Milking Equipment: Upgrades, Expansions, & What's New

1/22/2035

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Whenever You Lose Interest in being Better at Something, Chances are You've Already Stopped Being Good At It!


MELBY AIED

Today's Presentation

- Short history of machine milking
- What are the impacts of machine milking and mastitis
- Milking system maintenance
- Parlor expansion concerns
- What's new in the milking machine world, Reid's top 3
- Summary Thoughts

Life Rule # 1:

When you are in deep shit, look straight ahead, keep your mouth shut and say nothing!

Goals

1. Healthy Cows Are Profitable
2. Control Inputs
3. No Management Belief Is Beyond Questioning
4. Make No Changes Without First Establishing How Their Effect will Be Measured.

Dr. John Ferry 1993

Paradigm Lockdown

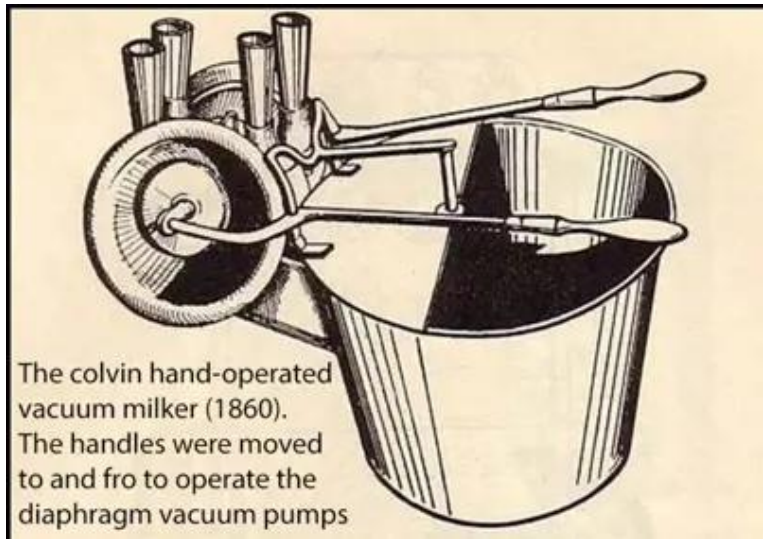
"That's when you have a good way of doing something so you lock down on it as being the best way, rather than considering it a good way and that there might be a better way that you need to find."

Burke Teichert 2011

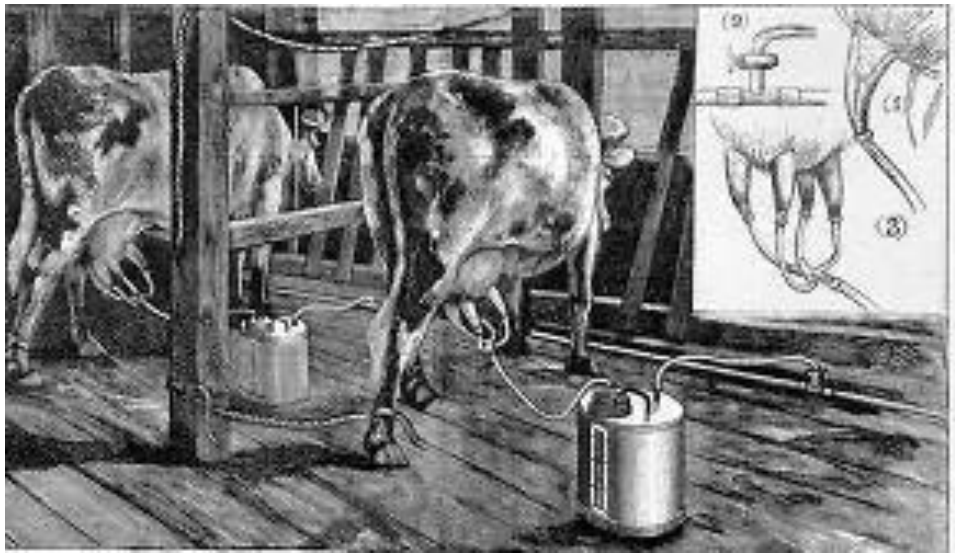
Put another way, thinking whatever you are doing is the **best way**, prevents you from looking for a **better** way to perform a given task.

Machine Milking History

- 1891 1st patent for vacuum based milk removal was with no pulsation



The colvin hand-operated vacuum milker (1860). The handles were moved to and fro to operate the diaphragm vacuum pumps



- 1892 Patent for 2 chambered teat cup
- 1895 Pulsation patented
- 1902 Patented improved 2 chambered teat cup

Machine Milking History

For the last 124 years, almost all milking is with the current 2 chambered teat cup assembly

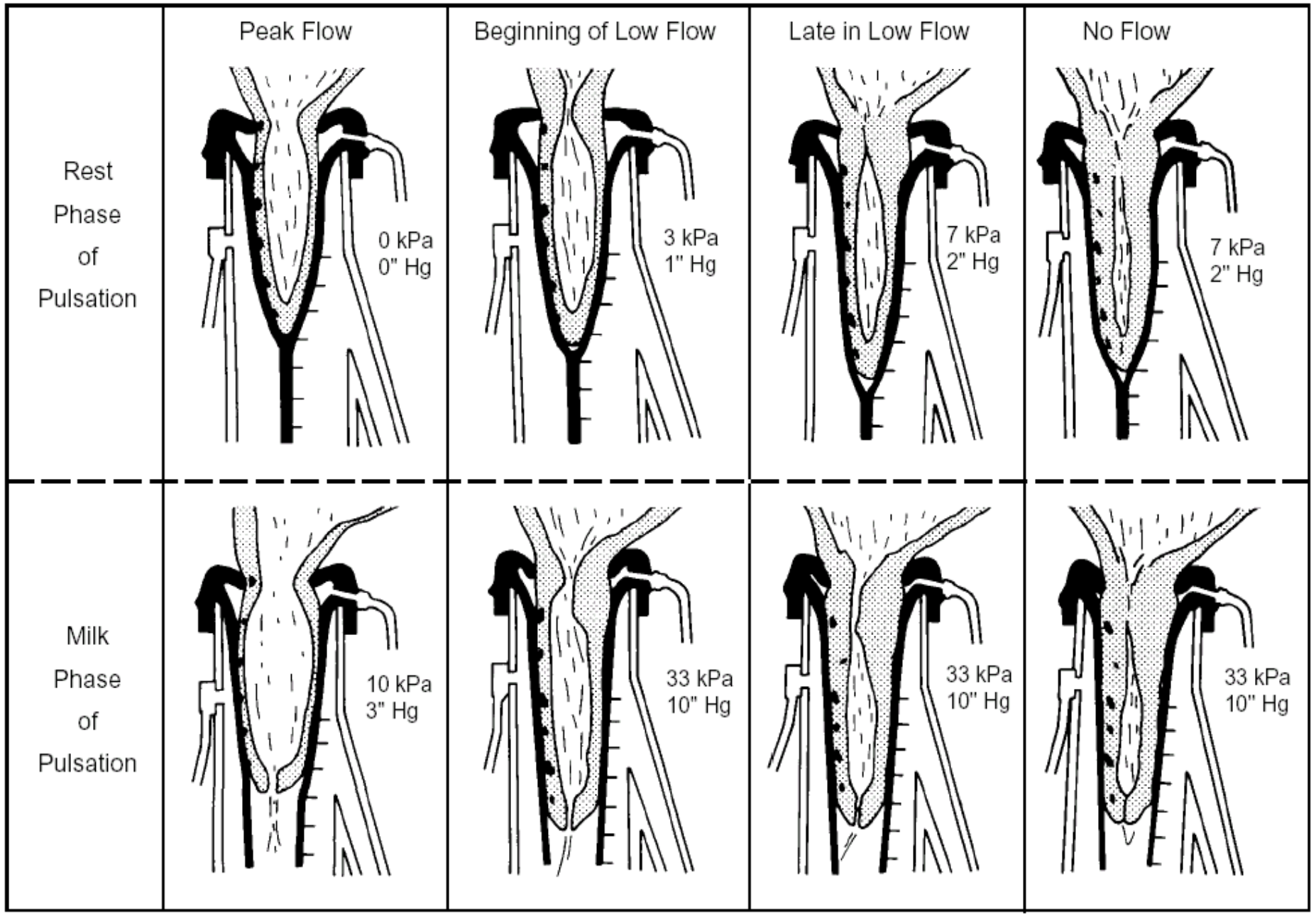
- Real world experience based, trial & error, not data derived until a 1981 in a study by Williams, Mein and Brown
- "Biological response of the bovine teat to milking: information from *measurements* of milk flow rate within a single pulsation cycle"

