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Data Networking in Modern Calf Rearing

Several methods for electronic control and data recording are available for calf rearing, e.g. automatic milk substitute and concentrate feeders, as well as temperature and weight measurement. They will be added to a test series at the TU Munich, where the amount of drinking water and roughage ingested are electronically recorded. Currently they are analysing to what extent conclusions can be drawn about first stomach development and early disease detection in calves using the acquired data. The aim is to identify possibilities for improved feeding and health management.

Fig. 1: System set-up (from left to right) milk feeding robot, feeding station with temperature measuring system and animal weighing system, concentrate feeding robot, drinking water robot and separated roughage weighing troughs

In animal husbandry, electronics ought to assist the farm manager by acquiring parameters of feed intake, animal behaviour and animal health and helps to identify unusual or critical situations as soon as possible. But in this sector, only proprietary, 'isolated applications' are offered for monitoring and control. Furthermore, the available number of sensors is still low and particularly, there is a huge deficiency in the collection and evaluation of ethological data.

First steps for a standardised interconnection of those systems are taken by ISOagriNet [1].

For calf rearing, a set of control technology components is already available (automatic milk feeders, concentrate feeders, electronic animal weighing machine, automatic tongue temperature measurement system), which simultaneously allow the recording of important process parameters. At present, a test series with automated individual registration of all relevant process parameters is taking place at the experimental station 'Hirschau' of the Technische Universität Munich. For this, an automatic measurement system for the collection of individual drinking water intake ('ATS', Förster-Technik GmbH, Engen) and a system for the registration of the ingested amount of roughage (Institute for Agricultural Engineering, Farm Buildings and Environmental Technology of the Bavarian State Research Centre for Agriculture, Freising) are deployed. The existent potential of the technology should be assessed with regard to an improved feed and health management. Also, possibilities for the optimisation of the rearing management should be analysed due to the automatically recorded animal data (*Fig. 1*).

Method

To estimate the technical and informational requirements as well as the potential of this complex networked monitoring system, several co-ordinated trials will be arranged. There are two mirrored partitions in a deep litter loose calf housing, each with a milk feeding robot, an automatic tongue temperature measurement system, an electronic animal weighing machine, a concentrate feeding robot, a drinking water robot and six electronic roughage weighing troughs for an individual registration of all relevant parameters. The data of all systems are stored in one collective database by the use of one central computer for control and acquisition. Furthermore, two data loggers are used to document the indoor climate and a video system is used to observe the animals. The operational reliability of the complete system has been tested in a comprehensive preliminary test.

On the basis of clinical-diagnostic, physiological and anatomical reference parameters, which are continuously taken, the relevance of the recorded parameters will be ve-

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Keywords

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rified in terms of calf growth and health status. Hereof, algorithms for process control in networked systems could be derived and their technical requirements could be devised (*Fig. 2*).

Description of the trial

At present, a 30-week trial is carried out. Data of 40 successively on the farm-born calves are acquired during the rearing period. Supposed correlations between the intakes of drinking water, roughage, concentrate and milk as well as growth and body temperature of each animal are analysed subsequently. In a preceding investigation at the Fachhochschule Osnabrueck, a correlation of the parameter drinking water intake and the intake of roughage, concentrate as well as animal growth and health status was estimated and partially proved [2].

Whilst running the trial, the calves are getting colostrum for one week and then milk substitute. Until the 43rd day of life, 8 l milk substitute are offered per day, until the 70th day the available amount of milk is continuously reduced to 2.5 l/d. Over the period of milk feeding, up to 2 kg concentrate per day and calf is allowed. Hay and water are available ad libitum, but the intake is acquired individually. In order to collect the ingested amount of drinking water, roughage and concentrate beyond the milk feeding period, the calves remain for another four weeks in the system.

Reference measurements

Clinical-diagnostic examinations are carried out regularly to precisely document the health status of each animal. Therefore, every day all calves are examined on the basis of a detailed diagnostic form and their health status is registered.

