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A Study of Factors Affecting Incidence of Lambing in the Yearling Ewe

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A number of 559 yearling ewes belonging to seven breeding groups (Barkis, Merinos and their crosses) raised on Ras El-Hekma Desert Research Experimental Station in the years 1963 to 67 were used to study the effect of age of ram, breed of ewe, year, pre-mating body weight and age of ewe on the incidence of lambing. Results showed that the first four factors affected significantly ($P < 0.01$) the percentage lambing. The year effect, however, was the most pronounced one. The two year old rams scored the highest performance followed by 3, 4 and 5 and more years old ones in a descending order. Although the Barki ewes were better in their performance compared to the imported Hungarian Merinos, yet the difference was not significant. For each increase of 1 kg in the pre-mating livebody weight of the ewes percentage lambing increased by 2.1 %. The corresponding rise in percentage lambing for each increas of 10 days in the age of ewes at time of joining the rams was found to be 1%.

Ewes are first exposed to the ram either as lambs when they are about 6 to 9 months old or as yearling when they are about 15 to 18 months old. Though fertility in the young ewe has been often reported to be low as compared to elder ones (Terrill and Stoehr, 1939, Watson and Gamble 1961, Bichard 1964 and Holland and Ruttle 1966) reasons behind this low fertility are not yet fully understood.

At Ras-El-Hekma Desert Research Station which is located in the Western Coastal Desert of Egypt, a flock of sheep consisting mainly of pure Hungarian Merinos and local Barki and their crosses is raised. The productive performance of the different breeding groups of the flock has been previously reported by Fahmy, Galal, Ghanem and Khishin (1969). Preliminary investigation on the flock has shown yearlings to be inferior to other age groups in their fertility (Shaaban, 1970). Thus, the present study was initiated to investigate the effect of some factors on the fertility of the yearling ewe. Factors studied were age of ram, breed of ewe, age of ewe, pre-mating livebody weight and the year.

Material and Methods

Source of data

Data used in the present study included the records of 559 yearlings which were exposed to the ram in five successive seasons (1963-67). These yearling ewes were part of a flock of sheep which is kept at Ras El-Hekma Desert Research Station.

The management of the Flock

The general management of the flock was described by Fahmy *et al.* (1969). Mating usually took place in June — July, thus, lambing occured in November-December which coincides with the natural grazing season which extends from late November to April. Ewes were kept separated from the rams all the year apart from mating time when they were alloted to rams in groups of 10 to 50 ewes per ram in separate mating pens. In most cases there were both yearling and older ewes and more than one breed of ewe in each mating group. Ewes are kept with the rams for a period which is almost equal in length to three oesturs cycles, *i.e.* 51 days. Flushing the ewes with concentrates usually took place for two weeks prior to mating. Rams were subjected to mild phenotypic selection on the basis of wool and growth traits and their ability to serve and they were well fed before mating. After the removal of the rams ewes are joined all together in one or two flocks and supplemented with concentrates at a lower level (1/4 kg/head/day) rising to a higher level (1/2 kg / head/day) towards the end of the pregnancy period. This is plus barley or wheat straw and berseem hay offered *ad libtum*. Ewes were weighed at monthly intervals and the weight prior to joining the rams was considered as the premating weight. Among the group of animals considered the maximum lapse of time between weighing and joining the rams was one week.

Statistical procedure

A least-squares analysis was carried out to estimate fertility performance and effects of factors affecting it. The following model was used.

$$Y_{ijk1} = u + b_i + a_j + t_k + B_1 \times_{ijk1} + B_2 \times_{2ijk1} + e_{ijk1}$$

where :

Y_{ijk1} is the observation on the 1*th* ewe of the j*th* breeding group mated to a ram of the j*th* age in the k*th* year. The observation takes the value of 1 when the ewe is conceived (as indicated by lambing or abortion) and takes a value of 0 otherwise.

u : is a common effect among all ewes.

b_i : is an effect due to the age of ram, i = 1, 2, 3, 4 and 5 years.

a_j : is an effect due to the breed of the ewe.

t : is an effect due to the year in which the ewe joined the ram.

