



WELCOME! OABP / DHMCP SPRING CE

May 27 and 28 2026

Reminders...

- Silence all cell phones
- Wi-Fi
- Fill out your evaluation sheet as the presentations end, and leave them on the table afterwards



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Refreshment Break Sponsors



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OABP Accounting and Year End Statements



Wednesday, May 27, 2026

8:00 - 9:15 AM	<i>Registration and Refreshment</i>
9:15 - 10:15 (8:30 for #1)	Workshops 1. (Provide Choices 1st to 3rd) ____ ____ ____ 1. 08:30 – 10:00 Practical Trimming and Treatment: An evidence-based approach (cadaver feet, in the Clinical Skills building - Dr Sara Pedersen) (max 8) 2. Making sense of bedding, towel, and pasteurizer cultures (Dr. Michael Zurakowski) (Max 20) (1725) 3. Rational use of antibiotics in calf diarrhea (Dr. Luiza S. Zakia) (Max 20) (1715)
10:15 - 11:00	<i>Refreshment break and Visit Sponsor Exhibits</i>
11:00-12:00 (10:30 for #1)	Workshops 2. (Provide Choices 1st to 3rd) ____ ____ ____ 1. 10:30 – 12:00 Practical Trimming and Treatment: An evidence-based approach (cadaver feet, in the Clinical Skills building - Dr Sara Pedersen) (Max 8) 2. Making sense of bedding, towel, and pasteurizer cultures (Dr. Michael Zurakowski) (Max 20) (1725) 3. Rational use of antibiotics in calf diarrhea (Dr. Luiza S. Zakia) (Max 20) (1715)
12:00-1:00	<i>Lunch and Visit Sponsor Exhibits</i>
1:00 - 1:15	Welcome and intros
1:15 - 2:15	Dr Sara Pedersen - A problem shared: A collaborative approach to lameness
2:15 – 2:45	Research summaries
2:45 – 3:15	<i>Refreshment break and Visit Sponsor Exhibits</i>
3:15 - 4:15	Dr. Michael J. Zurakowski - Microbiologist Approach to Mastitis
4:15 - 5:15	Dr. Wolfgang Heuwieser - Using AI for vet CE

Thursday, May 28, 2026

8:00 - 8:30 AM	<i>Registration and Refreshment</i>
8:30 – 9:15	Dr Sara Pedersen - Baby Steps: Why we need to focus more on pre-calving heifers to control lameness
9:15 – 9:45	Emily McDonald - DFO Milk quality update
9:45 – 10:30	Dr Sara Pedersen - Early Detection and Prompt Effective Treatment of Lameness: What does it actually mean?
10:30 – 11:00	<i>Refreshment break and Visit Sponsor Exhibits</i>
11:00-12:00	Dr. Stephen LeBlanc - Longevity and lactation length
12:00-1:00	<i>Lunch and Visit Sponsor Exhibits</i>
1:00 -1:30	Research summaries
1:30 – 2:45	Dr. Michael Zurakowski - Microbes, Machines, Management, and Mastitis
2:45 – 3:00	Questions. Evaluations. Adjourn.



Baby Steps: Why we need to focus more on our heifers

Dr Sara Pedersen
RCVS Specialist in Cattle Health and Production

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1

Focus on Heifers

Background

Interventions

1. Genetics
2. Digital Dermatitis
3. Heifer Groups
4. Hoof Trimming
5. Early Detection and Prompt Effective Treatment
6. NSAIDS



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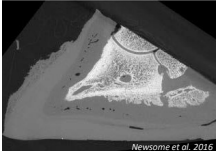
Background

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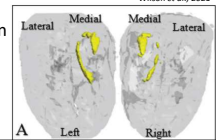
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The Age Effect

- Once a cow is lame she enters a chronic cycle:
 - Underlying damage due to inflammation
 - Pedal bone
 - Digital cushion
- Once a cow has been lame her risk of going lame is increased
- Disease processes start in heifers
- Need to shift away from cows and focus more on heifers
 - Pre-calving
 - First lactation



Newsome et al., 2016



Wilson et al., 2021

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How many of our heifers are lame?

Studies on lameness in 1st Lactation:

2006 (Bell):

- Mean prevalence **16.0%** (0-55.6%)

2017 (Mahendran et al.):

- **41.1%** of heifers went lame in 1st lactation
- Peak risk 29-42 days (12.2%)
- End of lactation 1.1%
- Transient and dynamic nature of lameness

Target prevalence in 1st lactation = <5%



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Interventions

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1. Genetic Selection

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1. Genetic Selection



- University of Liverpool work on select group of farms
- Genetic selection for some lesions is promising:
 - Digital Dermatitis: Heritability (h^2) = 0.34
 - Sole haemorrhage/bruising: Heritability (h^2) = 0.29
 - Sole Ulcers: Heritability (h^2) = 0.34
- Less so for white line disease (h^2 = 0.1)

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2. Digital Dermatitis

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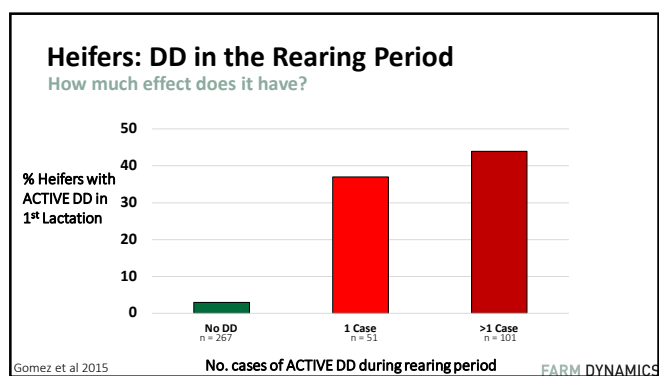
2. Digital Dermatitis



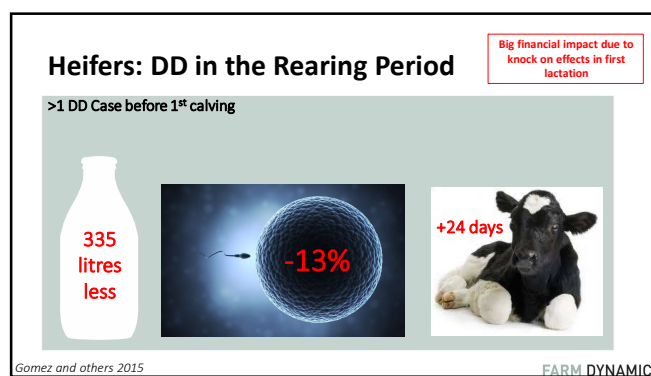
- Digital dermatitis pre-calving has a large impact on future risk
- Enter herd and drive 'flare ups'
- Long term herd control not possible without control in youngstock

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Preventing DD in Heifers

- Biosecurity between cows and heifers
 - Automatic/tractor scrapers
 - Gathering herd together for management tasks
- Building resilience through appropriate nutrition
 - Vitamins A, E & Biotin
 - Trace minerals: Zinc, iodine, selenium, copper
- Footbathing



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3. Heifer Groups

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3. Heifer Groups and Comfort

- Weaknesses in the foot around calving
- Longer recovery in heifers vs cows
- Strong evidence of benefit of straw yards 4wks before to 8wks after calving (Webster 2002)
- Comfortable, deep bed more practical to achieve?
- Separate heifer group:
 - Less bullying
 - Less impact on feeding
 - Improved lying times?



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Cubicles and Dimensions

- Train to cubicles prior to calving
- Lying times drop by 2.9-4.2 hours on introduction (von Keyserlingk et al., 2011)
- Protective effective of exposure to concrete prior to calving? (Randall et al., 2016)
- But cubicles need to be the right dimensions



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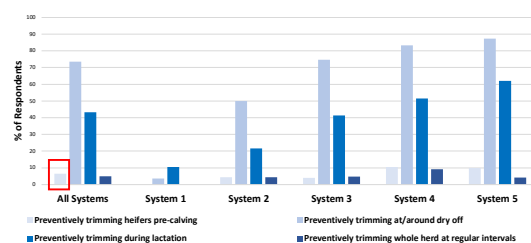
4. Hoof Trimming

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4. Hoof Trimming

Very few farms undertaking preventive trimming of pre-calving heifers

Pedersen et al. 2021
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What does the evidence say?

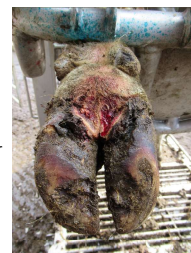
- That it increases risk of lameness!
- BUT confounding factors:
 - Close to calving (3 weeks)
 - High wear environment – sand on new concrete
- If we are thinking 'if' we should trim, should we also consider 'how'?

Mahendaran et al. 2017
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Enrolment Criteria

- Enrolled 50-70 d prior to predicted 1st calving
- Excluded if:
 - History of lameness
 - Clinically lame (MS ≥ 2) and/or requiring treatment for claw horn lesion at the point of enrolment
 - Not present at enrolment visit

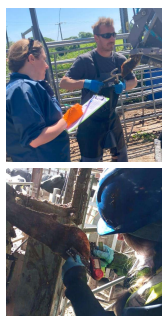


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Measurements

- **1,023 heifers enrolled in total**
 - Mechanical failures, incorrect treatment applied, Covid!
- Hoof trimming: 5 qualified hoof trimmers
- At enrolment (all undertaken by SP)
 - Mobility scored (adapted 0-3: 0, 1a, 1b, 2a, 2b, 3a, 3b)
 - BCS (visual)
 - Dorsal wall length (from where horn hard to roll of toe on axial wall)
 - Foot angle
 - Depth and width of model (if applicable)
 - Lesions recorded (if present): 0-3 severity
 - Corkscrew severity



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Follow Up

- Fortnightly mobility scored by same observer (SP) 60-90 days in milk
- 60-90 days in milk: Reinspected, trimmed with large model
- Additional measurements:
 - BCS
 - Lesions present
 - Dorsal wall length
 - Foot angle



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Main Results

• 888 heifers

- No statistical difference between Control and Small
- Statistically significant different between Control and Large
43% reduced odds of developing lesions
- Impacted by BCS and Farm

	No. Heifers	% with Lesion
No trim	313	16
Small	295	15
Large	280	10



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	Control (n=313)	Small (n=295)	Large (n=280)
Sole haemorrhage			
Severity 2	33 (10.54%)	27 (9.15%)	19 (6.49%)
Severity 3	10 (3.19%)	7 (2.37%)	2 (0.71%)
Sole ulcer	2 (0.64%)	3 (1.02%)	0 (0.00%)
Heel ulcer	2 (0.64%)	0 (0.00%)	1 (0.36%)
White line haemorrhage			
Severity 2	3 (0.32%)	0 (0.00%)	0 (0.00%)
Severity 3	0 (0.00%)	0 (0.00%)	0 (0.00%)
White line disease			
Severity 2	1 (0.32%)	6 (2.03%)	4 (1.43%)
Severity 3	0 (0.00%)	0 (0.00%)	1 (0.36%)
Axial horn fissure	1 (0.32%)	0 (0.00%)	0 (0.00%)

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What about Mobility Scoring?

No statistical difference between never vs ever lame between the groups

BUT mobility score is multifactorial

- More knocks in heifers?
- Better at hiding lameness?



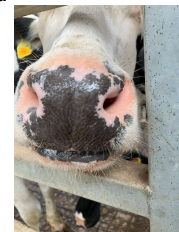
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Conclusion

In housed pre-calving heifers, trimming with a deep, wide model 50-70 days before predicted calving date significantly reduces the risk of developing a claw horn lesion in early lactation

BUT:

- Trim at the correct time
- Don't overtrim



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5. EDPET

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5. Early Detection and Prompt Effective Treatment

- Large proportion of heifers have moderate to severe bruising in first lactation
- Significant impact on milk yield
- Increases risk of future lameness
- Need to focus on picking up heifers early
- Better at compensating for lameness as smaller and fitter?



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6. NSAIDs at Calving

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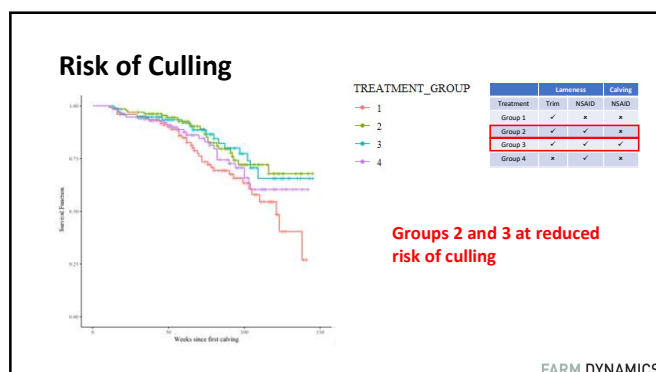
Effect of Routine NSAID at Calving

- 34 month randomised control trial
- Heifers recruited as they calved into herd (n = 438)
- Mobility scored fortnightly
- One of 4 treatment groups:

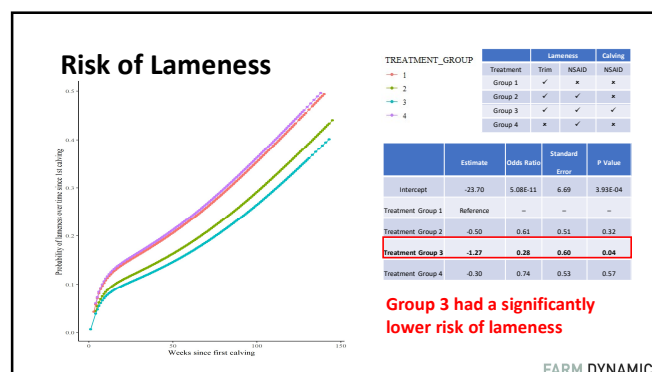
Treatment	Lameness		Calving
	Trim	NSAID	NSAID
Group 1	✓	×	×
Group 2	✓	✓	×
Group 3	✓	✓	✓
Group 4	×	✓	×

Wilson et al., 2022
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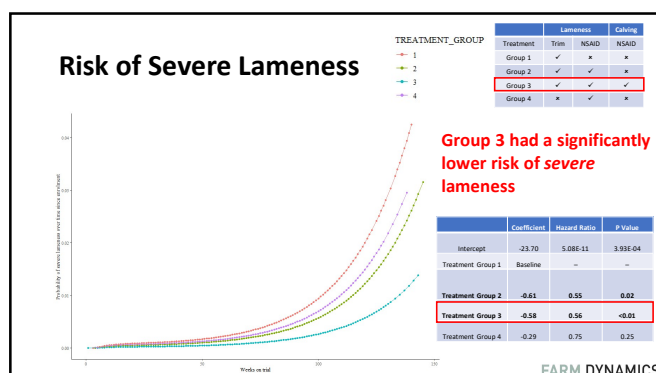
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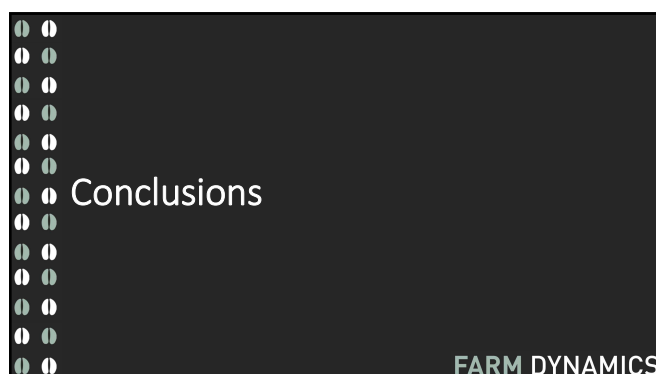
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6. NSAIDS

- Clear benefit in NSAID when lame
- What about calving?
- Benefit to giving 3 days of NSAID (ketoprofen) at calving
 - Reduced risk of culling
 - Reduced risk of lameness
 - Reduced risk of severe lameness
 - BUT this was also alongside EDEPT with NSAID use in new cases

This effect was not seen in cows!

34



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Conclusions

- Start recording and assessing lameness levels in heifers
- Aim for <5% lame
- Incorporate lameness indices in genetic selection
 - Should we breed heifer replacements from lame cows?
- Focus on DD control in heifers
- Is the heifer accommodation fit for purpose?
- Review hoof trimming protocols
- Consider NSAID use as routine at calving



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Thank you

Any final questions....



sara@farmdynamics.co.uk
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A Problem Shared...

A collaborative approach to lameness

Dr Sara Pedersen
Farm Dynamics Ltd™
Wales, United Kingdom

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Overview

- Tackling lameness is hard
- Many different...
 - Causes
 - Solutions
 - Opinions!
 - Barriers to change
- It takes time
- There is no single right way to approach it... or to talk about it



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Let's talk... but how?

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Different Methods of Knowledge Exchange

- Individual
- One to one: Adviser to producer
- One to all: Adviser to the whole farm team
- Peer to peer learning

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European Innovation Programme Project



- Explore how different methods of knowledge exchange influenced:
 - Perception
 - Knowledge
 - Behaviour
 and how this was related to changes in prevalence
- Pilot two new methods of knowledge exchange:
 - Healthy Feet Programme
 - Farmer Led Action Groups



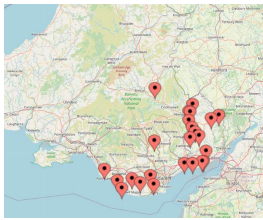
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Farm Overview



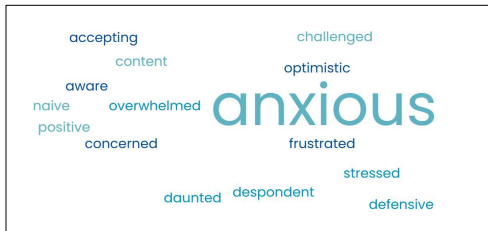
- 24 farms
- 5,422 cows
- Varied systems
 - Breeds
 - Calving pattern
 - Milking frequency
- Average 9,104 litres/cow/year
 - Range: 3,500-11,500 litres
- Total milk sold per year: 54.8million litres




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Impact on the Farmer: Start



Target for lameness:
0-5%

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Ways of team working



- Within the farm team
- Peer to peer learning/support

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The Farm Team

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The Foot Health Team

- Who's at the table?
- Are you all on the same page?
- Is everyone clear of their role?
- How often do you meet?
- How do you communicate?
- What's the goal?



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Team Work: Making it work

1. Establishing communication
2. Data analysis to drive decisions
3. Action planning

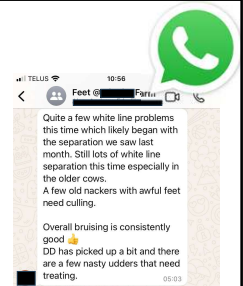


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1. Communication

- Needs to enable quick, easy and convenient sharing of information
- Everyone 'in the loop'
- Maintains momentum between hoof trimmer visits
- Feedback



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2. Data driven decisions

- Hoof trimmer data is invaluable
 - Identifies main challenge on farm
 - Gives economic insight
 - Monitors response to change or challenge

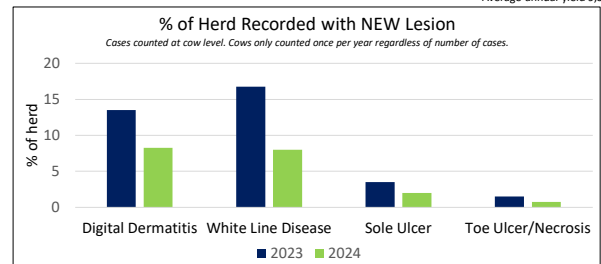


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Monitoring Progress

400 Holstein Cows
Autumn block calving herd
Grazing 8 months of year
Average annual yield 9,500L

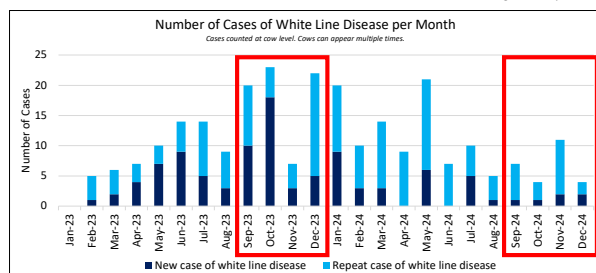


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Identifying Challenge Periods

400 Holstein Cows
Autumn block calving herd
Grazing 8 months of year
Average annual yield 9,500L

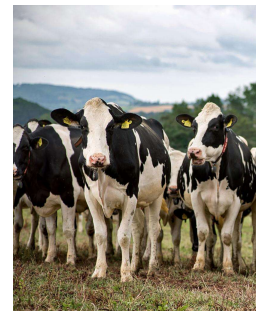


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3. Action Planning

- Need a plan with whole team buy in
- Facilitate it with the team
 - What's working well
 - What's not going well
 - What can we do?



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Beyond the Farm

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Beyond the farm: A different level of collaboration

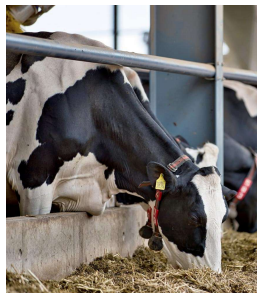
- It's often not the 'what' but the 'how'
 - Producer collaboration especially valuable
- Ways of working:
 - Sharing/benchmarking of data
 - Face to face action groups
 - Combination of these



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1. Benchmarking Data

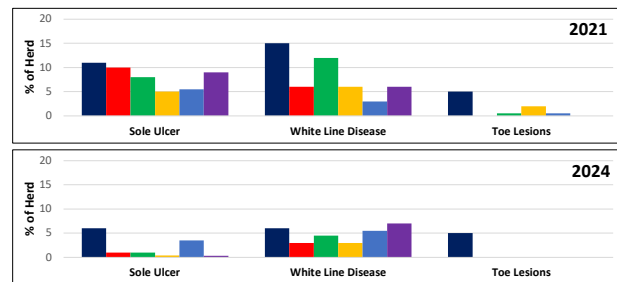
- Motivating
- Drives engagement
- Validates actions
- Provides reassurance
- Identifies common challenges



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1. Benchmarking Data



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2. Farmer Led Action Groups

- Based on the Danish Stable School approach
 - Common learning
- Focused purely on foot health
- 6-8 farmers in each group
- No advisory input, no 'expert' during meetings
- So successful continued and expanded as part of Agrisgôp action learning groups



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2. Farmer Led Action Groups

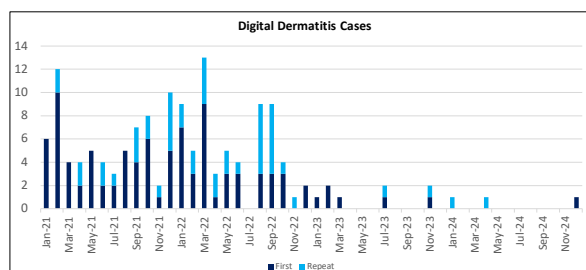
- Two hour meetings (11am-1pm)
- Every 6-8 weeks
- Each farm hosted during an annual cycle
- Focus on peer-to-peer learning
- Identify successes and challenges as focal points for discussion
- Farm walk followed by facilitated discussion around a table – action plan



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2. Farmer Led Action Groups



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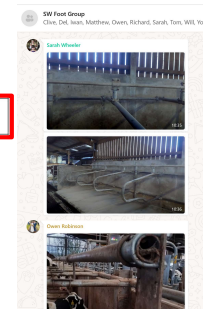
2. Ongoing Interaction

Agrisgôp Group 3 Meeting 5

Raise neck rail height using rail lifters so it is 122cm from the cubicle bed and 178cm horizontally from the kerb

22nd February 2024

Aim	Action
Improve consistency of digital dermatitis control	Install automatic Hooftcount Excel footbath at bottom of race; soak quite
Reduce pooling of water	Create narrow drainage channel to enable flow of water into slats (potentially tie in with grooving)
Improve tracks	Try concrete sleepers on bottom section. Use sand underneath to stabilise and asphalt on top.
Improve cubicle comfort	Ensure it is as shallow as possible.
Improve grip at back of parlour	Raise neck rail height using rail lifters so it is 122cm from the cubicle bed and 178cm horizontally from the kerb
Stop dry cows going through cubicles	Check height of cantilever loop
	Groove area with Acropave
	Place ratchet strap at front of dry cow cubicles to stop cows walking through. Place at eye level of lying cow.



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2. Ongoing Interaction

Agrislop Group 2: Meeting 5



ACTION PLAN

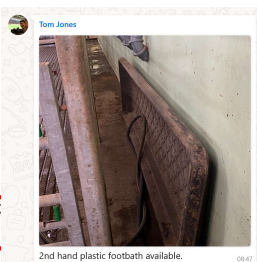
Tom @ Hackett Farm

22nd February 2024

Aim	Action
Improve consistency of digital dermatitis control	Install automatic Hoofcount Excel footbath at bottom of race; seek quote
Reduce pooling of	Create narrow drainage channel to enable flow of water into slats

Install automatic Hoofcount Excel footbath at seek quote

comfort	cubicle bed and 176cm horizontally from the kerb
	Check height of lamellae on hoof
Improve grip at back of parlour	Groove area with Accugrip
Stop dry cows going through cubicles	Place ratchet stop at front of dry cow cubicles to stop cows walking through. Place at eye level of lying cow.



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Taking it one step further... school trip!



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Conclusions

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Conclusions

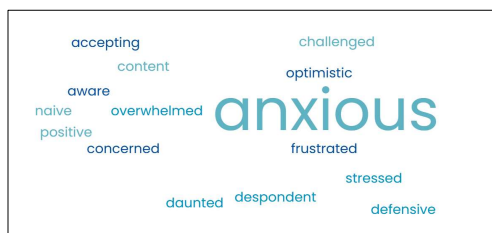
- No one size fits all
 - Solving lameness
 - Talking about lameness
- Collaboration is key
 - Within farm or between farms



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Impact on the Farmer: Start

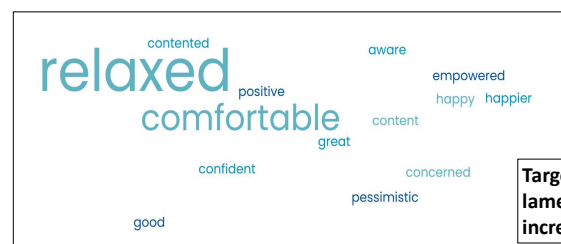


Target for lameness: 0-5%

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Impact on the Farmer: End



Target for lameness increased!

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Thank you!

 Sara Pedersen – Farm Dynamics
 @SaraPedersen3
 +44 7545 431800
 sara@farmdynamics.co.uk

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OABP / Dairy Guelph Spring Meeting 2026

EDPET: Early Detection and Prompt Effective Treatment

Dr Sara Pedersen
RCVS Specialist in Cattle Health and Production

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Early Detection and Prompt Effective Treatment (EDPET)

Early detection

- Defining lameness

Prompt Effective Treatment

- What impact does a delay have

What difference can it make?



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Early Detection

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Mobility Scoring

Why? The Benefits

Individual animal

- Early identification and effective treatment

Herd Level

- Identify trends and patterns to monitor success of prevention and treatment measures
- Consistently benchmark herd performance
- Farm assurance

National level

- Benchmarking and monitoring change over time
- Monitoring the success of regional interventions e.g. Welsh HerdAdvance

But what does this rely on.....?



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Defining Lameness

- Success of EDPET all depends on definition of a lame cow
- Detected too late:
 - EDPET fails
 - Producer loses faith
- Need to forget about the herd % and look at each individual cow
- "Scoring for the cow and not your processor"



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Signs of lameness: Which are most useful?

- Limp: Uneven weight bearing; non-weight-bearing; uneven dew claw drop; uneven rhythm
- Arched spine
- Slower walking speed
- Frequent stopping
- Shortened strides
- Soft foot placement (tenderness)
- Not tracking up
- Head nod (rising on painful foot)
- Low head carriage
- Feet wide/narrow (abduction/adduction)
- Heel- or toe-first foot placement
- Difficulty turning/rising
- Foot shaking
- Knuckling
- Stiff gait
- Swinging leg
- Twisting foot placement
- Gait consistency/inconsistency



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Signs of lameness: Which are most useful?

1. Limp: Uneven weight bearing; non-weight-bearing; **uneven dew claw drop**; uneven rhythm
2. Arched spine
3. Slower walking speed
4. Frequent stopping
5. **Shortened strides**
6. **Soft foot placement** (tenderness)
7. Not tracking up
8. **Head nod** (rising on painful foot)
9. Low head carriage
10. Feet wide/narrow (abduction/adduction)
11. Heel- or toe-first foot placement
12. Difficulty turning/rising
13. Foot shaking
14. Knuckling
15. Stiff gait
16. Swinging leg
17. Twisting foot placement
18. Gait consistency/inconsistency

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Subtle Signs for Earlier Detection

- Asymmetry in movement of dew claws
 - Those on affected leg don't descend to the ground as much – 'stiffer'
- Asymmetry in stride duration
 - One leg swinging through quicker than the other
 - 'Slow' leg is uncomfortable
- Shorter strides or a 'choppy' gait

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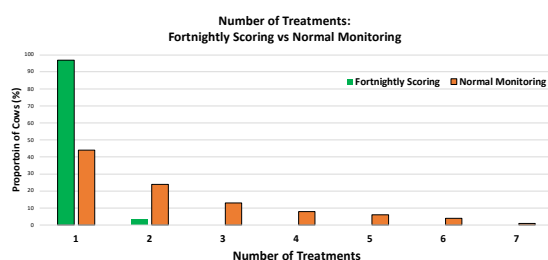
Prompt Effective Treatment

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The DCBT Early Detection Project

Results

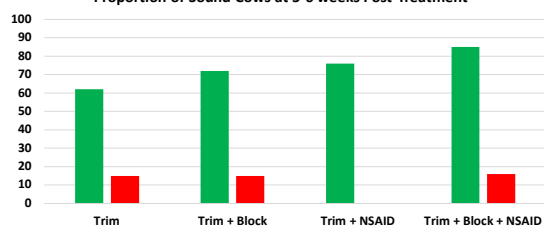


FARM DYNAMICS

10

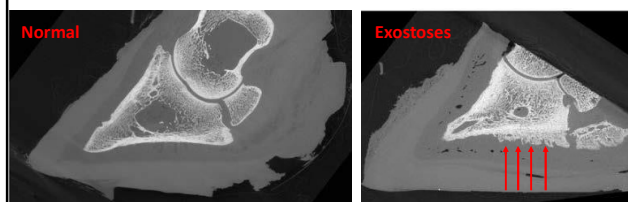
Claw Horn Lesions

Proportion of Sound Cows at 5-6 weeks Post-Treatment



FARM DYNAMICS

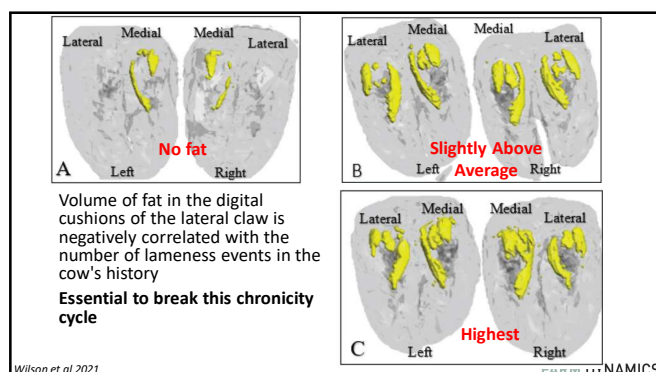
11



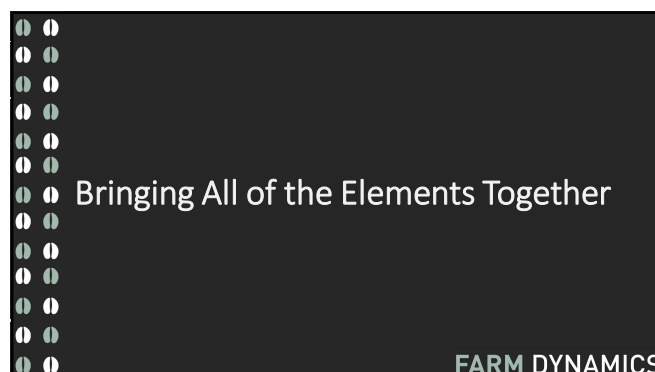
- Proposed that NSAIDs stop the formation of exostoses (Newsome et al. 2016)
- Cows with a history of lameness are more likely to go lame in the future... and the key drivers of lameness prevalence (Randall et al., 2018)

FARM DYNAMICS

12



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Gold Standard Approach

Lameness Detection and Treatment

- Fortnightly mobility scoring (with daily surveillance)
- Treatment of new cases within 48 hours of mobility score (severely lame cows ASAP)
- Trim, block and NSAID for new cases of claw horn lesion
 - Adapt block choice to suit the cow
 - Recheck blocks after 5-6 weeks

FARM DYNAMICS

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Mobility Scoring

Can we set targets?

