

## EWE LAMB CONCEPTION AS AN INDICATOR OF FUTURE PRODUCTION IN FARM FLOCK COLUMBIA AND TARGHEE EWES<sup>1,2</sup>

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### SUMMARY

One-hundred-thirty-nine Columbia and Targhee ewes born during 1966 through 1970 were exposed to Cheviot or Dorset rams at 7 months of age and to rams of the same breed as the ewes in subsequent years. Records for the second, third and fourth production years and for cumulative second through fourth year production were analyzed. Independent variables were ability vs inability to lamb at 1 year of age, breed of ewe, birth year and all possible interactions. Dependent variables were number of lambs born and weaned, kilograms of lamb weaned and grease fleece weight. Analyses were run both on a per ewe present at lambing and on a per ewe entering the experiment basis. Attrition rates for ewes not lambing at 1 year of age were higher than for ewes which did lamb at 1 year of age, but differences between groups in specific causes of death or culling were not apparent. For cumulative production per ewe present at lambing, ewes able to lamb at 1 year of age produced 5.6 kg more lamb and .4 kg less wool than ewes unable to lamb at 1 year of age. For cumulative production per ewe entering the experiment, the early lambing group weaned .84 more lambs and 27.4 more kilograms of lamb than the later lambing group ( $P < .05$ ) and produced slightly more wool. How effectively the ability to lamb at 1 year of age predicted future production differed between breeds, however. Early lambing Columbias produced 48.9 more kilograms of lamb and 3.7 more kilograms of wool, while early lambing

Targhees produced only 5.9 more kilograms of lamb and 1.3 more kilograms of wool than later lambing Targhees.

(Key Words: Ewe Lambs, Reproduction, Columbia, Targhee, Estrus.)

### INTRODUCTION

Hulet *et al.* (1969a) and Hight and Jury (1976) found that ewes exhibiting estrus during their first autumn had higher subsequent reproduction than contemporaries which did not. Ch'ang and Rae (1972) reported positive phenotypic and genetic correlations between the number of hogget estruses (from weaning to 14 months of age) and subsequent lamb production. In this experiment, Columbia and Targhee ewes were exposed to rams at from 7 to 8 months of age. The objective was to determine whether ability to lamb at 1 year of age was predictive of subsequent reproduction, lamb production and wool production.

### MATERIALS AND METHODS

*Population and Management.* Data were taken from a larger study conducted at the Eastern Oregon Agricultural Research Center, Union, between 1966 and 1974. In that study, groups of straightbred Columbia and Targhee ewes, born from 1966 to 1970 during the spring lambing season, were allotted at random within breeds and birth years to two groups, one to be mated as lambs and the second to be mated as yearlings. For the experiment reported herein, data from the groups mated as yearlings are ignored. A total of 139 ewes was exposed to rams at about 7 months of age. Of these, 75 were Columbia, and 64 were Targhee. Sixty-seven percent of the Columbias and 58% of the Targhees lambed at 1 year of age (table 1).

All replacement ewes grazed irrigated fescue (I.R.N. 2 01 879)/Ladino clover (I.R.N. 1 01

<sup>1</sup>Technical Paper No. 4505, Oregon Agricultural Experiment Station.

<sup>2</sup>Contribution to North-Central Regional Project NC-111, Increased Efficiency of Lamb Production.

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TABLE 1. NUMBER OF EWES, PERCENT FERTILITY PER BREED AND BIRTH YEAR GROUP AND AVERAGE WEIGHT AT THE BEGINNING OF MATING

Birth year	Columbia			Targhee			Average weight (kg) <sup>b</sup>	
	No. of yes <sup>a</sup>	No. of no <sup>a</sup>	Per-cent fer-tility	No. of yes <sup>a</sup>	No. of no <sup>a</sup>	Per-cent fer-tility	Yes	No
1966	9	7	56	8	7	53	47.5	42.8
1967	9	2	82	5	6	46	45.9	45.5
1968	10	7	59	6	2	75	50.3	50.3
1969	8	4	67	10	7	60	55.7	54.2
1970	14	5	74	8	5	62	52.7	50.3
Total	50	25	67	37	27	58	50.5	48.4

<sup>a</sup>Yes and No denote ewes able to lamb at 1 year of age and ewes unable to lamb at 1 year of age, respectively.