Early observations of milking

Early research using clear liners and shells and early x-ray machine

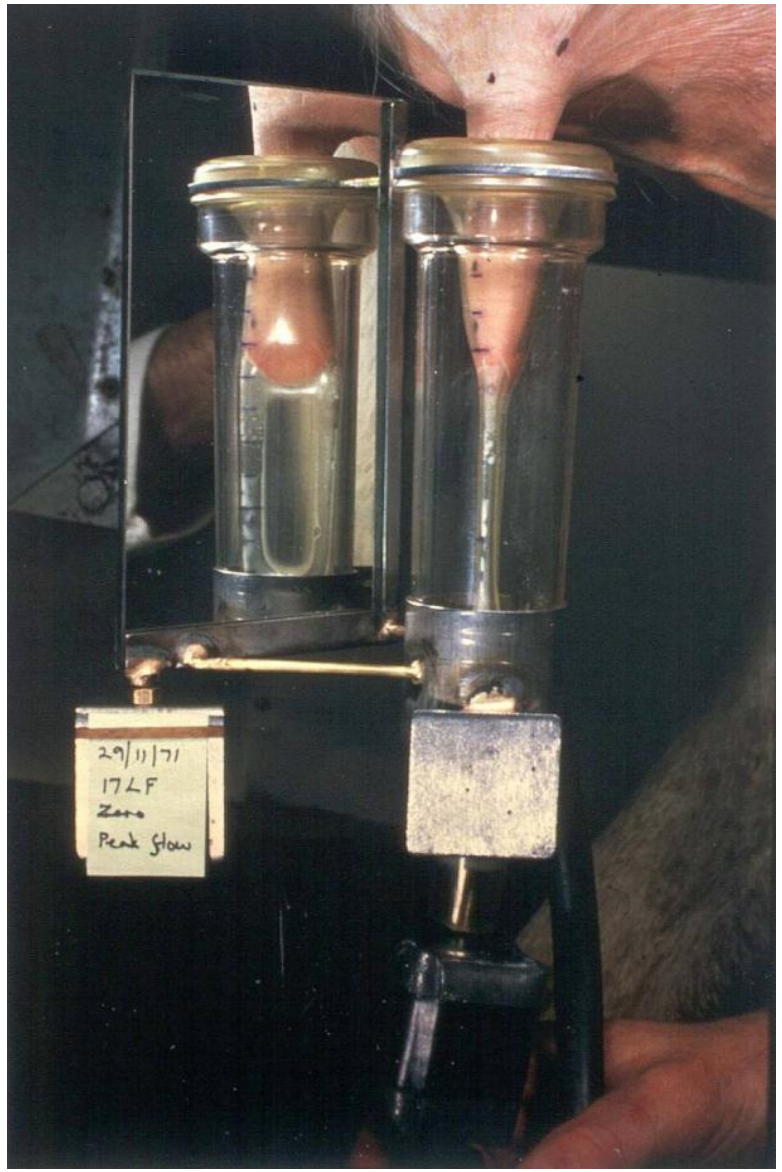
Liner Open Peak Flow

Action of Opening and Closing Inflations

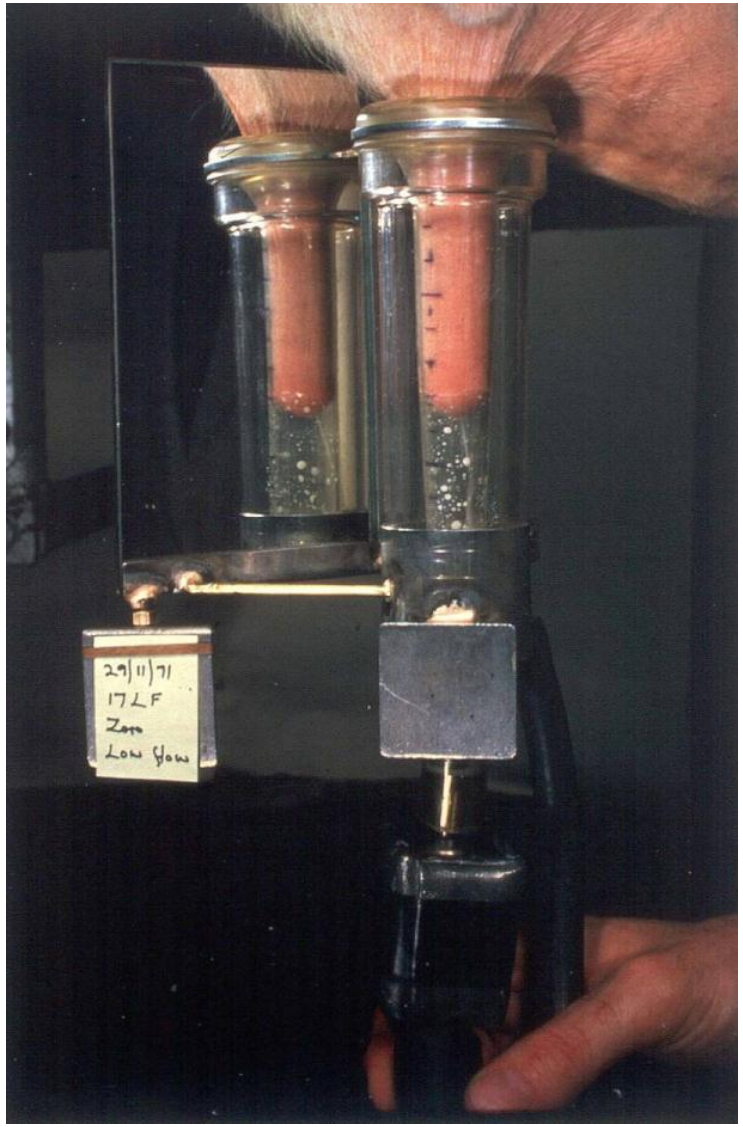


Open peak flow

Closed peak flow

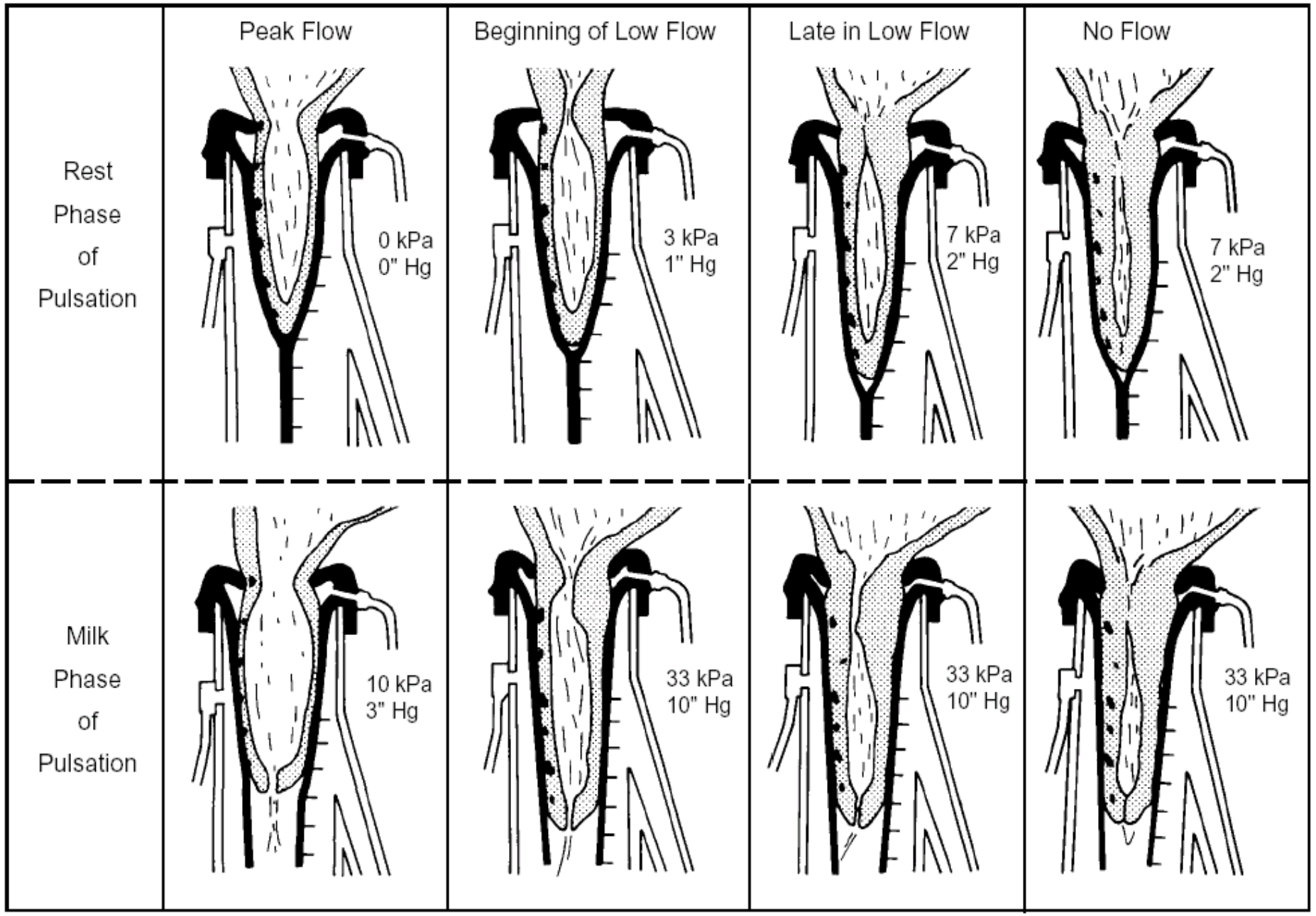


Open low flow



Closed low flow

Action of Opening and Closing Inflations



J. Dairy Sci. 108:11713–11732
https://doi.org/10.3168/jds.2025-27010

Invited review: Contribution of milk harvesting research to optimal interaction between biology and milking technology

J. Upton,[1]* R. M. Bruckmaier,[2] G. A. Mein,[3] D. J. Reinemann,[4] M. Wieland,[5] C. O. Paulrud,[6] J. Baines,[7] I. Ohnstad,[8] and M. D. Rasmussen[9]

Graeme Mein

- "Machine milking is a unique example of a mechanical process that requires the willing cooperation of the cow." (many years ago)

- "Milking depends on triggering the milk ejection reflex through tactile stimulation to release oxytocin. This process requires the willing cooperation of each animal to enter her milking position calmly, to stand quietly for milking and to leave calmly without endangering the milking staff." (2025)

Portions of the abstract of this paper

- "Machine milking has evolved from its early mechanical beginnings into a technologically advanced data-driven process that must balance speed, chosen completeness and gentleness on teat tissue to support efficient milk removal and optimal udder health."

- "At the machine level, key variables include milking vacuum, pulsation characteristics, liner properties and teatcup removal strategies."

What about machine function & Mastitis

- Estimates are the milking system effect may be up to 20% of new infections
  - Direct effects: cross contamination, bacteria transport & impacts
  - Indirect: impact on teat end & teat skin condition

Equipment issues that will impact milk quality

1. Acute transient vacuum fluctuations occurring during low milk flow
   a. Liner slips
   b. Vigorous machine stripping
   c. Abrupt cluster removal – can be significant especially in non-automated parlors

2. New infections are higher with pulsation failure & pulsation outside of acceptable limits (short D phase)

What about published articles & field experience?

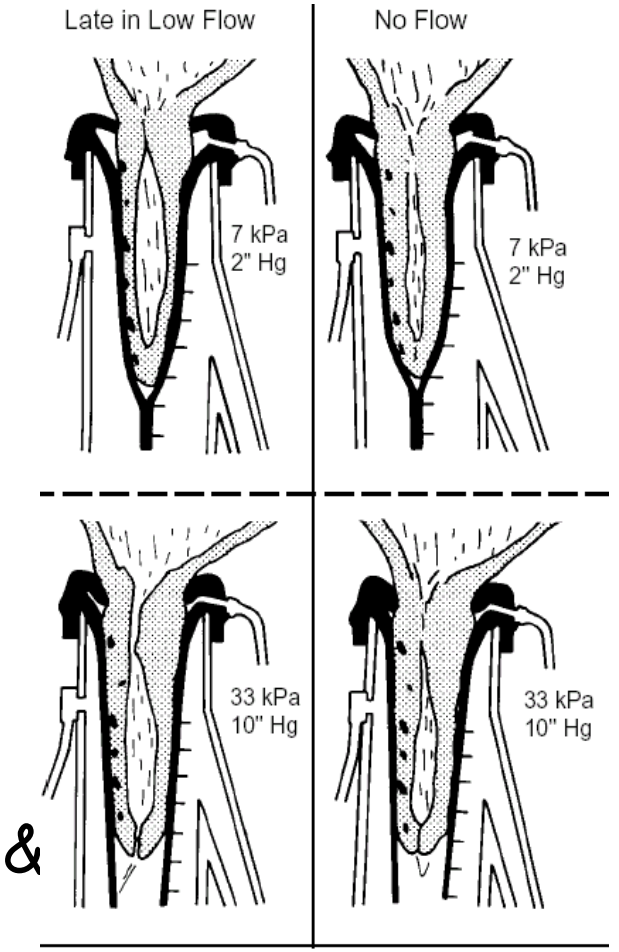
- Be careful, correlation does not imply causation!
- The world is full of testimonials & chance correlations!
- Murray Woolford 1995 quote, "further quantification of the overall contribution of the milking machine (to the new infection rate) is difficult and elusive because of the muti-factorial nature of the disease".