- Score 3s: 0%
- Score 2s <10%
- First lactation: <5%

Set realistic targets that are achievable and steadily work towards them



FARM DYNAMICS

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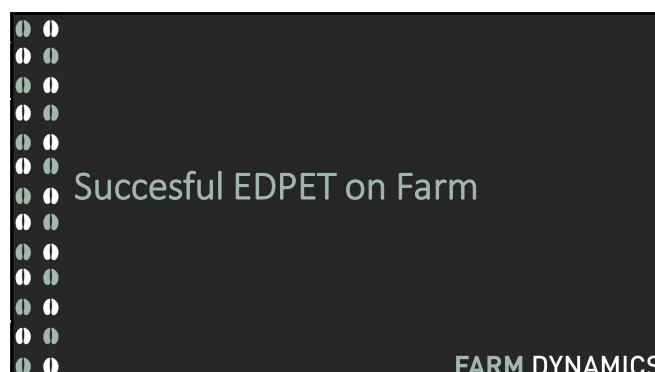
Trim/Inspection Protocols

Routine Inspections: 8-10 weeks before calving 60-80 DIM - Block rechecks at 4-6 weeks - In calf heifers 8-10 weeks before calving	Treatment: - DD: Licensed topical spray - Claw horn lesions: - NSAID - Block (if possible)
--	--

From Mobility Scores: - New cases of lameness - Repeat cases - Chronic cases every 10-12 weeks - All severely lame cows (unless non-foot)

FARM DYNAMICS

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4

QUALITY MILK PRODUCTION SERVICES

Making sense of quantified cultures

Pasteurizer, Towels, and Bedding Cultures

Mike Zurakowski, DVM
Quality Milk Production Services
Eastern Laboratory
Cobleskill, New York
MJZ6@Cornell.edu



Agenda

- Using MALDI-TOF technology
- Inoculating a quantified sample
- Processing and interpreting quantified samples while picking at bugs:
 - Pasteurized milk
 - Towels
 - Bedding

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MALDI-TOF

The **Autof ms1000** provides **automated, high-speed** and **high-confidence identification** and taxonomical **laser-induced classification** of bacteria, yeasts, fungi, and filamentous fungi based on proteomic fingerprinting. Numerous studies have demonstrated the **higher accuracy, faster time-to-result, and lower cost** provided by MALDI-TOF technology when compared to classical methods^{3,4,5}

Features:

- Faster time-to-result when compared to conventional methods and PCR
- Accuracy similar to nucleic acid sequencing technologies
- Can identify 96 samples in less than 20 minutes hands-on time
- Database of approximately 5,000 species created with over 15,000 strains
- Additions to organism database are provided automatically and free of charge
- Robust, intuitive software, supporting 21 CFR part 11
- Cost-effective operation with all software functions included in initial purchase price
- LIMS/LIS connectivity and support
- Installation Qualification/Operation Qualification/Performance Verification support

*Autof ms1000 is manufactured by Autobio Diagnostics Co. LTD. for Hardy Diagnostics

*For Research Use Only. Not for use in clinical diagnostic procedures



<https://www.youtube.com/watch?v=0jeFpXHZ8W0&list=WL&index=1&pp=gAQBiAQB>



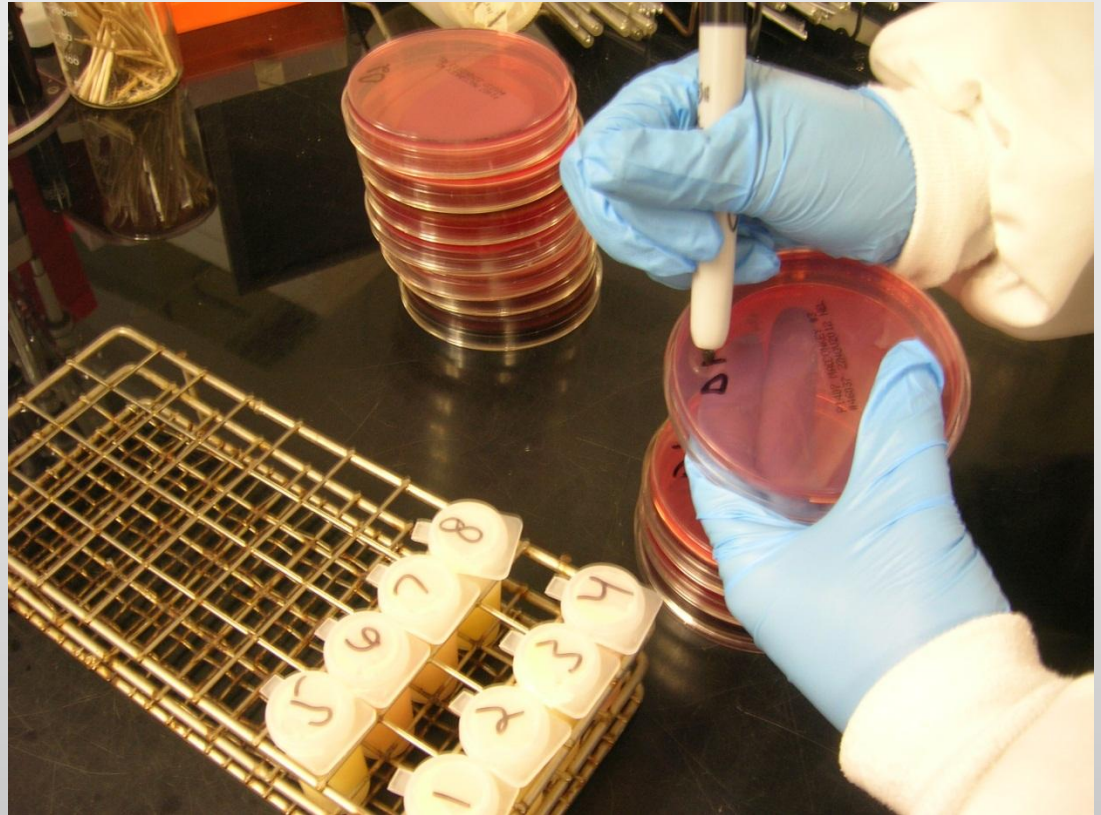
Processing Samples for Quantitative Cultures



Inoculating Culture Media

Label bottom of
two plates with:

1. Your name
2. Beer
3. Phone
4. (date and time)



Inoculating Quantified Cultures

1. Mix sample thoroughly
2. Make serial dilutions 10^{-1} and 10^{-2}
3. (1ml milk into 9 ml sterile PBS)
4. Inoculate 50 μ l of each dilution on media type labeled with dilution
5. Change pipette tips, spreaders, and loops if inoculating higher bacteria levels before lower bacteria levels

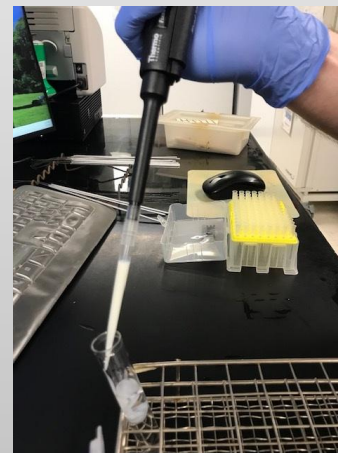


Plate Inoculation and Incubation Parameters (all sample types)

- 6.1 For each sample type, inoculate 50 µl of each dilution on each media type appropriately labeled with vetview sticker used as plate labels (dilution notated on sticker or plate) or other labeling as needed (TSAE, Ed, MAC), as noted in Table 1.
- 6.1.1 Pipette tip is changed between dilution tubes when inoculating from a dilution tube with the highest bacteria levels to a dilution tube with lower bacteria levels.
- 6.1.2 Vortex dilution tubes for an individual sample prior to inoculation if dilutions were not inoculated immediately after dilutions completed.

Table 1. Minimum dilutions to be plated, per sample type.

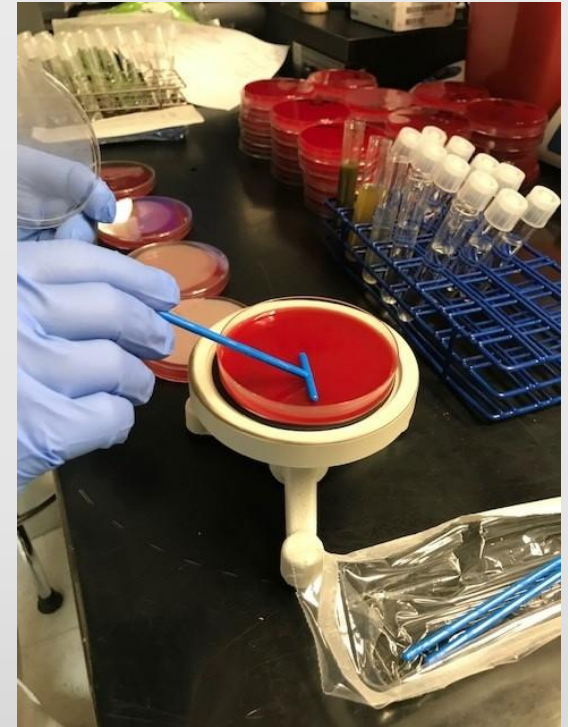
Sample Type	10 ⁰	10 ⁻¹	10 ⁻²	10 ⁻³	10 ⁻⁴
Bedding	X	X	X	X	X
Brush	X	X	X		
Filter	X	X	X	X	
Milk and Colostrum	X	X	X*		
Swab	X	X	X		
Towel	X	X	X		

*if requested by management.

- 6.1.3 Evenly spread inoculum onto each plate using a spreader and inoculation table, or streak in three directions with a sterile loop. A different spreader (or loop) must be used if spreading inoculum from the set of plates from the first dilution to the next lower dilution. (see QMPS-SOP-1016).
- 6.1.4 Allow plates to dry upright at room temperature (approximately 1 minute).
- 6.1.5 While plates are drying, place the most concentrated sample suspension tubes labeled appropriately (10⁰ for milk and colostrum, towels, filters, brushes or 10⁻¹ for swab) in the freezer as retain samples. Freeze original bedding sample as retain. Towel, filter, swab and brushes are disposed of properly.

Processing Quantified Samples

6. Evenly spread inoculum using a spreader or streak in three directions with a sterile loop
7. Allow plate to dry upright for a few moments
8. Freeze/retain dilution tubes for further dilution if needed



9. Incubate at 37 °C
10. Examine at 18-24 hours
11. Re-examine at 48 hours

Inoculating Culture Media

Let milk dry for a moment prior to inoculating



Incubating Culture Media

Incubate at 37°C



Incubation Conditions

For most pathogens

Aerobically

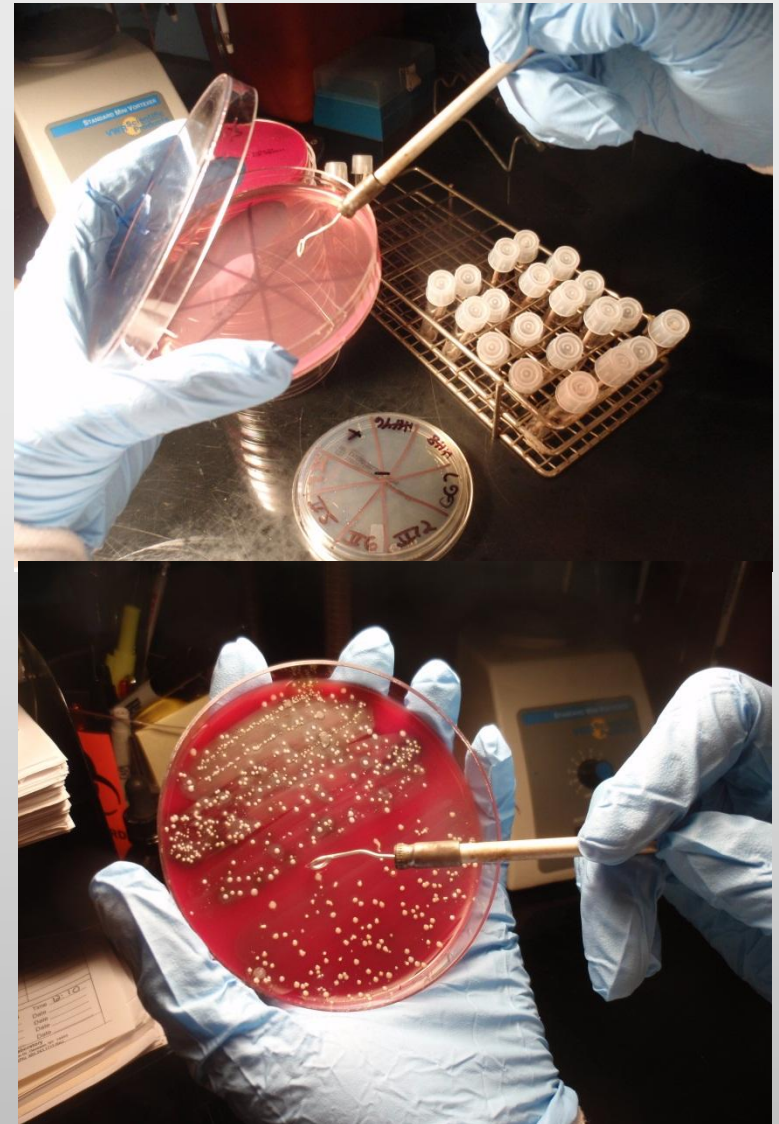
35°C-38°C

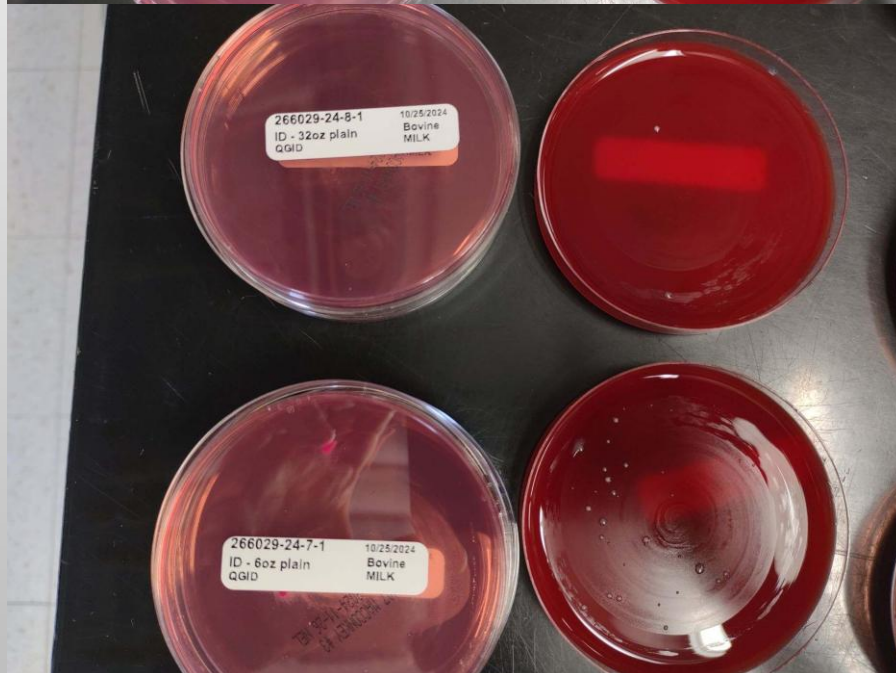
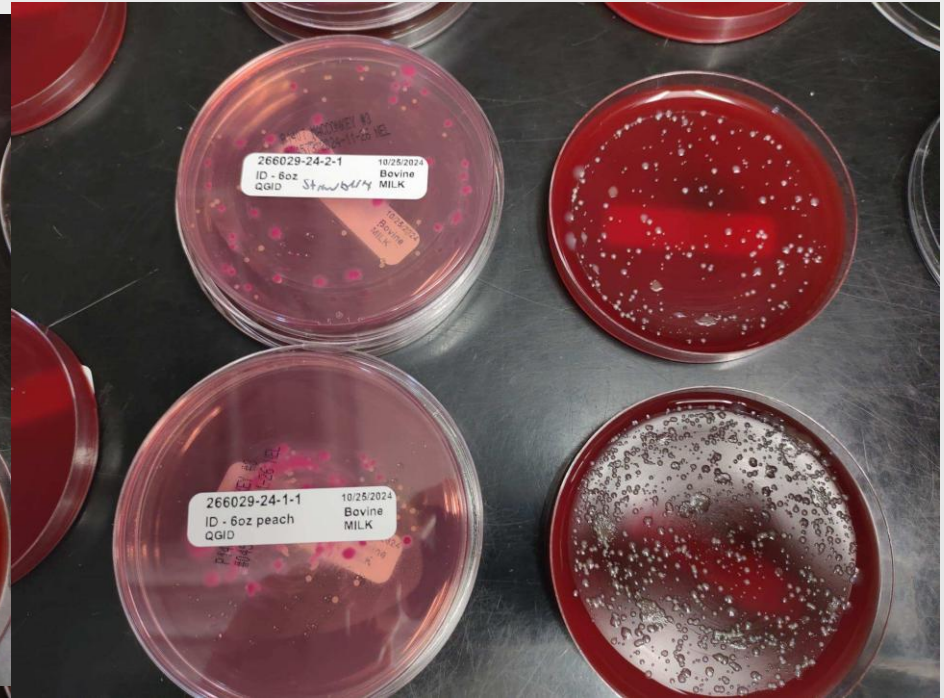
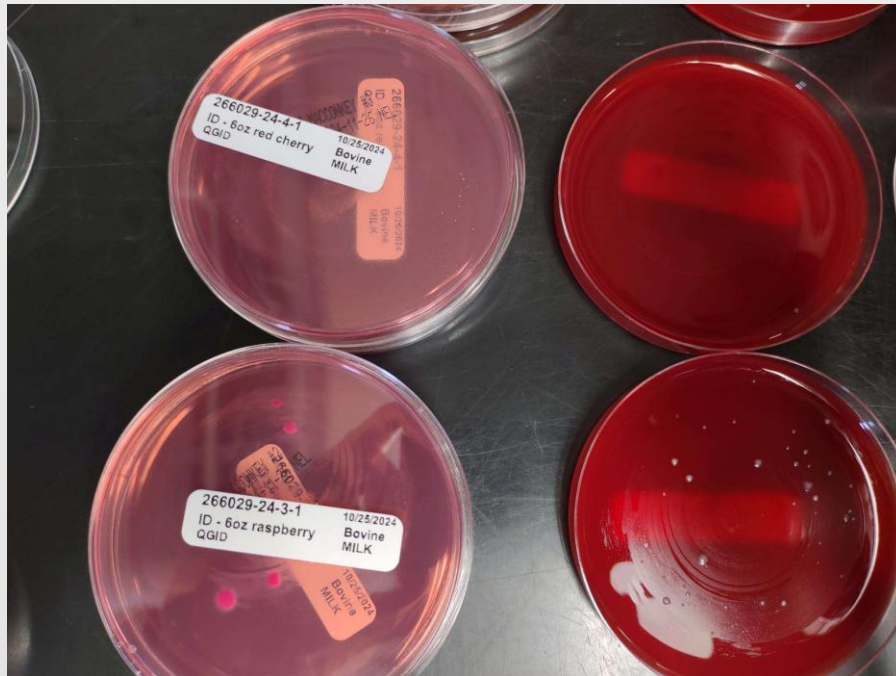
24-48 hours



Interpreting Culture Media

- After 18 – 24 hours, set-up tests
- After 48 hours, final identification

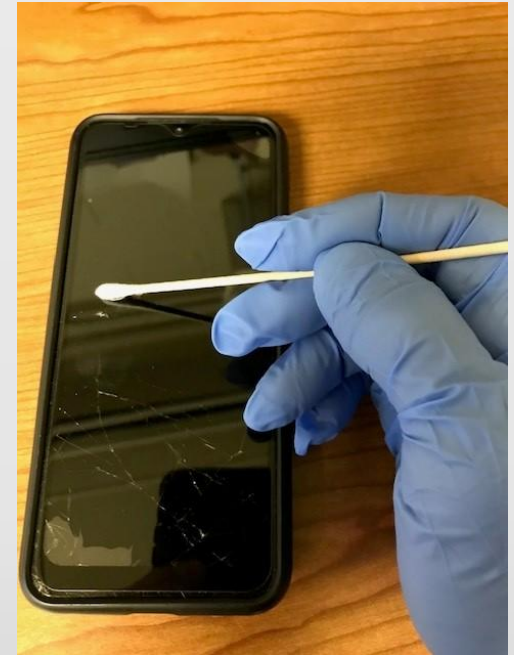




Count organisms on a dilution plate between 25 and 250 colony forming units (CFU)

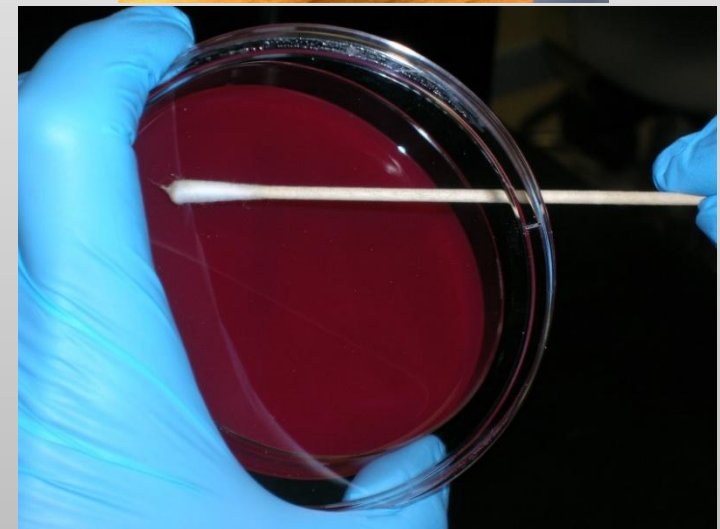
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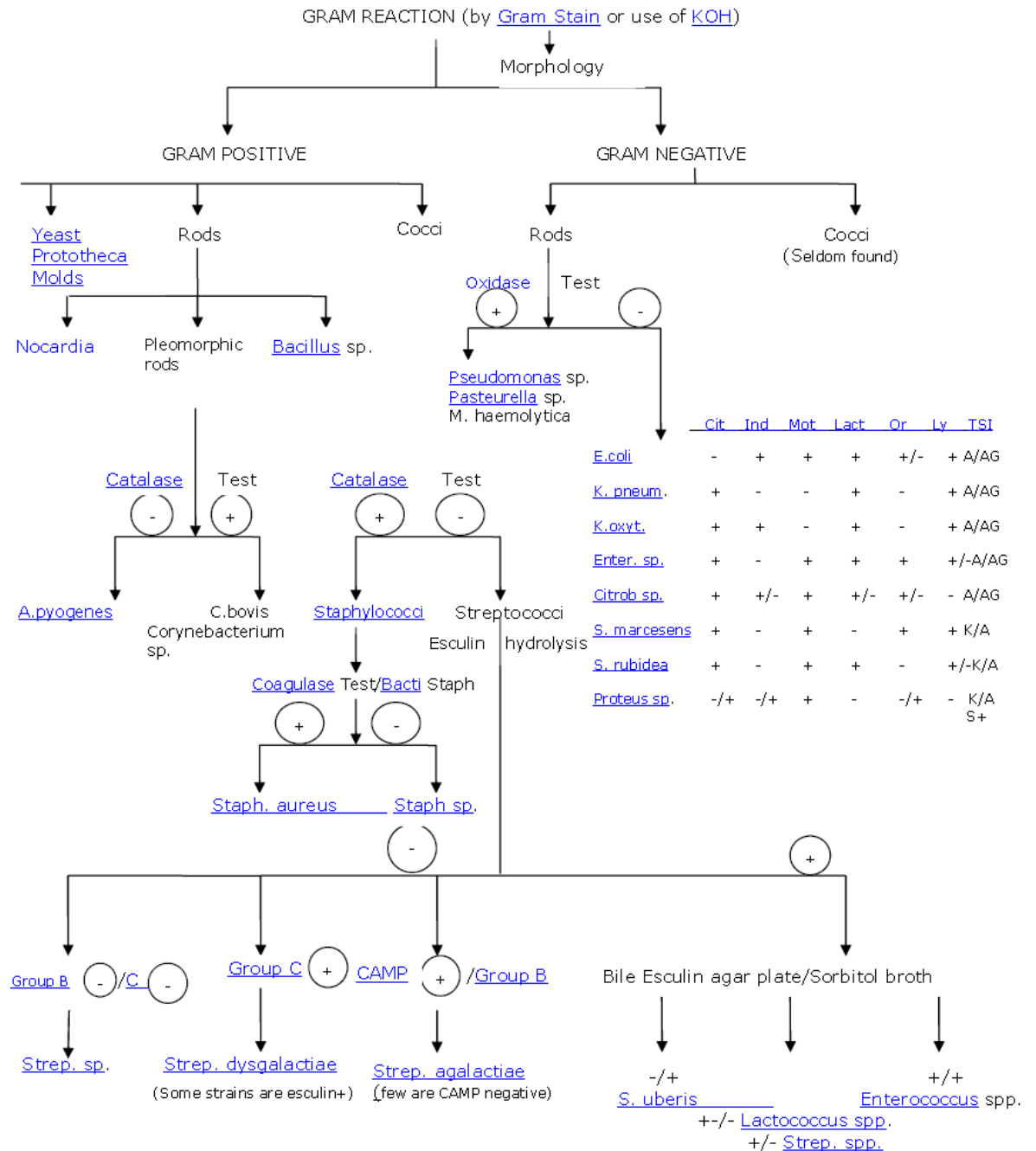
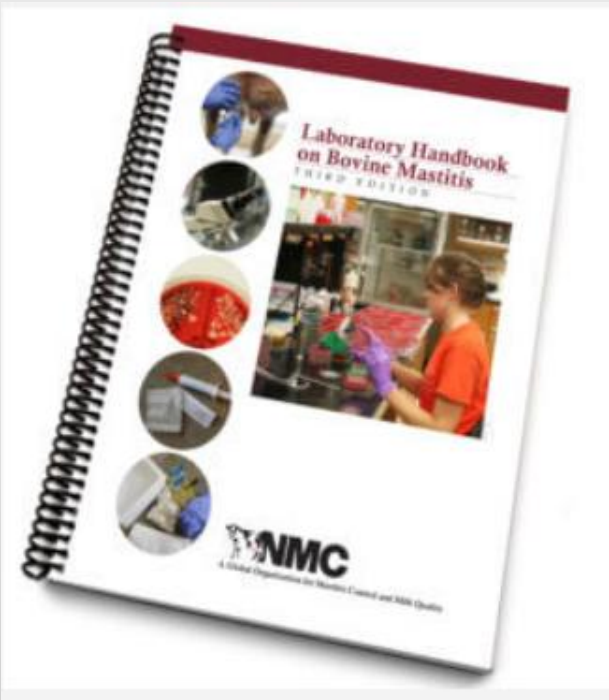


Mix sample thoroughly then dip sterile swab or loop into sample and inoculate labeled section of plate.

Let dry for a bit prior to inverting.
Incubate 35-38°C for 18-24 hours for test set-up then another 18-24 hours for final ID.



NMC Method



Milk

- Bulk tank milk
- Liquid calf feed
(waste milk, pasteurizer milk, mixed milk replacer)
- Colostrum





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Calculating Quantified Milk Cultures

Milk			Accession ID	
Plate ID				
Sample ID				
Organism	Plate	CFU	Count (cfu/ml)	
Streptococcus spp.	0	0		
Staphylococcus spp.	0	0		
E. coli	0	0	#DIV/0!	
Klebsiella spp.	0	0	#DIV/0!	
Other Coliforms	0	0	#DIV/0!	
Gram (-) Bacillus spp.	0	0	#DIV/0!	
Gram (+) Bacillus spp.	0	0	#DIV/0!	
Corynebacterium spp.	0	0	#DIV/0!	
T. pyogenes	0	0	#DIV/0!	
Pseudomonas spp.	0	0	#DIV/0!	
Prototheca spp.	0	0	#DIV/0!	
Yeast	0	0	#DIV/0!	
Mold	0	0	#DIV/0!	
Other fungus	0	0	#DIV/0!	
Total Streptococcus spp.			#DIV/0!	
Total Staphylococcus spp.			#DIV/0!	
Total Coliforms			#DIV/0!	
Total 'other' bacteria			#DIV/0!	
Total 'other' organisms			#DIV/0!	
Streptococcus agalactiae	Not Detected			
Staphylococcus aureus	Not Detected			

Media Type	Organism(s)
Edwards (Ed)	<i>Streptococci</i> spp. <i>Streptococcus agalactiae</i>
Hayflick (myco)	<i>Mycoplasma</i> spp.
MacConkey (Mac)	<i>Escherichia coli</i> <i>Klebsiella</i> spp <i>Pseudomonas</i> spp. Other Coliforms Gram-negative bacilli
Trypticase Soy Agar with 5.0% sheep blood and 0.1% esculin (TSAE)	Gram-positive bacilli <i>Corynebacterium</i> spp. <i>Corynebacterium bovis</i> <i>Trueperella pyogenes</i> <i>Prototheca</i> spp. Mold Non <i>Staphylococcus aureus</i> <i>Staphylococcus</i> spp. (NAS) Other Fungi <i>Staphylococcus aureus</i> Yeast

Milk and Colostrum

$A(1000/B)/C$

Where:

A = number of colonies (cfu)

B = inoculation volume (μl) = 50 μl

C = dilution value of the plate counted or dilution factor, n (10^{-n})

Pasteurizer case study

Pathogen Identified	Pre-pasteurizer vat (cfu/ml)	Post-pasteurizer vat (cfu/ml)	First delivery sample (cfu/ml)	Last delivery sample (cfu/ml)
Streptococcus spp	32,600	200	11,200	25,600
Staphylococcus ssp	40,000	1,000	13,900	22,000
Coliform bacteria:				
E. coli	2,300	not detected	1,000	1,700
Klebsiella	7,000	not detected	not detected	not detected
Other coliforms	not detected	not detected	not detected	not detected
Other bacteria:				
Pseudomonas	100	not detected	900	1,100
T. pyogenes	not detected	not detected	not detected	not detected
Other Organisms:				
Prototheca	not detected	not detected	not detected	not detected
yeast	not detected	not detected	not detected	not detected
Total count:	82,000	1,200	27,000	50,400

Swabs



Quantified Swab Culture and Calculation

1. Place swab into tube containing 1 ml PBS (10^0)
2. Shake or vortex for 40 seconds
3. Transfer 0.5ml into 4.5 ml PBS (10^{-1})
4. Repeat (10^{-2})
5. Inoculate

Brushes, Filters and Swabs

$$(A(1000/B)/C)D$$

Where:

A = number of colonies (cfu)

B = inoculation volume (μ l) = 50 μ l

C = dilution value of the plate counted or dilution factor, n (10^{-n})

D = dilution volume added to stomacher bag or vial (ml)

Filter/Swab			Accession ID
			Conducted and Verified by
			Date
Plate ID			
Sample ID			
Dilution volume (ml)			
Volume inoculated (μ l)			
Organism	Plate	CFU	Count (cfu/item)
Streptococcus spp.			
Staphylococcus spp.			
E. coli			#DIV/0!
Klebsiella spp.			#DIV/0!
Other Coliforms			#DIV/0!
Gram (-) Bacillus spp.			#DIV/0!
Gram (+) Bacillus spp.			#DIV/0!
Corynebacterium spp.			#DIV/0!
T. pyogenes			#DIV/0!
Pseudomonas spp.			#DIV/0!
Prototheca spp.			#DIV/0!
Yeast			#DIV/0!
Mold			#DIV/0!
Other fungus			#DIV/0!
Total Streptococcus spp.			#DIV/0!
Total Staphylococcus spp.			#DIV/0!
Total Coliforms			#DIV/0!
Total 'other' bacteria			#DIV/0!
Total 'other' organisms			#DIV/0!
Streptococcus agalactiae			Not Detected
Staphylococcus aureus			Not Detected

Pathogen Identified	Delivery hose (cfu/ml)	Outside of Nozzle (cfu/ml)	Nozzle receptor (cfu/ml)	Inside of nozzle (cfu/ml)
Streptococcus spp	57,000	1,700	2,700	91,200
Staphylococcus ssp	71,000	3,200	21,100	111,300
Coliform bacteria:				
E. coli	104,200	not detected	not detected	501,500
Klebsiella	9,100	not detected	300	11,100
Other coliforms	not detected	not detected	not detected	not detected
Other bacteria:				
Pseudomonas	77,100	not detected	not detected	23,300
T. pyogenes	not detected	not detected	not detected	not detected
Other Organisms:				
Prototheca	not detected	not detected	not detected	not detected
yeast	not detected	not detected	not detected	not detected
Total count:	395,100	4,900	26,800	738,400

1. Swab of the inside of the delivery hose
2. Swab of the outside of the nozzle at the end of the hose
3. Swab of the rubber receptor where the nozzle is held
4. Swab of the inside of the nozzle when taken apart

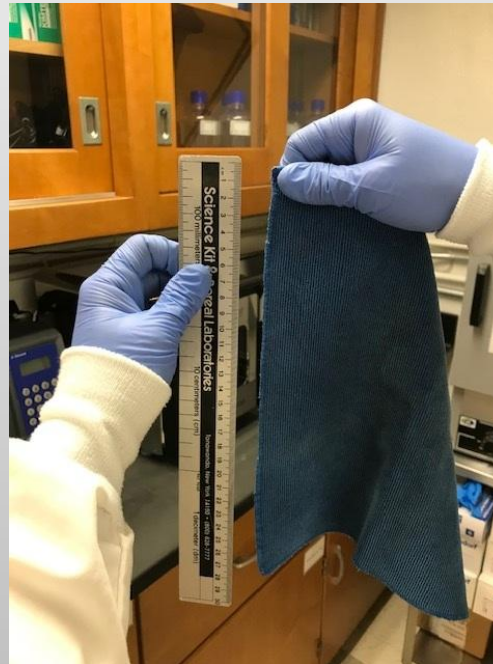
Towels



Towels



1. Measure length and width of towel
2. Place entire towel in stomacher bag
3. Add 250ml of sterile PBS
4. Mix or stomach for 2 minutes
5. Decant approximately 10 ml into empty sterile dilution tube
6. Make dilutions to 10^{-2}
7. Inoculate



Towel		Accession ID	
		Conducted and Verified by	
		Date	
Plate ID			
Sample ID			
Dilution volume (ml)			
Volume inoculated (μl)			
Towel width (cm)			
Towel Length (cm)			
Organism	Plate	CFU	Count (cfu/cm ²)
Streptococcus spp.	0	0	
Staphylococcus spp.	0	0	
E. coli	0	0	#DIV/0!
Klebsiella spp.	0	0	#DIV/0!
Other Coliforms	0	0	#DIV/0!
Gram (-) Bacillus spp.	0	0	#DIV/0!
Gram (+) Bacillus spp.	0	0	#DIV/0!
Corynebacterium spp.	0	0	#DIV/0!
T. pyogenes	0	0	#DIV/0!
Pseudomonas spp.	0	0	#DIV/0!
Prototheca spp.	0	0	#DIV/0!
Yeast	0	0	#DIV/0!
Mold	0	0	#DIV/0!
Other fungus	0	0	#DIV/0!
Total Streptococcus spp.			#DIV/0!
Total Staphylococcus spp.			#DIV/0!
Total Coliforms			#DIV/0!
Total 'other' bacteria			#DIV/0!
Total 'other' organisms			#DIV/0!
Streptococcus agalactiae	Not Detected		
Staphylococcus aureus	Not Detected		

Towel		Accession ID	
		Conducted and Verified by	
		Date	
Plate ID			
Sample ID			
Dilution volume (ml)			
Volume inoculated (μl)			
Towel width (cm)			
Towel Length (cm)			
Organism	Plate	CFU	Count (cfu/cm ²)
Streptococcus spp.	0	0	
Staphylococcus spp.	0	0	
E. coli	0	0	#DIV/0!
Klebsiella spp.	0	0	#DIV/0!
Other Coliforms	0	0	#DIV/0!
Gram (-) Bacillus spp.	0	0	#DIV/0!
Gram (+) Bacillus spp.	0	0	#DIV/0!
Corynebacterium spp.	0	0	#DIV/0!
T. pyogenes	0	0	#DIV/0!
Pseudomonas spp.	0	0	#DIV/0!
Prototheca spp.	0	0	#DIV/0!
Yeast	0	0	#DIV/0!
Mold	0	0	#DIV/0!
Other fungus	0	0	#DIV/0!
Total Streptococcus spp.			#DIV/0!
Total Staphylococcus spp.			#DIV/0!
Total Coliforms			#DIV/0!
Total 'other' bacteria			#DIV/0!
Total 'other' organisms			#DIV/0!
Streptococcus agalactiae	Not Detected		
Staphylococcus aureus	Not Detected		

Calculating Quantified Towel Cultures

Towel

$$(A(1000/B)/C)D/(E*F)$$

Where:

A = number of colonies (cfu)

B = inoculation volume (μl) = 50 μl

C = dilution value of the plate counted or dilution factor, n (10⁻ⁿ)

D = dilution volume added to stomacher bag (ml)

E = length of towel (cm)

F = width of towel (cm)

Media Type	Organism(s)
Edwards (Ed)	<i>Streptococci</i> spp. <i>Streptococcus agalactiae</i>
Hayflick (myco)	<i>Mycoplasma</i> spp.
MacConkey (Mac)	<i>Escherichia coli</i> <i>Klebsiella</i> spp <i>Pseudomonas</i> spp. Other Coliforms Gram-negative bacilli
Trypticase Soy Agar with 5.0% sheep blood and 0.1% esculin (TSAE)	Gram-positive bacilli <i>Corynebacterium</i> spp. <i>Corynebacterium bovis</i> <i>Trueperella pyogenes</i> <i>Prototheca</i> spp. Mold Non <i>Staphylococcus aureus</i> <i>Staphylococcus</i> spp. (NAS) Other Fungi <i>Staphylococcus aureus</i> Yeast



Towel Case Study

Sample ID: towel washer - Towel

Organism Category	Species	Result
Streptococcus	Streptococcus agalactiae	Not Detected
	Total Streptococcus spp.	0 cfu/cm^2
Staphylococcus	Staphylococcus aureus	Not Detected
	Total Staphylococcus spp.	46 cfu/cm^2
Coliform Bacteria	E. coli	Not Detected
	Klebsiella spp.	Not Detected
	Other Coliforms	Not Detected
	Serratia spp.	Not Detected
	Total Coliforms	0 cfu/cm^2
Other Bacteria	Pasteurella spp.	Not Detected
	Pseudomonas spp.	DETECTED
	Trueperella pyogenes	Not Detected
Other Organisms	Fungus	Not Detected
	Other	Gram positive bacillus
	Prototheca spp.	Not Detected
	Yeast	Not Detected
Totals	Total Count	4,959 cfu/cm^2
	Total Non-Coliforms	2,388 cfu/cm^2

Remarks:

heavy growth of Pseudomonas and Gram positive bacillus

Sample ID: towel bin - Towel

Organism Category	Species	Result
Streptococcus	Streptococcus agalactiae	Not Detected
	Total Streptococcus spp.	0 cfu/cm^2
Staphylococcus	Staphylococcus aureus	Not Detected
	Total Staphylococcus spp.	0 cfu/cm^2
Coliform Bacteria	E. coli	Not Detected
	Klebsiella spp.	Not Detected
	Other Coliforms	Not Detected
	Serratia spp.	Not Detected
	Total Coliforms	0 cfu/cm^2
Other Bacteria	Pasteurella spp.	Not Detected
	Pseudomonas spp.	DETECTED
	Trueperella pyogenes	Not Detected
Other Organisms	Fungus	Not Detected
	Other	Exiguobacterium profundum (Gram positive bacillus)
	Prototheca spp.	Not Detected
	Yeast	Not Detected
Totals	Total Count	419,192 cfu/cm^2
	Total Non-Coliforms	237,374 cfu/cm^2

Remarks:

heavy growth of Pseudomonas and Gram positive bacillus



Bedding



Risk Factors Associated with Environmental Mastitis

- The appearance of bedding has little correlation with bacterial load.
- Bacterial populations remain in stationary growth phase for up to 7 - 10 days.
- Particle size of bedding influences bacterial populations.
- Seasonal effects of bacterial populations in bedding are quite dramatic in some regions.



