

## Factors Influencing Lamb Gains From Birth to Market Weight

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### Introduction

A large portion of the commercial sheep industry in Oklahoma and adjacent areas consists of the production of "spring" milk-fed fat lambs. The success of this type of enterprise depends upon the use of ewes that will breed out of season (spring), and the availability of a succulent pasture as a source of cheap feed. The most desirable type of lamb is one that grows rapidly to market weight and possesses sufficient finish to bring a top or near top market price.

The individual lamb's growth is strongly influenced by its dam's milk supply and mothering ability, especially during the early stages of his life. On the basis of this maternal influence on a lamb's growth it appears that the rate of gain of a lamb during its early life might be a good indication of its dam's productivity. Likewise, the rate of gain of the same lamb later in its life might be a good index of its own ability to grow as it becomes less dependent on its dam and is able to utilize sources of nutrients other than its dam's milk.

Due to differences in sex, type of rearing (single or twin), and birth weight, lambs of equal genetic merit may differ considerably in their individual rates of gain. It is also possible that a lamb of inferior genetic merit may outweigh a superior lamb because of these environmental factors. These differences in lamb gains cause the breeder to make mistakes in culling the less productive ewes and in the selection of the most desirable lambs for replacements.

Differences in rate of gain due to sire may also be an important factor in a lamb's ability to gain. If there are important differences in rate of gain between sire progeny groups, then it would be worthwhile to select sires which had a high rate of gain as lambs and/or which have been progeny tested and found to be of superior genetic merit for this trait.

It was the purpose of this study to obtain measures of the effects of certain environmental factors on the rate of gain from birth to market weight and also estimate the differences in the rate of lamb growth due to sire after adjustments were made for these factors.

The sources of variation studied were:

1. Breed of dam
2. Sex (wether or ewe lamb)
3. Type of rearing (single or twin)
4. Birth weight
5. Sire differences after adjustment for these other factors were made.

### Experimental Procedure

The lambs used in this experiment were born in the late falls of 1956 and 1957. These were the second and third lamb crops produced by the dams of these lambs, which were western ewes (Rambouillet and  $\frac{1}{4}$  Panama— $\frac{3}{4}$  Rambouillet) purchased during the spring of 1955 in the Del Rio, Texas area. All the lambs were sired by Dorset rams purchased from purebred breeders in Oklahoma.

The lambs were ear tagged at birth and the ewe's number was paint branded on the lamb's back to make identification easier. When the lambs were approximately one week old the ewes and lambs were moved to a wheat pasture area where both had access to pasture. The lambs were creep fed a free choice mixture of two parts cracked sorghum grain and one part chopped good quality alfalfa hay. Individual weighing of the lambs began in December, when the older lambs were about two months old, and continued throughout the season at two week intervals.

Two separate analyses of the data collected during these two seasons were made. The 1956-57 lamb crop data were used to estimate the effect of breed of dam, sex, rearing type, and birth weight on the rate of gain of a lamb from birth to approximately 50 pounds, which occurred when the lambs were about 55 to 95 days old. In the second analysis the 1956-57 and 1957-58 lamb crop data were combined, and the effects of the factors mentioned above plus the effect of sire on the rate of gain of the lambs from approximately 50 pounds to market weight of about 90 to 92 pounds were studied. This market weight occurred when the lambs were about 130 to 175 days old. Twelve sires were used in these two years.

There were 181 lambs available for use in the first phase of the study which covered lamb growth from birth to approximately 50 pounds, and 330 lambs available for the second phase of the study which covered the growth period from 50 to 90 pounds.

### Results and Discussion

The results obtained from the first phase of this study are presented in Table 1. This table contains the percent advantage each factor studied had on the average daily gain of the lambs used from birth to 50 pounds and from 50 pounds to market weight of 90 to 92 pounds. Each figure may be interpreted as the percentage change in rate of gain due to this particular factor when the other factors are not changed. These values were calculated as a percent of the unadjusted average daily gain of all lambs used in both phases of this study. With the exceptions of birth weight and breed of dam the factors studied were considered to be non-genetic or non-hereditary as to their effect on lamb growth rate.