<sup>b</sup>Average weight of ewe lambs at the beginning of mating their first autumn.

363) or orchardgrass (I.R.N. 2 03 443)/alfalfa (I.R.N. 2 00 181) pastures from weaning to November. During the winter, grass/legume hay was allowed *ad libitum*. Each year the ewe lambs were exposed to Border Cheviot or Dorset rams from September 20 to November 1. Matings in subsequent years were to rams from the same breed as the ewes (Columbia × Columbia and Targhee × Targhee), and the mating seasons ran from August 15 to November 1. All rams were fertility tested. The ewes were flock mated with a ratio of one ram per 25 ewes for all breeding groups. For most of the year, ewes and lambs were on dryland or irrigated pastures or on hay stubble. Supplemental hay and/or grain were fed during late gestation and early lactation. The population and physical and management environments are described in greater detail by Hohenboken *et al.* (1977). Production records were kept from 1967 through 1974. Because of the small number of ewes initially present per group (table 1) and subsequent death and culling, data were analyzed only for the second through fourth production years of each birth year group.

*Statistical Procedures.* Weaning weights were adjusted for sex (Scott, 1975) and to a common 90-day weaning age according to the formula:

(1) Age adjusted weaning weight = (Actual weaning weight - Birth weight) / Actual weaning age × 90 + Birth weight.

In each birth year group, attrition was higher for ewes that failed to conceive as lambs. For this reason, data were analyzed on two bases:

1) per ewe present at lambing, and 2) per ewe entering the experiment. The first analysis, per ewe present at lambing, examined variation in inherent future productivity of ewes lambing *vs* not lambing at 1 year of age. The second, per ewe entering the experiment, also took into account variation caused by difference in rate of attrition between the two groups. In the second analysis, once a ewe died or was culled from the experiment, zeros were entered for lamb and wool production from the subsequent years in which she was no longer present.

In each analysis, the total number of lambs born (dead plus alive), the number of lambs weaned, the kilograms of lamb weaned, and the kilograms of grease wool produced for the second, third, and fourth production years and for the cumulative production period were subjected to least squares analysis of variance (Harvey, 1960). The factorial model included fixed main effects for ability *vs* inability to lamb at 1 year of age, breed of ewe, and birth year, all two factor interactions, and the single three factor interaction. Ewes were mated in multiple sire flocks, so the effects of lamb sire could not be fitted. In both analyses, the first year's production for ewes that lambed at 1 year of age was ignored, because the object of the experiment was to determine whether the ability of ewes to lamb at 1 year of age was predictive of higher future productivity, independent of production the first year.

## RESULTS AND DISCUSSION

Attrition rates are plotted in figure 1. Data are pooled over birth years. Through 8 years of

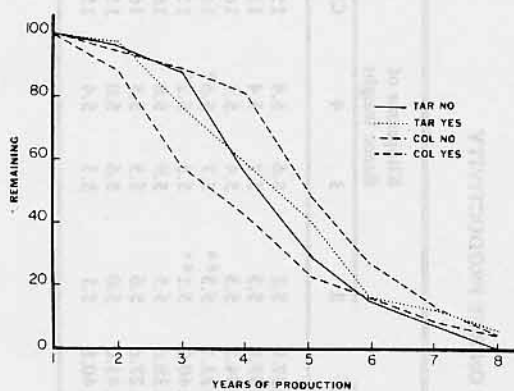


Figure 1. Percent of ewes remaining per breed  $\times$  ability (yes) vs inability (no) to lamb at 1 year of age subclass after each sequential year of production. Tar and Col stand for Targhee and Columbia, respectively. Data are pooled over birth year groups.

production, Columbia ewes which failed to lamb as ewe lambs left the flock from death or culling at a consistently higher rate than Columbias which did lamb. The difference was especially great through 4 production years, the time span examined in the current experiment. For Targhees, there was a tendency for higher attrition of ewes which failed to lamb at 1 year of age; but at the third production year attrition was lower for Targhee ewes which failed to lamb.

