Statistical Indicators
E-15
Breeding value Milking Speed

- **Introduction**

It is of importance to know how fast daughters of a specific sire milk. Cows that milk too fast have a greater chance of mastitis and may suffer from milk leaking. Cows that milk too slowly have an undesirably long milking time.

From 1991 in the VRV area (Belgium) and 1994 in The Netherlands, cattle breeders that participate in the linear classification program are requested to evaluate their heifers on Milking Speed. From April 1994 the breeding values for Milking Speed have been calculated on the basis of the data of these surveys.
From the data about Milking Speed the genetic effect of the cow, the so-called breeding value, can be calculated. By using a statistic model disturbing environmental factors that affect the Milking Speed are taken into account. Examples of disturbing environmental factors during the evaluation or measurement of the Milking Speed are: the milk yield of the cow and the lactation stage.
In this part the calculation of the Milking Speed breeding values will be explained. Moreover, the presentation and publication will be discussed.

- **Data**

Scores for Milking Speed are collected via the linear classification program. To this end Dutch cattle breeders who participate in the linear classification program are requested to evaluate their heifers on Milking Speed on a scale of 1 to 9 inclusive. The VRV scores on a scale from 1 – 5 till June 1st 2003 and 1 – 9 from June 1st 2003. The description of Milking Speed for the various scores is stated in Table 1.

In the NL animal model for Milking Speed the data must comply with the following requirements:
1. the cow must be registered in the herd book;
2. the cow (milking heifer) must have calved before 3 years of age;
3. the cow must have a known herd and calving date at the time of classification;
4. the cow must be classified according to the Z, R, Y or F standard;
5. the cow must be in the herd classification system or in an additional classification system;
6. Linear traits are scored from 1 to 9 or 1 to 5.
7. The first classification of cow is used in the breeding value estimation, when a cow is classified more than once as a heifer by the same or different organisations.

Table 1. Description of score for Milking Speed as used with the linear classification program (VRV: 1-5 till 01-06-2003 and 1 – 9 since 01-06-2003, NL: 1-9)

very slow		slow		average		fast	superfast	
1		2		3		4		5
1	2	3	4	5	6	7	8	9

▪ Use of Pedigrees

The use of pedigrees in the animal model for Milking Speed is equal to that in the breeding value estimation for type traits.

▪ Statistical Model

The calculation of the breeding values on the basis of the survey system is done with a sire model, in accordance with the BLUP technique (Best Linear Unbiased Prediction). In the calculation of breeding values, disturbing factors to the scores are taken into account, in which the following statistical model is used, based on research by De Jong (1993):

$$y_{ijklmn} = HS_i + AGE_j + LST_k + MLK_l + A_m + e_{ijklmn}$$

in which:

y_{ijklmn}	:	Score for Milking Speed (on a scale of 1-9 or 1-5) for a cow, present in herd i, calved in month j, at age k at the time of classification, with a deviation from the herd average of the milk production l, of cow m;
HS_i	:	Herd*season i, in which the cow is present. The herd*season is determined by herd*survey date;
AGE_j	:	Age j of the cow at the time of classification (17 classes, 24 to 40 months);
LST_k	:	Lactation stage k at the moment of classification (12 classes, 1 month - 12 months);
MLK_l	:	Effect of milk yield (305-days' lactation production) as deviation from the average of the other cows in the farm in the HS_i class, in which the deviations are divided into classes of 200 kg of milk. There are 15 classes in total;
A_m	:	Additive genetic effect of breeding value of animal m;
e_{ijklmn}	:	Residual term of y_{ijklmn} which is not explained by the model.

The effects A and residual are random effects, the other effects are fixed.

The effects in the model
The five effects in the model are:
1. herd;
2. age at the time of evaluation;
3. lactation stage at the time of evaluation;
4. milk yield;
5. additive genetic effect or breeding value.

Scale
The differences in scale: 1-9 and 1-5 scores are solved by taking the VRV data as a correlated trait. The genetic correlation between Dutch (NL) and VRV data is 0.99.

Herd
The scores a cattle breeder assigns to his cows via a survey are compared with one another within this survey. Each herd*survey combination forms a new group of cows. Within this group the cows are

compared with one another. By incorporating the herd effect in the model the difference in level of scores that cattle breeders may make in evaluating cows is taken into account.

Age
It turns out that animals that are evaluated at the age of 27 to 29 months are perceived to milk somewhat faster than animals that are evaluated at a young or at an old age.

Lactation stage
The Milking Speed of a cow is evaluated as milking more slowly at the beginning of the lactation than in the second half of the lactation.

Milk yield
The Milking Speed of a cow is evaluated as faster milking according as a cow distinguished herself as a better milk producer from the other cows at the farm.

Additive genetic effect of breeding value
For the calculation of breeding value for Milking Speed a heritability for Milking Speed of 0.23 is used for the NL data and 0.20 for the VRV data. For the calculation of breeding values see part E-7.

▪ Publication

Breeding values for Milking Speed are presented with an average of 100 and a standard deviation of 4. A breeding value of over 100 means that the cow milks faster than the average. In the case of a breeding value of lower than 100 one may expect the cow to milk more slowly than the average.

The meaning of 4 points standard deviation
The standard deviation of 4 points in the presented breeding values corresponds with a standard deviation of 0.52 points on the 1 to 9 scale. A sire can only transmit half of his breeding value to his daughters. This means that a sire with breeding value 104 will produce daughters who milk on an average 0.26 points faster, on a scale of 9 classes, than the daughters of a sire with breeding value 100. A sire with breeding value 110 will produce daughters who will score 0.65 points higher on an average than the daughters of a sire with breeding value 100. This sire with 110 breeding value decreases the chance of a slowly milking daughter as compared to a sire with breeding value 100. Based on other data, the standard deviation is comparable with a speed 0.6 kg per minute lower or higher.

Condition for publication
See chapter ‘Publication rules sires’.

▪ Basis

See chapter ‘Bases for breeding values and base differences’.

▪ Reliability

For the calculation of the reliability for Milking Speed, a heritability of 0.23 is used.

▪ Literature

De Jong, G, 1993. *Analyse van enquête voor gedrag bij melken, melksnelheid en melkuitliggen bij vaarzen. NRS-notitie 94-0210* (Analysis of survey of behaviour during milking, Milking Speed and milk leaking with heifers. NRS-note 94-0210)

Ouweltjes, W. en J.B.M. Wilmink, 1991. *De analyse van melkbaarheidsgegevens. NRS-notitie 91-0789* (The analysis of milkability data. NRS note 91-0789)

Pelt, M. 2008. Parameterschatting voor melksnelheid en karakater op basis van Nederlandse en Vlaamse scores. R&D/08.0122/MvP/MB.