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DIVERGENT SELECTION EXPERIMENT FOR TOTAL FLEECE WEIGHT IN ANGORA RABBITS: PRELIMINARY RESULTS

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ABSTRACT

This paper described a divergent selection experiment for total fleece weight. A high line and a low line were made up in 1994 with 80 females and 10 males each one. The selection criterion was the total fleece weight of the does for 3rd and latter harvests. Genetic values were estimated with a BLUP applied to an animal model. Heritability and repeatability were set to 0.31 and 0.51. The expected annual genetic progress for total fleece weight was equal to 14.8 grams. The coefficient of regression of the difference between the lines was equal to 13.8 grams between 1993 and 1997. It was weaker (9.4 grams) over the period 1993-1999. Since 1997, the genetic divergence between the lines had been stabilized without apparent reason. Mean total fleece weights of the two lines for each harvest were always statistically different after 1994.

INTRODUCTION

Divergent selection experiments are a powerful tool to explore genetic variability of quantitative traits. Comparison of high and low lines provides invaluable information on the effects of selection. It indicates the components of the trait, which were modified. The search for QTL between these same lines indicates moreover the zones of the genome, which are implied. Progress of functional genomic will allow soon to know genes responsible for these QTL. Study of genetic variability of a trait thus will change scale in the next years.

The total fleece weight in French Angora rabbit has a heritability ranging between 0.31 and 0.42 (Allain et al., 1999). The phenotypic standard deviation is approximately equal to 45 grams for harvests of adult does. We sought to exploit this additive genetic variability with a divergent selection experiment. This protocol, frequent in many species, is more original in Angora rabbit.

MATERIAL AND METHODS

The data were from the Angora experimental rabbit farm at Le Magneraud. Young rabbits were defleeced for the first time at 8 weeks. At 21 weeks, rabbits were defleeced a second time. Thereafter, they were defleeced every 14 weeks. At each harvest, total fleece weight was recorded. Studies were made on wool production of a total of 862 Angora rabbits from the French breed, which were born between 1994 and 1999. The experiment took place in a naturally lighted building almost open to the air. There was no heating and no forced ventilation. Animals were raised in individual cement hutches on straw beds, which were completely replaced once a month. Each had a creep feeder and an automatic drinking bowl. Rabbits received a pelleted commercial mixed food. Allain et al. (1999) provided a more complete description of the breeding system.

The aim of the selection experiment was to obtain two divergent lines on total fleece weight. Subsequently, the aim was to increase our experience of management of a population of Angora rabbit under selection. A high line and a low line were made up with 80 females and

10 males each one. The rabbits were distributed between the lines in order to have the same demographic structure and the same distribution of genetic values. The generations were overlapping. The renewal after selection was composed each year of 36 females and 5 males, alive at the second harvest in each line. The selection criterion was the total fleece weight of the does for 3rd and latter harvests. Twenty " best " does of each line were used for the renewal. Does were inseminated after harvests with an odd number between the third and the seventh harvest, then after each one. Does which had 6 daughters were not any more candidates. A doe, which gave a son, could not give a second one. The males born one year were used the following year then they were casted. Each of the 5 bucks was replaced by one of its sons. The genetic values were estimated with a BLUP applied to an animal model. Program MODANIM was used (Poivey, 1986). There were 3 fixed effects: reproduction with 2 levels (yes or not), the year of harvest (17 levels because one considered all the performances and the genealogies since the creation of the strain) and finally an effect dialling the season and the number of harvest (24 levels). There were 2 random effects: the animal and the permanent environment for harvests of a rabbit. Heritability and repeatability were set to 0.31 and 0.51.

RESULTS AND DISCUSSION

Number of rabbits

Our aim was to breed 36 does and 6 bucks, alive at the second harvest. It was possible to reach this objective except for 1994 (High and low line) and 1997 (Low line). There is an antagonism between wool production and reproduction in Angora rabbit (Bolet et al., 1996). It is thus important to be attentive with the demographic trends of the lines. At present, the reproduction was similar in the 2 lines.

Table 1: Number of does and bucks alive at the second harvest.

Year of birth	1994	1995	1996	1997	1998	1999
Low line						
Number of bucks	4	14	10	9	18	15
Number of does	23	51	42	22	42	40
High line						
Number of bucks	8	14	10	19	10	19
Number of does	14	49	37	40	46	54

Expected genetic progress

The expected annual genetic progress is equal to:

$$E(\Delta G)=\frac{iR\sigma_A}{L} \qquad (1)$$

Where i is the selection intensity, R the accuracy, s_A the additive genetic standard deviation and L the generation interval. From the bibliography (Allain et al., 1999) we choose values for the main parameters: the phenotypic standard deviation was equal to 45 grams; the heritability and the repeatability were equal to 0.31 and 0.51. Five harvests were used to estimate the genetic value of each doe. Therefore we get: $s_A = 25$ and $R = 0.71$. They are 4 pathways between 2 generations. Table 2 reviews p, the percentage of selected individuals, i and L for each pathway. From equation (1), the expected annual genetic progress for total

fleece weight is equal to 7.4grams. Thus the expected annual genetic difference is equal to 14.8 grams.

