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Yields and Persistency of Lactation in Friesian and Jersey Cows Milked Once Daily

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ABSTRACT

Effects of milking cows once daily throughout lactation at high stocking rates (17% more cows/ha than for those milked twice daily) were studied in 2 Friesian and 2 Jersey herds during 3 lactations. Cows were allocated to 2 herds within breed and were milked either once or twice daily, based on age, genetic merit, and previous performance. Cows remained in their original herd and were milked at the same milking frequency during all lactations. Culled cows (20% per year) were replaced by 2-yr-old heifers. Yields of milk, lactose, protein, and fat were measured every 2 wk by commercial herd test. Cubic splines (5 knots) were used to approximate the lactation curve for each cow-yr to provide estimates of performance for each day of lactation. Yields of milk were greater for Friesian and Jersey cows milked twice daily (4,751 ± 89 and 3,067 ± 81 kg/cow) than for cows milked once daily (3,329 ± 80 and 2,431 ± 75 kg/cow), respectively. Cows milked once daily had lesser total and peak yields of milk, lactose, protein, and fat than cows milked twice daily. Friesians had greater total and peak yields than Jerseys. Peak production for all milk components occurred earlier in lactation for cows milked once daily than twice daily (d 24 to 39 vs. 32 to 44). Three measures of persistency of lactation were considered for each cow with 2 measures (Pers1 and Pers2) indicating that cows milked twice daily had better persistency than those milked once daily. Ranking of herds in persistency tended to match the ranking based on total yields. Measures of persistency (Pers1 and Pers2) were positively related to total yield in the Jerseys milked once daily and negatively related to peak yield in the Friesians. The third persistency measure (Pers3) ranked once-daily Jerseys first and twice-daily Friesians last, and was negatively correlated with total yield in the Friesian herds and negatively correlated with peak yield in all herds. For most performance measures, cows milked twice daily had better total yields and persistency than cows milked once daily.

Key words: persistency, once daily milking, milking frequency

INTRODUCTION

Milking frequency is an important contributor to costs of production in the pastoral systems of the New Zealand dairy industry. Milking cows once daily can reduce farm expenses, particularly labor costs and milking parlor consumables. Furthermore, it may increase quality of life and improve health and welfare of cows, primarily through increased body condition and potentially, decreased lameness because of less walking (Woolford et al., 1985; Carruthers et al., 1989; Davis et al., 1998, 1999). Cows milked once daily carry a greater volume of milk in their udder, but no differences exist in the incidence of IMI between cows milked once and twice daily (Lacy-Hulbert et al., 2005). The major disadvantage of once-daily milking is reduced milk production. Losses reported in previous experiments ranged from 7 to 38% for part-lactation periods of once-daily milking (Davis et al., 1998) and losses from full lactations ranged from 22 to 35% in New Zealand studies (Holmes et al., 1992; Tong et al., 2002). Wide variation in production losses of individual cows (compared with those of identical twins milked twice daily or with their previous twice-daily production) has been observed, ranging from 0 to 47% in part-lactation studies (Claesson et al., 1959; Carruthers et al., 1989), and from 5 to 85% in full-lactation studies (Claesson et al., 1959; Holmes et al., 1992).

Dependence on pasture as a feed source in New Zealand has contributed to a concentrated national calving period, causing the period of peak production to coincide for many cows. Consequently, supply to milk processors varies considerably during the year, from large quantities during the spring peak to very low quantities during winter. This creates inefficiencies in the milk-processing system, so methods of distributing the national milk yield more evenly throughout the year are of interest to both dairy producers and milk

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processors. Once-daily milking has been identified as a method of reducing peak yields while having little effect on production during later lactation relative to twice-daily herds (Harding et al., 1990). Other studies, however, have identified a greater difference in production between once- and twice-daily herds during late lactation than in early lactation (Claesson et al., 1959), indicating that the persistency of cows milked once daily is less than that of cows milked twice daily. Harding et al. (2002) observed that some cows dried off very early in lactation when milked once daily, indicating that persistency of lactation may be a problem in once-daily milking systems. Persistency of lactation is a measure of the rate at which milk production declines after peak yield (Turner, 1925; Togashi and Lin, 2003) and can be quantified by using a variety of measures. Persistency of lactation has not been extensively studied in the once-daily system, but because of the smaller peak yields, and the early drying off of some cows, persistency of lactation may be an important determinant of the total yields of cows milked once daily.

