

---

---

UNIVERSITY OF THE STATE OF MISSOURI.

COLLEGE OF AGRICULTURE AND MECHANIC ARTS,

Agricultural Experiment Station

BULLETIN NO. 53.

**Breeding Experiments With Sheep.**

- I. Some Factors Influencing the Weight  
of Lambs, at Birth.**
- II. Milk and Food Records of Ewes.**

COLUMBIA, MISSOURI.

November, 1901.

---

---

Press of E. W. Stephens, Columbia, Missouri.



University of the State of Missouri.

---

COLLEGE OF AGRICULTURE AND MECHANIC ARTS.

# Agricultural Experiment Station.

---

## BOARD OF CONTROL.

THE CURATORS OF THE UNIVERSITY OF THE STATE OF MISSOURI.

---

### THE EXECUTIVE COMMITTEE OF THE BOARD OF CURATORS.

HON. CAMPBELL WELLS,  
Platte City.

HON. G. F. GMELICH,  
Boonville.

HON. WALTER WILLIAMS,  
Columbia.

---

### ADVISORY COUNCIL.

THE MISSOURI STATE BOARD OF AGRICULTURE.

---

## OFFICERS OF THE STATION.

### THE PRESIDENT OF THE UNIVERSITY.

H. J. WATERS, B. S. A.....	DIRECTOR
PAUL SCHWEITZER, Ph. D.....	CHEMIST
J. C. WHITTEN, M. S.....	HORTICULTURIST
J. M. STEDMAN, B. S.....	ENTOMOLOGIST
J. W. CONNAWAY, M. D. C.....	VETERINARIAN
C. THOM, Ph. D.....	BOTANIST
T. I. MAIRS, M. S.....	ASSISTANT IN AGRICULTURE
N. O. BOOTH, B. S.....	ASSISTANT IN HORTICULTURE
A. E. HACKETT.....	METEOROLOGIST
JOHN SCHNABEL.....	GARDENER
J. G. BABB, A. B.....	SECRETARY
R. B. PRICE.....	TREASURER
C. L. WILLOUGHBY, B. Agr.....	CLERK AND STENOGRAPHER

---

The Bulletins and Reports of the Station will be mailed free to any citizen of Missouri upon request. A cordial invitation is extended to all persons to visit the Station grounds at any time. Address, Director Agricultural Experiment Station, Columbia, Boone County, Missouri.

# Breeding Experiments With Sheep.

---

By FREDERICK B. MUMFORD, Professor of Agriculture.

---

## I. SOME FACTORS INFLUENCING THE WEIGHT OF LAMBS AT BIRTH.

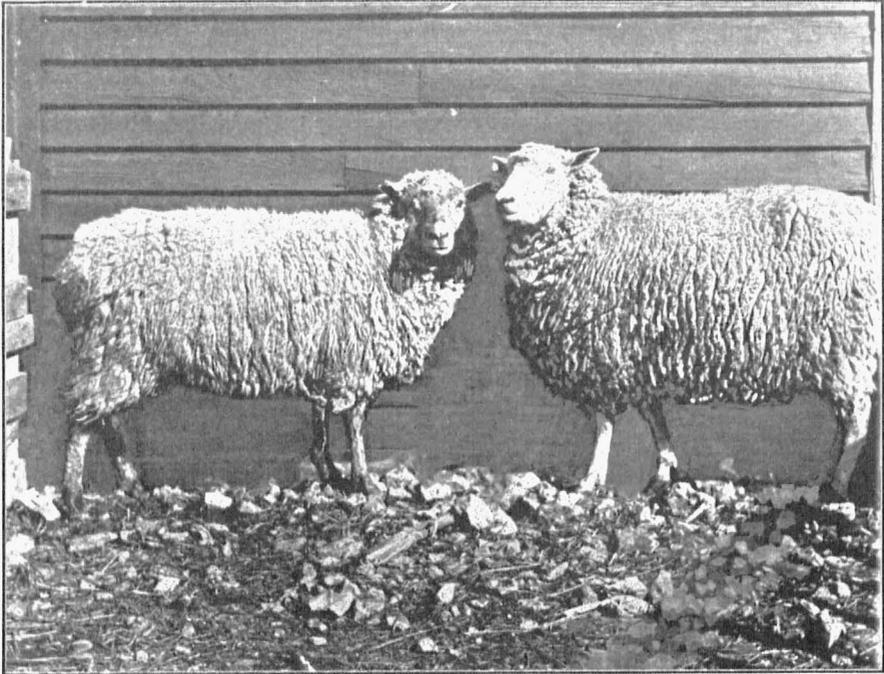
### SUMMARY OF RESULTS.

