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Effects of frequency of milking and supplementary feeding on milk production of cows in early lactation

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Summary

Thirty-two Friesian and Australian Friesian Sahiwal cows in early to mid-lactation were used in two experiments, each of six weeks duration. The first compared the effects, in terms of milk yield and milk composition, of milking 14 or 13 times a week, combined with giving supplementary grain 7 or 6 times a week. The second assessed the effects on milk yields of milking unsupplemented cows 14 or 13 times a week.

Omitting one milking a week reduced milk production by 7 L per cow per week for cows given supplement and 4.5 L per cow per week for cows not given supplement ($P>0.05$). Milk production was reduced ($P<0.01$) on the day milking omission occurred, but production on the following day was higher ($P<0.01$), than for cows milked 14 times a week. There was no difference ($P>0.05$) in milk yields from cows given maize 7 or 6 times a week.

Weekly yields of butterfat, solids-not-fat and total solids were consistently reduced by milking 13 times a week while feeding strategy had no effect on yields of milk components. Butterfat percentage was increased by giving supplement 6 rather than 7 times a week (4.0 vs. 3.8%). Butterfat percentage was reduced on the day milking was omitted, but rose to above normal the following day and then returned to normal for the rest of the week. There was an increase in Wisconsin mastitis test scores due to omitting both one milking and one feeding a week.

INTRODUCTION

The omission of one milking a week over a complete lactation has been shown in several experiments to result in losses in milk production from 3.5% (Radcliffe, Bailey and Horne 1973) to 8.0% (Walsh 1972). Autrey, Rollins and Cannon (1963) found no significant difference in mean daily production of fat corrected milk over an 11 week period between a group of cows milked 13 times and given concentrates 12 times per week and a control group milked and given concentrates 14 times per week.

No work could be found where feeding and milking systems were varied for cows grazing tropical pasture. It is possible that cows grazing tropical pastures producing less milk than cows on temperate pastures (Stobbs and Thompson 1975) require a continuous supply of energy supplement to maintain milk yields (Davison, Marschke and Brown 1982). This situation could be further affected by milking frequency in that milk yields may decrease at a faster rate where cows are forced to ingest a lower quality forage, such as tropical pastures.

In a large number of Queensland dairy farms cows are given supplementary grain in the milking shed during milking. If a milking is omitted the cows also miss their supplementary feed for that milking. The aim of our first experiment was to measure the effects on milk production and composition of omitting a milking each week for cows which were allocated their weekly intake of concentrates in either six or seven equal portions. The second experiment was conducted with a group of cows grazing unsupplemented pasture and investigated the effect of missing one milking a week on milk yield and composition.

MATERIALS AND METHODS

Location

The experiments were conducted during February and March 1977 at Kairi Research Station on the Atherton Tablelands, North Queensland (17° 14′ S, 145° 25′ E, and altitude 700 m). Total rainfall during the experiment was 495 mm, 221 mm above the 25 year average for this period. Mean minimum and maximum temperatures during this period were 18.3°C and 26.6°C respectively.

Pasture

The pastures were a green panic (*Panicum maximum* var. trichoglume) and glycine (*Neonotonia wightii* cv. Tinaroo) mixture which had been established 20 years previous to this experiment. They were growing on a highly fertile krasnozem soil and provided a vigorous weed free sward. A stocking rate of 1.5 cows/ha was used and all cows grazed together as one group. Cows were rotated through 12 day and 12 night paddocks on a one period grazing, 11 period spelling basis. Pasture yields from concurrent experiments showed that pasture on offer was not limiting to milk production (Cowan and O'Grady 1976; Davison, Cowan and O'Rourke 1981).

Experiment 1

Eight Friesian cows and twelve Australian Friesian Sahiwal (AFS) cows from 4 to 21 weeks into lactation were blocked according to breed, milk production and calving date. Within each block cows were randomly allocated to the following treatments:

1. 14 times a week milking, 7 times a week supplementary feeding (14M 7F)
2. 14 times a week milking, 6 times a week supplementary feeding (14M 6F)
3. 13 times a week milking, 7 times a week supplementary feeding (13M 7F)
4. 13 times a week milking, 6 times a week supplementary feeding (13M 6F)

Management

All cows had received since calving 4.5 kg of hammermilled maize each day. Cows were individually given maize each morning between 7.00 and 7.30 a.m. and cows not receiving supplement were held on concrete yards during this period. All cows had access to a coarse salt and Christmas Island phosphate supplement at the milking shed.

During the experiment cows in treatments 14M 7F and 13M 7F received 4.5 kg maize a day. Cows in the other two groups received 5.25 kg maize on each of the 6 days a week when normal milking routine was practised. No grain refusals occurred. Milking times were from 5.30 to 7.00 a.m. and from 3.00 to 4.00 p.m. Cows in treatments 13M 7F and 13M 6F were not brought in from pasture at the time of the omitted milking.