Collecting Bedding Samples

- Sample collection
 - Multiple random handfuls collected from 60 cm x 60 cm space in the back 1/3 of several stalls
 - Clean bedding vs. used bedding
 - All relevant housing areas
 - Representative within area
- Sample results
 - Counts: total, *Staphs*, *Streps*, coliforms



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7



Sample 3 to 5 representative stalls.
Use a new bag for each sample.

8



Only sample bedding from the 2' x 2' section where the udder would touch the stall.
Scrape 1 inch off the top of the bedding material into a new bag.

9



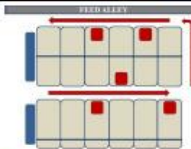
DO NOT Walk behind the vehicle delivering new bedding.
Have vehicle dump extra bedding in 5 stalls (throughout pen) and collect from the top of this pile (avoiding any used bedding).

10



Open a new bag and let some bedding flow into the bag.

11



Keep following the bedding vehicle throughout the whole pen and collect 5 samples.
All 5 samples go into 1 bag.

12



Label the bags with this information
Farm
Date
New or used bedding
Type of bedding (e.g. sand, manure solids)

60 cm x 60 cm

Collecting Fresh and Used Bedding Samples

- Standard Operating Procedure (SOP) is very important for analysis.
- Our general recommendations are:
 - Sample at the same time
 - For example, right before new bedding is due to be applied
 - Avoid manure piles
 - Sample multiple stalls
 - Gather **Fresh** bedding **as it is being applied** to the stalls (but make sure it doesn't get mixed with old stuff)
 - Record stall condition
 - Bedding quantity
 - Stall cleanliness
 - Write down bedding type (new vs. used; sand/sawdust/etc.)

ALL SAMPLES: LABEL & KEEP COLD OR FROZEN



Label the bags with this information

Farm

Date

New or used bedding

Type of bedding (e.g. sand, manure solids)



Place the samples in a cooler with ice for travel.

Freeze, if they are not processed the same day.

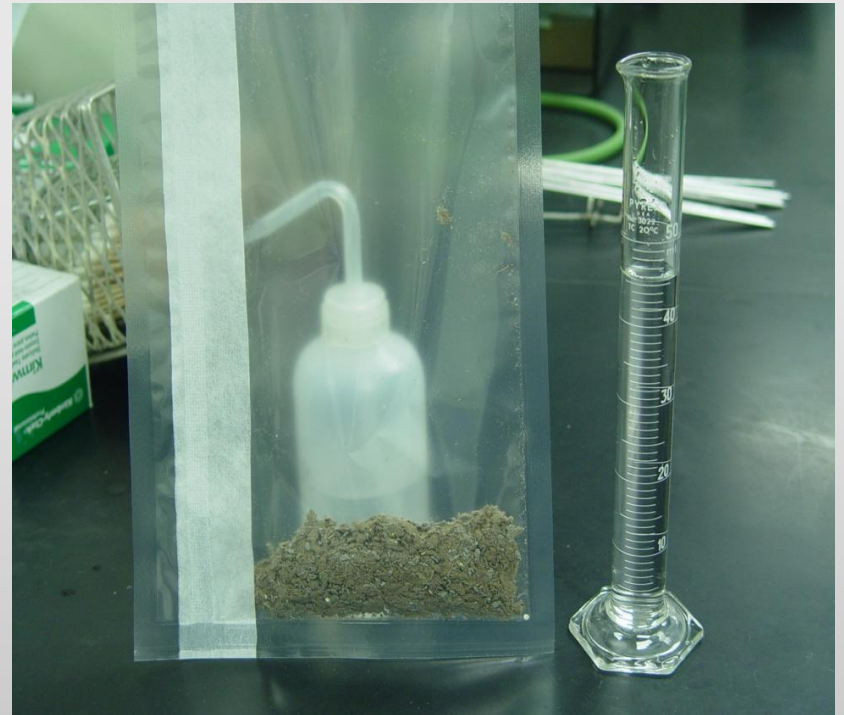
Bedding: Water=1:10

Weigh bedding material into digester bag or sterile vial if using vortex.



Bedding: Water=1:10

- Add 90 ml of sterile Phosphate buffered saline (PBS) to 10g of bedding material.



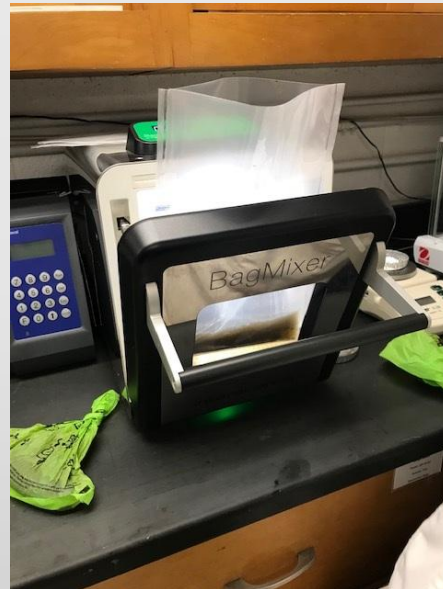
Quantified Bedding Culture

Lab Protocol

- 10g mixed bedding added to 90 mL of PBS
 - In stomacher for 2 minutes, shake/vortex for 40 seconds
 - 6 serial dilutions
 - 50 μ L of each dilution inoculated different 4 media
 - Trypticase Soy Agar with 5% sheep blood and 0.01 esculin, Edwards, MacConkey, PIM
 - Plates dried at room temperature
 - Inverted, and incubated at 35-38° C for 24 – 48 hrs then evaluated
 - Quantification on dilution with 25 – 250 CFU, CFU/g
 - ID based on morphology
 - Confirmatory test as needed

Stomacher or Vortex/Shaking

Vortex or shake for 40
seconds



Stomach for 2
minutes

Measuring Dry Matter (Percent Moisture)



>4 hours at 100°C

Bedding			Accession ID	
			Conducted and Verified by	
			Date	
Plate ID				
Sample ID				
Wet wt. (g)				
Dry wt. (g)				
Volume inoculated (μl)				
Organism	Plate	CFU	Raw Ct (cfu/g)	Adj Ct (cfu/g)
Streptococcus spp.				
Staphylococcus spp.				
E. coli			#DIV/0!	#DIV/0!
Klebsiella spp.			#DIV/0!	#DIV/0!
Other Coliforms			#DIV/0!	#DIV/0!
Gram (-) Bacillus spp.			#DIV/0!	#DIV/0!
Gram (+) Bacillus spp.			#DIV/0!	#DIV/0!
Corynebacterium spp.			#DIV/0!	#DIV/0!
T. pyogenes			#DIV/0!	#DIV/0!
Pseudomonas spp.			#DIV/0!	#DIV/0!
Prototheca spp.			#DIV/0!	#DIV/0!
Yeast			#DIV/0!	#DIV/0!
Mold			#DIV/0!	#DIV/0!
Other fungus			#DIV/0!	#DIV/0!
Total Streptococcus spp.			#DIV/0!	#DIV/0!
Total Staphylococcus spp.			#DIV/0!	#DIV/0!
Total Coliforms			#DIV/0!	#DIV/0!
Total 'other' bacteria			#DIV/0!	#DIV/0!
Total 'other' organisms			#DIV/0!	#DIV/0!
Streptococcus agalactiae	Not Detected			
Staphylococcus aureus	Not Detected			

Quantified Bedding Culture Procedure

For dirty bedding, dilutions to 10^{-6} are needed for countable results.



Mix tubes thoroughly between dilutions.



Quantified Bedding Culture Procedure

Plate the last three dilution tubes using
50 μ l per plate.



Bedding	Accession ID	
	Conducted and Verified by	
	Date	

Plate ID	
Sample ID	
Wet wt. (g)	
Dry wt. (g)	
Volume inoculated (μl)	

Organism	Plate	CFU	Raw Ct (cfu/g)	Adj Ct (cfu/g)
Streptococcus spp.				
Staphylococcus spp.				
E. coli			#DIV/0!	#DIV/0!
Klebsiella spp.			#DIV/0!	#DIV/0!
Other Coliforms			#DIV/0!	#DIV/0!
Gram (-) Bacillus spp.			#DIV/0!	#DIV/0!
Gram (+) Bacillus spp.			#DIV/0!	#DIV/0!
Corynebacterium spp.			#DIV/0!	#DIV/0!
T. pyogenes			#DIV/0!	#DIV/0!
Pseudomonas spp.			#DIV/0!	#DIV/0!
Prototheca spp.			#DIV/0!	#DIV/0!
Yeast			#DIV/0!	#DIV/0!
Mold			#DIV/0!	#DIV/0!
Other fungus			#DIV/0!	#DIV/0!

Total Streptococcus spp.			#DIV/0!	#DIV/0!
Total Staphylococcus spp.			#DIV/0!	#DIV/0!
Total Coliforms			#DIV/0!	#DIV/0!
Total 'other' bacteria			#DIV/0!	#DIV/0!
Total 'other' organisms			#DIV/0!	#DIV/0!

Streptococcus agalactiae	Not Detected
Staphylococcus aureus	Not Detected

Media Type	Organism(s)
Edwards (Ed)	Streptococci spp. Streptococcus agalactiae
Hayflick (myco)	Mycoplasma spp.
MacConkey (Mac)	Escherichia coli Klebsiella spp. Pseudomonas spp. Other Coliforms Gram-negative bacilli
Trypticase Soy Agar with 5.0% sheep blood and 0.1% esculin (TSAE)	Gram-positive bacilli Corynebacterium spp. Corynebacterium bovis Trueperella pyogenes Prototheca spp. Mold Non Staphylococcus aureus Staphylococcus spp. (NAS) Other Fungi Staphylococcus aureus Yeast

Calculating Quantified Bedding Cultures

Bedding

$$((A(1000/B)*9)/C)/(D/E)$$

$$\left(\frac{\left(\frac{A \text{ CFU}}{50 \mu\text{L}} \right) * \left(\frac{1000 \mu\text{L}}{1 \text{ mL}} \right)}{\left(\frac{10 \text{ g}}{90 \text{ mL}} \right)} \right) * C * \left(\frac{E}{D} \right) = \left(\left(\left(\frac{A \text{ CFU}}{50 \mu\text{L}} \right) * \left(\frac{1000 \mu\text{L}}{1 \text{ mL}} \right) \right) * \left(\frac{90 \text{ mL}}{10 \text{ g}} \right) \right) * (10^n) * \left(\frac{E}{D} \right)$$

$$= X \text{ CFU/g}$$

Where:

A = number of colonies (cfu)

B = inoculation volume (μl) = 50 μl

C = dilution factor, n (10⁻ⁿ)

D = dry weight (g)

E = wet weight (g)

% moisture

$$((A+B)-C)*100/10$$

Where:

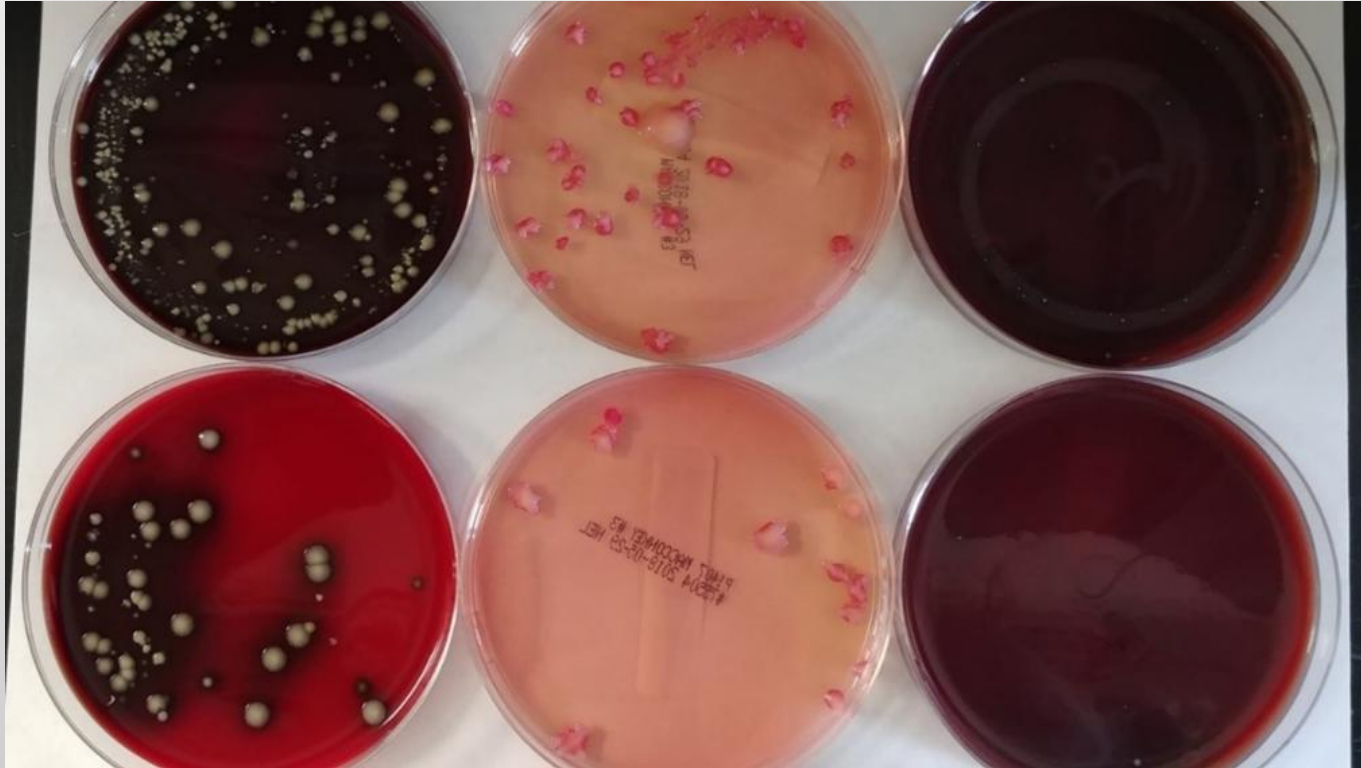
A = Empty dish

B = Bedding weight (added to dish to go into oven)

C = After drying (dish + bedding)



Dilution Series Results



General

Coliforms

Streptococci

Example Bedding Report

General Information on Bedding Results

Sample ID: Pen 1 RMS 1.14 - Bedding Material

Organism Category	Species	Result
Bedding Composition	% Dry Matter	52 %
	pH Level	9.1
Streptococcus	Streptococcus agalactiae	Not Detected
	Total Streptococcus spp.	20,582,524 cfu/g
Staphylococcus	Staphylococcus aureus	Not Detected
	Total Staphylococcus spp.	0 cfu/g
Coliform Bacteria	E. coli	DETECTED
	Klebsiella spp.	DETECTED
	Other Coliforms	DETECTED
	Serratia spp.	Not Detected
	Total Coliforms	221,359 cfu/g
Other Bacteria	Pasteurella spp.	Not Detected
	Pseudomonas spp.	Not Detected
	Trueperella pyogenes	Not Detected
Other Organisms	Fungus	Not Detected
	Other	Strep infantarius Strep equinus Bacillus cereus thuringiensis PG IV Comamonas kerstersii
	Prototheca spp.	DETECTED
	Yeast	Not Detected
Totals	Total Count	97,087,379 cfu/g
	Total Non-Coliforms	376,699 cfu/g

Remarks:

Total count is higher than reported.
Streps are mixed
Coliform count is made up primarily of E coli.

Bacteria are grouped under different categories

Counts are reported as CFU/g

“Os” are not reported, if organism not identified, it will say “not detected”

Bedding Case Study

Sample ID: Fresh [REDACTED] - Bedding Material

Organism Category	Species	Result
Bedding Composition	% Dry Matter	40 %
	pH Level	8.9
Streptococcus	Streptococcus agalactiae	Not Detected
	Total Streptococcus spp.	16,458,853 cfu/g
Staphylococcus	Staphylococcus aureus	Not Detected
	Total Staphylococcus spp.	0 cfu/g
Coliform Bacteria	E. coli	DETECTED
	Klebsiella spp.	DETECTED
	Other Coliforms	Not Detected
	Serratia spp.	DETECTED
	Total Coliforms	45,387 cfu/g
Other Bacteria	Pasteurella spp.	Not Detected
	Pseudomonas spp.	Not Detected
	Trueperella pyogenes	Not Detected
Other Organisms	Fungus	Not Detected
	Other	Bacillus cereus thuringiensis PG IV, Acinetobacter indicus
	Prototheca spp.	DETECTED
	Yeast	Not Detected
Totals	Total Count	124,688,279 cfu/g
	Total Non-Coliforms	224,439 cfu/g

Remarks:

Total count is higher than reported.
Coliform count is primarily made up of E coli.
Streps are mixed.

Sample ID: Pen 1 [REDACTED] Bedding Material

Organism Category	Species	Result
Bedding Composition	% Dry Matter	52 %
	pH Level	9.1
Streptococcus	Streptococcus agalactiae	Not Detected
	Total Streptococcus spp.	20,582,524 cfu/g
Staphylococcus	Staphylococcus aureus	Not Detected
	Total Staphylococcus spp.	0 cfu/g
Coliform Bacteria	E. coli	DETECTED
	Klebsiella spp.	DETECTED
	Other Coliforms	DETECTED
	Serratia spp.	Not Detected
	Total Coliforms	221,359 cfu/g
Other Bacteria	Pasteurella spp.	Not Detected
	Pseudomonas spp.	Not Detected
	Trueperella pyogenes	Not Detected
Other Organisms	Fungus	Not Detected
	Other	Strep infantarius Strep equinus Bacillus cereus thuringiensis PG IV Comamonas kerstersii
	Prototheca spp.	DETECTED
	Yeast	Not Detected
Totals	Total Count	97,087,379 cfu/g
	Total Non-Coliforms	376,699 cfu/g

Remarks:

Total count is higher than reported.
Streps are mixed
Coliform count is made up primarily of E coli.

Table 1. Suggested benchmarks to interpret bedding culture results (cfu/cc of wet bedding) (Source: Patel et al, 2019).²⁴

Bacteria group	Bedding type	Bedding Bacteria Count Category (cfu/cc) ¹		
		Low	Moderate	High
Unused bedding (Collected from bedding storage area)				
Staph ²	NS / RS / ON / MS	0	.	>0
<i>Klebsiella</i> spp	NS / RS / ON / MS	0	.	>0
Coliforms	NS / RS / ON / MS	≤500	.	>500
SSLO ³	NS / RS / ON	0	1-1,000	>1,000
	MS	≤1,000	1,001-750,000	>750,000
Used bedding (Collected from stalls or cow resting area)				
Staph ²	NS / RS / ON / MS	0	.	>0
<i>Klebsiella</i> spp	NS / RS / ON / MS	0	.	>0
Coliforms	NS / RS / ON	≤10,000	.	>10,000
	MS	≤10,000	10,001-200,000	>200,000
SSLO ³	NS / RS / ON / MS	≤500,000	500,001-2,000,000	>2,000,000

NS: New sand, RS: Reclaimed sand, ON: Organic non-manure (Shavings/Straw), MS: Manure solids

¹ Minimum limit of detection for bedding culture is 25 cfu/cc (reported as 0)

² Staph: *Staphylococci* spp

³ SSLO: Streptococci or streptococci-like organisms



Chipping away at the tough questions about bedding management and mastitis

Sandra Godden,¹ BSc, DVM, DVSc; **Erin Royster**,¹ DVM, MS; **Sam Rowe**,¹ BVSc MVM, Dipl. ABVP;

Kruthika Patel,¹ BVSc, MVSc, MS; **Jennifer Timmerman**,¹ BS; **Brian Crooker**,² BS, MS, PhD; **Larry Fox**,³ BS, MS, PhD

¹ Department of Veterinary Population Medicine, University of Minnesota, Saint Paul, MN 55108

² Department of Animal Science, University of Minnesota, Saint Paul, MN 55108

³ Department of Animal Sciences, Washington State University, Pullman, WA 99164

Corresponding author: Dr. Sandra Godden, godde002@umn.edu

Bedding Case Study

Sample ID: bedding - Bedding Material

Organism Category	Species	Result
Bedding Composition	% Dry Matter	35 %
	pH Level	9.27
Streptococcus	Streptococcus agalactiae	Not Detected
	Total Streptococcus spp.	10,764,873 cfu/g
Staphylococcus	Staphylococcus aureus	Not Detected
	Total Staphylococcus spp.	0 cfu/g
Coliform Bacteria	E. coli	Not Detected
	Klebsiella spp.	DETECTED
	Other Coliforms	DETECTED
	Serratia spp.	Not Detected
	Total Coliforms	6,798,867 cfu/g
Other Bacteria	Pasteurella spp.	Not Detected
	Pseudomonas spp.	DETECTED
	Trueperella pyogenes	Not Detected
Other Organisms	Fungus	Not Detected
	Other	Citrobacter freundii, Comamonas kerstersii, Vagococcus fluvialis
	Prototheca spp.	Not Detected
	Yeast	Not Detected
Totals	Total Count	137,677,054 cfu/g
	Total Non-Coliforms	8,498,584 cfu/g

Remarks:

N/A

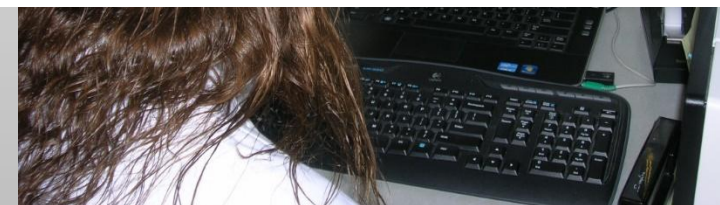
Lab Proficiency Support



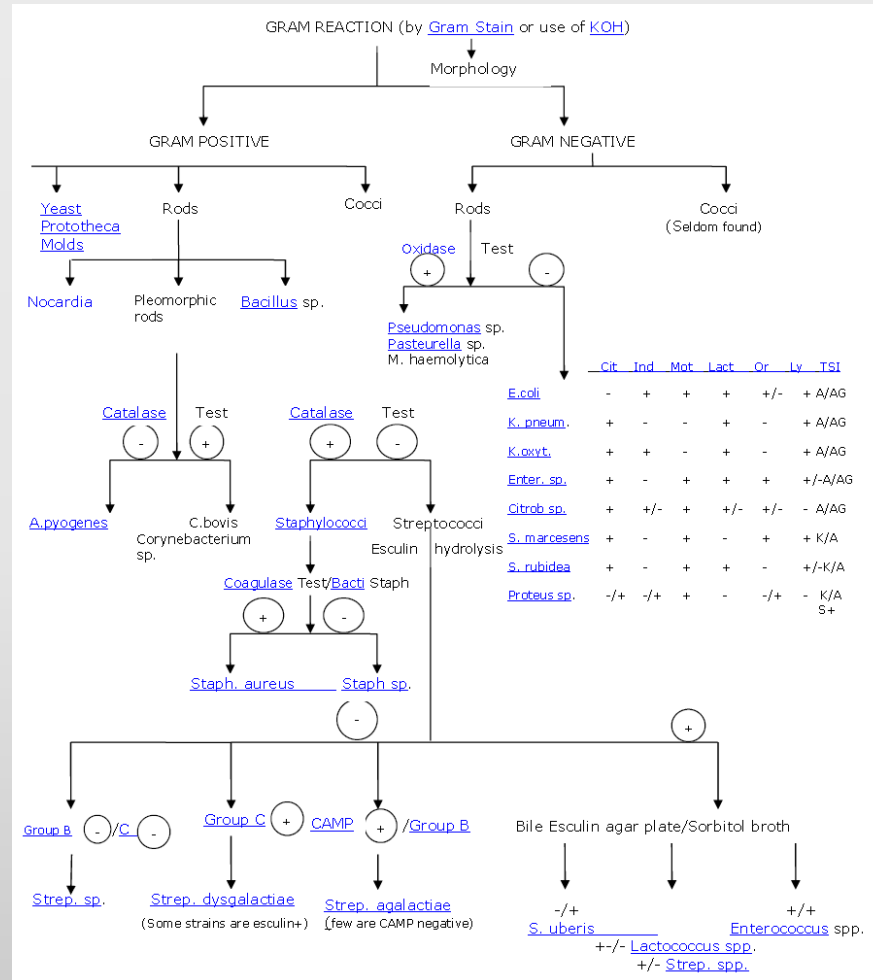
Laboratory Proficiency Testing Program

- Provides external quality assurance for diagnosing intramammary infections in veterinary labs
- Designed for large and mixed animal veterinary practices
- Participants receive quarterly kits with milk samples, forms, and a follow-up report
- Samples contain mastitis-causing pathogens to help improve diagnostic skills over time
- Participants identify pathogens, document results, and submit findings within two weeks
- QMPS reviews results and offers feedback and training on incorrect identifications
- Certificate of Participation awarded to all participants
- Call 1-877-645-5524 to enroll

<https://www.vet.cornell.edu/animal-health-diagnostic-center/programs/quality-milk-production-services/services/laboratory-proficiency-testing-program>



Thank you



QMPS Pathogen Codes

QMPS Code	Alpha Code	Pathogen Name
0	N	No Growth
1	A	<i>Streptococcus agalactiae</i>
2	S	<i>Streptococcus species</i>
3	R	<i>Staphylococcus aureus</i>
4	C	<i>Staphylococcus species</i>
5	E	<i>Escherichia coli</i>
6	K	<i>Klebsiella</i> spp.
7	P	<i>Pseudomonas</i> spp.
8	W	<i>Pasteurella</i> spp.
9	O	<i>Proteus</i> spp.
10	O	<i>Serratia</i> spp.
11	O	Gram (-) <i>bacillus</i> spp.
12	Y	Yeast
13	O	Mold
14	O	<i>Nocardia</i> spp.
15	H	<i>Prototheca</i> spp.
16	T	<i>Trueperella pyogenes</i>

QMPS Code	Alpha Code	Pathogen Name
17	B	<i>Corynebacterium bovis</i>
18	Z	Gram (+) <i>bacillus</i> spp.
19	X	Contamination
21	M	<i>Mycoplasma</i> spp.
23	O	Fungus
27	O	<i>Corynebacterium</i> species
28	O	<i>Enterobacter</i> spp.
29	O	<i>Citrobacter</i> spp.
30	O	<i>Streptococcus</i> group "G" spp.
33	D	<i>Streptococcus dysgalactiae</i>
34	U	<i>Streptococcus uberis</i>
35	O	Other
39	F	<i>Enterococcus</i> spp.
42	G	<i>Lactococcus</i> spp.
50	N	No Important Growth @ 48 hrs.
60		<i>Mycoplasma</i> spp. Negative
NA	L	Lab Pending

QUALITY MILK

PRODUCTION SERVICES

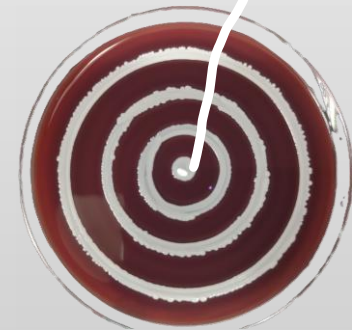
Microbes, Machines, Management, and Mastitis

An approach from barn to bulk tank

Mike Zurakowski, DVM
Quality Milk Production Services
Eastern Laboratory
518-255-5681
Mjz6@cornell.edu

Objectives

- Overview and case study of milking center and farm audit
- How we evaluate equipment, people, and cows
- Case study on *Prototheca*
- Case study on *Strep uberis*



Strategies for Success

Milking Center and Farm Audit Program

- Identify the key players in your milk quality team:
 - Utilize each in their area of expertise
 - Encourage communication and data sharing between parties
 - Hold farm meetings of all parties to
 - Interpret all the data together
 - Identify specific opportunity areas for your farm

Goals of a Milking Center and Farm Audit Program

- Provide each individual herd and their milk quality team a robust set of data that can be used to identify opportunity areas to improve milk quality
- Clarify if these opportunity areas are at the:
 - Whole system level
 - Individual personnel management level
 - Combination of both
- After a change is made, re-assess all the relevant areas to document the effects of the change

Goals of a Milking Center and Farm Audit Program

- Repeat this data collection every 3-4 months to:
 - Develop a trend-line of the data
 - Prevent issues
 - Promote continuous improvement
 - Assess any changes that have been made

Why do we need scoring systems?

- Gives us a true picture of what is happening at the cow level that impacts the risk of mastitis
 - If these scoring systems are performed correctly and consistently, they can be an objective measurement
- Helps to identify opportunity areas
 - Is there a problem with the whole system or with an individual person in the system?

What do we measure?

- Average claw vacuum at peak flow
- Pulsation under load
- Milkline vacuum for 30 minutes
- Unit alignment scoring

Equipment/Machines

- Milking routine timing
- Milk flow rate analysis
- Milking efficiency and throughput timing
- Strip yields

People/Management

- Dry-off procedure audit
- Teat scoring
- Teat-end cleanliness
- Udder cleanliness
- Environmental assessment

Cows and Microbes

Perform full NMC equipment evaluation every 6 months

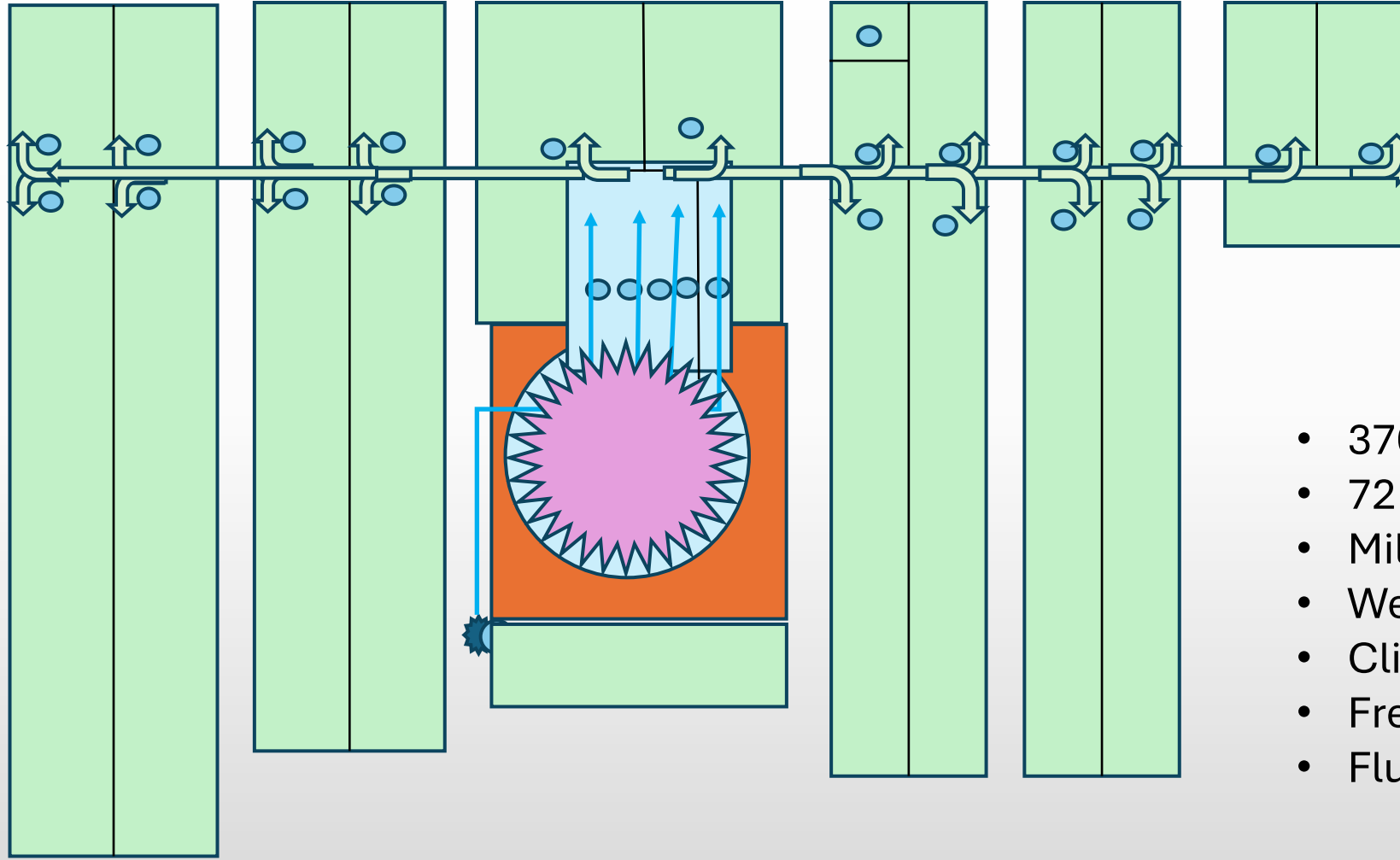
QUALITY MILK PRODUCTION SERVICES

Parlor and Farm Audit March 3, 2026

- Katie Keller, QMPS-Cobleskill
- Kaitlyn McFarlan, The Ohio State University
- Mike Zurakowski, QMPS-Cobleskill



Case Report: Project Farm

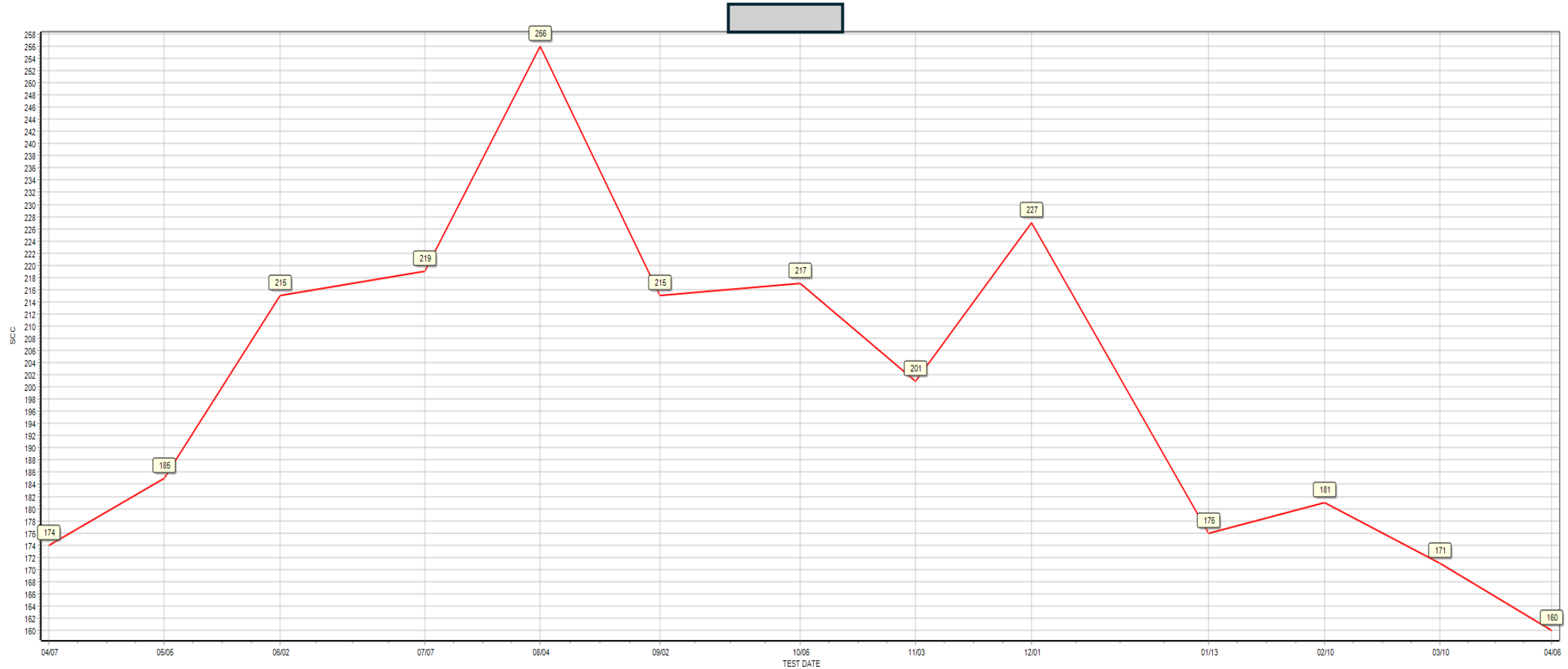


- 3700 cow dairy
- 72 stall rotary parlor
- Milking 3x
- Well managed
- Clinical mastitis cultures
- Fresh cow cultures
- Flush water system

- Your records show that bulk tank SCC is trending downward. Percent chronic infections is still above goal. High fresh and dry cow new infection risk are meeting the goals.
- *Strep uberis* continues to be the dominant mastitis pathogen.
- Many teat ends are firm when the milking unit is removed but the goal of less than 20% is achieved. **Teat-end scores continue to not meet the goal with 35% of teats score slightly to very rough.**
- Lag time from stimulation to unit attachment continues to meet the goal.
- **Two minute milk is good but has declined and bimodal milk flow is still present. Consider having milkers strip for an additional second on the two teats they are stripping.**
- Strip yields are very good.
- **Teat-end cleanliness has improved with only 15% of teat-ends too dirty (25% last visit).**
- Post-dip coverage of all four teats by the robot was successful 88% of the time.
- **Pulsators # 1, 30, 68, and 70 had shortened D phases.**
- Sand levels looked reasonable in the lactating cow pens with good stall cleanliness.

