Støttet af Fødevareministeriet og EU
Landdistrikter.dk
Ministeriet for Fødevarer, Landbrug og Fiskeri
Den Europæiske Landbrugsfond for Udvikling af Landdistrikterne
Danmark og EU investerer i landdistrikterne.

Den Europæiske Union ved Den Europæiske Fond for Udvikling af Landdistrikter og Ministeriet for Fødevarer, Landbrug og Fiskeri har deltaget i finansieringen af projektet.

Recording of data and identification issues

Anders Fogh[1], Gert Pedersen Aamand[1], Line Hjortø[1] and Uffe Lauritsen[2]

[1]Knowledge Center for Agriculture, Cattle. Agro Food Park 15, 8200 Aarhus N. Denmark
[2]RYK – Livestock Registration and Milk Recording, Agro Food Park 15, 8200 Aarhus N. Denmark

Abstract
In Denmark, the central cattle database consists of many different types of registrations that are reported by farmers, milk recording technicians, AI technicians, veterinarians, hoof trimmers, lab and abattoir workers. The recording system has evolved through many years and new types of registrations have been added stepwise. However, the inclusion of new registrations has increased rapidly over the last five years due to the use of new electronic farm equipment and new analysis methods.

Live weight, teat coordinates, milk flow and milk yield per quarter from automatic milking systems are examples of new registrations that already are reported to the central database. Further, beta-hydroxybutyrate from milk samples and methane production, activity level and rumination time from a variety of stand-alone systems are underway. Today, results of different feed, urine and feces tests are collected for research purposes but they could also be interesting to use in the genetic evaluation. Overall, these new registrations can add valuable knowledge to our basic understanding of cow functionality.

The new registrations can be used in combination with the existing registrations to improve or create new phenotypes. For instance, it may be possible to improve the phenotype for udder health based on veterinary treatments by including milk yield per quarter and conductivity in milk or to create a phenotype for feed efficiency on the basis of measures of milk yield, rumination time, live weight and methane production. Alternatively the new registrations can be used as correlated traits in the genetic evaluation.

The new and improved phenotypes open up the possibility of new and improved breeding values. For instance these new phenotypes are in some cases closer to the biological traits we want to improve than the existing phenotypes. However, the new phenotypes may also provide challenges, e.g. how to use the new phenotypes along with the existing phenotypes.

Introduction
In Denmark, the central cattle database consists of many different types of registrations that are reported by farmers, milk recording technicians, AI technicians, veterinarians, lab and abattoir workers (Aamand, 2006).

The recording system has evolved through many years and new types of registrations have been added stepwise. However, the inclusion of new registrations has increased rapidly over the last five years due to the use of new electronic farm equipment and new analysis methods.

From the farmers' point of view, data are primarily collected for management use; however they are also valuable for breeding purposes. Table 1 shows examples of new sources of recordings, which are already used in the genetic evaluation or which hold great potential. The list is not exhausted.

Table 1. New equipment and methods for data collection and central storing

Collection started within the last 5 years	Collection is expected to start within the next 5 years
Hoof trimmers	Methane equipment
TruTest Milk Meters	Heatime equipment
AMS systems	Sampling of feces and urine
Veterinarians in connection with systematic health recording	Lab tests of milk samples
Lab tests of SNPs **(**Single Nucleotid Polymorphisms)	

The aim of this paper is to give information about new recordings in Denmark and how these recordings can be used to achieve genetic progress for new and existing traits.

New records - from barn to central use

Today, Danish barns are fitted with a variety of electronic equipment that register and store many types of data on farm. Lab technology has also evolved in recent years. For that reason prices of new tests have been brought down to an affordable level. Both milk and tissue samples are analyzed. However, milk samples from milk recording are still numerically superior.

The main purpose of almost all these recordings is the ability to take better management decisions. However, the recordings are also a valuable spinoff that can be used to achieve more genetic progress.

The challenge, in relation to new farm equipment, is to transfer data from the barn to the central database. Data exchange is difficult to establish because the equipment uses different data formats. It is easier to transfer results from new lab tests to the central database because results from existing tests are already being transferred.

In Denmark, all data relating to cattle are stored in one central database. This makes it possible to use data from different recording systems jointly for management and breeding purposes. We believe that the farmer gain more knowledge by combining the different recordings than by using the recording one at a time. Thus, the possibility of combining data adds more value to the equipment.

New data types collected today

Recordings from hoof trimmers, TruTest milk meters, AMS systems, veterinarians and lab test of SNPs (Single Nucleotid Polymorphisms) on the cattle chromosomes have started within the last 5 years. For many of these recordings data are already used to improve the genetic evaluation.

Hoof trimmers have had the option to collect data at each trimming since 2011. The incidences are recorded while trimming using a tablet PC placed on the hoof trimming box. Data are transferred directly to the central database. Many different hoof diseases are being recorded (Nielsen, 2013). 50% of the hoof trimmers' record hoof diseases, which correspond to about 40 % of all cows.

TruTest Milk Meters are used for milk recording purposes on 60-70 % of all Danish cows. In addition to milk volume, the TruTest Milk Meters measure milking time. Transfer of data to the central

database is carried out by the milk recording technicians. In 2003, data collection started on a large scale. Data from TruTest Milk Meters are collected at each testday which correspond to 6 or 11 times a year.

AMS is a widely used milking system in Danish barns. DeLaval and Lely are the major providers; however there are others companies present. The AMS record data on milk level (total yield, yield per quarter, conductivity, milking time, etc.) and cow level (teat coordinates and weight). A project is currently running, where detailed data from individual cows are collected. In this initial project, extraction from the AMS is done by milk recording technicians that visit the farm 6 or 11 times a year. We aim for a wider data collection later covering all brands of equipment. In Denmark, 26 % of all cows are milked in AMS.

