
On farm recording of fertility and health data using mobile devices

T. Strabel, T. Nowak and K. Rzewuska

*Poznan University of Life Sciences, Department of Genetics and Animal Breeding, ul. Wolynska
33, 60-37 Poznan, Poland
(Corresponding author: strabel@man.poznan.pl)*

Cow fertility and health traits are of continued interest to breeders due to their economic importance and slow genetic progress. Optimized herd management is important for financially successful farming, thus it should include functional traits. Genomic selection provides new opportunities in genetic improvement of these traits by use of cow reference populations with a limited number of observations compared to national systems. Both, genetic and environmental improvement, require information collected on farms. Several sources of this type of data exist: milk recording, AI organizations, veterinarians, on-farm computer software. Unfortunately, even if all sources are combined, they do not cover all areas of interest. Lack of completeness of insemination records, for example, limits their usefulness for both management and genetic evaluations. Moreover, for short term decisions (e.g. whether to continue to inseminate or not) on farm recording of fertility is regarded as probably the only practical solution as it provides fast access to information. Immediate use by the breeder of the data collected on farm could be, to a large extent, a guarantee of their quality and completeness. It is important for the farmers and veterinarians to have quick and easy access to herd fertility data. Only then can acute fertility problems, which may be related to management, be detected and addressed promptly. Hence an Internet-based tool was developed. A hybrid mobile/web application is proposed for online and offline collection of cow fertility data available for mobile devices. It can be run on different platforms (Android, iPhone, Windows Mobile) and PCs under various operating systems (Windows, Linux, iOS). Capabilities of modern web browsers are utilized to enable operation without Internet connection by using browser's local storage and offline web application mechanism. The central database is accessed through an HTTP API which provides possibilities for additional processing with simple tools. The system aims to collect broad range of female fertility and health data including: calving dates, insemination, fertility disorders, results of pregnancy tests and further hormone assays, heat observation, veterinary treatments, hoof trimming results and culling data. The system can be easily fed with milk production and composition data. By doing so we obtain a complete set of basic information required by veterinary and nutritional advisors. Collecting a complete set of information opens up opportunities for cooperation between veterinarians and nutritionists who aim to cooperate on the development of this system. The system can be used for making quick management decisions, can provide information on the current status of the herd and trends including recent years. By collecting adequate cow fertility and health data for complex analysis of the status of individuals and herds we hope to enable opportunities for genetic evaluation of new functional fertility and health-related traits with higher accuracy than offered by the current national system

Abstract

Keywords: dairy cattle, health and fertility traits recording, genomic selection.

Introduction

Cow fertility and health traits are of continuous interest to breeders due to their economic importance and slow genetic progress. Optimized herd management is important for financially successful farming, thus it should include functional traits. Reproduction, mastitis, feet and legs problems are the main reasons for involuntary culling (CanWest DHI and Valacta, 2014). Direct information on health traits could increase the efficiency of breeding programs not only for mastitis resistance (Heringstad *et al.*, 2007) but also for claw health (Van der Linde *et al.*, 2010). The challenge is to develop a system for recording diagnoses nationwide. Genomic selection provides new opportunities for genetic improvement of these traits by use of cow reference populations with limited number of observations compared to national systems (Pszczola *et al.*, 2012). Both, genetic and environmental improvement, require information collected on farms. Several sources of this type of data exist: milk recording, AI organizations, veterinarians, on-farm computer software. Unfortunately, even if all sources are combined, they do not cover all areas of interest (Egger-Danner *et al.*, 2013). Lack of completeness of inseminations, for example, limits their usefulness for both management and genetic evaluations. Moreover, for short term decisions (e.g. whether to continue to inseminate or not) on farm recording of fertility is regarded as probably the only practical solution as it provides fast access to information. Immediate use by the breeder of the data collected on farm could be, to large extend, a guarantee of their quality and completeness. It is important for the farmers and veterinarians to have quick and easy access to herd fertility data. Only then can acute fertility problems, which may be related to management, be detected and addressed promptly.

Material and methods

Hence an Internet-based tool has been developed for online and offline collection of cow fertility data. It is accessible on different mobile platforms (Android, iPhone, Windows Mobile) and PCs under various operating systems (Windows, Linux, iOS). Hardware independency allows following technical progress and avoids vendor lock-in to ensure reasonable prices. Numerous capabilities of mobile devices and modern web browsers are utilized to enable operation in the field work, i.e. without Internet connection or constant power supply. Open source software is used for data processing and storage for limitless extensibility and code transparency. The central database can be accessed through an HTTP API which provides possibilities for additional processing with simple scripts and tools.

The profitability of dairy farms is limited by involuntary culling resulting from deterioration of fertility and health. Therefore, the system aims to collect broad range of female fertility and health data including:

- Basic reproduction data: calving dates, insemination.
- Novel fertility data: heat observation, ovarian activity, results of pregnancy tests.
- Fertility disorders: metritis, cystic ovaries.
- Veterinary treatments and hormone assays.
- Hoof trimming results and claw disorders.
- Culling data.