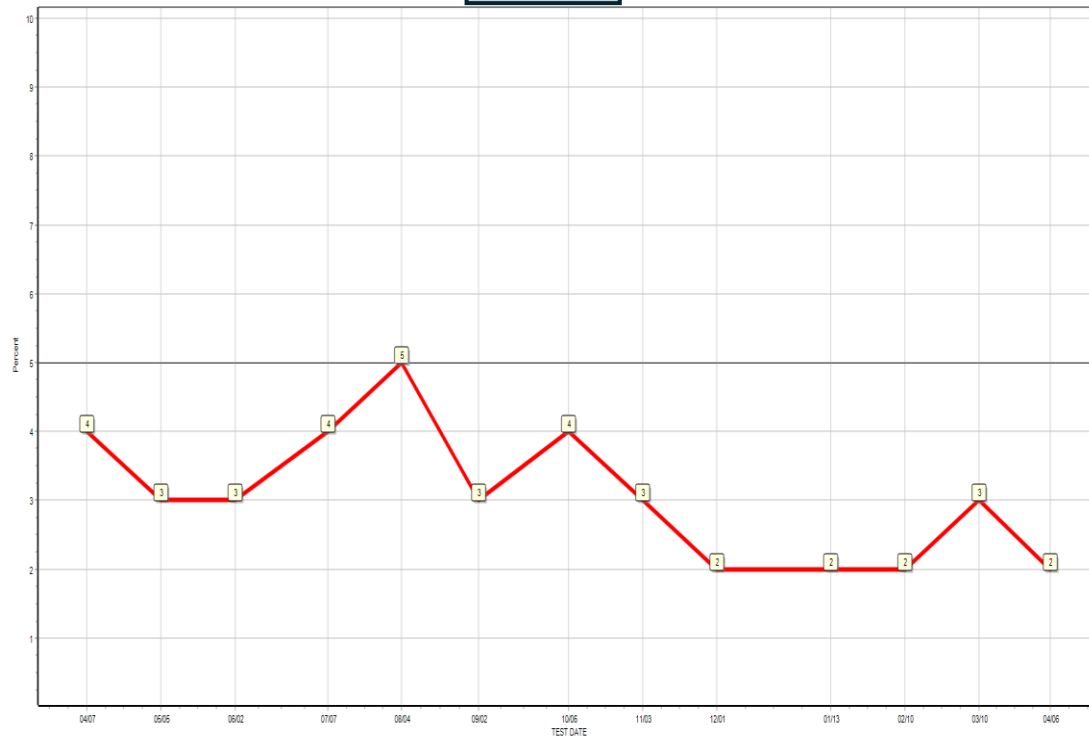
A photograph of three black and white dairy cows. The cow on the left is the largest and closest to the camera, looking directly at the viewer. Two smaller cows are positioned behind it to the right, also looking towards the camera. The background is a clear, bright blue sky. The text "Dairy Herd Management Data" is overlaid in white, centered horizontally across the middle of the image.

Dairy Herd Management Data

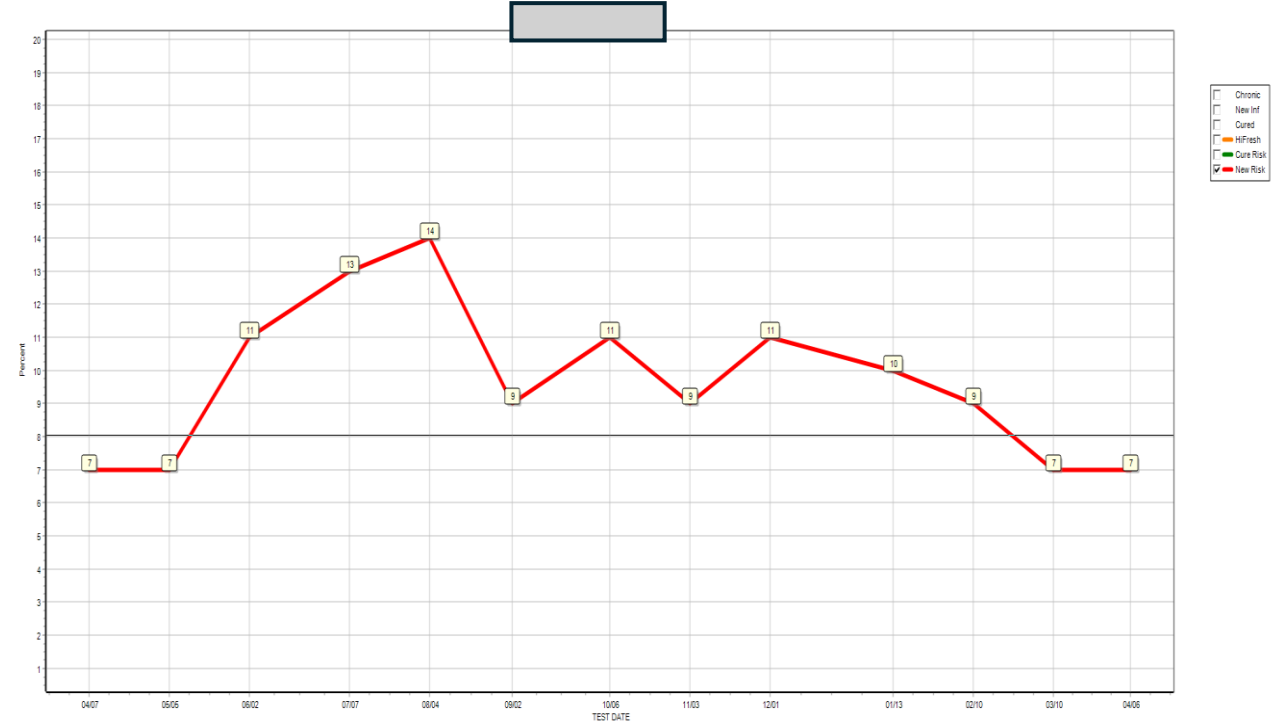


- This is the calculated test day bulk tank SCC which may not be the same as the SCC from the plant.

L=1

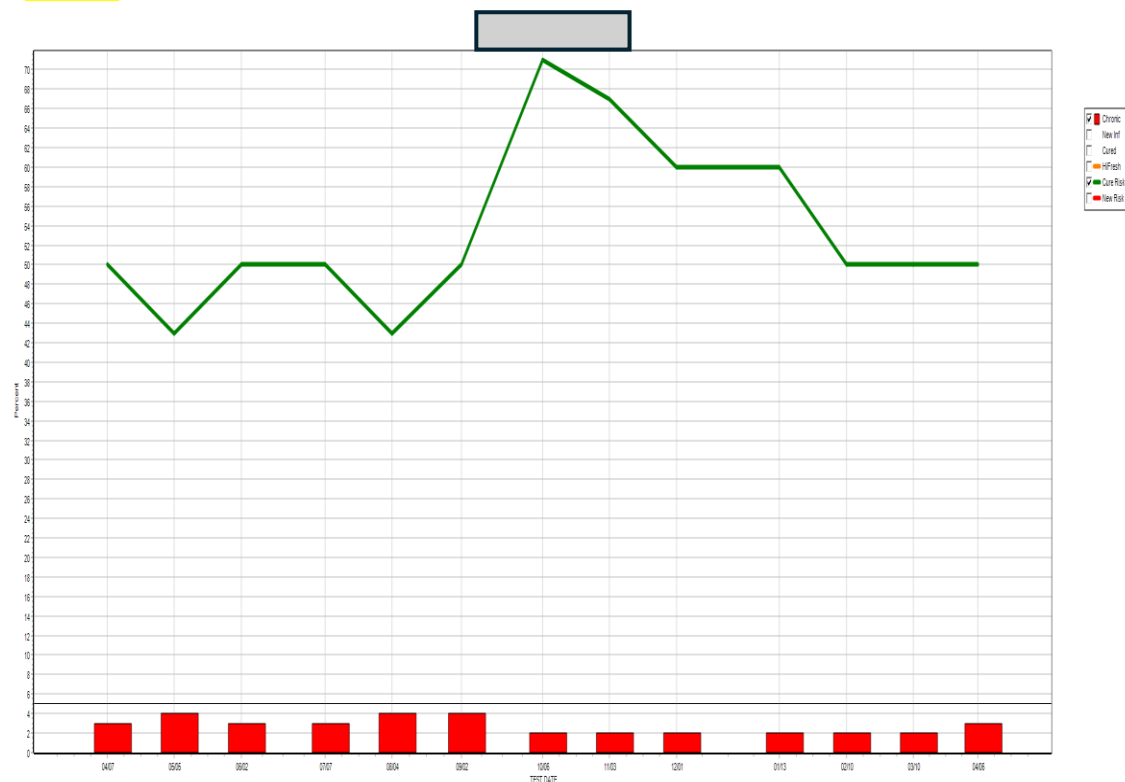


L>1

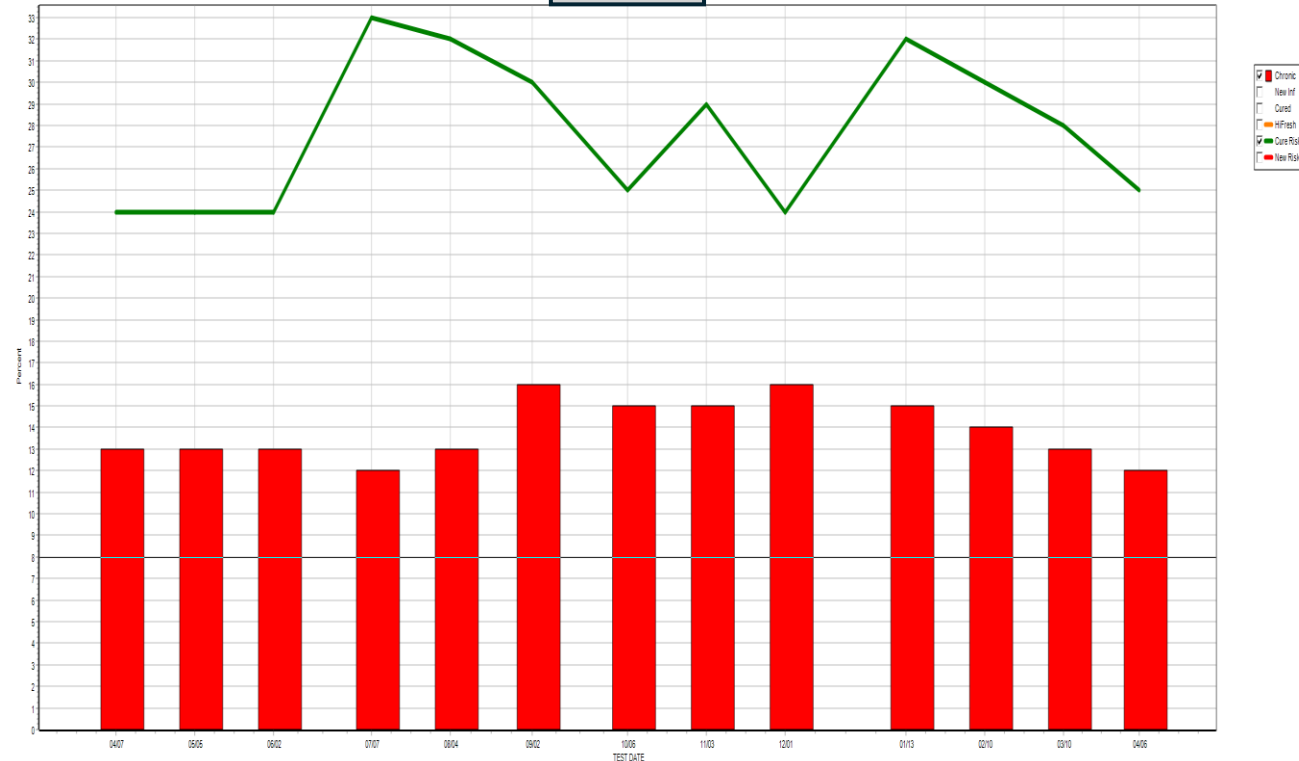


- This is a graph of the new infection risk over the last year by first lactation (left) and mature cows (right). The first lactation animals have been at or below the goal for past year. The mature cows are now below the goal of less than 8%.
- The largest opportunity areas that we identified on this extension survey are to maintain teat end cleanliness, correct the abnormal pulsators, continue to work with the cow movers to make sure stall cleanliness stays good, and to continue to work on the positioning of cows in the stalls especially on the head to head rows in the big barns.

L=1

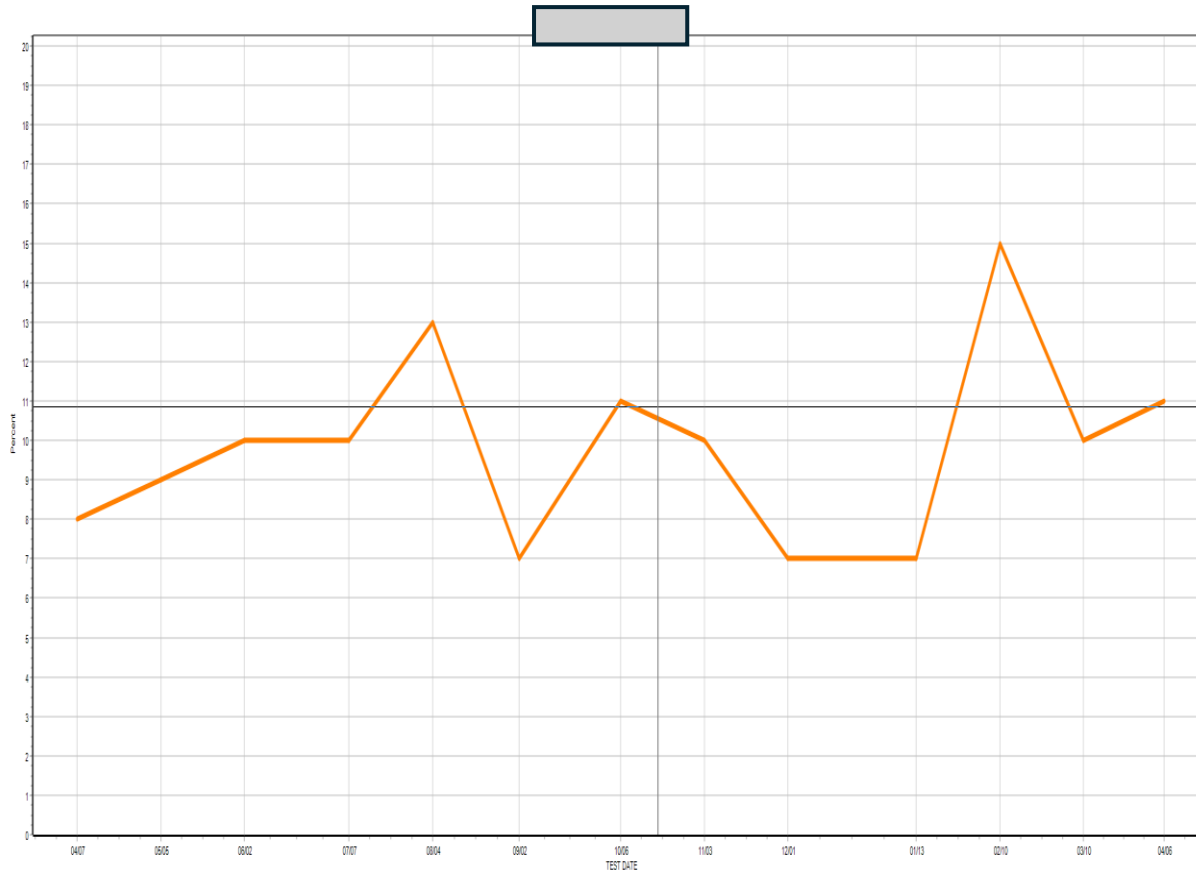


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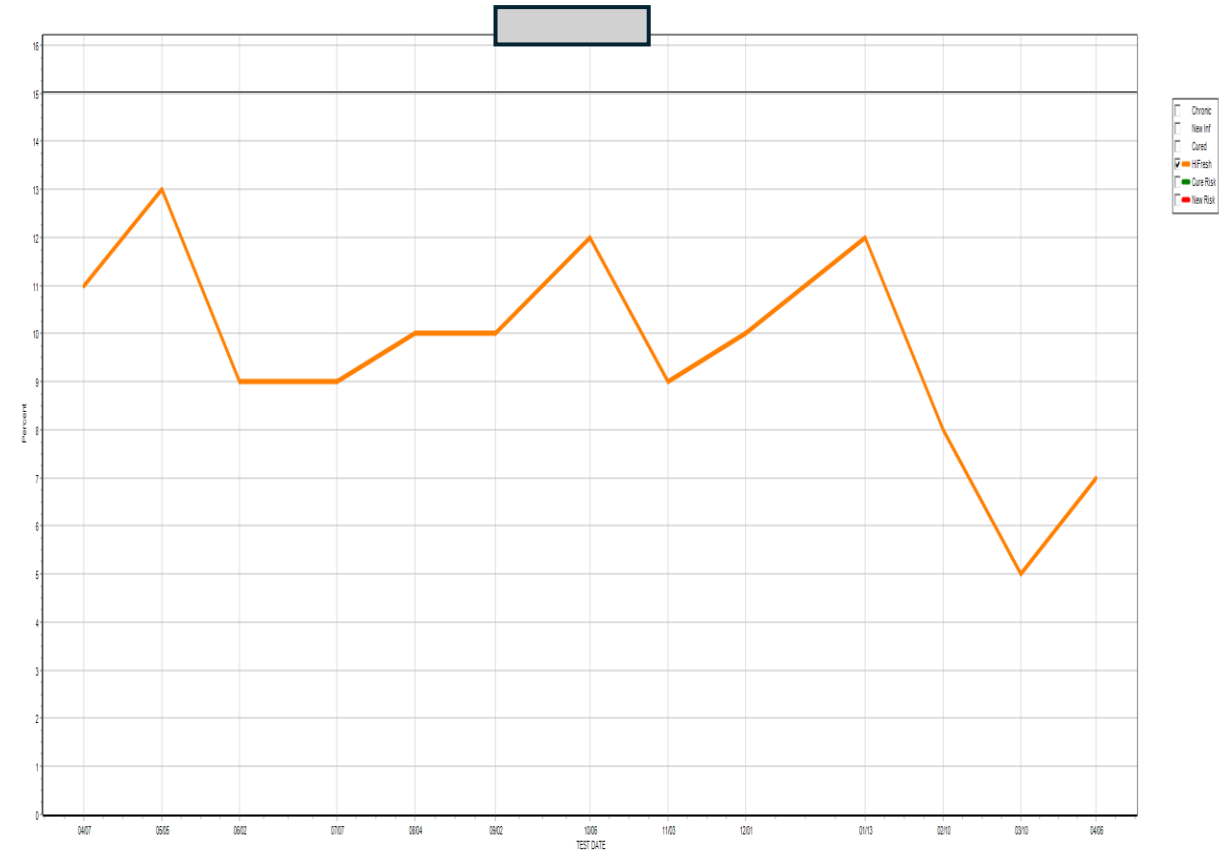


- This is a graph of the percent chronic infections and cure risk for first lactation (left) and mature cows (right). The first lactation animals are meeting the goal of less than 5% chronic infections. The mature cows are trending down. The cure risk for mature cows has not met the goal of greater than 35% this year which means you continue to accumulate chronic cows. This is related to the number of environmental Streps and Strep Strep-like organisms identified in clinical milk samples.

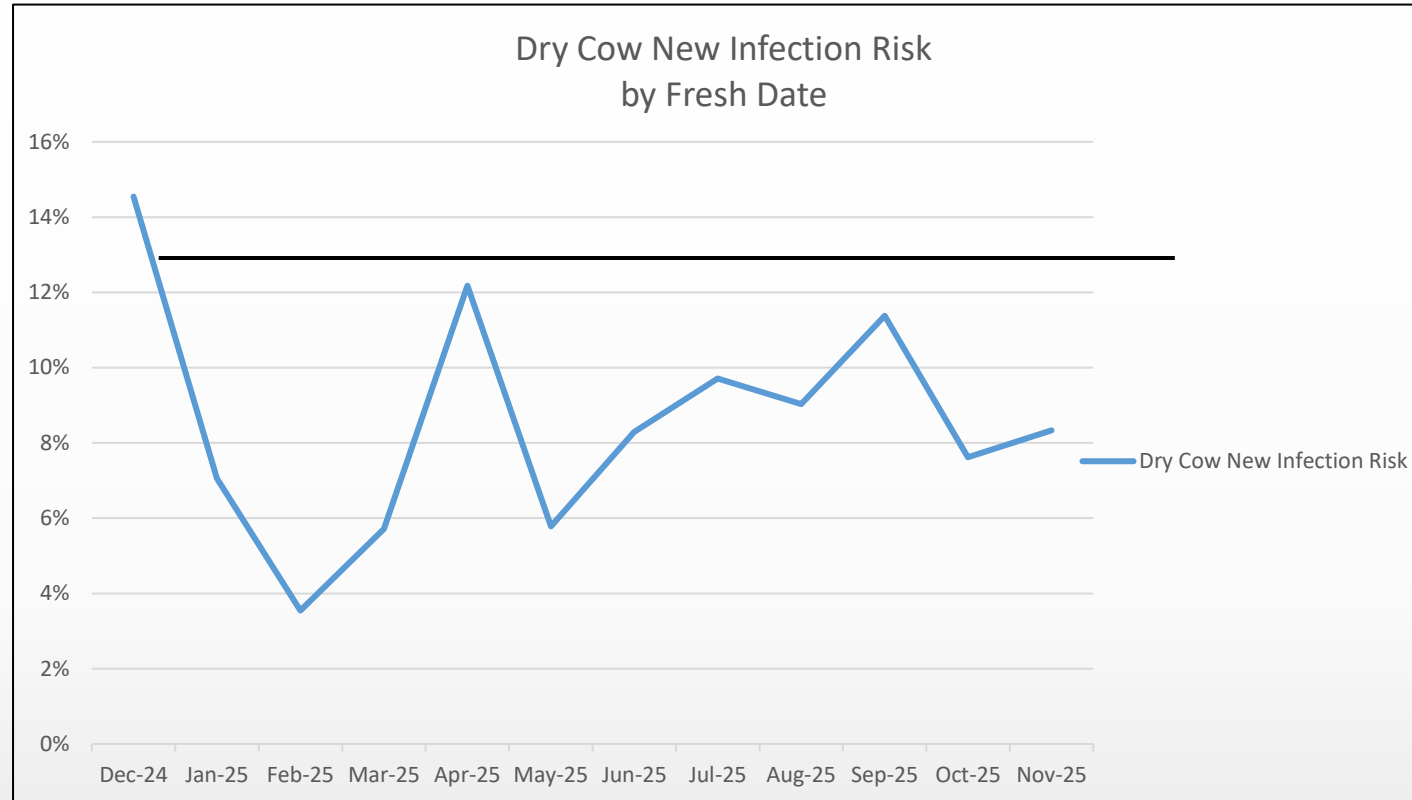
L=1



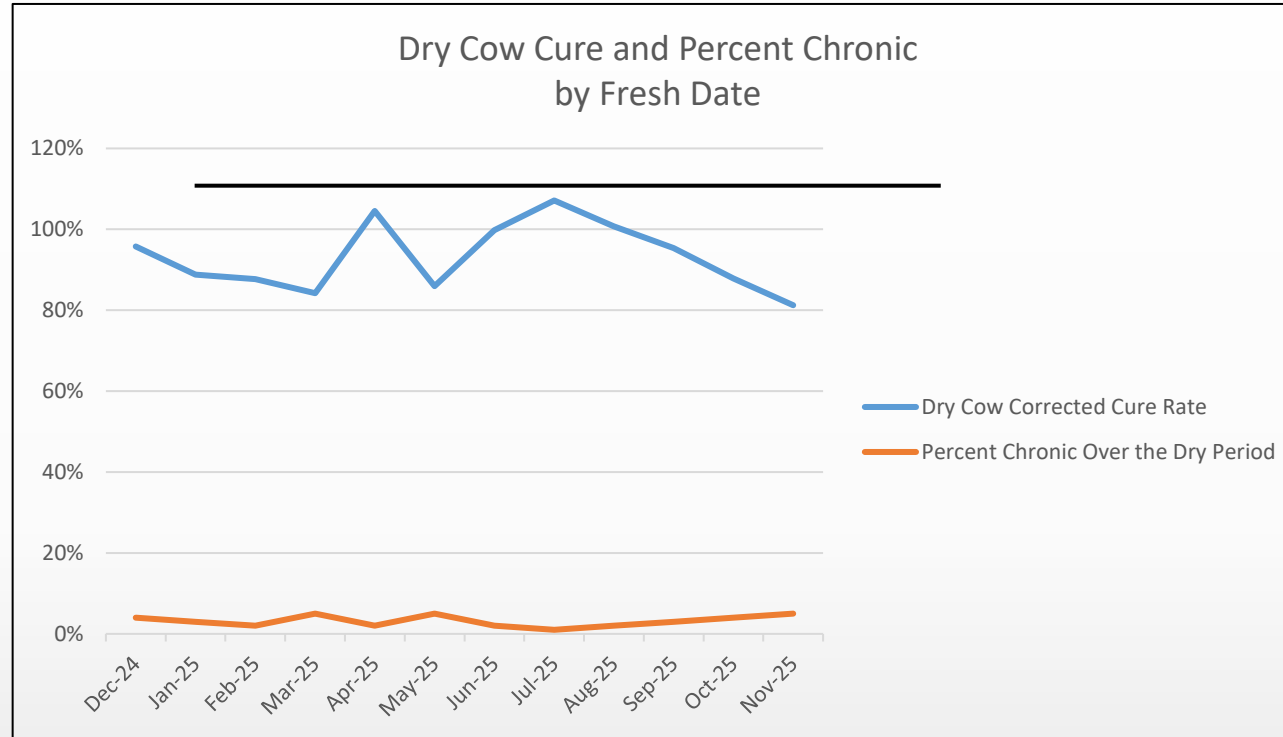
L>1



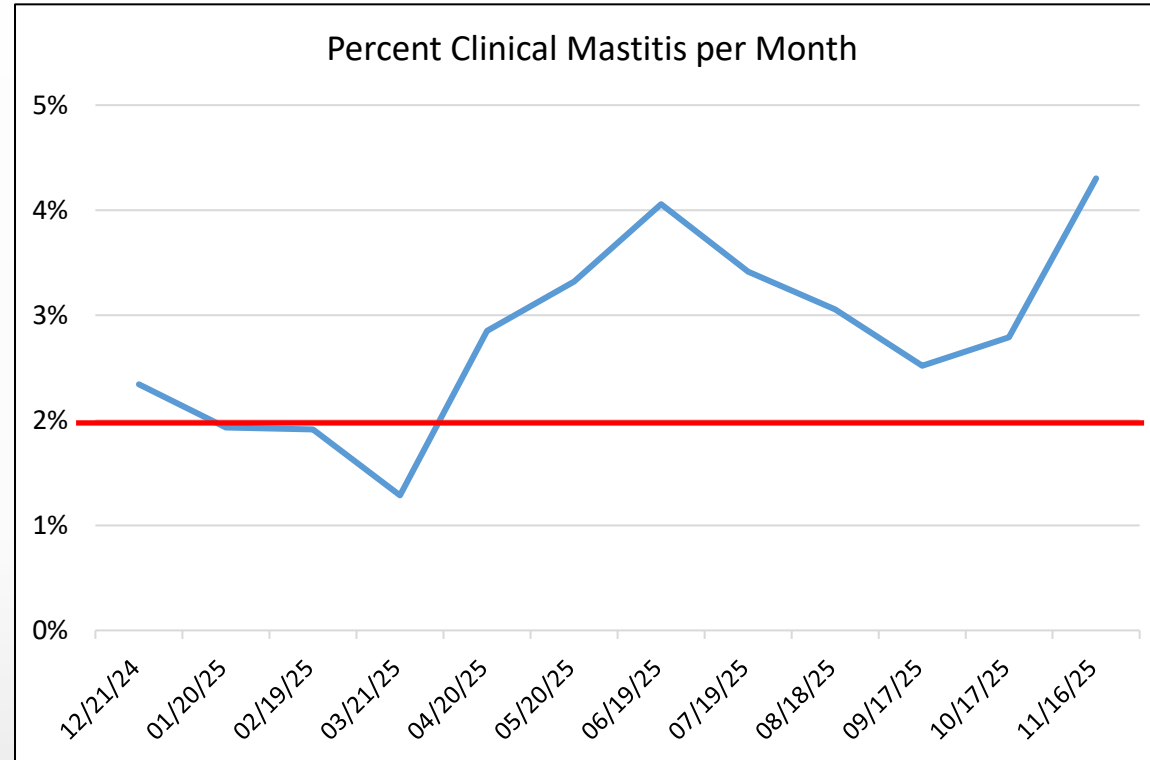
- This is a graph of the high fresh percent for first lactation animals (left) and mature cows (right). First lactation animals spiked in March 2026 and are currently at the goal of less than 15%. Mature cows have met the goal for the past year. Continue to monitor the dry off procedure and how the dry and pre-fresh stalls are managed.



- This is a graph of the dry cow new infection risk over the last year. Aside from spikes in April and September 2025, the dry cow new infection risk has been very good. Continue to regularly monitoring dry off procedures and pre-fresh pens (at least weekly). Continue to monitor calving areas in search of areas to improve.

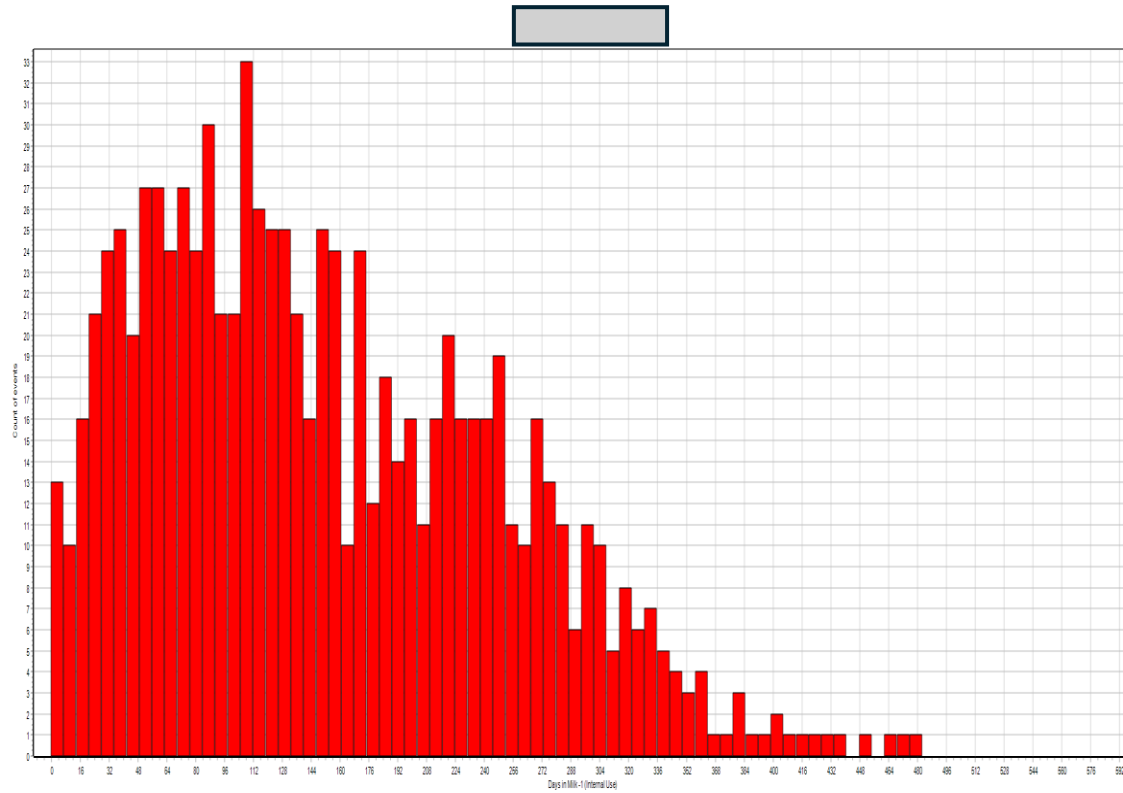


- This is a graph of the dry cow corrected cure rate (blue line) and the percent chronic infections over the dry period (red line). The cure rate has been above the goal of 80% for the majority of the year which is good. The percent chronic is low and so is less of a factor.

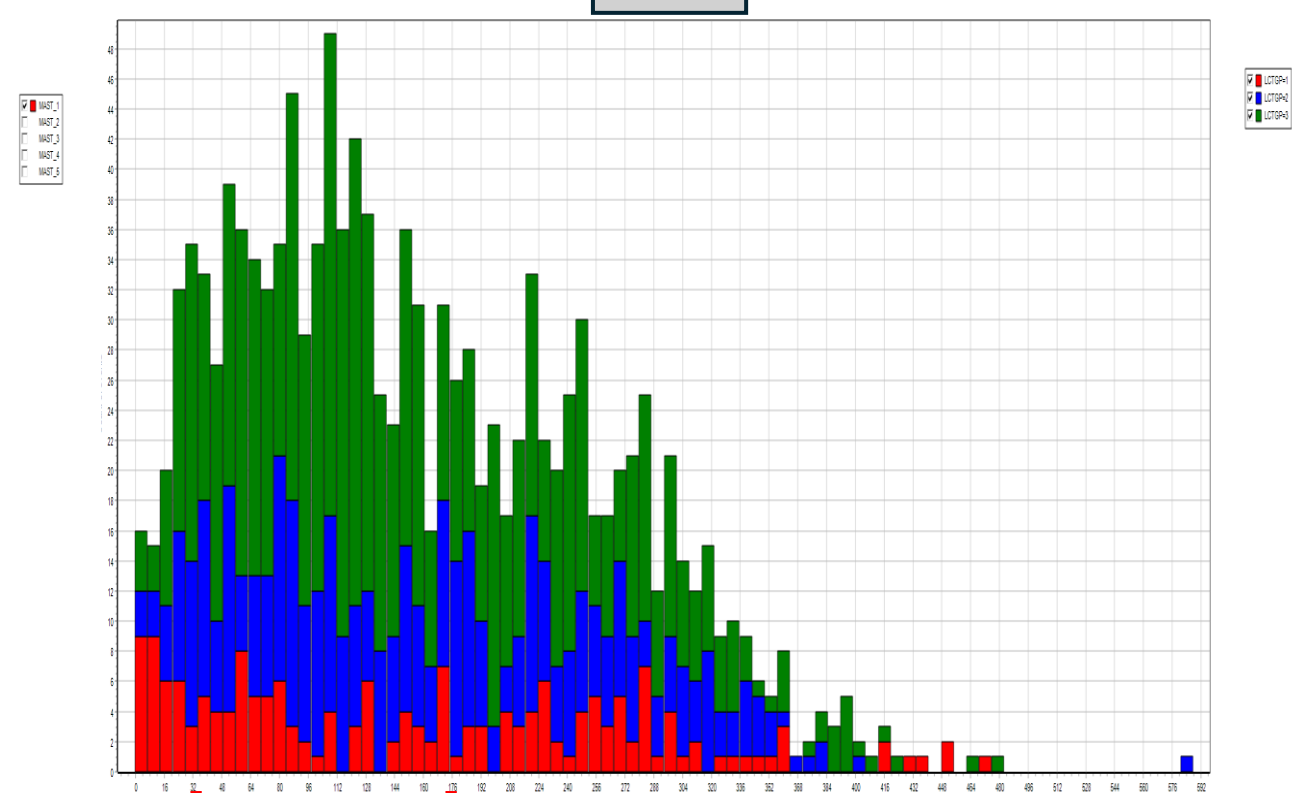


The percent clinical mastitis (based on entered MAST events) continues to be above the goal of less than 2%. Recurrent mastitis is 30%, which is within our goal of <50%.