The results of these observations seem to point to the following conclusions:

1. The birth weight of lambs is largely or entirely controlled by the mothers.
2. The lambs having the heaviest birth weights were from the heaviest ewes. The birth weights of the lambs and the weights of their dams seem to be closely related and vary together.
3. Neither the breed nor the size of the rams used, were determining factors in fixing the birth weight of the lambs.
4. Male lambs were sixteen per cent heavier at birth than female lambs.
5. The male lambs made a slightly better gain for an average period of seven weeks after birth, the extent of our observations, than did the female lambs.
6. The average birth weight of twin lambs was only one-half pound below the general average.
7. The gains of the lambs for an average period of seven weeks, the extent of our observations, after birth were decidedly in favor of the lambs having a heavy birth weight.

## DETAILS OF THE EXPERIMENT.

The conditions which determine the birth weight of animals are not well understood and investigators seem to have paid little attention to this class of facts. The birth weight of lambs in many cases seems to be closely associated with the subsequent growth and development of the young animal



**Fig. 1. Native Ewes of Mixed Breeding, Comprising the Breeding Flock used in this Experiment.**

and in general it may be said that a comparatively heavy birth weight is desirable. Within certain limits not yet well defined, this is probably true of other domestic animals. There is undoubtedly a normal birth weight which is fairly

uniform for all healthy animals of a given size and breed. It is also true that this birth weight may be greatly influenced by the conditions surrounding the mother.

The nutrition of the embryo which will be largely dependent upon the condition of the mother during pregnancy will be a determining factor in the birth weight. It is also possible that the condition of the mother just before conception will influence the nutrition of the embryo and consequently the birth weight of the young. Other influences which seem to have a direct connection with the birth weight are the sex of the young, the size of the mother, the number of young at a birth and possibly cross-breeding.

The facts here recorded are based upon observations made during a continuous period of four years. The ewes comprising the breeding flock were natives of mixed breeding. They were purchased in the vicinity of the Experiment Station for the purpose of determining the value of pure bred rams of several breeds in establishing grade flocks. These ewes showed some evidences of Shropshire and Cotswold crosses. Taken together the flock was decidedly common. The animals illustrated in figure 1 are fairly representative of the breeding flock. They were bred to pure bred registered rams of the Hampshire, Shropshire and Delaine Merino breeds. The flocks bred to the rams of different breeds were cared for under the same conditions throughout the experiment. The records kept included a statement of the date of birth, the breed of the ram, the birth weight, the sex of the lamb and the gains made for a period of six to nine weeks after birth and before weaning. Each ram served annually a flock of ten or twelve ewes. The general condition of the flock throughout the experiment was below rather than above desirable breeding form.

The average birth weight of the lambs of all breeds and sexes was 7.7 pounds. In the general averages and elsewhere all lambs born dead were eliminated from the calculations. It is, however, interesting to note that in nearly every case

still born lambs were much smaller than the average. In no case were lambs born dead, weighing as much as 8 pounds.

#### BIRTH WEIGHT OF HALF BLOOD LAMBS.

It is quite generally believed that the breeding of ewes of the small breeds to rams of the larger breeds is attended with some risk. It is claimed that such crosses are likely to result in producing a lamb too large to be readily expelled from the generative organs of the mother. Whether the difficulty arises from the lambs being too large at birth or from any other cause, there seems to be little doubt that trouble of this kind sometimes results from breeding small or immature ewes to large rams.

In order to carefully study this matter and find out if possible a probable explanation, the data recorded in Table I. were arranged to show the relation of the breed of the ram to the birth weight of the lambs.

TABLE I.—BIRTH WEIGHT OF HALF BLOOD LAMBS.  
NATIVE EWES. PURE BRED RAMS.

