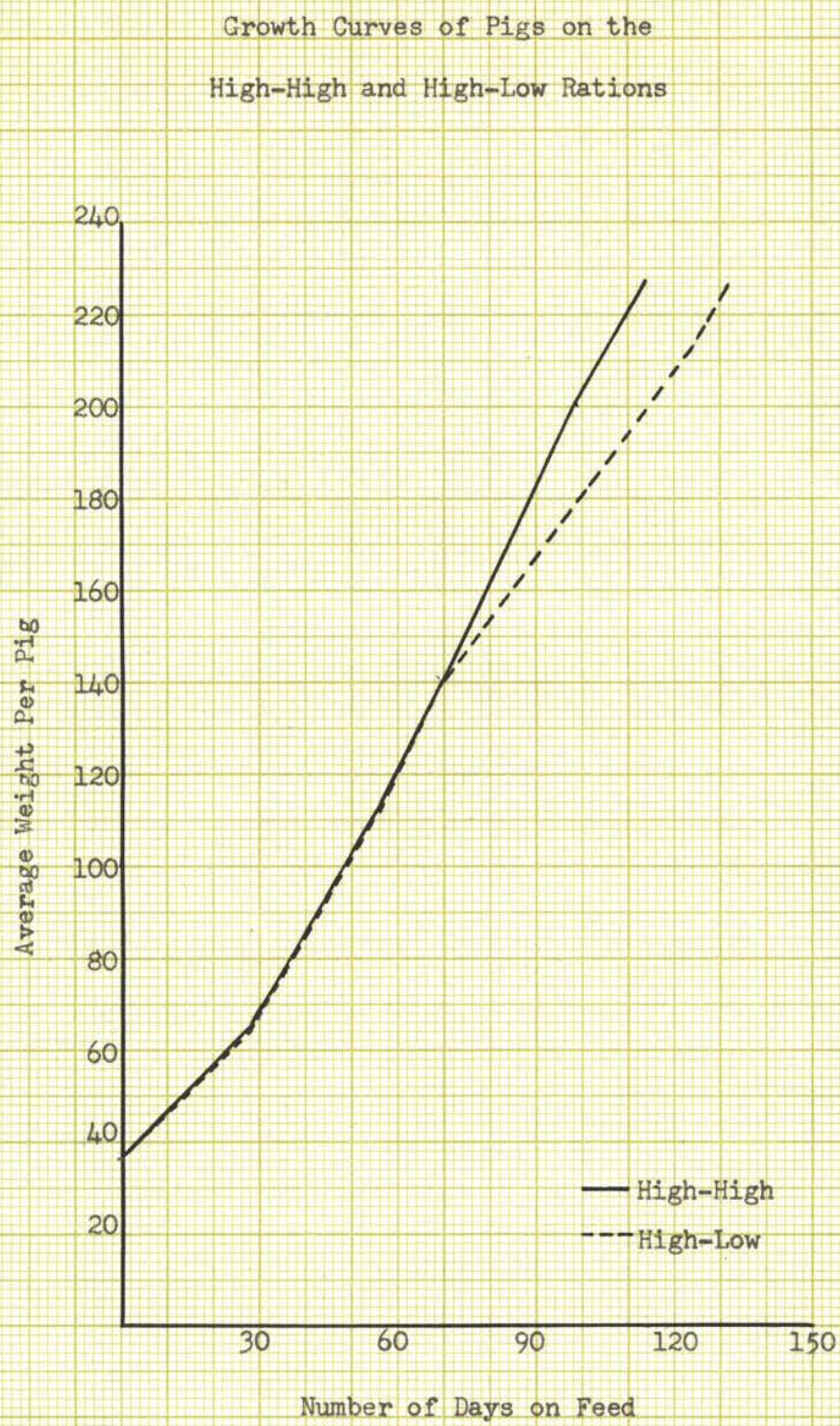
Growth Curves of Pigs on the
High-High and High-Low Rations
Average Weight Per Pig
240
220
200
180
160
140
120
100
80
60
40
20
30
60
90
120
150
Number of Days on Feed
High-High
High-Low

Figure 1

The means for the different breeding groups are given on twelve carcass items in Table 6. Differences in means indicated that the Duroc line T and the Landrace-Poland line were of dissimilar genetic composition. Significant differences due to breeding were found in seven of the twelve carcass items (Table 7). In three other items significant differences due to breeding were not found until the orthogonal comparisons were analyzed. Results of the orthogonal comparisons were as follows:

Comparison one. Crossbred and Landrace-Poland carcasses were superior to Duroc carcasses in seven measurements, i.e., ham, loin, lean cuts, average back fat thickness, specific gravity, ham lean area, and loin lean area.

