

# Increasing Milking Frequency

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## ■ Take Home Message

- ▶ Milk yield increases by a fixed amount due to increased milking frequency, and not by some percentage of previous milk yields.
- ▶ Six times-a-day milking frequency from calving through six weeks postpartum results in not only increased production during the period of high frequency milking, but also in a significant carry-over during the remainder of lactation while milked three times-a-day.
- ▶ Four times-a-day milking frequency from calving through four weeks postpartum also results in a significant carry-over effect on increased milk production during times of twice-daily milking. The four times-a-day milkings were not every six hours, but instead, conducted before and after the herd's normal twice-daily milkings on an eleven and thirteen hour interval basis.

## ■ Introduction

Increasing the frequency of milking dairy cows results in increased milk production (Amos *et al* 1985). If the herd is provided with adequate nutrition to support the increased milk production, then the benefits are maintained over time. This approach to increased production usually is found to be profitable by dairy producers and is typically maintained if the herd has adequate access to a high quality supply of labor that is required.

The percentage of herds using increased milking frequency to boost milk yields has increased in USDA sire summaries (Wiggans, personal communication). In countries where bovine somatotropin supplementation is prohibited, such as Canada, the use of increased milking frequency may be even more attractive and common than in the United States.

When herds wish to consider adopting increased milking frequency as a management policy to elevate herd production, the question “How much response should we expect” is often posed. There is much confusion regarding the amount of response in the scientific, educational and popular literature available to producers. Sometimes herds wish to decrease milking frequency at some stage of later lactation, and the question is posed “Will there be any carry-over of the benefits from increased milking frequency once we stop the extra milkings?” Most producers have observed milk production levels returning to twice-daily milk production levels after ceasing the three times-a-day milking frequencies. The objective of this presentation is to describe studies that evaluated responses to increased milking frequency in dairy herds.

### ■ Fixed Response to Milking Frequency

A common response to the question of “How much response should we expect” is “About fifteen or twenty percent of the herd’s previous production.” The USDA uses a percentage of the herd’s production level to account for increased milking frequency when calculating sire summaries. Yet, many dairy herd consultants have observed that herds had a fixed response, typically 3 or 3 1/2 kilograms of milk per cow per day. There were no reports in the scientific literature evaluating whether the response was a percentage of the herd’s previous production or a certain number of kilograms, termed a “fixed yield response.”

One approach to studying this question is to conduct a statistical analysis of previously published trials, and this approach is termed a “meta-analysis.” The meta-analysis approach is common in human and veterinary medicine. A total of 19 research literature reports were found and utilized in the meta-analysis. Some reports contained multiple comparisons, and each comparison in a research report of once daily (1X), three times-a-day (3X) and four times-a-day (4X) versus twice daily (2X) was considered as if it was a ‘herd’ that had compared the various milking frequencies.

There were varying amounts of information published in the results. Some reports contained information concerning cow parity and others contained information concerning milk components. The average difference for the results of the comparisons for milk, fat and protein yield are in Table 1. There was a significant benefit of 3.5 and 4.9 kg/cow/day for 2X vs 3X or 4X, respectively. There was a significant reduction of 6.2 kg/cow/day when going from 2X to 1X milking. In herds with seasonal calving, there is an interest in using 1X milking during late lactation. The penalty for 1X milking may be too large for adoption by many producers, however.

Table 1. Difference in milk yield with various milking frequency

**(X= number of milkings per day).**

Comparison	# Studies	Milk Yield (kg/cow/day)
<b>2X vs 3X</b>	40	3.5
<b>2X vs 4X</b>	4	4.9
<b>2X vs 1X</b>	4	-6.2

Source: Erdman and Varner, 1995.

The differences within each comparison were statistically correlated with the level of milk production, and no significant regression coefficient was found for the 2X vs 3X comparison. This is clear evidence that the benefit of 3X milking is fixed and not proportional to herd milk production level. There was insufficient number of trials to make a meaningful comparison for 4X and 1X vs 2X regression evaluation.

