

Selection for milk production in a single Holstein herd: effects on correlated traits

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Introduction Selection is the main tool used by animal breeders to improve the performance of their stock. Despite large gains being made at industry level in the major dairy traits (Royal *et al.*, 2000) very few reports exist for the results of experiments on persistent selection for dairy traits in a single herd, particularly with reference to the correlated effects on other dairy traits. This paper reports one such set of results between 1980 and 2005 from SAC's Langhill herd, which has been under maximal selection for milk production during this period.

Materials and methods This work was based on the intensively recorded Langhill herd of cows originally maintained at The University of Edinburgh's Langhill Farm until 2002, and then transferred to SAC's Crichton Royal Farm. Details of the management of this herd have been described by Pollott and Coffey (2008). This 200-cow herd was equally divided into a Selection Line and a Control Line; only results from Selection Line animals are reported in this paper. Bulls were chosen from all AI bulls available at the time of mating which had the highest fat plus protein PTAs, had semen available and were not related to the cows back to grandparent level. The data used in this study were the PTAs for all traits produced as part of the national genetic evaluations carried out by EGENES on behalf of DairyCo. Results presented are the mean annual PTA values for Langhill Selection Line cows each year between 1980 and 2004. Linear regression on year of birth was applied to each set of trait PTAs to estimate the mean annual genetic response.

Table 1 The genetic gain (1980-2004), change per year, its standard error and the fit for the linear regression of trait on year of birth for cow PTAs

Trait	Genetic gain	Change per year	SE	R ²
Fat+protein (kg)	76.2	2.66	0.106	0.576
Milk (kg)	717.5	34.9	2.13	0.365
Test-day yield (kg)	7.56	0.295	0.0121	0.563
Persistency (%)	2.13	-0.859	0.0144	0.071
Calving Interval (d)	22.7	0.671	0.0351	0.438
Non-return rate	-0.057	-0.0032	0.000228	0.292
Number of services	0.128	0.00663	0.000500	0.271
Days to 1 st service	6.08	0.418	0.0217	0.445
Condition score	-2.11	-0.0672	0.00311	0.498

Results The genetic trend information summarised in Table 1 was derived from 466 cows born in the Selection Line from 1980 to 2004. Selecting sires on the basis of their fat+protein PTA resulted in an average annual PTA increase of 2.66kg per lactation. The other changes shown in Table 1 represent correlated genetic responses in other traits occurring because of the selection on fat+protein PTA. Milk production increased by 35kg a year and test-day yield at about day 110 also increased. All other traits deteriorated with cows having poorer fertility, persistency and becoming thinner. The regression of each trait PTA on year of birth explained a differing amount of the variation in each trait. In several traits the regression line accounted for more than half of the variation whereas the regression of persistency PTA on year had a poor fit to the data. Over the 14-year period described by these results the proportion of Holstein genes in the Selection Line cows rose from about 0.25 to almost 1.0.

Conclusions Several authors have reported on the changes that have occurred in dairy cow productivity and fertility at national or regional level (Butler and Smith, 1989; Royal *et al.*, 2000; A.-Ranberg *et al.*, 2003). The general trend is for an improvement in milk production at the expense of fertility. However, such studies do not account for the effects of farm, management, feeding changes and health status on the measured traits. In this study we have demonstrated that selection for increased milk production unequivocally leads to deterioration in genetic merit for fertility and condition score.

References

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