MAST 1 by DIM

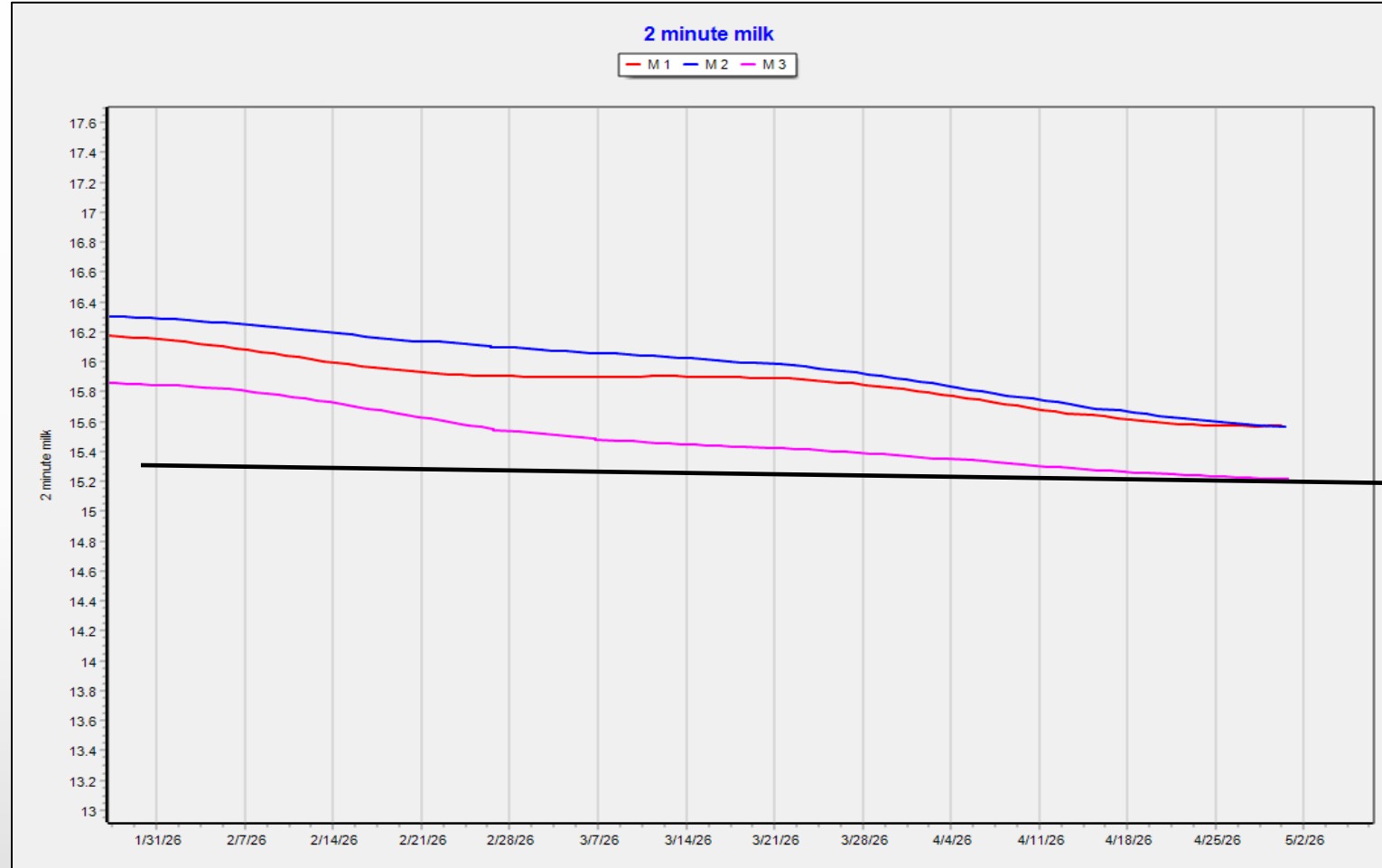


All MAST by DIM by LCTGP



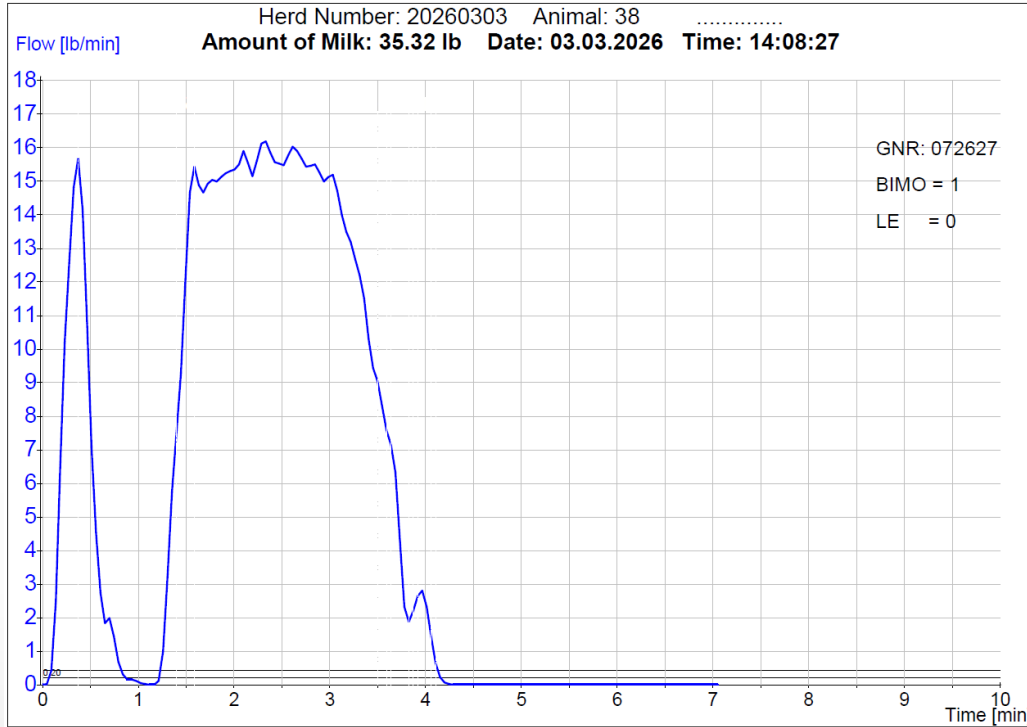
- This is a graph of the MAST 1 events by DIM on the left and all mastitis by lactation group by DIM on the right. The highest risk period looks to be around 30-120 DIM. Parlor activities, movement of animals to and from the parlor and lactating stalls should be our focus. The trends by lactation do not stand out as abnormal this period.

Parlor Performance

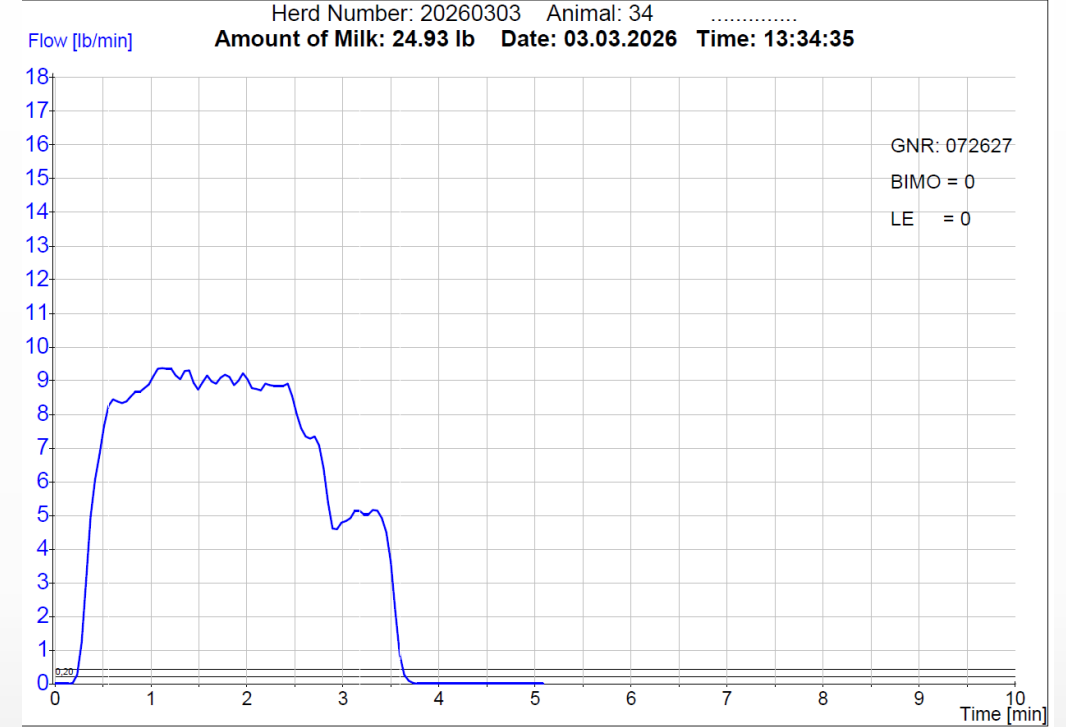


- This is a graph of 2 minute milk over the last 3 months by milking. The goal for this parameter is to be above 15 pounds for a 3X herd (black line). All three milkings continue to meet the goal.

LactoCorder® Analysis



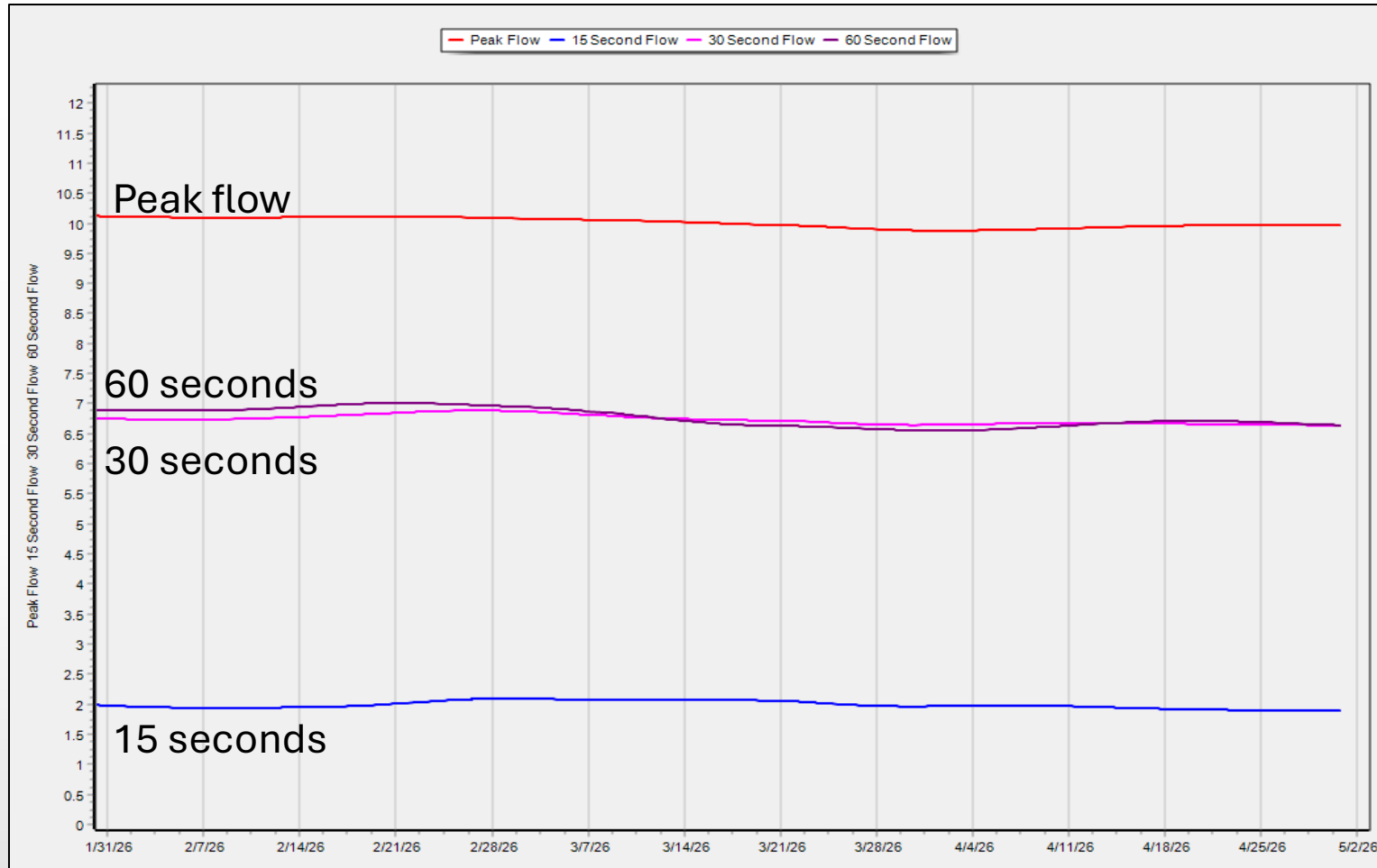
Bimodal Milk Curve



Good Let-Down Milk Curve

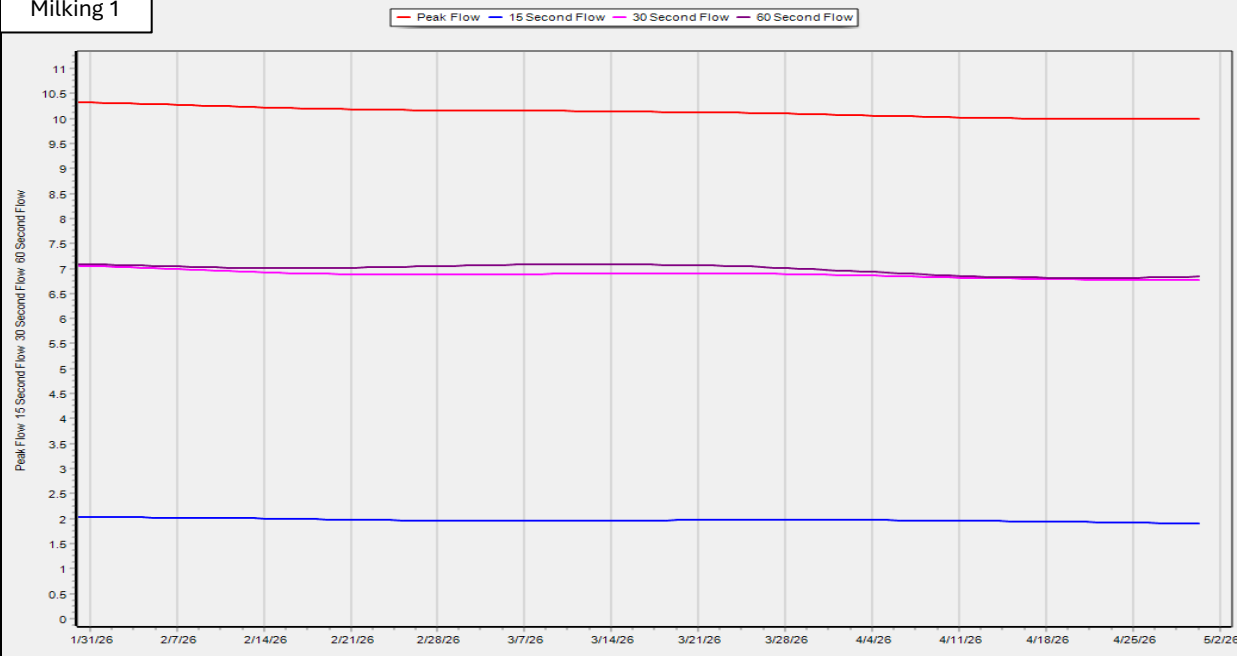
- During our visit, we ran 12 Lactographs. Lactographs record milk flow over time and generate milk flow curves (see above). 50% (6/12) showed bimodal milk curves. Our goal is less than 10% showing bimodal milk curves.
- The higher level of bimodal curves is most likely due to the shortened lag time.
- Stimulation time from pre-dip to unit attachment and pre-stripping to attachment tends to be short. All timings we performed showed appropriate lag times of greater than 90 seconds. Perhaps improving stimulation will reduce the number of bimodal curves observed.

Flow Rate Intervals for 3 months

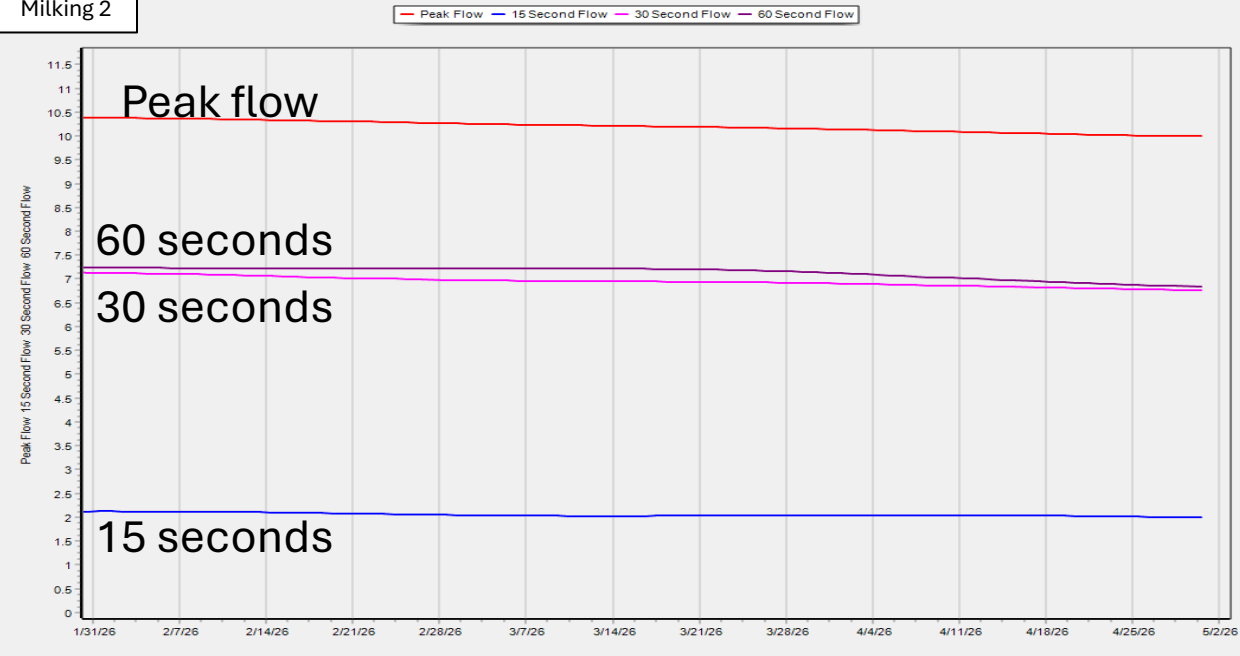


- This is a graph of the milk flow rate intervals over the last 3 months by milking. Based on this data, milk flows have gotten more bimodal since February 2026. The next slide shows this same data broken out by milking.

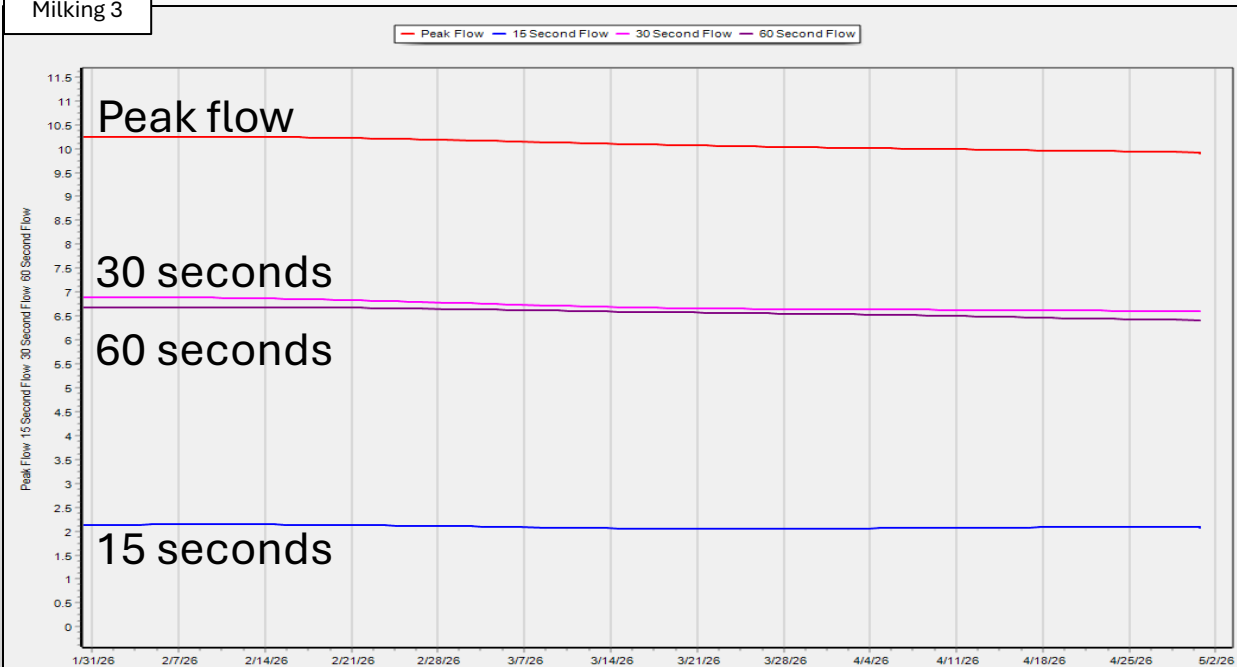
Milking 1



Milking 2

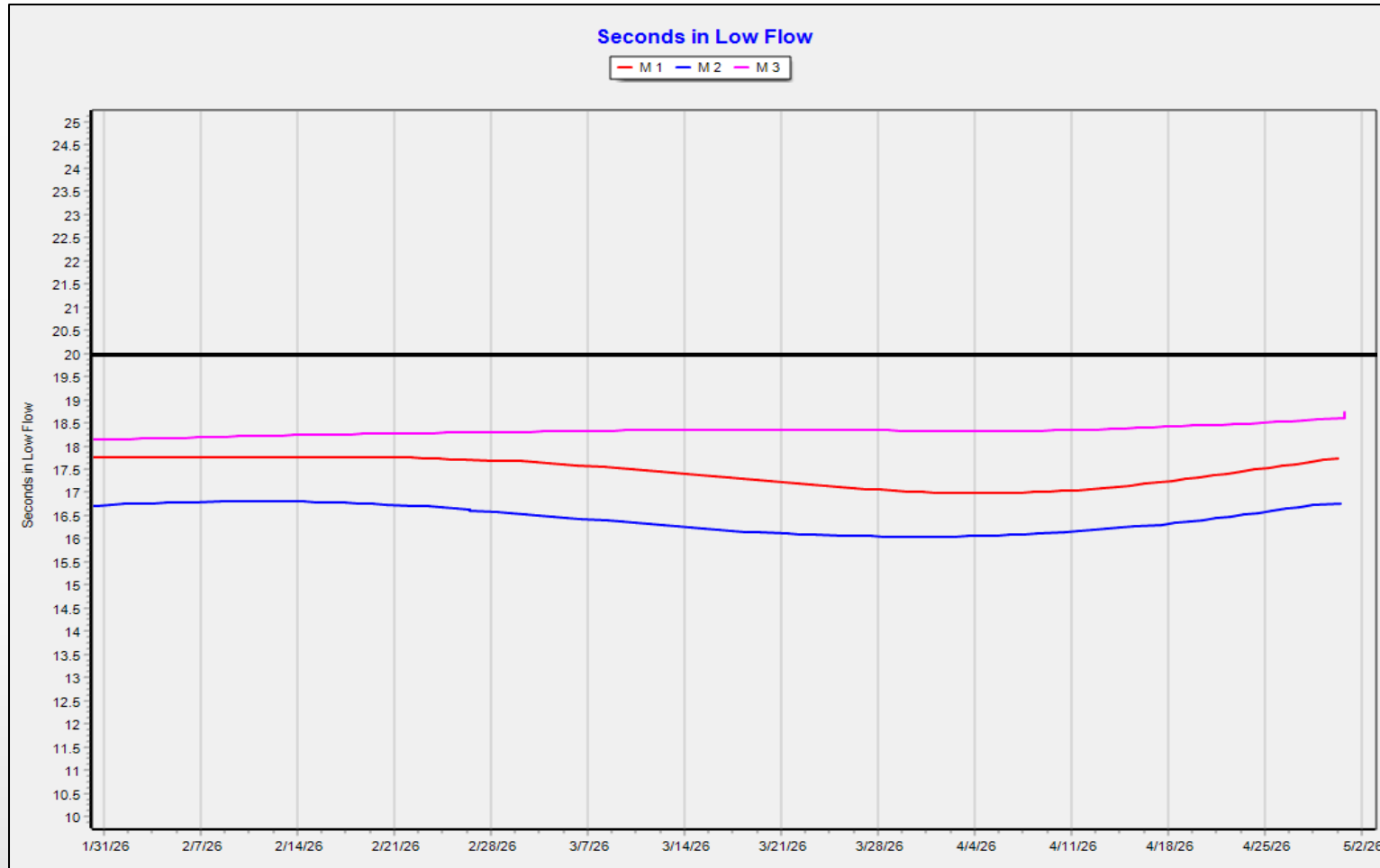


Milking 3



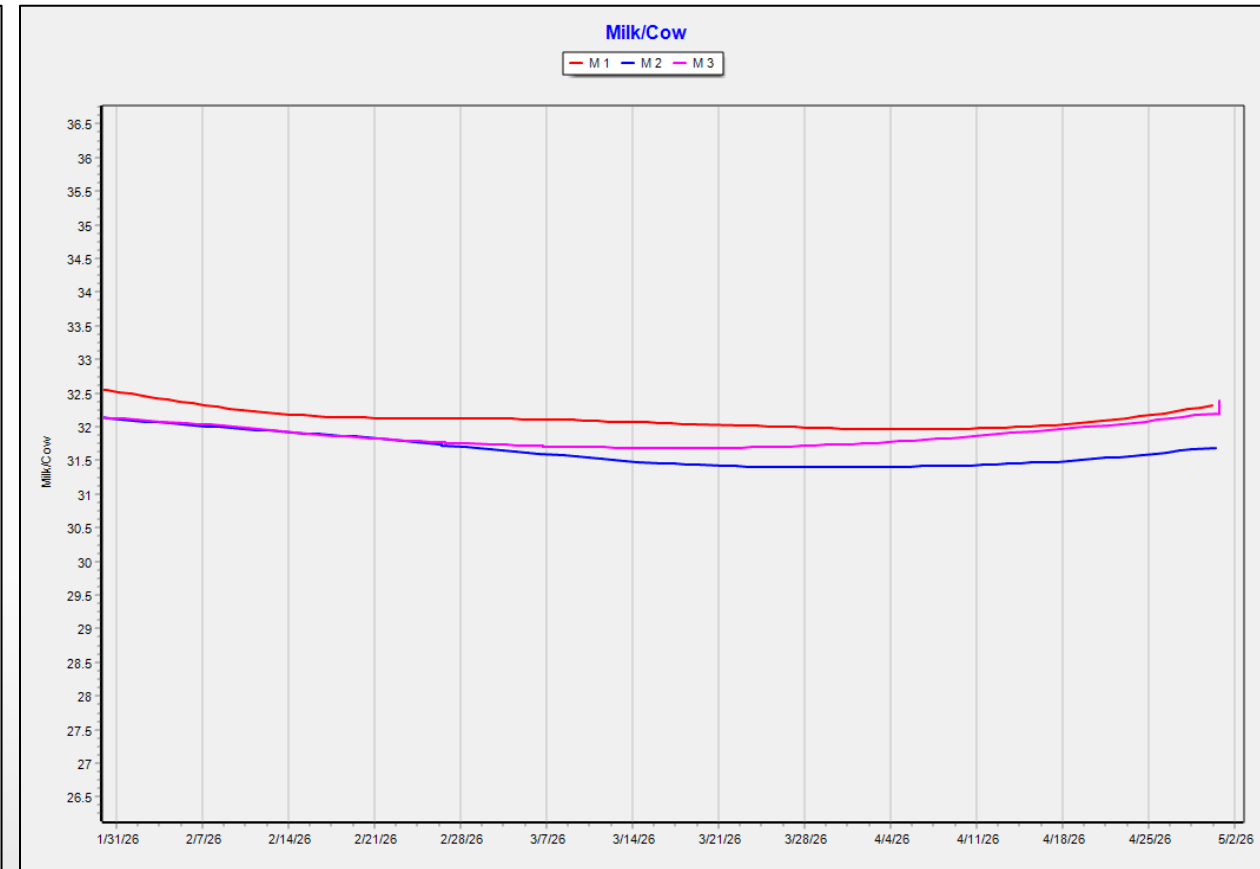
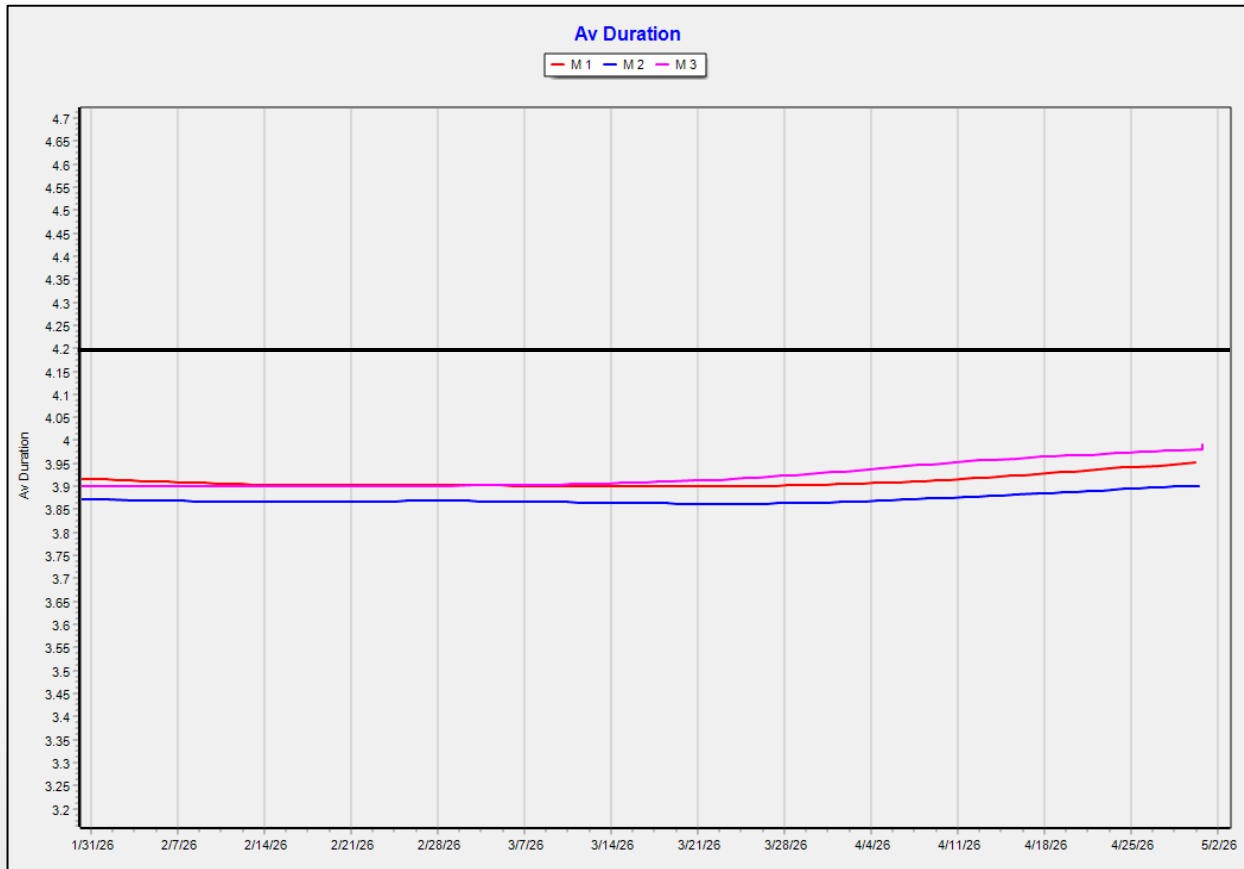
- Notice on milking 3 is consistently bimodal. Milking 1, the lines are on top of each other and 2 milking shows good milk flow.

Seconds in Low Flow



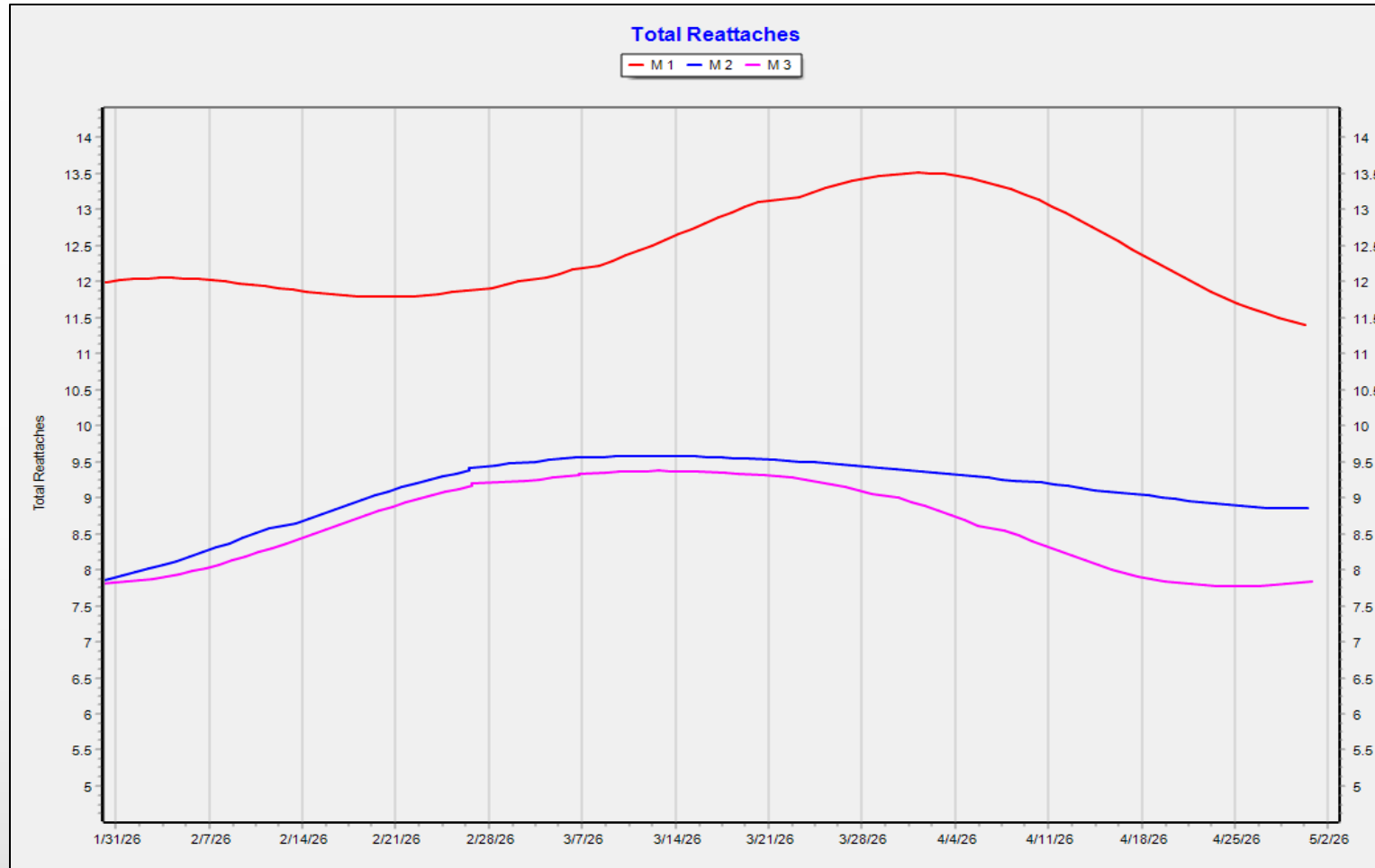
- This is a graph of the seconds in low flow over the last 3 months by milking. The goal is less than 60 seconds per day or 20 seconds per milking on a 3X herd (black line). You are still meeting the goal on all shifts.

