Genetic Evaluation for Milking Speed in German Holstein Population Using Different Traits in a Multiple Trait Repeatability Model

S. Rensing and W. Ruten
VIT, Heideweg 1, D-27283 Verden, Germany

Abstract

In Germany information on milking speed had always some importance. Data on milking speed and milking temperament were available in many regions but for different trait definitions and from different data sources. VIT established a genetic routine evaluation using all traits and data sources in a multi trait repeatability model. Heritability for measured milking speed was significantly higher (0.28) than for owners scored milking speed (0.10) and for owners scored milking temperament (0.07). Teat traits had only low to moderate genetic correlations to milking speed. High milking speed has unfavourable genetic correlation to cell count (0.23). No significant genetic correlation to longevity was found. Official EBVs were published for the first time in February 2004 and acceptance is high. For the future data on milking speed will be recorded for a random sample of daughters of all A.I. bulls.

1. Introduction

Information on milking speed (MS) A.I. bulls transmit has always had some relevance in Germany. Different sources of data on MS and temperament during milking (MT) were used for mating advices, e.g. measured MS (kg/min) or owners scoring. In some regions breeding values based on measured milking speed (mMS) of test bull daughters were estimated and published by the local authorities or milk recording organisations. But there was no central evaluation for MS. With growing average herd size and bigger milking parlours there was demand for central genetic evaluation and comparable estimated breeding values (EBV) for MS.

2. Materials and Methods

2.1 Data

There are two different sources of data on MS and MT: official milk recording and linear owner scoring of MS and MT.

Measured Milking Speed

The milk recording data base contains about 1,6mio records of measured MS since 1990 (see table 1). These are either single records of test bull daughters and herd mates in first lactation or repeated measures from all tests days within first lactation in case official milk recording was carried out with a LactoCorder. Data are recorded as average MS in kg per minute.

Table 1. Data included in genetic evaluation for Milking Speed (MS) in February 2005.

Region/ breeding org.	Records measured MS	Records owner sored MS
LTR	1,800	-
NOR	**4,400**	**147,000**
OHG	450	**23,300**
RBB	**12,800**	1,200
RBW	**86,800**	-
RMV	**11,700**	-
RSA	**2,100**	-
RSH	**595,700***	1,700
RUW	**22,100**	**110,200**
SRB	**854,400***	-
SRV	7,200	-
VOST	3,300	1,900
WEU	950	**58,000**
ZBH	5,100	**39,200**
Total	**1,608,800**	**382,500**

*) repeated records per animal from milk recording with LactoCorder

Some regional herdbook associations collect data on measured milking speed from automatic daily milk recording on farm level. The result of the last milking prior to the visit of the classifier is recorded for test bull daughters and herd mates.

Linear Scoring of Milking Speed and Milking Temperament

Within the system of linear type classification in some regions data on MS and MT are recorded as optional traits as well. The classifier asks the owner to score MS and MT for the test bull daughters and their herd mates. Beside the standard scale of 1-9 (9 = high MS/calm MT) for linear conformation traits in some regions scales of 1-5 and 1-3 were used for sMS and sMT.

For the future the German Holstein Association recommends to use a scale of 1-5 because it is difficult for farmers to use the full range of a wider scale.

About 380,000 records for scored MS and MT from first lactation were included in the first routine evaluation in February 2005 (see table 1).

Absolute and relative quantity of data on MS from the different sources and on MT vary significantly across regions. In total about 75% of all officially published actual A.I. bulls have MS proofs.

2.2 Evaluation model

The evaluation model for MS and MT basically is the same multitrait animal model as the one used for the conformation traits (see table 2).

Beside the target traits MS measured and scored and MT the linear udder traits Teat Placement Front (TPf) and Teat Length (TL) as predicting traits are included. The environmental effects considered in the model can be seen in table 2.

Calving age (6 classes) and days-in-milk (8 classes) are included for all traits. For the scored traits classifier and herd x year effect are included additionally. For the measured MS a herd-test-day effect is fitted as the major fixed effect.

