

USING COMPUTERIZED DATA TO FIND TIME FOR MILK QUALITY

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Large, progressive dairies are faced with a dilemma: How to operate a capital-intensive, labor-intensive parlor in a manner to allow calm milking of all cows on a regular schedule without sacrificing either production or milk quality. While this dilemma seems insurmountable on many dairies, careful analysis of the on-farm milking process can often find the “extra” time needed to ensure production of high quality milk from high producing individuals without unnecessarily slowing cow throughput.

One tool that has helped find this extra time without sacrificing good parlor performance has been the information and reports obtained from in-line milk meters and management software.

Determining Parlor Efficiency

The goals for parlor efficiency could be described as follows:

- Have cows enter the parlor and occupy stalls calmly yet quickly.
- Have the milker begin an excellent udder prep routine within 60 seconds of cow entry. This procedure should result in a well-stimulated cow that has clean, dry, sanitized teats, including teat ends.
- Have the unit be applied to the cow within 60 seconds of the start of udder preparation. Unit should be placed on cow with minimal air leakage, minimal excitement to the cow, and properly adjusted for position.
- Have the cow milk out quickly and completely.
- Have the unit removed immediately upon cessation of milk flow.
- Have the cow exit calmly within a minute of unit removal.
- Have the next cow occupy the same stall calmly yet quickly.

Several factors, including number of milkers and desired milk quality, interact to determine parlor efficiency, but one of the most important is maximizing total pounds of milk per day being harvested in the parlor. Total cows milked per day (or per hour) is commonly used as a proxy for pounds of milk output, but too often it is used as the only measure.

In simplistic terms, increasing milk per hour can be achieved in three ways:

1. Increasing the production per cow.
2. Increasing the average milk flow while the units are attached.
3. Decreasing the amount of time that the units are not attached to cows.

While production per cow may be influenced more by other factors such as nutrition and cow comfort, cows milked calmly after adequate stimulation may give more milk and will milk out

more quickly and completely. Fortunately, premilking procedures that ensure high quality milk and excellent mastitis control usually also result in good stimulation of oxytocin release.

However, premilking procedures are typically the first thing abandoned with a harried schedule. This typically results in a deterioration of milk quality and udder health. Too often the management and labor force become overwhelmed with this juggling act and become pre-occupied with the single goal of merely getting the cows milked. Milk quality and individual cow productivity can slip considerably during these periods of stress

Therefore, to maintain highest quality milk, emphasis needs to be placed on finding ways to save time in areas other than premilking or postmilking hygiene. The two main ways are decreasing the time the units are on cows and to minimize the time milking units are idle (unattached to cows).

Decreasing Unit On-Time

Decreased unit on-time can be achieved through a combination of well-stimulated cows, proper claw vacuum levels, proper pulsation rates and ratios, and through more “aggressive” or “wetter” settings for automatic take-offs.

A field study is now being conducted to determine the relative influence of each of these milking equipment factors on unit on-time. Effects on average flow rate, production, teat end health, and parlor throughput will also be examined. It appears from early analysis and field work that in many herds (if not most), unit on-time can be significantly decreased by adjustment of equipment settings with little or no negative effect on production or milk quality.

Minimizing Unit Idle Time

Minimizing the time between unit removal from one cow to attachment of the same unit to the next cow can be achieved by identifying the causes of delays and removing them. Delays can occur for a variety of reasons, including:

1. Delays in cow entrance into the parlor from holding area.
2. Delays from entering parlor and occupying a parlor stall.
3. Delays between time cow occupies parlor stall and unit attachment.
4. Delays when exiting the parlor.
5. Delays due to empty holding area, e.g., between two groups of cows.
6. Delays from attachment of first unit on a side to last unit on same side.
7. Delays due to long unit on-time for one cow, holding up rest of side.
8. Delays due to equipment factors decreasing milk flow rate.
9. Delays due inadequate stimulation decreasing milk flow rate.

In addition to on-site activities (visual observation, timing, etc.), data from milk meter systems can be very useful in detecting and eliminating of many sources of parlor delays, including:

- Measuring the time from ID of cow at entrance to time unit is attached to the same cow monitors how long cow was in parlor before unit was attached. This can often spot problems in routines where the milkers are waiting until the last cow is in the parlor before putting on the

first unit. This is also a very good way to demonstrate quickly the difference a new prep routine makes.