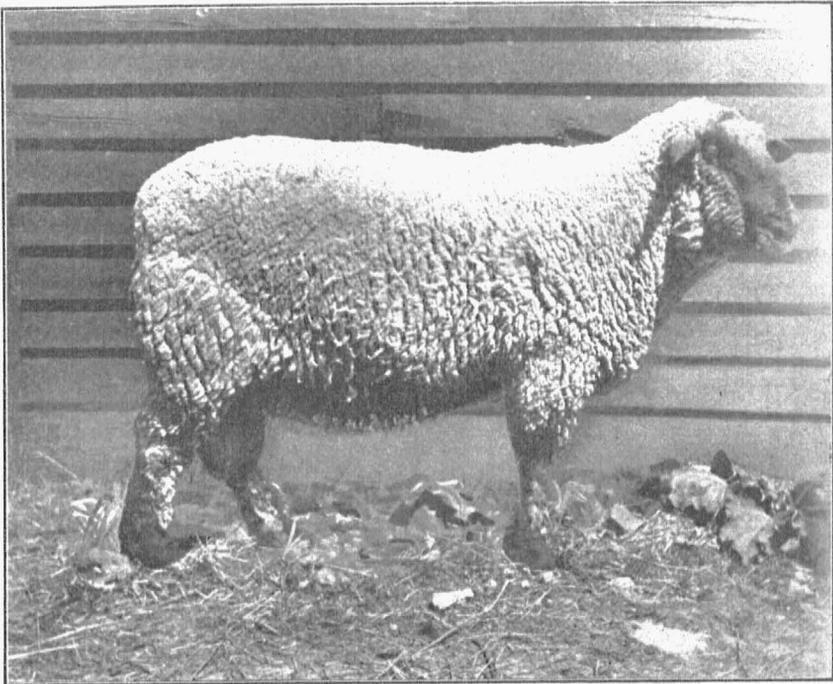
Year.	Number of Lambs.	Breed of Ram.	Birth Weight of Lambs.
1898	11	Hampshire.	8 54 pounds.
1899	8	Hampshire.	7.91 pounds.
1900	10	Hampshire.	7.41 pounds.
1901	12	Hampshire.	7.48 pounds.
1898	7	Shropshire.	9.78 pounds.
1899	10	Shropshire.	8.00 pounds.
1900	8	Shropshire.	7.94 pounds.
1901	8	Shropshire.	7.93 pounds.
1898	6	Merino.	8.75 pounds.
1899	9	Merino.	7.99 pounds.
1900	10	Merino.	7.53 pounds.
1901	11	Merino.	7.55 pounds.

Birth weight of 41 half blood Hampshire lambs 7.83 pounds.

Birth weight of 33 half blood Shropshire lambs 8.41 pounds.

Birth weight of 36 half blood Merino lambs 7.70.

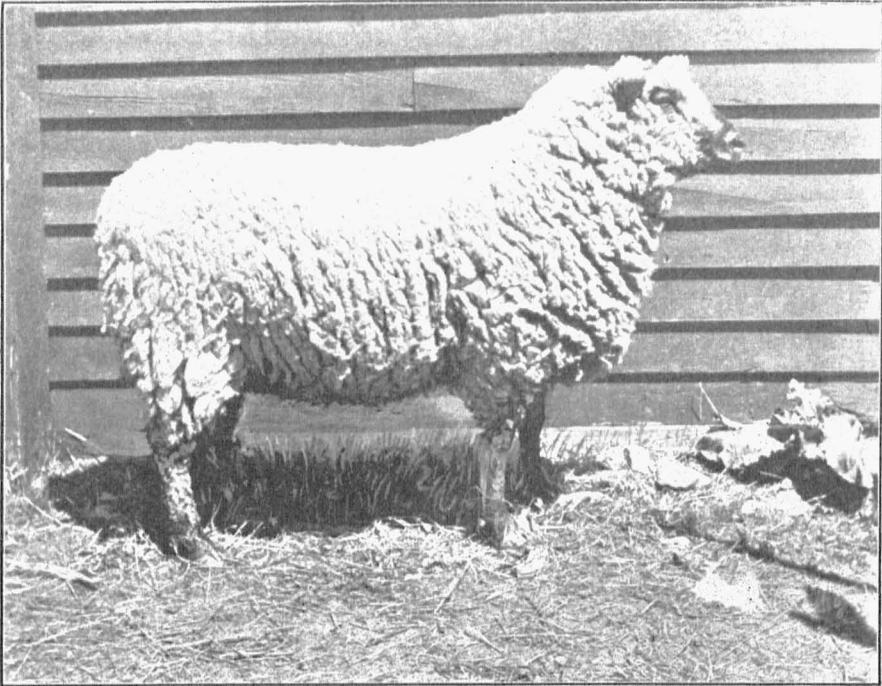
A study of Table I. will at once suggest the fact that in this experiment the breed of the ram has little or nothing to do with the weight of the lamb at birth. The highest average birth weight was recorded for the Shropshires in 1898, the second highest for the Merinos in 1898 and the third highest for the Hampshire also in 1898. The lowest average birth



**Fig. II. Hampshire Ram, Weight, 225 lbs. Sire of Lambs born in 1900 and 1901.**

weight was 7.41 pounds for the Hampshires in 1900, but this is only slightly below the lowest recorded for the Merino and Shropshire. The weights of the rams used were in some cases above the average for the breed and others below the recognized standard for mature rams. Of the breeds used in this

experiment the Hampshire is considerably larger than the Shropshire, and the Shropshire again is considerably larger than the Merino. If the ram is responsible in any degree for the weight at birth, then we should expect the half blood Hampshire lambs to be the heaviest. For the same reason the Merino lambs should be lightest, but as shown in Table I.



**Fig. III. Shropshire Ram, Weight, 140 lbs. Sire of Lambs born in 1900 and 1901.**

the Shropshires were the heaviest and the lambs from the heaviest breed, the Hampshires, and from the lightest breed, the Merinos, had practically the same weight at birth.