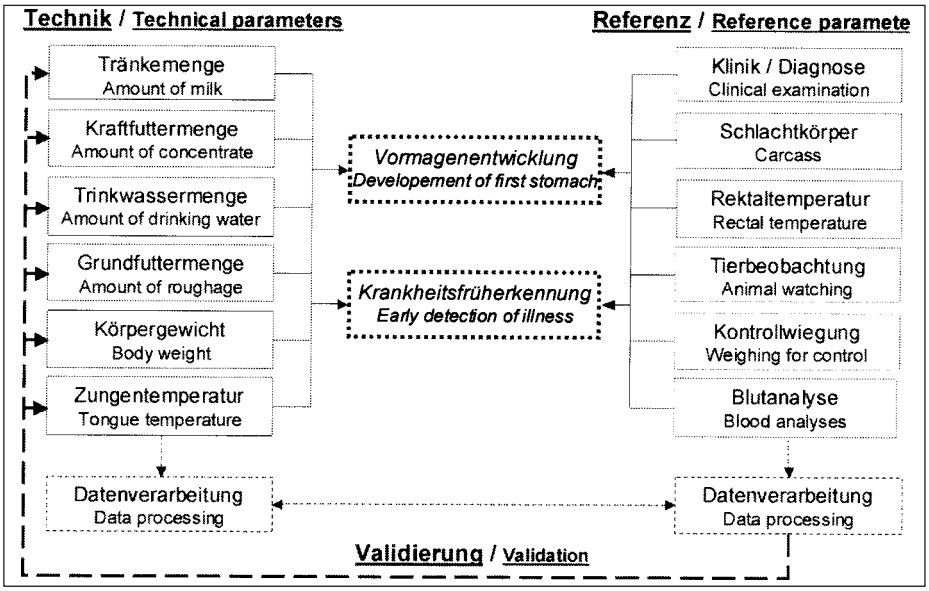

Fig. 3: Validating the significance of recorded parameters on the basis of reference measurements

To make a statement about the first stomach growth of a calf, allotted animals are slaughtered at several fixed dates and their first stomachs are examined. Thereby, the area and weight of rumen and reticulum will be noted and tissue samples will be taken from defined regions to get the number and admeasurements of the mucosa villi.

Continuative research work

The identified correlations of feed intake, drinking water intake as well as body growth, first stomach growth, body temperature and health status of the running trial should be the basis for further test series. The statistical acquired correlations should be proved further by a systematic variation of single parameters.

Outlook

In the following, the results can be taken to use technical acquired parameters for automatic control of individual calves and for the adaptation of the feeding regime in a networked calf rearing system. In detail, this means the individual control of the offered amount and concentration of milk and the length of the rearing period per calf. Likewise it can be expected that the use of an increased number of check values allow a more efficient and to a large extent automatic health monitoring and therewith an early disease treatment.

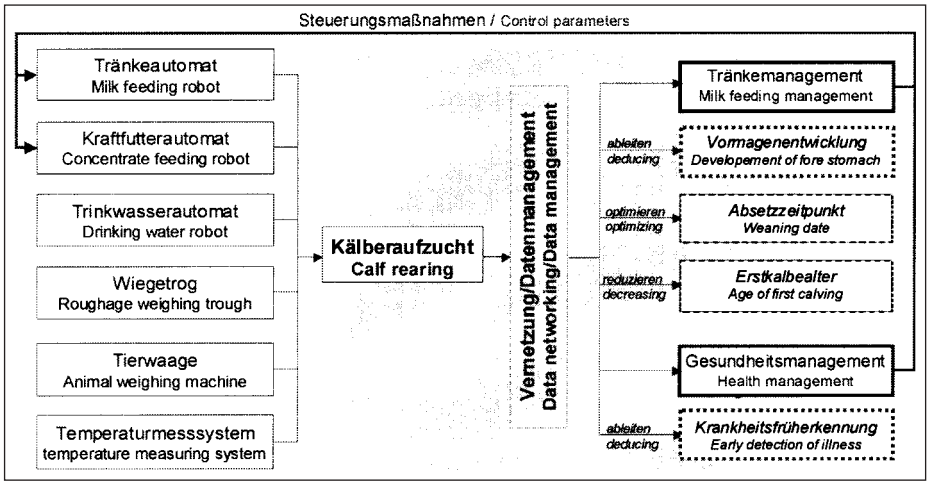

Fig. 2: Data networking in process control, using the example calf rearing

Literature

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