ESTIMATION OF BREEDING VALUES OF POLISH BLACK AND WHITE CATTLE USING TEST DAY YIELDS

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SUMMARY

The data set consisted of 151,413 test day yields of 22,068 cows calving for the first time from 1992 through 1994. A single trait random regression model was used. The fixed regressions were calculated within four genetic groups (defined according to the proportion of HF genes), four age groups and two seasons.

The lactation curves derived from the fixed regression coefficients peaked very early. In all subclasses, the genetic groups ranked exactly the same, according to the proportion of HF genes. Lowest yields and similar lactation shapes were found in pure Black and White and less than 50% HF genetic groups. The correlation between 305-d official and 305-d TD cow breeding values was 0.66. The relationship (r=0.79) between official and TD 305-d evaluations of 79 bulls with 50 or more daughters was also lower than in other studies. The relatively low correlation is partly due to the fact that the TD data set included only a small proportion of the data set used for the official evaluation.
Keywords: Lactation curve, random regression model, test day yield, breeding value.

INTRODUCTION

In recent years there is a growing interest in using test day (TD) records for genetic evaluation of cattle. Ptak and Schaeffer (1993) used fixed regression to describe the lactation curve and estimate breeding values. A model containing both fixed and random regressions was proposed by Jamrozik *et al.* (1997). An evaluation based on TD instead of traditional 305-day yields accounts better for environmental effects.

The purpose of this paper was to estimate breeding values of sires and cows using the TD yields and random regression model of Jamrozik *et al.* (1997) and to compare the results with the official animal model estimations based on 305-d lactation yields. The shapes of the lactation curves calculated from the fixed regressions for four genetic groups with different proportions of HF genes were also compared.

MATERIALS AND METHODS

The data set consisted of test day yields of 22,068 cows calving for the first time from 1992 through 1994. The data are characterized in Table 1. The cows were progeny of 1,339 sires and 20,039 dams and represented 4,661 herd-year-seasons (HYS).

The following single trait random regression model (Jamrozik *et al.* 1997) was used:

$$y_{ijkl} = HYS_i + \sum_{n=0}^{4} b_{kn}x_{jln} + \sum_{n=0}^{4} a_{jn}x_{jln} + pe_j + e_{ijkl}$$

where y_{ijkl} is l-th record of j-th cow at t_{jl} day in milk (DIM) for a cow belonging to k-th subclass of the genetic group by age at calving by season of calving and i-th HYS; b_{kn} and a_{jn} are the fixed and random regression coefficients with var(a)=$\mathbf{G}\otimes\mathbf{A}$; pe_j is random permanent environmental effect for all TD yields of j-th cow with var(pe)=$\mathbf{I}\sigma_p^2$; e_{ijkl} is random residual effect with var(e)=$\mathbf{R}$; and $\mathbf{x}_{jl}$ is the vector of covariates defined as $(x_{jl0}, x_{jl1}, x_{jl2}, x_{jl3}, x_{jl4})' = (1, t_{jl}/305, (t_{jl}/305)^2, \ln(305/t_{jl}), \ln^2(305/t_{jl}))'$. Matrix $\mathbf{R}$ is the diagonal matrix with the diagonal elements calculated as a value of the linear and quadratic regressions on DIM.

The two seasons were April to September and October to March. The genetic groups were defined according to the proportion of HF genes: pure Polish Black and Whites (PBW), <50%, <75% and up to 100% of HF genes. The age groups were 18 to 23 mo, 24 to 29 mo, 30 to 35 mo and 36 to 48 mo.

Table 1. Number of test day records by age, genetic group and season of calving

Season	Genetic group	Age at calving (months)				Total
		18-23	24-29	30-35	36-48	
Apr-Sep	PBW	672	4,078	1,730	961	7,441
	<50% HF	1,109	11,587	4,787	1,226	18,709
	<75% HF	1,178	11,816	3,259	452	16,705
	up to 100% HF	366	4,947	1,537	111	6,961
Oct-Mar	PBW	1,169	10,192	5,321	1,961	18,643
	<50% HF	2,548	19,177	11,516	3,116	36,357
	<75% HF	2,006	19,116	8,509	1,455	31,086
	up to 100% HF	871	9,318	4,776	546	15,511
Total		9,919	90,231	41,435	9,828	151,413

RESULTS AND DISCUSSION

The lactation curves derived from the fixed regression coefficients and calculated within genetic groups, seasons and age groups peaked very early, in most cases between 13 and 21 days after

calving. The peaks in age groups from 24 to 29 mo and 30 to 35 mo were higher than in both younger and older age groups. Also higher were summer season peaks, and their decline was slower than in the winter season. In all subclasses, genetic groups ranked exactly the same according to the proportion of HF genes. Lowest yields and similar lactation shapes were found in the pure Black and White and <50% HF genetic groups. The two other genetic groups with higher proportions of HF genes peaked slightly later but declined at the same rate as the other groups. The lactation curves for 30-35 mo in both calving seasons are shown in Figs 1 and 2.

