

Individual Water Intake of Cattle at Photovoltaic Pasture Drinkers

Using solar electric current to supply water for grazing cattle is a safe, but still not widely disseminated concept for saving working time and costs. In a suckler cow herd a system for recording the individual water intake and drinking patterns is being tested. The photovoltaic pasture „centre“ was designed by the authors and the construction financed by the ATB. Examinations are being made on whether information about individual drinking patterns is of interest for herd management. The system is described and the results from the first months of testing

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Keywords

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Pastures with long distances to the farm require more working time, especially for offering enough and good quality drinking water for the animals and for checking the security of fences. The management of larger herds needs some help of technical equipment to observe the health status and calving process in suckling cow herds. Otherwise there is a lot of time necessary too, or a loss of information as the result of non permanent presence of the herdsman. The drinking behaviour gives individual information of grazing cattle. A cow goes away from the herd shortly before calving. Cattle with lameness or other illness can't follow the movement of the herd and have different drinking times and activities. Pumping of drinking water using solar energy is a successful application for photovoltaics in agriculture under Central European conditions [1, 2]. The demand of water by cattle depends on the climatic conditions and follows the supply of solar energy [1, 3].

The project „Photovoltaical-pasture-facilities for cattle with monitoring of individual behaviour“ has the following aims: Development and testing of a system to apply and register the drinking water individual for each animal of the herd; development of models for evaluation of the individual water intake. This article describes the technical concept and first results about the performance of the system.

Description of system

The system is divided into two parts, fixed on trailers. Trailer 1 contains the solar collectors, weather-station, control unit for electricity storage and use, data logger and solar batteries. Trailer 2 (fig. 1) is the pasture drinker with water storage tank, six drinkers with animal identification, unit for control and data logging of individual drinking behaviour and water intake. Both trailers are designed for short distances between (up to 30 metres) each other and to close to a well.

Solar collectors

The collectors have worked since 1993 in another experiment. The area of the collec-

tors is 6.74 m² with an angle of 50° to horizontal line and a power of 672 W_p at 12 V.

Storage capacities

Batteries (6 pieces „Classic OpzS single cells“) with 350 Ah are used to store electrical power. A water tank with a storage capacity of 4,000 litres has a function as buffer and store on the trailer with the drinkers. When the water tank and the batteries are filled, the pump continues to work and the water flow is measured by a special water meter. So it is possible to ascertain the maximum capacity of the photovoltaic-system.

Well and pump

The well is a drill-hole with 200 mm diameter and is 7 m deep. Water level is about 2 m below the surface. The pump, type „SHURFLO 9300“, runs with 24 V and brings the water up from a depth of 5 m. As a part of the whole system, this pump has a maximum output of 420 litres per hour. The realised output will be recorded as a sum of an hour and is counted by a water meter.

Drinkers

Three drinkers (SUEVIA Model 180) at each long side of trailer 2 have low pressure valves. There is a separate water meter with an impulse counter (12.95 ml/impulse) for each of the drinkers. The left dividing construction contains the antenna for animal identification. The drinkers were installed 450 mm above standing base of animals. Water is supplied to each animal, whether it is identified or not.

Animal identification

70 transponders connected with common ear tags (ALLFLEX) are in the investigation. Each of these ear tags has a number (1 to 70) and is positioned at the left ear of the cattle. The process of identification starts with an impulse of the water meter, when the cattle starts the water intake. In this case, the antenna gets active. If the transponder is identified, the impulses of the water meter will be counted. After short time there is an identification process again. Unambiguous data will be stored in the data logger. The data bank

contains the transponder number, the time of the first and the time of the last impulse and the total number of impulses.

Weather-station

For description of the local climatic conditions there is an automatic weather-station with data logging of following parameters: temperature, relative humidity, solar radiation, wind speed and rainfall.

Testing conditions

The described system supplies a herd of 80 suckling cows and 20 heifers with water. It is positioned on a permanent pasture (marsh) with some sandy elevations. The trailer with the drinkers stands at one of these elevations. Between the well and the solar trailer is a distance of 5 metres. If the pasture is divided in two parts, the trailer with the drinkers can be moved to the second part. In this case the distance between solar trailer and drinkers is about 30 metres. .

Results

The system has been working since 26. May 2003. In this first analysis, data up to 12. August 2003 are included. .

Security of water supply

The herdsman checks in his daily routine the water level in the storage tank, the running of the pump and all connections of cables between both trailers. For emergency there is an open trough, which can be filled with the help of an other tank trailer. In the analysed time, there was no case of emergency.

The volume of pumped water per day was equal or higher than the demand of all animals. The buffer function of the tank was successfully used to eliminate the variation over the day. This means that the batteries had only a few times to supply energy to the pump during night time.

Use of single drinkers

After installation of the system, the cattle were interested in this new equipment within their well known environment. The whole herd was around the trailer with the drinkers. The low position of drinkers makes it possible for calves to drink, too. The intensity of use of the different drinkers around the trailer can be analysed by the number of impulses of the identification system (water intake with successful identified animal) and by the supplied water per drinker. The last one



Fig. 1: Pasture drinkers to list individual water intake

gives the full information. In the period of settling in (8 days) the use was of equal value for the drinkers. Later there a slightly higher frequency at drinker 1 (see table 1) could be observed.

Individual water intake

The daily water intake of one animal has an enormous variation. But not only the water intake, the drinking behaviour varies, too. At this point of time it isn't possible to give reliable data about the real water intake per animal and day. E.g. the cow with transponder 5 had in the period between 22. July and 6. August two days without any registration at the drinkers. On the other days there were between two and 14 registrations (successful identifications and water intake). Some of these were at the same drinker with only short time between the single registrations. The counted water intake within one registration period varies between 0.3 and 52.53 litres. The fastest water intake was about 7 litres per minute.

Discussion

The technical concept has been tested successfully in the first months of operation. The individual water supply and the registration of drinking behaviour with a solar energy driven system was used in a field test. This is in line with former publications [1, 2, 3]. Water supply to grazing cattle is a useful application of photovoltaics in agriculture.

The large difference between the sum of impulses of all water meters and the sum of the impulses with identification makes it ne-

cessary to improve the hard- and/or software for identification.

The collected data can be used to analyse the correlation between climatic parameters and water intake for the whole herd. This knowledge makes a calculation of the demand for water possible, depending on different climatic conditions. Especially the long and hot summer period with nearly no rainfall gives a lot of interesting information about the maximum water intake of suckling cows and heifers on pastures. This is important for the design of solar based pasture drinkers. Enough water at all time is necessary for the cattle, but an inordinately large system is expensive and should be avoided.

Literature

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Drinker	1	2	3	4	5	6
26.5.- 4.6.03	1923	1656	1326	1350	1685	1865
5.6. - 12.8.03	28307	23202	24268	21697	19804	21016

Table 1: Water intake at the single drinkers (litres)