Genetic Selection As Alternative To Tail Docking In Hampshire Down And Clun Forest.

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Introduction

Tail docking was a regular practice on sheep farms in the Netherlands. The main purpose was to reduce the accumulation of faeces and urine stain in order to prevent myiasis (Scobie and O' Connell, (2002)). As such, it is an example of a management practice which causes a temporary decrease in animal welfare in order to avoid larger problems later in life. Behavioural and endocrinological studies demonstrate pain caused by docking (Mellor and Murray, (1989a and 1989b), Kent et al. (1993); Graham et al. (1997)), and it is considered a unwanted mutilation by policymakers in the Netherlands. Therefore, there is an active policy to promote alternatives for such management practices. With better management i.e. cleaning tails and (preventive) medical treatment, myiasis can be prevented. Consequently tail docking is prohibited in The Netherlands since January 1st 2008. Three English breeds (Suffolk, Clun Forest and Hampshire Down) have too long tails for efficient prevention of myiasis and are temporary exempted from this prohibition on the provision that a breeding programme is started to breed for shorter tails. Moderate to high heritabilities for tail length have been found for the Finnish Landrace with $h^2 = 0.77$ (Branford Oltenacu and Boylan (1974)), for the Rambouillet $h^2 = 0.39$ (Shelton (1977)) and for the Suffolk $h^2 = 0.41$ (De Haas and Veerkamp (2004)). The objective of this study was to quantify genetic variation for tail length at birth for Clun Forest and Hampshire Down sheep in The Netherlands as a starting point for a breeding programme.

Material and methods

Data. Information on tail length at birth was available for 749 Hampshire Down lambs born in the Netherlands between 2005 till 2009 and 311 Clun Forest lambs born between 2007 and 2009. Birth weight was recorded on 733 Hampshire Down lambs and 274 Clun Forest lambs. Tail length at birth and birth weight were measured on the farm by the breeder up to 2 weeks of age. Birth weight was measured in kilograms and tail length in centimetres. The pedigree file consisted of 21,640 animals for Hampshire Down and 10,441 animals for Clun Forest. After pedigree selection 2786 and 1178 animals were left for Hampshire Down and Clun Forest respectively.

Statistical analyses. The effect of herd, sex, and litter size were analysed and the effect of birth weight was estimated. Variance components were estimated with ASREML (Gilmour et al. (2006)). For Hampshire Down a bivariate analysis with tail length and birth weight with an animal model was used. Due to the smaller data set the animal model did not

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converge in the Clun Forest, and we reduced the model to a sire model with a univariate analysis on tail length. The used models were

$$Y = \mu + \text{fixed effects} + \text{animal} + \text{error for Hampshire Down and}$$

$$Y = \mu + \text{fixed effects} + \text{sire} + \text{error for Clun Forest.}$$

Fixed effects included in the model were herd, sex of the lamb, litter size of the sheep and birth weight of the lamb. For Clun Forest lambs, birth weight was analysed by taking the residuals of the regression of tail length on birth weight.

Breeding values were estimated with the use of ASREML. Breeding values were presented with an average of 100 and using the genetic standard deviation such that accurate breeding values got a standard deviation of 10. A higher breeding value means a better breeding value for shorter tails at birth.

Results and Discussion

The mean tail length at birth was 15.6 cm for Hampshire Down and 17.8 cm for Clun Forest. Clun Forest had the most variation in tail length (see Table 1). For Clun Forest, ram lambs had longer tails at birth than ewe lambs (18 cm vs 17.6 cm). On average, ram lambs had a higher birth weight than ewe lambs (4.91 kg vs 4.43 kg, respectively). So Ram lambs were heavier than ewe lambs and appeared to have longer tails. For Hampshire Down no difference in tail length at birth was seen between the ram and ewe lambs. Single born lambs had longer tails than multiple born lambs (see Table 2) for both sheep breeds. But then again single lambs were bigger and heavier than lambs born in a multiple birth.

There was a difference in average tail length at birth between the breeders/herds within breed. Minimum tail length for Hampshire Down and Clun Forest was 13.6 cm and 14.3 cm, respectively, and the maximum tail length 20.7 cm and 21.7 cm between all breeders. These differences might be explained by small differences in the method used to measure tail length. In the genetic analyses this effect was controlled by adding a herd effect as a fixed effect in the model. Herd and breeder are confounded, and therefore, it was not necessary to include breeder as a separate effect in the model.