The experiment was conducted over a 6 week period. The first 2 weeks were used as an adjustment period and measurements were recorded during the next 4 weeks.

Measurements

Milk yield was recorded at each milking. In weeks three and five of the experiment samples of milk from each afternoon and morning milking for each cow were taken over 7 days. The afternoon and morning samples were kept separate, while individual cow samples within each treatment were bulked and a subsample was taken for analysis.

Samples were analysed for butterfat content using a Milko-tester mark II, solids-not-fat (SNF) hydrometrically, total protein by the Foss electric pro-milk method standardised against Kjeldahl determinations and freezing point depression by the thermistor cryoscope. Samples were also analysed for mastitis score using the Wisconsin mastitis test (WMT).

Statistical analysis

Milk yields were analysed by analysis of variance to isolate the effects of 14 and 13 times a week milking, 7 and 6 times a week supplementary feeding, as well as their interaction. The error term was estimated from cow to cow variation after an allowance was made for treatments and blocks. Milk composition data were not able to be analysed as milk samples were bulked across cows.

Experiment 2

Eight Friesian and four AFS cows were blocked into six pairs according to breed, stage of lactation and milk production. These cows had been lactating for an average of 13 weeks. Cows within blocks were then randomly assigned to being milked either 14 or 13 times a week.

This experiment was conducted over 6 weeks concurrently with Experiment 1. Except for imposed treatments, grazing and management were the same as in Experiment 1. Composite milk samples were taken during weeks four and six in the same way as in Experiment 1.

RESULTS

Experiment 1

The average weekly milk yields of cows in the four treatments are given in Table 1. There was an increase in percentage butterfat of milk for cows given supplement six rather than seven times a week. The solids-not-fat, total solids and total protein percentages in milk were reduced by giving the supplement six rather than seven times a week for cows milked 14 times a week, but increased for cows milked 13 times a week (Table 1). By contrast less frequent feeding reduced the WMT scores for cows milked 13 times, but increased for cows milked 14 times a week.

Table 1. Mean milk yield and milk composition of cows milked 14 and 13 times a week with grain fed either 7 or 6 times a week (Experiment 1)

Variate	14 milkings		13 milkings		s.e.
	7 feeds	6 feeds	7 feeds	6 feeds	
Milk yield (L/cow/week)	93.1	90.2	83.9	85.1	5.0
Butterfat yield (kg/cow/week)	3.6	3.6	3.2	3.4	0.2
Butterfat %	3.82	4.01	3.76	4.05	0.42
SNF yield (kg/cow/week)	8.6	8.2	7.6	7.7	0.4
SNF %	9.24	9.04	8.93	9.07	0.29
Total solids yield (kg/cow/week)	12.2	11.8	10.7	11.2	0.6
Total solids %	13.06	13.04	12.68	13.12	0.58
Total protein yield (kg/cow/week)	3.0	2.8	2.7	2.8	0.2
Total protein %	3.2	3.1	3.1	3.3	0.92
Freezing point (°C)	-0.537	-0.539	-0.541	-0.538	0.10
WMT score	8.64	9.28	13.71	9.07	0.67

Though total milk production was not significantly reduced by treatment, milk production of cows milked 13 times a week was significantly reduced ($P<0.01$) on the day when milking was omitted, and increased ($P<0.01$) the following day (Figure 1). Similar trends were evident in butterfat and total solids content of milk (Figure 2).

The nett loss of milk from omitting one milking a week was 10% for cows given supplement seven times a week, and 6% for cows given supplement six times a week.

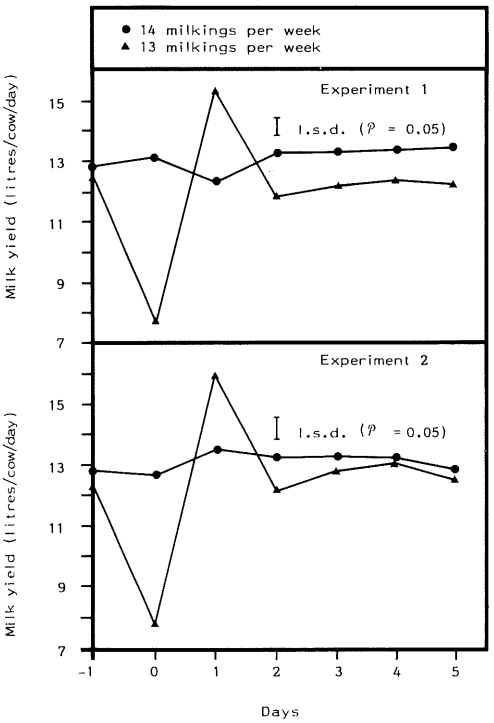

Figure 1. Daily milk yields of cows in Experiments 1 and 2, milked 14 times a week and 13 times a week.

