System Fitness of Grazeable Forages for Large Herds in Automatic Milking Systems

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The 22nd International Grassland Congress (Revitalising Grasslands to Sustain Our Communities) took place in Sydney, Australia from September 15 through September 19, 2013.

Proceedings Editors: David L. Michalk, Geoffrey D. Millar, Warwick B. Badgery, and Kim M. Broadfoot

Publisher: New South Wales Department of Primary Industry, Kite St., Orange New South Wales, Australia

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Keywords: Automatic milking system, walking distance, complementary forage rotation, herd size.

Introduction

Automatic milking rotary (AMR) systems have the capacity to milk 800 cows. To maintain a pasture-based system whereby >50% of the total diet is pasture (Garcia and Fulkerson, 2005), large herds milked by AMR will be required to walk significant distances. Walking distances of greater than 1-km are associated with an increased incidence of undesirably long milking intervals and reduced milk yield (Lyons N, unpubl. data). The aim of this study was to investigate the total land area required and associated walking distance for large automatic milking system (AMS) herds when incorporating complementary forage rotations (CFR; Garcia *et al*., 2008) into the system.

Methods

Thirty-six scenarios consisting of 3 AMS herds (400, 600, 800 cows), 2 pasture utilisation levels (current AMS utilisation of 15.0 t dry matter (DM)/ha, termed as 'moderate'; optimum pasture utilisation of 19.7 t DM/ha, termed as 'high') and 6 proportions of farm area (0, 10, 20, 30, 40, 50%) as grazeable CFR were investigated. To calculate the distance a cow traveled for a particular farm area (ha), an AMS farm was divided into 30 equally sized paddocks where the dairy was located at the centre of the AMS. Walking distances (m) required for grazing cows to reach a particular location of the paddock out of 30 paddocks was measured from the centre of the dairy. Farm areas (ha) required to supply 50% of the total metabolisable energy (ME) requirement from home-grown forages (HGF) was calculated based on herd sizes and yield of pastures or CFR in the system (Islam *et al*., 2012). The supply for HGF per year was calculated by multiplying a particular farm size (ha) with ME yield from a particular system.

Results

Automatic milking system cows were required to walk greater than 1 km when the farm area was greater than 86 ha (Fig. 1). Home-grown feed produced within 1 km distance of the dairy (*i.e.* 86 ha land) provided only 43, 29 and 22% of the ME required by 400, 600 and 800 cows, respectively from 'moderate' pasture (Table 1). Introduction of pasture (moderate): CFR in AMS at a ratio of 80:20 was able to provide sufficient feed for a 400 cow AMS herd, and 42% and 31% of the ME requirements for 600 and 800 cows, respectively with pasture (moderate): CFR at 50:50 levels. In contrast, sufficient HGF was able to be produced for the 400 cows herd when pasture utilisation was modelled at the 'high' level of 19.7 t DM/ha. However, there was insufficient feed produced within 1 km distance of the dairy for 600 or 800 cows (Table 1).

Table 1. Farm areas and stocking rate of cows required for different herd sizes managed in moderate and high pasture utilisation system with different rates of grazeable complementary forage rotation (CFR) in automatic milking system.

Pasture utilisation	CFR (%)	Stocking rate (cow/ha)	Farm areas required (ha)			%Home grown feed produced on farm		
			Herd size (n)			Herd size (n)		
			400	600	800	400	600	800
Moderate (15.0 t DM/ha)	0	4.0	100	150	200	43	29	22
	10	4.3	100	140	190	47	31	24
	20	4.7	90	130	170	51	34	25
	30	5.0	80	120	160	55	36	27
	40	5.5	80	110	150	58	39	29
	50	5.7	70	110	140	62	42	31
High (19.7 t DM/ha)	0	5.0	80	120	160	57	38	28
	10	5.5	80	110	150	59	40	30
	20	5.7	70	110	140	62	41	31
	30	5.7	70	110	140	64	43	32
	40	6.2	70	100	130	67	44	33
	50	6.7	60	100	130	69	46	35

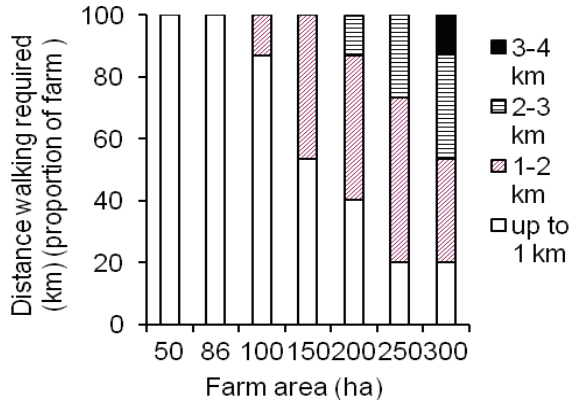

Figure 1. Walking distances (km) required by cows for different farm areas (legends show distances in km; walking distances were calculated from the centre of the dairy based on farm areas and location of the paddock.

A 600 cow herd required 150 ha (46% of paddocks outside 1 km; Fig. 1) and 120 ha (27% paddocks outside 1 km; Fig. 1) with 'moderate' and 'high' pasture utilisation, respectively (Table 1). An 800 cow herd required 200 ha (60% paddocks outside 1 km; Fig. 1) and 160 ha (47% paddocks outside 1 km; Fig. 1) on 'moderate' and 'high' pasture-based system, respectively. However, an 800 cow herd required 140 and 130 ha on 'moderate' and 'high' pasture, respectively with the introduction of pasture: CFR at a ratio of 50:50 (Table 1).

Conclusions

Grazing areas of herbage greater than 86 ha will likely reduce the milk yield in AMS. Increasing the amount of herbage grown within this area through the use of CFR, shifting feed grown outside this area closer to the dairy either through conservation or cut and carry and/or purchasing feed would minimise any milk yield penalty. Further work should be conducted on financial and management risks in order to maintain large AMS herds within 1-km distance of the dairy.

Acknowledgements

We acknowledge funding from Dairy Australia, NSW Department of Primary Industries, The University of Sydney, and DeLaval.

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