Comparison two. There were no significant differences in the carcasses from the Duroc line T and the line cross Durocs.

Comparison three. Carcasses of the (Tx3)x(CxS) line cross had a higher percentage of loin than did the T x 3 line cross.

Comparison four. There were no significant differences between the Duroc x Landrace-Poland crosses when compared to the Minnesota No. 1 x Landrace-Poland crosses and the Landrace-Poland carcasses.

Comparison five. Outbred Duroc x Landrace-Poland carcasses had a higher percentage of shoulder and a larger loin lean area but shorter carcasses than the Duroc line T x Landrace-Poland carcasses.

Comparison six. Carcasses from the Landrace-Poland line had higher percentages of loin, lean cuts, and primal cuts than the Minnesota No. 1 x Landrace-Poland crosses.

As might be expected, in view of previous reports, significant differences between barrows and gilts were found in nearly all (ten out of twelve) carcass items as shown in Table 7. The means are shown in Table 8. The gilt carcasses were superior to the barrow carcasses in ham, loin, shoulder, lean cuts, primal cuts, carcass length, average back fat thickness, specific gravity, and loin lean area. Gilts yielded carcasses of lower dressing percentage and a smaller percentage of belly. This lower dressing percentage reduced the gilts advantage in carcass value per hundred pounds of live weight to only twenty cents more than that of the

TABLE [illegible]

Means of Carcass Data by Breeding Groups

		Breeds						
		Duroc			Crossbred			Landrace Poland
		T	Tx3	(Tx3)x(CxS)	T x Landrace-Poland	Outbred Duroc x Landrace-Poland	Minn. No. 1 x Landrace-Poland	
Number of Pigs		8	8	8	8	4	8	4
Shrunk Weight		216	214	218	216	216	216	217
Dressing Percentage 1/	(x)	73.1	74.0	73.6	73.9	74.2	72.4	74.8
Per cent Ham 2/	(x)	10.5	11.3	11.4	12.2	13.3	12.6	13.3
Per cent Loin 2/	(x)	9.4	9.5	10.1	11.1	10.8	10.2	11.0
Per cent Shoulder 2/	(x)	11.5	11.3	11.3	10.9	12.3	11.2	12.0
Per cent Lean Cuts 2/	(x)	31.3	32.0	32.8	34.2	36.4	34.0	36.4
Per cent Belly	(x)	12.6	12.2	12.0	12.2	11.4	11.3	12.3
Per cent Primal Cuts	(x)	43.9	44.2	44.8	46.3	47.8	45.3	48.7
Per cent Fat Trim		20.0	20.7	19.2	17.4	17.2	17.9	16.1
Per cent Lean Trim		3.2	3.4	3.7	3.8	3.6	3.3	4.1
Carcass Value per 100 lbs. Live Wt. 3/		$21.99	22.38	22.57	23.13	23.80	22.69	24.12
Carcass Length	(x)	29.7	29.2	29.5	30.9	28.6	29.8	31.2
Av. BF Thickness	(x)	1.86	1.88	1.74	1.57	1.54	1.68	1.45
Specific Gravity	(x)	1.032	1.032	1.033	1.038	1.038	1.039	1.040
Loin Lean Area	(x)	3.88	4.18	4.12	5.27	6.78	5.38	5.41
Ham Lean Area	(x)	22.35	23.88	24.26	27.04	28.02	27.52	29.50

1/ Chilled carcass weight as a percentage of shrunk live weight, hogs dressed packer style with head and leaf fat removed.

2/ Cuts very closely trimmed and expressed as a percentage of shrunk live weight.

3/ Wholesale prices per pound used to figure value per 100 pounds live weight:

Skinned Ham	$0.518	Belly	$0.332
Trimmed Shoulder	0.390	Fat Trim	0.128
Trimmed Loin	0.450	Lean Trim	0.350

(x) Measurements statistically analyzed.

