

## Facilitating grazing for organic dairy farms with expanding herd size

FRANK WILLEM OUDSHOORN<sup>1</sup>, KIRSTINE LAURIDSEN<sup>2</sup>

**Key words:** Grazing, Dairy farming, gates, sensors, logistics.

### Abstract

*Maximized grazing, in time and amount, must be the primary aim for organic animal management. Herd sizes have been expanding the last years, and automatic milking is being used in around 10% of the organic herds in Denmark. Limited acreage for grazing and desire for optimum feeding, makes the desire for the farm manager to control grass offer in the field and grass intake of the herd even more acute. Research with controlled logistics, intelligent gates, and sensors for estimation of grazing time, have shown promising results.*

### Introduction

Organic dairy farming is inseparably connected with grazing. One of the key objectives and core indicators for sustainability is to respect the animals' natural behaviour (SAFA 2013), and on this issue there is no doubt that the dairy cow is a grazing animal. Of course organic dairy farmers have to answer to the call for increasing production volume and continuity of delivery; therefore seasonal calving is mostly omitted, and barn feeding with supplements and concentrates is required in countries with no winter growth. However, maximized grazing, in time and amount, together with loose housing using straw or biomass mattresses for the winter periods, must be the primary aim for organic animal management. Farm and herd sizes have been expanding the last years due to increase of automation and mechanization, and rising labour costs. In Denmark the average herd size for organic herds has increased dramatically. (Tab. 1)

**Table 1. Organic dairy farms statistics in Denmark**

	2003	2009	2010	2011	2012	2013
Amount of org. dairy farms in DK	636	399	422	417	409	392
Milk delivery (1000 t)	434	453	478	490	499	505
Average delivery pr. farm (t)	682	1135	1133	1175	1220	1288
Average herd size (nr.)	85	126	126	131	136	143

Often the farm structure (fields surrounding the farm buildings and milking parlour), was destroyed by expanding farm size. Remote fields are not usable for grazing dairy cows, but used for cut and carry regimes or grazed by heifers and dry cows. The fields that are in reach of the milking herd are limited, and lack of land in the proximity is sometimes reason for the organic dairy farm to strive for further expansion. If all fields were ideally distributed in the near surroundings of the barns and 50% of the fields could be used for grazing (with 0.5 ha per cow), an average farm in 2013 would need about 150 ha adjacent to the farm. If herds should expand further, the distance from barn to fields would exceed one km. For normal batch milking in milking parlours or carousels this is not an insuperable problem, but for farms with automatic milking (AMS), this is problematic. The gregarious character of the cattle and the distance to the AMS hampers cows to visit the AMS voluntarily on individual basis (Ketelaar-De Lauwere, 2000). In addition, limited acreage makes the desire for the farm manager to control grass offer in the field and grass intake of the herd even more acute.

<sup>1</sup> Aarhus University, department of engineering, Blichers Alle 20, 8830Tjele, www.eng.au.dk Denmark fwo@eng.au.dk

<sup>2</sup> Organic Denmark, advisory service. Silkeborgvej 260, 8230 Abyhøj, Denmark

## Material and methods

During the last five years (2008-2013) Danish researchers together with the extension services and organic dairy farmers, have investigated the possibilities to facilitate the farms with innovative technology and design, with the aim of improving grazing and grazing management (technology for grazing). The projects have been financed by the Danish agricultural department and Danish Dairy. In the following article we describe some of the results.

## Results

### Logistics and walkway stabilizers

By actively involving farmers and their experiences, some interesting best practice suggestions came forward. One of the comments obtained, was that cows have the habit of remembering unpleasant experiences associated with logistics. Permanent and robust cow tracks, attractive openings and gates to fields, open water troughs and easily accessible entrances to the barn, greatly improved cow traffic. Cow tracks can be a source of nuisance if they become muddy, slippery or impassable; hoof sores and starting inflammatory and contagious diseases can occur.

Different kinds of coverage materials were tried out in experiments, permanent concrete or asphalt, removable plastic grids, and recycled rubber mining belts have been implemented. All materials greatly improved the walkability but needed a good foundation of sand and gravel, as well as drainage. Removable material was cheaper per square meter and can be used in other fields, when field rotation is practiced. Rubber belts could be slippery in wet weather, and should be kept sand-covered

### Intelligent gates

Gates to the fields and gates from barn to field can easily be made intelligent. One-way gates to secure traffic in the desired direction, timer connected one-way gates to open automatically (Fig 1), and gates in the field that can direct the herd two or three ways as preferred (Fig 2), have been tested. In combination with RFID tags the latter two or three way gate could direct the cows individually.



Figure 1. Timer connected gate.



Figure 2. Selection gate.

### RFID to register cows' behaviour

Cows in Denmark are being equipped with RFID tags in the left ear. Antennas to register the RFID tags can be programmed to register time of contact, and store the information or send it real-time to the herd manager.