The results seem to point to the conclusion that there is little difference in the birth weight of lambs from rams of the

different breeds provided the ewes are of similar size and breeding. But as explained above the rams used in this experiment were not typical, as regards size, of the breeds. The Hampshire ram used during the years 1898 and 1899 weighed 145 pounds. The Hampshire ram used in 1900 and 1901 weighed 225 pounds. The Shropshire employed during the first two years weighed 250 pounds, while the Shropshire ram used during the last two years weighed only 140 pounds. So great a disparity between the weight of the individual and the standard for the breed might have a specific effect upon the birth weight of lambs.

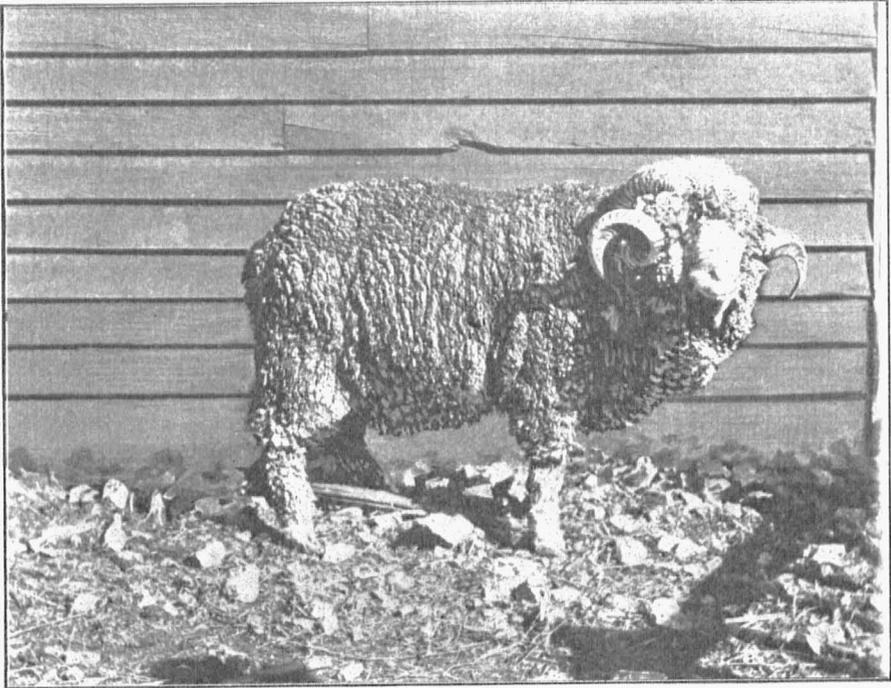
It becomes necessary then to study the relation of the weight of the ram to the birth weight of the lambs. This is done in Table II.

TABLE II.—RELATION OF WEIGHT OF RAM TO BIRTH WEIGHT OF LAMBS.

Breed.	Weight of Ram. Pounds.	No. of Lambs.	Birth Weight of Lamb. Pounds.		Average 2 years.
			1898	1899	
Shropshire.....	250	17	9.78	8.	8.89
Hampshire.....	145	19	8.54	7.91	8.22
Merino.....	140	15	8.75	7.99	8.37
			1900	1901	
Shropshire.....	140	16	7.94	7.93	7.93
Hampshire.....	225	22	7.41	7.48	7.45
Merino.....	145	21	7.53	7.55	7.54

The results recorded in Table II. are very interesting. There seems to be no definite relation whatever between the birth weight of the lamb and the weight of the rams. The average weight of the two heaviest rams; the Shropshire used in 1898-9 and the Hampshire used in 1900-1 was 237 pounds. The average birth weight of 29 lambs sired by these rams was 8.16 pounds. The average weight of the four light-

est rams was 142 pounds. The average birth weight of 71 lambs from these rams was 8.02 pounds. The differences observed may easily be within the limits of error and from these experiments the conclusion seems justified that the size of the ram is not a controlling factor in determining the size and weight of lambs at birth. This conclusion refers only to the



**Fig. IV. Merino Ram, Weight, 145 lbs. Sire of Lambs born in 1898 and 1899.**

cult parturition. The later development of the lamb is of birth weight and does not necessarily imply that the lamb may not inherit certain skeletal or other characters from the ram. It may be, as sometimes claimed, that the heads of lambs from large rams of the mutton breeds and small ewes,

are so large as to materially increase the dangers from difficulty influenced by the size and other valuable qualities of the ram.

RELATION OF THE WEIGHT OF THE MOTHER TO THE BIRTH  
WEIGHT OF LAMBS.

