Automatic Milking In Pastoral Dairy Systems

Jenny G Jago and Jennie K Burke DairyNZ, Hamilton, New Zealand

Dairy production in New Zealand is based on low-cost, efficient farming systems that utilize extensive grazing to grow and harvest high quality pasture to produce milk. Automatic milking systems (AMS) use a technology that has the potential to reduce the labour cost associated with milking and improve the lifestyle and work environment for staff. The Greenfield Project was established in 2001 to test the viability of automatic milking in New Zealand pastoral farming systems. A herd of up to 180 cows was milked by two AMS on the 54 hectare, all-year grazing, Greenfield Farm. In 2008, two farmlets were established to test the performance of two production systems typically found in New Zealand. DairyNZ uses a standard classification to categorize farms into one of five production systems based on the timing, purpose and amount of non home-grown feed used (Dairy Economic Survey 2007-08). The systems range from all grass, no supplement fed (10% of farms) to at least 20% of total feed imported and fed at both ends of lactation or all year round. The more intensive systems typically have a higher stocking rate, higher production per cow and per hectare and herds tend to be larger. The objective of the study was to compare the performance of an all-grass system with a high number of cows per AMS, with a higher feed input system with a lower ratio of cows to AMS.

Method

The existing Greenfield herd was divided into two spring calving herds which were managed on adjacent farmlets from June 1st 2008 to 30th April 2009. Herds were balanced for age (mean 5.3 years, range 2-14 years), breed (84% Friesian, 4% Jersey, 12% Crossbred), genetic merit expressed as breeding worth (BW) and expected calving date. After calving, each herd had continuous access to one of the two AMS throughout the lactation. The GRASS farmlet comprised 28.8 ha and 92 cows (3.2 cows/ha). A small quantity of concentrate (up to 0.5 kg per cow per day) was fed in the AMS to assist with cow flow. With the exception of the concentrate (4% of the total diet) the diet was fresh pasture supplemented when necessary with silage conserved from within the farmlet and fed at pasture. The GRASS+ farmlet comprised 20.0 ha and 72 cows (3.6 cows/ha). Feed grown off the farmlet comprised 20% of the diet and consisted of a mixture of grass silage and concentrate (48% each of maize and barley, 4% molasses fed during early lactation, or wheat nuts) ranging from 0.8 -3.7 kg per cow per day, fed in the AMS.

The herds were given access to fresh areas of pasture at 8am, 2pm and 11pm daily by remote selection units located on dual raceways (Jago et al., 2004). Each cow had a milking frequency target set within the herd management software (Crystal 0.44, Fullwood Fusion, Holland) and upon entering a selection unit an electronic identification device (EID) was read and the cow drafted accordingly; all cows due for milking went to the milking parlour, while cows not due for milking were either directed back to the grazing, or to a new pasture area dependent on the time of visit. Water was available in the selection units and at the exit from the milking parlour. Pre- and post-grazing herbage mass was assessed daily using a rising plate meter (RPM, Farmworks, New Zealand) from which total pasture intakes were calculated. Data on milk yield, time of milking and duration were recorded automatically by the herd management software. Milk composition (fat and protein) was determined on four occasions.

Results and Discussion

The GRASS+ herd had a higher production per cow and per hectare than the GRASS herd, consistent with the differences in farm system design resulting from the higher feed input and stocking rate in the former (Table 1). Despite lower per cow production the low input GRASS herd produced more milk and milk solid per AMS, as a result of the higher ratio of cows per AMS. The average milking frequency was higher for the GRASS+ herd being close to twice daily milking, but the GRASS herd achieved a higher AMS utilization. Both herds recorded high AMS utilization rates and at peak lactation both AMS were effectively fully utilized, after taking account of washing time, maintenance and time between milkings for cows to exit or enter the AMS. Annual pasture grown was 15.1 t DM/ha for both farmlets. Annual pasture eaten was 13.4 and 13.6 t DM/ha for GRASS and GRASS+, respectively.

Table 1. Performance measures for the GRASS and GRASS+ farmlets.

	GRASS	GRASS+
Number of cows	92	72
Milk solids (fat + protein) per cow (kg)	372	422
Milk solids/ha (kg)	1,188	1,520
Milk solids/AMS (kg)	34,223	30,402
Total milk yield (kg)	390,725	354,915
Average milking frequency (milkings per day)	1.6	1.9
AMS utilization at peak (% time AMS occupied/d)	81	74
Average milk yield/AMS/d (kg, at peak month)	1,345 (1,792)	1,241 (1,699)
Average daily milk yield (kg/d/cow)	17.0	19.2
Average days in milk	255	263

Profitable pastoral dairy systems are based on a compromise between production per cow and per hectare. The cost of production imposes a limitation on yield per cow through imported feed costs. An additional consideration for an automatic milking farm is production per AMS. The economic viability of automatic milking in pastoral systems depends strongly on the daily milk harvesting capacity and the number of cows milked per unit (Jago et al., 2006), as well as the ability to achieve high pasture utilization. Milk production for AMS may be increased by milking more cows through each AMS and decreasing the milking frequency per cow. This study has shown that AMS can be successfully integrated into both all-pasture and higher supplementary feed systems. Unlike conventional milking it is important to take account of AMS utilization and hence milking frequency to ensure the system operates effectively.

References

DairyNZ Economic Survey 2007-08. http://www.dairynz.co.nz/page/pageid/2145845982/DairyNZ_Economic_Survey_2007-08.

Jago, J., K. Bright, P. Copeman, K. Davis, A. Jackson, I. Ohnstad, R. Wieliczko, and M. Woolford. 2004. Remote automatic selection of cows for milking in a pasture-based milking system. Proc. NZ Soc. Anim. Prod. 64: 241-245.

Jago, J.G., K.L. Davis, M. Newman, and M.W. Woolford. 2006. An economic evaluation of automatic milking systems for New Zealand dairy farms. Proc. NZ Soc. Anim. Prod 66: 263-269.