In Danish herds with more than 100 dairy cows, it is mandatory to enter into a herd health agreement where the veterinarians do systematic health registrations. In most cases the herd is visited once a week or once every fortnight and all cows that have calved since the last visit are being examined for a specified list of records. Records are transferred by veterinarians to the central database. Among the most interesting records are score of ketone bodies and uterine score. These can be seen as indicators for ketosis and uterine infection. The recording started in 2006, and the number of records made has grown since then. At present 40% of all herds are in recording.

In 2008, routine analyses of 54K SNP chips were introduced in most countries. Later on different Low density SNP panels have been introduced and LD panels are expected to be used on a large scale for females. This development made it possible to predict breeding values on the basis of genomic information. In the beginning only bulls were genomically tested, but in the last years also a proportion of the cows are tested as the prices of tests are decreasing rapidly. Data are being transferred from lab to the central database automatically. In 2012, 2,500 females were tested, but this number will without doubt increase in the coming years.

Use in genetic evaluation

Finland, Sweden and Denmark have a joint balanced breeding goal (NTM) which focuses on increasing income from milk and beef and on reducing cost related to health, fertility, mortality, labor, etc. New recordings can be used to improve existing traits by adding more registrations or because they are genetically correlated to traits in the breeding goal. Both result in more reliable breeding values and thereby higher genetic gain. They can also be used to predict breeding values for new economically important traits. When more economically important traits are included in a total merit index it will give a higher economic progress.

Claw health is a new trait in the genetic evaluation. It was introduced in 2011 on the basis of data from hoof trimmers. The large proportion of cows with registrations makes it possible to predict breeding values with a high reliability. Claw health is economically important because a genetic improvement will reduce costs and it is therefore included in the NTM.

Information from SNPs can be considered as any other phenotypic record. Genomic information was introduced in the routine genetic evaluation in 2011. Information from SNPs increases the reliability of EBVs for all existing traits in the breeding goal resulting in a more balanced genetic progress.

Previously, milking speed was judged by the dairy farmers. Naturally, this trait was largely affected by management. Analyses have shown that heritability estimates for milking time measured by TruTest Milk Meters were higher than for milking speed judged by dairy farmers. The genetic correlation between the two traits was high. Thus, they express the same trait. Milking time from TruTest Milk Meters was included in the breeding evaluation in 2011 and the addition of more recordings caused an increase in reliability. Studies have shown that records of milking speed from AMSs also express the same trait as other types of records. Next step therefore is to use these records to raise reliability further

Data from AMSs and from systematic health registrations can be used to improve the reliability of the current EBVs for health. In the Nordic countries there are EBVs for udder health and other diseases (digestibility, feet&leg, and reproductive diseases). At present, veterinary treatments form the basis of the genetic evaluation. The new registrations could be used in combination with the existing to improve the current phenotype or as correlated traits. Treatment is not an objective record that tells if a cow is sick or healthy. It depends, among other things, on the farmer's ability to observe diseases and his threshold for initiating a treatment. For instance, it may be possible to improve the phenotype for udder health based on veterinary treatments by including milk yield per quarter and conductivity in milk. This is a research project in 2014. Preliminary analyses of data from veterinary health registrations - score of ketone bodies and uterine score - have been performed in 2010 and the results showed that the traits are heritable. A new project with more data will be initiated in 2014.

Data from AMSs can also be used to create a phenotype for feed efficiency, which is an economically important trait. Measures of rumination time could for instance be a good indicator of feed efficiency. This is a research project in 2013-2016.

New data types collected in the future

Even though we have had a large increase in new records in the last 5 years we believe there are many new records in the pipeline that will be available on a large scale in the next 5 years.

In Denmark, there are more than 1,000 Heatime stand-alone systems that record activity and in many cases also rumination. It is not possible to transfer data from these systems. However a new system is marketed where it is possible to transfer data back and forth from the central database. Together with Milkline in Italy data transfer is being developed. As mentioned above rumination time can probably be used genetically as an indicator for a new breeding value for feed efficiency and activity could be used to increase the reliability of the genetic evaluation for fertility. The latter is being analyzed in a PhD project.

Milk recording are being used for a variety of tests already. The latest test to be implemented in Denmark by RYK is BHB (beta-hydroxybutyrate) that is an indicator for ketosis. It will be offered to Danish farmers on a large scale in 2014. BHB might have the potential to increase reliability of breeding values for digestibility diseases which is a part of the breeding value for other health traits.

Methane emission has been recorded in test herds in the last couple of years. The equipment is expensive, but new and cheaper equipment seems to be available. At present the new equipment is being tested. Measurements of methane emission can probably be used genetically as an indicator for feed efficiency.

A variety of measures in feed, feces and urine samples are being developed for management purposes. It could for instance be dry matter content and energy efficiency in feces or urea in urine. Samples from 1,000 cows have been analyzed already and a system for collection of samples will be developed in 2014. The most obvious use for breeding purposes would probably be in relation to feed efficiency.

Conclusion

Many new recordings have become available in the last 5 years and many more will come in the next 5 years. Some recordings have already been implemented in the Nordic genetic evaluation, some are underway and still others have the potential but need to be analyzed.

Recordings will be used as correlated traits for already existing traits in the NTM, while others make it possible to define new economically important traits. All together they give more economically genetic progress.

Literature:

Aamand, G.P. (2006). Improving the health traits by recording and evaluation. ICAR meeting 7 - 10 June 2006. Koupio, Finland

Nielsen, P. (2013). Electronic recording of data from hoof trimmers. ICAR technical workshop 29 - 31 May 2013. Aarhus. Denmark