Further examination of Table 1 indicates that in the first phase of the study lambs from the Panama—Rambouillet ewes gained 0.2 per-

**Table 1.—The Percentage Effect of Breed of Dam, Sex, Rearing Type and Birth Weight on a Lamb's Rate of Gain from Birth to Approximately 50 Lbs. and from 50 Lbs. to Market Weight (90 to 92 Lbs.)**

Variable	Percent Advantage in Average Daily Gain	
	Birth to 50 lbs.	50 lbs. to Market Wt.
Breed of Dam (Panama X Ramb.-Ramb.)	0.2	1.0
Sex (Wether - Ewe)	6.6	5.8
Rearing Type (Single - Twin)	7.2	1.9
Birth Weight <sup>1</sup>	4.4	3.8

<sup>1</sup> Percent increase or decrease in average daily gain for each one pound above or below the average birth weight of all lambs, respectively.

cent faster than lambs from the Rambouillet ewes, wethers gained 6.6 percent faster than ewe lambs, and single reared lambs gained 7.2 percent faster than twin reared lambs. The advantage for birth weight means that each additional pound above the average birth weight of all lambs used (6.8 pounds) caused a 4.4 percent faster average daily gain to 50 pounds. Likewise, each pound below this average birth weight of 6.8 pounds caused a 4.4 percent decrease in average daily gain.

In the second phase of this study lambs from the crossbred ewes gained 1.0 percent faster than lambs from the Rambouillet ewes, wethers gained 5.8 percent faster than ewe lambs and single reared lambs gained 1.9 percent faster than twin reared lambs. Each additional pound above the average birth weight (7.9 pounds) of all lambs used caused a 3.8 percent faster average daily gain, and each pound below this average birth weight caused a 3.8 percent decrease in average daily gain from 50 to 90 pounds.

Breed of dam, which was estimated to be the difference between the  $\frac{1}{4}$  Panama-  $\frac{3}{4}$  Rambouillet and Rambouillet ewes, was found to have a small effect. Therefore, breed of dam has had little effect on the rate of gain of lambs in this particular flock.

Sex differences in rate of gain are considerably larger. The advantages of 6.6 percent and 5.8 percent for the two phases of this study are consistently in favor of the wether lambs. In terms of days to market weight the wethers will average reaching market weight about a week to ten days before the ewe lambs.

Differences in average daily gain of lambs due to type of rearing appeared to be very important during the early growth of a lamb (birth to 50 pounds) but decreased in magnitude of effect during the later growth period (50 to 90 pounds). The advantages of 7.2 percent and 1.9 percent are in favor of single reared lambs in both phases of this study. This indicates that even though ewes rearing twins give more total milk than ewes rearing singles, twin lambs do not receive

as much milk per lamb as singles. The difference in rate of gain between singles and twins decreased as the lambs grew older. This indicates that the twin lambs were gaining faster during later life after they had begun to eat sufficiently and were no longer completely dependent on the ewe's milk supply. There were a few lambs born as twins and reared as singles. The average daily gain of these lambs was below that of single lambs during the lamb's early growth period but tended to approach the rate of gain of singles as the lambs grew older.

Since the same ewes were bred each year it was not possible to obtain a direct estimate of age of dam or year effect on rate of gain. However, in a preliminary study based on the first two lamb crops (1955-56 and 1956-57) from these ewes, a difference in rate of gain from birth to 50 pounds between single and twin reared lambs of 16.1 percent was obtained during the early part of the first season. When this difference of 16.1 percent in 1955-56 was compared with the 7.2 percent difference between single and twin reared lambs in 1956-57, it appeared that the younger ewes (1½ years old at first lambing) were not sufficiently developed to do a good job of raising lambs, especially twins.

A breeder may make mistakes when culling less productive ewes and when selecting replacements if adjustments are not made for some of the known sources of variation considered in this study. Table 2 presents correction factors which may be applied when selection is made. These correction factors are applicable when lambs weigh approximately 50 and 90 pounds. They should not be used on lambs whose weight varies greatly from these values. Also selection of lambs after corrections have been made should be between lambs from dams of the same age, since age of dam has an influence on the lamb's rate of gain. Breed of dam was omitted because its effect was found to be negligible in this study. Also a breeder probably will make his selection within a breed since a common breed of ewe (western) is usually used in commercial lamb production in Oklahoma.