It would seem that the size of the mother and her nutritive condition must have an important relation to the size and weight of the young at birth. It is highly important that the mother should possess a controlling influence in determining birth weight, otherwise disastrous results might universally follow the mating of small females and large males. If the male has a controlling or even an equal share in the determination of the birth weight then it must follow that the mating of small females with large males is attended with some risk.

The facts already recorded indicate that in this experiment neither the size nor the breed of the ram are important in fixing the weight of the lamb at birth.

Does then the size or the nutritive condition of the mother influence the birth weight of her offspring? This experiment gives us no data for studying the nutritive condition of the mother, if, indeed, it is possible to secure reliable facts about a condition which involves so many factors beyond our control, and beyond our power to accurately measure. The relation of the size of the mother, however, may be easily studied. The weights of all ewes were taken December 30, 1899, and all the conclusions drawn here are based upon this weighing. The facts include the study of 53 single lambs and 38 twin lambs. The table (III.) is arranged to show the relation between the size or weight of the dams and the birth weight of the lambs. When the data are arranged so that the birth weight of the lambs may be compared with the weight of the dams the following facts seem to be established:

TABLE III.—RELATION OF WEIGHT OF DAM TO BIRTH WEIGHT OF LAMB.

Weight of Dams.	Number of Single Lambs.	Average Birth Weight of Single Lambs.	Number of Twin Lambs.	Average Birth Weight of Twin Lambs.	Average Birth Weight of All Lambs.
Below 90 lbs. ....	8	7.2 lbs.	0	0	7.2 lbs.
90 to 100 lbs. ....	6	7.4 lbs.	0	0	7.4 lbs.
100 to 110 lbs. ....	14	8.6 lbs.	8	6.4 lbs.	7.5 lbs.
110 to 120 lbs. ....	12	8.7 lbs.	20	7.2 lbs.	7.9 lbs.
120 to 130 lbs. ....	13	8.9 lbs.	10	7.6 lbs.	8.3 lbs.

1. The heavier the ewe the greater the birth weight of the lamb.

2. The birth weight seems to increase with considerable uniformity and in direct relation to the increased size of the dam.

We must conclude from the exhibit here made, comprising the results of 61 births, that the weight of the mother has a direct influence upon the birth weight of the offspring and that in general the lambs having a heavier weight at birth are produced from the larger ewes.

#### SEX OF LAMBS AS INFLUENCING BIRTH WEIGHT.

The sex of all lambs was recorded for three years. During this period 93 lambs were born. The average birth weights are shown in Table IV.:

TABLE IV. RELATION OF SEX TO BIRTH WEIGHT OF LAMBS.

Sex of Lambs.	Number of Lambs.	Average Birth Weight. Lbs.
Both sexes ...	93	7.62
Males ...	53	8.10
Females ...	40	6.98

It will be seen from the above table that the male lambs averaged 1.12 pounds or 16 per cent heavier than the female lambs. In Table VII. it is shown that a comparatively heavy birth weight is usually indicative of better thrift and the ability to gain more rapidly. If this be true and the male lambs are uniformly heavier at birth it must follow that male lambs are more desirable feeders.

It is generally believed by sheep feeders that wether lambs make better gains and are generally more desirable feeders than ewe lambs. The difference, if any exists, is probably small, but there is very little published work along this line. In this experiment there seems to be little foundation for this general opinion among sheep feeders.

In order to compare directly the birth weight of male and female lambs in relation to subsequent growth the table below (V.) was prepared:

TABLE V.—RELATION OF SEX OF LAMB TO LATER GROWTH.

Sex.	Number of Lambs.	Average Birth Weight.	Length of Feeding Period.	Average Weekly Gain.
Male . . . . .	23	8.6 lbs.	7.5 weeks	4.01 lbs.
Female. . . . .	23	7.9 lbs.	6.8 weeks	3.97 lbs.

The small number of lambs compared in this exhibit is due to the fact that the records do not include a history of the growth after birth except in the years 1899 and 1900. From the table it appears that the male lambs may possess some slight advantage over the females. The growth of the male lambs was slightly greater than the females but this advantage is too small to be seriously considered. It may be that the later growth would show a more marked difference in favor of the male lambs, but in this experiment we must conclude that the female lambs grow as rapidly as male lambs for the first six or seven weeks after birth.

BIRTH WEIGHT OF TWIN LAMBS COMPARED WITH SINGLE LAMBS.

The twin lambs in an ordinary flock are usually smaller than single lambs. Whether the smaller size is due primarily to the lack of proper nutrition after birth or to a small size at birth or to both these conditions has not been clearly determined. It would seem from Table VI. that the twin lambs are usually somewhat smaller at birth but this difference is less than is usually supposed.

TABLE VI.—BIRTH WEIGHT OF TWIN LAMBS, COMPARED WITH SINGLE LAMBS.

