

The merits of 3X vs. 2X milking

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Milk production is greater, but there may be breeding problems

Interest in milking dairy cows three times (3X) daily has increased, particularly in dairy states where herds are large, production is high, and the dairy has modern milking facilities and equipment. During 1983, 209 California Dairy Herd Improvement test herds with 92,997 cows were being milked 3X daily. The 3X herds averaged 445 cows per herd with 18,818 pounds milk and 678 pounds fat per cow per year. Compared with herds milked twice daily (2X), the 3X herds were 21 percent larger and produced 11 percent more milk and 9 percent more fat. Merced, Stanislaus, and San Joaquin counties have the highest number of 3X herds in California. Dairy operators who have switched from 2X to 3X milking have done so to increase milk yield and reduce production costs.

Success of 3X milking depends on the response in milk yield, but research information has been limited, and trials have often been short. Yield increases of 5 to 20 percent with 3X milking have been reported, usually from short experiments at various stages of lactation. Analyses of Dairy Herd Improvement complete lactation records have shown milk yield increases ranging from 7 to 25 percent.

The objective of our study was to compare the effects of 3X and 2X milking during complete (44-week) lactations. Two age groups were used: (1) first-calf heifers and (2) cows in lactation 2 or greater (older cows). Response measures for each cow included milk yield and composition, feed intake, body weight change, and reproductive performance.

Procedures

We used 53 Holstein cows (15 first-calf heifers and 38 older cows) in the experiment. Cows were assigned to treatments (table 1) at calving and remained on trial for 44 weeks. Older cows in

groups 2X and 3X-A were changed to lower energy diets at similar production levels, whereas 3X-B cows were switched at higher levels. First-calf heifers milked 2X and 3X daily were switched at similar production levels. The 2X cows were milked at 12-hour intervals, and the 3X at 8-hour intervals.

Individual cow records included feed intake, body weight, yield of milk and milk components, and reproduction data. Data were analyzed separately for older cows and first-calf heifers (by a one-way analysis of variance). Reproduction data for services per conception and conception rate were not statistically analyzed, because these are group averages.

Results

Both 3X groups of older cows yielded significantly more milk (17 and 13 percent more in 3X-A and 3X-B, respectively) over the entire lactation than did older 2X cows (table 2). Milk yield was not different between 3X-A and 3X-B groups, even though 3X-B cows were changed to diets of declining energy concentration at higher milk production. Yield of fat, protein, and solids-not-fat were greater for 3X than 2X cows. Percentages of milk components were not altered.

Milk yield for 3X cows was higher after week 7 of lactation (fig. 1), but the advantage in milk yield of 3X over 2X was not significant until week 17. Cows milked 3X maintained peak production slightly longer.

Intakes of feed and energy were not significantly different between 3X and 2X cows, with only a small increase in feed intake for 3X cows (table 2). As a consequence of no change in feed intake and greater production of milk, 3X cows gained less body weight. Cows milked 2X reached minimum body weight at week 7, after which they gained steadily (fig. 2). The 3X cows reached minimum

weight at about week 13 and showed little weight gain until after week 20.

Yields of milk and milk components were not significantly different between 2X and 3X first-calf heifers. Over the entire lactation, a nonsignificant improvement of 6 percent in milk yield was observed for 3X milking. Milk composition also was not altered by milking frequency. For first-calf heifers, 3X milking increased milk yield during the first five weeks of lactation (fig. 3), but after that, there was little difference in milk output.

Intakes of feed and energy were not significantly different for 2X or 3X first-calf heifers. As in older cows, first-calf heifers milked 3X daily gained less body weight over the lactation; the 3X first-calf heifers had a slower rate of gain (pounds per day) after week 15 (fig. 4).

Older cows' production efficiency was greater in 3X than in 2X milking; first-calf heifers showed no significant difference. The greater energy efficiency of production for 3X above 2X older cows resulted from their significantly higher

TABLE 1. Milking frequency and dietary treatments for 3X vs. 2X milking groups

Milking frequency	Diet change at lb/day production*
Older cows:	
2X	H to M at 62 M to L at 51
3X-A	H to M at 62 M to L at 51
3X-B	H to M at 68 M to L at 55
First-calf heifers:	
2X	H to M at 55 M to L at 44
3X	H to M at 55 M to L at 44

* H = high energy, M = medium energy, and L = low energy diets. Diet changes were based on daily milk production (lb/day) for each cow.

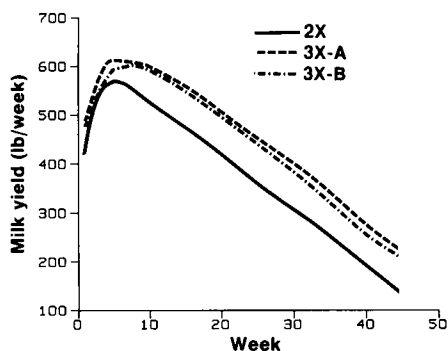


Fig. 1. After week 7, older cows milked 3X daily (A and B) produced more milk per week than did older 2X cows.

