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Oestrus Detection in Cattle

Comparative Studies on the Operation of Pedometers and Neck Transponders

Common pedometers and neck transponders from different suppliers for the measurement of activity changes are crucial in animal data collection for the evaluation of oestrus development and animal health. In comparative tests with suckler cows, the reliability and the accuracy of different measuring systems were examined on the same animal. The prototype of an improved pedometer with three measuring parameters (activity, resting time, outdoor temperature) and a variable measuring period has been included in the results.

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Literature

Literature references can be called up under LT 03215 via internet http://www.landwirtschaftsverlag.com/landtech/local/literatur/htm.

In addition to feeding, it is mainly good herd health and high reproductive performance of the dairy cows that secure profitability and efficiency in milk production. In production, oestrus or cow diseases which are not detected or detected too late exert a negative influence on the dairy and fertility performance and the period of utilization of the herd. For a fairly long time, common measuring systems, such as pedometers or neck transponders, have therefore been used in dairy cattle herds as aids for the measurement of animal activity as a means of oestrus detection. In comparative tests of pedometers and neck transponders, the different kind of attachment of the pedometers/neck transponders to the animal, operation during activity impulse counting, and the suitability of the collected data were examined.

The storage-telemetry-logger (STL-pedometer) used allows for the time-interval-dependent, continuous collection and storage of the following parameters: step activity, resting time in the stomach position, resting time in the side position, and ambient temperature. Data transfer to the notebook is wireless and carried out manually with the aid of a read-out modem.

Material and Method

Trial 1
Examination of neck transponders and pedometers on suckler cows. At the same time, all test animals were equipped with a neck transponder and a pedometer attached to the first phalanx of the left foot.

Trial II
Conventional pedometers were compared with an STL-pedometer. For this purpose, a pedometer was attached to the left or right first phalanx of each animal.

With regard to the measuring parameter animal activity, the pedometers operate differently. Conventional pedometers work according to the principle of electric impulse counting. In this measuring principle, the activity of an animal is registered as an electric impulse triggered by the movement of a mer-

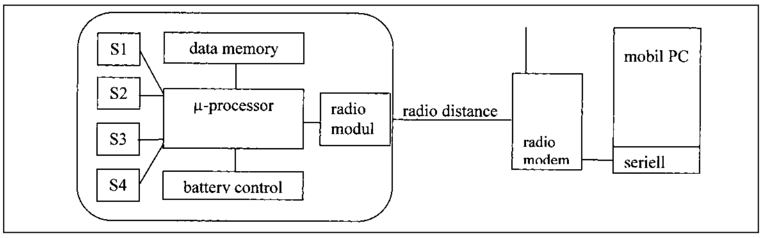

Fig. 1: Block diagram of STL-pedometer

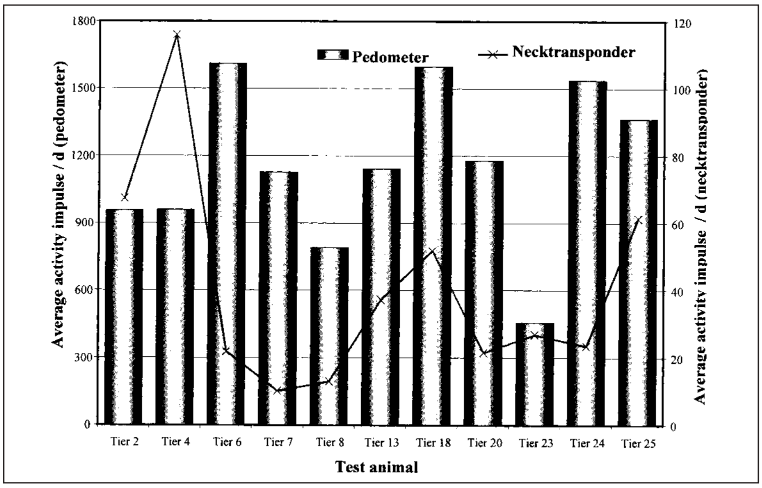

Fig. 2: Results from comparing pedometers and neck transponders (all test animals)

cury drop between two contacts in a glass tube. The design of the STL-pedometer is shown in *Figure 1*.

The STL-pedometer has two sensors for the digital measurement of the resting positions of the animal, one thermosensor for the measurement of the ambient temperature, and an analogue sensor with a Schmitt trigger for the measurement of step activity.

Operation

The µ-processor continuously measures the step activity and the resting positions of the animal and adds them up over the measuring interval configurated at the beginning of the trials. After this time is completed, the value is filed in the storage unit. The sum of step activity, the resting positions, and the ambient temperature each form one set of data. In the STL-pedometer, the measuring frequency can be configurated in a range between 1 and 99 minutes. Storage capacity comprises 2,045 sets of data. The pedometer must be read out cyclically.