$\times_{1ikj1}$: is the deviation of the age (month) of the ijklth ewe at joining the ram from the mean of that age.

$\times_{2ijk1}$: is the deviation of the weight (kg) of ijkl*th* ewe at joining the ram from the mean of that weight.

B_1 : is the partial regression of fertility on the age of the ewe at joining the ram.

B_2 : is the partial regression of fertility on the weight of the ewe at joining the ram.

elijl : is a random error associated with the ijkl*th* observation.

Since the observations are expressed in 1 or zero an assumption of the normality of the error might not be perfectly correct. A part of the residual sums of squares will be due to the binomiality. (Shannon, 1964) and thus the error term is inflated. Therefore, more of type II error is expected to be committed in the test of significance i.e. to be more on the conservative side. The use of such scale and tests of significance however are not uncommon in the literature, e.g. Sidwell, Everson and Terrill (1962) and Vesely, Peters and Slen (1965).

Results and Discussion

Effect of breed of ewe

Breed of ewe affected significantly ($P < 0.01$) percentage lambing, Table 1 and 2, with the 3/4 M having the highest performance (87.8%) followed by Barkis, 5/8 M, 1/2 M, Merinos, 3/8 M and 1/4 M in this order. Breed of ewe could explain 5.3% of the total variance in percentage lambing. Breed of ewe notations represent a blood ratio and not a mating system. For example MB ewes were produced from either M × B or B × M. Likewise, 3/8 M 5/8 B were produced either by crossing 1/2 M by 3/8 M or 3/4 M by B or/and their reciprocals, 5/8 M 3/8 B were produced by crossing M × 1/4 B or by 3/4 M × 1/2 B or/and their reciprocals. Under the condition of this study neither the heterosis phenomenon nor the increment of blood ratio of a certain breed in the crossbred ewes would provide sound explanation for the ranking of the different breeds and crosses. However, the superiority of Barki ewes as compared to Merinos may be due partly to their adaptability to the desert environment.

Vesely *et al.* (1965) found no differences in fertility between five breeds of ewes reared on range (Rambouillet, Romnelet, Columbia, Targhee and Suffolk).

Effect of age of ram

Age of ram was found to be a significant source of variation in affecting percentage lambing, Table 2. The best performance was that of the 2 years old rams followed by 3, 4 and 5 years and more old ones in this order. The 4 and 5 years and more old rams did not differ significantly from each other while each of the 2 and 3 years old rams differ significantly from any other age group, Table 1. The superiority of the 2 years old rams as compared to other age group, in affecting percentage lambed in this study may be due to the fact that yealring rams were usually joined with lesser number of ewes as compared to older ones Under range condition Wiggins (1956) reported that fertility in a flock would not be decreased and might even be increased by the extensive use of young rams (yearlings and 2-year-olds). Terril (1962) concluded that fertility in young rams (16-20 months old) is similar to that in 3 to 5 year old ones. After removing variation due to continuous variables (weight and age of ewe at joining the rams) age of ram accounted for 5.3% of the total variability, Table 2.

TABLE 1. Least squares constants, standard errors and test of significance of differences between constants.

Class	No.	Constant ± S.E.	DMRT*	Actual mean
General mean	559	.628 ± 0.25		
Breed of ewe				
Barki	201	.038 ± .034	a	.666
Merino	86	—.022 ± .045	a	.606
1/2 M	114	.007 ± .041	a	.635
3/4 M	75	.250 ± .052		.878
5/8 M	28	.024 ± .071	a	.652
3/8 M	31	—.093 ± .069	a	.535
1/4 M	24	—.204 ± .075	b	.424
Age of ram				
2-yr-old	198	.127 ± .021		.755
3-yr-old	150	.080 ± .011		.708
4-yr-old	121	—.101 ± 0.31	a	.527
5-yr-old and over	90	—.106 ± .037	a	.522
Year				
1963	110	.042 ± .038	a	.670
1964	74	.013 ± .015	a	.641
1965	192	.151 ± .031		.779
1966	89	.042 ± .041	a	.670
1967	94	—.248 ± .020		.380
X_1 Regression on tupping wt. (kg)		.021 ± .003		
X_2 Regression on age of ewe (days)		.001 ± .28		

* DMTR, Duncan's New Multiple Range Test. Within the same classification, any two constant having no letter in common differ significantly from each other at the five per cent level.