Description of Lambs.	Number of Cases Observed.	Average Birth Weight Lbs.
All lambs.....	117	7.7
Single lambs (both sexes).....	57	7.8
Single male lambs.....	33	8.11
Single female lambs.....	24	7.34
Twin lambs (both sexes).....	38	7.07
Twin male lambs.....	17	7.45
Twin female lambs.....	21	6.53

These results seem to point to the fact that the average birth weight of twin lambs is but slightly below the general average. The birth weight of the twin male lambs is greater than the birth weight of the single female lambs. The average birth weight of all twin born lambs is about one-half a pound below the general average for all lambs. The single female lambs weighed at birth only eight-tenths of a pound more than the twin born females. The smaller size of twin lambs observed in most flocks is undoubtedly more the result of insufficient nutrition while suckling than it is the inferior size at birth. Very few ewes yield sufficient milk to properly nourish two thrifty, early maturing, lambs. If such lambs are early taught to eat grain and hay, the twin lambs will in most

cases thrive equally as well as the single lambs of the same birth weight.

With a little attention lambs may be taught to eat at a very early age and grain fed at this time, while the lamb is suckling, will produce larger gains than at any later time. If the twin lambs begin early to supplement the milk of the mother by eating corn, oats, clover hay and possibly a little oil meal, they will thrive and in the end become as thrifty as single lambs. A flock of ewes that has been bred for the production of twins may thus become considerably more profitable than a flock producing single lambs only. On the other hand, if the breeder fails to supply the extra feed and care necessary for the twin lambs it may be, as often stated, that one good single lamb is better than two puny twins.

#### RELATION OF BIRTH WEIGHT TO LATER GROWTH.

Is it desirable that lambs should have a comparatively heavy birth weight? Will lambs that possess a heavy birth weight grow and develop faster than lighter lambs? The records of the growth after birth for periods of six to nine weeks have been tabulated to show the relation, if any, existing between the birth weight and subsequent growth.

TABLE VII.—RELATION OF BIRTH WEIGHT TO SUBSEQUENT GROWTH.

Birth Weight of Lambs.	Number of Lambs.	Average Length of Feeding Period. Weeks.	Average Weekly Gain Including Birth Weight Lbs.	Average Weekly Gain Excluding Birth Weight Lbs.
10 lbs. and above..	7	8.55	5.4	4.5
9 to 10 lbs. ....	8	6.05	5.5	4.2
8 to 9 lbs. ....	14	7.33	3.7	2.5
7 to 8 lbs. ....	13	9.03	3.4	2.3
Below 7 lbs. ....	6	7.05	2.62	1.7

Table VII. shows that in this experiment lambs possessing a heavy birth weight made better average weekly gains

than the lighter lambs. The lambs weighing at birth nine pounds and above gained two pounds weekly per head more than those having a birth weight under eight and over seven pounds. These figures are of the greatest significance as indicating that we can profitably pay more attention to the development of the unborn lamb. All those conditions which tend to increase the birth weight of the lamb are directly useful in promoting its later growth. The one condition under our control is the nutrition of the mother at the time of breeding and during pregnancy. The practice of turning ewes on fresh, nutritious pastures two weeks before mating with the ram has been employed by the best shepherds for a very long period. This practice is undoubtedly founded upon a rational scientific basis and should be extended. During pregnancy the ewe should receive a nutritious ration made up largely of muscle making and bone building foods. An exclusive ration of corn, although generous in quantity, may utterly fail to properly nourish the unborn lamb. Corn should be supplemented with clover hay, cowpea hay, alfalfa, soybeans, linseed meal, bran or other foods supplying the nutrients which are deficient in corn.

#### RELATION OF CROSS-BREEDING AND GRADING TO THE BIRTH WEIGHT OF LAMBS.

Incidentally some facts based on the results of cross-breeding and grading on the birth weight of lambs were recorded. The data secured are too limited to warrant any conclusions but it seems desirable to place them on record in connection with the other results.

The half blood ewe lambs of all the breeds were saved and bred to pure bred rams of their respective breeds. The three-quarter blood lambs resulting from this mating were weighed at birth. The average birth weights of these lambs are compared in Table VIII. with the birth weights of the half-blood lambs also from pure bred rams.

TABLE VIII.—RELATION OF CROSSING AND GRADING TO BIRTH WEIGHT OF LAMBS.