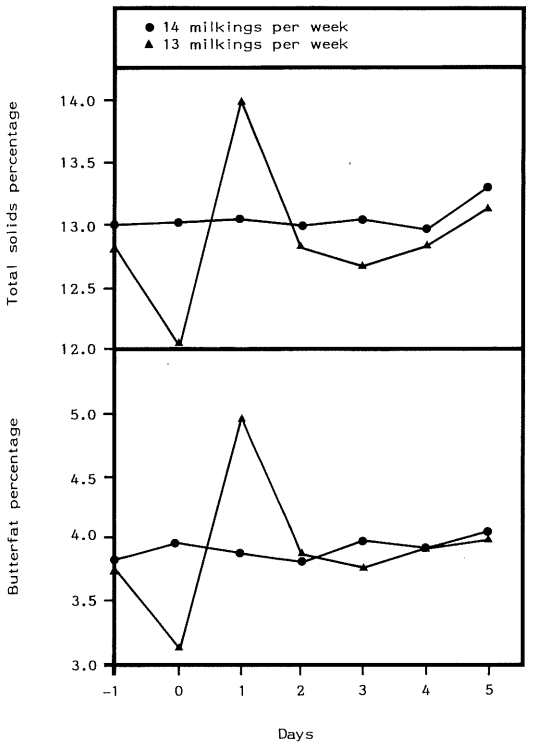

Figure 2. Changes in butterfat and total solids content of milk in Experiment 1, for cows milked 14 times a week and 13 times a week.

Experiment 2

The average weekly milk yields and milk composition data of cows in this experiment are given in Table 2. Milk production of cows in this experiment followed similar trends to cows in Experiment 1. Milk yield decreased ($P<0.01$) on the day milking was omitted (12.2 compared with 7.7 L per cow per day), increased on the following day (16.0 L per cow per day) and then returned to a similar level to the yield of cows on 14M for the rest of the week. Differences in total weekly yields of milk constituents were also similar to those in Experiment 1.

DISCUSSION

The two experiments showed that weekly milk yields declined by a weighted yield of 6.7% when one milking per week was omitted and is consistent with that reported in other experiments. Moore (1967) reported a reduction in milk yield of 7%, Labussiere and Coindet (1968) reported a 7.5% loss and Radcliffe and Bailey (1970) reported that omitting one milking per week from high producing cows could reduce milk production by over 7%. The results from this and other experiments suggests that pasture system has little influence on the depression in milk yield when milking omission occurs. Moore (1967) used corn silage and alfalfa hay *ad. lib.*, Labussiere and Coindet (1968) used temperate pasture silage, while Radcliffe and Bailey (1970) used temperate pastures in a grazing regime. While our results show no statistically significant depression in milk yield the trends were consistent and indicated a significant financial penalty from a reduced milking frequency. At a milk price of 20 cents per litre to the farmer the financial loss in milk production from omitting one milking a week in our experiment was $1.23 per cow per week when compared with cows milked 14 times a week.

Table 2. Mean milk yield and composition of unsupplemented cows milked 14 or 13 times a week (Experiment 2)

Variate	14 milkings	13 milkings	s.e.
Milk yield (L/cow/week)	91.6	87.1	2.3
Butterfat yield (kg/cow/week)	3.3	3.2	0.10
Butterfat %	3.58	3.71	0.42
SNF yield (kg/cow/week)	7.8	7.6	0.2
SNF %	8.61	8.67	0.28
Total solids yield (kg/cow/week)	11.1	10.9	0.3
Total solids %	12.19	12.38	0.62
Total protein yield (kg/cow/week)	2.5	2.5	0.1
Total protein %	2.78	2.89	0.12
Freezing point (°C)	-0.543	-0.542	0.12
WMT score	12.64	15.00	1.57

Butterfat percentages took two days to return to normal following milking omission and this is similar to the results of Labussiere and Coindet (1968) and Radcliffe and Bailey (1970). Generally it would be unlikely that farmers would have difficulty in meeting minimum requirements for butterfat (3.3%) if milking omission was practised. However, in the situation where milk is collected daily, that collected on the morning after an omission of milking may be low in butterfat.

Natzke, Schultz, Barr and Holtmann (1965), using the Californian mastitis test, reported an increase in mastitis in quarter samples from 48 cows which had missed an afternoon milking. Our results, using the WMT test, also showed an increase in WMT scores due to milking omission, but no clinical mastitis was detected during the experiment.

The sixteen cows in 13M treatment in our experiment took an extra 15 minutes to milk on the morning following milking omission. Nielsen and Sorensen (1976) reproted that an extra 1.4 man minutes per cow was necessary on the morning after a milking had been omitted the previous afternoon.

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