DOCILE LIMOUSINE COWS ARE NOT POOR MOTHERS

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INTRODUCTION

Behavioural traits are more and more becoming important in farm animal selection, as they can be involved in several important parameters including production, handlers' safety and animal welfare. Most social relationships are built up during their life (Scott, 1981). Some sensitive periods are particularly important in that process (Bateson, 1981). However experience is not the only factor involved in the variability of behaviours and the genetic selection could be also one way to improve those traits. Two of those traits will be more particularly the concern of that paper, maternal behaviour, and animal docility.

The care the dam gives to her calf is of particular importance for its survival. That care is more important during the first few days after calving when the calf is more vulnerable. During that period the cow stimulates the calf helping it to suck as soon as possible after its birth in particular by licking it (Le Neindre, 1984). They can also protect them against threatening events. It seems the cows can see human as a threatening events or a predator (Estep and Hetts, 1992). A large proportion of post calving cows, especially when reared outdoors, can be aggressive (Le Neindre *et al.*, 1999). Differences between cows from different breeds in their relationships with their calves have been described (Le Neindre, 1989). However the few estimates of heritability on the protective behaviour are low and ranging between 0.06 and 0.09 (Buddenberg *et al.,* 1986 ; Morris et *al.*, 1994).

All farmed animals have to deal to some extend with human. Price (1995 and 1998) presents a low reactivity to human as one of the important trait in the domestication process. A low reaction during handling, so-called "docility", is of particular importance for the cattle welfare but as they are large it is also important for the handlers' safety. In Europe, most suckling cattle had until now a lot of positive contacts with humans during their life and in particular during early age. However the trend is towards a decrease of those contacts due in particular to the herd size increase and to more extensive managements. In those conditions the mother has to take care of her calf and any failure can threaten the calf' life as human will not so easily help her. In those extensive conditions the building up of the human-cattle relationships is not optimal and cows can react negatively to human contacts (Boivin *et al.,* 1994). A way to make the handling of the cattle easier is to select the ones reacting positively to handling. Differences between breeds have been observed (Fordyce *et al*., 1988, Murphey *et al*., 1981). Several authors have shown that this trait is heritable in cattle (Burrow, 1997 ; Le Neindre *et al.*, 1995 ; Mathiak *et al.*, 1999).

Docility and maternal behaviour could be linked for example because intermediate variables, as emotional reactivity, modulate those different traits. At a practical level the question is whether selecting cows on their docility could have negative consequences on their maternal behaviour. The text reports results from an experiment conducted in a progeny-testing farm on those behavioural traits in limousine cattle in order to estimate their heritabilities and their genetic and phenotypic correlations.

MATERIAL AND METHODS

Animals. 558 Limousine heifers from 21 different sires were gathered from different farms in two batches, one in 1996 and the other in 1997, in a progeny-testing farm. One reference sire had daughters in the two different batches. From those animals 183 two years old primiparous from 14 different sires were observed with their calves born from two different sires. The animals were in loose stable during the winters and at pasture during the grazing periods.

Methods of observation. Two different sets of observations are reported :
Each heifer was observed during a docility test (Boivin *et al*., 1992) when 9 months of age. During that test the target animal was sorted from the pen group in an adjacent pen. After 30 sec, a handler came in the pen and stayed still for 30 sec then he tried to maintain the animal during consecutive 30 sec in a corner of the pen opposite to the one where the peers are. If the animal was dangerous or if he could not be maintained in the corner before 2 minutes the test was over. A docility score was calculated as described in Le Neindre *et al*. (1995). The score varied from 7.5 to 17. The bigger the score was the more docile the heifer was.
Just after calving, 183 primiparous were isolated with their calves in a specific pen close to their peers for 2.5 hours. Their behaviours were video recorded. The licking time, which is one of the important components of the maternal behaviour, is reported here. Such measurement gives an indication of the maternal behaviour of the cows (Le Neindre, 1984).

Statistical analyses. The different parameters were estimated by using a mixed model combining fixed and random factors. The REML method was chosen with 50 iterations and a convergence factor of 0.001. The sire variances and the error variances estimated by the models were used for calculating the heritabilities of the variates using all the possible animals. The phenotypic and genetic correlations between the docility score and the licking time were estimated using all the animals observed after calving.
The models used are :
For the licking time :
$Y_{ijklmnqrstuv} = m + A_i + T_j + N_{ik} + R_j + C_m + M_{in} + J_q + V_r + S_s + H_t + D_u + e_{ijklmnqrstuv}$
For the docility :
$Y_{ijklmnq} = m + A_i + T_j + N_{ik} + R_j + C_m + O_n + e_{ijklmnq}$
For estimating the correlation :
$Y_{ijklmnqrstuv} = m + A_i + T_j + N_{ik} + R_j + C_m + M_{in} + J_q + V_r + S_s + H_t + D_u + O_n + e_{ijklmnqrstuv}$

m : constant ; A_i : year ; T_j : sire ; N_{ik} : months of birth of the cow within the year ; R_j : region ; C_m : husbandry system before weaning ; M_{in} : month of calving ; J_q : time of the day ; V_r : easy birth score ; S_s : calf's sex ; H_t : calf's weight ; D_u : calf'sire ; O_n : handler ; $e_{ijklmnqrstuv}$: residual random effect.

RESULTS AND DISCUSSION

The mean docility score was 12.55 indicated a rather good docility (Table 1). Four factors had a significant effect : the sire ($P<0.001$), the month of birth ($P<0.05$), the husbandry system ($P<0.01$) and the handler ($P<0.001$). The mean docility score was 14 for the daughter of the best sire and 11.2 for the worst. The heritability was estimated as moderate (Table 1).

During the first 2 hours, the cows spent 25% of their time licking their calf. Two factors had a significant effect: the sire ($P<0.05$) and month of birth ($P<0.05$). The licking time ranged from 66.6 min for the mean of the daughters of the best sire to 33.3 for the worst. The heritability was estimated as moderate (Table 1).

The phenotypic correlation between the two parameters was low ($r = + 0.09$) but the genetic one moderate ($r = + 0.34$).

Table 1. Statistical estimates of the docility score and licking time

	Docility score	Licking time (min.)
Number of animals	558	183
Mean	12.55	38.5
Standard error	2.15	22.0
Range	7.5 – 17.0	0 -93.7
Heritability ± standard error	**0.29 ± 0.13**	**0.32 ± 0.23**

CONCLUSION

Both docility and licking time are genetically influenced. The significance of the heritability of the docility trait is then confirmed. The moderate heritability of the licking time is for the first time observed in cattle.

The positive genetic correlation between the two parameters indicates that it should be possible to select for docility traits without decreasing at least one parameter of the maternal behaviour, the licking time. It is even possible that by selecting docility that maternal trait will be improved. However it is important to notice that those estimates have been obtained with small numbers of cows and sires and the conclusions need to be confirmed on a larger sample.

Our experiment highlights the existence of a strong handler effect in the docility test by contrast to Boivin *et al*. (1992) and Le Neindre *et al*. (1995). Then we suggest that factor to be controlly carefully in further research.

Finally if the genetic correlation between docility and maternal behaviour is confirmed, it would be important to better understand how those two parameters are related perhaps through an intermediate variable as the general reactivity of the animals.

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