

## SHEEP-BREEDING.

By S. SMITH TRAVERS.

Read 11th July, 1871.

In the remarks on sheep-breeding which I am about to submit to you, I must beg you to understand that I do not profess to be able to offer you the results of any experiments of my own, nor any theory founded on the experiments of others.

I cannot find, indeed, that any experiments have ever been made upon any scientific principle, and upon such a scale as to arrive at any defined and certain laws, such as must underlie and govern the science of artificial selection, whilst on reference to those authorities who have written on the subject, I find discordancies of opinion, coupled with vagueness of technical phraseology, that must leave every one in doubt as to whether indeed we do know *scientifically* more of breeding now than we did one hundred years ago.

And if what we do know be not scientifically known, and proved and arranged, I must contend that it is not really known, and does not really belong to us. It is true that owing to the attention of a very great number of highly educated men to the subject, the most extraordinary improvements in our various breeds of sheep and cattle have been effected. But if these distinguished breeders were to be taken away, where should we find, or be able to lay down any of the principles on which they have proceeded? It is very well to point to Mr. Bakewell, who in the middle of last century originated the Dishley Leicesters, and to the MacArthurs, Learmonth, Coxes, Mr. Bailey, and others to whom we owe our Australian breeds; but the question is what are the principles of selection on which they have proceeded? Had they any?

The reply, I suspect, would be that the principle, the only principle governing their selection, was to choose the finest ram, and put it to the finest ewe or ewes, according to the individual judgment. If we could ascertain the truth, we should find that these celebrated breeders depended entirely on their natural gifts of hand and eye, and upon some intuitive sense of harmony, symmetry, and perfection which has enabled them to choose and artificially select, till in a certain number of years, the same eye and hand and intelligence always presiding at the drafting yard, they have culminated in certain flocks of surpassing excellence. The question therefore remains—have these breeders, either in England or Australia, anything in common in their plan of action? Can we

ascertain if, apart from their individual genius and aims, they obey or seem to obey one common law?

The English sheep-breeder—from reasons easy to comprehend, aims at carcase rather than wool—the Australian at wool rather than carcase. In these different objects do we find them both adhering to one practice. Is the path by which each seeks to obtain perfection but a different bye-way of the one high road?

I believe the answer to be that all intelligent breeders pursue and have pursued one common route, though their paths may differ. They all breed, or try to breed, in-and-in.

Their aim may be for carcase or for wool; and again, amongst wool-breeders for combing or for clothing wools. But all experience shows that speciality and excellence in any one quality is to be obtained only by breeding in-and-in; by breeding like with like. And though not a part of my subject, I may remark parenthetically, that with cattle and horses the same general law is accepted.

This point, the necessity of in-and-in breeding, I am compelled to assume; it would take me too long to bring before you evidence in support of what I assert, and I doubt if it be necessary.

But it is curious and illustrative of our scientific ignorance of breeding, that whilst every celebrated horse, or bull, or cow, or sheep, is invariably the result of in-and-in breeding, the wide and fixed popular prejudice is against it, and is in favour of cross-breeding. And whilst every farmer or squatter, if he wish to improve his breed, will give an extravagant price for an animal, which is the triumphant proof of what in-and-in breeding in certain hands can achieve, yet as a rule, you will find he declines to breed in-and-in himself, generally alleging that he has tried it and that it does not pay.

At present what is the practice, or what is I believe the practice? It is to confine on one station so many thousand sheep of both sexes. If not to breed together absolutely higger-mugger fashion, yet subject to the selection of the drafter, who culls and rejects all inferior specimens, to let the rest breed together, fathers, mothers, sons, and daughters promiscuously, and regardless of all shades of affinity.

But I argue that this is illogical. If affinity considered in the gross has worked such wonders—if the mere shutting out all foreign strains of blood has done so much for breeding—what might not be effected if the principle were carried out, and applied in the minor shades scientifically?

Might not this law, if applied *scientifically*, save the expense and time wasted and lost in breeding the animals, which after all have to be culled and sent to the butcher? Not that the

breeder's judgment and experience would be less wanted, but his time, the time of the station, now wasted in breeding useless varieties, might be saved, and instead of its taking thirty years to bring a flock or a brand to perfection it might be that ten years or less would suffice.

My object therefore is to examine, if I can, this said system of in-and-in breeding, this breeding like with like, and by symbolising the relations that arise amongst sheep on those stations, where in-and-in breeding is observed, I hope to suggest a method by which to classify and arrange the various degrees of affinity into groups, as a preparatory step towards those experiments, which will I believe, if made by competent persons, and on a sufficient scale, enable us to lay down and define the laws governing the art of selection.

