

Fertility in Scottish Sheep.

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My attention was first directed to the subject of fertility by Mr. Walter Heape, to whom I am much indebted.

Experiments have been described in agricultural publications on the effects of different methods of feeding and general treatment upon wool or meat production; but excepting, so far as I am aware, for Mr. Heape's report on "Abortion, Barrenness, and Fertility" in sheep in the South of England for the year 1896 to 1897,* no systematic attempt has been made to deal with the factors which influence fertility either in the sheep or in other animals. Numerous experiments, however, are annually conducted by flock-masters for a practical object, and it has been thought desirable to put the results of some of these on record with a view to making comparisons, and in the hope eventually of reaching definite conclusions upon this subject.

That differences in food and environment exercise an influence over fertility in the sheep as in other animals has long ago been recognised,† and recently attention has been called to the wide range of variability in the sheep's sexual capacity, this animal showing a complete gradation between the monœstrous condition and the most extreme degree of polyœstrum.‡

As a preliminary step in an investigation on fertility in sheep, it was decided to issue a schedule of queries addressed to various flock-masters chiefly in the East of Scotland. The present communication consists of a condensed account of some of the information contained in their replies.§

The preparation and issue of the schedule was undertaken by the Highland and Agricultural Society of Scotland, under whose auspices the work is being carried on. I am under no light obligation to the members of this society for their co-operation, as well as to all those gentlemen who have supplied

* "Abortion, Barrenness, and Fertility in Sheep," 'Journ. Roy. Agric. Soc.,' vol. 10, 1899. "Note on the Fertility of Different Breeds of Sheep," 'Roy. Soc. Proc.,' vol. 64, 1899.

† Darwin, "Animals and Plants," Popular Edition, London, 1905.

‡ Marshall, "The Œstrous Cycle and the Formation of the Corpus Luteum in the Sheep," 'Phil. Trans.,' B, vol. 196, 1903.

§ It is hoped that a full report may be issued next year in the 'Transactions' of the Highland Society.

me with information regarding their personal experiences. The comparatively small number of schedules issued and returned (the latter being about 50), rendered it possible to obtain fuller information than would otherwise have been the case, while the information obtained in this way was in some cases supplemented by personal conversation or further correspondence. For the purpose of showing the percentages of lambs per ewes, of barrenness, and of abortion (Tables I, II, and III) among flocks treated in different ways, these are divided into six groups as follows :—*

Division A.—This includes hill sheep (Scotch Black-faced and Cheviots), which were kept all the year round on the sides of hills, and received no sort of special treatment.

Division B.—This includes hill sheep (Scotch Black-faced and Cheviots), which were placed upon better grass at tupping time (*i.e.*, during the sexual season) or shortly before.

Division C.—In this division are included half-bred (Border Leicester × Cheviot) ewes which underwent a process of flushing by being fed on turnips, cabbages, oats, dried grains, maize, or other artificial food during tupping and for about three weeks before. The ewes were in most cases merely fed on grass during the greater part of the year, but received a certain amount of extra food (turnips, etc.) during the latter part of pregnancy (*i.e.*, usually from about the beginning of the year).

Division D.—This includes two flocks of Cheviot ewes which were flushed at tupping time but were fed on grass during the rest of the year.

Table I.—Number of Lambs per 100 Ewes.

Flocks.	Under 90 p. c.	90 p. c.	100 p. c.	110 p. c.	120 p. c.	130 p. c.	140 p. c.	150 p. c.	160 p. c.	170 p. c.	180 p. c.	190 p. c.	Total.
Division A	2	10	2	1	—	—	—	—	—	—	—	—	15
” B	—	1	1	—	1	—	1	—	—	—	—	—	4
” C	—	—	—	—	1	1	—	2	3	1	—	2	10
” D	—	—	—	—	1	1	—	—	—	—	—	—	2
” E	—	—	—	—	—	—	1	1	3	—	1	1	7
” F	—	—	—	—	—	—	1	1	2	2	—	—	6
Total.....	2	10	3	1	3	2	3	4	8	3	1	3	44

The numbers represent the numbers of flocks, the total being 44. The percentages are the percentages of lambs per ewes in the different flocks. The flocks are arranged in six divisions, according to the methods of feeding, as explained in the text.

* The variation in the number of flocks in the three tables is due to the flock-masters not having supplied complete information in all cases. Some flocks, therefore, are included in one table but not in another.

Table II.—Percentage of Ewes that Aborted.

Flocks.	None.	Under 1 p. c.	1 p. c.	2 p. c.	3 p. c.	4 p. c.	5 p. c.	Total.
Division A	—	—	6	3	2	2	1	14
„ B	—	3	—	—	—	1	—	4
„ C	4	3	2	1	—	—	—	10
„ D	—	1	1	—	—	—	—	2
„ E	2	3	1	1	—	—	—	7
„ F	2	1	1	—	—	1	—	5
Total	8	11	11	5	2	4	1	42

The numbers represent the numbers of flocks, the total being 42. The percentages are the percentages of ewes which aborted in the different flocks. The flocks are arranged in six divisions, according to the methods of feeding, as explained in the text.

Table III.—Percentage of Barren Ewes.