The reason for higher attrition among ewes which failed to conceive as ewe lambs is not known, since an examination of culling records did not reveal differences between groups in specific causes of death and culling. A possible explanation is that most of the ewe lambs who were unsound or disease susceptible may have failed to lamb at 1 year of age. If that were true, the experimental design would have placed ewes more likely to die or to be culled for unsoundness in the group that did not lamb at 1 year of age. The mean weights at the start of the breeding season of the two groups for each birth year are presented in table 1. Ewes which did lamb at 1 year of age were equal to or heavier than ewes which did not lamb for each birth year, ranging from 4.7 kg heavier for the 1966 group to equal weights for the 1968 group. The 1966 ewes also showed the most extreme difference in attrition rates in favor of ewes able to conceive. In support of this interpretation, Hulet *et al.* (1969a) documented the tendency for range ewe lambs not showing estrus their first fall to be culled slightly more

intensively in subsequent years than ewes which did exhibit estrus.

*Production per Ewe Present at Lambing.* With one exception, no significant differences were found in any of the production traits between ewes lambing vs not lambing at 1 year of age (table 2). The one exception was for kilograms of lamb weaned during the fourth year of production, when early lambing ewes weaned 13.6 more kilograms of lamb than the later lambing group ( $P < .05$ ). Cumulative differences the second through fourth production years were not significant, however.

Ewes lambing at 1 year of age bore .18 fewer lambs per ewe present at lambing than ewes not lambing at 1 year of age, but they weaned .14 more lambs weighing 5.6 more kilograms for cumulative second through fourth year production. Wool production was slightly less for the early lambing group. However, the differences were not statistically significant.

The effect of ability vs inability to lamb on future production differed between breeds, but the interaction was not statistically significant. Per ewe present at lambing, there was a positive but nonsignificant association of early conception and subsequent lamb production for Columbia ewes, and this did not take into account the extra lamb crop produced at 1 year of age by the early lambers. Columbia ewes which lambed at 1 year of age weaned 11 kg more lamb over 3 production years than later lambing Columbias. There was no association between early conception and subsequent lamb production in Targhee ewes, with only .2 kg more lamb weaned by the early lambers. For both breeds there was a slight negative association between lambing at 1 year of age and subsequent wool production.

There were breed  $\times$  birth year interactions for number of lambs and kilograms of lamb weaned in the second year of production ( $P < .05$ ). Within 2 birth years, Targhees surpassed Columbias for these traits, but for the other 3 birth years, Columbias were more productive than Targhees when lambing at 2 years of age. Thus, breed differences were not consistent over years.

*Per Ewe Entering the Experiment.* Ewes lambing at 1 year of age had greater production for number of lambs weaned and kilograms of lamb weaned in the third production year ( $P < .05$ ), for both traits in the fourth production year ( $P < .01$ ) and for cumulative number and kilograms of lamb weaned ( $P < .05$ ). Ewes

TABLE 2. EFFECTS OF ABILITY VS INABILITY TO LAMB AT 1 YEAR OF AGE AND OF BREEDS ON EWE PRODUCTIVITY PER EWE PRESENT AT LAMBING

Effect	Number of lambs born			Number of lambs weaned			Kilograms of lamb weaned			Kilograms of fleece weight						
	2 <sup>b</sup>	3	4	2	3	4	2	3	4	2	3	4				
Overall average	1.30	1.42	1.60	4.65	1.13	1.18	1.32	4.00	37.3	41.7	44.4	137.0	5.3	5.6	5.4	15.9
Yes <sup>a</sup>	1.30	1.49	1.67	4.56	1.16	1.26	1.48	4.07	38.1	43.4	51.2*	139.8	5.3	5.7	5.4	15.7
No	1.30	1.35	1.53	4.74	1.10	1.10	1.16	3.93	36.5	40.0	37.6*	134.2	5.3	5.4	5.4	16.1
Columbia	1.18	1.42	1.48	4.34	1.07	1.28	1.22	3.82	34.1	42.1	42.5	133.1	5.5**	5.7	5.6*	16.3
Targhee	1.42	1.42	1.72	4.96	1.19	1.08	1.42	4.13	40.5	41.3	46.3	140.9	5.1**	5.5	5.2*	15.5
Columbia Yes	1.29	1.49	1.61	4.45	1.20	1.36	1.44	4.05	39.0	47.3	50.0	138.6	5.5	5.9	5.8	16.2
Columbia No	1.06	1.34	1.34	4.23	.94	1.20	1.00	3.69	29.2	43.3	35.0	127.6	5.6	5.5	5.5	16.4
Targhee Yes	1.30	1.41	1.74	4.67	1.12	1.15	1.52	4.09	37.2	39.5	52.4	141.0	5.0	5.6	5.0	15.2
Targhee No	1.55	1.36	1.71	5.25	1.26	1.01	1.32	4.17	43.8	36.7	40.2	140.8	5.1	5.3	5.4	15.8