I know that my method is crude and deficient in many respects, wanting in the accuracy so necessary to scientific research. I regard it entirely as the suggestion of an unscientific person to men more capable, who may be able to discern the truth, if there be any in it, and who in that case may give precision to the symbolisation I propose to use.

My proposal is to regard the organisation of the individual, its race, its blood, or whatever is understood by these generalisations, as a quantitative quality, and to treat it quantitatively.

Thus if I call the ram A, and the ewe B, I term the product of their union AB for the male issue, and BA for the female. If I marry A the father with BA the daughter, I call their issue  $A^2 B$  if a ram lamb, and  $BA^2$  if a ewe lamb. If, again, I marry AB the son with his mother, I call the progeny  $AB^2$  if male, and  $B^2 A$  if female. If I marry AB the son with BA the daughter, I call the issue  $A^2 B^2$  if male,  $B^2 A^2$  if female.

By this method I hope to make the changes in the shades of affinity apparent and tangible.

In the sketches of pedigrees appended to the paper, and which I now lay before you, I assume that the ewes produce 100 per cent., and an equal proportion of sexes. This for convenience.

Pedigrees No. 1 and No. 4 show the breeding of a ram with his daughters, grand, and great granddaughters, and if we examine the practice of every station where in-and-in prevails, it will be found that the results of this plan of breeding, and the strain it produces, must be the prevailing strain, and the action in that direction progressively increasing in force.

It is true that the stud rams are each year recruited with a small accession from their sons. But the number of sons

breeding with mothers, or of brothers with sisters, is small compared to the regular and extensive majority of sires breeding each season with their female progeny.

In pedigree No. 2 you will see the effect of four generations breeding back to the mother's race. But to be a tolerably perfect experiment you will remark that in this case it is necessary that the 50 ewes or 50 B shall be whole sisters. In breeding back to the father's line, from the power the male possesses of impregnating numbers, the relationship of his ewes, one to the other, does not signify to the same extent. Indeed, unless quite certain that they are of the highest strain, it is better when starting a station that they should not be whole sisters. For if not of the highest known strain the breeder would lose the superior chance offered by putting 50 ewes of similar but not so closely allied family, the chance of some atavism in some of them being awakened and called out which should hit in with the male and produce some exceptional animals.

To return to pedigree No. 2. If the ewes are not whole sisters the experiment no longer carries out its intention, as you will see by reference to pedigree No. 5, where I letter the different ewes B C D E F. Turning to pedigree No. 4, if B has a male lamb the experiment is only so far perfect that I can breed him with his mother, and there will be 24 other ram lambs to breed back with their mothers. The 25 ewes that produce ewe lambs are out of the experiment, and those ewe lambs go to strengthen pedigree No. 1 and its effects.

I must, you perceive, breed each ewe that has a ram lamb with that son, or I do not breed back to her blood. For, if I take any one ram lamb, say AB, and breed it next generation with all the ewes, they, not being sisters, would merely receive and transmit B's influence, without in the least effecting our purpose. AB with his mother would get, it is true,  $AB^2$  or  $B^2A$ , but with the 24 other ewes, who are C D E F G, the result would only be ABC, ABD, ABE, ABF, ABG.

If AB begets from his mother a ram lamb or  $AB^2$  the next generation would be  $AB^3$ ,  $AB^2D$ ,  $AB^2E$ , etc.

But this is not pure line breeding back to the mother, except with one individual, and at any moment that too is liable to stop, by B's progeny being female.

Again, if all the ewes are sisters, and you each generation breed AB and  $AB^2$  with the original mothers, it is only an approximation, and AB breeds back only with one mother and 49 aunts.

I have gone into this to prove that without extraordinary trouble pure line breeding back to the maternal line is

impracticable, unless you begin with whole sisters, and even then it is only an approximation. With old stations, when all the females become more nearly allied, the young rams, when first put in, must be regarded as breeding with their aunts, and producing a sensible effect upon the female progeny.

The effects of breeding brothers with sisters, as in pedigrees 3 and 6, must again presuppose all the ewes to be sisters, for if not sisters, you will find by looking at pedigree 6 that instead of  $A^{16}B^{16}$  and  $B^{16}A^{16}$  you get  $A^{16}B^4 D^2 FG$  or its equivalent; results so different from those of pedigree No. 1 that if *that* be the main principle which asserts itself, and if *that* be the beneficial principle of in-and-in breeding, I doubt if this be also beneficial.