Flocks.	None.	Under 1 p. c.	1 p. c.	2 p. c.	3 p. c.	4 p. c.	5 p. c.	6 p. c.	7 p. c.	Total.
Division A	—	1	—	2	3	—	5	2	1	14
„ B	—	—	—	1	1	1	—	1	—	4
„ C	3	—	—	3	1	1	—	—	—	8
„ D	—	—	1	1	—	—	—	—	—	2
„ E	—	—	2	4	—	1	—	—	—	7
„ F	—	—	2	1	—	1	1	—	—	5
Total.....	3	1	5	12	5	4	6	3	1	40

The numbers represent the numbers of flocks, the total being 40. The percentages are the percentages of barren ewes in the different flocks. The flocks are arranged in six divisions, according to the methods of feeding, as explained in the text.

Division E.—This includes flocks of Border Leicester and half-bred (Border Leicester × Cheviot) ewes which were placed on better pasture during tupping and for some time (usually about three weeks) before, but which otherwise received no sort of special treatment; in some instances, however, the ewes received a limited number of turnips during pregnancy.

Division F.—This division includes Border Leicester, and half-bred (and a few Cheviot) ewes which were fed all the year round on grass, receiving no special treatment of any kind.

Table I shows very clearly that the percentage of lambs was, as a rule, larger among flocks which underwent a process of artificial stimulation during the sexual season, while Table III shows that the percentage of barren ewes was generally relatively less in such flocks. The Cheviot and Black-faced sheep in Division B which produced less than 100 lambs per 100 ewes (Table I) are stated to have been unusually unprolific owing to their never

having properly recovered from the extreme cold in March and April, 1904. This case, therefore, may be regarded as exceptional. The percentage of barren ewes in this flock was six (Table III).

In the three cases in which the percentage of lambs was over 190 the exact numbers were 191·5 per cent., 193·75 per cent., and 196 per cent.

In the first of these the ewes (which were half-bred Cheviot × Border Leicester) were fed on grass only, during the previous summer. For three weeks (during tugging) they were given a full supply of turnips on grass, and between tugging and lambing (five months) they were given a mixture of dried grains and turnips, and "lamb food" for three weeks before lambing. The rams (which were pure Border Leicesters) were given bruised oats during tugging. No record was kept of the ages of the ewes. One ewe had four lambs and 12·5 per cent. had triplets.

In the second case the ewes (half-bred) were fed upon Bombay cake, bruised barley and a little linseed as well as turnips and cabbages during tugging (after grass), and some turnips were given during pregnancy. The rams (Border Leicester and Oxford Down) were similarly treated. The ewes were all three-shear. Flushing with turnips was found to bring the ewes in season very rapidly. Triplets were produced by 13·5 per cent. of the ewes.

The third case is recorded under Division E, but ought possibly to have been included under Division C. At tugging time the ewes (which were half-bred) were put upon better pasture, and between tugging and lambing they were given some turnips and as much cut hay as they would eat. Previously to tugging they were fed on grass alone.* The ewes were all ages up to four-shear. The rams (which belonged to the Border Leicester, Oxford Down and Cheviot breeds) were supplied with no artificial food at tugging.

The twins appear almost invariably to have been born early during lambing time, thus showing that the reproductive activity of the ewes is generally greatest early in the tugging season. Only two returns record that twins were mostly born late, while 28 state that early twins were the rule, both among the artificially fed flocks and those which received no special treatment.

There is abundant evidence also that flushing hastens forward the tugging time. It has recently been shown that "heat" in animals is almost certainly brought about by an internal secretion elaborated in the ovaries.† It would appear, therefore, that the artificial feeding exercises a stimulating influence

* Cheviot ewes, kept on the same farm, and treated similarly, produced only 10·0 per cent. lambs.

† Marshall and Jolly, "Contributions to the Physiology of Mammalian Reproduction. Part II.—The Ovary as an Organ of Internal Secretion," *Phil. Trans., B*, vol. 198, 1905.

over the secretory activity of the ovaries, while at the same time causing the Graafian follicles to mature more rapidly and a larger number to discharge during the earlier œstrous periods in the sexual season.

Regarding the effects of artificial feeding during one tupping season upon the fertility of the sheep in after years, it has so far been difficult to obtain precise information. The opinion usually expressed is that flushing is not detrimental to subsequent fertility unless it is overdone; but in a very few of the returns the view is stated that the after-effect is adverse. It is also said that if ewes are flushed one year the process must be repeated the next: otherwise the ewes tend to be less fertile than if they had never been flushed at all.

On the other hand, several of the returns show that sheep which produce twins one year very frequently bear twins also in the year following. This seems to occur irrespectively of whether it was the practice to flush the ewes. It would appear, therefore, that an increased degree of fertility is characteristic of certain particular ewes.

That fertility is a character which can be inherited admits of no doubt. It is to be noted, however, that with the breeds considered in this paper, twins are seldom if ever selected for purposes of tupping, since they generally are not so well developed, owing to their having had less nourishment when they were young lambs. It would seem, therefore, that the fertility of these breeds is diminished owing to the fact that the rams which are probably naturally the most fertile are the ones which are the least frequently employed for breeding