The system can be easily fed with milk production data. By doing so we obtain a complete set of basic information required by nutritional and veterinary advisors.

Data was recorded in one of the big commercial dairy farms in the Wielkopolska region. Herd of about 330 Polish Holstein-Friesian cows was housed in a free-stall barn with automatic milking system. Information on pregnancy status and fertility related health records was collected from 309 cows between November 2014 and April 2015. Gynecological examination was carried out by a veterinarian using rectal palpation and ultrasound measurement. Pregnancy was checked 247 times and 66% of the tests were positive. Twin pregnancy were found in two cases. Date of heat was determined in 181 cases. Ovarian activity and state of the uterus was examined in 543 animals. The overall incidence of metritis, cystic ovaries and inactive ovaries were 5%, 5% and 2%, respectively. Disease frequencies are low and therefore the accuracy and completeness of the data is extremely important (Figure 1).

Collection of data on claw and leg disorders was implemented earlier and performed for 13 months. Data was entered by a hoof trimmer. Scored claw disorders were digital dermatitis (DD), interdigital dermatitis (ID), interdigital hyperplasia (IH), sole ulcer (SU), sole hemorrhage (SH), white line disease (WLD), interdigital necrobacillosis (IN)

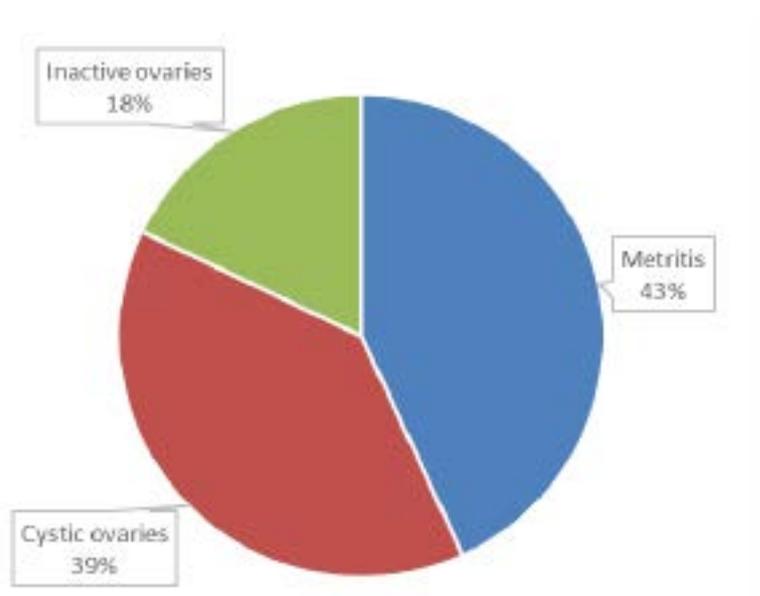


Figure 1. Percentage of cases of fertility disorders.

and heel erosion (HE). 1214 diagnoses were recorded, in 53% of the cases lesions were found. The highest percentages of disorders were found for SU and DD. The remaining disorders accounted for less than 10% of the cases (Figure 2).

The system can be used for making quick management decisions, can provide information for current status of the herd and trend including recent years. Simple access to the data on individual animals is a key, however large volumes of collected information requires better integration of data and creation of parameters which could be an indicator of overall management. Consultancy nowadays requires a comprehensive analysis of the causal factors in order to identify effective solutions for a problem. For example, low pregnancy rate in a herd can result from prolonged anestrus, disorders of ovarian activity, prevalence of silent heat, low effectiveness of artificial insemination or embryonic death. The data collected allow not only to diagnose problems in a herd, but also to identify the

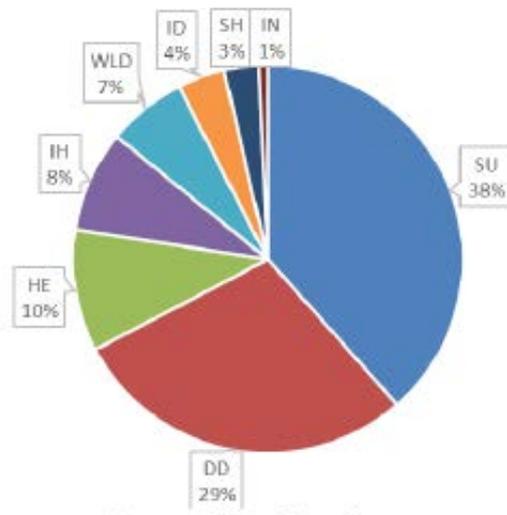


Figure 2. Percentage of cases of claw disorders.