In pedigree No. 1 you simplify and intensify. In pedigrees Nos. 3 and 6 you add continually equal increments to each side, and it seems to me strive to intensify the crossing, and not to eliminate a type.

I am, therefore, forced to believe that pedigree No. 1 is the beneficial principle—not because I see that it carries out any theory of my own, but because it is so much the prevailing and progressively prevailing effect that I conclude, if it were bad in principle, no in-and-in breeding on the present loose system would have been possible without deterioration.

If, therefore, I am asked what deductions I draw from the preceding figures, I would say that I am a believer in the indestructibility of type or organisation, but that I do not believe those original types to have been inferior but superior to the highest specimens now extant. I do not believe the original Dishley Leicester sheep to have been an awkward, ungainly, ugly wretch, with no good qualities of any kind. Mr. Bakewell, doubtless, found such an animal, but I believe that that was not the original type; it was the result of centuries—nay, thousands of years—of mongrelization, of bad impressions and conditions, and of non-observance of the law of in-and-in and like with like.

In every animal, I believe, a certain type resides, the characteristics of which are confused or brought out by the most recent female conjunctions. The male blood I regard as the indestructible organisation, and the impressions of the female, whether for good or evil, more or less temporary. But I do not look on female blood as a thing apart. I regard her only as the recipient, and as the conduct and channel for other male blood. When A marries B we must enquire who was B's father, for it is his blood, and B's father's father's and mother's father's blood that, if it appear, is impressed on A and B's offspring, and as it may be discordant or harmonious

with A, will clash or hit, and produce discordant or harmonious results. The ram A in like manner has latent in him the blood not of his mother, but his mother's father. But this, like other maternal influence, is but temporary in its effect, to be succeeded in coming generations by other temporary female impressions, the blood he hands down permanently being his father's father's father's and great-grandfather's blood.

To give the question a human significance, I believe that a man hands down to his sons his father's influence, modified temporarily by his maternal male blood and his wife's male blood—to be modified in their turn by their mother's male blood and their wife's.

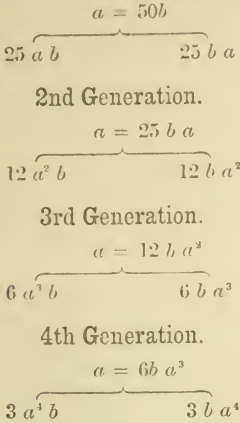
In all the pedigrees I have made out I have only treated of one ram with 50 ewes. To examine the subject in the proper manner, by the hypothesis of a number of rams put to a larger number of ewes, would have made it too complicated for my purpose. It suffices to point out that in due course the rams become by the action of pedigree No. 1 brothers and half-brothers, and that though their action is only in a certain number of cases direct, that is to say, that of own great-grandfather to own great-grand-daughter, yet if not direct, it is indirectly so, and that it tends to become that of grand and great-grand-uncle with their grand and great-grand-nieces.

The whole tendency of in-and-in-breeding with sheep, owing to the power of one ram to impregnate 50 females, is more and more to intensify and revert to A's type.

If these are the tendencies of in-and-in-sheep-breeding, cannot the desired object be attained more effectually and quickly than now? I believe it can.

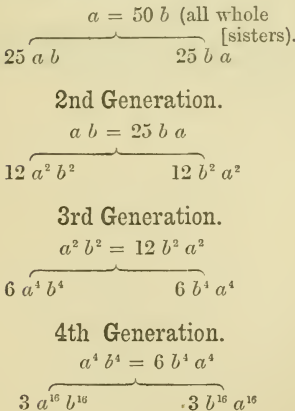
**PEDIGREE No. 1,**

Or, line-breeding back to Sire.



**PEDIGREE No. 3,**

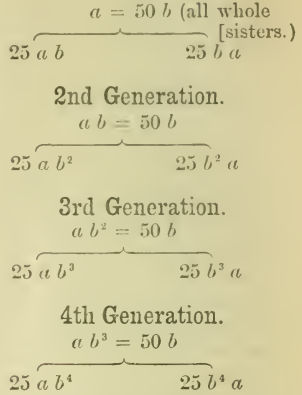
Or, Progeny with Progeny.



If Pedigree No. 1 be an instance of in-and-in breeding, this is not. And yet these two systems, so utterly opposed in principle, come under the present nomenclature of "in-and-in breeding"!!

**PEDIGREE No. 2,**

Or, line-breeding back to Maternal line.