Ewes may be more accurately culled on the basis of their lamb's rate of gain to 50 pounds than to 90 pounds because milk producing ability of the ewe, which is the best criterion of her ability to raise a lamb, manifests itself more in the young lamb. The correction factors in Table 2 indicate that approximately four pounds should be added to a ewe lamb's weight and five pounds to a twin reared lamb's weight when selection is made at approximately 50 pounds, which occurs at 75 days of age on the average. Also, if birth weights are available, their average can be computed and two pounds should be added to the lamb's weight for each one pound that his birth weight was below the average. Likewise, two pounds should be subtracted from his weight for each one pound that his birth weight was above the average. When the weights of all lambs in the flock are corrected by this system, the rate of gain can be computed, and a more correct basis for culling the less productive ewes is established.

The percentage figures in Table 1 were combined to enable correction factors to be interpolated for use in selecting lambs at approxi-

mately 90 pounds body weight. These correction factors are also contained in Table 2. These factors indicate that approximately 6 pounds should be added to a ewe lamb's weight and 7 pounds to a twin reared lamb's weight when selection is made at about 90 pounds. Also, three pounds should be added or subtracted for each one pound the lamb's birth weight was below or above the average birth weight of all lambs in the flock.

**Table 2.—Correction Factors to be Used When Adjusting Lamb Weights to a Standard at Approximately 50 and 90 Pounds Body Weight.<sup>1</sup>**

Variable	Pounds to Add to Adjust to a Standard Body Weight	
	50 Pounds	90 Pounds
Sex		
Female	4	6
Rearing Type		
Twin	5	7
Birth Weight		
Each 1 lb. below ave.	+2	+3
Each 1 lb. above ave.	-2	-3

<sup>1</sup> Recommended for use on lambs from two-year-old and older ewes.

The sex correction from Table 2 is useful only when one is evaluating lambs or groups of lambs of different sexes. When a breeder is selecting ewe lambs for replacements the sex correction does not apply. However, the rearing type and birth weight corrections may be used to correct ewe lamb weights when selection is made at approximately 90 pounds. This weight occurs when the lambs are around 150 days old. If birth dates of the lambs are known approximately, then the rate of gain from birth to the corrected weight may be computed fairly accurately. *This system of selection tends to select replacements from ewes that gave the most milk, and replacements that have the greatest ability to gain. Therefore, selection for both milk producing and gaining ability occurs.*

If a breeder is interested in selecting for gaining ability only, the rate of gain from approximately 50 to 90 pounds should be chiefly considered. This period of gain occurs after the ewe's milk production has decreased greatly and when the lamb's own ability to gain should be manifest.

Table 3 presents a portion of the results obtained from the second phase of this study in which the average daily gain of lambs from 50 to 90 pounds sired by twelve different rams was determined. All investigated factors other than sire which contribute to variations in lamb gain were removed so that sire effect would not be overshadowed by other variable factors.

Table 3.—Corrected Average Daily Gain of Lambs from Twelve Sires.

Sire Number	Average Daily Gain of Lambs by Sire
6	.57
11	.57
4	.54
2	.53
5	.53
8	.53
9	.52
12	.52
1	.51
10	.50
3	.49
7	.48

It can be noted from Table 3 that the fastest gaining lambs were sired by sires 6 and 11. Their lambs gained 0.57 pounds per day. The slowest gaining lambs were sired by sire number 7. His lambs gained 0.48 pounds per day. When the total difference in average daily gain between sires 6 and 11 and sire 7 was computed the difference was 0.09 ( $0.57 - 0.48$ ) between the fastest gaining and slowest gaining lambs by sire. Therefore, lambs from the superior sires gained about 19 percent faster than lambs from the inferior sire ( $0.09 \div 0.48 = .19$ ). It required approximately 75 to 80 days for these lambs to grow from about 50 pounds when selected to approximately 90 pounds when marketed. In this period of 75 to 80 days the lambs from the two superior sires (sires 6 and 11) weighed approximately 6.7 to 7.2 pounds more than the lambs from the inferior sire (sire 7). This indicates that the lambs from the two superior sires would reach market weight about two weeks sooner than lambs from sire 7.

Further investigations into this part of the study revealed that the hereditary effect contributes about 30 percent of the total variation in average daily gain of lambs from 50 to 90 pounds, when the previously discussed factors of breed of dam, sex, rearing type and birth weight are ignored. However, these factors, other than possibly birth weight, are not due to heredity. Hence, when a correction was made for the effects of these factors the variation due to heredity increased to about 44% of the remaining variation in lamb growth rate from 50 to 90 pounds.

This information indicates that heredity is of considerable importance in the rate of gain of a lamb from 50 to 90 pounds which occurs after the dam's milk flow decreases.

### 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.