Use of data from electronic milk meters and perspectives in use of other objective measures

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Danish registrations of milk flow from electronic TruTest Milk Meters are used in the joint Nordic estimation of breeding values for milking speed. Next step is to use data from automatic milking systems (AMS's) to increase the reliability of these breeding values. Other data from AMS's are potentially beneficial in the estimation of breeding values and for management purposes.

Introduction

In Denmark, we have a central cattle database where all registrations, such as milk yield, veterinary treatment of diseases, inseminations etc. are stored on individual cows together with information on pedigree, date of birth, date of calving and date of culling (Aamand, 2006).

New sources of data are coming along. Data from different kinds of electronic farm equipment are now stored in the central database. Today, we focus on data from TruTest Milk Meters and Lely milking robots. In the future, we will collect and store data from other equipment as well such as DeLaval milking robots and Heatime systems.

The challenge is on one hand how new types of data can be used together with data already stored in the central database and give extra economic benefit to the farmer. On the other hand it is important to use these new types of data to generate benefit to all farmers no matter if they have the equipment or not.

Key words in this context are that data from electronic equipment more objectively reflects the performance of the cow and further that data are collected in an effective way that reduces costs of collection.

1 Data from electronic TruTest Milk Meters

Data from TruTest Milk Meters are collected at each testday. In Denmark, TruTest Milk Meters are used in milk recording for 60-70 % of all cows. Data on milking time and milk volume are collected by milk recording technicians and transferred to the central database. Data are collected 6 or 11 times a year.

1.1 Present improvement of breeding values for milking speed

Previously estimated breeding values (EBV's) for milking speed were calculated on the basis of registrations done by the farmer. The farmer received a questionnaire where he should judge the milking speed of the individual cow on a scale from 1 to 9. This is time consuming for the farmer and it is also difficult since farm size has increased rapidly in the last 10 years. Thus, the farmer has difficulties in remembering the behavior of the individual cow.

This is the reason why flow calculated on the basis of data from milk meters is interesting. The registered milking time from flow start to end of flow is converted to flow of milk solids (kg milk solids/minute) on the basis of milking time, milk volume and content of fat and protein in the milk. Genetic analyses show that there is a high genetic correlation (above 0.9) between milking speed from farmer questionnaires and flow of milk solids calculated on the basis of data from TruTest Milk Meters. It means it is nearly the same trait which is measured. Further, milking time from TruTest milk meters has only been measured since 2003 and only in Denmark. In the Nordic countries, breeding values for all traits are calculated jointly between Denmark, Sweden and Finland, therefore farmer questionnaires still have to be used. The present Nordic EBV for milking speed therefore comprises of both farmer registrations and flow from milk meters.

In total 90% of all Danish data in the genetic evaluation for milking speed are from TruTest Milk Meters and the rest are still from farmer questionnaires. One record is used per cow x lactation and for cows having flow data an average of up to 7 test days are calculated. The average is standardized so it has the same standard deviation as registrations from farmers.

Genetic analyses show that heritabilities are much higher for flow data compared to farmer questionnaires (figure 1).

Table 1. Heritabilities for milk flow and farmer registrations

Heritabilities	RDC* and Holstein	Jersey
One flow record per lactation	0.34	0.27
Average based on 4-6 flow records per lactation	0.42	0.35
Farmer registrations	0.25	0.19

* RDC = Red Dairy Cattle

Use of data from TruTest Milk Meters has improved reliability of EBV's for milking speed considerably both for cows and sires. For a young test sire number of daughters with records has increased from 20 to more than 80 – which mean that reliability has increased from 70% to 90%. Danish data from TruTest Milk Meters were included in the routine evaluation for milking speed in 2011.

2. Data from Lely milking robots

Routine transfer of data from Lely milking robots to the Danish Cattle Database started in autumn 2011. Data are extracted from the computer that controls the milking robot. Extraction is done by milk recording technicians that visit the farm 6 or 11 times a year. Data are validated on the farm by the recording technician and then transferred and stored on the central database. The collected data give information on yield (total yield and yield per quarter), time of milking (before, during and after milk flow), udder conformation (positioning of teat), feeding/reproduction (live weight, activity, rumination time) and health (conductivity, milk temperature).

Data from AMS's are objective and registrations are done intensively. Further, data are available for all cows in the herd and over more lactations. At present data from Lely robots are not used routinely for breeding or management purposes. However, many potential areas are identified.

2.1 Improvement of breeding value for milking speed

The EBV for milking speed has been improved recently by using data from TruTest Milk Meters. Next step is to include data from Lely robots. The main benefit will be that each of the cows in the AMS herds gets an EBV with higher reliability. The reliability of EBV's for progeny tested bulls is already high.

In the Lely milking robots a measure of time from start to end of milk flow is available. So it is possible to calculate flow of solids. Genetic analyses show, that there is a genetic correlation above 0.9 between farmer questionnaires, flow of solids from TruTest Milk Meters and flow of solids from Lely robots. Further, there is a higher heritability when using data from Lely robots than data from milk meters. This is because average milk volume and milking time from 7 or 14 days are used

On this background data from Lely robots will be in cooperated in EBV's for milking speed in the future.