The objectives of this study were to identify effects of once-daily milking at a greater stocking rate in Friesian and Jersey herds on 1) total yields, 2) persistency of lactation, and 3) correlations between persistency of lactation and total and peak yields, using 3 different measures of persistency.

MATERIALS AND METHODS

Animals and Management Conditions

Four herds were milked during 3 consecutive lactations. The herds consisted of Friesian and Jersey cows, with 1 herd of each breed milked once daily and the other twice daily. The 4 herds were balanced for age, calving date, live BW, BCS, breeding worth, and milk protein and milk fat production during the previous season. Breeding worth is the official national economic index used to rank cows and bulls according to their genetic potential (inherited by their progeny) to convert 4.5 tonnes of DM into farm profit. Each herd was located on a separate 10-ha pasture, managed according to the decision rules developed by Macdonald and Penno (1998). Dry-off date of cows was determined by their production (if their daily yield fell below 5 L) or SCC (>400,000 cells/mL in 2 consecutive herd tests). Some cows reached these thresholds earlier than the set dry-off date and consequently, were dried off earlier. Once-daily herds were stocked at a greater stocking rate (1.17 times more cows/ha) than twice-daily herds to compensate for expected declines in milk yield per cow and feed requirements (Holmes et al., 1992). Herd sizes (numbers of cows calving each year) were as follows: Friesian once daily (n = 35); Friesian twice daily (n = 30); Jersey once daily (n = 42); and Jersey twice daily (n = 35).

Once allocated to a herd, each cow remained in that herd until culled. Cows were culled for failing to conceive within the mating period, high SCC, or health problems, with minimal culling based on production. Culls were replaced by 2-yr-old heifers of the appropriate breed and breeding worth, with the annual replacement rate set at 20% to ensure that the herds had similar age structures. The number of complete lactation records collected was 100 for the Friesians milked once daily; 85 for the Friesians milked once daily; 119 for the Jerseys milked once daily; and 101 for the Jerseys milked twice daily.

Measurements

Individual milk yields were recorded automatically at each milking. Milk composition (fat, protein, and lactose) was measured in individual cow samples at biweekly (every 2 wk) intervals throughout lactation using a Milkoscan 133B milk analyzer (Foss Electric, Hillerød, Denmark), calibrated for different matrix effects of milk from different breeds. The SCC for individual cows was measured every 2 wk using a cell counter (Fossomatic, Foss Electric). Calving date and age were recorded for each cow.

A cubic spline (with 5 knots) was fitted to each lactation of each cow (SAS Inst. Inc., Cary, NC) to provide a continuous lactation curve for milk, lactose, protein, and fat. Daily yields were predicted using these splines for each day from calving to drying off. Total yields, peak yields, and days of peaks were calculated based on these predicted daily yields.

Three measures of persistency were used. The first measure (**Pers1**) was based on that developed by Turner (1925) and involved dividing the period from peak daily yield to drying off into 7 equal-length periods. Percentage of a previous period of production remaining was calculated for periods 2 to 7, and the percentages averaged to get Pers1:

$$Pers1 = \frac{100 \times \sum_{i=2}^{7} \frac{P_i}{P_{i-1}}}{6}$$

where P_i = total yield in period i.

A second measure (**Pers2**) was based on that used in the Canadian dairy sire evaluation system (Murray and Brand, 2000). The Pers2 was calculated as production 20 d before dry off divided by peak production and multiplied by 100 to get the percentage value. Day of peak varied for the different milk components and