TABLE 2. Analysis of variance of lambing performance

Source of variation	d.f.	MS	σ^2 (variance) component	variance %
Breed of ewe	6	.745**	.011	5.3
Age of ram	3	1.203**	.011	5.3
Years	4	2.059**	.020	9.4
X_1 (Weight of ewe)	1	8.032**	—	—
X_2 (Age of ewe)	1	.019	—	—
Residual	543	.166	.166	80

Effect of Year

The year was another significant source of variation in affecting percentage lambing, Table 2. Ewes mated in 1965 scored the highest performance followed by those mated in 1963 and 1966, 1964 and 1967. Ewes mated in any particular year were those born in the previous one. Differences in year accounted for 9.4%of the total variability in fertility, being the most important classificatory factor in this study. The rainfall which is the main factor in affecting the condition of the grazing season in years 1962-67 was 83, 74, 399, 126 and 117 mm., respectively. The highest performance obtained by 1965 yearlings was probably a result of good grazing condition in years 1964 and 1965. However, the performance of the yearlings in the different years does not follow the same trend of the rainfall. However, other environmental factors such as temperature, humidity, sandstorms and the amount of feed might have been responsible for differences between years in percentage lambing.

Effect of Pre-mating weight

Table 3 shows the relationship between the pre-mating weight and percent lambed in these yearlings. Results of the statistical analysis Table 1 show that for each one kg. increase in mating weight there was an increase of 2.1% in the average percentage lambed. The importance of tupping weight in affecting the fertility in sheep has been reported by Williams (1955), Allen and Lamming (1961), Coop (1962), Bowman (1966) and Younis (1967). Coop (1962) found that barrenness in 2-tooths is relatively independent of livebody weight at mating above approximately 90–100 lbs but below this critical weight barrenness increases rapidly. Bowman (1966) has shown the relationhsip between pre-mating body weight and percentage lambed in crossbred hoggs out of Clun and hill ewes by Colbred,

Border Leicester and Teeswater rams. Bowman's results were examined statistically (Younis 1967) in order to measure the regression of percentage lambed on pre-mating body weight. The regressions calculated were 7.648 and 7.063 per cent for each 10 lb increase in premating weight as unweighted and weighted by the number in the classes, respectively. The weighted estimate shows that for each 10 lbs increase in the pre-mating weight the percentage lambed increased by approximately 7%. Nevertheless, Bowman's Statement that "the percentage lambing is closely related to the weight at mating.", should be discussed in terms of both regression and correlation coefficients. The correlation coefficient could be more indicative of the closeness of the relationship. In the present study the partial correlation coefficient between fertility and mating weight was estimated as .337, highly significant but of not great magnitutide.

TABLE 3. **Fertility in the yearlings classified by the pre-mating livebody weight.**

Weight range (kg)	Total number	Number lambed	% lambed
18 — 20	1	0	0.0
20 — 22	10	1	10.0
23 — 25	12	1	8.3
25 — 27	30	15	50.0
28 — 30	58	37	63.8
30 — 32	70	46	65.7
33 — 35	84	60	71.4
35 — 37	77	60	78.0
38 — 40	87	69	79.3
40 — 42	57	49	86.0
43 — 45	39	35	84.6
45 — 47	25	21	84.0
48 — 50	5	4	80.0
50 — 52	2	2	100.0
53 — 55	2	2	100.0
All weights	559	400	71.6

Younis (1967) working on Clun Forest hoggs found that for each increase of 10 lbs in livebody weight at mating the percentage lambed increased by 5%. The same author reported a very low correlation between both traits (r = 0.148). Based on these findings it would be generally expected that percentage lambing in young ewes would increase by 5–10% for each increase of 10 lbs in their pre-mating livebody weight. However, though an increase in the average mating weight of the ewe would probably result in a rise in the percentage lambing, yet the accuracy to predict the outcome of any particular mating remains poor.