TABLE 7

Mean Squares of Carcass Analyses

Source	d.f.	Ham	Loin	Shoulder	Lean Cuts	Belly	Primal Cuts
		Carcass Measurements					
Total	47						
Main plot	(11)						
Breeding	(6)	7.12**	3.45*	1.36	22.78*	1.31	18.11
Durocs vs Crossbreds and LP	1	33.32**	14.64**	.03	95.49**	----	64.86*
T vs Line Cross Durocs	1	2.90	.45	.24	3.57	----	1.88
Tx3 vs (Tx3)x(CxS)	1	.02	1.50*	.01	2.17	----	1.38
Duroc x LP vs Minn. No. 1 x LP and LP	1	.82	1.30	.12	.01	----	.43
T x LP vs Outbred Duroc x LP	1	3.60	.20	5.13*	13.80	----	5.80
Minn. No. 1 x LP vs Landrace-Poland	1	2.04	2.60*	2.60	21.66*	----	35.28*
Error a (Between Litters W/in Breeding)	5	.62	.21	.58	2.38	1.15	4.92
Subplot	(36)						
Treatment	1	1.27*	1.24*	1.47*	11.91**	8.25**	.33
Sex	1	6.30**	5.54**	.70	32.51**	8.75**	7.52*
Treatment x Sex	1	.08	.01	.05	0	.29	.21
Treatment x Breeding	6	.19	.24	.18	.42	.43	1.28
Sex x Breeding	6	.58	.50*	.28	2.52*	.56	1.49
Treatment x Sex x Breeding	6	.21	.15	.42	1.29	.62	.41
Error b	15	.22	.15	.23	.88	.50	.86

* Significant at .05 level
** Significant at .01 level

TABLE 7 (cont.)

Mean Squares of Carcass Analyses

		Carcass Measurements					
Source	d.f.	Dressing Percentage	Carcass Length	Av. BF Thickness	Specific Gravity°	Loin Lean Area	Ham Lean Area
Total	47						
Main plot	(11)						
Breeding	(6)	3.73	4.46	.1691*	87.5*	5.7671*	42.18**
Durocs vs Crossbreds and LP	1	----	5.94	.7202**	488.0**	27.4367**	219.73**
T vs Line Crosses	1	----	.96	.0032	2.0	.2283	15.76
Tx3 vs (Tx3)x(CxS)	1	----	.30	.0826	2.0	.0189	.59
Durocs x LP vs Minn. No. 1 x LP and LP	1	----	.20	.0051	19.0	.8103	4.00
T x LP vs Outbred Durocs x LP	1	----	13.35*	.0017	0.0	6.0904*	2.60
Minn. No. 1 x LP vs Landrace-Poland	1	----	6.00	.2017	15.0	.0181	10.40
Error a (Between Litters W/in Breeding)	5	6.11	1.31	.0336	12.4	.6614	3.95
Subplot	(36)						
Treatment	1	47.80**	1.45*	.5250**	554.0**	.7326	7.92
Sex	1	13.54**	5.53**	.3400**	527.0**	3.9852*	10.55
Treatment x Sex	1	1.80	0	.0008	7.0	.2277	2.75
Treatment x Breeding	6	.99	.20	.0369*	5.2	.4129	2.41
Sex x Breeding	6	.83	.93*	.0219	19.5	.2474	5.99
Treatment x Sex x Breeding	6	.25	.10	.0057	6.8	.0819	2.32
Error b	15	1.30	.23	.0112	7.9	.2490	4.19

* Significant at .05 level
** Significant at .01 level
° Coded Mean Squares

TABLE 8

Means of Carcass Data by Ration and Sex

		Treatment		Sex	
		High-High	High-Low	Barrows	Gilts
Number of Pigs		24	24	26	22
Shrunk Weight		217	215	215	217
Dressing Percentage 1/	(x)	74.6	72.6	74.0	73.1
Per cent Ham 2/	(x)	11.7	12.0	11.5	12.2
Per cent Loin 2/	(x)	10.0	10.4	9.9	10.5
Per cent Shoulder 2/	(x)	11.2	11.6	11.3	11.4
Per cent Lean Cuts 2/	(x)	32.9	33.9	32.8	34.2
Per cent Belly	(x)	12.4	11.6	12.4	11.6
Per cent Primal Cuts	(x)	45.4	45.5	45.2	45.8
Per cent Fat Trim		19.9	17.4	19.4	17.7
Per cent Lean Trim		3.6	3.5	3.5	3.5
Carcass Value per 100 lbs. Live Wt. 3/		$22.87	22.70	22.69	22.89
Carcass Length	(x)	29.7	30.0	29.6	30.1
Av. BF Thickness	(x)	1.81	1.60	1.76	1.64
Specific Gravity	(x)	1.032	1.039	1.033	1.039
Loin Lean Area	(x)	4.70	4.94	4.59	5.14
Ham Lean Area	(x)	25.20	26.01	25.09	26.21

1/ Chilled carcass weight as a percentage of shrunk live weight, hogs dressed packer style with head and leaf fat removed.