\*P<.05.

\*\*P<.01.

<sup>a</sup>Yes and no denote ability vs inability to lamb at 1 year of age, respectively.

<sup>b</sup>Second, Third, Fourth production years and cumulative observed through fourth production year.

<sup>c</sup>Computed only for ewes who had three production years.

TABLE 3. EFFECTS OF ABILITY VS INABILITY TO LAMB AT 1 YEAR OF AGE AND OF BREEDS ON EW E PRODUCTIVITY PER EW E ENTERING THE EXPERIMENT

Effect	Number of lambs born			Number of lambs weaned			Kilograms of lamb weaned			Kilograms of fleece weight				
	2 <sup>b</sup>	3	4	2	3	4	2	3	4	2	3	4	C	
Overall average	1.30	1.12	.97	3.49	1.10	.82	2.82	36.2	32.1	28.6	96.9	5.2	4.3	3.4
Yes <sup>a</sup>	1.30	1.20	1.17*	3.78	1.10	1.09*	3.24*	36.1	37.6*	36.9**	110.6*	5.0	4.8*	3.8
No	1.30	1.04	.77*	3.20	1.10	.71*	2.40*	36.3	26.6*	20.3**	83.2*	5.4	3.8*	2.9
Columbia	1.17*	1.09	.96	3.32	1.04	.84	2.85	33.1	34.3	29.9	97.3	5.4	4.1	3.5
Targhee	1.43*	1.15	.98	3.66	1.16	.83	2.80	39.3	29.9	27.3	96.5	5.0	4.5	3.3
Columbia Yes	1.29	1.29	1.28	3.98*	1.13	1.17	3.55	36.8	43.4	41.6	121.8	5.2	5.1*	4.5*
Columbia No	1.05	.89	.64	2.66*	.95	.51	2.15	29.3	25.3	18.3	72.9	5.6	3.1*	2.5*
Targhee Yes	1.31	1.11	1.06	3.58*	1.07	.94	2.94	35.3	31.8	32.2	99.4	4.9	4.4*	3.1*
Targhee No	1.55	1.19	.90	3.74*	1.24	.68	2.66	43.3	27.9	22.3	93.5	5.2	4.5*	3.4*

\*P<.05.

\*\*P<.01.

<sup>a</sup>Yes and no denote ability vs inability to lamb at 1 year of age, respectively.

<sup>b</sup>Second, Third, Fourth production years and cumulative observed through fourth production year.

lambling at 1 year of age weaned an average of 3.24 lambs weighing 110.6 kg for the second through fourth production years, while ewes which did not lamb at 1 year of age weaned an average of only 2.40 lambs weighing 83.2 kg, 27.4 kg less than the early lambers (table 3). Again, this does not take into account the extra lamb crop produced by the early lambers in the first production year. The main reason for this difference was that ewes unable to lamb at 1 year of age died or were culled sooner than ewes which did lamb at 1 year of age.

There were significant interactions between ability *vs* inability to lamb at 1 year of age and breed for total cumulative number of lambs born, as well as for wool production for years 3 and 4 and for total cumulative wool production ( $P < .05$ ). Within breeds, early lambing Columbias had a large advantage in subsequent lamb production; while early lambing Targhee ewes had only a slight advantage. Early lambing Columbias weaned 1.4 more lambs weighing 48.9 more kilograms than later lambing Columbias. They also produced 3.7 more kilograms of wool for the second through fourth production years. Early lambing Targhees weaned only 5.9 more kilograms of lamb but produced .7 less kilograms of wool than later lambing Targhees. This difference is caused at least partly by the difference between breeds in the relationship between ability *vs* inability to lamb at 1 year of age and attrition rate (figure 1).