Bimodal Milk Flow

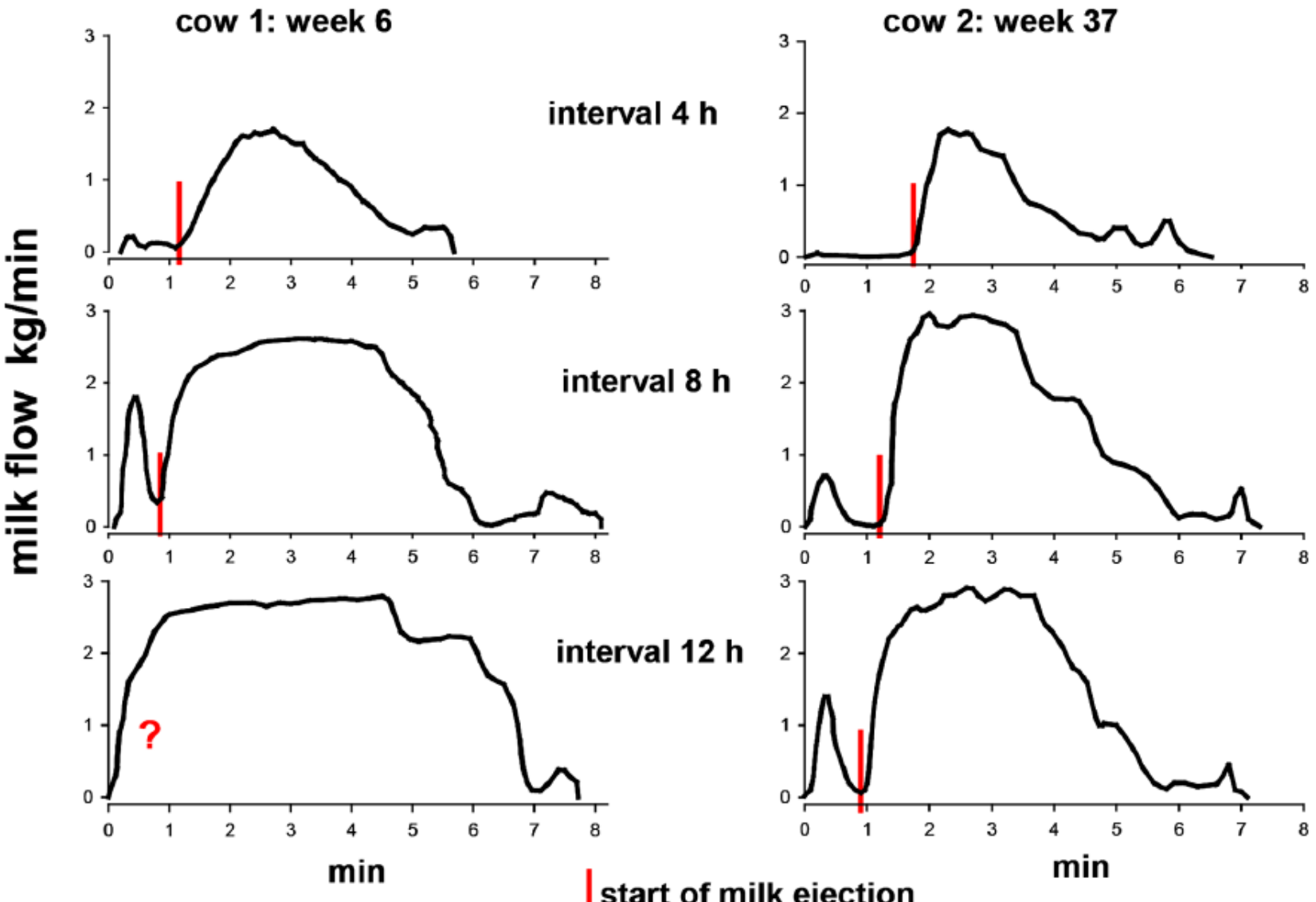
- Risk Factors/Causes
  - Udder stimulation or lack thereof
  - Level of udder fill; 2 or 3 or 4 milkings per day
  - Breed/physical udder size
  - Stage of lactation
  - Teat size/shape
  - Chronic mastitis infections
- Research
  - Bimodal flow will influence average milking duration (1996, 2023)
  - **Speculation**; may affect teat health under certain conditions, recent studies have not confirmed consistent association with teat end condition or mastitis new infection rate

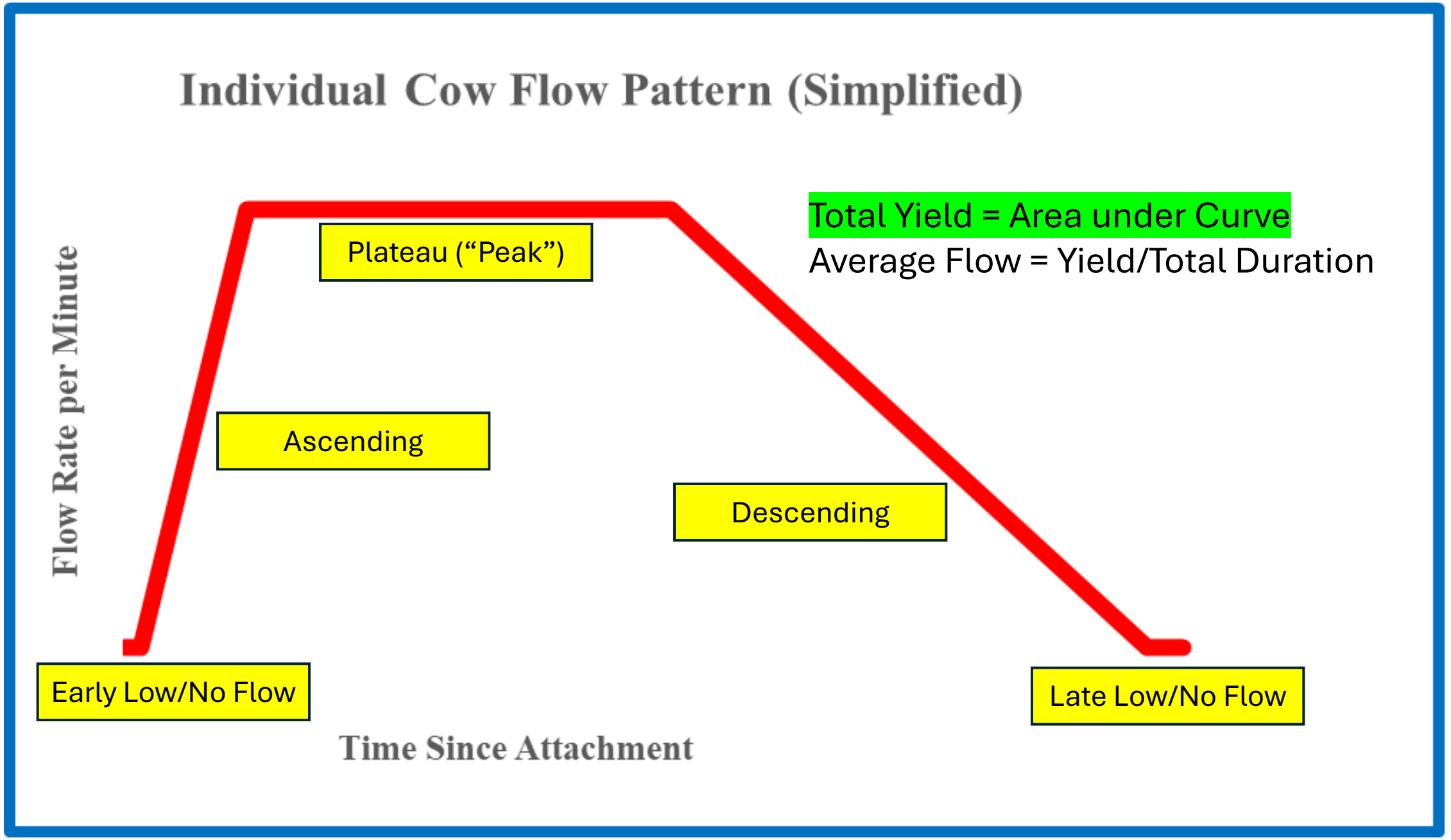
What is the definition of Bimodal?

- Is it just a calculated number based on early calculated flow data?
  - Vacuum sweep impact?
- Based on vacuum levels during dynamic testing?
- Based on observation of "dry milking at the start of milking, no milk flow?
  - Field experience/observations; dry milking shortly after attachment can be a significant issue, increased unit kickoffs/falloffs, slower overall milking & lower milk production



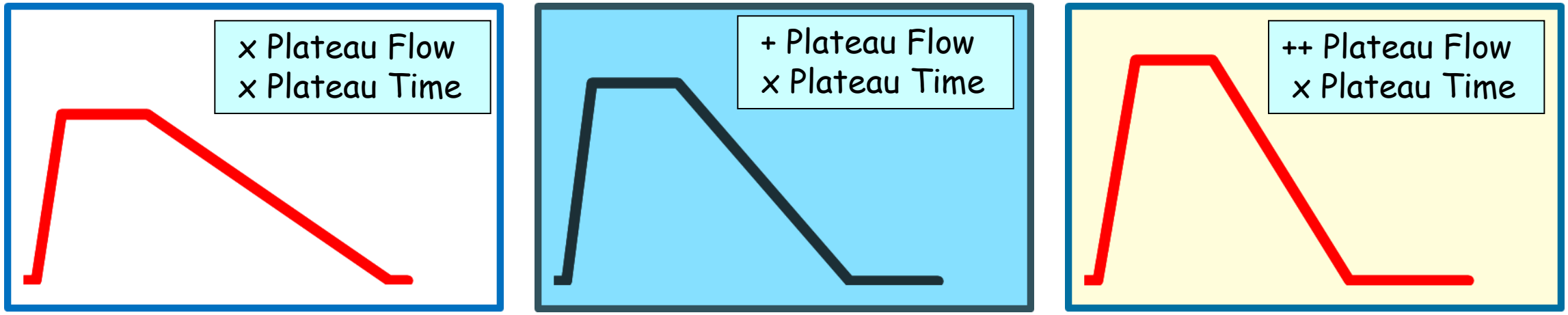
Milking interval & Bimodal flow 2025 JDS




Individual Cow Flow Pattern (Simplified)
Flow Rate per Minute
Plateau (“Peak”)
Ascending
Descending
Early Low/No Flow
Late Low/No Flow
Time Since Attachment
Total Yield = Area under Curve
Average Flow = Yield/Total Duration

