

# The behaviour and production of dairy cattle when offered green pasture or exercise pen

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## Abstract

The aim of the experiment was to investigate the activity and behaviour of dairy cows with access to different outdoor areas. The study took place on two commercial farms with loose-housing and automatic milking systems (AMS). One farm offered 2.8 hectares of green pasture and the other offered a 0.7-hectare exercise pen. Sixty-six percent of the cows with access to green pasture went outside whenever possible. More activity was observed on 'pasture-days'. Most observations were spent grazing (72.2%). Milk yield was, however, lower ( $P < 0.01$ ) and number of visits to the AMS fewer ( $P < 0.001$ ), on days with access to pasture. In the farm with access to an exercise area, only 31% of the cows went outside when possible. Most of the observations were standing/walking with head up (43.2%) and lying (33.2%). The number of cows outside was mainly controlled by the indoor feeding interval. Access to the exercise pen did not affect the daily milk yield, but resulted in an increase in number of milking visits ( $P = 0.005$ ). In conclusion, access to outdoor areas, preferably pasture, is important for dairy cows and may have a positive effect on animal welfare and their ability to practice natural behaviour.

**Keywords:** behaviour, milk yield, weather factors, animal welfare

## Introduction

Norway has experienced major structural changes in its dairy production and the country now has the highest number of dairy barns with AMS in Scandinavia. One consequence of this seems to be reduced grazing and pasture access for the cows. Van den Pol-van Dasselaar *et al.* (2008) found less use of grazing on farms with AMS than on farms with other milking systems, and farmers claim that the milk production and number of visits to the AMS will be reduced if pasture is offered. Previous research has shown that cows are reluctant to leave an attractive pasture field to be milked (Ketelaar-de Lauwere *et al.*, 1999) but this also emphasizes the fact that access to green grass is positive for animal welfare. Norwegian animal welfare legislations now demand that all dairy cows, regardless of housing-system, are offered access to pasture for a minimum of eight weeks during summer (LMD, 2004). Some farmers consider using exercise enclosures as an alternative to pasture due to a lack of suitable pastures. The regulations permit this, when pasture is unavailable. Current knowledge on the behavioural effects of pasture vs exercise enclosures is, however, limited. The aim of this study was to investigate behaviour and activity of dairy cows offered different outdoor areas, on two commercial farms with AMS located indoors.

## Materials and methods

The pilot study was performed in two commercial dairy farms with loose housing and AMS on the coast of Helgeland (65°N) in Norway during the summer of 2013. Farm 1 had a herd of 50 dairy cows and a DeLaval milking robot (DeLaval, Tumba, Sweden) with controlled cow traffic. A 2.8-ha field with green pasture was offered, just outside the barn. All cows were allowed access to the pasture, using strip grazing, after the first harvest, for a total of 33 days (8 July to 26 August) between 9:00 am and 16:00 pm on days without precipitation ( $< 3 \text{ mm day}^{-1}$ ). Farm 2 had a herd of 50 dairy cows and a Lely milking robot (Lely Holding, Maassluis, the Netherlands) with free cow traffic. The cows were offered an exercise enclosure of 0.74 ha in a small forest in connection with the building. Cows had access to the outdoor area the whole day for 15 days (from 12-27 August), except on rainy days. Both farms had Norwegian Red (NRF) dairy

cattle, and offered the normal feed ration (grass silage and a commercial concentrate) indoors during the experimental periods. Water was only available indoors.

At both farms, a present observer performed direct observations of the cows when outdoors. Each observation period lasted 90 minutes. We performed 28 observation periods at farm 1 and 6 observation periods at farm 2. The total number of cows outdoors and the number of cows performing each of seven pre-defined behaviour categories were registered. Observations were done between 9 am and 4 pm, using instantaneous sampling in two minutes intervals for a minimum of 90 minutes per day. Mutually exclusive behaviour categories were defined. Focal animals were fitted with activity loggers. Weather factors were recorded and later categorized according to air temperature, wind speed and direction and precipitation. Production data from the AMS units were gathered from both farms from seven days with access, and seven days without access to the outdoor area. A Generalized Linear Model (GLM) was applied to test effects on number of cows outdoors and pre-defined behaviours. The following class variables were utilized; 'weather category' (1-5) and 'number of days since outdoor access' (1 = first day out this year, 2 = three to five days since outdoors due to bad weather; 3 = the cows were outdoors the day before). The latter variable was specified as a random effect in the model. Differences between means were analysed using a Tukey-Kramer test. The effect of access to outdoor area on cow activity, milking frequency and milk yield was tested using paired T-tests for data on same individuals over seven selected days with, and seven days without access to outdoor areas.