- Measuring the time from ID of first cow at entrance to time of ID of last cow at entrance on same side, same turn often helps spot problems with entrance into the parlor, either from basic design or from milker routines.
- Measuring time from unit attachment of first cow to time of unit attachment of last cow same side, same turn can spot problems with efficiency of unit attachment. In addition, patterns of unit attachment can be discerned, permitting compliance monitoring with suggested premilking procedures.
- Measuring the time from unit detachment of final cow on a side to ID of first cow on the same side in next turn assists in detecting delays due to poor parlor exiting or poor parlor entrance and also to empty holding pens.
- Measuring the time from unit attachment of first cow on a side to detachment of final cow on the same side, same turn assists in detecting delays due to poor unit attachment routines, poor udder stimulation, improper equipment settings, or to individuals that have extended milking times.

Conventional wisdom is to put extended milking time cows together in a separate group, often allowing for extending take-off settings. While this advice may improve parlor throughput somewhat, it is not clear that this is the best solution for either the cow herself or optimal parlor flow. Taking the opposite approach can be successful with premilking stimulation, proper vacuum settings and pulsation settings, more aggressive take-off settings, and by setting maximal on-times (often about 8 minutes).

- Milker performance can be monitored by measuring average flow rate, unit on-times, production, and efficiency of unit turnover at each milking. Better premilking stimulation can be quickly reflected in higher average flow rates and lower unit on-times without losing production. Increases in unit turnover efficiency can also be monitored closely.
- Similarly, milking equipment can be monitored on a stall-by-stall basis for a variety of factors, including flow rates, unit on-times, conductivity, etc. This helps spot potential problems as they arise.

Parlor Performance Reports

Some types of reports that commercial dairymen are finding useful include:

1. Summary reports following each milking (Figure #1).
 - a. Total milk by pen and total herd.
 - b. Milk and cows per hour by pen and total herd.
 - c. Start, stop, and total times by pen and total herd.
 - d. Average unit on-time.
 - e. Milk per minute of unit on-time (average milk flow rate).

- f. Percent of time units actually on cows versus hanging.
2. Detail of sequence and time intervals between unit attachments (Figures #2&3).
3. Detail of total time for attachment for a side and turn (Figure #2).
4. Detail of time gaps between turns and between pens (Figure #2).
5. List of cows with long unit on-times.
6. List of "errors".
 - a. ID system errors.
 - b. Cows not identified as entering parlor.
 - c. Cows entering parlor, but no unit attached (Figure #4).
 - d. Cows coded as dry but identified as having entered parlor.
 - e. Cows milked in a "wrong" pen.
 - f. Cows manually detached or re-attached.

A summary report can be printed after the completion of each milking. Information is reported on total milk, milk per hour, cows per hour, total cows, cows per hour, total parlor time, start time, stop time, average milk per minute of unit on-time, average unit on-time, and deviation from expected milk, by pen and total herd.

Figure 1. Parlor Performance Summary Report

Milking report for 12/ 4/98 Milking 1 at 12:42PM K450 Settings: 18: 1

PEN	Total Milk	Milk /Hr	Milk /Cow	Cows	Cows /Hr	Total Time	Start Time	Stop Time	Avg #/m	Avg Dur	Avg Dev	Not ID
1	2631	3671	27	94	131	0:43	4:58	5:42	5.7	5.0	0	2
3	2766	4610	31	89	148	0:36	5:43	6:19	6.5	4.9	1	1
5	3482	4263	26	129	157	0:49	6:18	7:07	6.1	4.4	1	1
7	3985	4347	30	130	141	0:55	7:05	8:00	6.5	4.8	1	2
8	4265	4569	34	123	131	0:56	8:01	8:58	6.9	5.1	2	1
6	3382	3689	27	122	133	0:55	8:58	9:54	5.5	4.9	2	0
2	3512	3902	35	100	111	0:54	9:54	10:48	6.8	5.3	1	2
4	3317	4326	36	91	118	0:46	10:43	11:30	6.7	5.5	2	0
9	462	2310	24	19	95	0:12	11:33	11:45	5.7	4.4	3	1
Total	27802	4098	30	897	132	6:47	4:58	11:45	6.3	4.9	1	10

Units were attached 36 percent of the time

The line stating the percent of time units were attached is the total time units were on cows milking versus the total time spent in the parlor. In many herds the number is in the teens or 20s. In higher efficiency parlors it has been in the upper 30s. While higher is usually better, very high percentages may mean that units are being left on all cows a prolonged time, being detached too soon, or moving cows excessively fast entering or exiting parlor.