Patterns with Equal Milk Yields and Durations

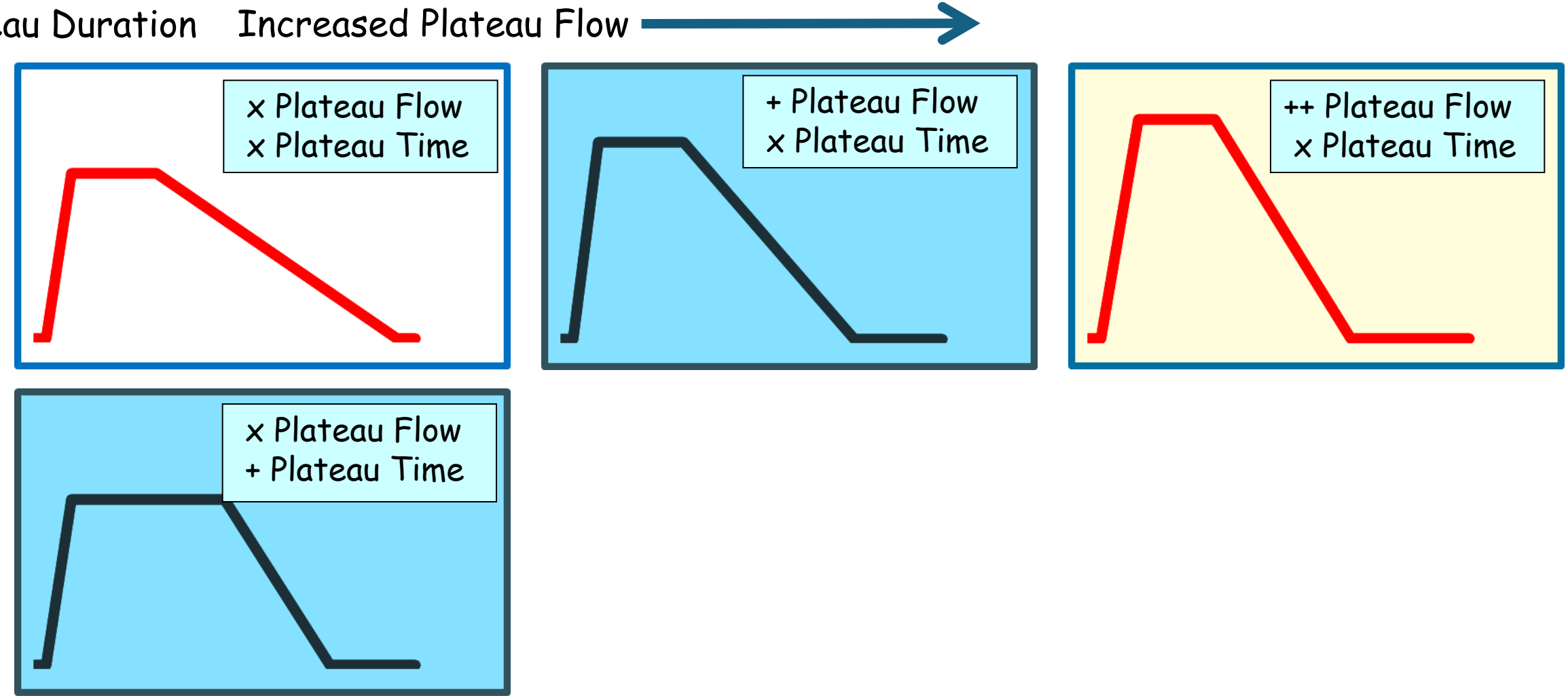
Increased Plateau Flow →



Patterns with Equal Milk Yields and Durations

Increased
Plateau Duration

Increased Plateau Flow



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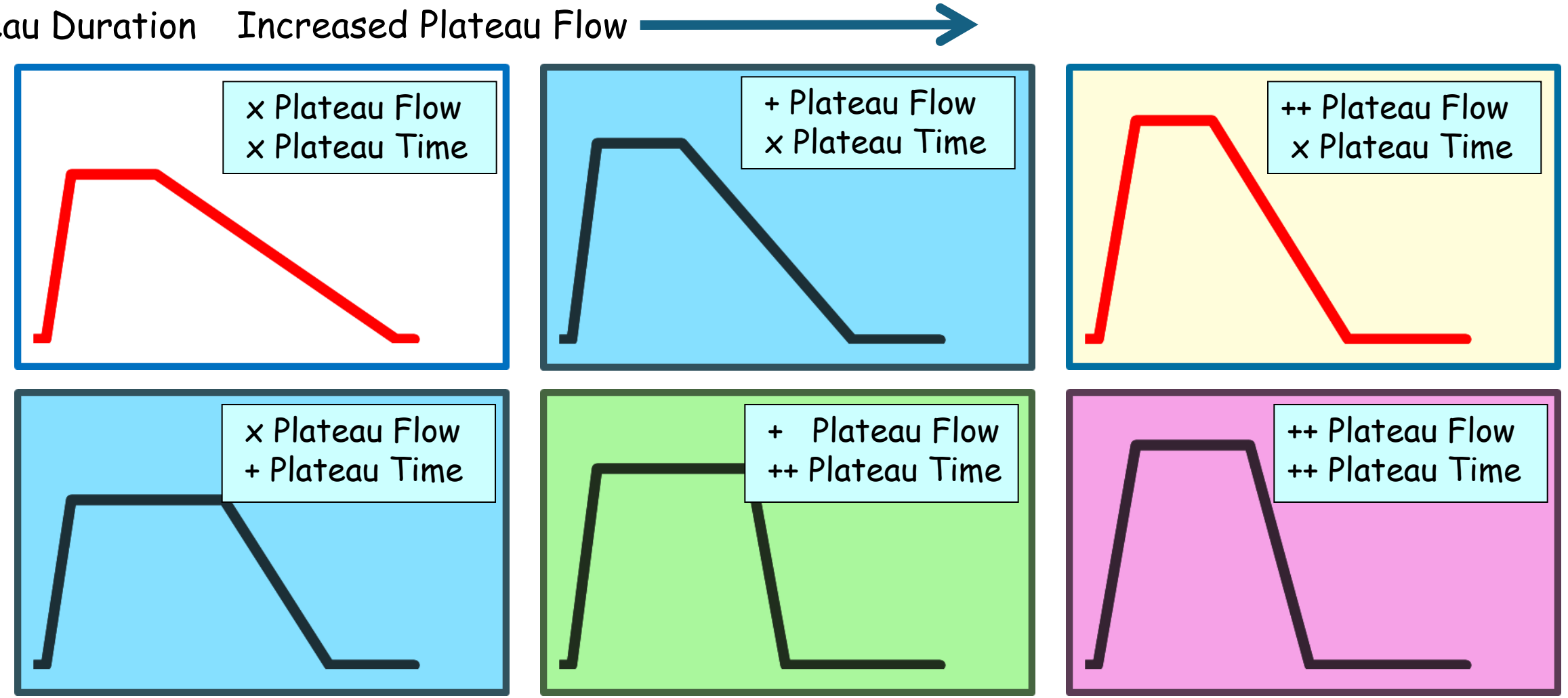

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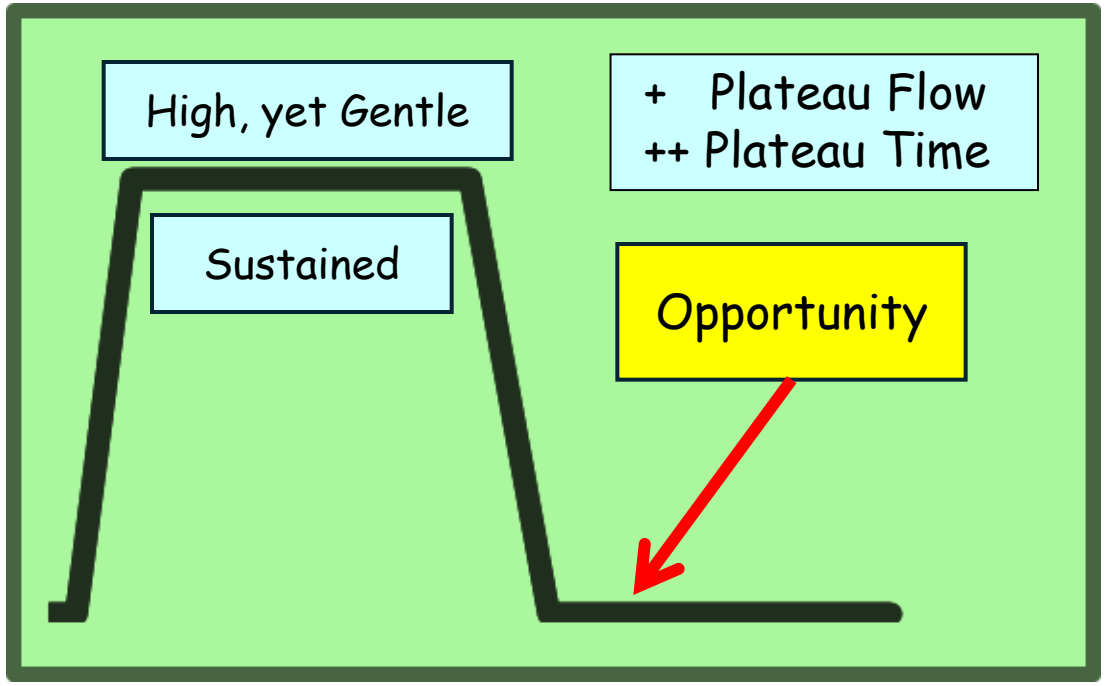


1. Very short low flow at start
2. Rapid rise to high, yet gentle, plateau flow
3. Sustained high plateau flow
4. Rapid decline near end
5. Opportunity to remove unit and reduce unit on-time

System Maintenance

System maintenance is the biggest mechanical issue I observe on dairies – small, large or mega –doesn't matter, maintenance is the issue

Does your dairy calculate the cost per cow per day for a full maintenance program based on your manufacturer's recommendations?

How many cows are milked in every stall per day?

Most producers know maintenance is important!

- Do you have a written document that outlines your equipment maintenance?
- Who performs each task?
- Who documents that the work was done?
- What is the schedule for dynamic testing?
- Does the dairy have the owner's manual for the following?
  - Pulsation system
  - Vacuum system – including vacuum regulation
  - Automation: meters, shutoffs, retraction cylinders

Example Herd Input Costs

2300 cows milked 3X in a double 30 parlor

70 pounds of milk per day

Full scheduled service program

$44,000 Parts/year

$63,000 Parts & Labor/year

Example Herd Input Costs

Daily Costs

Parts only = $120.59 or 5.24 cents/cow/da

Parts &Labor = $170.68 or 7.4 cents/cow/day

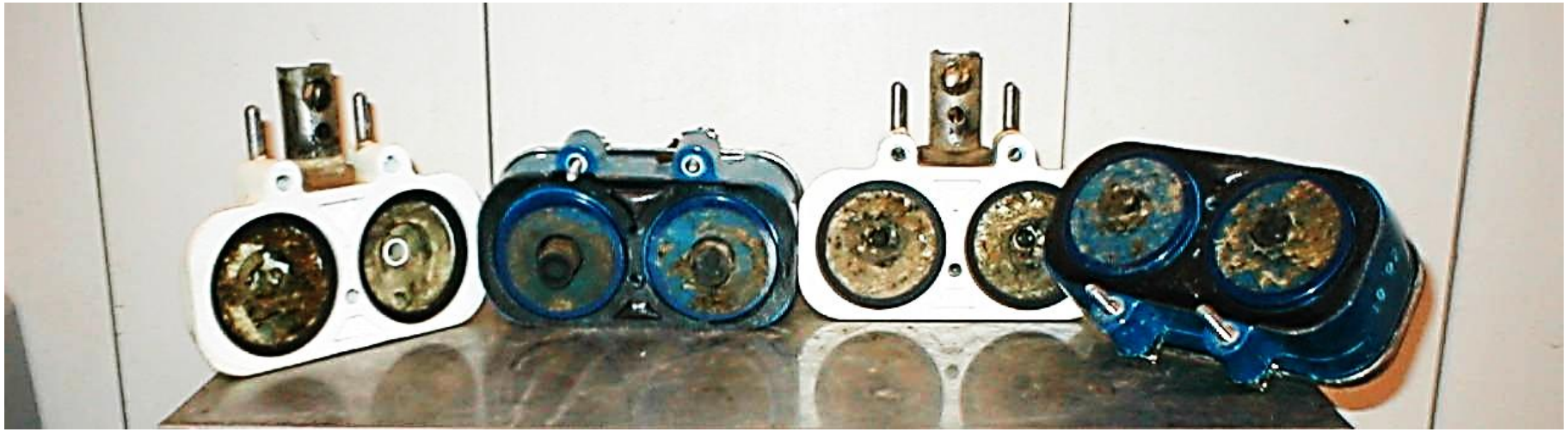
Example Herd Input Costs

If two pulsators are plugged, how many cows are at risk?