causes of their occurrence. Furthermore access to information about the history of treatment supports making the right decisions on continuation of medical treatment. A number of indicators which measure herd reproductive performance are calculated and could be used to assess effectiveness of hormonal therapy. The system based on user-defined estrus synchronization programs calculates the date for subsequent drug applications and creates a list of tasks for a dairy farmer to complete each day. The system allows to enter information directly, right next to the cow, which should limit the number of errors. Collecting this kind of complete set of information opens opportunities for cooperation between veterinarians and nutritionists who aim to cooperate in the development of this system. By collecting adequate cow fertility and health data for complex analysis of the status of individuals and herds, we hope to be able to create opportunities for genetic evaluation of new functional fertility and health-related traits with higher accuracy than offered by the current national system. Pregnancy check enables early detection of insemination effectiveness and avoids limiting the data to cows with subsequent calving. At the same time interval between calving and first heat is a better indicator of ability to resume luteal activity in the postpartum period than the interval from calving to first insemination because it is independent from voluntary waiting period. Information about occurrence of diseases allows for direct selection for improved health. In order to obtain accurate and complete health data cooperation with veterinarians and farmers is necessary. User-friendly tool can replace on-farm documentation and become a source of data for management purposes not only for large farms. However in small herds veterinary care is not permanent and veterinary diagnoses occur only in sporadic cases. Therefore, the information especially concerning fertility, will be collected from large herds of high-quality management and probably performance above the national average (Figure 3).

Health and fertility traits are not easy to improve using genetic selection. Although genomic selection allows us to double the genetic progress in functional traits, collecting phenotypes for these traits is still a challenging task. Milk recording is run and insemination records are collected however completeness of the collected data is limited causing problems in genetic evaluations. The proposed system due to low investment costs and immediate use of collected records can solve these limitations.

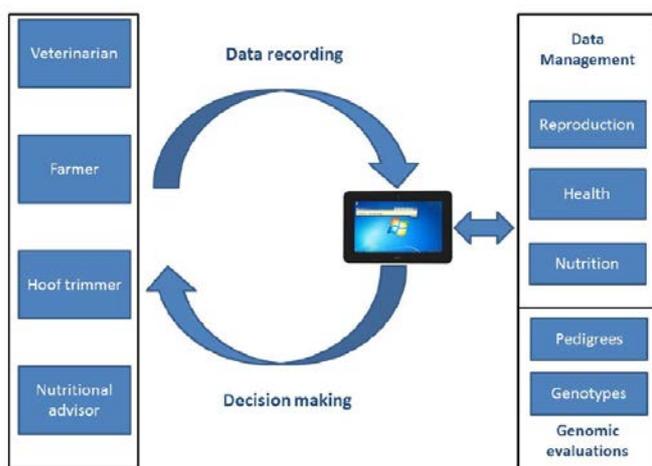


Figure 3. Diagram of the system.

Collection of a substantial number of records should allow, in the future, to make use of them in genetic evaluations. As genomic selection is becoming popular in Poland, running genomic evaluation should also be possible, with a possible female and male reference population. One of the limiting factors, which may arise is due to the fact, that the system will most probably be preferred by large herds with intense production. It may therefore introduce bias in the evaluations.

The new system for collection of reliable phenotypes without additional work of farmers was implemented on the first dairy farm. It allows for collection of complete data as the collected information is used immediately to support management decisions. By collecting a broad range of information on health and fertility status, current status and trends in herds can be presented and used by extension. Further development of the system includes a comprehensive analysis of data for management purposes. In the future the system will allow for comparisons between herds, support benchmarking and overall herd management evaluation. Through close cooperation with academia, research can easily continue. As more farms use the system, further collection of data for use in genomic evaluations should be feasible.

Conclusions

CanWest DHI and Valacta www.dairyinfo.gc.ca/pdf/genetics-cull_e.pdf (15.05.2015)

Heringstad, B., G. Klemetsdal & T. Steine 2007. Selection responses for disease resistance in two selection experiments with Norwegian red cows. *J. Dairy Sci.* 90: 2419-2426.

Egger-Danner, C., O. K. Hansen, K. Stock, J. E. Pryce, J. Cole, N. Gengler & B. Heringstad 2013. Challenges and benefits of health data recording in the context of food chain quality, management and breeding. *Proceedings of the ICAR Conference, Aarhus, Denmark, 30-31 May 2013. Proceedings of the ICAR Conference, Aarhus, Denmark, 30-31 May 2013. (No. 17). International Committee for Animal Recording (ICAR).*

List of references

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

Pszczoła, M., T. Strabel, H. A. Mulder & M. P. L. Calus 2012. Reliability of direct genomic values for animals with different relationships within and to the reference population. *J. Dairy Sci.* 95: 389-400.

Van der Linde, C., G. De Jong, E. P. C Koenen & H. Eding 2010. Claw health index for Dutch dairy cattle based on claw trimming and conformation data. *J. Dairy Sci.* 93: 4883-4891.