Description of Lamb.	Number of Lambs.	Average Birth Weight.	Difference in Favor of Half Blood Lambs.
		Lbs.	Lbs.
Half Blood Shropshire..	33	8.41	
Three Quarter Shropshire	6	7.40	1
Half Blood Hampshire..	41	7.83	
ThreeQuarter Hampshire	12	7.19	.64
Half Blood Merino.. . . .	36	7.70	
Three Quarter Merino...	3	5.2	2.50

The figures show a decided advantage in favor of the half-blood lambs. Whether this greater birth weight of the half-blood lambs is due to the effect of crossing or other conditions, is not easy to determine. If the birth weight of the lamb is not influenced to any considerable extent by the male, as seems probable from Tables I. and II., it is hard to see how cross-breeding can affect the birth weight. On the other hand it has been shown that the weight of the mother is a factor in determining the birth weight. While we do not have sufficient data to study the influence of the size of the dam in connection with crossing, enough facts are available to suggest that the difference here observed is not so much due to crossing as to the greater weight of the ewes. The half-blood ewes were considerably lighter in weight than the average of the original flock. These half-blood ewes were also younger and later experiments may show that the lambs from young ewes are lighter than from older ones.

## II. MILK YIELD OF EWES.

In connection with some experiments undertaken by the Department of Entomology, it became necessary to milk a few ewes. It was considered desirable to keep a careful record of the milk yield, and determine the composition of ewe's milk as produced under conditions existing here.



**Fig. V. Grade Cotswold Ewe, No. 34. Total yield 15 weeks, 285 pounds milk.**

A careful record of the daily yield was kept for five ewes. At first these ewes were milked four times daily, later three times and toward the end of the period only twice daily. The five ewes selected for this record were the heaviest milk-

ers in the flock consequently it may be inferred that the average lamb from a ewe like those in this experiment receives considerably less milk daily than the average yield recorded for these ewes. The ewes were fed on alfalfa and clover hay and corn. Fat determinations were made at intervals with the Babcock test. Some variation was observed in the fat content. Several samples were analyzed by the chemist whose report will be found on page 23 of this bulletin.

The ewes selected for this experiment were natives of mixed breeding. The accompanying illustrations indicate the general character of these ewes. In ewe No. 34 Cotswold blood predominated while ewes 32 and 35 were probably about three-quarter blood Shropshires.

AVERAGE WEEKLY MILK YIELD FROM EWES.

Week Ending.	EAR TAG NUMBER OF EWES.				
	30	32	33	34	35
1903	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
February 23. . . . .	19.09	. . . . .	14.87	28.12	. . . . .
March 2. . . . .	20.81	16.34	15.09	28.18	5.71
March 9. . . . .	16.75	22.21	14.59	26.84	21.03
March 16. . . . .	14.43	17.90	11.68	22.78	15.46
March 23. . . . .	16.81	18.46	15.31	22.28	16.46
March 30. . . . .	16.34	16.09	11.18	19.34	14.65
April 6. . . . .	13.50	12.03	10.65	16.28	12.71
April 13. . . . .	13.00	10.12	10.96	16.78	14.90
April 20. . . . .	12.01	10.60	11.10	14.00	14.20
April 27. . . . .	15.20	13.40	14.20	17.00	14.50
May 4. . . . .	13.50	13.90	14.9	15.2	13.3
May 11. . . . .	13.7	12.6	14.9	14.8	13.2
May 18. . . . .	16.9	16.3	15.4	16.2	13.6
May 25. . . . .	15.0	16.7	13.6	13.0	12.3
June 1. . . . .	15.4	16.5	15.0	14.2	12.8
Total . . . . .	232.44	213.15	203.43	285.00	194.82
Average weekly . . . . .	15.5	15.2	13.56	19.0	13.9

## AVERAGE DAILY MILK YIELD FROM EWES.

Week Ending.	EAR TAG NUMBER OF EWES.				
	30	32	33	34	35
1902	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
February 23. ....	2.72	.....	2.12	4.01	.....
March 2. ....	2.97	2.72	2.15	4.02	1.90
March 9. ....	2.39	3.17	2.08	3.83	3.00
March 16. ....	1.87	2.55	1.66	3.25	2.20
March 23. ....	2.40	2.65	2.18	3.18	2.35
March 30. ....	2.33	2.30	1.68	2.85	2.09
April 6. ....	1.92	1.71	1.52	2.32	1.81
April 13. ....	1.85	1.44	1.56	2.39	2.13
April 20. ....	1.70	1.50	1.60	2.00	2.00
April 27. ....	2.10	1.90	2.00	2.40	2.00
May 4. ....	1.90	1.9	2.1	2.1	1.9
May 11. ....	2.00	1.8	2.1	2.1	1.9
May 18. ....	2.40	2.3	2.2	2.3	2.9
May 25. ....	2.20	2.3	2.0	1.8	1.7
June 1. ....	2.20	2.3	2.1	2.0	1.8
Average. ....	2.19	2.18	1.94	2.70	2.06

The average daily milk yield varied from 1.85 pounds, the production of ewe 33, to 3.02 pounds, the yield of ewe 34. The largest yield is equivalent to a production of 26.1 pounds daily for 1,000 pounds live weight. This compares favorably with the cow in total milk yield. The analyses show that ewe's milk may often contain 19 per cent of total solids. It will be seen, therefore, that the ewe may produce a relatively large amount of dry matter. A cow producing at the same rate per 1,000 pounds live weight would produce daily 38.1 pounds milk. But this yield is far above the average for the dairy cows of this country. It is true that the period of lactation in the ewe is relatively short but it is also true that this period might be greatly lengthened by the same methods which have increased the lactation period in cows.