2.2 Improved breeding values for conformation

Functional udder conformation is important when aiming for time efficient cows. In Denmark a large part of cows in 1st lactation is classified. The proportion classified in 2nd and 3rd lactation is much lower. This is rea-

sonable because there is a high correlation between udder conformation in 1st and later lactations. However, the breed organizations also wish to identify those sires where daughter's udder conformation changes considerable over lactations in a cost efficient way.

Feasibility of using teat coordinates from Lely robots has been analyzed. Lely robots register tip of teat coordinates in a 3-dimentional space. The scale is arbitrary, but it is possible to calculate the distance between the teats, e.g. the distance between the front (rear) teats can be used as a measure of front (rear) teat placement. Further, measures of udder balance and udder depth can also be estimated.

Genetic analyses based on Lely data from more than 5,000 Holstein cows in 1st lactation gave heritabilities that are considerably higher than heritabilities based on classifications done by experienced classifiers (table 2). Furthermore, genetic correlations between the two data sources are higher than 0.9 for all traits (Byskov et al. 2012).

Table 2. Heritabilities for udder conformation traits based on either classifications or data from Lely robots

	Heritability	
	Data from Lely robots	Classification
Front teat placement	0.51	0.20
Rear teat placement	0.28	0.26
Udder balance	0.39	0.17
Udder depth	0.68	0.37

Results imply that data from later lactations from Lely robots, where we only have few classifications today, should be included in EBV's for udder conformation.

In the future, data from Lely robots from 1st lactation could also be valuable because nearly all udder traits can be calculated from AMS data. Classifying fewer traits will make classification more efficient. In Denmark classification work will be evaluated closely in the future.

2.3 Improved breeding values for health traits

The current genetic evaluation for health traits in the Nordic countries are based on records of veterinary treatments (Negussie et al. 2010; Johansson et al. 2008). Treatment is not an objective record that tells if a cow is sick or not. It depends, among other things, on the farmer's ability to observe diseases and his threshold for initiating a treatment.

In Lely robots, traits are recorded that probably can be used as indicators of mastitis and metabolic diseases. Possible indicator traits for mastitis could be chewing activity, daily changes in milk per quarter or variation between quarters and conductivity. In relation to metabolic disorders weight changes and registrations of chewing activity could be indicators of disease.

In 2013 research will be initiated to determine how these traits could be combined to give the best measure of the health status of the cow. Such information will be used to improve the present genetic evaluation and it will hopefully result in higher reliabilities of the EBV's and thus in higher genetic progress.

2.4 Breeding values for feed efficiency

The ability to improve feed efficiency genetically has a large economical potential because feed is a large input factor in dairy production. In addition, high feed efficiency has a positive effect on the climate. Until now the problem has been to record feed intake in an economically feasible way and on a large scale.

Instead of recording feed intake directly, it might be possible to record indicators of feed intake. In 2013 genetic analyses will be initiated to estimate correlations between possible indicators and actual feed intake on data from Danish research herds. Possible indicators are rumination time and weight changes. If these analyses prove to be fruitful in describing a part of the variation in feed intake it might be possible to calculate EBV's for feed intake or feed efficiency in the future.

2.5 Optimal time for insemination

Data from Lely robots can be used widely for management purposes. This can for instance be in relation to feeding, milk quality and reproduction. By compiling reproduction data from Lely robots with existing reproduction data from the central database the farmer gets a tool for deciding if he should inseminate a cow or not. A cow in heat can always be inseminated but if she has mobilized large energy reserves or if she has not fully recovered from a previous disease the insemination might not result in a pregnancy. Under those circumstances it might be better to postpone start of insemination.

In 2013, an investigation will start with the aim of identifying factors which influence insemination success and developing a management tool. The latter can for instance be a list with cows that are open and ready for insemination. Cows enter this list when they meet certain limits for insemination success.

Using both existing data and data from Lely robots adds extra value to the farmer compared to the two types of data alone.

3. Potential future data sources

In the future new possibilities will arise that enables collection of data from other types of farm equipment. This gives the opportunity to use these data sources for management tools and for estimation of breeding values.

3.1 Other milking robots

At the moment data from other milking robots are not to the central database. However, work is ongoing to develop a system that can extract data from the management system of DeLaval robots and transfer it to the database.

Potential variables from other robots are the same as from Lely robots.

3.2 Heatime systems

A new generation of activity devices from Heatime has been developed. We assume that these can transfer data and that these data can be stored on the Central Danish Cattle database. These devices measure both physical activity and rumination activity.

4. Summary

Data from electronic milk meters, robots and other types of farm equipment can be used for both breeding and management purposes. We have data on a large scale from some equipment already and new types are in the pipeline.

Central use of data from different equipment – TruTest Milk Meters, Lely robots, DeLaval robots, Heatime - together with existing data from the Central Danish Cattle database adds additional value to on farm use of data. However, data can also be valuable for all farmers when used for breeding purposes.

<u>Literature:</u>

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