There were interactions between birth year and breed for number of lambs born and number of lambs weaned, all for the second production year ( $P < .05$ ). There was also a significant interaction between ability *vs* inability to lamb at 1 year of age and birth year for number of lambs weaned in production year 2.

### Discussion

The results obtained for Columbia ewes are in general accord with a study of whiteface range ewe lambs conducted by Hulet *et al.* (1969a), as well as experiments reported by Ch'ang and Rae (1972) and Hight and Jury (1976). In Hulet's study, Targhees showed a positive association of early estrus and lamb production through 3 production years but none thereafter, while Columbias showed a small but steadily increasing association which reached significance only after five production records were completed. Rambouillets exhibiting estrus as lambs showed the greatest advan-

tage in lamb production per ewe present at lambling. Over 5 production years, Targhee and Columbia ewes exhibiting estrus their first winter but not bred to lamb at 1 year of age weaned 10.9 and 19.1 kg more lamb, respectively, than Targhees and Columbias which did not exhibit estrus their first winter.

Working with a randomly selected flock of New Zealand Romney ewes, Ch'ang and Rae (1972) found phenotypic correlations ranging from .18 to .20 ( $P < .01$ ) between number of hogget estruses and lamb production for the next three lambings. Hight and Jury (1976) reported that Romney ewes exhibiting estrus their first year under New Zealand hill pasture conditions produced .56 more lambs over four lambings (2 through 5 years) than Romney ewes which did not exhibit estrus. In the same experiment, Border Leicester  $\times$  Romney ewes exhibiting estrus their first year produced .68 more lambs over four lambings than ewes of the same breeding which showed no estrus as hoggets.

In his study of estrus in range ewe lambs, Hulet *et al.* (1969a) found that 13.9% of Targhees and 9.6% of Columbias showed estrus during their first winter. This contrasts with an average of 58% of Targhees and 67% of Columbias able to conceive during their first year in this experiment. Ewe lambs at the Union Station were on a higher plane of nutrition than the ewe lambs in the Idaho experiment, particularly from weaning until breeding time; and this should account for the difference in ewe lamb conception rate between the two groups.

Hulet *et al.* (1969a) also found that of 138 Rambouillet, Targhee and Columbia range ewe lambs who showed signs of estrus, 62% showed estrus only once, 25% twice, and only 2% had five heat periods. Further study is needed on the relationship of ewe lamb ovulation rate and length of breeding season to subsequent lamb production. Hulet *et al.* (1969b) found intra-ewe correlations of .21 and .27, respectively, between ovulation rate of 18 month and 30 month old ewes and multiple birth rate 17 months later ( $P < .05$ ). Ch'ang and Rae (1972) found genetic correlations ranging from .44 to .98 between the number of hogget estruses and fertility for three subsequent lambings. Hight and Jury (1976) found that Romney and Border Leicester  $\times$  Romney ewe lambs which exhibited estrus outproduced ewes of the same breeding which did not exhibit estrus as lambs,

but that within the group exhibiting estrus as lambs there was no consistent relationship between ovulation rate and subsequent lamb production.

There is general agreement (Hulet *et al.*, 1969a; Ch'ang and Rae, 1972; Hight and Jury, 1976; and the present study) on the positive association of ewe lamb estrus or reproduction and subsequent lamb production. These results suggest the possibility of establishing a simple selection procedure for identifying ewe lambs with superior inherent lamb producing ability when production conditions or management decisions do not permit lambing at 1 year of age. Vasectomized rams equipped with marker harnesses could be placed in the lamb flock and crayons changed each 16 days. Lambs exhibiting the greatest number of estrous cycles their first year could then be selected as replacement ewes. In estimating relative efficiencies of selection techniques, Ch'ang and Rae (1972) predicted that selecting for number of hogget estruses would be 1.4 times more efficient than direct selection for fertility over three lambings.

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