Table 2. Effects included in the models.

	statistical model				
effect	**mMS**	**sMS**	**MT**	**TPf**	**TL**
herd x test day	x				
herd x year		x	x	x	x
calving age	x	x	x	x	x
days-in-milk	x	x	x	x	x
classifier		x	x	x	x
animal (random)	x	x	x	x	x

3. Results and Discussion

3.1 Genetic Parameters

Genetic parameters were estimated with the same model described before on a data set collected between 2000 and 2003 and including bulls with minimum 40 daughters. Heritabilties and genetic correlation estimates are given in table 3.

Table 3. Genetic parameters (heritabilities on diagonal, genetic correlations off-diagonal).

	mMS	**sMS**	**MT**	**TPf**	**TL**
Measured Milking Speed (mMS)	**0,28**	**0,79**	**-0,03**	**0,10**	**-0,19**
Owner scored Milking Speed (sMS)		**0,10**	**0,00**	**0,10**	**-0,23**
Milking Temperament (MT)			**0,07**	**0,05**	**-0,09**
Teat Placement front (TPf)				**0,25**	**-0,26**
Teat Length (TL)					**0,29**

The repeatability of measured MS within first lactation is 0.47.

The heritability of measured MS (0.28) is significantly higher than for the owners scored MS (0.10) and MT (0,07). Nevertheless the owners scores for MS and MT are useful data for genetic evaluation of milking speed and temperament of A.I. bulls.

The genetic correlation between measured and scored MS is high (0.79) but not equal to one. MS and MT are completely independent traits with genetic correlation close to zero. The correlation of TPf to MS is low (0.10). Correlation between TL and MS is low to

moderate (-0.19/-0.23). Because higher MS (and calm MT) is defined as favourable the negative correlation means that longer teats tends resulting in lower MS. Overall the additinal information on MS and MT contributed by the predictor udder traits is limited.

3.2 Publication of Proofs

The original proofs for measured and scored MS are not published. Both traits are combined to one MS index with equal weights for one genetic standard deviation. The published index is called RZD a relative breeding value with average 100 and a genetic standard deviation of 12 within (base are actually A.I. bulls born 1995-1997). Figures above 100 indicate higher milking speed. RZD of a bull is published if he has either 10 daughters in 5 herds with measured MS or 20 daughters in 10 herds with scored MS. Holstein and Red Holstein bulls are expressed on the same base. The Red Breed/Angler have a separate base.

Due to the very diversified quantity of data from different regions bulls from the most recent years may have official RZD with reliabilities in the range of 50% reliability (20 daughters with scored MS) up to 85% reliability (100 daughters with multiple measured MS by LactoCorder). In the western German states with mainly family herds (average 50 cows in milk) recording data on owners scored MS and MT within the system of linear scoring for conformation traits is possible. In the large herds in the eastern German states people milking the cows are not available during the visit of the classifier. Because official measuring of MS by supervisor during official milk recording is relatively expensive, the tendency goes towards recording the data for daughters of test bulls and their herd mates from herd management computers. This has still to be done manually. Automatic data transfer from herd management computers directly to the central data base is still in development. For the future it may be expected that the data are available from each milking. Then almost the same high accuracy could be reached for most A.I. bulls like already today from regions where official milk recording is done with LactoCorder (i.e. Schleswig-Holstein and Bavaria).

Proofs for MT are published for a bull as well as relative breeding value (mean 100, s 12) if it includes at least 20 daughters scored in at least 10 herds. Figures above 100 indicate calm temperament.

The first routine evaluation for MS and MT was conducted in February 2005. Routine evaluations will be done with every official proof release (February, Mai, August).

3.3 Correlations with SCS and Longevity

High MS is expected to be negatively correlated with udder health. But at the same time very low milking speed may have negative effects on udder health as well caused by longer/more mechanical stress during milking and incomplete milked out udders.

