

### Summary

The effects of breed of dam, sex, type of rearing, and birth weight on average daily gain of lambs from birth to approximately 50 pounds and from 50 pounds to approximately 90 pounds were estimated. Breed of dam had little effect on rate of gain, but sex, type of rearing, and birth weight were of considerable importance. These factors were more important during the early gain of lambs (birth to 50 pounds) than during the latter growth period (50 to 90 pounds).

Correction factors were computed to aid in making adjustments for these known sources of variation. Rate of gain to approximately 50 pounds can be adjusted to a standard to aid in the culling of less productive ewes from the flock since the ewe's milk production has a large effect on a lamb's rate of growth during its early life. Rate of gain to approximately 90 pounds can be adjusted by use of these correction factors to aid in selecting the fastest gaining ewe lambs for replacements.

The average daily gain of lambs from 50 to 90 pounds sired by twelve different rams was determined. When corrections were made for the other variables considered in this study, approximately 44% of the remaining variation in lamb growth rate was apparently due to hereditary effects.

Therefore, the use of correction factors to adjust lamb growth rates aids in culling mature ewes from the flock and in selection of replacements with the greatest ability to gain. This gaining ability trait is apparently highly heritable. Consequently, selection of fast gaining ewe lambs should grade up the gaining ability of lambs produced in a flock. Also, selection of sires which were superior gainers as lambs and/or which have been tested for their progeny's ability to gain deserves consideration in a well managed sheep breeding program.

## Performance Tests with Purebred And Crossbred Pigs from Two Lines of Breeding

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One of the objectives in the Oklahoma swine breeding project<sup>1</sup> is to develop lines for use in a commercial rotation crossbreeding program. Two of these lines (Duroc line OK8 and Beltsville No. 1 line OK9) have been in a reciprocal selection program at the Stillwater station since 1951. In this program the two lines are crossed in order to identify the purebred parents that produce the best crossbred progeny. The purebred parents or their purebred offspring are then selected for propagating the lines.

<sup>1</sup>This is a cooperative project between the Oklahoma Agricultural Experiment Station and the Regional Swine Breeding Laboratory, Agricultural Research Service, U. S. Department of Agriculture.

Although feeding and slaughter tests were used primarily to test crossbred progeny, purebred pigs were included in some of the tests in order to compare the performance of the two lines with each other and with their reciprocal crosses. The results in seven of these tests were summarized in order to characterize the lines and their crosses in feed-lot and carcass traits, and to appraise possible changes in the lines as a result of the selection program.

### Procedure

The same ration was self fed to all pigs in any year and season test, but the rations were not necessarily the same in different tests. Within each test a higher protein ration was fed the first month and a lower protein ration the remainder of the test. A general description of the rations fed in the different tests is given in Table 1. A corn ration was fed in the first two years. The grain used in the 1957 fall test was milo.

**Table 1.—General Description of Rations Fed and Allotment Plan for Feeding and Slaughter Test.**

Year	Seas.	Rations Fed	Allotment Plan for:	
			Feeding Test	Slaughter Test
1951	Fall	Complete mixed meal ration of corn, protein, mineral and antibiotic supplement.	2 barrows and 2 gilts per litter in each lot.	1 barrow and 1 gilt from each litter.
1953	Fall	Complete mixed meal ration of corn, protein, mineral and antibiotic supplement.	Same as 1951 Fall.	All pigs from half of litters. 1 barrow and 1 gilt from rest of litters.
1957	Fall	Complete mixed meal ration of milo, protein, mineral and antibiotic supplement.	2 barrows and 1 gilt from each litter. 2 litters in each lot.	2 barrows from each litter.
1958	Spr.	Complete mixed meal ration of corn, protein, mineral, vitamin and antibiotic supplement.	2-3 barrows per litter. Gilts used when barrows not available.	1-2 barrows per litter.
1958	Fall	Complete pelleted ration of corn, milo and protein, min., vitamin and antibiotic suppl.	2 barrows per litter. Two litters per lot.	1-2 barrows per litter.
1959	Spr.	Same as 1958 Fall except for slight change in mineral, vitamin and antibiotic supplement.	2 barrows per litter. Two litters per lot.	1-2 barrows per litter.
1959	Fall	Same as for 1959 Spr.	Same as above.	Same as above.

In this test there was considerable feed waste, and for that reason the feed per 100 lbs. gain in this test has little meaning. A return to the corn ration with some additional vitamin supplementation was made in the 1958 spring test. Some feed waste was still evident in this test, as was true in tests the first two years. This led to the trial of a pelleted ration using both corn and milo as the grain base in the 1958 fall test. Nearly all feed waste was eliminated in this test, and essentially the same pelleted ration was fed in the two 1959 tests.

All pigs were fed in concrete floored pens equipped with self-feeders and automatic waters. The pens varied in size but the minimum floor space per pig was 20 sq. ft. and in most tests there was 30 sq. ft. allowed per pig. Water sprinklers were used for cooling during the summer months.