2/ Cuts very closely trimmed and expressed as a percentage of shrunk live weight.

3/ Wholesale prices per pound used to figure value per 100 pounds live weight:

Skinned Ham	$0.518	Belly	$0.332
Trimmed Shoulder	0.390	Fat Trim	0.128
Trimmed Loin	0.450	Lean Trim	0.350

(x) Measurements statistically analyzed.

barrows. In three items (loin, lean cuts, and carcass length) there were interactions indicating that sex differences were not the same for all breeding groups.

Significant differences due to treatment, although generally smaller than sex differences, were found in nine of the twelve carcass items (Table 7). The high-low group of carcasses were superior to the high-high group in seven items, i.e., ham, loin, shoulder, lean cuts, carcass length, average backfat thickness, and specific gravity. The high-high pigs yielded carcasses of higher dressing percentage and a higher percentage of belly. Even though the high-low pigs yielded leaner type carcasses, they were not worth as much per hundred pounds live weight. This was largely accounted for by their lower dressing percentage. A significant treatment x breeding interaction indicated that the treatment difference in average backfat thickness was not the same for all breeding groups.

DISCUSSION

Reducing the energy content of ration 3b by including prairie hay in place of part of the corn did not give desirable results. Since the fiber content of the ration was about twice as high as commonly recommended for swine, this probably accounts for the unpalatability of the ration and the resulting excessive wastage of feed. The high percentage of fiber may have caused some reduction in efficiency of gain because (1) a portion of the fiber may not have been digested, and (2) the high fiber content may have depressed the digestability of other nutrients. However, these are only speculations because the difference (if any) in feed utilization of rations 3a and 3b were not accurately measured. Self feeding a ration of reduced energy content may require less labor than other feeding methods, but, before it can become practical, a method must be found to reduce the energy content without inducing excessive feed wastage.

The high-low treatment decreased rate of gain and produced leaner carcasses as indicated by higher specific gravity, less backfat, and a higher percentage of lean cuts. This is illustrated by a comparison of the unskinned ham and the untrimmed loin of a high-low pig as compared with the same cuts from a high-high pig of the same breeding (Figures 2 and 3). Although the carcasses from the high-low group of pigs were worth more in the cooler, the high-low pigs were worth slightly less on foot due to their lower dressing percentage. Since the carcass value per 100 pounds live weight was practically the same for both feeding methods, the feed cost of the high-low group would have to be as economical as the high-high group to be practical. In this experiment the gains of the high-low group were not as economical as the high-high group. The feed cost per 100 pounds gain was 11 per cent greater.

Figure 2. The (Tx3)x(CxS) gilt RL893 was on the high-high treatment and made an average daily gain of 1.97 pounds. Feed cost per 100 pounds of gain for all pigs on this treatment was $11.45 and the carcass value per 100 pounds of live hog was $22.87.

Figure 3. The (Tx3)x(CxS) gilt RL876 was on the high-low treatment and made an average daily gain of 1.54 pounds. Feed cost per 100 pounds of gain for all pigs on this treatment was $12.86 and the carcass value per 100 pounds of live hog was $22.70

Other methods of limiting the feed intake in dry lot and on pasture may give more favorable results, but the feeding of hogs of different breeding on the same ration indicates that a leaner and more valuable carcass can be produced without increasing feed costs. This is confirmed by a study of the results of the full-fed pigs representing the different breeding groups (Table 9). The Landrace-Poland pigs produced carcasses worth $1.71 more per 100 pounds of live hog than the Line T pigs.

A cross sectional view of the relative portion of fat and lean of the unskinned ham and the untrimmed loin from pigs of two extreme breeding groups is shown in Figures 4 and 5. Both pigs were on the high-high treatment. This indicates that possibly more improvement can be made through breeding methods than by controlling the nutritional environment.

TABLE 9

Differences in Carcass Value and Feed Costs of the Breeding Groups Full Fed Throughout the Experiment

Breeding Groups	Carcass Value per 100 Pounds Live Weight	Feed Cost 100 Pounds Gain	Difference
T	$22.20	$11.66	$10.54
T x 3	22.44	11.38	11.06
(T x 3) x (C x S)	22.82	11.20	11.62
T x Landrace-Poland	23.17	11.84	11.33
Outbred Duroc x Landrace-Poland	23.83	10.57	13.26
Minn. No. 1 x Landrace-Poland	22.73	10.98	11.75
Landrace-Poland	23.91	12.64	11.27

From the consumer viewpoint the crossbreds and the Landrace-Poland line were more desirable than the Durocs as they yielded a higher percentage of lean cuts and less fat.