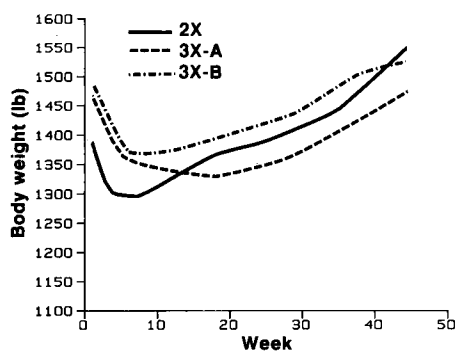


Fig. 2. Older 2X cows gained steadily after a minimum weight at week 7; 3X cows showed little gain until after week 20.

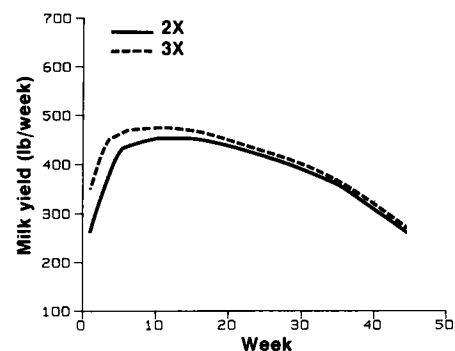


Fig. 3. Milking 3X increased yield from first-calf heifers in first five weeks, but showed little difference after that.

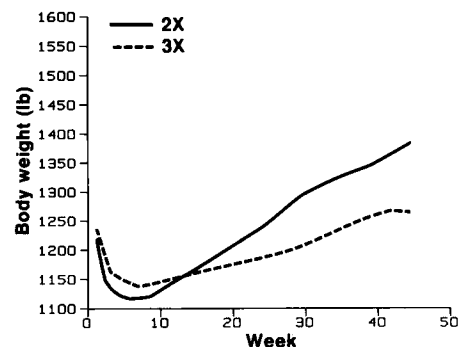


Fig. 4. First-calf heifers milked 3X gained less during lactation and gained at a slower rate after week 15, compared with first-calf heifers milked 2X.

milk output and the small change in their feed intake.

The total number of cows in our study was small for critical evaluation of reproductive performance and the data should be viewed with caution (table 3). Cows milked 3X daily showed generally poorer reproductive performance, tending toward increased days to first breeding and increased days open. In the 3X-A group of older cows, the slightly longer days to first breeding as compared with days open was due to one cow that had a long interval to first service and never conceived. The total number of services per conceptions was slightly higher for 3X milking. This difference was reduced when only services for cows conceiving were considered. Incidence of mastitis was not affected by 3X milking nor were any other measures of health.

Conclusions

Milking three times daily increases milk production and the efficiency of production but requires improved management of nutrition and reproduction.

Increasing feed intake early in the lactation is necessary to meet energy and nutrient demands of production. Many producers in California who are milking 3X feed high-quality diets and offer feed more frequently than twice daily to stimulate intake. Producers who are feeding by milk production strings (high, medium, and low) may wish to feed only two production strings. This would allow cows to remain on the high-production diet longer, meeting more nearly the demands of milk production and permitting greater body tissue repletion. Feeding to production as recommended previously for 2X milking may not be sufficient.

Similarly, reproductive management must be improved, because cows spend a greater proportion of their time in the milking parlor. If high-producing cows conceive with greater difficulty, 3X milking may make it harder to settle cows by day 85 postpartum and maintain a 12-month calving interval. More information is needed to determine whether a 12-month calving interval is optimal for

3X milking. Performance data on cows milked 3X over a number of lactations are needed to determine optimal nutritional management during lactation and the dry period.

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TABLE 2. Performance of older cows and first lactation heifers during the 44 week lactation trial

Item	Age and treatment				
	Older cows			First lactation	
	2X	3X-A	3X-B	2X	3X
Milk (lb)	17,037	19,873	19,224	17,290	18,293
Fat (lb)	561	664	660	625	671
Fat (%)	3.4	3.3	3.4	3.6	3.7
Protein (lb)	515	614	601	546	570
Protein (%)	3.1	3.1	3.1	3.1	3.1
Solids not fat (lb)	1,437	1,747	1,692	1,562	1,619
Solids not fat (%)	8.8	8.8	8.8	9.0	8.9
Dry matter intake (lb)	12,952	13,221	13,664	12,253	12,225
Estimated net energy for lactation (NE _L) intake (Mcal)	9,997	10,284	10,579	9,631	9,536
Body weight change (lb)	163	7	64	174	37
Estimated energy efficiency* (%)	51.7	60.0	56.8	58.6	62.4

* Efficiency = Milk energy (Mcal)/Est. NE_L intake (Mcal) × 100%.

TABLE 3. Reproductive performance of older cows and first lactation heifers

Item	Older cows			First lactation	
	2X	3X-A	3X-B	2X	3X
Days to 1st breeding (d)	76.3	105.0	89.8	79.6	104.7
Days open (d)	78.1	100.0	124.3	84.3	134.5
S/C*	1.50	2.30	1.92	1.75	4.33
S/C†	1.00	1.10	1.42	1.25	2.00
CR‡(%)	91.7	71.4	92.3	80.0	60.0

NOTE: Breeding was by artificial insemination.

* S/C = Services per conception = total number of services for the group/number conceptions for the group.

† Services per conception = total number of services for cows conceiving/number of conceptions for the group.

‡ CR = Conception rate = (cows conceiving for the group/cows bred for group) × 100%