The correlations between the breeding values (BV) of cows based on TD yields and official BV evaluations are shown in Table 2. The correlation between 305-d official and 305-d TD cow breeding values was 0.66. The relatively low correlation is due partly to the fact that the TD data set included only a small proportion of the data set used for the official evaluation. The same reason could explain the relationship r=0.79, lower than in other studies, between the official and TD 305-d evaluations of 79 bulls with 50 or more daughters (Table 2). Jamrozik *et al.* (1997) reported a correlation of 0.93 for 1730 sires. The correlations between the official 305-d evaluation and TD breeding values for part-lactation yields (1-100 days, 101-200 days, 201-305 days) were low. Only the correlation with 101-200 days resembles the correlations with the 305-d official evaluation, for both cows and bulls (Table 2).

The TD records have been saved since 1992, and more comprehensive comparisons will be possible when the data accumulate.

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Table 2. Correlations between breeding values (BV) for milk yield for 79 sires with more than 50 daughters (above diagonal) and for cows with records (below diagonal)

	BV_T	BV_{100}	BV_{200}	BV_{305}	BV_{AM}
BV_T		0.719	0.919	0.791	0.794
BV_{100}	0.391		0.631	0.182	0.566
BV_{200}	0.834	0.254		0.651	0.777
BV_{305}	0.605	-0.436	0.388		0.602
BV_{AM}	0.656	0.350	0.579	0.299	

BV_T - 305-d yields, BV_{100}, BV_{200}, BV_{305} - partial lactation yields 1-100 days, 101- 200 days and 201-305 days, respectively, BV_{AM} - 305-d official

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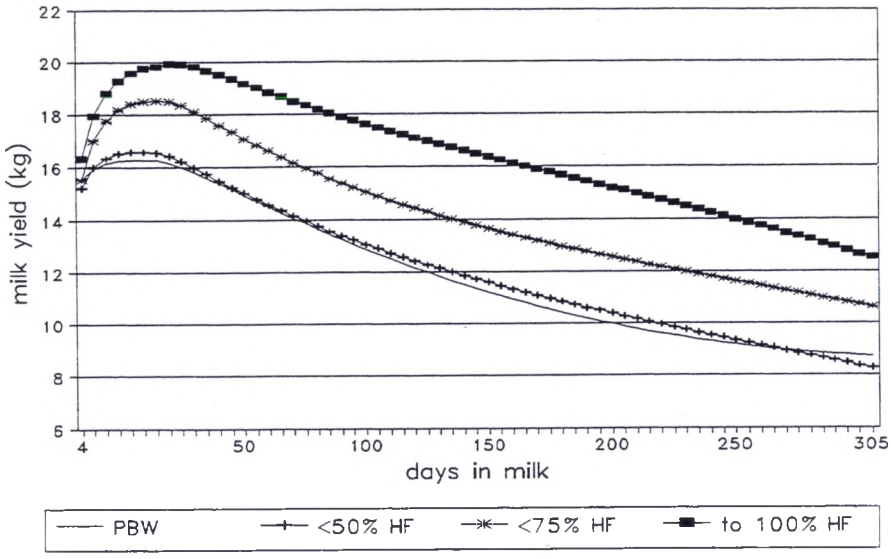

Figure 1. First lactation curves for cows calving 30-35 mo and in April-September season, by genetic group.

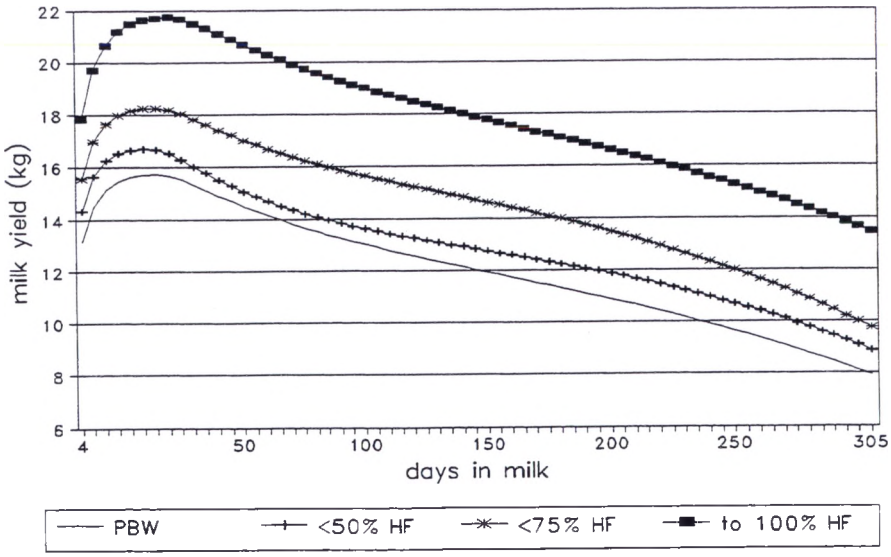

Figure 2. First lactation curves for cows calving 30-35 mo and in October-March season, by genetic group.