The genetic correlations in figure 1 (approximated with the method of CALO) show an unfavourable genetic correlation between MS index (RZD) and relative EBV SCS (RZS) of 0.23. This correlation is not as close as some breeders expected. Figure 1 shows that the correlation is quite linear over the whole range of classes for MS index RZD. There is no significant genetic correlation between MS and functional herd life (0,03). Figure 1 shows that even for bulls transmitting very low MS (<88 i.e. one standard deviation below average) longevity is not significantly reduced compared to other bulls. Extreme low milking speed may be a reason for culling a cow, but the results indicate that MS in general doesn't cause problems in the German Holstein population.

4. Conclusions and Outlook

VIT has developed a routine genetic evaluation system for MS and MT including all sources of data with a multitrait repeatability model. The genetic parameter estimates show that evaluation based on owners scores is useful. Further harmonisation of the scales and definitions should result in improved genetic parameters. The acceptance of the new proofs

is high. Within bigger herds efficiency of milking becomes more and more important. In addition the introduction of official proofs for MS coincided with the upcoming of high sons of some international sire of sons with poor MS. Since the begin of 2004 data on MS will be collected in all regions/by all breeding organisations of Germany so that EBVs for MS for all bulls sampled in Germany will be available in the future.

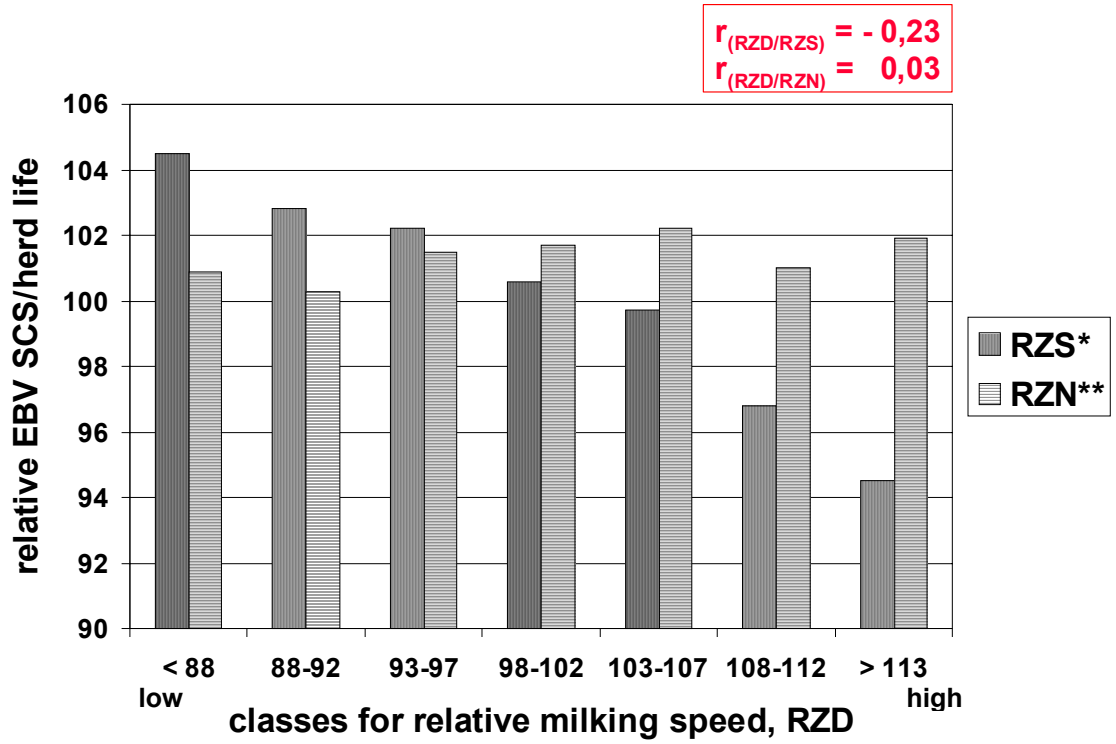

Figure 1. Correlations between Milking Speed (RZD)and SCS/longevity.
*) RZS=rel. EBV SCS, i.e. >100 is valuable = low SCS
**) RZN= relative EBV functional herd life