Unit on Time/Milk per Cow



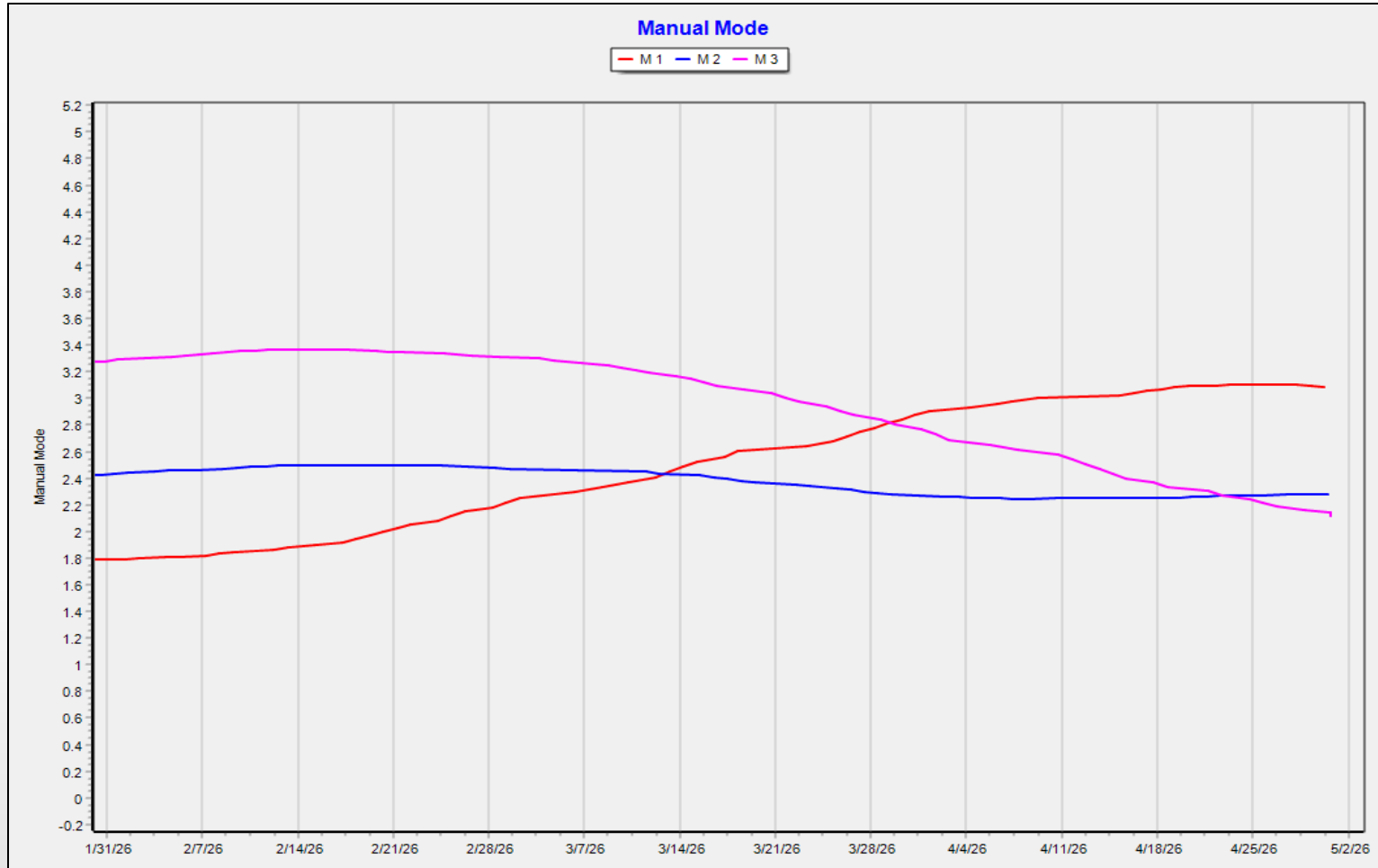
- This is a graph of the unit on time on the left and milk/cow on the right over the last 3 months by milking. The goal for unit on time based on your milk production would be less than 4.2 minutes per milking which is where the black line is placed. **Unit on time is meeting the goal on all 3 shifts.**

Reattaches



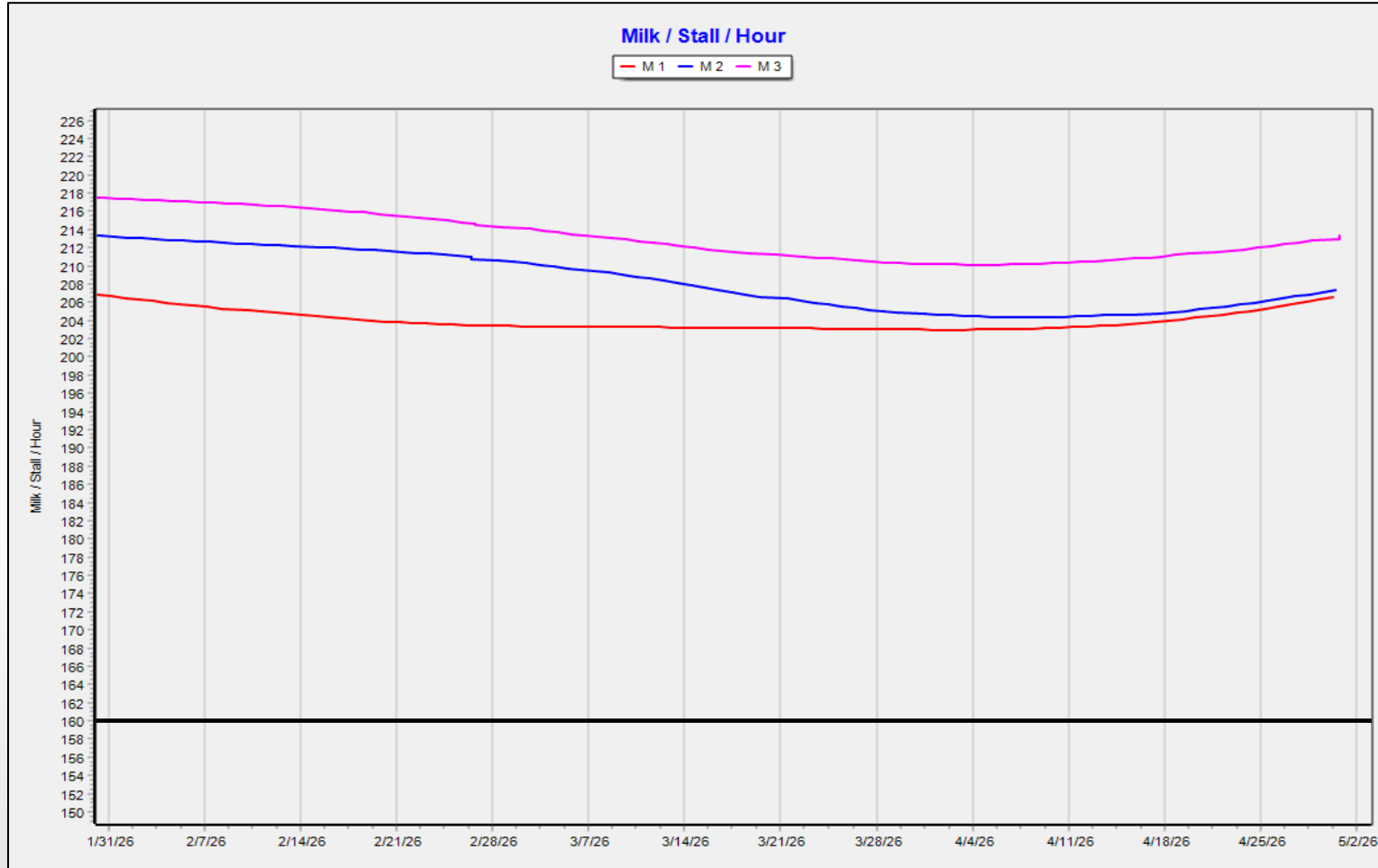
- This is a graph of the total reattaches over the last 3 months by milking. This does not look to be a significant issue on your farm.

Manual Mode



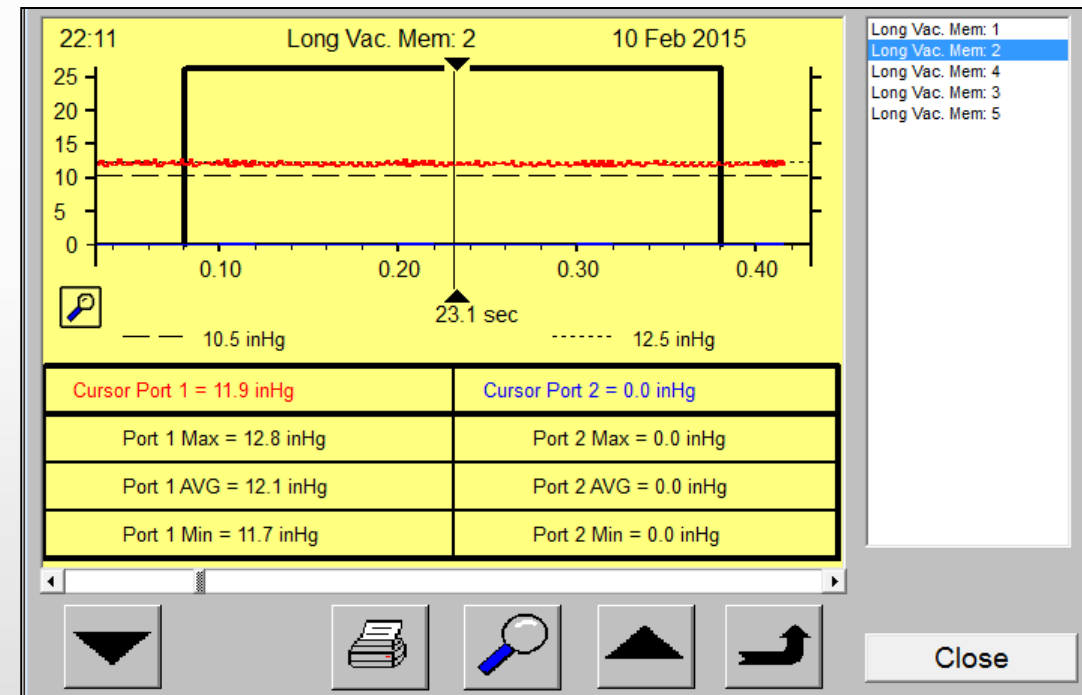
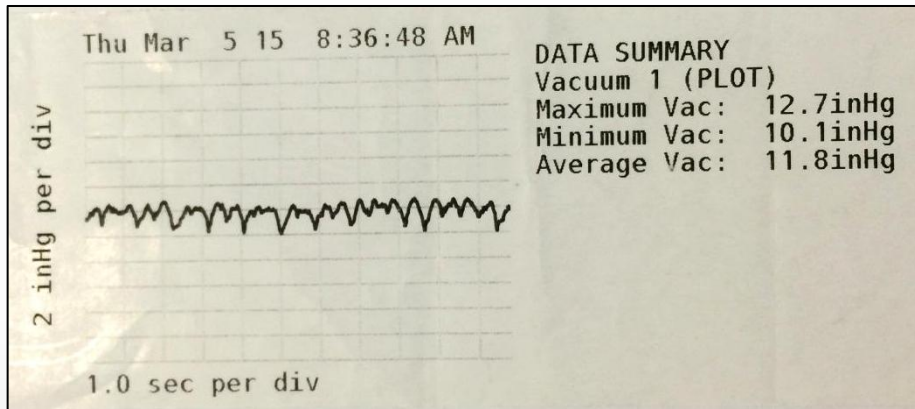
- This is a graph of the units on manual over the last 3 months by milking. This does not look to be a significant issue on your farm.

Milk/Stall/Hour



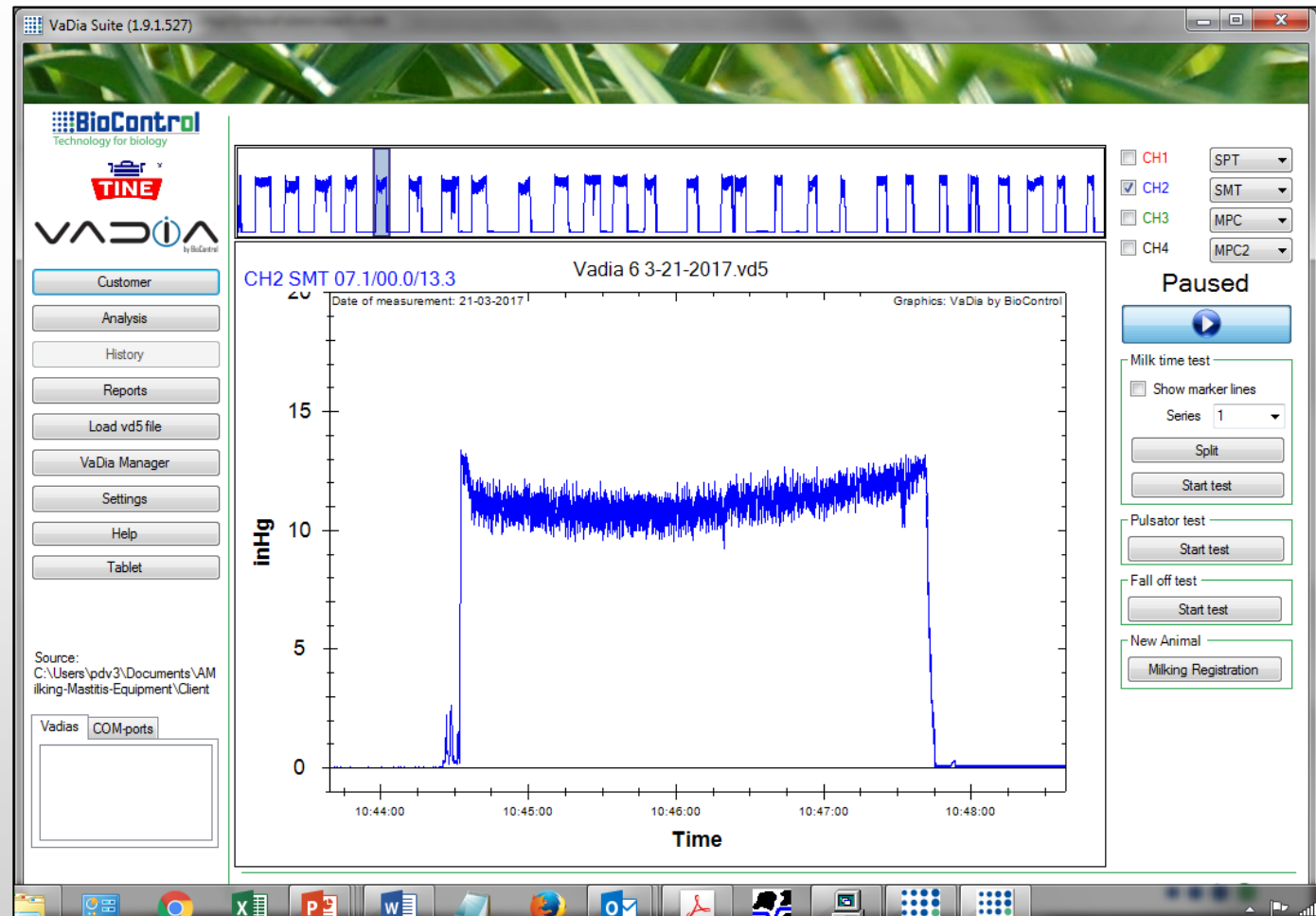
- This is a graph of the milk/stall/hour over the last 3 months by milking shift. The goal for a 3X rotary dairy is to be at 160 pounds of milk/stall/hour. **You are well above this goal and climbing which is excellent!**

Average Claw Vacuum at Peak Flow for a 5 to 20 second interval

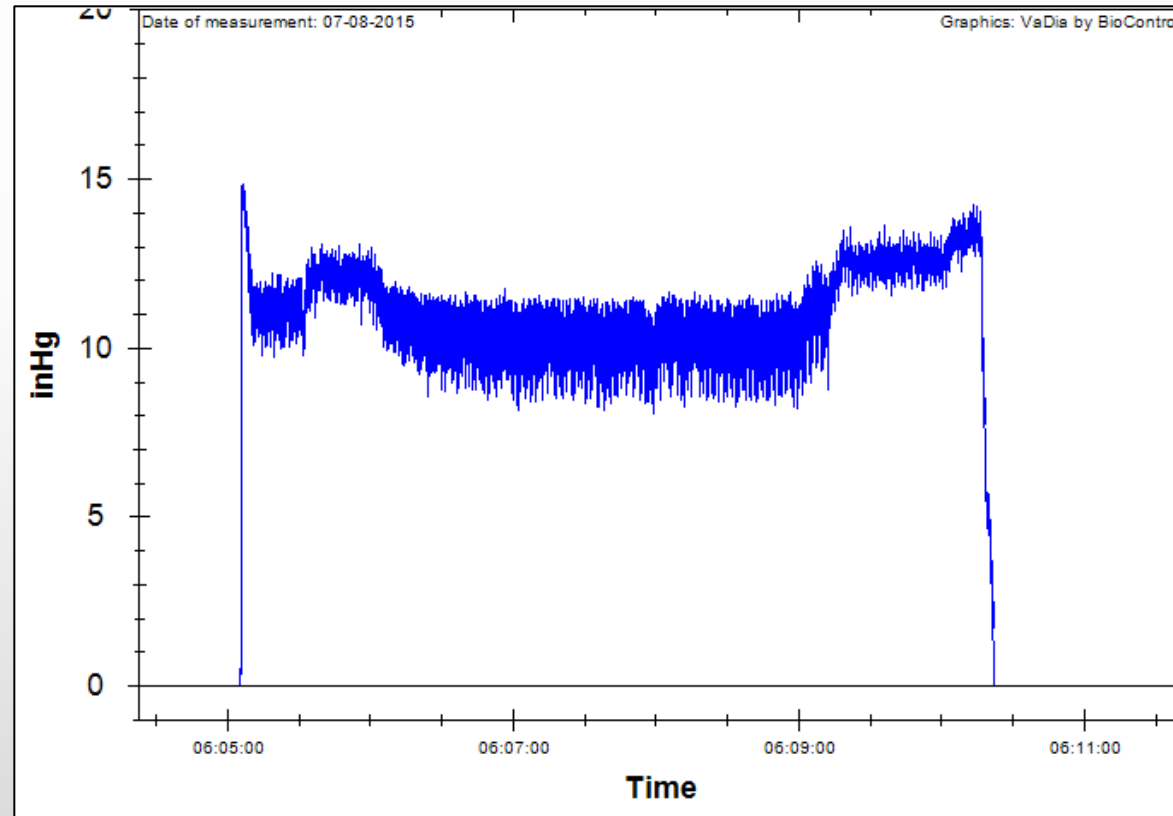
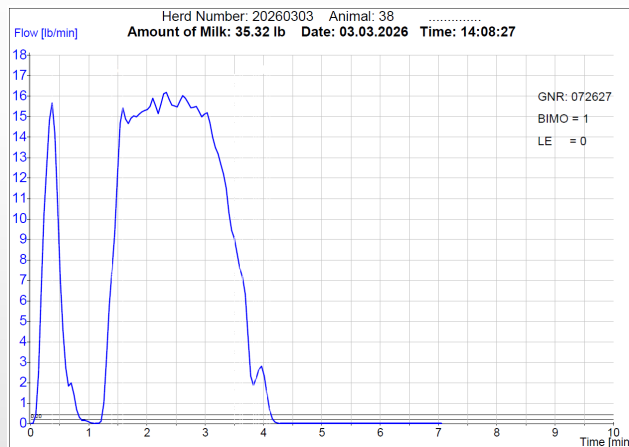


This is the vacuum reading that you use to set your system vacuum

Example: Claw Vacuum Graph

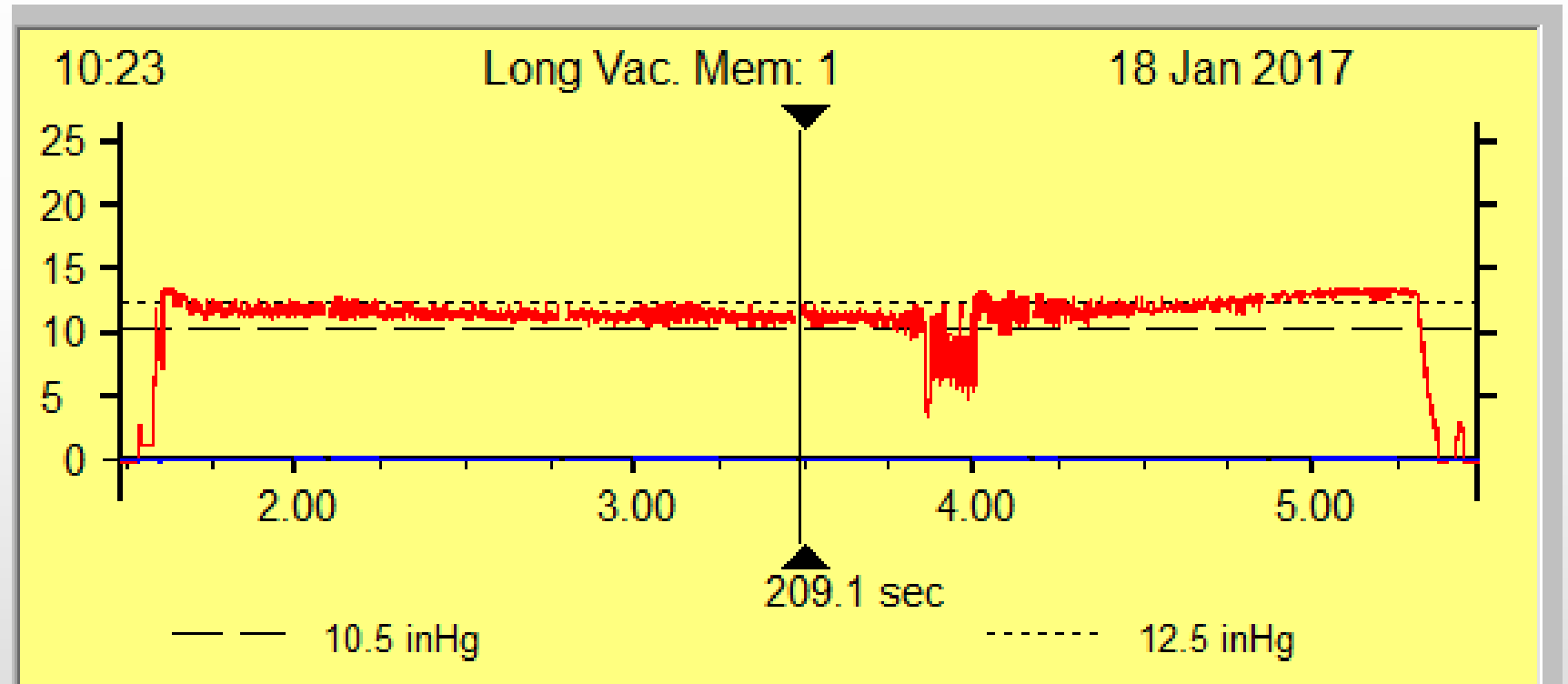


Example: Claw Vacuum Graph



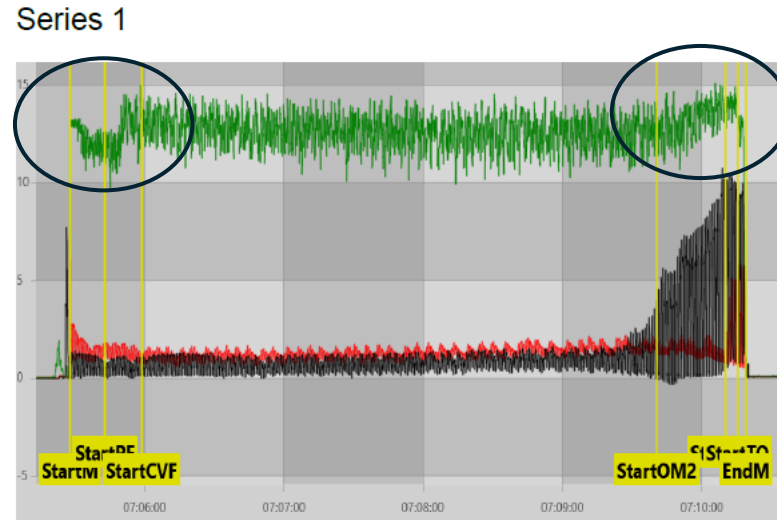
What 2 things does this flow pattern suggest?

Example: Claw Vacuum Graph



Notice liner slip as vacuum starts to rise

Average Claw Vacuum



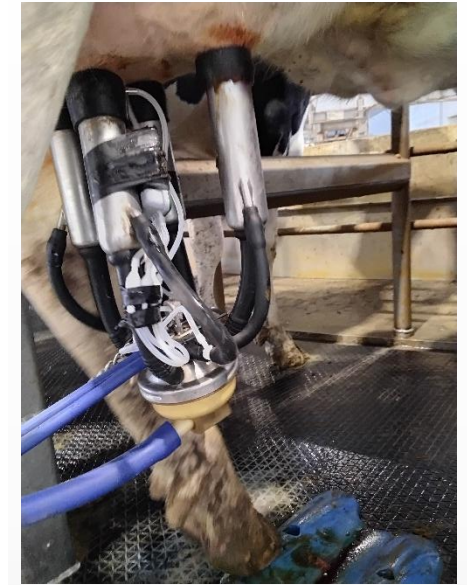
Animal	
Animal	8
Milk Yield	0.0
Av. Milk Flow	0.0

Time	
Start Preparation	00:00:00
Preparation time	00:00
Attachment lag time	00:00
Attachment	07:05:27
MachineOn	04:51
Overmilking	00:05
General Overmilking	00:05

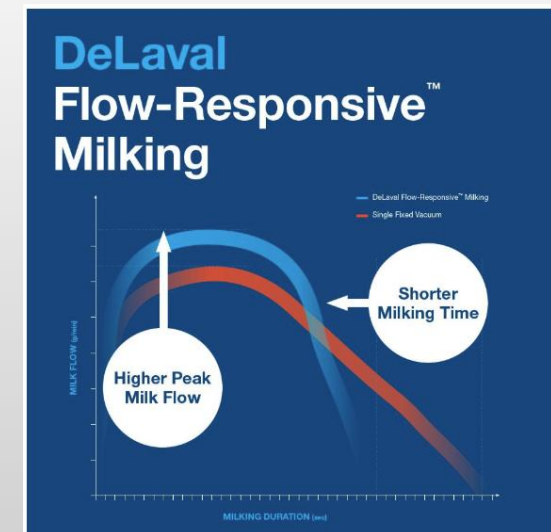
MPC vacuum	
MPCVac. PFP	1.3
MPC2Vac. PFP	0.8
MPCVac. Total	1.4
MPC2Vac. Total	1.3
MPCVac. Overmilking	2.1
MPC2Vac. Overmilking	4.4
MPCVac. Favorable	0.0
MPC2Vac. Favorable	0.2

SMT vacuum	
Average short milk tube vacuum	
- Total	12.6
- PF period	12.7
- Overmilking	14.0

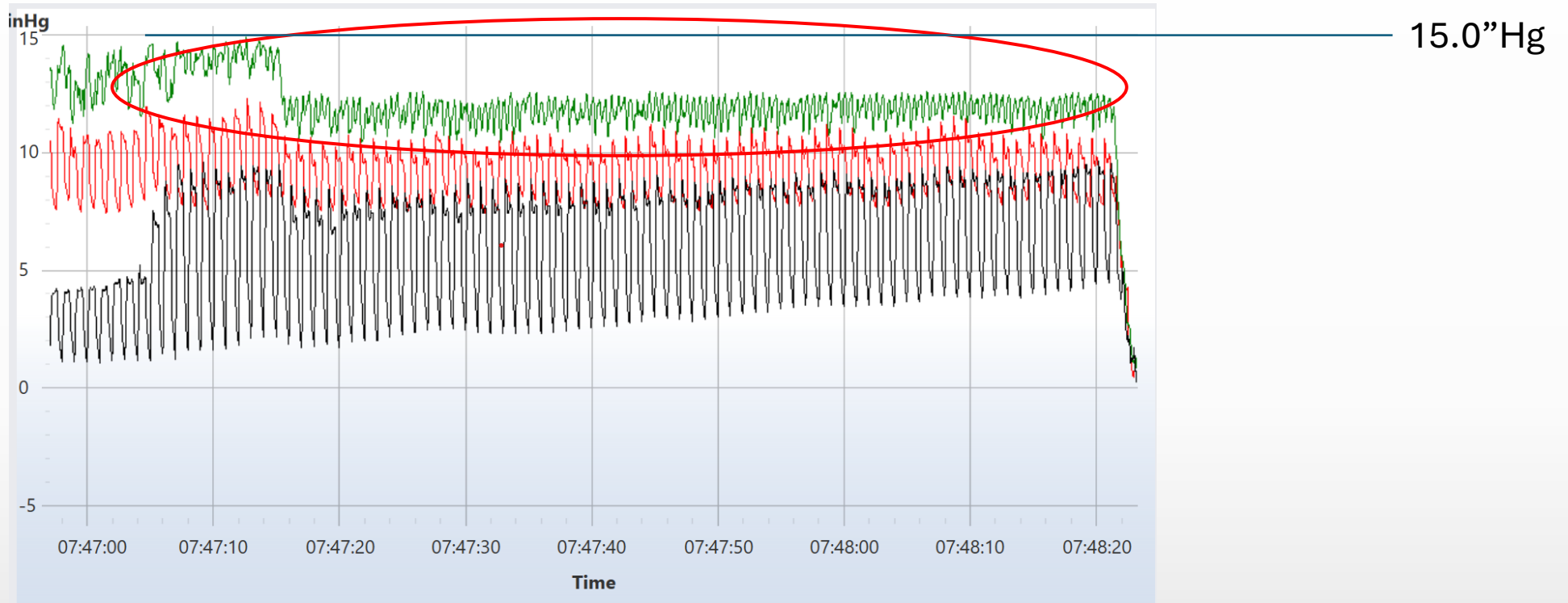
Cyclic vacuum fluctuation	
Cycl. Vac. Fl.	
- Minimum	12.0
- Average	13.0
- Maximum	14.1
Irr. Vac. Fl. Type1 (IVF1)	0



- The graph above depicts the last 30 seconds of milking before the systems lowers the system vacuum and during this time period the claw vacuum averaged 12.7" Hg and was as high as 14.0" Hg.



Average Claw Vacuum



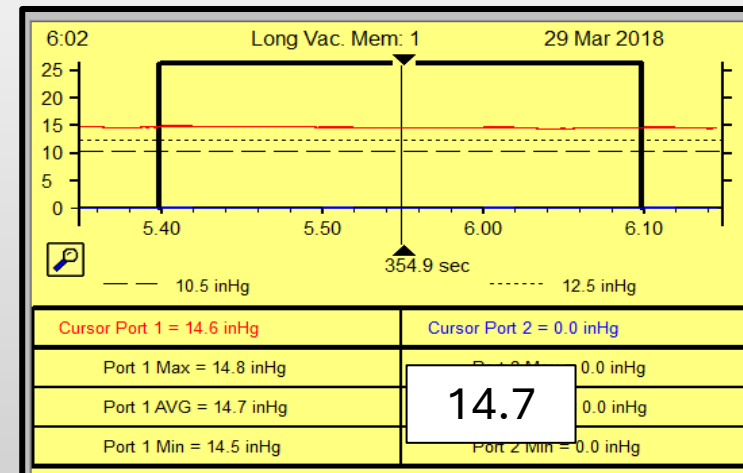
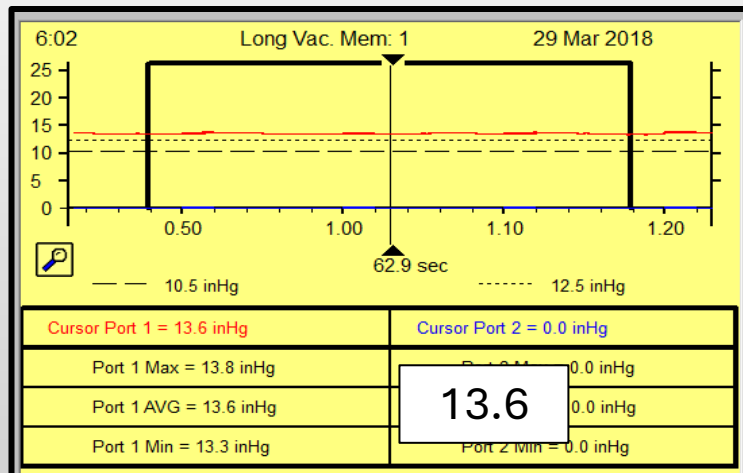
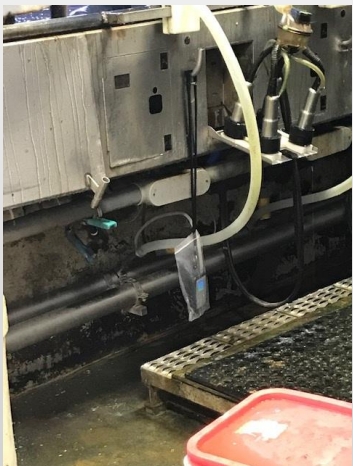
The graph above is of claw vacuum with the green line representing claw vacuum and the red and black lines representing mouthpiece vacuums. Circled is the vacuum drop during the last 60 seconds of milking.

Average Claw Vacuum

- Average Claw Vacuum at Peak Flow for 5 to 30 seconds
- Your average claw vacuum is: **12.2"** based on 23 cows
- 12/23 or 52% of claw vacuum recordings during peak milk flow exceeded 12.5" Hg
- 3/23 vacuum recordings ≥ 13.0 " Hg.
- This is outside the NMC recommendation of 9.5-12.5".
- There is concern for short-term teat end congestion after milking and long-term hyperkeratosis given the high claw vacuum recordings during peak milk flow.