Estimated heritabilities for tail length at birth were 0.20 (± 0.10 s.e.) for Hampshire Down and 0.27 (±0.35) for Clun Forest. These results are smaller in comparison to the heritabilities of 0.41 and 0.34 estimated for Suffolk in 2004 and 2008 by De Haas and Veerkamp and De Jong (2008) respectively. Hampshire Down had a higher genetic variation in comparison to Clun Forest (0.69 vs 0.14, respectively). Phenotypic correlation between birth weight and tail length at birth was 0.42 for Hampshire Down and 0.48 for Clun Forest. Although, the standard error was very large the genetic correlation for Hampshire Down between tail length at birth and birth weight could be estimated and was -0.07 (s.e. = 0.27). Predicted breeding values varied from 80 to 115 for Hampshire Down and from 95 to 105 for Clun Forest (Figure 1). Animals with a breeding value above 100 have more tendency to have offspring with shorter tails. Hampshire Down has the largest variation in breeding values. The range in breeding values for Clun Forest is much smaller than for the Hampshire Down. For Clun Forest the correlation between the phenotypic data and the breeding values was 0.008. The small variation and the low correlation for Clun Forest are caused by lack of data which means that reliability of the breeding values is very low.

Table 1: Number of observations (n), mean, phenotypic standard deviation (σ_p) and minimum and maximum score, overall and divided by sex for tail length and birth weight of Hampshire Down and Clun Forest.

			N	mean	σ_p	min	max
Hampshire Down	Tail length	All	749	15.6	1.94	9	25
		Ewes	395	15.6	1.89	9	25
		Rams	354	15.6	1.99	10	23
	Birth weight	All	733	4.60	0.95	1	7.4
		Ewes	384	4.53	0.97	1	7.2
		Rams	349	4.67	0.92	1.9	7.4
Clun Forest	Tail length	All	310	17.8	2.34	10	25
		Ewes	165	17.6	2.44	10	24
		Rams	145	18.0	2.23	10	25
	Birth weight	All	274	4.66	1.26	1.5	9
		Ewes	142	4.43	1.14	1.5	8.5
		Rams	132	4.91	1.34	1.5	9

Table 2: Average tail length at birth (in cm) for single born, twin, triplets and quadruplets for Hampshire Down and Clun Forest lambs.

Littersize	Hampshire Down	Clun Forest
1	15.6	18.4
2	15.6	18.1
3	15.4	16.6
4	14.6	n.b

n.b: no tail length at birth of quadruplets measured for Clun Forest

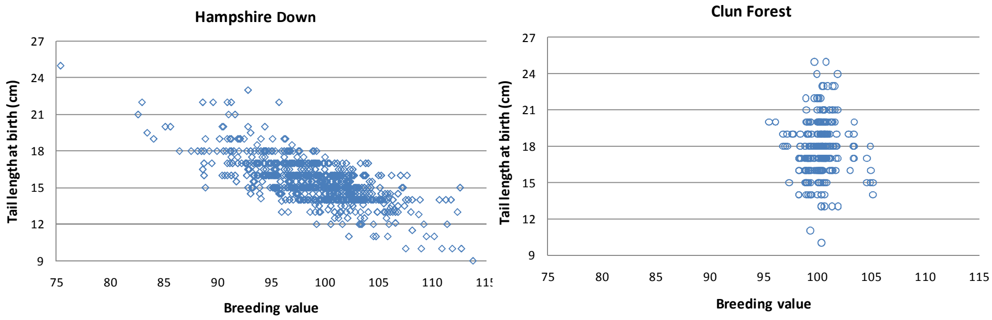

Figure 1: Breeding values and true measured tail length at birth (in cm) for Hampshire Down and Clun Forest.

Conclusion

The heritabilities show that there are considerable genetic differences in tail length at birth in the Dutch Hampshire Down as well as in the Dutch Clun Forest population. Therefore, reduction of tails is possible if breeders are willing to select on tail length. Speed of reducing tail length at birth with genetic selection depends on both the selection intensity, as well as the number of animals measured for tail length at birth and the selected population size. Measurements of tail length do not have to be expensive and can be done by the farmer within two weeks after birth for example when weighing the lamb. To avoid systematic measurement differences careful instructions by the different studbooks are needed. De Haas and Veerkamp (2004) found a maximum genetic response of 0.62 cm per year for the Suffolk. This indicates that a reduction of the tail length at birth with 50% takes around 15 years. Overall, breeding can provide an alternative for welfare unfriendly management practices. However, it takes time and for effective breeding, data on all lambs born in the population should be gathered.

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