Production pasture versus exercise and recreation pasture for cows in automatic milking systems

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Abstract

In an automatic milking unit, a daytime grazing system with production pasture (group P) was compared with offering cows a small grass-covered paddock only for exercise and recreation, i.e. exercise pasture (group E). Two experiments (Exp1 and Exp2) were performed during 12 and 5 weeks with 53 cows and 42 cows, respectively. Group P was offered new pasture daily with night-time access to grass silage *ad libitum* (Exp1) or in restricted amounts (Exp2). Group E was offered exercise pasture and silage *ad libitum* during 24 (Exp1) or 16 hours (Exp2) daily. In Exp1, group P had significantly ($P<0.05$) higher daily milk yield (+1.6 kg Energy Corrected Milk) than group E and daily silage intake in groups P and E was 9.8 and 12.2 kg dry matter (DM) per cow, respectively. In Exp2, cows in group P had similar milk yield to cows in group E and daily silage intake was 6.2 and 11.5 kg DM in group P and E, respectively. These results show that it is possible to achieve either higher milk yield (Exp1) or considerably lower intake of supplementary silage (Exp2) on production pasture compared with exercise pasture.

Keywords: grazing, automatic milking, supplements, restricted grazing, daytime, dairy cows

Introduction

Grazing during only part of the 24-hour period can offer several advantages, especially for dairy systems with automatic milking (AM). With part-time production pasture, cows are offered a new pasture area during 8-12 h daily and are given supplements when restricted indoors. In this system, pasture utilisation is high but the area needed for pasture is smaller than with full-time grazing. Thus, the distance to the pasture area can be shorter, which has been shown to give higher milk yield in AM systems (Spörndly and Wredle, 2004). Furthermore, the negative effects of large variations in pasture supply and quality can be avoided. In several Scandinavian countries (e.g. Sweden and Norway), animal welfare legislation requires cows to be grazed on pasture in summer and it is common for farmers with AM to comply with this law by offering access to a small field only for exercise and recreation, combined with full indoor feeding for the cows. The question is whether using production instead of exercise pasture can give higher yields or lower feed costs.

This study compared production pasture with exercise pasture in an AM system with daytime grazing. The hypothesis was that daytime production pasture, with silage supplementation during non-grazing hours, would give (1) lower intake of silage indoors and (2) higher milk yield than daytime exercise pasture with 24 h *ad libitum* silage feeding.

Materials and methods

Two experiments were carried out to study this hypothesis. Experiment 1 (Exp1) was performed with 53 cows of the Swedish Red Breed (SR) during 12 weeks in 2011 and experiment 2 (Exp2) with 42 cows of the Swedish Holstein (SH) and SR breeds during 5 weeks in 2013, with approximately one-third primiparous cows in both studies. In both experiments, milk yield, milking frequency, feed intake indoor and time on pasture (only Exp 2) were recorded automatically. Milk samples were collected for analysis before experiment start and thereafter every second week. All cows on pasture in each experiment were observed every 15 min over three days and the following behaviours were recorded: location (cow lane or pasture/exercise area), position (standing or lying) and activity (grazing or other).

Pasture height and pasture allowance were measured daily, and samples of pasture and supplementary feed were collected daily for analysis to determine nutrient composition. Cows had access to the outdoor pasture/exercise area during 9.5-12 h in daytime and could move freely from the house to the pasture or exercise area during this time. During the remaining time, they were restricted to the house with access to supplementary feed.

Cows in both groups were offered drinking water in the house and were given concentrates according to milk production before the start of the experiment. The cows were then blocked and randomly assigned to the production pasture (P) or exercise pasture (E) treatments, which were applied simultaneously in each herd. On passing through a selection gate at the house exit, cows in each group were directed to their own pasture area (P or E) and stayed there from 06:00-15:30 in Exp1 and 06:00-18:00 h in Exp2. Silage and concentrate feeding and recording were performed at individual cow level using transponders.

Treatment E: Cows had access to the same 1-ha field (distance 200 m) throughout the experiments (continuous, low sward height and low allowance, 3 kg dry matter (DM) day^{-1}). Group E cows received silage *ad libitum* in the house during 24 h day^{-1} in Exp1 and 16 h day^{-1} in Exp2.