Results

Trial 1

Figure 2 shows the results of the comparison of pedometers attached to the first phalanx and neck transponders. The results of both measuring systems exhibit significant differences. Even though the measuring points for the registration of activity and the kind of measurement value registration are very different, approximately identical results had nonetheless been expected. However, this is not confirmed by Figure 2. In the results, the differences in the technical form and operation (measuring operation) of the pedometers and neck transponders lead to significant differences in the activity level. While the mean activity of all animals measured with neck transponders reached 41 ± 37 activity impulses/d, the pedometers on the first phalanx on average registered 1,156 ± 467 activity impulses. These differences between pedometers and neck transponders with the same animal and under identical conditions need to be addressed in further studies rather than the differences in the level of the activity impulses/d.

Only in test animals 2 and 23 is the activity registered at the neck and the first phalanx in the same range. The differences between the activity impulses of the measuring systems (animals 6, 7, 18, 20, 24), which are very large in some cases, raise the question of what is measured as an „activity impulse" in the neck transponder. The activity impulse measured at the first phalanx is clearly defined as a leg movement on the spot or as an active leg movement directed sidewards, frontwards, or backwards. It was shown that alterations in activity were registered more accurately by sensors which were attached to the animals' feet than by neck transponders. Other authors share this opinion [1, 2, 3]. While the activities counted at the foot are clearly motor activities, animal activities at the neck exhibit a significantly larger range with regard to the kind and cause of the counted activity impulses. Despite these differences, one can say that the current animal data measuring systems are aids which enable information for oestrus detection to be gained.

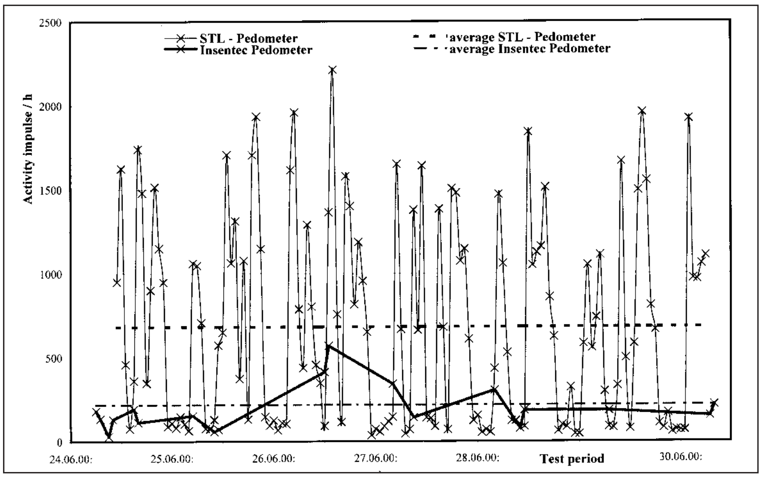

Fig. 3: Results of recorded activity impulses from the same test cow (number 12) with different pedometers (STL- and INSENTEC-pedometer)

Trial II

Figure 3 shows the results of comparative tests of STL- and INSENTEC-pedometers using one test animal as an example.

The results show that the different kind of impulse registration has a significant influence on the absolute and average levels of the activity curves. The mean number of activity impulses measured by the STL-pedometer amounts to 681 impulses/h as compared with the 218 impulses/h measured by the INSENTEC-pedometer. The results of the field studies on perinatal behaviour are shown in *Table 1*, which lists the step activity and the resting time of two calving cows during the night before calving, the calving night, and the night after calving.

The step activity and the resting time of both animals exhibit significant alterations. As compared to the night before, the activity of cow 1 increased by 15.4% during the calving night. In the night after calving, it decreased by 32.9%.

In cow 4, the increase amounted to 16.2% in the calving night, while the decrease during the following night amounts to 44.3%.

The same tendencies also manifest themselves in the animals' resting behaviour. While the resting time of cow 1 diminished by 52.4% in the calving night as compared to the previous night, the decrease in cow 4 amounted to only 26.3%. In the night after calving, the resting time of cows 1 and 4 grew by 31.0% and 57.6% respectively. A difficult birth leading to great exhaustion, which was compensated for by more rest in the following night, can be assumed to be the reason for the large increase in the resting time of cow 4.

Conclusions

In herd management, reliable, understandable results are an important criterion for oestrus detection on the dairy farm. Both in the case of increases (oestrus) and decreases (disease), activity changes in cattle can be registered more precisely using pedometers on the animals' feet rather than at their necks. Pedometers are well attached to the limbs of the animals. At the foot, only clear motor activities are recorded, while the kind and cause of activities measured at the neck exhit a significantly larger range of variation. A direct comparison of pedometers has shown that common pedometers with mercury as an impulse counter react more slowly than analogue sensors with an integrated Schmitt trigger in the STL-pedometer used. The additional animal data (resting time, outdoor temperature) in the STL-pedometer improve the information about oestrus and birth.

	Steps Cow 1	Steps Cow 4	RT in h Cow 1	RT in h Cow 4
Night before calving (11 p.m. until 7 a.m.)	4557	6276	4,2	1,9
Calving night (11 p.m. until 7 a.m.)	5387	7491	2,0	1,3
Night after calving (11 p.m. until 7 a.m.)	3615	4175	2,9	3,3

Tab. 1: Step activity and lying time of cow 1 and cow 4 during the night and the early morning