Ulrich Brehme and Ulrich Stollberg, Potsdam, Roland Holz, Falkenhagen, and Thomas Schleusener, Mixdorf

Safer Oestrus Detection with Sensor-Aided ALT-Pedometer

Continuous animal data gathering is a decisive prerequisite for dairy cattle herd management. Pedometers on the animals' ankles to record animal activity play an important role in oestrus detection and evaluating animal health. This new pedometer system can measure three parameters - activity, lying time, outside temperature around ankle.

Dr. agr. Ulrich Brehme and Dipl.-Ing. (FH) Ulrich Stollberg are scientists in the Department Livestock Engineering at theInstitute of Agrartechnik Bornim e. V. (ATB); e-mail: *ubrehme@atb-potsdam.de*
Dipl.-Ing. Roland Holz is Owner of an Engineering Office in Falkenhagen; e-mail: *ing.holz@t-online.de*
Dipl.-Ing. Thomas Schleusener is Owner of an Engineering Office in Mixdorf; e-mail: *info@ibs-elektronik.de*

Keywords

Oestrus detection, pedometer

Literature

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The results of new studies from The Netherlands (Utrecht university) and the USA (Virginia Tech University, Blacksburg) show fluctuations in the cycle length, shorter mating season intensity and short mating season duration for high-producing milk cows.

The researchers came to similar results in Blacksburg with 2600 milk cows. Here the average mating season duration of the Holstein cows was 7.3 hours, with Jersey it was 8.8 hours.

The fluctuations in the cycle length lay between 18 and 25 days [2]. In the consequence of this development, often only 50 % of the oestrus cycles are detected.

This development indicates with all urgency that observing the mating season in the dairy cow is of greater importance, if the financial losses shall not become an economic problem by an insufficient herd fertility.

For recognising sick, ready for mating, quiet heat or stressed animals, fast and suitable objective measuring systems are needed in animals husbandry.

Modern sensors (sensors, bio sensors) and increasingly not invasive measure and transfer methods improve decisively the possibilities of gathering data from the animals. The animal data measuring system with ALT-pedometers developed jointly by the ATB with two Brandenburg engineering offices can be an effective aid for this.

Structure and function mode of ALT-pedometer

The mode of operation of pedometers for the measuring parameter "animal activity" works according to the principle of the pulse metering.

ALT-pedometer are an animal data acquisition system developed further on the base of customary pedometers. ALT - this one stands as synonym for activity, lying time, temperature nearly by the pedometer. These parameters will be measured at the cows and be used for oestrus detection and animal health monitoring. The decisive advantages of this type of pedometers, compared to the models used at present are the following characteristics:

- Measuring three animal-individual parameters (activity, ambient temperature at the pedometer, lying time) instead of a feature (activity). Selectable collection interval for the collection all parameters in the measuring range between 1 and 60 min.
- Continuous measuring data acquisition, storage as well as manual or automatic data transmission by means of radio modem to the PC.
- high correlation between the measuring parameters "activity" and "lying time" for oestrus detection and health observation.

The pedometer has four sensors for collecting the ambient temperature at pedometer, the lying positions as well as the step activi-

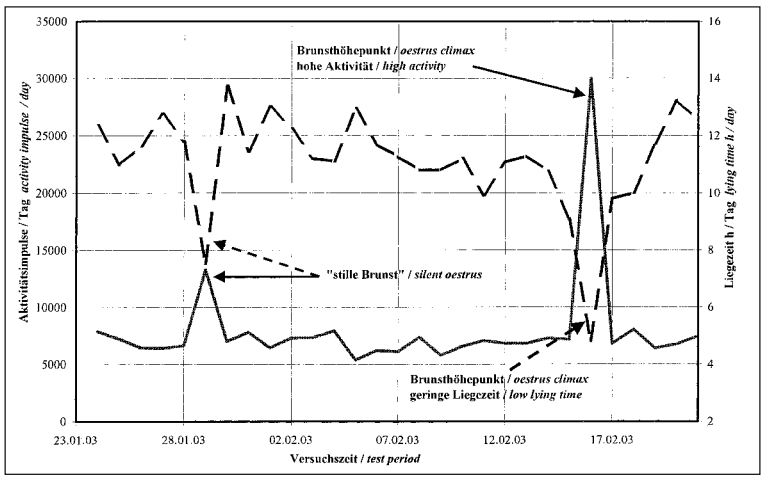

Fig. 1: Course of lying time and activity from a test cow with silent and normal oestrus

ty, the µ-processor, the data memory as well as the radio module to the wireless data transmission.

Starting coming autumn, a real-time clock will complete the measuring technique in the pedometer.

Since cattle rests besides the normal lying position (belly position with under-struck legs), cattle rests also in the side position, two lying sensors were integrated. When putting on markings in this case the correct function for the recording of the lying time has to respected.

The µ-processor records step activity and lying positions of the animal continuously and this sums up about the measuring interval configured at the test beginning for 1 till 60 min. The sums of the step activity, of the laying time and of the ambient temperature form one record. The storage capacity of the ALT-pedometer is 1178 records.