2300 cows X 3 milkings = 6,900 cows milked

6900 cows = 115 cows/unit or **230 cows @ RISK Every day!!!**

60 units

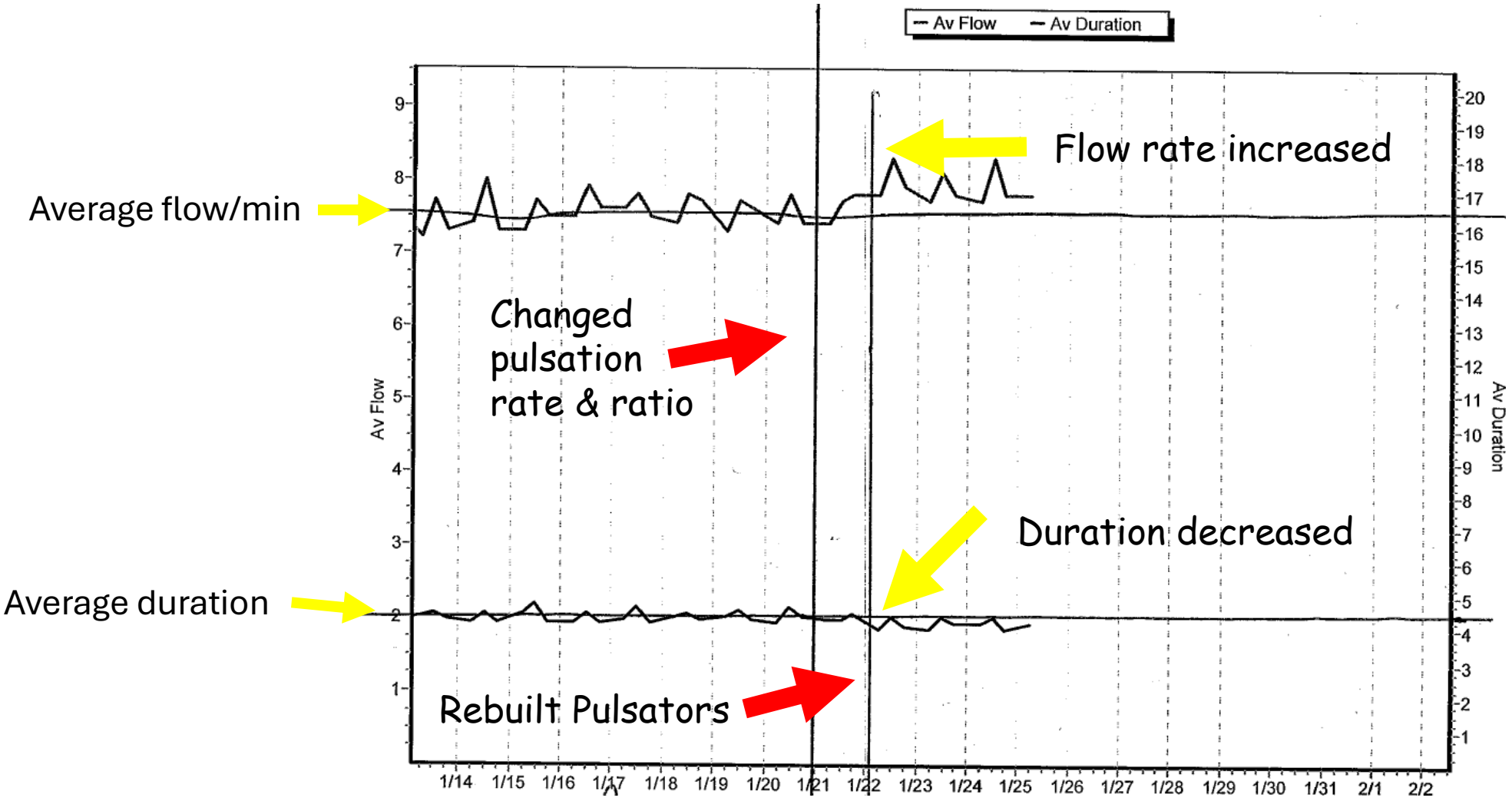


System Maintenance

Maintenance isn't a "someday" project, it should be a calendar item based on parlor size, number of cows and manufacturer recommendations.

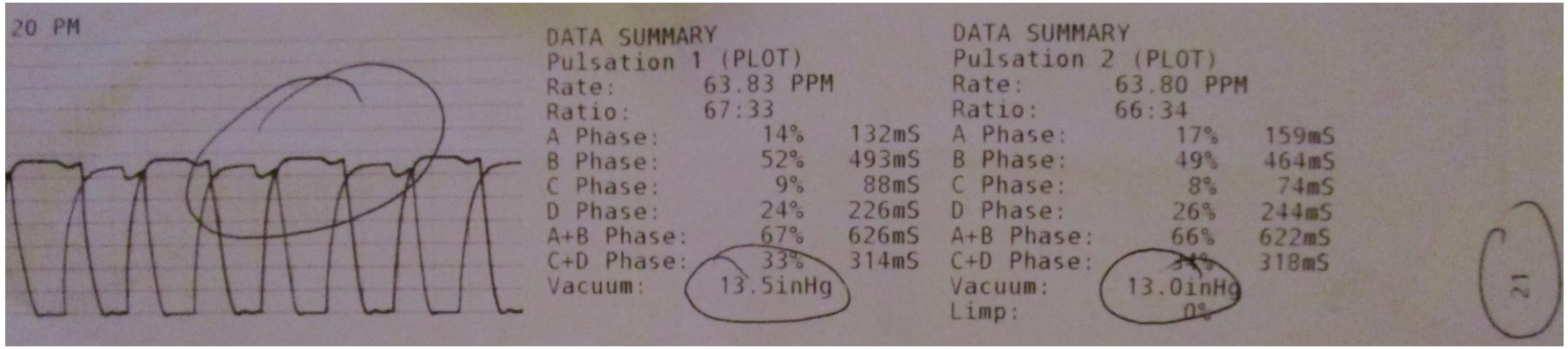
Field experience shows that proper maintenance will maximize milking efficiency and production!

Is pulsator performance important; what changed?



Pulsation system maintenance

- Pulsator rebuilding schedule based on manufacturer's recommendation.
- Short air tubes, 2 months maximum!
- Twin tubing to units from curb manifold, or pulsator depending on location, every 4 months Maximum


20 PM
DATA SUMMARY
Pulsation 1 (PLOT)
Rate: 63.83 PPM
Ratio: 67:33
A Phase: 14% 132mS
B Phase: 52% 493mS
C Phase: 9% 88mS
D Phase: 24% 226mS
A+B Phase: 67% 626mS
C+D Phase: 33% 314mS
Vacuum: 13.5inHg
DATA SUMMARY
Pulsation 2 (PLOT)
Rate: 63.80 PPM
Ratio: 66:34
A Phase: 17% 159mS
B Phase: 49% 464mS
C Phase: 8% 74mS
D Phase: 26% 244mS
A+B Phase: 66% 622mS
C+D Phase: 318mS
Vacuum: 13.0inHg
Limp: 0%
21


DeLaval

System Maintenance

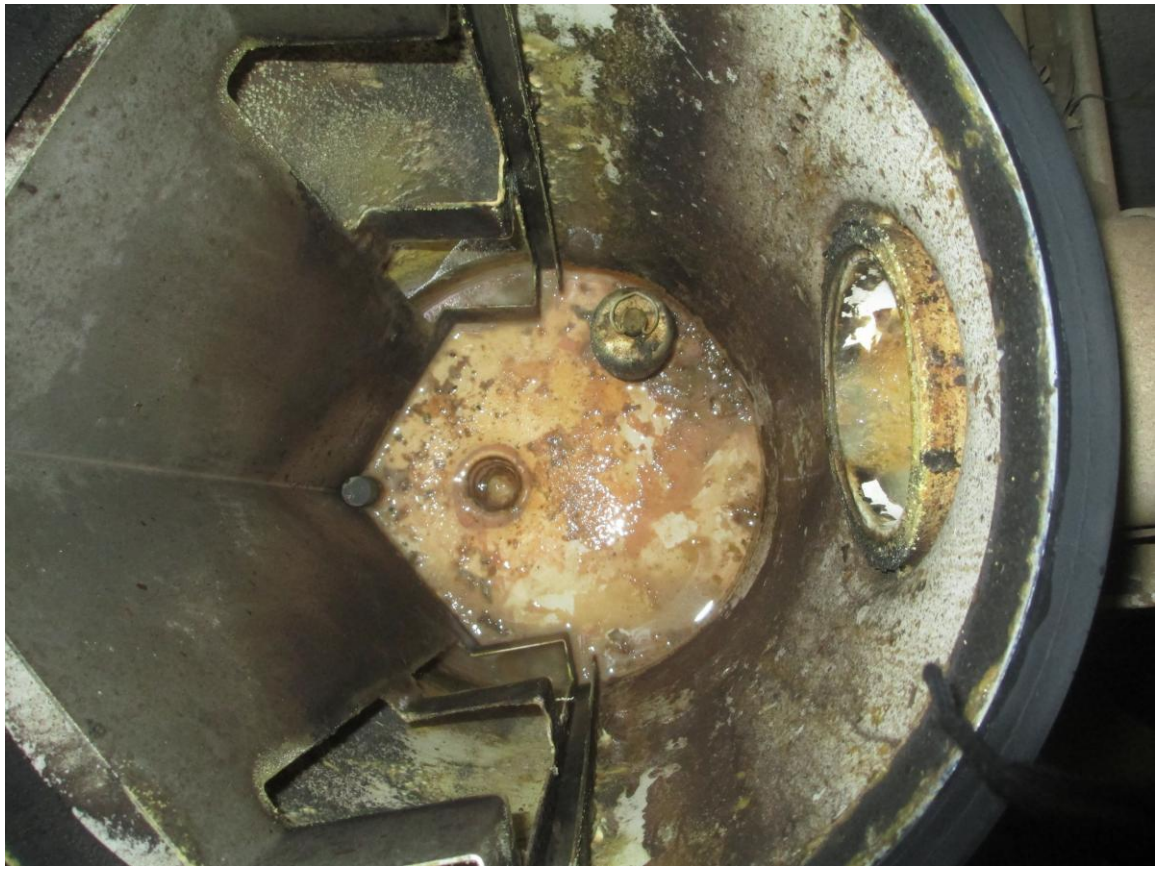
- Milk hoses; curb to claw every 4 months maximum
- All other milk & wash hoses, annually

Maintenance Vacuum System

- Are filters on "add air valves" on the schedule?

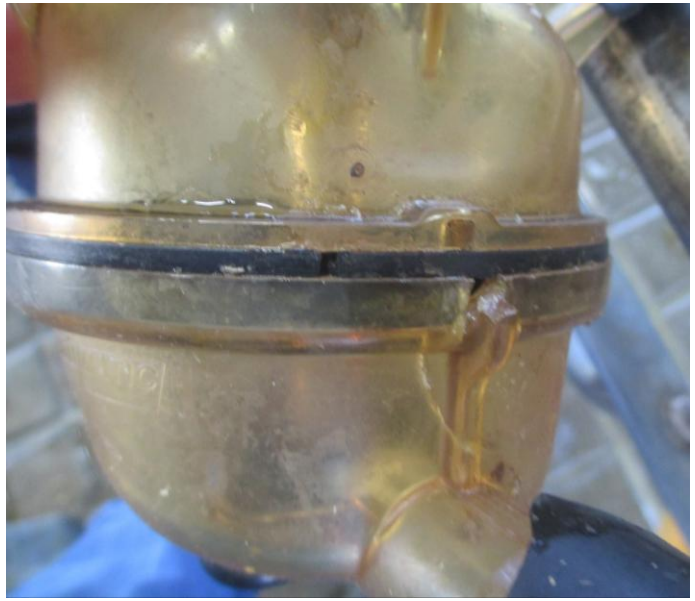
- Are vacuum regulators maintained according to the manual?