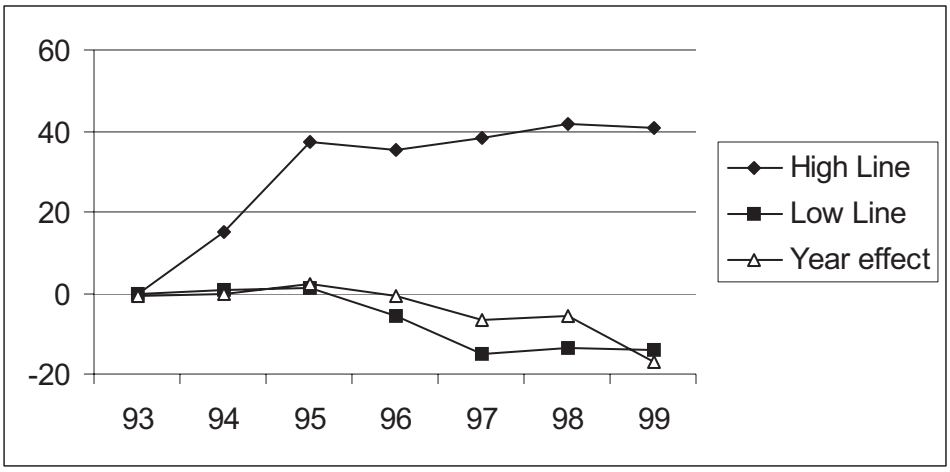
Table 2: Percentage of selected individuals (p), selection intensity (i) and generation interval for each pathway (L).

Pathway	p	i	L
Buck buck	100	0	1
Buck doe	100	0	1
Doe buck	10	1.76	2.5
Doe doe	30	1.16	2.5
Mean value		0.73	1.75

Genetic evolution of total fleece weight

Genetic evolution of total fleece weight was shown in figure 1. Mean genetic values of the two lines were always statistically different after 1994. The genetic value of the high line had boomed between 1993 and 1995, and then it had been flattened out. The evolution of the low line had been different. After stagnation between 1993 and 1995, it genetic value had fall slightly. An asymmetric answer is often observed in the divergent selection experiments (Falconer 1989). The coefficient of regression of the difference between the lines was equal to 13.8 grams between 1993 and 1997. It was weaker (9.4 grams) over the period 1993-1999. These values were not very different from the expected genetic progress. Since 1997, the genetic divergence between the lines had been stabilized without apparent reason. The year effect evolved unfavourably which would represent a degradation of the breeding conditions.

Figure 1: Mean genetic value for total fleece weight in grams for each line and value of the year effect

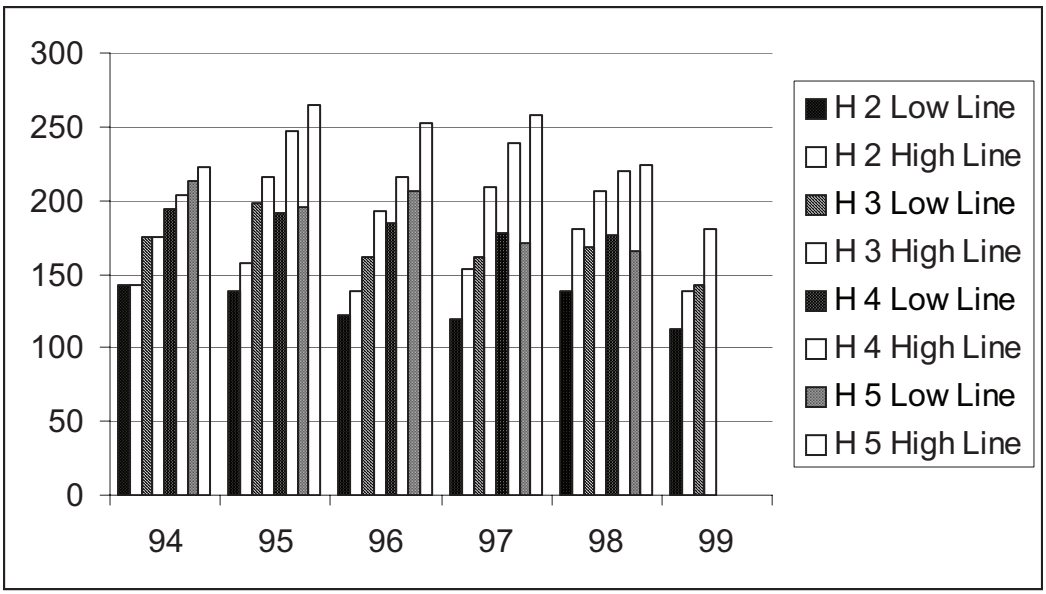


Phenotypic evolution of the fleece weight

The evolution of the total fleece weight for the first 5 harvests was presented on figure 2. Mean total fleece weights of the two lines for each harvest were always statistically different after 1994. This evolution confirmed the observations made on the genetic values. It was curious to note that, in the high line, the wool production progressed between 2nd and 5th

harvest. It did not increase any more in the low line after the 3rd harvest. This point will have to be confirmed.

Figure 2: Total fleece weight of the does of each line for 2nd to 5th harvest



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