Milk fat percentage declined as milk production increased. Nevertheless, the increase in 3X milk yield resulted in a significant increase in fat yield of 92 g/cow/day. This increase in fat yield was not dependent on herd production level, and no significant correlation could be found in regression analysis. There was insufficient number of reports that included analysis of protein levels, so no statistical evaluation was conducted. Milk protein yield was increased by 84 g/cow/day in 3X groups.

Some studies split out the results for first-lactation cows and multi-lactation cows. Milk production from adopting a 3X milking frequency was 3.3 and 3.5 kg/cow/day in first-lactation versus multi-lactation cows, respectively. These results suggest that USDA's use of a 20, 18 and 15% milk production adjustment factors for first, second and later lactation, respectively, are not accurate.

Dairy producers who are considering use of increased milking frequency must evaluate whether the increased revenue from milk and components is sufficient to cover the increased labor, feed and utility costs. If a producer uses an estimate of increased milk production that is based on a proportion of existing herd production, the economic evaluation may be faulty, as these results suggest that producers should be using a fixed production response.

## ■ Six Times-A-Day (6X) Milking

Researchers have used increased milking frequency to study the cow's physiological response to high levels of milk production. One study used six times-a-day (6X) milking to increase milk production and the researchers found that there was still a significant elevation in milk production levels after returning to the herd norm of 3X (Bar-Peled, *et al.* 1995). These workers found that cows milked 6X had an increase of 7.3 kg/cow/day over the 3X controls during the time of 6X milking. After the six weeks of 6X milking, all cows were milked 3X, and the 6X group still had a 5.0 kg/cow/day benefit. This maintenance of all, or at least part, of the additional milk from early-lactation increased milking frequency can be termed the "carry-over effect."

The potential for 6X milking during the first six weeks of lactation to induce a significant carry-over effect was determined under the demanding conditions of a private herd. Data were collected on a 2000 cow private dairy with Holsteins. Fifty cows that calved during a two-week period were assigned to the trial. Both first-lactation and multi-lactation cows were assigned, and half were milked 6X during the first six weeks of lactation. The milk production results are in Table 2.

**Table 2. Milk yield (kg/cow/day) and standard error of the mean (SEM) for various treatment groups and parity.**

Week of Lactation	First Lactation			Second& Later Lactation		
	6X	3X	SEM	6X	3X	SEM
Full Lactation	36.0	36.7	1.3	41.1	38.2	1.9
Weeks 1-6	31.0	29.3	1.6	44.1	38.1	1.1

A significant treatment by parity interaction was determined. While there was a significant effect of 6X milking on both first and later lactation cows during the first six weeks of lactation, the cows in the 6X first lactation group had reduced milk production levels after starting 3X milk production. The multi-lactation cows had a significant carry-over effect on milk production. First-lactation cows were significantly lighter in body weight at 15 weeks after calving (487 vs 592 kg). The average age at calving for first-lactation cows was 23 months, so they were also a little young. The young age may have contributed to the lighter weight, which prevented the first lactation cows from having any carry-over effect.

There was no significant difference in fat or protein percent for 6X milking, though there was a parity by treatment interaction for fat and protein yield, due to the effects on milk production described above. There was no significant difference in milk somatic cell count for any of the treatment groups. First service conception rate was low for the herd (~20%), due to warm weather, but there were no significant differences in conception rate between groups.

The maximal amount of difference in level of milk production between 6X and 3X multi-lactation cows was observed at three weeks after calving. This observation suggests that increase in milking frequency may not have to be a full six weeks to develop a full carry-over effect.

## ■ Four Times-A-Day Milking

Increasing the milking frequency during early lactation has some important practical limitations to application. One limitation is that cows are sometimes handled in a separate group until the milk is clean and salable. Another is when to do the extra milkings. These two factors were evaluated in a 4X versus 2X trial.

Thirty cows were assigned to one of three treatments (Hale *et al* 2002). One group were milked 4X starting at the first day of lactation (termed IMF-1). The second group was milked 4X starting on the fourth day of lactation (termed IMF4), when milk could be sold. The third group was the control group and was milked 2X for the entire lactation. The 4X treatments were done for the first three weeks of lactation, and then the cows were milked 2X for the remainder of lactation. The 4X milkings were done at the beginning and end of the herd 2X milkings, so there was not an even 6 hour milking interval for the 4X groups. The 2X groups had an 11 – 13 hour milking intervals, so some 4X intervals may have been as short as 4 hours and as long as 8 hours.