Pigs were started on the feeding test at weaning (about 56 days of age and an average weight of 40 to 45 lbs.). Test pigs were selected to be representative of their litters. Generally pigs selected were near the average of the litter in weaning weight. The smallest and the heaviest pigs were rejected as were the obviously unsound. The general allotment plan for each year and season is given in Table 1. A litter sample of four pigs (two barrows and two gilts) was fed in each pen in the first two tests. Beginning with the 1957 fall test emphasis in the testing program was shifted from a litter test to a sire progeny test. In order to test more pigs from different litters by the same sire, pigs from two litters of comparable age by the same sire were fed together. In the last two years gilts were tested only when there were insufficient barrows to complete a test group. Pigs were weighed off test individually at weights averaging about 210 lbs.

Pigs selected for slaughter were chosen at random from the tested group. In the first two years gilts and barrows were slaughtered. In the last five tests barrows were used for the slaughter tests except when it was necessary to slaughter a few gilts in groups where the numbers of barrows were low. Because of the significant sex differences in carcass traits all carcass measurements on gilts were adjusted to a barrow equivalent by subtracting .2" to carcass length, adding .1" to carcass backfat and subtracting .35 sq. in. to the loin lean area. A few of the pigs were slaughtered at the College Meats Laboratory but most of the pigs were slaughtered at the Wilson and Company plant in Oklahoma City. The carcass measurements were obtained through the cooperation of personnel at Wilson and Company.

The distribution by line and testing season for the 637 pigs fed and 406 pigs slaughtered is shown in Table 2. There were more crossbred pigs tested than purebred pigs, because the crossbred progeny test was the primary objective of these tests. However, it is felt that sufficient numbers of pigs from the lines were tested to be representative of the

Table 2.—Number of Pigs Tested in the Different Lines and Different Years.

Year	Seas.	Line									
		8		9		8x9		9x8		Total	
		Fed	Slaugh	Fed	Slaugh	Fed	Slaugh	Fed	Slaugh	Fed	Slaugh
1951	Fall	16	8	16	8	16	8	16	8	64	32
1953	Fall	24	18	11	11	24	18	39	26	98	73
1957	Fall	12	8	26	18	50	33	33	22	121	81
1958	Spr.	17	9	14	6	34	22	33	24	98	61
1958	Fall	31	10	12	8	28	20	12	10	83	48
1959	Spr.	32	11	13	9	28	19	17	13	90	52
1959	Fall	18	16	8	6	28	18	29	19	83	59
Total		150	80	100	66	208	138	179	122	637	406

lines. In 1951 and 1959 purebred and crossbred pigs were sired by the same boars, but in the other tests the sires of purebred and crossbred pigs were different.

### Results

In average daily gain, the crosses gained .1 lb. per day faster than the average of the two lines (Table 3). Line OK8 gained about as fast as the crosses, but line OK9 gained about .2 lb. per day less than the crosses. Line differences were highly significant as were differences between sires within lines. These are indicative of important hereditary differences between lines as well as within lines. Highly significant differences were also noted between the different tests, which may be largely due to ration differences.

There were no significant differences between lines and crosses in feed required per lb. of gain (Table 3), but the crosses were slightly more efficient than the lines. A significant difference between sires within lines indicated that selection of sires on the basis of progeny tests for feed efficiency would be effective. Differences between years and seasons in feed efficiency were highly significant. The most notable differences were the large amount of feed required per lb. of gain in the 1957 fall test when there was considerable feed waste, and the much improved feed efficiency in 1958 fall, 1959 spring, and 1959 fall, when the ration was pelleted and there was very little feed waste. Whether this improvement is due entirely to pelleting is unknown, but the results strongly suggest that it is.

Line OK9 produced the longest carcasses which were 1.3 in. longer than the carcasses in line OK8 (Table 3). The crosses were just slightly shorter than the OK9 carcasses and averaged .5" longer than the average of the two parent lines. Line differences in carcass length were highly significant, and so were differences between sires within lines. Year differences were also highly significant. The results strongly suggest that there has been genetic improvement in carcass length in line OK8

Table 3.—Comparisons of the Performance of Lines OK8 and OK9 and Their Reciprocal Crosses.