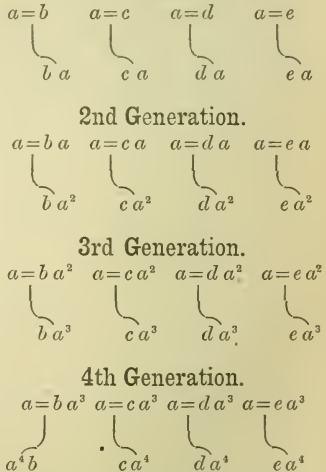


**PEDIGREE No. 4,**

Fathers with Daughters.

Or, No. 1 re-stated (the Ewes not being Sisters).

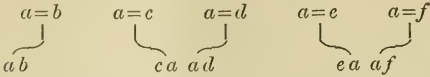
To save trouble, those only are taken who are supposed to have female offspring—except in the last, where  $b \ a^3$  has a ram-lamb.



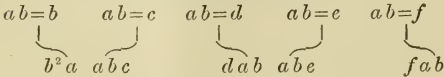
The fact of the ewes not being sisters does not affect the result which is, to breed back to  $a$  without intermixture.

## PEDIGREE No. 5,

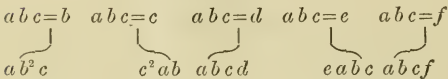
Line-breeding back to Maternal-line (the Ewes not being Sisters) ; and is No. 2 re-stated.



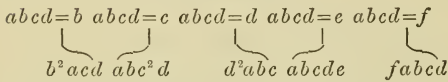
### 2nd Generation.



### 3rd Generation.

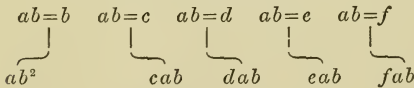


### 4th Generation.

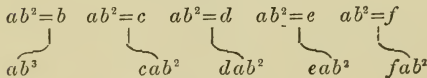


In this scheme is shewn how impossible it seems to intensify the mother's blood, unless all the mothers are whole sisters.—Not being sisters, and assuming that you must each generation take a young ram from a different mother, which virtually must be the case, as you cannot suppose one ewe always to produce ram-lambs, nor, if she did, can you suppose them always fitted for the stud. Suppose, however, this to be the case, and that the ewe *b* had a grandson by her son, and a great-grandson by her grandson, then it would show thus with the other ewes :—

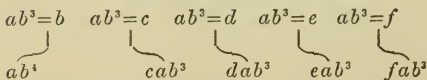
### 2nd Generation.



### 3rd Generation.



### 4th Generation.



Either all the ewes must be sisters, or you must find a ewe who always breeds ram lambs.



## PEDIGREE No. 6,

Or No. 3 re-stated.

Or, half-Brothers, half-Sisters and Cousins; the original Ewes not being Sisters.

To save figures and trouble, the ewes are supposed to give female lambs,—save and except one in each generation, from which I take the ram to carry on with; his maternity I vary each generation.

$$\begin{array}{ccccccc}
 a=b & a=c & a=d & a=e & a=f & a=g & a=h \\
 \downarrow & \downarrow & \downarrow & \downarrow & \downarrow & \downarrow & \downarrow \\
 ab & ca & da & ea & fa & ga & ha
 \end{array}$$

### 2nd Generation.

$$\begin{array}{cccccc}
 ab=ca & ab=da & ab=ea & ab=fa & ab=ga & ab=ha \\
 \downarrow & \downarrow & \downarrow & \downarrow & \downarrow & \downarrow \\
 ca^2b & a^2bd & ea^2b & fa^2b & ga^2b & ha^2b
 \end{array}$$

### 3rd Generation.

$$\begin{array}{ccccc}
 a^2bd=ca^2b & a^2bd=ea^2b & a^2bd=fa^2b & a^2bd=ga^2b & a^2bd=ha^2b \\
 \downarrow & \downarrow & \downarrow & \downarrow & \downarrow \\
 b^2a^4cd & b^2a^4ed & a^4b^2df & b^2a^4gd & b^2a^4hd
 \end{array}$$

### 4th Generation.

$$\begin{array}{cccc}
 a^4b^2df=b^2a^4cd & \& =b^2a^4cd & \& =b^2a^4gd & \& =b^2a^4hd \\
 \downarrow & \downarrow & \downarrow & \downarrow & \downarrow & \downarrow \\
 b^4a^{16}d^2cf & b^4a^{16}d^2ef & a^{16}b^4d^2fg & & b^4a^{16}d^2hf &
 \end{array}$$