Treatment P: Cows were given a new grazing area daily at a high pasture allowance (>20 and 15 kg DM per cow and day in Exp1 and Exp2, respectively). During indoor confinement hours, cows were offered silage *ad libitum* in Exp1 and 6 kg DM silage in Exp2. The total area used for treatment P in Exp1 and Exp2 was 3.6 and 5 ha, respectively, and the distance to pasture was 20-200 m and 200-400 m, respectively. The results were analysed in a general linear model using the SAS programme (Ver. 9.2; SAS Institute Inc.). The model for statistical analysis of the production parameters (milk yield and milk components) in Exp1 contained the variable treatment (P or E) and lactation stage (only milk yield), using milk yield before experiment start as a covariate. The model for Exp2 was similar, but contained the additional variables breed and age (primiparous/multiparous) and excluded lactation stage due to lack of significance. In analysis of behaviour results in Exp1 the model contained only treatment as the variable, while in Exp2 the variables breed and age were also included as they were statistically significant.

Results and discussion

Both years were characterised by normal pasture conditions during the first part of the experiment, followed by dry weather during the latter part. The metabolisable energy content in silage and pasture herbage, and sward height differed between feed sources and years (Table 1) There were some significant differences in production and behaviour between Exp1 and Exp2 (Table 2). During Exp1 the cows on treatment P had 1.6 kg higher energy corrected milk yield than those on treatment E (Table 2). There was no significant difference in milking frequency (2.83 and 2.72 in the P and E groups, respectively). As

Table 1. Mean (± standard error) content of metabolisable energy in silage, production and exercise pasture, and sward height in experiment 1 and 2.

	Experiment 1			Experiment 2		
	Silage[1]	Production	Exercise	Silage[2]	Production	Exercise
Metabolisable energy, MJ kg^{-1} DM	10.8 (0.27)	11.0 (0.55)	11.1 (0.49)	11.2 (0.27)	9.7 (0.31)	9.4 (0.72)
Sward height, cm		9.3 (1.79)	2.6 (0.90)		11.3 (1.33)	2.6 (0.80)

[1] Dry matter (DM) in silage 40%.

[2] DM in silage 32%.

Table 2. Production and behaviour data (least square means) for cows on production or exercise pasture in experiment 1 and 2.

	Experiment 1			Experiment 2		
	Production	Exercise	Sig.[1]	Production	Exercise	Sig.[1]
Production						
Milk, kg	35.6	33.3	**	32.2	32.6	NS
ECM[2], kg	35.8	34.2	*	32.5	32.1	NS
Milk fat, %	4.03	4.25	*	4.04	3.91	NS
Milk protein, %	3.36	3.37	NS	3.37	3.32	NS
Behaviour[3], hours (h)						
Outdoor time, h	3.1	1.9	***	4.5	3.5	***
Grazing time, h	2.0	1.1	***	2.3	1.1	***

[1] Significance: NS = not significant; * $P<0.05$; ** $P<0.01$; *** $P<0.001$.

[2] ECM = energy corrected milk.

[3] Data from 18 days of automatic recordings.

regards behaviour on pasture (Table 2), in Exp1, cows in group P spent approximately 3 h daily on pasture and only 2 h grazing, even though they were offered new pasture daily. Besides eating pasture herbage, cows in group P had an average indoor intake of 9.8 kg DM silage per day, whereas silage intake in group E cows was 12.2 kg DM per day. Thus, while the milk yield for group P cows was higher, the cost of this increased production was also high, as these cows were offered new high quality pasture herbage daily, yet they consumed large amounts of conserved feed.

In Exp2, average silage intake was 11.5 and 6.2 kg DM in groups E and P, respectively. There was no difference between the groups in milk yield or milk composition (Table 2). For milking frequency, there was a significant ($P<0.05$) interaction between treatment and parity in group E, with 2.75 and 2.51 milkings day^{-1} for primiparous and multiparous cows, respectively, while group P had similar frequencies for both ages (~2.65 milkings day^{-1}). There was also a significant interaction in milking frequency between breed and parity, with significantly lower milking frequency for multiparous compared with primiparous cows of the SR Breed (2.45 and 2.75 milkings day^{-1}, respectively; $P<0.01$) and compared with multiparous cows of the SH breed (2.72 milkings day^{-1}; $P<0.05$). The results of Exp2 showed that even when pasture conditions are less favourable (Table 1), cows on treatment P can achieve similar production results as cows on treatment E. In both Exp1 and Exp2, there was a significant difference in the time that the cows on the different treatments spent outdoors and spent grazing (Table 2). The cows on P pasture only exploited the opportunity to be outdoors for around 30-40% of the outdoor access time in both studies, and spent only around 20% of the outdoor access time grazing. Overall, the results show that it is possible to achieve either higher milk yield (Exp1) or a lower intake of supplementary silage (Exp2) on daytime production pasture compared with exercise pasture.

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References

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