In the next example of a double 10 parlor (header line of 1 to 10 refers to parlor stall number by side), the table is displayed by order of unit attachment. Note:

1. Time to attach units on a side was 3 to 4 minutes.

2. Turn 2 Side 1 took 18 minutes from the time the first unit was attached to the final unit being removed. Since unit attachment time was relatively short, this would indicate one or more cows had a prolonged duration. Selecting duration for display could confirm it.
3. Turn 4 Side 1 & 2 had gaps from the previous sides of 13 and 17 minutes. This is likely due to a change in groups, with the holding pen being empty for a period of time.
4. Turn 1 Side 2 was attached in reverse order.
5. Turn 3 Side 1 was attached in somewhat random order.

Figure 2. Parlor Performance Detail Report

Milking 1								Order									
T	S	Pen	MY	Gap	Att	Det	FstAt	1	2	3	4	5	6	7	8	9	10
1	1	1	33	0	4	15	04:58	1	2	3	4	5	6	7	8	9	10
1	2	1	30	0	4	15	04:54	10	9	8	7	6	5	4	3	2	1
2	1	1	30	6	3	18	05:19	1	2	3	4	5	6	7	8	9	10
2	2	1	33	5	3	12	05:13	1	2	3	4	5	6	7	8	9	10
3	1	1	34	3	4	12	05:41	1	2	7	5	6	3	4	8	9	10
3	2	1	35	7	4	12	05:31	1	2	3	4	5	6	7	8	9	10
4	1	2	34	13	3	13	06:06	1	2	3	4	5	6	7	8	9	10
4	2	2	35	17	4	14	06:00	1	2	3	4	5	6	7	8	9	10
20	2		32	6	3	11											

T=Turn, S=Side, MY=Milk Yield.

Gap Time 1st unit attached minus last detach same side, previous turn.

Att Time last attach minus first attach, same side same turn.

Det Time final detach minus first attach, same side same turn.

FstAt Time of day first unit attachment.

The next example is timing (in seconds from first unit on) of attachment of the units. The milker was supposed to prepare and attach in patterns of five cows. On the first turn first side the order and timing are correct; on side two the order is correct, but units were attached without a break between stall 5 and 6.

Figure 3. Parlor Performance Detail Report

Milking 1								Time of Attachment									
T	S	Pen	MY	Gap	Att	Det	FstAt	1	2	3	4	5	6	7	8	9	10
1	1	1	33	0	4	15	04:58	0	15	31	44	60	100	115	132	145	163
1	2	1	30	0	4	15	04:54	0	6	12	17	23	32	41	48	52	61

Some other data available are duration of unit on-time, milk production, conductivity, delay from time of ID to attachment, average flow rate of milk, and how long each prolonged duration cow held up her side.

Reports can be generated of cows entering parlor, but not milked. All cows had times of ID (ITOD) and parlor stall assigned, but no time of attachment (ATOD) and no milk or unit on-times. ITODs are close and stalls are all on same side.

Figure 4. “Error” Messages from Parlor Performance Summary Report.

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3534 No milk from Stall: 1; ITOD= 2:18 ATOD= None PEN= 7 Dur= 0.0
5518 No milk from Stall: 2; ITOD= 2:19 ATOD= None PEN= 7 Dur= 0.0
1584 No milk from Stall: 3; ITOD= 2:20 ATOD= None PEN= 7 Dur= 0.0
2333 No milk from Stall: 4; ITOD= 2:21 ATOD= None PEN= 7 Dur= 0.0
3392 No milk from Stall: 5; ITOD= 2:22 ATOD= None PEN= 7 Dur= 0.0
3381 No milk from Stall: 6; ITOD= 2:22 ATOD= None PEN= 7 Dur= 0.0
3330 No milk from Stall: 7; ITOD= 2:22 ATOD= None PEN= 7 Dur= 0.0
3628 No milk from Stall: 8; ITOD= 2:23 ATOD= None PEN= 7 Dur= 0.0
5330 No milk from Stall: 9; ITOD= 2:23 ATOD= None PEN= 7 Dur= 0.0
6628 No milk from Stall: 10; ITOD= 2:23 ATOD= None PEN= 7 Dur= 0.0
  
