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Computer monitoring of suckler cows

Sensor and computer supported monitoring could gain more importance for suckler cow systems in the future. The methods involved and the elements of computer supported dairy cow production which could be utilised were investigated. Existing sensors were used to record weight gain, water intake and concentrate feed consumption by calves. Two systems were compared for the determination of animal activity. Here, the pedometer system showed advantages over neck recounters. In further investigations linked with mathematical models the effect of the systems are to be analysed.

Have computer supported monitoring systems a useful role in suckler cow production? Arguments against include the fact that because suckler systems are extensive and linked with large area pasture systems costs, as well as the flexibility needed for different grazing areas, would hinder the application of computer controls.

Investigation aims

So what existing possibilities are there for online recording of parameters? To examine this question a research project was initiated in our specialist department with the following aims:

1. Development of a system for computer-supported monitoring in suckler herds by using solutions applied in dairy cow monitoring.
2. Testing the practical suitability of these systems and adjustments required to suit suckler cow production.
3. Determining and recording cow „normal condition“ via the parameters used and the analysis of deviations. Developing mathematical models for describing stable relationships and identifying situations which differ from such.
4. Extending the sensor systems where necessary for additional data collation.
5. Testing the systems under practical conditions with a large number of animals.

The first two targets are covered in this report. The elements of the system and their relationships are shown in *figure 1*. The information to be collected by the different sensors should be hypothetically applied for the following statements, associations and conclusions:

Scales

The scales is so positioned that the animals have to pass over to and from their accommodation. Drinkers and concentrate feed automat for the calves are located in the housing area. This layout means cows and calves are weighed several times daily. It can be assumed with the cows that weight loss indicates metabolic disorders. An unobserved still-

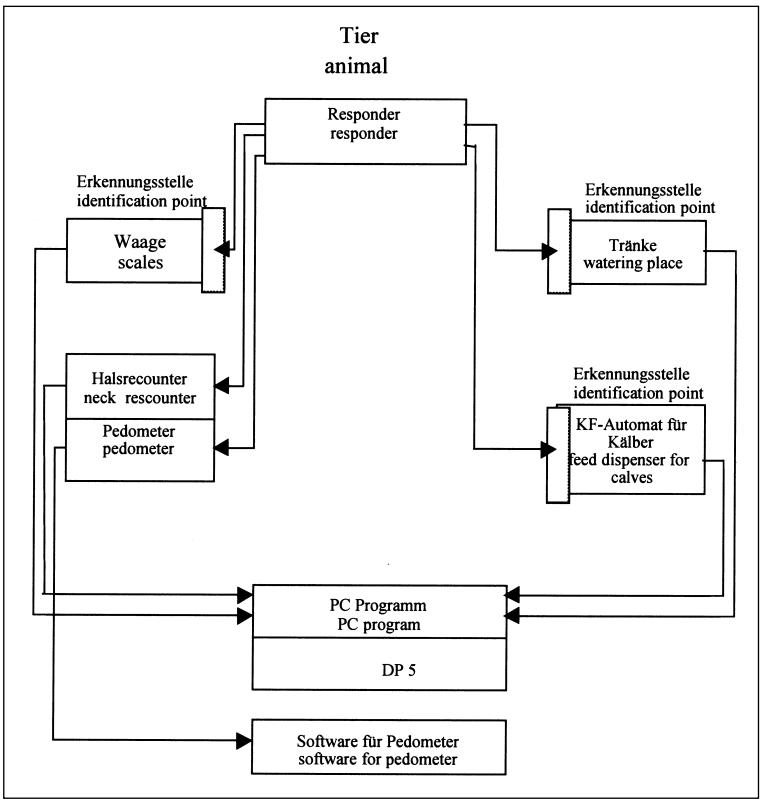

Fig. 1: Structure of animal control system

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Computer-aided animal husbandry management, suckler cow management, sensor technology

birth could also cause considerable weight loss. Such weight information is especially interesting from the economical aspect. Thus, old cows destined for slaughter can be chosen at the optimum time. Calf daily liveweight gain (dlwg) informs on development and thus over the mother's milk production.

Drinkers
Amount and times of drinking were taken for recording water intake. Recording precision was 0.5 l. Changes in intake can infer acute disease. Additionally, water consumption reduces immediately before birth. Also, deviations in drinking behaviour can indicate a change in animal condition (heat), although outside influences such as climate, lactation stage and the feed must also be considered in this aspect.

