Frequent Milking in Early Lactation: Considerations for Implementation

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Take Home Messages

- Labor availability and parlor capacity are key factors when considering a change in milking frequency.
- Increases in early lactation milking frequency may provide a better return when labor supply is limited than 3X milking.
- Cow movement and time budgets must be optimized for any increase in milking frequency to succeed.

A number of management factors need to be evaluated when a shift in milking frequency is under consideration. Besides the obvious labor supply and schedule questions, these include nutritional factors such as feed availability and time at the bunk, cow movement and distance to the parlor, and throughput of the milking system. In addition, when to implement the higher frequency of milking, throughout lactation or only in the early weeks, is also a factor that must be considered. While not an exhaustive list, the objective of this paper is to highlight major decision points that require investigation before movement from the typical twice daily (2X) schedule is implemented.

As with other mammals, when cows are milked more frequently they produce more milk. Because milk yield is ultimately a function of the number of mammary epithelial cells that are active and the relative metabolic activity of those cells, it is reasonable to expect that more frequent milk removal influence both of those endpoints. However, when in the lactation cycle mammary cell number versus metabolic activity is affected may differ. More complete knowledge regarding when and how frequency responses change during lactation will allow for more appropriate management decisions to optimize production and profitability.

The most common milking frequency of 2X removal likely evolved as the trade-off between labor efficiency and milk output. Twice daily milking provides significant yield advantage over milking once a day, and that advantage is magnified as the absolute level of production increases. For example, the depression of yield that occurs with a decline to once daily milk removal has been estimated to be as little as 20%, yet most of the studies examining that effect were completed in late lactation cows, at relatively low production levels, and under challenging nutritional conditions of late season pasture. Though direct comparison of 1X versus 2X milking under conditions more typical of North American management is not available, it is likely that yield depression on 1X would far exceed the 20% reported.

In contrast to the 1X vs. 2X comparison, a number of studies have compared 2X to 3X and greater frequency under intensive management conditions. Summaries of those experiments suggest that an average increment of 8 lb/d of milk can be expected throughout lactation with 3X compared to 2X. Because the increment is fixed over a range of production levels rather than increasing as production rises, the 8 lb/d value (or less) should be used in economic decisions rather than a herd specific value based on an expected percentage increase. Using percentage increases, particularly in higher production herds, can result in overestimation of the expected increase in production as well as inaccurate estimations of feed resources required to support that production response. The same consideration should be applied to continually milking 4, 5 or 6X.

Rather than milking cows at a higher frequency than 2X over the entire lactation, recent studies suggest that cows milked at a frequency of 4 to 6X in early lactation, and then returned to 2x or 3X, continue to produce more milk throughout the remainder of that lactation. For example, one study compared a 6X frequency to 3X frequency for the first 21 days of lactation, from which time all animals were milked 3X until they went dry. Cows in the 6X group produced over 2000 lbs. more milk than the 3X cows, and the higher yield persisted long after they were returned to the 3X frequency. Similar effects on persistency have been noted when cows were milked 4X for the initial 21 d in milk and then milked 2X. That is, the 4X cows produced more milk when milked at the higher frequency, and continued to yield more milk than 2X cows through 40 weeks of lactation.

Potential Collateral Benefits

In addition to the positive milk yield responses, there are some other potential benefits that may accrue from increasing milking frequency, especially in the early lactation phase. Some studies indicate that higher milking frequencies are associated with improved udder health. The most common endpoint for udder health is somatic cell count (SCC) or score. Relative to 2X, cows milked 3X over the entire lactation have lower SCC. There is some evidence that even the transient high frequency milking in early lactation, i.e. 4-6X for the first 21 d in milk, can produce persistent reduction in SCC well into lactation. In situations where premiums are offered based on milk quality, lower SCC must be considered as another potential revenue benefit to offset additional costs of implementation.

Although less tangible, behavioral benefits of higher milking frequency have also been noted. Increasing the number of visits to the parlor may accelerate training of first lactation animals to the parlor and milking procedures. Because transition cows tend to be immuno-suppressed relative to later lactation animals, they are prone to a variety of diseases, both primary and secondary to an infection. Surveillance of cows during this critical period, including temperature monitoring, is useful to detect and treat disease events early and limit the overall effect on the cow. Thus the increased number of observations on a cow that is milked at a higher frequency should provide for earlier detection of problems and limit progression of those incidents.

