**Grazing systems for robotic milking: the impact of daytime pasture access on dairy cow performance**

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**Application:** This research shows that daytime pasture access for robotically milked dairy cows can have a negative impact on cow performance.

**Introduction:** As the dairy industry strives to improve labour efficiency, cow management and cost of production, the interest and adoption of robotic milking technology has grown. However, challenges exist in relation to the integration of this technology into a pasture-based system. Previous research has highlighted that full-time summer grazing can have a detrimental impact on milking frequency and animal performance (Lyons et al., 2014). Grazed grass continues to be the most cost-effective feedstuff for Northern Irish dairy farms and thus there is a need to utilise this valuable resource within robotic milking systems. This research investigates the use of daytime access to pasture in comparison to a fully housed system for high yielding dairy cows milked via a robotic milking system.

**Materials and methods:** Fifty spring-calving dairy cows (12 parity 1, 38 parity 2+) were on a continuous design experiment during summer 2021. Treatment groups were balanced for lactation, days in milk, milk yield, liveweight, body condition score and the Predicted Transmitting Ability (PTA) for milk, fat, protein and Profitable Lifetime Index (£PLI). Two treatments consisted of (i) full-time housing, (ii) daytime pasture access for 16 hours per day. All cows were fed a total mixed ration (TMR) via feedboxes (15 kg DM grass silage:3 kg DM concentrates) and concentrates to yield through the robot (at a rate of 0.45 kg/L above M+25 for cows and M+20 for heifers). In addition, grazed cows were offered 2-way grazing from 4am to 8pm each day. During the 63 day study, cow performance, feed intake, milking behaviour, cow activity and grazing efficiency were monitored. Statistical analysis were conducted using Genstat (21st Edition). Number of paddock visits and percentage of cows grazing which were analysed as a linear mixed model. All other analysis were completed using a linear mixed model with repeated measures. The correlation between time points was accounted for using an AR model of order 1, with the exception of intake and grazing data which used an antedependence model of order 1.

**Results:** Milk yield (P<0.001) and milk protein (P<0.01) were significantly greater for housed cows yet milk fat did not differ significantly (P>0.05) (Table 1). Number of milkings (P<0.001) and number of refusals (non-milking visits) (P<0.001) were significantly greater for housed cows (Table 1). TMR intake and concentrate intake were also greater (P<0.001) for housed cows than for grazed cows. The grazed cows showed a greater preference for morning grazing than afternoon grazing demonstrated by a greater number of paddock visits (1.26 vs 1.01, P<0.001) and cows grazing (90.9% vs 74.8%, P<0.001). Grazing utilisation rate did not differ (P>0.05) between morning and afternoon paddocks. Margin over feed costs was greater (P<0.001) for housed cows. However, 29% of grazed cows had a margin over feed costs what was greater than the mean (£6.49) for the housed group.

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| **Table 1:** The impact of daytime pasture access on dairy cow performance |
|  | **Grazed** | **Housed** | **SED** | **P value** |
| Milk yield (L/d) | 28.76 | 31.97 | 5.442 | <0.001 |
| Milk fat (%) | 3.69 | 3.88 | 0.101 | NS |
| Milk protein (%) | 3.38 | 3.51 | 0.0457 | <0.01 |
| Number of milkings | 2.87 | 3.46 | 0.0409 | <0.001 |
| Number of refusals | 4.56 | 8.92 | 0.564 | <0.001 |
| TMR intake (kg DM/d) | 10.69 | 14.34 | 0.494 | <0.001 |
| Total concentrate intake (kg DM/d) | 7.96 | 10.42 | 0.663 | <0.001 |
| Margin over feed costs (£/cow/d) | 5.20 | 6.49 | 0.290 | <0.001 |

**Conclusion:** This study showed that daytime pasture access can result in a decline in milk yield, which may have been impacted by the reduced number of milkings and/or lower concentrate intake for grazed cows. Margin over feed costs demonstrated that at the level of performance achieved in this study, housing robotically milked cows was more economical than offering daytime pasture access. However, the variability within the grazed group illustrates that there is potential for some cows to perform well or better at grass. Further investigation will identify the key drivers of this, which could be used to further refine grazing systems for robotic milking or develop a methodology to pre-select animals that are suitable for these systems.

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**References:** Lyons, N.A., Kerrisk, K.L. & Garcia, S.C. (2014). Livestock Science, 159, 102-116.