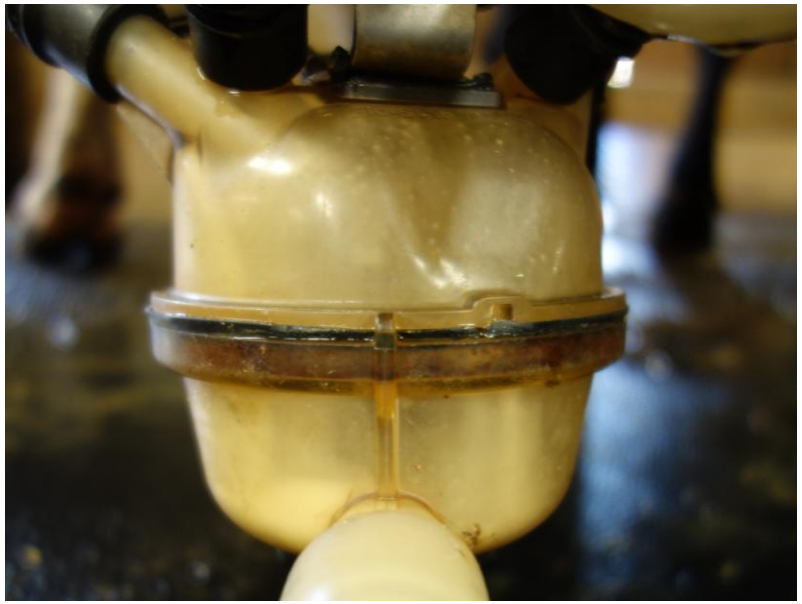
These Filter tanks will not pass the “Vet Test”!

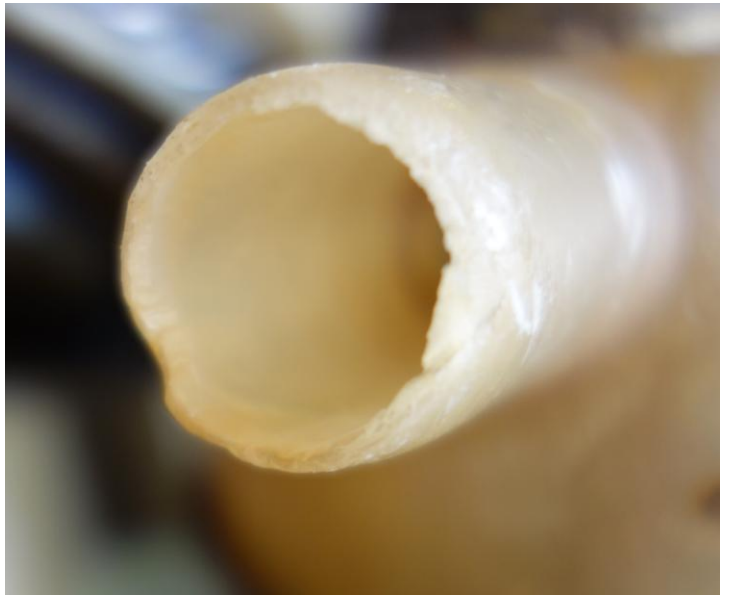


Claw Gaskets

- High use 18+ hrs/day, 6 month maximum
- Inspect at every gasket change







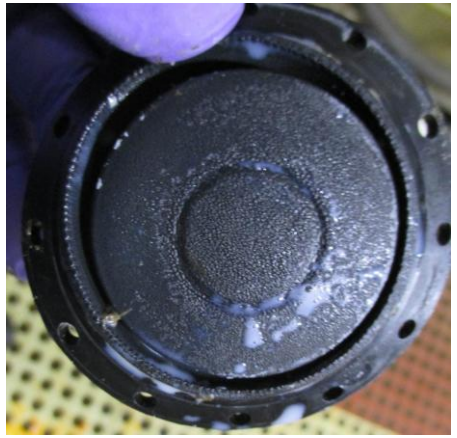
Maintenance Wash System

- Air injector filters & air blow filters

- Scheduled chemical pump capacity evaluation; is the volume correct?

System Maintenance

- Diaphragms in shutoff valves
  - No more than 4 months



- Retraction cylinders & connections to claws
  - How many units hit the deck?
  - How many units hang on the teats after retraction starts?

Parlor Considerations

- All parlors have a limit to the number of cows that can be successfully milked, what is your parlors capacity?
  - Quickly, gently and completely

- What happens when a glitch occurs, how far behind do you get.
  - 4000 cows, 3X = 6.9 turns/hour
  - Stressed milk harvest technicians
  - The milk you miss never comes back!

- Are those extra cows really worth it?

Parlor Upgrade Considerations

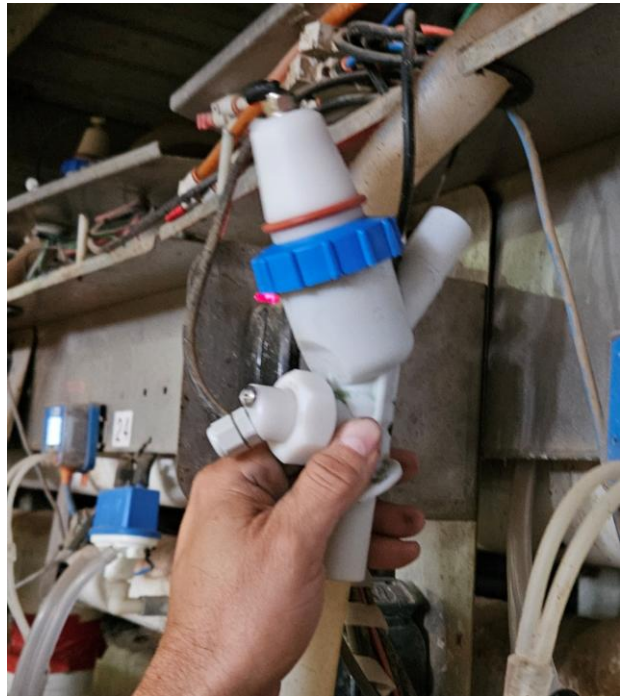
- If you build a bigger parlor, does it fit your current pen sizes?
  - Holding pen size
- Many existing parlors do not have basements
  - Shutoffs, sensors, or meters are in a very difficult position to service
  - May require significant labor to achieve proper slope to the milk lines, pits for receivers, relevel milk lines
- Parallel parlors loss efficiency as they get longer
  - Expansion may not bring the anticipated capacity potential
  - Load times are at least 1 second per stall

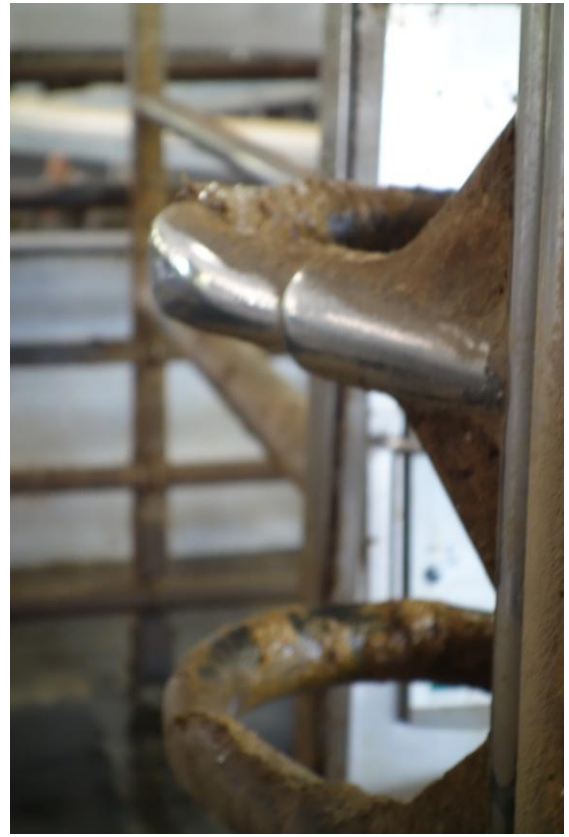
Parlor Expansions/New parlors

- Closely review installation plans, build it right the first time!
  - Do all areas have correct slope and grade of concrete, hire an engineer!
  - Are there test ports installed at correct locations
  - Consider methods to reduce noise

Parlor Expansions/New parlors

- Install it correctly the first time
- Do all low points on vacuum supply lines have drains
- Do all vacuum supply lines have inspection ports/tees
- How easy it to access
  - Pulsators
  - Shut off valves
  - Meters
  - Retraction cylinders
  - Other monitoring devices





Proliferation of large Rotary Parlors

- Easier to train milk harvest technician's; constant position
- Can allow for automation as newer systems come on line which can operate faster, ie pre-post dip robots/arms
- Question:
  - Why do most if not all have wide entry ways?

Natural cow behavior is to follow another cow

Large Rotary parlors

- Normal walking speed for a dairy cow is 2 miles per hour
  5280 ft X 2 = 10,560 ft/hour
  10,560 divided by 60 = 176 ft/min
  176 ft/min divided by 60 = 2.93 ft per second

Do we need entrance alleyways that are 8 or more feet wide?

Rotary Shielding

- Most rotaries do not have shielding high enough
  - Cows should not be able to see over the top, focus cows on the cow in front of them, line them up single file and build the entrance correctly

Reid's top 3 What's New

- DairyProX from GEA.com
- Vortex by Udderways.com
- Shelex 360 auto assist system from Ag Sherpa info@agsherpa.ca

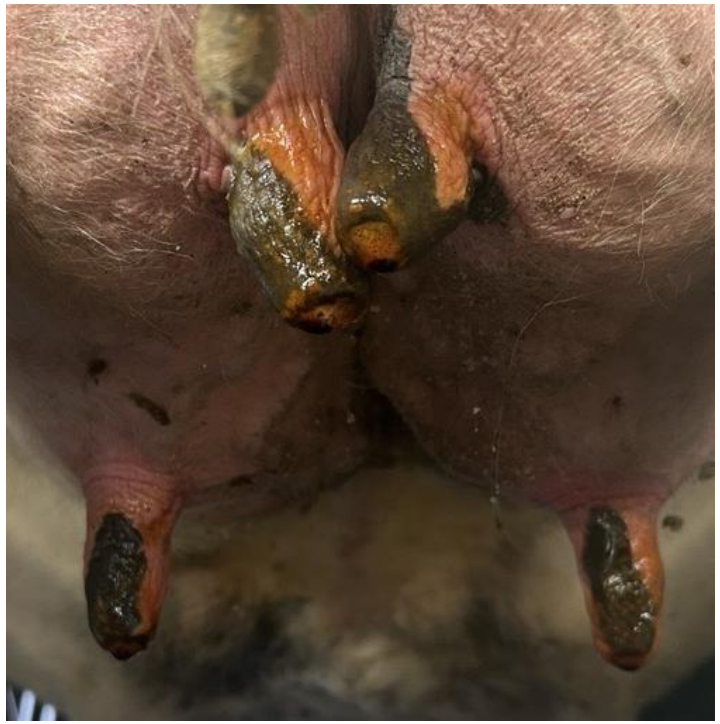
DairyProX

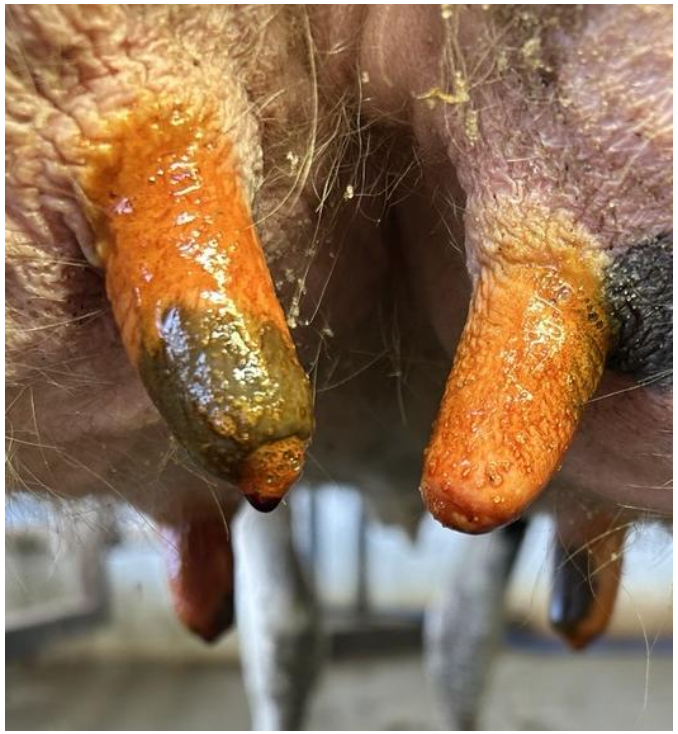
- Removes the arm & camera, technicians only attach units, with the advantage of “absolutely consistent” udder preparation!
- Components are installed in the basement, a much better environment than a box robot!
- Now with several test dairies in NA
- Works with any system with a basement, will need GEA claws and liners only, can keep automation/meters