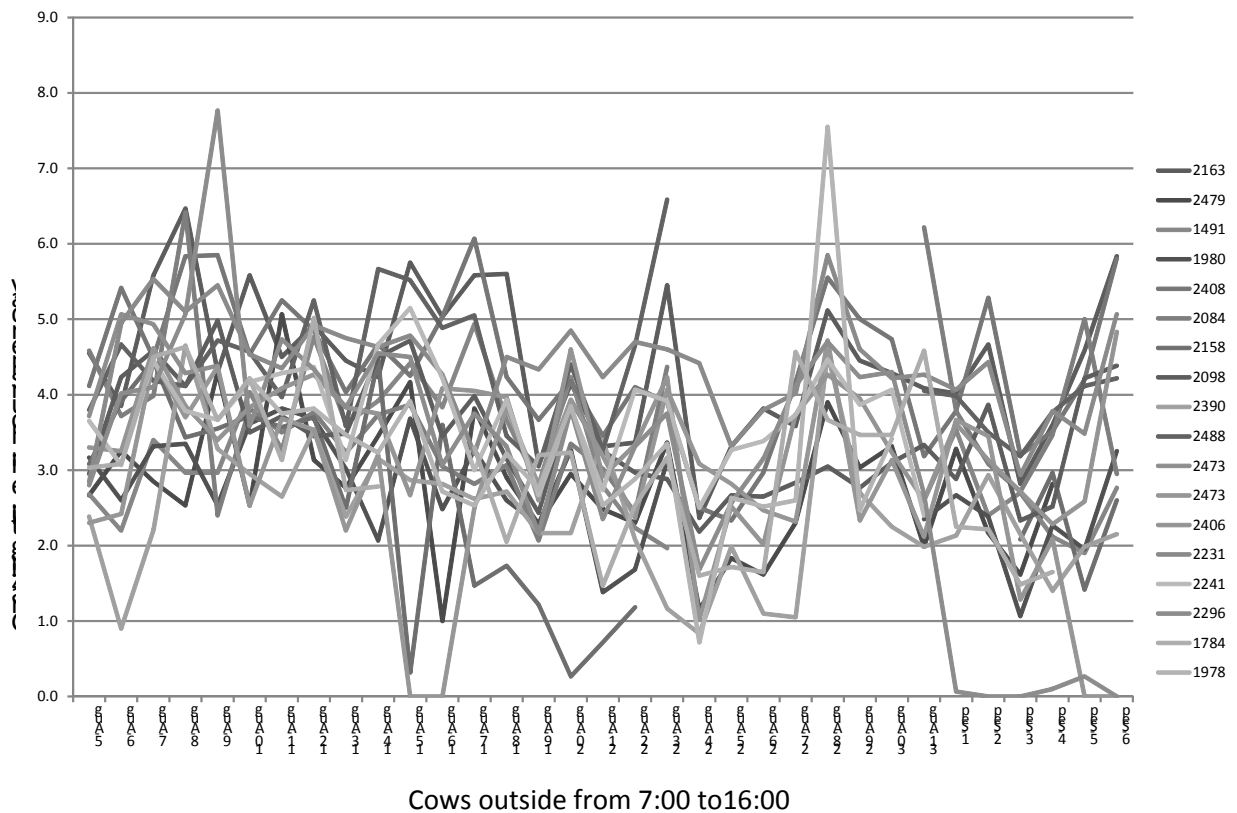
The information can be used to register time spent outside when the antennas are installed close to the entrance (Fig 3), and from this information grazing time can be controlled. Especially in situations where herd managers were in doubt if the herd or specific animals had been outside long enough, the information was found to be valuable.



**Figure 3. Gates with RFID scanner**

**Sensors for measuring cow behaviour**

Different sensors can be used for measuring cow behaviour. Most of them are utilized with accelerometers. They register movement and can, by use of developed algorithms, translate these movements to key indicators (e.g. standing, walking, or grazing, Fig 4). The algorithms should be calibrated for different races and grass heights and can, although crudely, give information on grass intake. By increasing the measuring frequency of the accelerometers, grass intake can be estimated more accurately (Oudshoorn et al., 2013). More efficient supplement feeding and concentrates supply can be the result.



**Figure 4. Information on individual grazing time per day for 18 cows.**

## Conclusions

Organic dairy farming can and is interested in using innovative technology. Best practice management experiences for improving grazing results in larger herds and herds with AMS should be extended by farm schools. Wireless contact to gates and sensors attached individually to cows' halters could save labour and increase feeding efficiency.

## References

- Ketelaar-de Lauwere, C.C. Ipema, A.H., Lokhorst, C., Metz, J.H.M., Noordhuizen, J.P.T.M., Schouten, W.G.P., Smits, A.C. 2000. Effect of sward height and distance between pasture and barn on cows' visits to an automatic milking system and other behaviour. *Livestock Production Science*, 65 131–142.
- Oudshoorn, F.W., Cornou, C., Helwing, A.L.F., Hansen, H.H., Munksgaard, L., Lund, P., Kristensen, T. 2013. Estimation of grass intake on pasture for dairy cows using tightly and loosely mounted di- and tri-axial accelerometers combined with bite count. *Computers and Electronics in Agriculture* 99 (2013) 227–235.
- SAFA, Sustainability Assessment of Food and Agricultural Systems, version 2.0. July 2013. Visited 08-01-2014 on <http://www.fao.org/>.