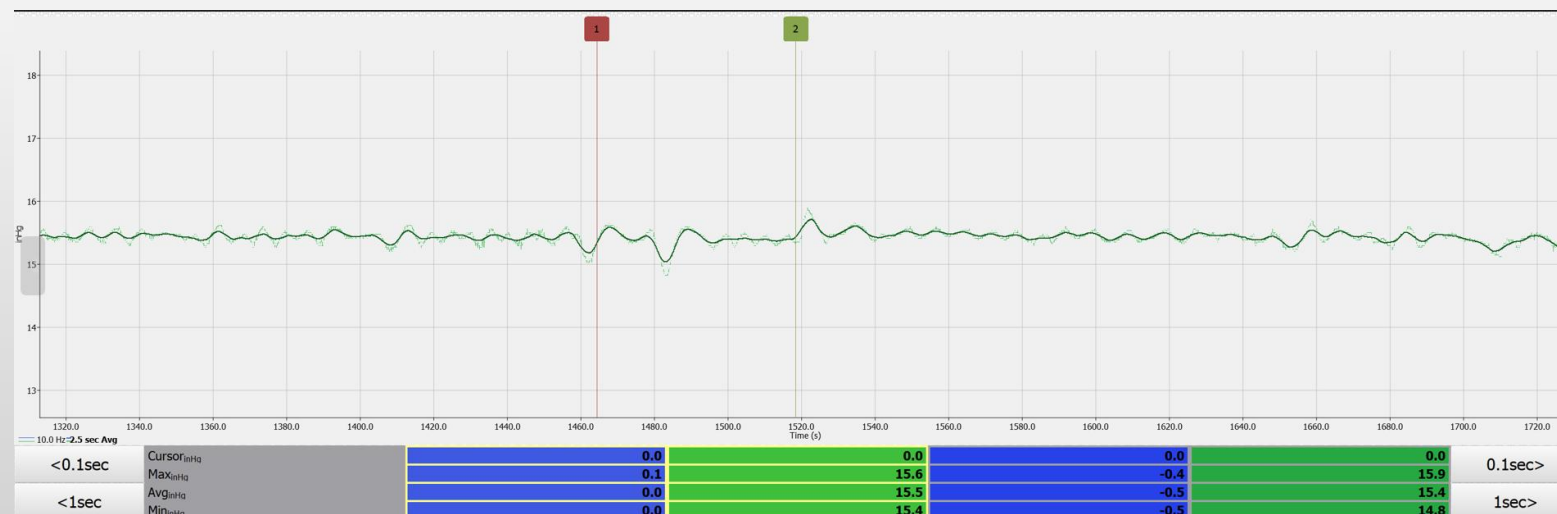
Milkline Vacuum for 30 minutes

- Continuous recording of milkline vacuum for 30 minutes during normal milking.
- Allows a reasonable assessment of whether major problems with vacuum regulation are present.
- Dbl 24 parlor - Left graph with all units on one side and right graph is with only 12 units on



Milk-line Vacuum During Milking

- We ran a milkline vacuum for 28 minutes during normal milking to assess how well your system responds to normal events during milking.
- The milkline vacuum was within 0.1"Hg above and below the average of 15.5"Hg for the majority of time.
- We also performed a two unit fall off during this time and your system was able to maintain stable vacuum with a vacuum drop, undershoot, of 0.5"Hg and overshoot of 0.4"Hg.



Pulsators

- Usually do 3 to 4 pulsators when the unit is on the cow and milk is flowing
- Save the pulsation graph at peak flow
- **Also do all pulsators in the parlor as a dry test**

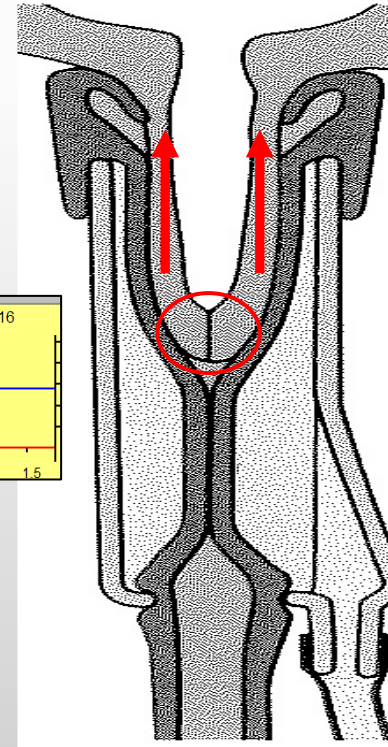
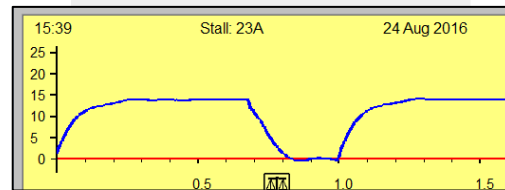
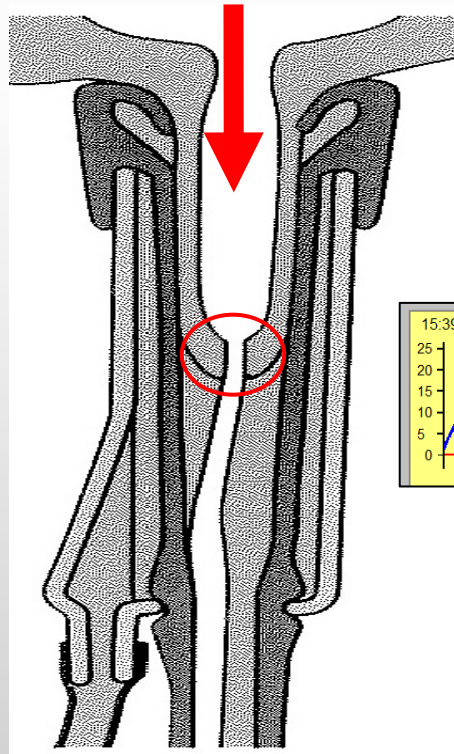
Full Milking Load

A = 16.0 %	A+B = 64.7 %
B = 48.7 %	Max Vac = 13.6 inHg
C = 11.4 %	Dsec = 236.0 ms
D = 23.5 %	Rate = 59.9 CPM
Limp = 0.0 %	B.Drp = 0.4 inHg

Forces on fluids within the teat during pulsation cycles

B phase (open phase)

D phase (closed phase)

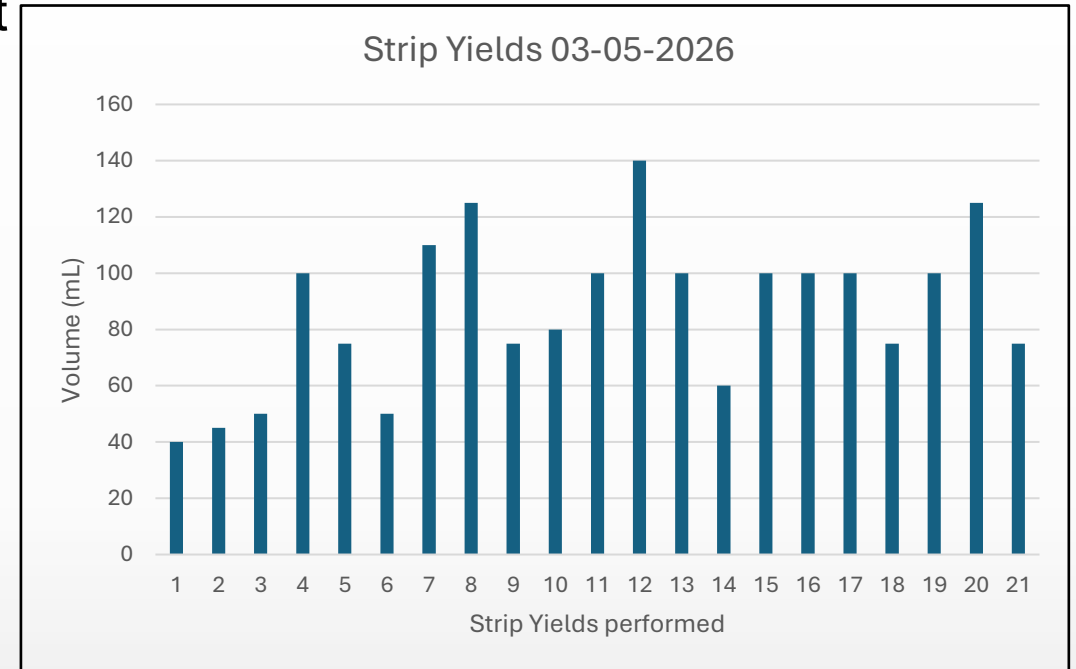


- Pulsator Rate= 60 ppm
- Pulsator Ratio = 65:35
- Pulsation under load:
 - B phase of pulsation = 501 ms
 - D phase of pulsation = 238ms
- **Pulsators #1, 30, 68, and 70, should be examined as they have a shortened D Phase.**

Shortened D phase reduces blood flow to the teat-end and may cause hardness/firmness causing discomfort and leading to roughened teat-ends. Often debris in the pulsator will cause pulsators to be out of specifications.

- All other pulsators conform to ASAE standards.
- Katie is planning on coming in every 2 months to graph pulsators.
- **No changes in pulsation parameters are recommended.**

- Animals were stripped for 1 minute immediately after unit detachment. (15 seconds for each quarter)
- Strip yields on 21 animals has improved
 - All strip yields were less than 150 ml
 - No strip yields were between met the goal of 150 – 250 mL (1/2 to 1 cup)
 - Goal is 80% in this category
 - **Average strip yield was 87 ml**
 - Strip yields are too low.
- Consider adjusting take-off to come off earlier.



Retraction Data

- This is the timing of the retraction time of each individual unit. We turn the unit on and then hit retract and start the stop watch when it starts moving and stop it at the point of full retraction.
- **We identified any unit taking longer than 4 seconds to retract. Units #38 and 56 should be further evaluated.**

Unit	Time	Unit	Time
1	0.21	37	0.5
2	0.73	38	5.28
3	0.17	39	1.08
4	2.3	40	0.71
5	1.09	41	1.18
6	0.62	42	1.13
7	0.73	43	1.08
8	1.18	44	1.98
9	1.09	45	1
10	1.68	46	1.41
11	0.43	47	1.21
12	0.91	48	0.98
13	0.56	49	1.48
14	1.18	50	1.37
15	0.18	51	2.42
16	1.05	52	2.09
17	1.23	53	1.01
18	0.94	54	1.18
19	0.96	55	1.2
20	0.1	56	4.45
21	1.75	57	0.65
22	1.04	58	1.54
23	1.16	59	1.03
24	1.48	60	1.65
25	0.35	61	1.04
26	1.21	62	1.19
27	1.41	63	1.11
28	0.91	64	1.18
29	1.46	65	1.35
30	1.08	66	1.24
31	1.03	67	1
32	1.32	68	0.76
33	1.31	69	1.9
34	1.44	70	0.91
35	0.35	71	2.29
36	1.06	72	1.23

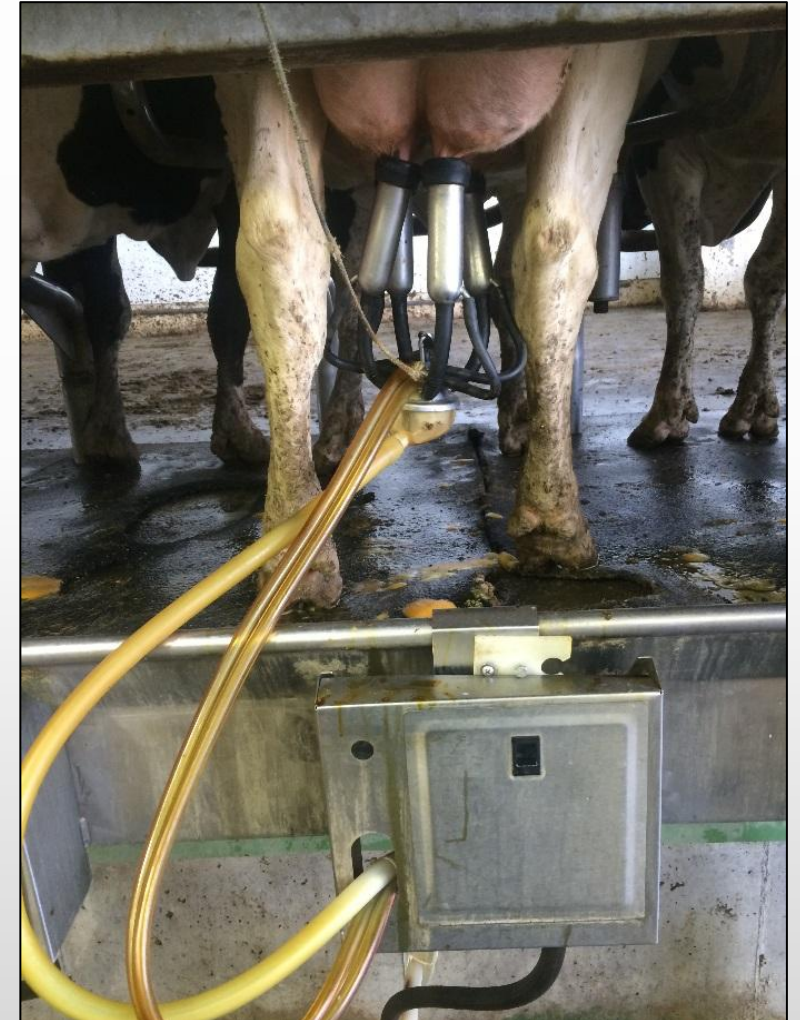
Unit Alignment Scoring

- 2 category scoring system
 - Proper
 - Improper
- Score within first 2 minutes of milking
- Do not score:
 - $\frac{3}{4}$ cows
 - Poor udder conformation



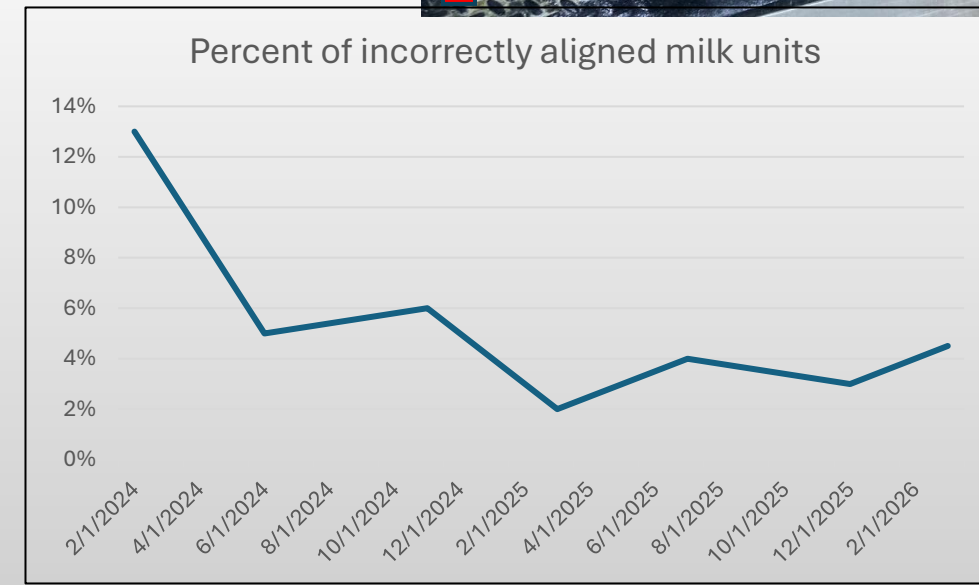
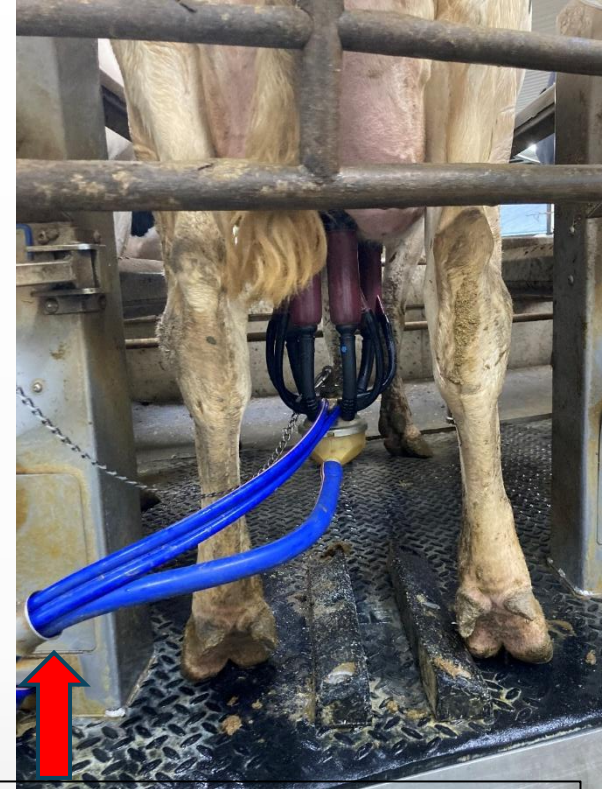
Unit Alignment Scoring

- Poor unit alignment
 - Increases the risk for liner slips
 - Influences milking speed of individual quarters
 - Increases the risk of teat damage
 - Decreases parlor efficiency
 - Prolonged unit on time
 - More chance of reattach



Unit Alignment

- Unit alignment is very good.
- 95.5% were properly aligned.
- Alignment is a function of adjusting the hose length in the coupling (red arrows)
- Why does it matter?
 - Prolonged unit on time due to quarters milking at different speeds
 - Decreased parlor efficiency
 - Increased risk of teat damage due to prolonged time in low flow
 - Cows kicking at units leading to more manure on units and teats
 - Increased number of liner slips
 - Causing units to come off early as the detacher kicks in (major issue if bimodal letdown at front end of milking)
 - Either cow leaves not milked out or
 - Reattached which slows up the parlor and increases risk of teat damage due to prolonged time in low flow



People Performance

Milking Routine 72 Stall Rotary

- 1st Milker
 - 1.) Pre-strips and then foams with a cup foamer (stall 1-2)
- 2nd Milker
 - 2.) Wipes cow with cloth towel (stall ~7)
- 3rd Milker
 - 3.) Attaches unit (see below as variable by group)

Turn time was approximately 6.5 seconds per stall. The 2 year olds and low production cows have a longer lag time with mat at approximately stall 20-21 and high production cows with a medium lag time with mat at stall 17-18.

Milking Routine Timing

	Dip contact time 1st cow	Dip contact time last cow	Lag time cow 1	Lag time cow 5
Average	0:48	2:26	1:23	0:53
	> 0:30	> 0:30	> 1:30	

- Example of timings from a recent farm visit where the lag time was too short.

Excellent

Needs attention

Poor values

Milking Routine 72 Stall Rotary

Dip contact time	= 36 seconds	= Good
Lag time from stimulation to unit attachment	= 106 Seconds	= Good
• Percent below 90 seconds	= 0%	= Excellent
Average Strip/stimulation time (2 teats left side)	= 3 second	= fair
		(1.5 seconds per teat)

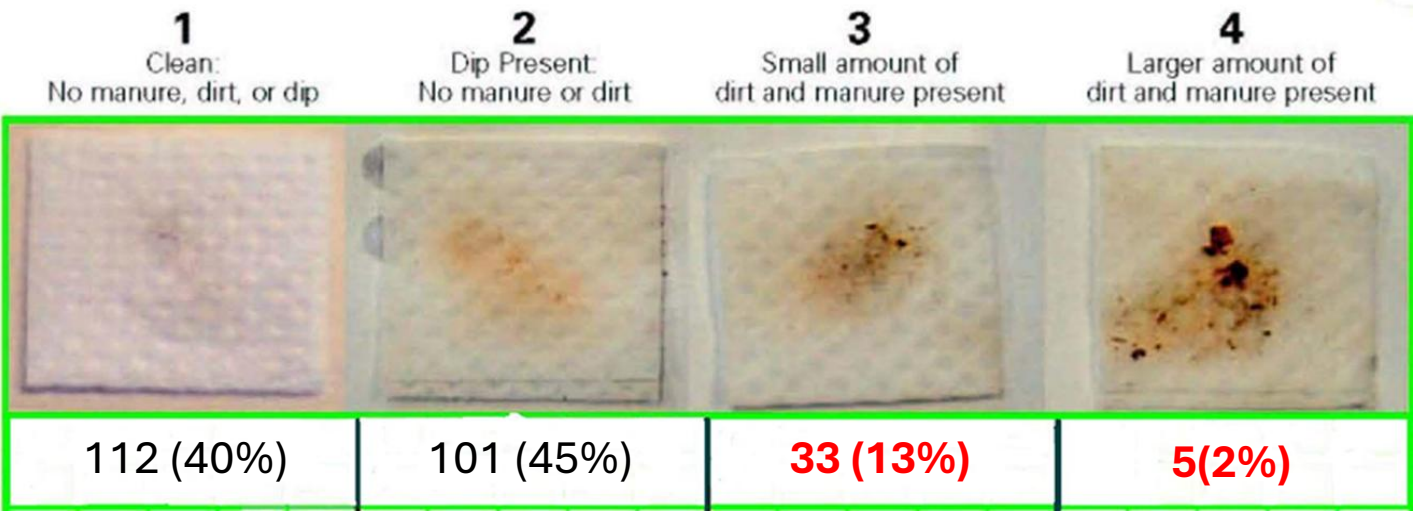
Average unit on time: 03:46

Routine is meeting the goal of >30 seconds for dip contact time. The lag time from stimulation to unit attachment is within the goal of 90 to 180 seconds and is above 90 seconds for all cows we timed! 2 minute milk is good but has declined some.

Stripping stimulation is short. When stripping all four teats, hands-on stimulation lasted for approximately 1.5-2 seconds per teat (8 seconds total). Milkers are performing the same routine but now on only two teats.

Is it possible for milkers to strip for an additional second on each teat?

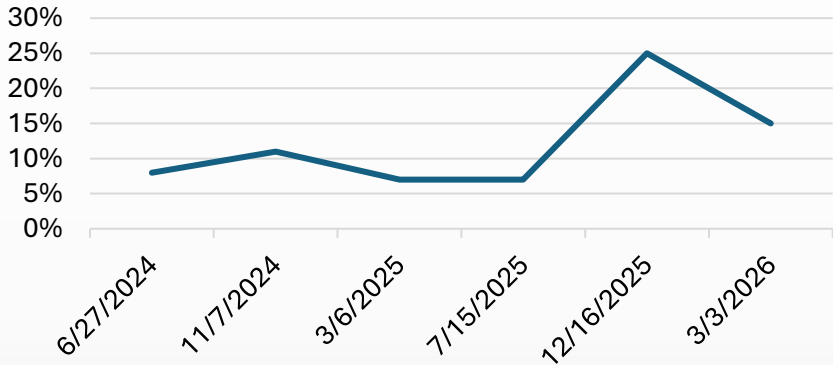
Teat End Cleanliness



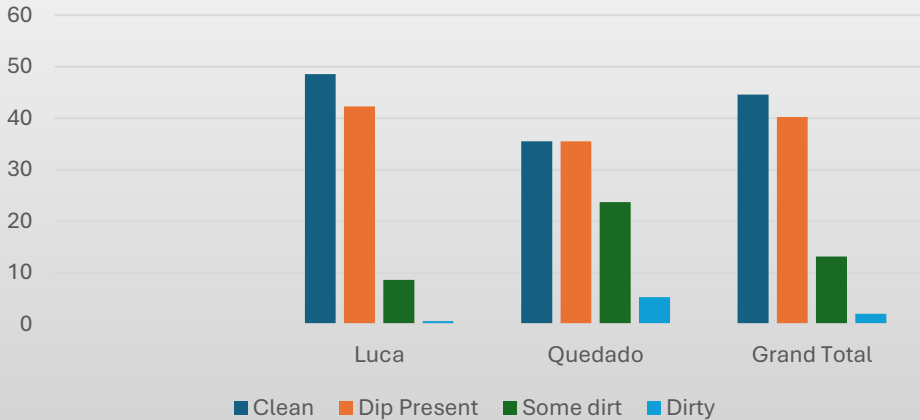
All
Groups

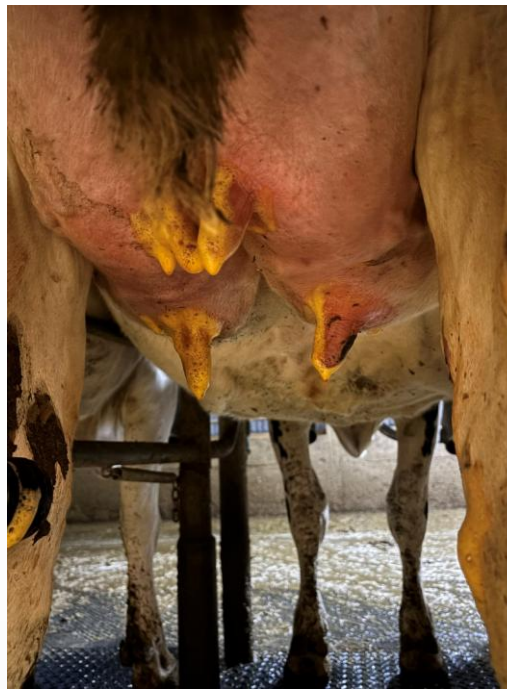
- 15% of the 251 teat-ends that we scored were too dirty.
- This has improved since December 2025 but is still higher than the goal of less than 10% in category 3 or 4.
- Continue to work on training and motivating milkers in this area.
- Continue to perform routine teat-end cleanliness scoring.

Percent Teat End Cleanliness Scored in
Categories 3 & 4 Over Time



Teat-end Cleanliness by Milker
03-03-2026

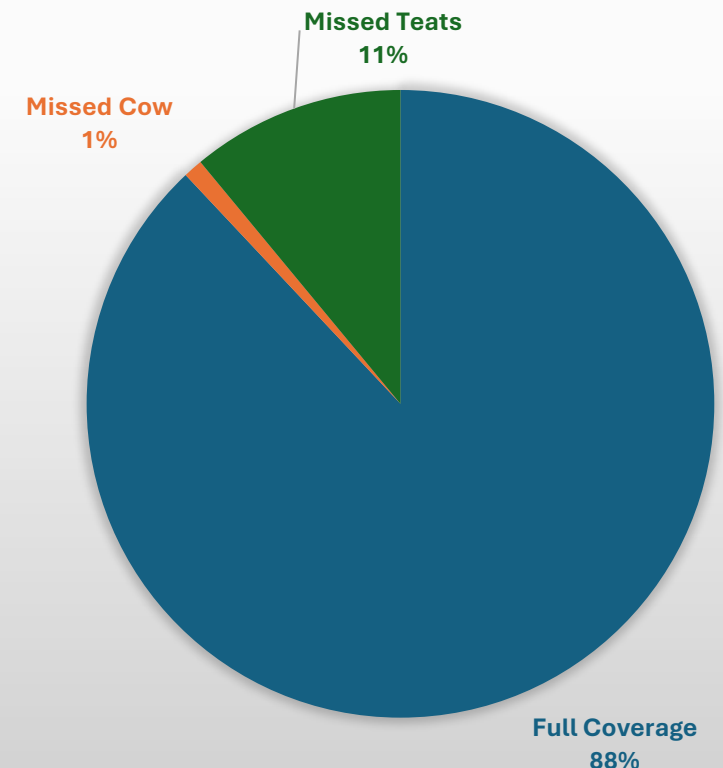




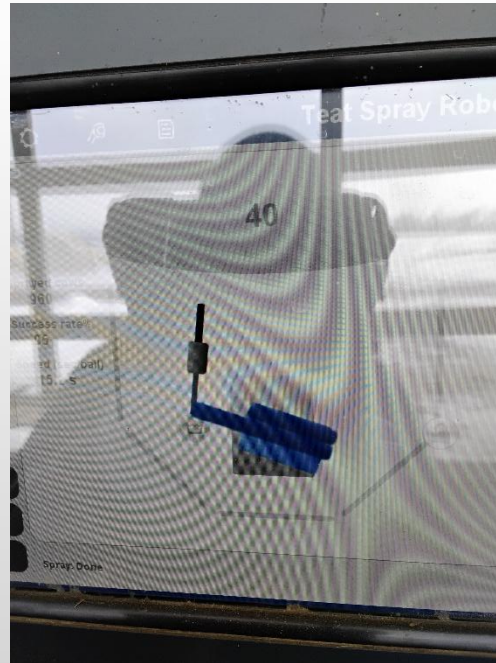
Teat-dip Coverage

- Pre-dip coverage looked reasonable on the day we visited. Just keep an eye on the consistency of the pre-dip to make sure it does not get too dry as you want it wet enough to flow to the teat-end.
- Post-dip is applied with a robot. See the chart to the right for the coverage data based at the cow level. 88% of the 103 cows we observed showed full teat-dip coverage of all teats.

POST-DIP COVERAGE
3-3-2026



Post-dipping



- 100 animals were monitored during post-dipping
- 15% of the animals monitored had 1 or more teats missed.
- The robot reports that 95% success rate.

Post-dipping



- Cows tend to stand with their right hind leg back
- This prevents the robot from entering between their legs and spraying teats
- Consider moving leg separator back

Animal Assessments

Teat Scoring after Unit Detachment

- All teats are scored with 60 seconds of unit detachment using the Teat Club International guidelines
- Two main categories
 - Short/medium term effects
 - Is the cow happy with the way she was milked today?
 - Longer term effects
 - What changes are present that have happened over time?

Short and Medium-term Effects

- Teat color
- Swelling at the teat base
- Hardness at the teat end

Primarily associated with milking machine faults or poor milking management resulting in long periods of low flow (Teat Club International)

Firmness at Teat End



Post-Milking Teat Evaluation

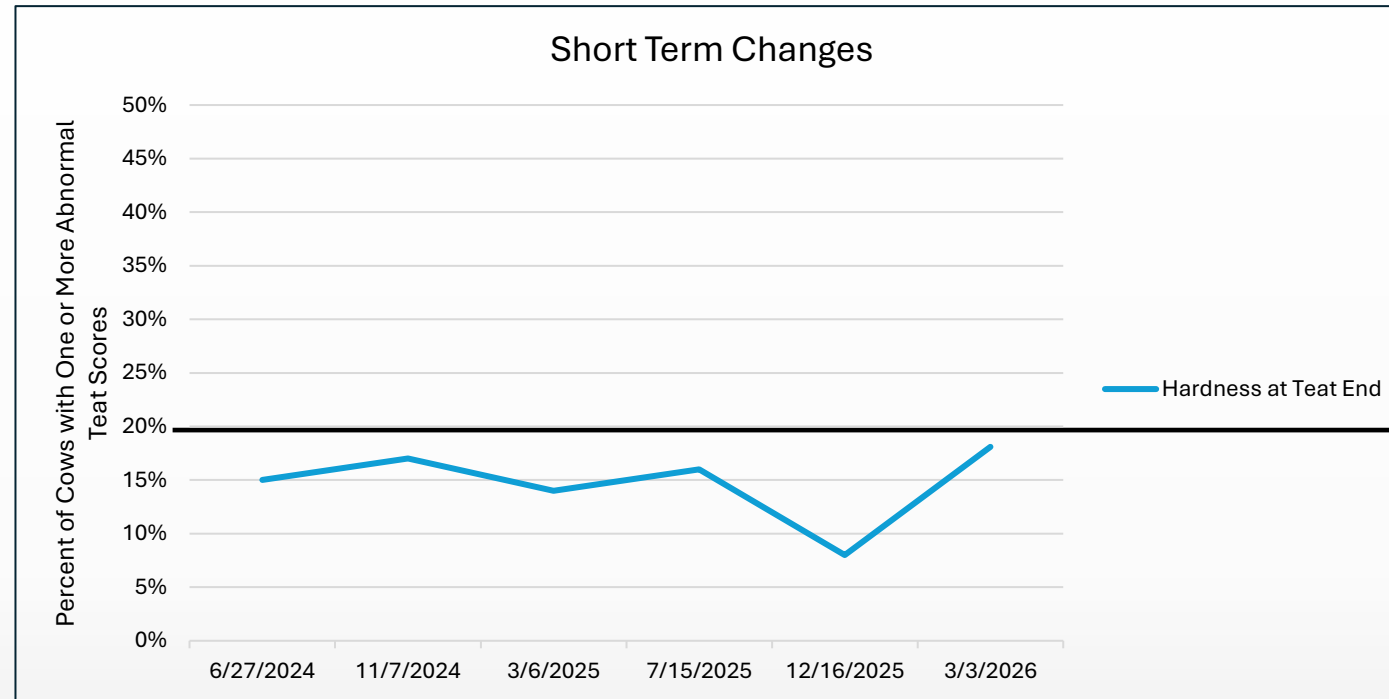
- 532 cows (2,128 teat-ends) were scored in Groups 6,8,9,10,11,12,and 13 to evaluate short-term and long-term teat-end conditions
- Teats were scored within 60 seconds after the milking unit detached
- Teat color, hardness at teat-end and swelling at teat base are short-term changes
- Skin condition and teat end scores are long-term changes

Post-Milking Teat Evaluation – Short Term

Categories	GOAL	FARM DATA
	Percent of cows with one or more abnormal teats	Percent of cows with one or more abnormal teats
Teat color	<20%	3.4%
Hardness at teat-end	<20%	18.1%
Swelling near teat base	<20%	<1%
Visible mark	<20%	1.1%
Hemorrhage	<10%	Not noted
Total Cows Scored	>20% (of milking cows)	532 cows

- Short term teat-end condition is very good despite bimodal milk curves noted.

Post-Milking Teat Evaluation – Short Term



- The short-term teat scores are still good and meeting the goal of less than 20%.
- The 2-minute milk continues to improve which keeps the time in low flow at the beginning of milking lower.
- Based on the data collected on this survey, the opportunity areas to help keep the short-term teat scores in line are to correct the abnormal pulsators, and continue to actively monitor the milker performance.

Longer Term Effects

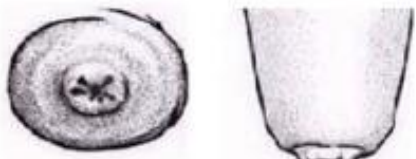
- The changes that have happened over a slightly longer period of time
 - Teat Skin Condition
 - Normal, Dry, Open Lesion
 - Teat End Hyperkeratosis
 - Normal, Smooth, Slightly Rough, Rough, Very Rough



Shukken et al

Post-Milking Teat Evaluation – Long Term

Teat End Condition Score Card

Score	Description	Illustration
Score 1 (N)	No Ring. The teat-end is smooth with a small, even orifice. This is a typical status for many teats soon after the start of lactation.	
Score 2 (S)	Smooth or Slightly Rough Ring. A raised ring encircles the teat orifice. The surface of the ring is smooth or it may feel slightly rough but no fragments of old keratin are evident.	
Score 3 (R)	Rough Ring. A raised, roughened ring with isolated fragments of old keratin extending a short distance from the teat orifice.	
Score 4 (VR)	Very Rough Ring. A raised ring with rough fragments of old keratin extending out from the teat orifice. The rim of the ring is rough and may be cracked, often giving the test-end a “flowered” appearance.	
Score 5	Open Lesions or Scabs.	<i>Not pictured.</i>

- 2128 teat-ends were evaluated.
- Teat-end condition has improved in each group evaluated. Now 35% of teats are slightly rough to very rough. This is down from 67% in March 2025,
- Approximately 80% of the animals evaluated had normal (76%) or smooth (4%) teat-ends.
- 9% of teat-ends were slightly roughened, 8% were rough, and 3% of animals evaluated had very rough teat ends.

Post-Milking Teat Evaluation – Long Term

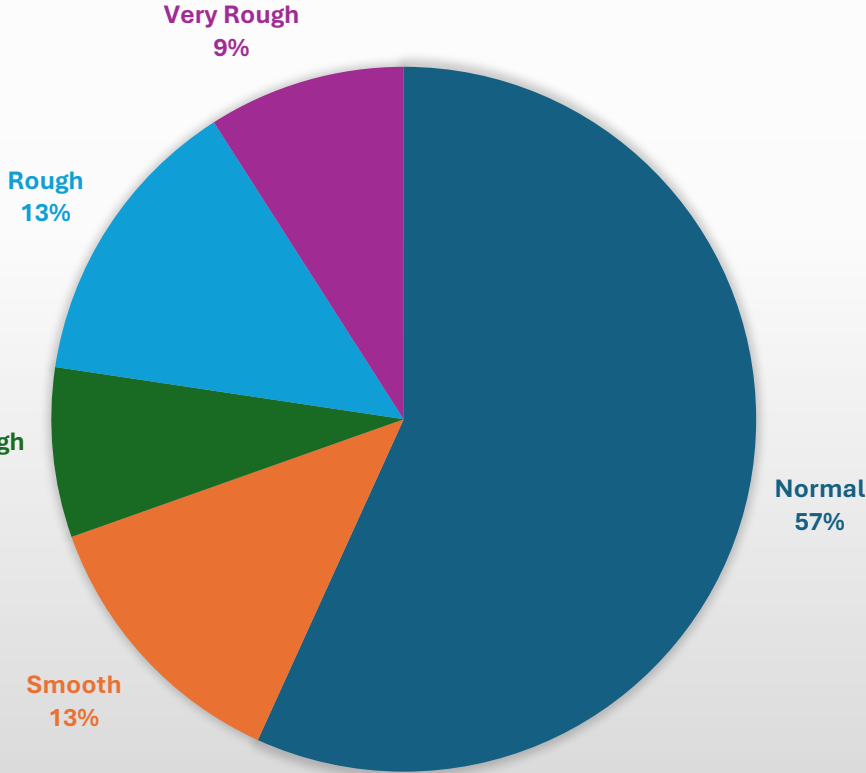
Categories	GOAL	FARM DATA
	Percent of cows with one or more abnormal teats	Percent of cows with one or more abnormal teats
Teat-End Score	<20%	35%
Teat Skin Condition	<20%	2.7%
Open Lesions	<5%	<1%
Total Cows Scored	>20% (of milking cows)	532cows

- 35% of animals were noted with abnormal slightly roughened to very roughened teat-ends. Herd goals are less than 20% of animals with abnormal teat-ends.
- Skin condition was very good with 2.7% dry teat abnormalities noted. Very few open lesions were observed.