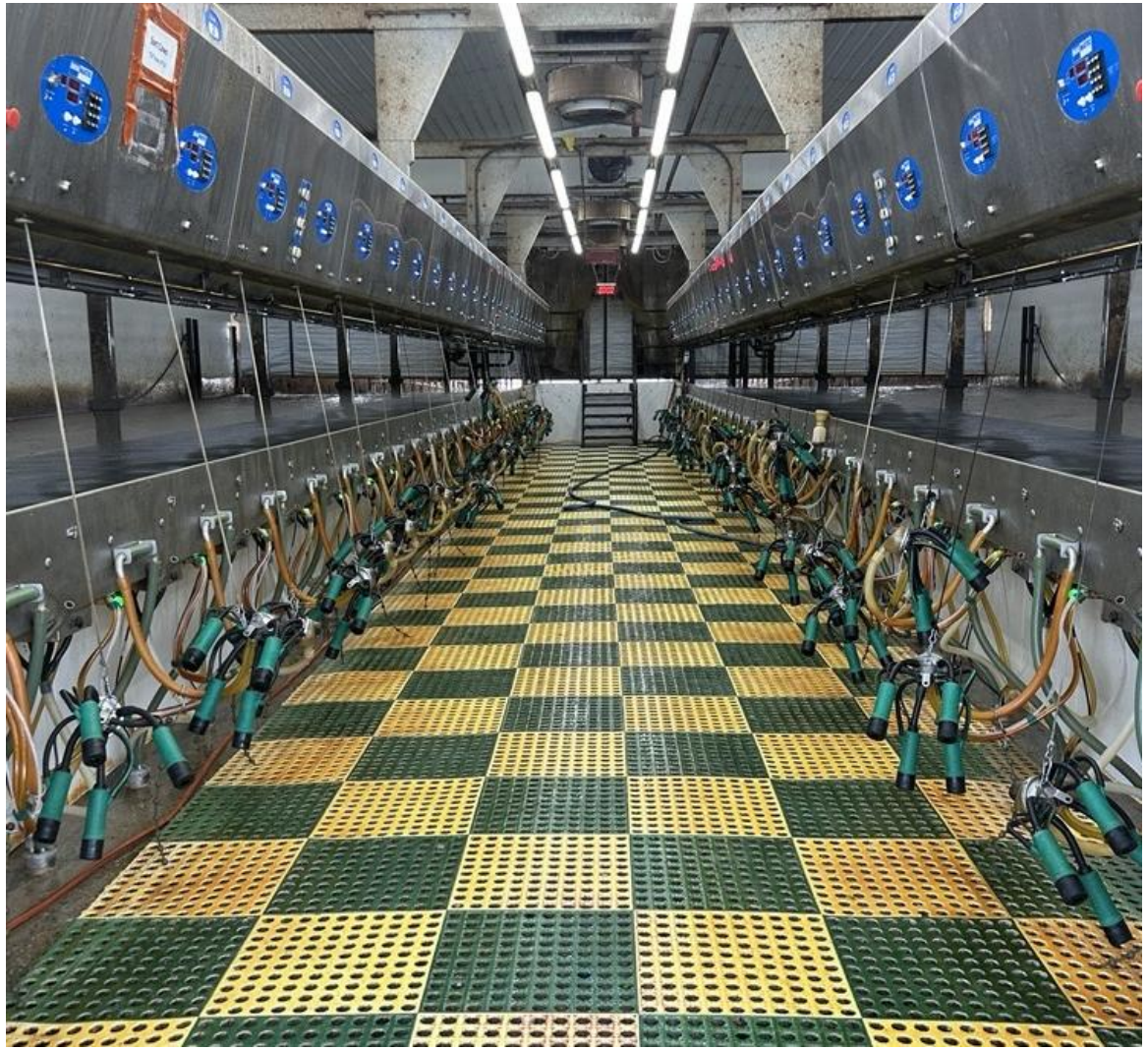

GEA
DairyProX


GEA
DairyProX


GEA
GEA
GEA
GEA








1
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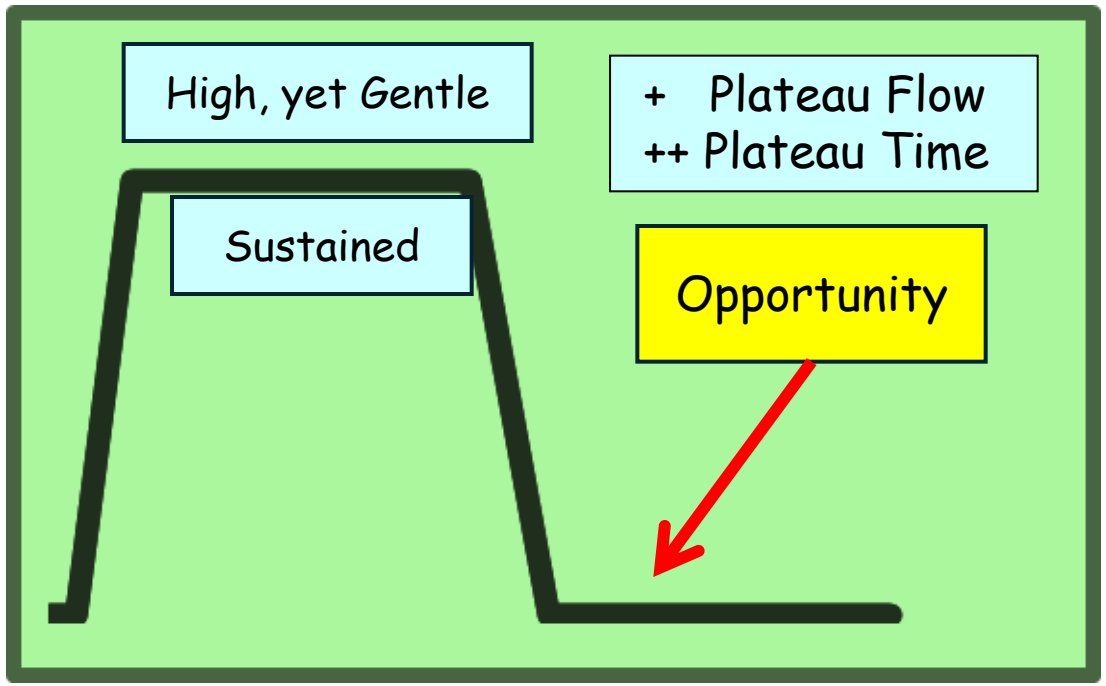
DairyProX



1. The milk flow graphs approach the model used by Steve Stewart, DVM for milk line capacity calculations in 2025

2. Once the cleaning/stimulation phase ends, rapid increase to plateau milk

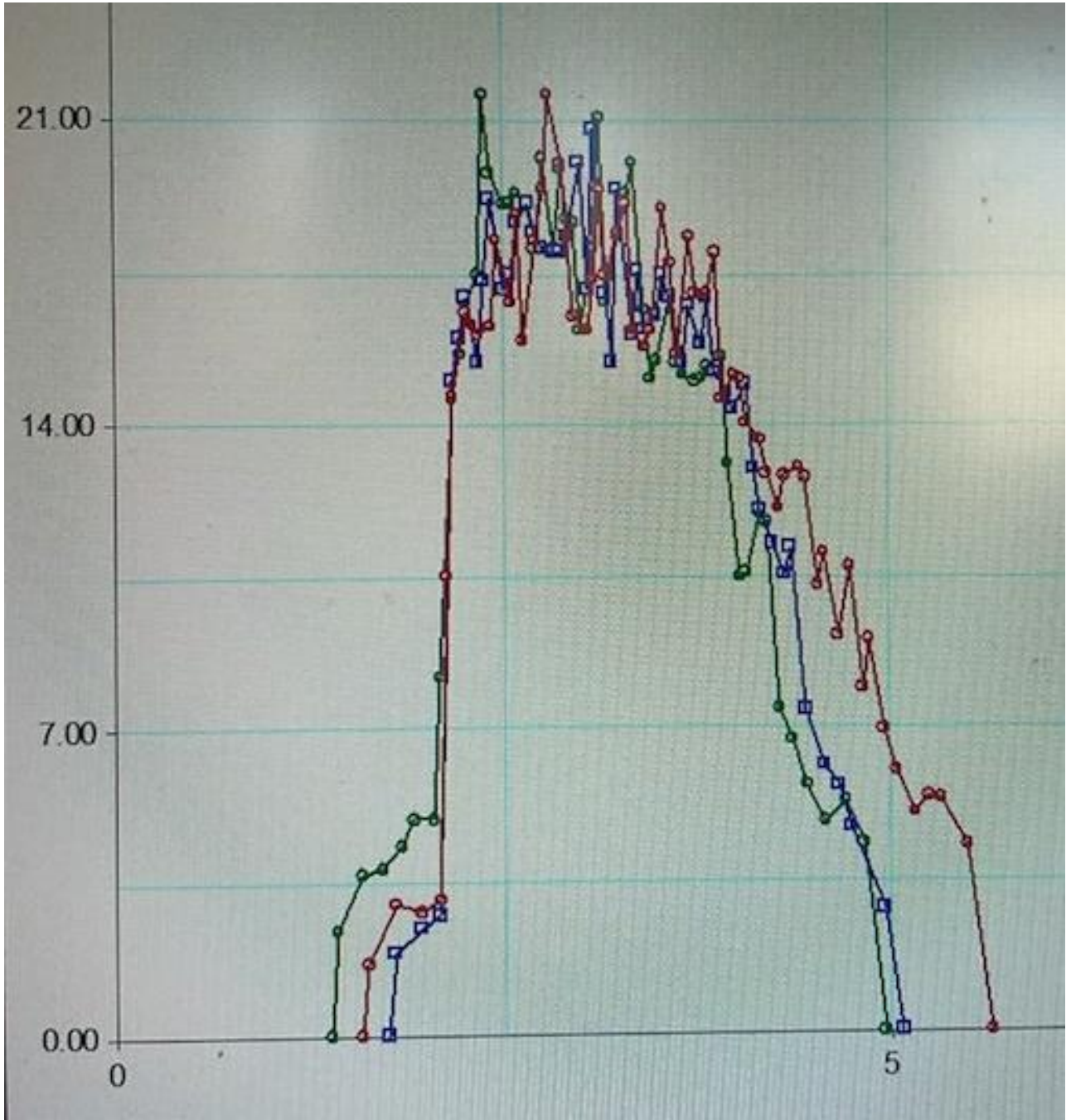
3. Opportunity to remove unit and reduce unit on-time