Concentrate feed automat
The concentrate feed automat is only accessible to the calves and mainly applied for its influence on weight gain. Where dlwg is below pre-calculated levels, perhaps through lack of mother milk, concentrate feeding can be used to compensate.

Neck recounter/pedometer
Every animal has a pedometer and a neck recounter fitted for recording movement activities. Two systems are applied simultaneously because the reactions from each are different and therefore have to be checked one against the other for suitability in the relevant investigations. This work will be reported elsewhere. The measurable changes in animal activity are not only recorded for signs of heat but also to indicate changes occurring under stress, disease or during birth, for example. Recording and storage of data from all sensors takes place with the Westfalia DP5 program developed for dairy cows. Pedometer readings are registered by a system from the firm Insentec and processed with an associated program.

Functional reliability

The checking of reliability and technical suitability has been completed enabling an appropriate evaluation:

Weight data is recorded as animals pass over the *scales*. Following adjustments, recording has been reliable with no significant problems. However, the process computer had to be renewed twice within 2.5 years. Because the scales was outdoors all electronic components have to be well protected. With hard frost in winter the weighing platform can freeze-up.

Water is supplied through a modified calf drink automat in portions of 0.5 l continuously offered during each calf drinking action. Flow rate is 8 l/min. This meets the physiological requirements of the calves. The system works reliably.

The *concentrate feed automat* for the calves has proved reliable up until now.

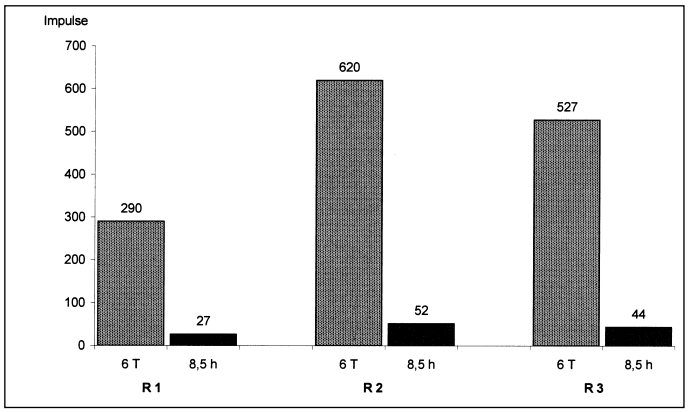

Fig. 2: Number of impulses measured in 6 days respectively 8.5 h (3 rescounters on one neck)

Measuring activity

There were intensive investigations into functioning and evaluation of the activity measurements. At first all animals got a neck recounter. This system was specially developed for identifying heat. During the investigation, however, it was discovered that the system wasn't recording activities accurately, for instance different speeds of movement were given equal value and the same movements were sometimes awarded different values. To check differences, an animal was fitted with a neckband equipped with three recounters. The resultant impulses were recorded over one week and then compared. In *figure 2* the number of the measured impulses over a long (6 days) and a short (8.5 h) recording interval in each case from all three recounters, are compared with each other.

The values from figure 2 emphasise the different reactions to the same movements of the three recounters on the neck. This led to pedometers being fitted as an additional activity measuring system. These counted the steps taken by each animal. The movement values from the separate systems were also recorded separately. Selected results from this comparison from 6 animals over 20 days are presented in *table 1*.

Table 1: Number of impulses measured of neck recounter and pedometer on the same cow, coefficients of variation and correlation

Cow	Impulse per day				
	Pedometer		Neck recounter		
	x̄	S%	x̄	S%	r
1	826	46.6	142	49.5	0.206
2	1458	39.7	23	30.3	0.013
3	1051	67.5	10	70.5	0.762
4	706	48.2	11	2.8	0.286
5	1403	44.7	48	13.9	0.306
6	1250	75.1	23	42.6	0.531

The comparison shows that the pedometers counted more impulses than the neck recounters. Using variation coefficients which can be regarded as a measurement of data precision, a higher value was determined for the pedometer. The limited amount of agreement in activity measurements was generally emphasised by the low correlations.

Outlook

In further investigations, the sensor-recorded parameters will be tested for their information content. This will be based on actual heat periods, animal reactions before and during calving and on the presence of selected diseases (mastitis, foot illnesses). Furthermore it will be tested as to how animal behaviour is represented by recorded parameters regarding development of mother-calf relationship and at weaning.