Year	Season	Line				Av. of Crosses	Av. of lines	Crosses -lines
		8	9	8x9	9x8			
<b>Average Daily Gain (Lbs.)</b>								
1951	Fall	1.72	1.58	1.65	1.61	1.63	1.65	—02
1953	Fall	1.70	1.63	1.79	1.75	1.77	1.66	.11
1957	Fall	1.68	1.47	1.62	1.75	1.68	1.58	.10
1958	Spr.	1.64	1.50	1.65	1.67	1.66	1.57	.09
1958	Fall	1.90	1.66	1.96	1.84	1.90	1.78	.12
1959	Spr.	1.89	1.74	1.98	1.97	1.98	1.82	.16
1959	Fall	1.90	1.58	1.92	1.90	1.91	1.74	.15
	Av.	1.78	1.59	1.80	1.78	1.79	1.68	.11
<b>Lbs. of feed per lb. of gain</b>								
1951	Fall	3.67	3.63	3.51	3.64	3.58	3.65	—07
1953	Fall	3.49	3.52	3.31	3.52	3.42	3.50	—08
1957	Fall	4.09	4.07	3.97	3.87	3.92	4.08	—16
1958	Spr.	3.51	3.57	3.26	3.40	3.33	3.54	—21
1958	Fall	3.22	3.18	3.15	3.27	3.21	3.20	.01
1959	Spr.	3.13	2.99	3.05	2.98	3.02	3.06	—04
1959	Fall	3.15	3.33	3.29	3.19	3.24	3.24	0
	Av.	3.47	3.47	3.36	3.41	3.38	3.47	—09
<b>Carcass length (in.)</b>								
1951	Fall	27.8	29.3	28.7	29.0	28.8	28.6	.2
1953	Fall	27.7	28.8	29.2	28.8	29.0	28.2	.8
1957	Fall	28.5	30.1	29.5	29.9	29.8	29.3	.5
1958	Spr.	28.5	30.2	29.9	30.3	30.1	29.4	.7
1958	Fall	28.5	30.3	29.9	29.7	29.8	29.4	.4
1959	Spr.	29.4	30.4	29.9	29.5	29.7	29.9	—2
1959	Fall	28.6	29.1	30.1	29.5	29.8	28.9	.9
	Av.	28.4	29.7	29.6	29.5	29.6	29.1	.5
<b>Carcass backfat (in.)</b>								
1951	Fall	1.93	1.56	1.67	1.67	1.67	1.74	—07
1953	Fall	1.86	1.48	1.66	1.59	1.62	1.67	—05
1957	Fall	1.68	1.44	1.51	1.59	1.56	1.55	.01
1958	Spr.	1.93	1.43	1.53	1.54	1.54	1.68	—14
1958	Fall	1.72	1.50	1.54	1.58	1.56	1.61	—05
1959	Spr.	1.71	1.54	1.63	1.66	1.64	1.62	.02
1959	Fall	1.65	1.39	1.66	1.50	1.58	1.52	.06
	Av.	1.78	1.48	1.60	1.59	1.60	1.58	.02
<b>Loin lean area (sq. in.)</b>								
1951	Fall	---	---	---	---	---	---	---
1953	Fall	---	---	---	---	---	---	---
1957	Fall	3.22	3.70	3.74	3.56	3.65	3.46	.19
1958	Spr.	2.78	4.06	3.57	3.38	3.48	3.42	.06
1958	Fall	3.36	4.43	4.18	4.15	4.16	3.90	.26
1959	Spr.	3.17	4.01	3.95	3.61	3.78	3.59	.19
1959	Fall	3.70	4.24	4.00	3.60	3.80	3.97	—17
	Av.	3.25	4.09	3.89	3.66	3.78	3.67	.11

over the period covered by the data. This improvement in the line has also resulted in an increase in the carcass length of the crosses. Since the beginning of these tests line OK8 increased about one inch in carcass length and about this same increase was shown in the crosses.

Line OK8 also seems to have decreased in carcass backfat thickness and some improvement in this respect has also been shown in the crosses (Table 3). Overall the average of the crosses was about the same as the average of the lines, but line OK8 was significantly fatter than OK9.

Loin lean areas were obtained from planimeter measurements of tracings made at the 10th rib. These tracings were not made in the 1951 fall and 1953 fall tests, and these are missing from the data. Line differences and sire differences within lines were highly significant. Line OK9 carcasses averaged 4.09 sq. in. and line OK8 carcasses averaged .84 sq. in. less or 3.25 sq. in. (Table 3). The crosses averaged .11 sq. in. more than the average of the lines.

Of particular note is the improvement in backfat thickness and loin lean area in line OK8 in the 1959 fall test. This improvement is the result of the use of one sire that was purchased a year ago in an effort to improve the carcass qualities in this line. Nine barrows from this sire were fed and eight were slaughtered. His barrows yielded carcasses with .52" less backfat and 1.04 sq. in. more loin lean area than the carcasses from other pigs in this line. In fact, this sire's carcasses were comparable in measurements to the carcasses in line OK9.

### Summary

Seven tests were conducted during the period from the fall of 1951 through the fall of 1959, in which lines OK8 (Duroc) and OK9 (Beltsville No. 1) and their reciprocal crosses were compared. During this period 637 pigs were fed and 406 slaughtered. The crosses gained faster, were slightly more efficient, and had longer carcasses and slightly larger loin eyes than the average of the two lines. Line OK8 pigs gained faster than line OK9 pigs, but line OK9 carcasses were significantly longer with less backfat and more muscling.

Over the period covered by this study improvement in the carcasses in line OK8 was shown by an increase in carcass length and loin lean area and a decrease in backfat thickness.

Significant differences were noted among progeny of different sires in the same line and season in feed required to produce a lb. of gain, and highly significant differences were noted in average daily gain, carcass length, carcass backfat thickness, and loin lean area. These differences indicate the importance of heredity in these traits and the value of testing for these traits in a progeny test and family selection program.