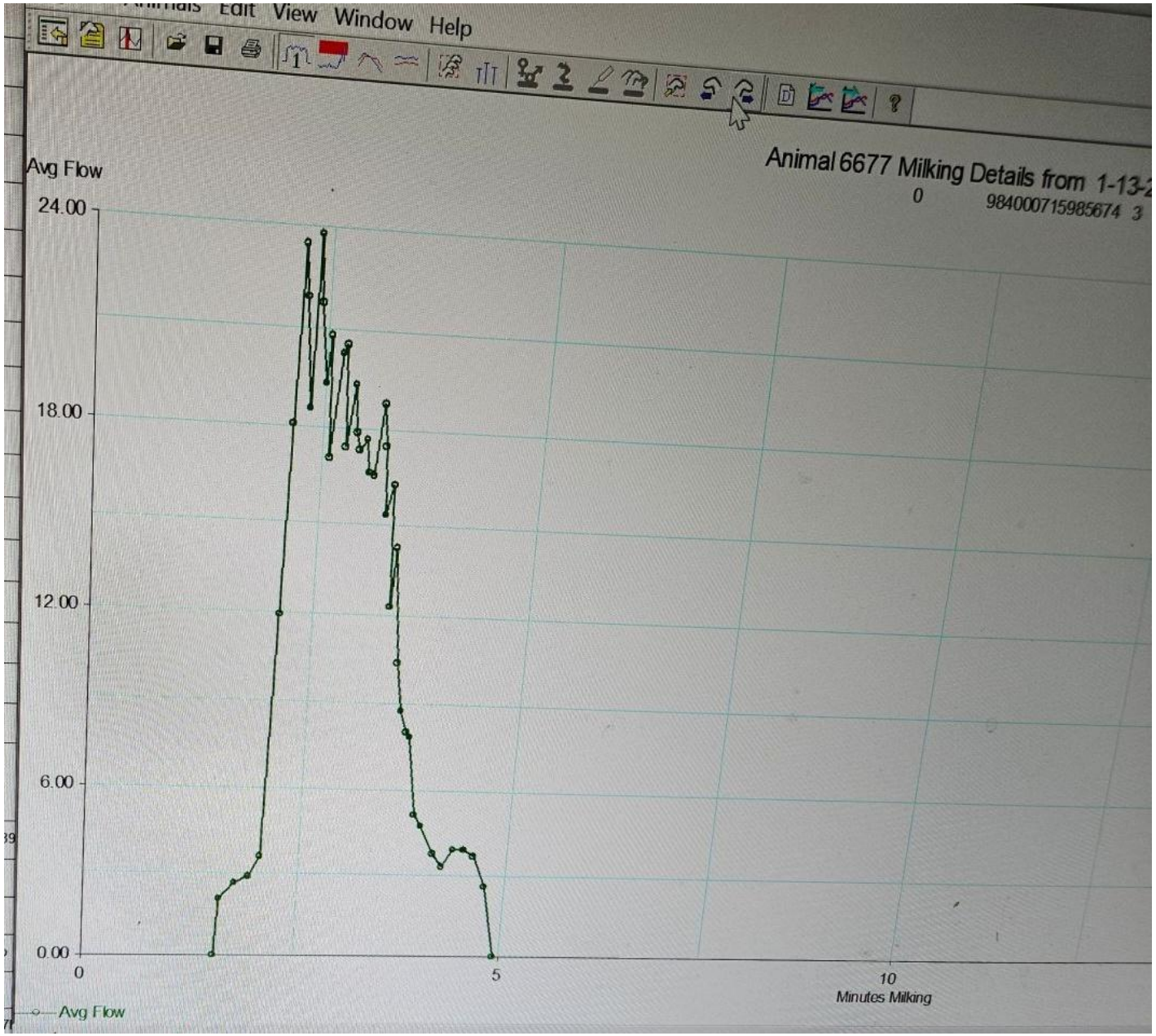
3 Milkings Same Cow with exactly the same udder preparation

red 35#

blue 32#

green 26#

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Avg Flow
Animal 6677 Milking Details from 1-13-2
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24.00
18.00
12.00
6.00
0.00
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5
10
Minutes Milking
Avg Flow

Vortex by Udderways.com

info@udderways.com 585-201-8332

- Uses high pressure water and compressed air to clean & stimulate cows.

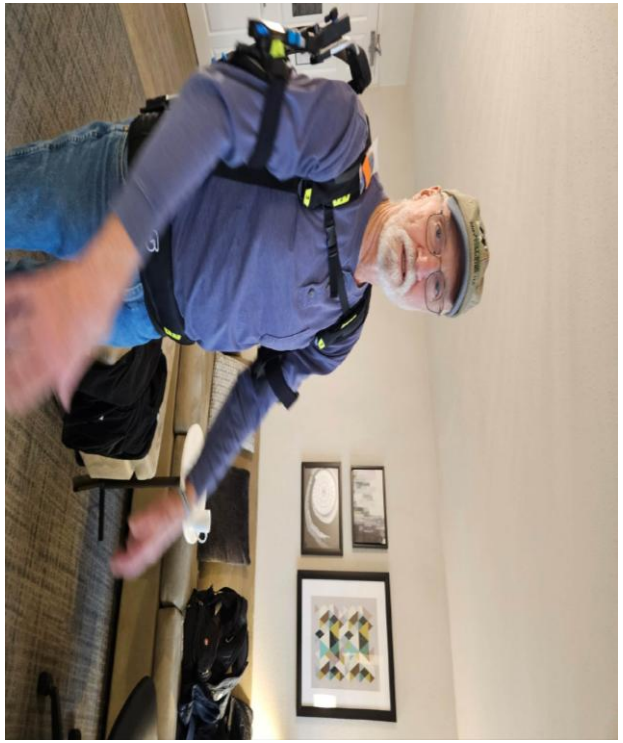
Vortex: Actively looking for trial herds

- Advantages
  - No brushes; limits contamination
  - Testimonials say that the unit actually has some lift due to the spray pattern
    - Low fatigue for milk harvest technicians compared to conventional brush systems
  - When used properly, drying is without towels

- Challenges
  - Water use level
  - Still investigating germicides compatibility and still be economical for the volume of water requires

Skelex 360

Skelex 360 takes a literal weight off your shoulders—lightweight, maintenance-free, and designed to support your arms during milking and overhead tasks



Skelex 360

- Reduces fatigue, especially when brush systems are being used.

Ray Brubacher Story BullVine

Bullvine.com founded by Andrew Hunt

- A legendary Holstein breeder and judge
- This article highlights his character, honesty and relationships over his career. He left several high profile jobs due to changes made to verbal agreements. He based his career on "Trust".
- This story also highlights the changing dairy landscape; we are losing roughly 4+% of the dairy herds in the US every year
- **Will you still be milking cows in 2035 when USDA projects 15,000 herds left in the US?**

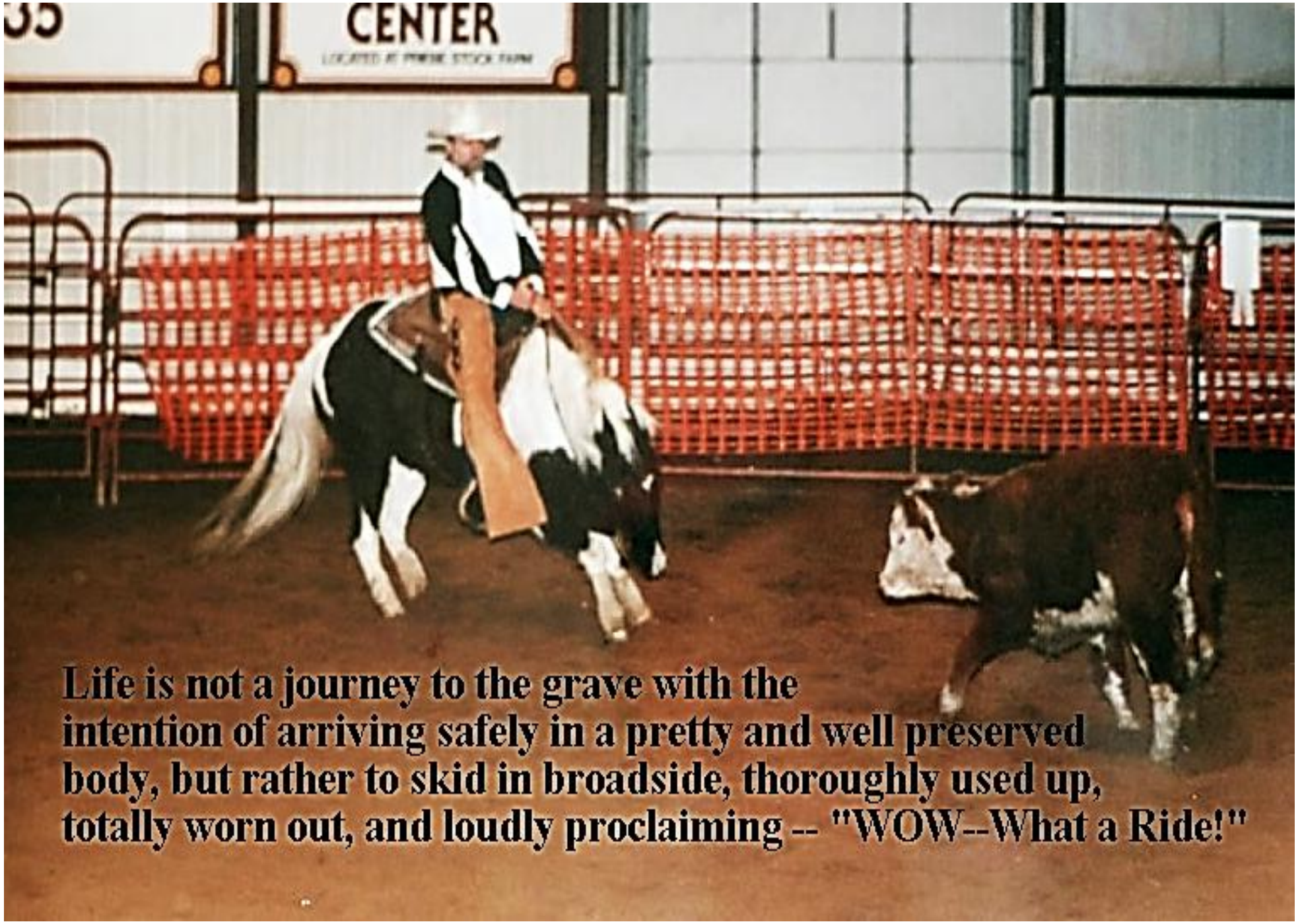
Highlights from this article:

- "Think about your operation right now.
  - Your banker
  - Your feed supplier
  - Your veterinarian.
  - Your milk buyer
  - Your employees
- Do they trust your word?
  - When you say you'll do something, do you do it?
  - Even when it's inconvenient?
  - Even when circumstances change?"

- “Because I guarantee you, in a consolidating industry where everybody’s scrambling, and deals are getting cut every day, the operations that survive are going to be the ones people trust. The ones where a handshake still means something. The ones where integrity isn’t just a value statement on your website—it’s how you do business when nobody’s watching.”

- “Your word is the only thing that appreciates while everything else depreciates.”

- “Reputation is your only appreciating asset. Barns depreciate. Genetics become outdated. Trust compounds.”


CENTER
Life is not a journey to the grave with the
intention of arriving safely in a pretty and well preserved
body, but rather to skid in broadside, thoroughly used up,
totally worn out, and loudly proclaiming -- "WOW--What a Ride!"