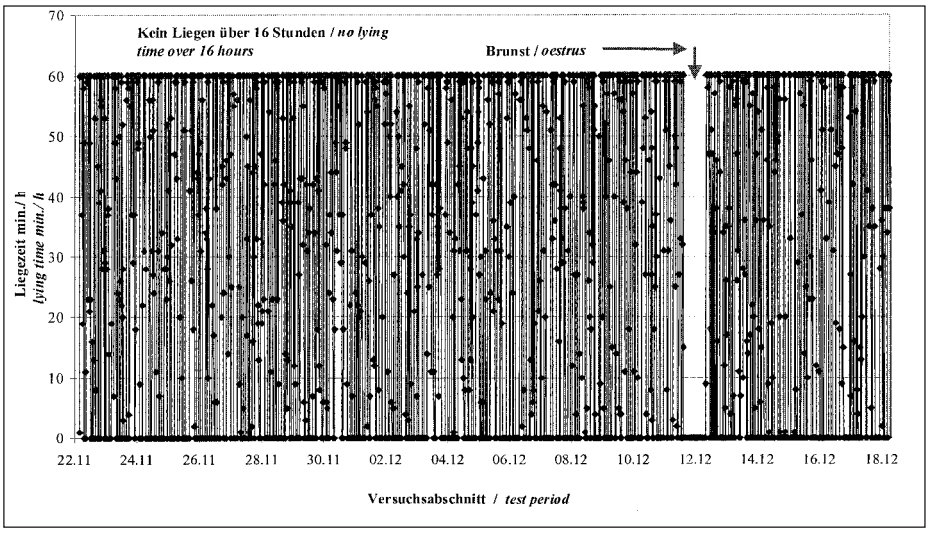

Fig. 2: Typical oestrus picture for measurement parameter - lying time (cow was not lying over 16 hours)

Examinations

After finishing the different stages of development of the measuring system, practice examinations were carried out in four dairy cattle farms.

It was aim of these series of tests to examine the functional safety of the system at the data acquisition, the data transmission and the usefulness of the readings for the oestrus cycle prediction.

The normal farm measures for oestrus cycle observation were continued and recorded for comparing the visual oestrus cycle observation by the staff (milker, A.I. technician, stockbreeding manager with automatic animal data acquisition systems.

By the combination of the parameters activity and lying time, a safe identification of the optimal oestrus climax is ensured exactly and at the earliest possible time.

Results

In all investigations it was shown that with the ALT-pedometer substantially more oestrus cycles were detected. The share of more registered cycles is between 25 and 61 %. Direct comparison with the herd management system ALPRO of the company DeLaval shows that the ALT-pedometer reports the incipient oestrus cycle 1 till 2 days earlier. The reason for this is the shorter cyclical selection interval of the ALT-pedometer.

The detection of "quiet oestrus" proves to be a main emphasis of the visual observation by the staff. For the difficulties of detecting a quiet or weak oestrus, two aspects can be named:

- The number of registered oestrus cycles between 06:00 p.m. and 06:00 o'clock a.m. was more than 50 %. In this time, there are half of all cycles, after completion of the stable work. By the reduction of the oestrus intensity and duration [2] quiet oestrus and fewer, less intensive cycles are not detected anymore.
- The cycles with a weak mating season intensity or quiet oestrus recognised by ALT-pedometers very frequently show an oestrus symptoms only through the measuring parameter "lying". The activity impulses found are not typical for an oestrus, but more frequent at a low level. With normal pedometers (only the activity) this form of the "quiet oestrus" cannot be detected.

Earlier examinations brought about an increase of the number of detected oestrus cycles by a more sensitively adjusted threshold value at the pedometer.

This rise was however also connected with a higher number of "wrongly positively" messages [3]. This shows the problem of using only one measuring parameter (activity) for a safe oestrus detection prediction.

Figure 1 shows a quiet and a normal oestrus cycle course with a test animal. The insemination on 16. February led to a successful pregnancy. The animal is also a typical example of a shortened cycle lengths and night oestrus appearing.

Both cycles lies from each other only 18 days, the beginning of the quiet oestrus is 08:00 o'clock p.m. The daily lying time difference between the quiet and normal oestrus is 3.0 hours. This shows that during a quiet oestrus more short-time quiet periods appear than within a normal oestrus cycle. The standard is similar for the activity impulse per day, which is twice as high for a normal oestrus than in the case of a quiet oestrus.

The following *Figure 2* is characteristic for the course of the lying time within the oestrus cycle. In the example presented, the cow didn't rest for 16 hours. Decisive advantage of the ALT-pedometer system is the combined recording of the measuring parameters activity and lying time.

Results

In the dairy cattle husbandry the improvement of animal health and fertility is a crucial objective. It concerns the development of the reserves of every individual animal.

The operating result can be improved and stabilised lastingly only in such a way.

- The use of ALT-pedometer brought an increase of detected oestrus cycles of 25 to 61 % (normal oestrus, quiet oestrus) in all examined farms.
- Reasons for the improved cycle recognition are: approx. 50 % of all oestrus cycles start after the end of the stable work between 06:00 p.m. and 06:00 o'clock a.m. Oestrus cycle controls in this time don't take place continuously in dairy cattle farms. A shortened mating season and lower oestrus intensity aggravate the visual observation for oestrus detection.
- The high interdependency of the measuring parameters activity and lying time allows sure and exact oestrus cycle predictions.
- ALT-pedometers allow the animal prediction of illnesses (lameness, metabolism illnesses), besides the oestrus cycle prediction.
- Without sensor-aided animal data measuring systems, significantly less oestrus cycles are detected , because cycle length, mating season duration and oestrus intensity have developed negatively at high animal performanc.
- For dairy cattle farms without technical systems this means extension and intensification for the visual oestrus observation also during the evening and night hours.