The outbred Duroc x Landrace-Poland was the most profitable breeding group as shown in Table 9. Although the Landrace-Polands were the most valuable on foot, they were one of the least profitable due to

Figure 4. The T x 3 barrow L582 was on the high-high treatment and made an average daily gain of 1.88 pounds. Feed cost per 100 pounds gain for T x 3 pigs was $12.32 and the carcass value per 100 pounds of live hog was $22.38.

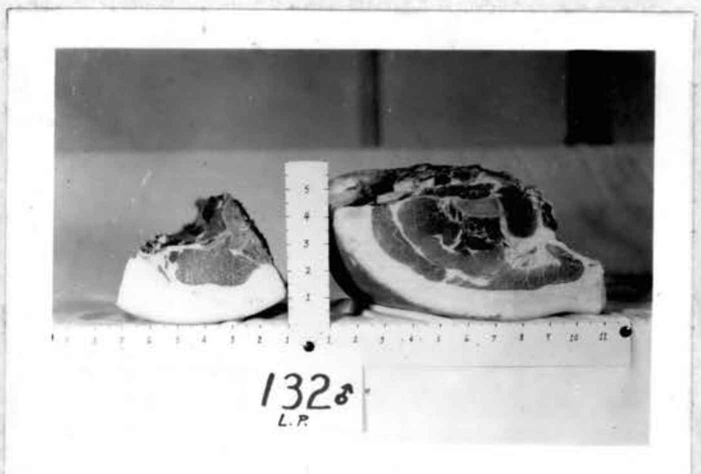

Figure 5. The Landrace-Poland barrow 132 was on the high-high ration and made an average daily gain of 1.77. Feed cost per 100 pounds gain for Landrace-Poland pigs was $12.70 and the carcass value per 100 pounds of live hog was $24.12.

their high feed cost. Line T was the least profitable breeding group as their carcasses were valued at only $10.54 per 100 pounds live weight over feed cost. This was $0.70 more per 100 pounds than the average of the high-low treatment. This does not make any allowance for carcass quality which would probably be in favor of the high-low group.

Unequal subclass numbers frequently make it difficult to plan animal breeding experiments which lend themselves readily to the logical statistical analysis. The precision of the statistical analysis of this experiment would have been improved if it had been possible to have equal sex numbers and equal number of litters within all breeding groups. The error term used to test breeding differences in the carcass data was the difference between litters of the same breeding group. Two breeding groups were not represented in this error term. The same applies to the error term used to test treatment and sex differences. In this case the error term was the difference between pigs of the same sex of the same breeding group on the same treatment. Again two breeding groups were not represented in this error term. The loss of the degrees of freedom due to these two missing breeding groups in the error term may have reduced the reliability of some of the significant differences found. Future experiments should be set up so that the proper error term may be used in making the appropriate statistical analysis.

SUMMARY

Feed lot and carcass data of 48 hogs were studied to determine the effect of restricting the energy intake of pigs of different breeding for the production of leaner type hogs. An inbred Duroc line, two Duroc line crosses, crossbreds, and a Landrace-Poland line were included in this study. All pigs were treated alike up to 140 pounds, then, two pigs from each of 12 litters were fed a high energy ration to 225 pounds and two pigs from each litter were fed a low energy ration. Feed lot data included rate of gain, feed required per 100 pounds gain, and cost of gain. The carcass measurements and evaluations included dressing percentage, specific gravity, carcass length, average backfat thickness, loin lean area, ham lean area, percentage of four primal cuts, and value per 100 pounds live weight.

Reducing the average daily gain of the high-low group was done effectively during the latter part of the fattening period by substituting prairie hay for part of the corn in a self fed ration. Breeding groups were significantly different in average daily gains. There were no significant differences in efficiency of gain although there was considerable spread in the feed costs per 100 pounds gain.

The carcasses from the high-low group of pigs were leaner than those from the high-high group, however the differences between barrows and gilts were greater. The carcasses of the gilts were significantly leaner than those of the barrows according to specific gravity, average backfat thickness, and percentage of lean cuts. Carcass differences were more marked between breeding groups than between treatments or sexes. The crossbreds and the Landrace-Poland line produced the most desirable

carcasses while the Duroc line T and T x 3 line cross were the least desirable.

Using prairie hay to reduce the energy content of the ration in the latter part of the fattening period did produce a leaner type hog but the method was not economical. Full feeding hogs with the proper genetic makeup appears to be the most profitable method of producing hogs with leaner carcasses.

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TYPIST PAGE

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