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Monitoring After Change in Equipment Settings

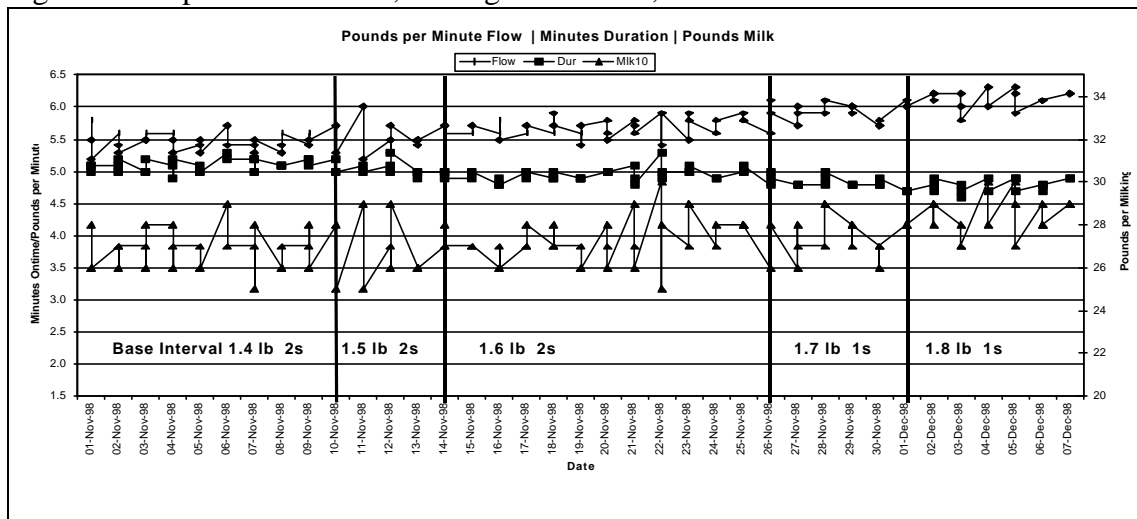
As an example, the table and graph below was used to predict and monitor the effect of changes in milking equipment settings. The settings shown should not be viewed as recommendations and may not be applicable to other dairies or other milking systems.

In this case, take-off settings (level and delay) were changed on a 900 cow dairy milking three times a day using a Bou-Matic ProVantage milk metering system in a double 15 parlor. Effects on unit on-time (duration), average pounds per minute unit on-time (average flow rate), and milk production were then monitored.

Table of Measurements (Take-Off Settings Changes) Change from Base

	Start	End	Level (lbs/m)	Del (s)	Milk (lbs)	A.Flow (lbs/m)	Dur (Min)	Milk (lbs)	Flow (lbs/m)	Dur (sec)
Base	11/01	11/09	1.4	2	26.8	5.47	5.10			
1	11/10	11/13	1.5	2	26.7	5.51	5.06	-0.1	0.0	-2.6
2	11/14	11/25	1.6	2	27.3	5.69	4.96	0.5	0.2	-8.5
3	11/26	12/01	1.7	1	27.5	5.89	4.85	0.7	0.4	-15.4
4	12/01	12/07	1.8	1	28.4	6.11	4.78	1.6	0.6	-19.2

Figure 5. Graph of Production, Average Flow Rate, and Unit On-Time



During the changes in take-off settings, production has risen by over a pound, average flow rate has risen by over one-half pound/minute, and unit on-time has decreased by nearly 20 seconds. This is especially interesting in that this dairy already had take-off settings that were considerably more “aggressive” than commonly used in the industry. Twenty seconds per side per turn in this 900 cow dairy translated to an extra 20 minutes per milking. This “extra” time can then be used for other purposes, such as milk quality or allowing more time for washup. This time would be in addition to other savings such as more rapid unit attachment, setting of maximum unit on-times, etc.

Conclusion

To achieve the goal of good parlor throughput without abandoning milk quality or individual productivity requires both an understanding of the process and a means to measure and monitor the necessary parameters. Data captured from daily milk meters can aid in this process and allow managers to monitor their parlor personnel, milking equipment, and cows more precisely and regularly.

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