Effect of age of ewe (at mating)

For each increase of 10 days in the age of the ewes at the time of joining the rams percentage lambed increased by 1% Table 1. This effect was found non significant in the present study. However, non significance of age nonsignificant effect could be due to the small variation in the age of ewes at joining the ram (range is less than 51 days). According to Younis (1967) percentage lambed in Clun Forest ewelambs increased by 3.2 % for each increase of 10 days in their age at mating, a somewhat higher value than that obtained in this study. Differences between the two sets of results are quite expected since yearlings of this study must have reached their puberty by the time of joining the rams. This is plus the fact that ewes could experience oestrus all over the year under the conditions General of Egypt a situation which is different from that of the U.K.

Discussion

The fertility rate of yearling ewes used in this study was rather low (62.8%) and almost similar to that reported on the same flock by Shaaban (1970). This low fertility rate could not be explained on the basis of sexual immaturity defined by attainment of puberty since almost all ewes were marked by fertile rams. On the other hand all factors studied did not explain much of the variation in fertility. The three variables included in the model (breed of ewe, age of ram and the year) have explained only 20% of the variation in the incidence of lambing. The year contribution to the variability was almost double as much as that of either the breed of ewe or age of ram. The rest of the variation, however, is due to other unknown factors. While the reproductivity of the ewe is determined by her gene complement other factors such as nutrition have a bearing on the final production. Year to year differences in the fertility of the yearlings used in this study is partly due to differences in the nutritional condition. The live weight of the ewe at mating reflects the nutritional condition to which the ewe is subjected. In the present work the pre-mating live weight was found to have some effect on the ability of the ewes to lamb, though this was limited. Generous feeding to the ewe before mating lead to fattening and this in turn would adversely affect its fertility. Therefore, one would not expect that the relationship between live weight at mating and fertility to be linear. A study on the optimum level of nutrition for the ewe before and during mating will be of special importance.

The low fertility reported in this study is probably due to a low rate of ovulation, fertilization or implanation and/or embryonic loss. The estimation of these physiological parameters deserves a study of itself.

From the results of this study the use of relatively young rams (2 and 3 years old) in mating a limited number of yearlings might be recommended.

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دراسة لبعض العوامل المؤثرة على معدل الولادات فى النعاج

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استعمل فى تلك التجربة سجلات ٥٥٩ نعجة صغيرة من سلالة الأغنام البرقى المحلية والمرينو المجرى وخليطها الموجودة فى محطة أبحاث رأس الحكمة من عام ١٩٦٣ ـ ١٩٦٧ .

درس فى تلك التجربة تأثير كل من عمر الكبش ، سلالة النعجة ، السنة ، وزن النعاج وعمرها عند بدء التلقيح على معدل الولادات .

أثرت كل من العوامل الأربعة الأولى تأثيرا معنويا على معدل الولادات وكانت السنة أكثر تلك العوامل تأثيرا . ارتفعت نسبة الولادات عند استعمال كباش عمر سنتين ثم انخفضت هذه النسبة تنازليا بزيادة عمر الكباش المستخدمة حتى عمر ٥ سنوات فأكثر .

وكانت خصوبة النعاج البرقى المحلية مرتفعة بالمقارنة بنعاج المرينو المستورد وان كان الفرق غير معنويا .

زادت نسبة الولادات بمقدار ١ر٢٪ لكل ١ كجم زيادة فى وزن النعاج عند التلقيح فى حين زادت بنسبة ١٪ لكل زيادة مقدارها ١٠ أيام فى العمر عند بداية موسم التلقيح ..