Cost Considerations

The major cost factors associated with higher frequency milk removal are feed, labor, and supplies and utilities associated with each milking. With regard to diet, it appears that increasing milking frequency does not require a change from normal feeding practices. That is, cows fed ad libitum will increase intake to meet the greater caloric demand of higher milk production. In fact higher intakes in early lactation have been observed with higher frequency milking in early lactation. Of interest there is little indication that 3X milked cows consume more feed than cows milked 2X in the same study. However, the duration of those studies that directly compare 2X to 3X feed consumption may not have been extended into lactation long enough for significant divergence in intakes to appear. It is likely that 3X cows will have to replace body condition in later lactation and so increased intake should be assumed and budgeted for. Further, any factors that limit feed consumption, either physical (e.g. bunk space limitations) or environmental (e.g. heat stress), are likely to have a negative influence on the ability of cows to respond to higher frequency milking no matter what stage of lactation that it is imposed on.

Labor cost and capacity must both be considered before shifting to a higher frequency scheme. Moving from 2X to 3X is often viewed as a low input approach to improve production efficiency. Certainly it is expected that returns from 3X milking will cover variable input costs (Table 1 and 2), but capacity of the labor supply to sustain a 3X schedule may vary by farm and cow number in particular. In the case of a single owner-operator milking 100 cows, implementation of 3X is likely to be impossible to sustain, yet a 2X/4X system may be easily integrated into the schedule, and ultimately produce 60 to 70% of the revenue of 3X (Table 1). Conversely, a dairy milking 1200 cows 2X may be able to add a shift of milkers to increase to 3X, if there is a reliable supply of labor available.

Management Factors

An area of concern with greater milking frequency is that of time budgeting for other activities to support optimal lactation. Research suggests that cows spend approximately 21 hrs/d resting, ruminating, and feeding, so it is easy to envision a situation where doubling the frequency of milking could negatively impact a cow's ability to meet baseline needs for performance. It is critical that factors such as distance traveled to the parlor, relative mobility (i.e. lameness), and standing time on concrete in the holding pen be managed appropriately so that a response is not negated by other limitations. Particularly in the case of fresh cows milked at high frequency (i.e. 4X to 6X), time away from stalls, feed and water should be minimized. Fresh cows should be housed in a pen close to the parlor, grouped so that extra time in the holding pen is minimized, and lame cows may not be candidates for increased milking frequency. Indeed, even if cows are typically milked 3X (or more) for the entire lactation, managers may want to consider penning lame cows separately and reducing the number of milkings for that group in order to maximize their ability to rest and feed.

Milking frequency is just one of a number of management options to increase milk yield per cow so how does it impact responses to other techniques such as bST or

photoperiod? There is evidence that increasing milking frequency, either early or throughout lactation can be effectively combined with bST with the expectation of an additive response. Many producers use long day photoperiod to increase milk yield, yet there are no studies that have directly examined the combination of greater milking frequency and extended light exposure. While there is no reason to believe that well-fed cows would not respond to higher frequency milking and long days, it is critical that lights not be left on continuously to sustain the response. That is, the increased milking frequency must be accomplished within the constraints of an 18 hr light period so that cows will continue to have a 6 hr period of darkness. Heat abatement that prevents declines in milk yield can also be combined with greater frequency, though again care should be taken to ensure that cows are exposed to fans and soakers in holding pens if they are spending more time there.

A number of milking system and performance factors need to be evaluated before increasing milking frequency. The first question should relate to parlor capacity and flow dynamics. If parlor capacity is already maximized, then increasing milking frequency early or throughout lactation may not be an option. But milking cows more frequently in early lactation requires less capacity than if the frequency is maintained throughout lactation, because only 8 to 12% of the herd will be fresh at any point. Another important area to evaluate is milking system settings. Particularly when milking at 4Xor 6X, the additional milkings may lead to teat end damage if they are continued to long into lactation. If the extra milkings are not at even intervals, the cows may experience a less robust oxytocin release, and milk ejection may be delayed. This can lead to periods of low flow at the beginning of milking. At the end of milking care must be taken to avoid excess manipulation of the teats from over milking. Thus, flow rates for automatic take-offs should be set at the higher rather than lower end of the scale so that teat end strain is avoided.