## FEED RECORD OF MILCH EWES.

Three ewes were separated from the others and a careful individual record was kept for a period of one week of the food consumed by each, the yield of milk and the per cent of butter fat. This record was made during the week ending March 23, 1902:



**Fig. VI. Grade Shropshire Ewe, No. 32. Total yield, 14 weeks, 213 pounds milk.**

## SEVEN DAY'S RECORD OF FEED AND MILK YIELD.

Ewe.	Corn.	Clover Hay.	Milk Yield.	Per cent Butter Fat.	Weight of Ewe.
	Lbs.	Lbs.	Lbs.		Lbs.
No. 32 . . . . .	12.3	14.5	18.4	7.1	90
No. 34 . . . . .	12.0	18.5	22.3	6.9	115
No. 35 . . . . .	12.3	14.5	16.4	7.8	110

## FEED REQUIRED FOR PRODUCTION OF MILK AND BUTTER FAT.

No. of Ewe.	Grain for 1 pound Milk.	Roughage for 1 pound Milk.	Grain for 1 pound Fat.	Roughage for 1 pound Fat.	DryMatter* for 1 pound Milk.	DryMatter* for 1 pound Fat.
32	.68 lbs.	.79 lbs.	9.6 lbs.	11.2 lbs.	1.3 lbs.	18.0 lbs.
34	.54 lbs.	.82 lbs.	7.8 lbs.	12.0 lbs.	1.2 lbs.	17.1 lbs.
35	.77 lbs.	.90 lbs.	9.8 lbs.	11.5 lbs.	1.4 lbs.	18.6 lbs.

\*Average analyses from Bul., U. S. Dept. of Ag.

## GAIN OF LAMBS ON EWE'S AND COW'S MILK.

In the experiment mentioned above it became necessary to feed lambs on ewe's milk from a bottle, cow's milk from a bottle and still others were allowed to suckle their dams. The record of the gains made by these lambs is tabulated below:

## RECORD OF GROWTH OF LAMBS.

Feed of Lambs.	Number of Lambs.	Length of Period.	Total Gain.	Average Weekly Gain.	Average Weight at end.
Cows milk from bottle	4	77 days	118 lbs.	2.95 lbs.	44.3 lbs.
Cows milk from bottle	7	77 days	248 lbs.	3.22 lbs.	42.7 lbs.
Ewes milk from bottle	4	77 days	181 lbs.	4.11 lbs.	58.1 lbs.
Suckling Ewes . . . .	4	77 days	163 lbs.	3.70 lbs.	45.1 lbs.

It will be observed that the highest gains were made by the lambs receiving ewe's milk from a bottle. The greater gain of this lot over the lot allowed to suckle their dams is accounted for by the fact that the four lambs fed with a bot-

tle received the entire milk from eight ewes. The gains made on cow's milk were not large but were still satisfactory and indicate that lambs may be successfully reared on cow's milk alone.

The lambs receiving ewe's milk developed a more abundant yolk and this was of a uniform yellow color. The yolk in the fleeces of the lambs receiving cow's milk was not evenly distributed and was very light colored. This difference in the quality and quantity of the yolk was very noticeable and the greater oiliness of the fleeces of the lambs fed ewe's milk increased proportionally much faster than on the lambs fed cow's milk.

ANALYSES OF EWE'S MILK, MADE BY DR. SCHWEITZER.

	May 14. No. 34.	May 26.			June 3—No. 34.	
		No. 32.	No. 34.	No. 35.	Morning.	Evening.
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
Total Solids ..	19.968 20.016 19.952 19.968	16.79 17.38	17.47 18.23	17.78 18.30 18.29	16.07 15.88 15.94	17.22 17.08 17.12
Average .....	19.98	17.08	17.85	18.12	15.96	17.14
Protein . . . .	5.096 5.129	5.7			5.022 4.986	5.044 4.937
Average .....	5.11	5.22	5.31	4.79	5.00	4.99
Fat . . . . .	9.248 9.304					
Average .....	9.27	6.01	6.64	7.48	5.197	6.096
Ash . . . . .	0.890 0.899					
Average .....	0.89	0.87	0.93	0.81	0.822	0.855
Sugar (by difference)	4.688	4.98	4.77	5.04	4.922	5.145



Fig. VII. Grade Shropshire Ewe, No 35. Total yield, 14 weeks, 195 pounds milk.