## Results and discussion

Farm 1 with pasture: the cows went outdoors whenever possible. On average, 66% of the cows were located outdoors at any given time during each observational period. The weather conditions did, however, influence the duration of the outdoor visits. On days with warm (15-20 °C), sunny weather or rain/drizzle, significantly fewer cows ( $23.6 \pm 0.3$ ) were found outdoors than in partly cloudy weather and 10-15 °C ( $30.2 \pm 0.35$ ;  $P < 0.05$ ). With access to pasture the cows were more active, spending  $80.4 \pm 2.6\%$  of their time in an upright position vs  $36.8 \pm 2.9\%$  on days without access to pasture ( $P < 0.05$ ). The most common behaviour on pasture was grazing ( $72.2 \pm 0.4\%$  of total observations), and lying behaviour ( $4.7 \pm 0.2\%$ ) was observed much less than in farm 2 ( $33.2 \pm 1.3\%$ ).

In this study, cows with access to green pasture reduced their mean daily milk yield with  $0.8 \text{ kg milk day}^{-1}$  on 'pasture days' (Figure 1), and number of visits to the AMS were reduced from 2.7 when indoors to 2.5 ( $P < 0.001$ ), on days with access to pasture.

Farm 2 with exercise enclosure: only 31% of the cows went outside when possible, and the number of cows outdoors and outdoor behaviour was not sensitive to weather conditions. This was probably due to

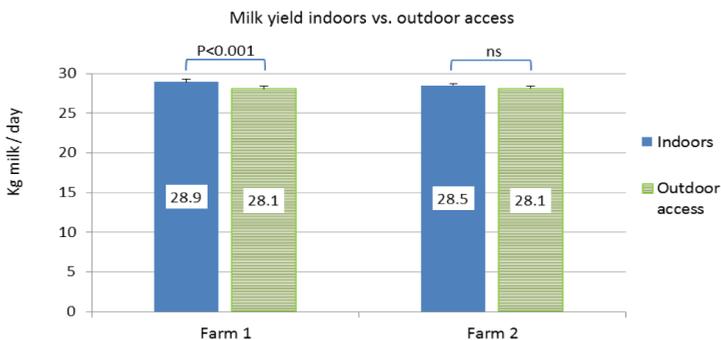


Figure 1. Mean individual milk yield in two farms, with and without access to outdoor areas.

a low number of observations at this location. The cows returned to the barn as soon as they heard the automatic feeder start to administer fresh roughage. Access to the exercise pen did not affect the daily milk yield (Figure 1), but resulted in an increase in number of visits to the AMS from 2.9 to 3.1 visits per day ( $P=0.005$ ). Even though cows at farm 2 got all their feed indoors and they only had access to a small forest area, grazing/eating constituted  $18.3\pm 1.1\%$  of the observations.

All forms of outdoor access and exercise are considered positive for health and behaviour in dairy cows (Krohn, 1994; Boyle *et al.*, 2008). Studies have shown that it is possible to maintain and even increase milk yield on pasture but it requires high quality pastures combined with optimal management, grass-species and number of animals per hectare (e.g. Sairanen *et al.*, 2006). By introducing rotational or strip grazing it might be possible to provide sufficient AMS visits (Lyons *et al.*, 2013).

## Conclusions

A reduction in daily milk yield was found when cows were offered green pasture, compared to when only kept indoors. This effect may, however, be counteracted by optimal pasture management and cow traffic control through the AMS.

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