Examples

Given the previous discussion it is useful to develop some examples for the decision process producers may encounter as they consider a management shift from 2X to another milking scheme. First, let's examine a herd of 100 cows, where all labor is provided by the owner and the family; a typical situation on many dairy farms in the upper Midwest and Canada. Parlor size is sufficient to support additional throughput of cows, and feed resources are adequate for more cows or greater intake of cows already on the farm. With a desire to optimize cash flow and production efficiency, the question becomes should they go from 2X to 3X or 2X/4X fresh cows? Or, should more cows be added? Critical areas to review for the decision are housing and labor. In the case of housing, the barn has 100 freestalls, so even though additional cows could likely be accommodated in the parlor, overstocking would be necessary in the barn. Labor is the larger issue, as there is no extra labor to assist with the third milking, and even with hiring a milker the revenues of 2X/4X are expected to be about 70% of all cows being milked 3X (Table 1). Therefore, 2X/4X is likely to be the choice for this producer over 3X, even though the daily cost of the extra milkings in early lactation is not profitable. That is because the cost is recovered from milk revenues after frequent milking ends at 21 days, whereas 3X milking requires sustained input throughout lactation.

Table 1. Comparison of predicted milk response and potential economic benefit from derived from milking all cows 4X for the first 21 days of lactation, or milking all cows 3X for the entire 305 day lactation, in a 100 cow herd. Note that labor and supply costs are presented on a per day of treatment basis (i.e. for 21 d in 2X/4X), but are spread over 305 days for the calculation of lactation returns.

	2X/4X Day	2X/4X 305 Day	3X Day	3X 305 Day
Additional milk/cow	4 lb	1220	8 lbs	2440 lbs
Labor[a]	$0.42	$17.50	$0.20	$61.00
Feed[b]	0.14	$42.70	0.28	85.40
Supplies, utilities[c]	0.12	$2.52	0.06	18.30
Milk revenue[d]	0.44	$134.2	0.88	268.40
Marginal profit/cow[e]	-0.24	71.48	0.34	103.70
Marginal profit/farm[f]	$-24.00	$7,148	34.00	$10,370

[a] Labor cost of $10/hour and 4 turns/hr; 2 parlor turns/d for 2X/4X of 12 cows, 8 turns/d for 3X of 100 cows.
[b] Dry matter at $.07/lb; 0.5 lb DM for each lb of milk increase.
[c] Cost for supplies for an extra milkings including dip, towels, utilities, detergent, and sanitizer.
[d] Milk at $11.00/cwt.
[e] Estimate is for each day of a typical 305 day lactation, during and after milking frequency treatment is imposed.
[f] Calculated from profit/cow for 305 day lactation for 100 cow herd.

Next let's look at a herd of 600 cows milked in a double 20 parlor. Cows are currently milked 2X, but the herd size will be doubled over the next 12 months to better utilize the facilities on hand. Milking parlor capacity is in excess now, and a good labor force is available. As indicated in Table 2, the best option now is to milk 3X and milk fresh cows at the higher frequency because facilities are overbuilt and that scenario maximizes cash flow and efficiency. However, parlor capacity will be limited after expansion to 1200 cows (i.e. it will take 7.5 hrs to complete each milking), so 3X/6X would not be an option after expansion. In addition, animal movement and time away from stalls may become a negative factor after expansion because of the relatively low parlor throughput, and that would potentially limit the effectiveness of the additional milkings in early lactation.

Table 2. Comparison of predicted milk response and potential economic benefit from derived from milking all cows 4X for the first 21 days of lactation, or milking all cows 3X for the entire 305 day lactation, in a 600 cow herd. Note that labor and supply costs are presented on a per day of treatment basis (i.e. for 21 d in 2X/4X), but are spread over 305 days for the calculation of lactation returns.

	2X/4X Day	2X/4X 305 Day	3X Day	3X 305 Day
Additional milk/cow	4 lb	1220	8 lbs	2440 lbs
Labor[a]	$0.19	$3.94	$0.07	$21.35
Feed[b]	0.14	$42.70	0.28	85.40
Supplies, utilities[c]	0.12	$2.52	0.06	18.30
Milk revenue[d]	0.44	$134.2	0.88	268.40
Marginal profit/cow[e]	-0.01	85.04	0.47	143.35
Marginal profit/farm[f]	$-6.00	$51,024	34.00	$86,010

[a] Labor cost of $10/hour and 4 turns/hr; 6 parlor turns/d for 3X/6X of 80 cows, 15 turns/d for 3X of 600 cows.
[b] Dry matter at $.07/lb; 0.5 lb DM for each lb of milk increase.
[c] Cost for supplies for an extra milkings including dip, towels, utilities, detergent, and sanitizer.
[d] Milk at $11.00/cwt.
[e] Estimate is for each day of a typical 305 day lactation, during and after milking frequency treatment is imposed.
[f] Calculated from profit/cow for 305 day lactation for 600 cow herd.

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