Milk production levels are in Figure 1. There was a significant increase in milk production in both 4X groups during the first three weeks of lactation. There was also a significant carry-over effect through the remainder of lactation. There did not appear to be a significant difference between the IMF-1 and IMF-4 treatment groups for milk production.

These results demonstrate that 4X milking frequency for only three weeks and applied without a regular milking interval, can lead to a significant carry-over effect. The effects of treatment on milk components and the dynamics of mammary cell numbers will be determined.

## ■ Summary

Increased milking frequency results in increased levels of milk production. This increase is fixed and not proportional to level of milk production at the time of increase. Milking cows more frequently during the first weeks of lactation may provide a significant improvement in milk production for the remainder of lactation. The minimum amount of time required is not known, but may be as little as three weeks. The increase in frequency does not appear to have to start

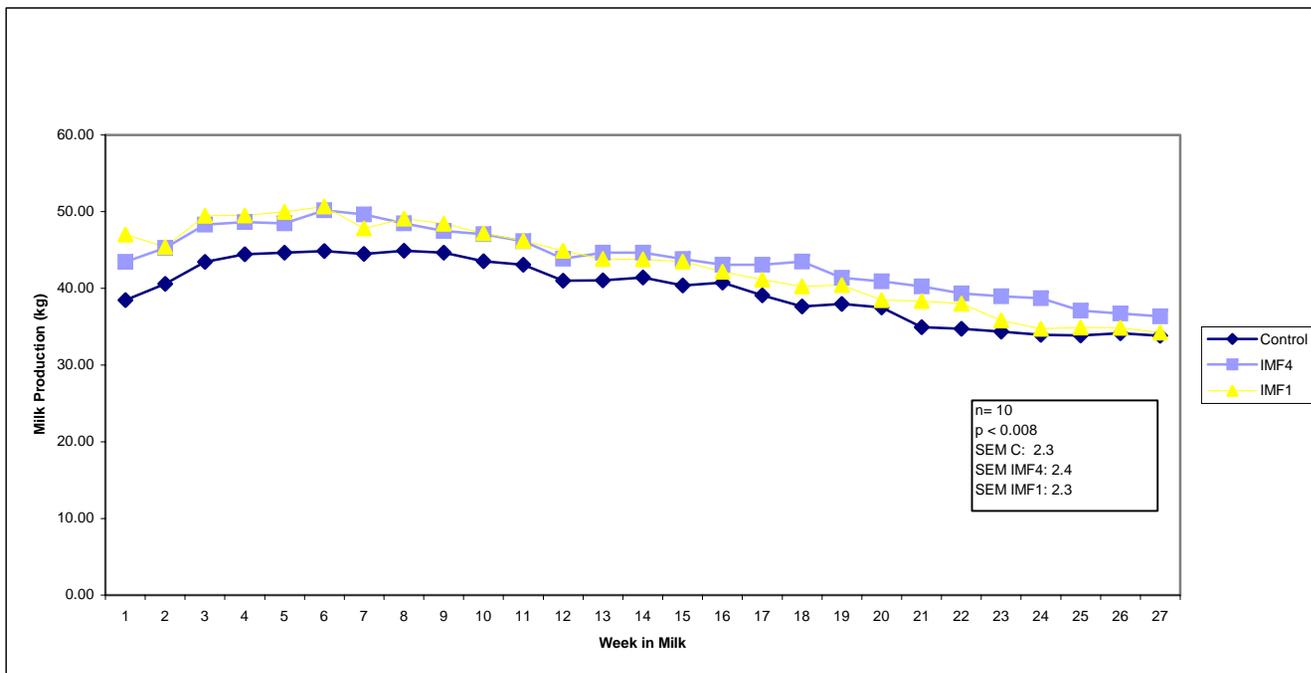


Figure 1. Milk Production in Cows Milked 2x vs. 4x

immediately after calving, and the milking intervals do not have to be equal in length. It appears that conducting the increased frequency milkings at the beginning and end of the herd's standard milking interval is sufficient.

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