Post-Milking Teat Evaluation – Long Term

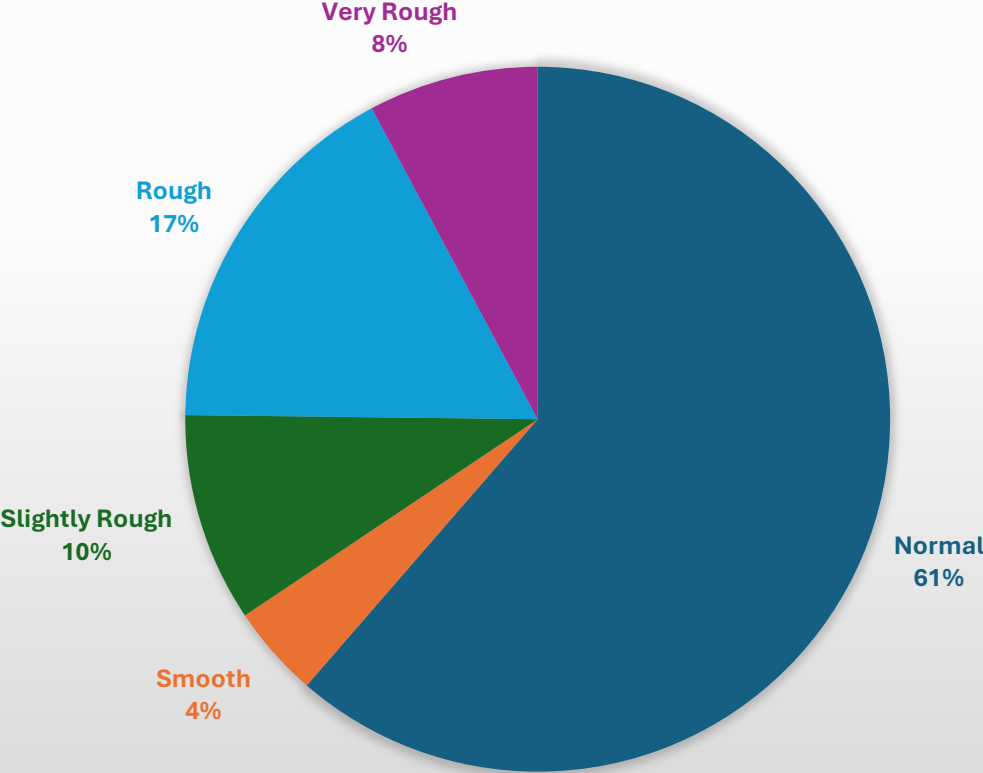
LONG-TERM TEAT END SCORES

DAIRY 12-16-2025

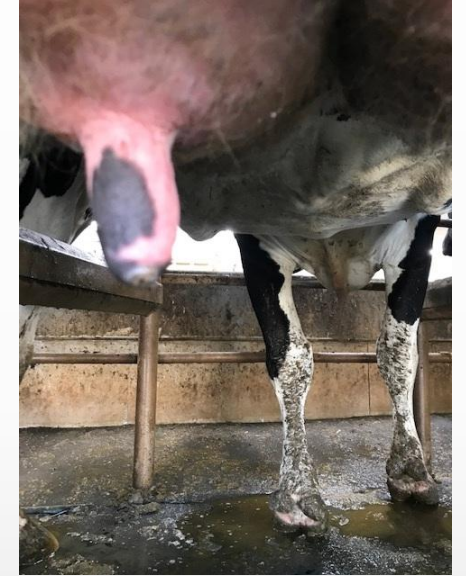
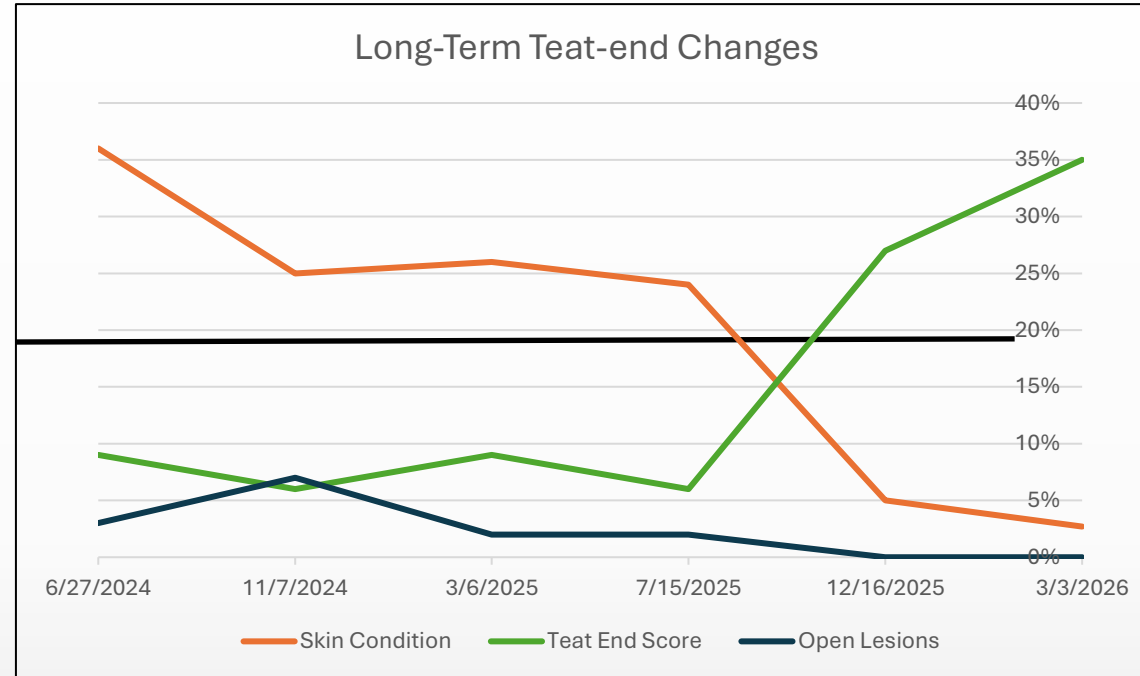


LONG TERM TEAT-END SCORES

DAIRY 03-03-2026



Post-Milking Teat Evaluation – Long Term



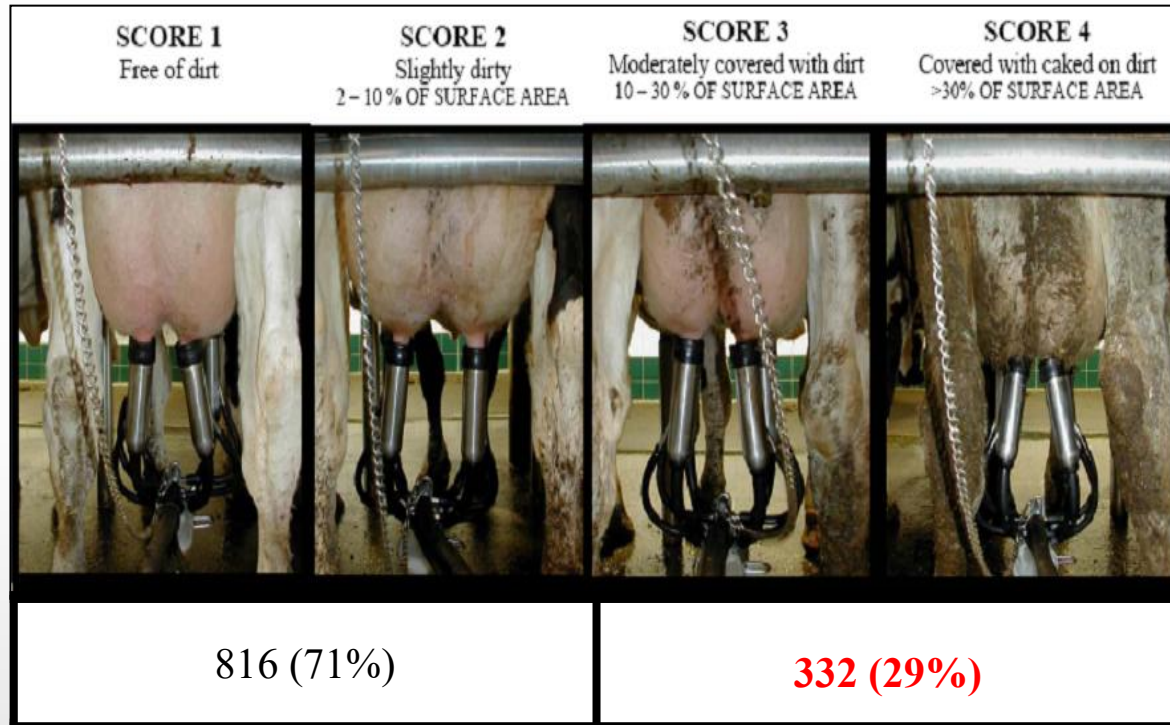
- Teat-end scores have improved some since out audit in December 2025.
 - Continue to focus on maintaining the short-term changes in order to maintain the teat-end scores.
- Skin condition – Skin condition has improved and open lesions are minimal.
 - **Continue to use the same emollient package..**
 - Continue to have the robot on when pre-fresh animals are brought through the rotary to get some dip on them and allow the emollients to work.

Udder Hygiene Scoring System

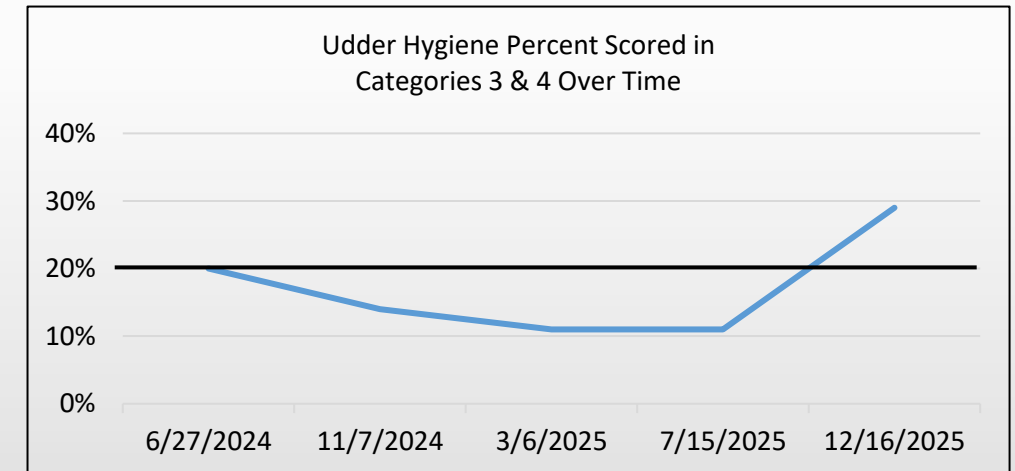
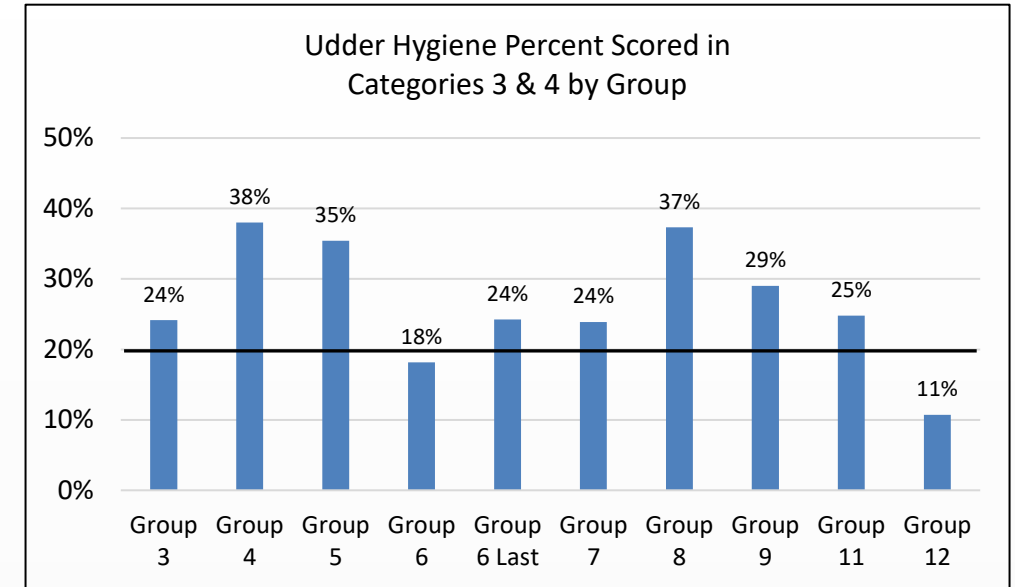
- Poor udder hygiene
 - Makes it harder to achieve clean and dry teats prior to unit attachment
 - Increases the risk for mastitis
 - Increases the milking time due to increased prep time



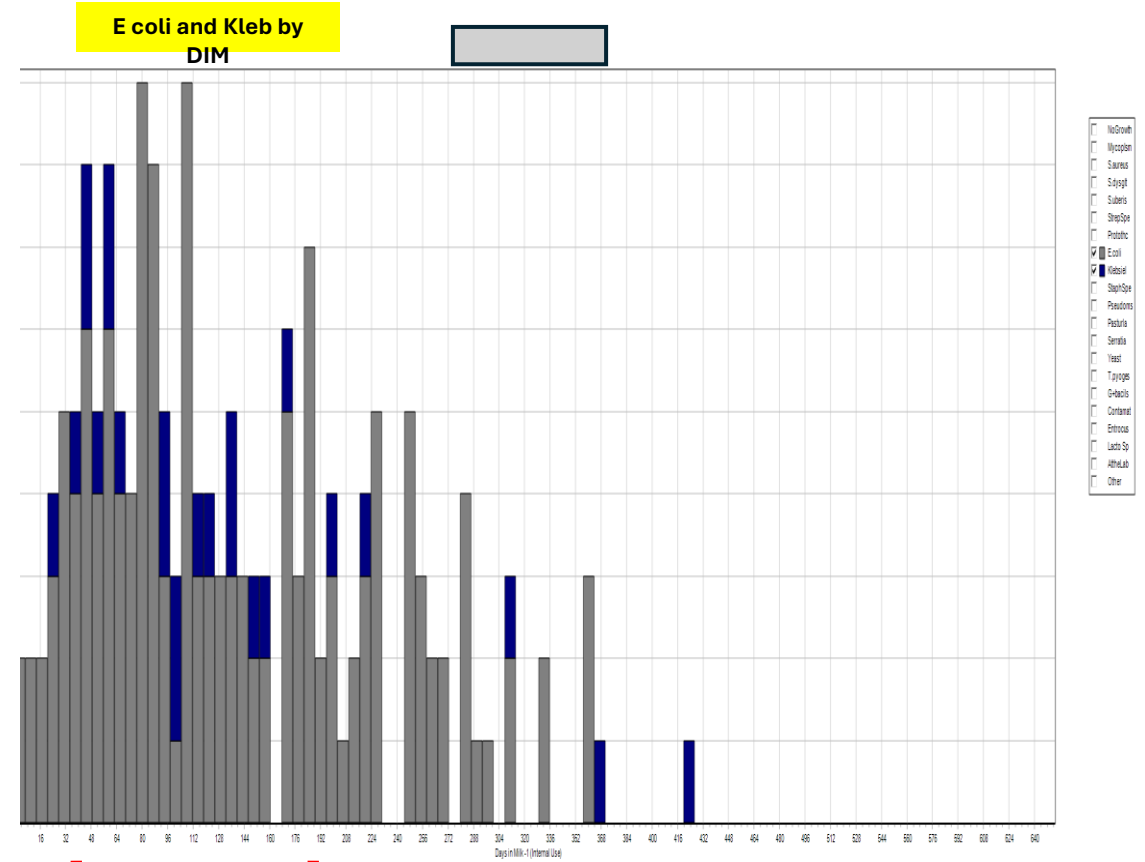
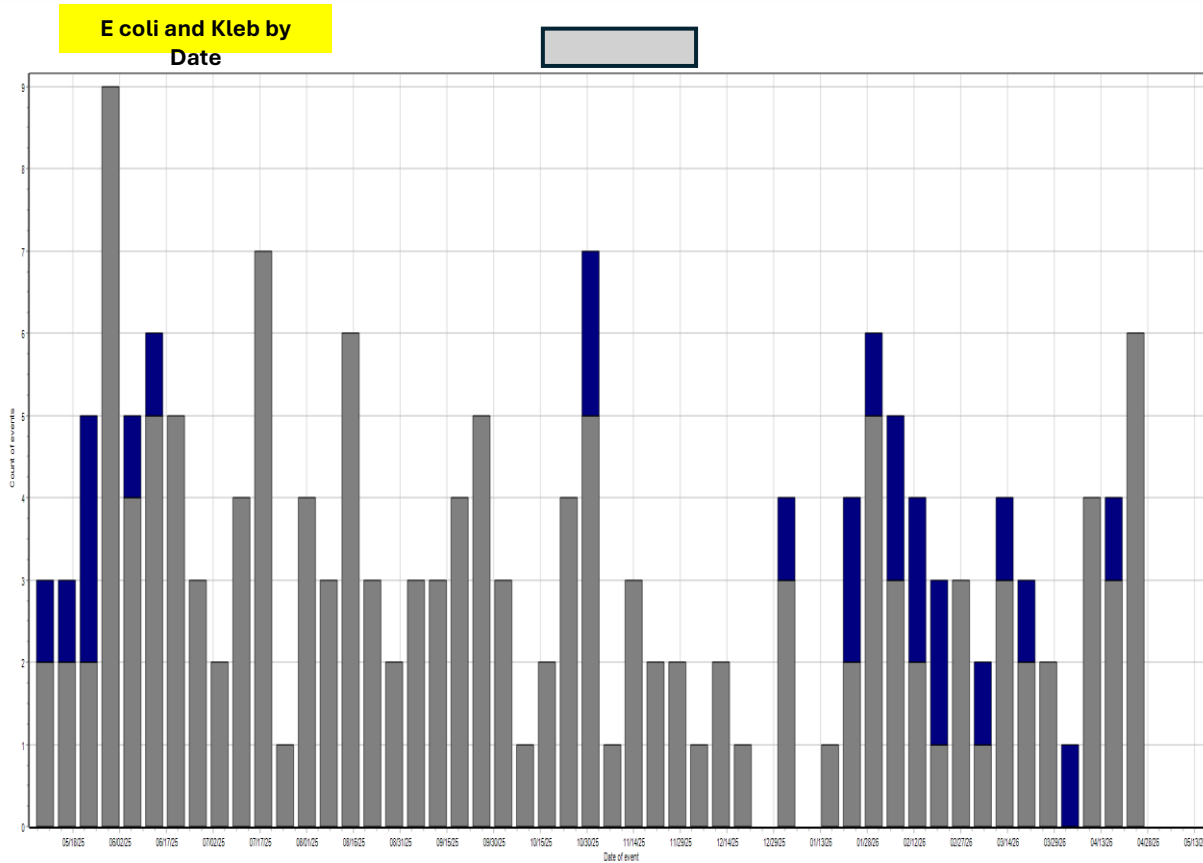
Udder Hygiene



- Cows were more dirty than usual
- 29% of the cows that we scored were in category 3 or 4. **This is not meeting the goal of less than 20% in category 3 and 4.**
- As shown on the next few slides there is still room for improvement as the back of the stall beds are being contaminated with manure due to poor cow positioning in some groups.

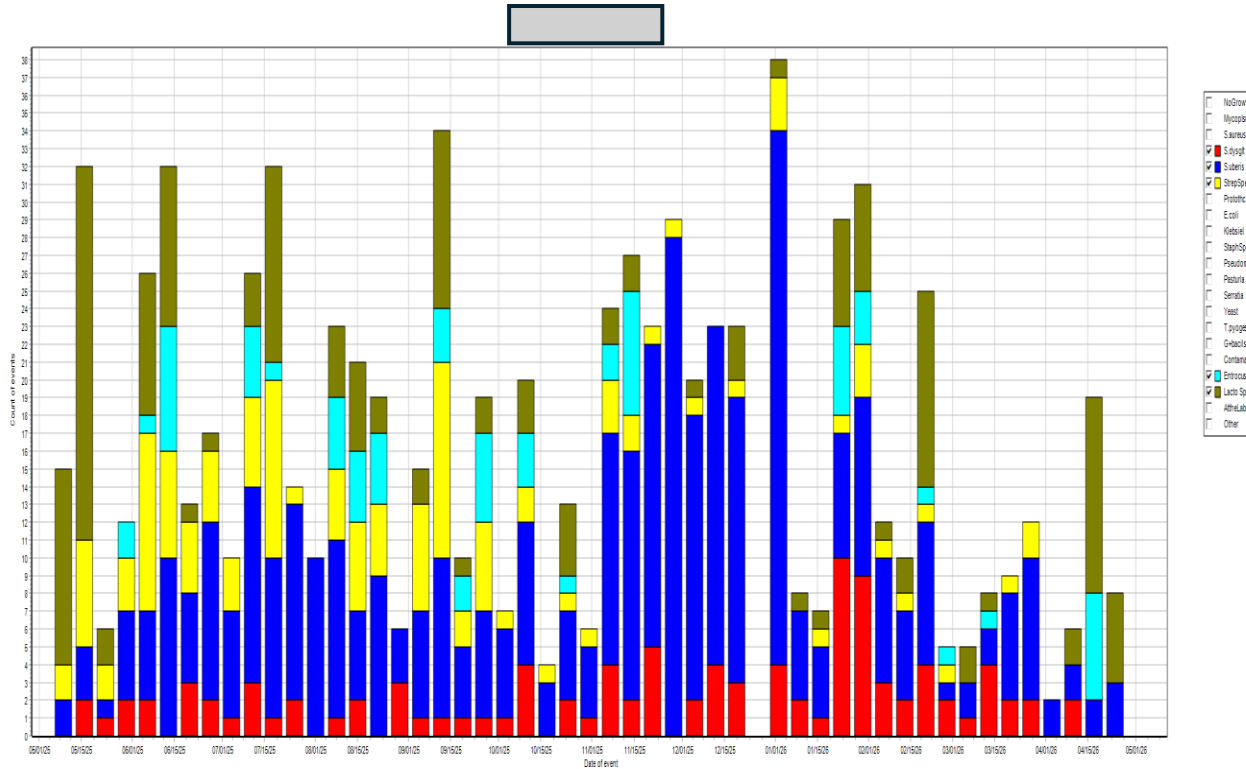


Culture Data

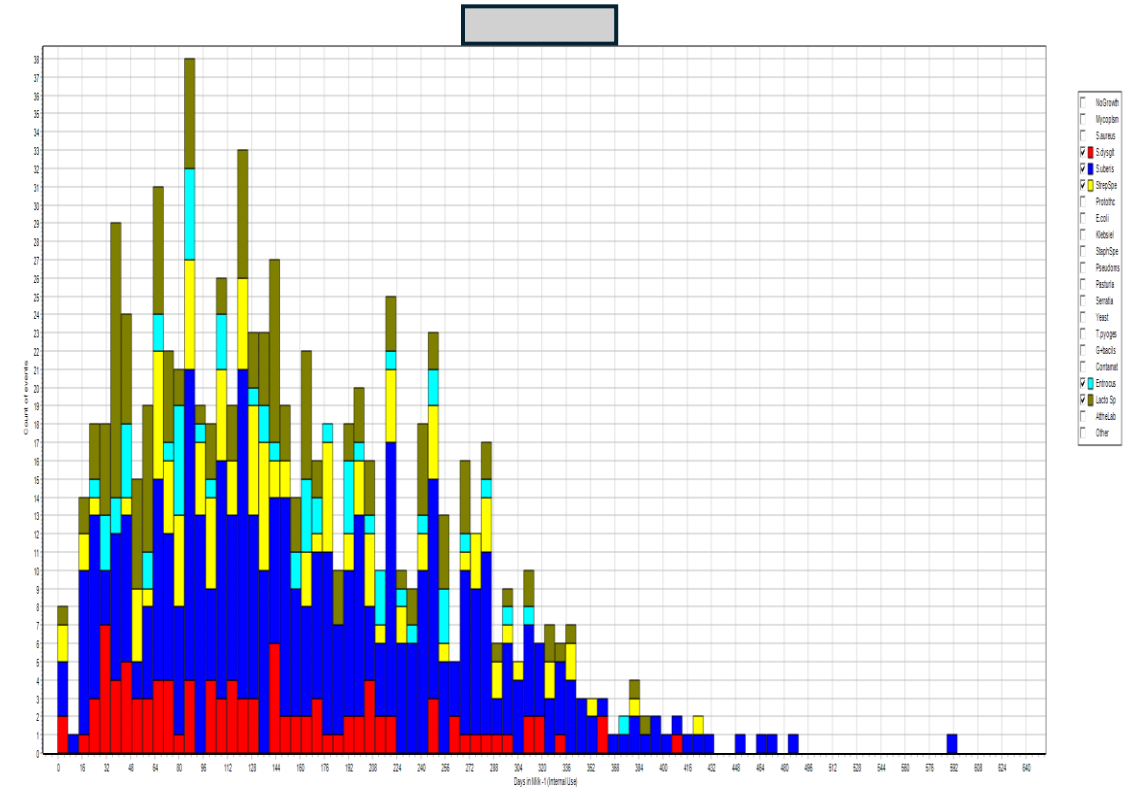


- This is a graph of just the *E. coli* and *Klebsiella* cultures by date on the left and by DIM on the right. The highest risk period for *E. coli* infection is also 30-120 days in milk. Parlor activities, movement of animals to and from the parlor and lactating stalls should be our focus.

Streps by Date



Streps by
DIM

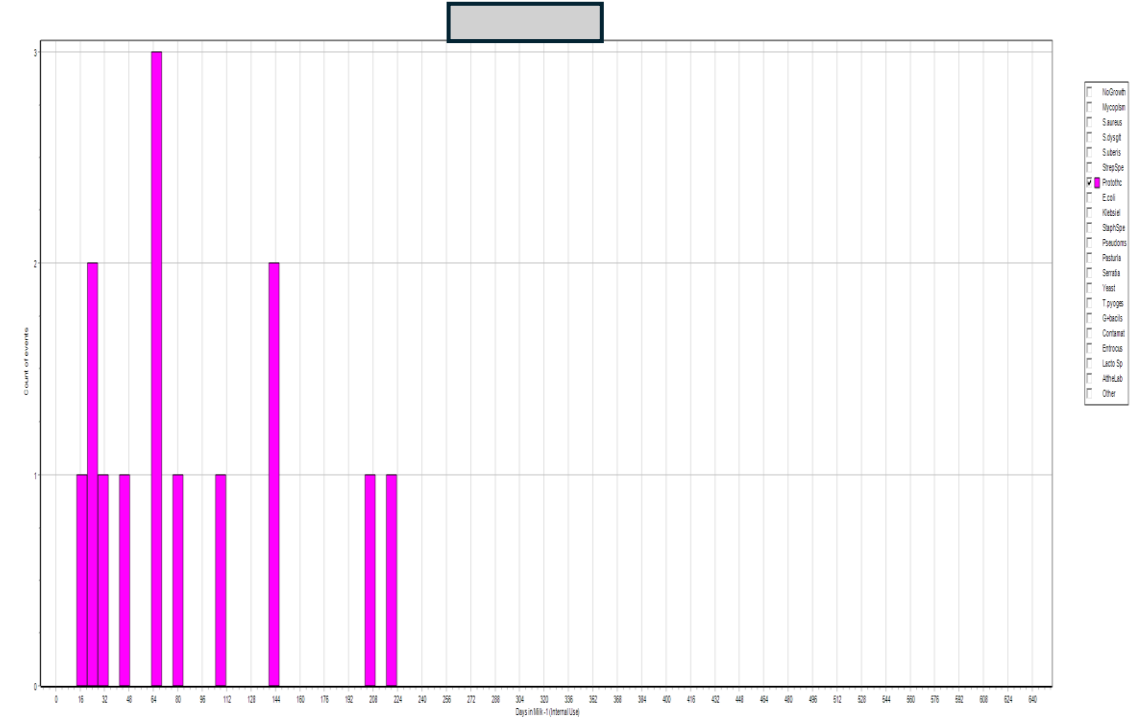


- This is a graph of just the *Strep* and *Strep*-like cultures results by date on the left and by DIM on the right over the last year from DC 305. *Strep uberis* was a predominant organism during the fall 2025. Many of these infections occur in early to mid lactation.

Prototheca by Date

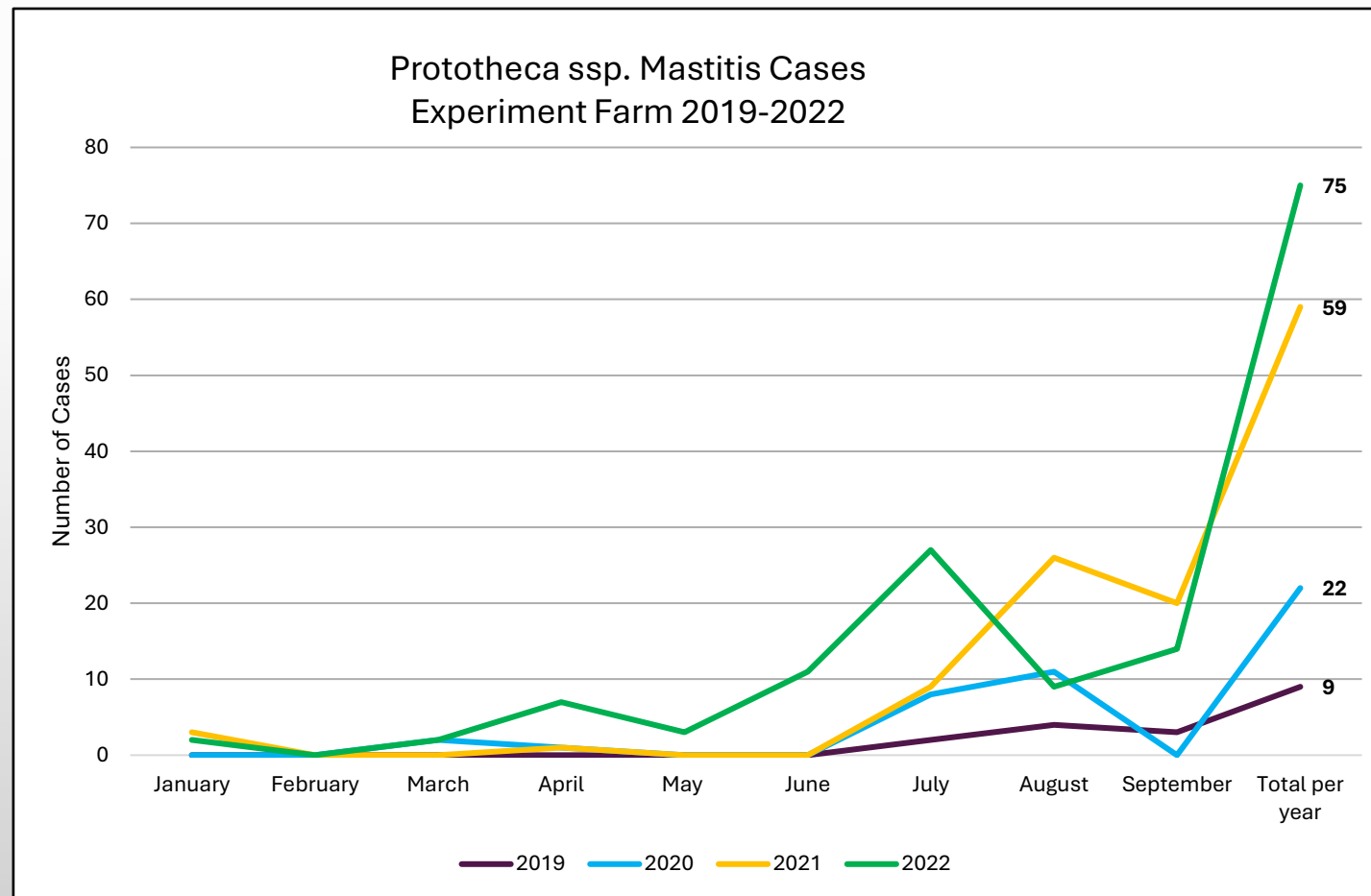


Prototheca by DIM



• This is a graph of just the *Prototheca* cultures by date on the left and by DIM on the right over the last year from DC 305. There does continue to be some found although it looks lower recently.

Please fix this...



Case Report: Reducing *Prototheca* Biofilms with Ultra-Pure Chlorine Dioxide



**Michael J. Zurakowski¹, Jeniece L. Schroeter²,
Katelyn M. Keller¹, and Scott M. Sloan²**

¹Quality Milk Production Services, Cornell University
Cobleskill, New York, USA

²Virus Shield Biosciences, Melbourne, Florida, USA



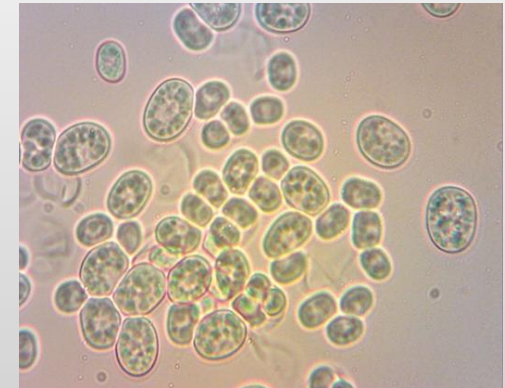
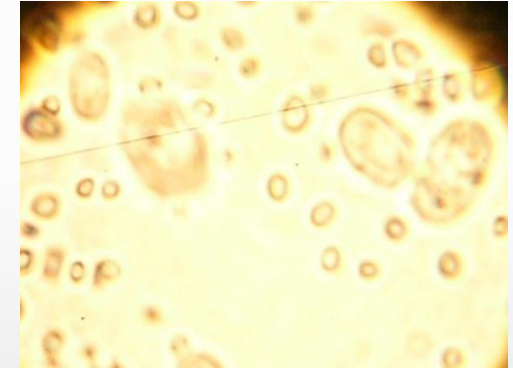
Objectives

- *Prototheca* characteristics
- *Prototheca* mastitis
- *Prototheca* diagnostics
- Case Report
- Future Plans



Prototheca characteristics

- First identified in 1894 by Kruger from slime flux of trees
- First identified as a mastitis pathogen in 1952 by Lerche
- Unicellular
- Colorless
- Chlorophyll-lacking
- Algae
- Often placed in yeast or yeast-like group
- Linked to disease in mice, rats, dogs, pigs, deer, cattle, and man
- Zoonotic



Prototheca characteristics

Prototheca bovis
April 2020

Pathogenic

- *P. zopfii* genotype 1 & 2
- *P. blaschkeae*
- *P. wickerhamii*

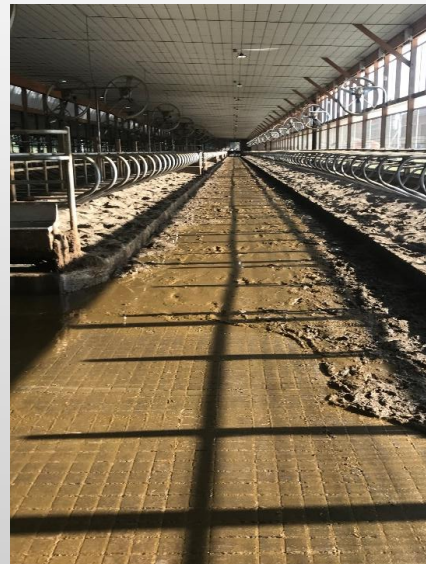
Environmental

- *P. ulmea*
- *P. stagnora*
- *P. moriformis*

Prototheca characteristics

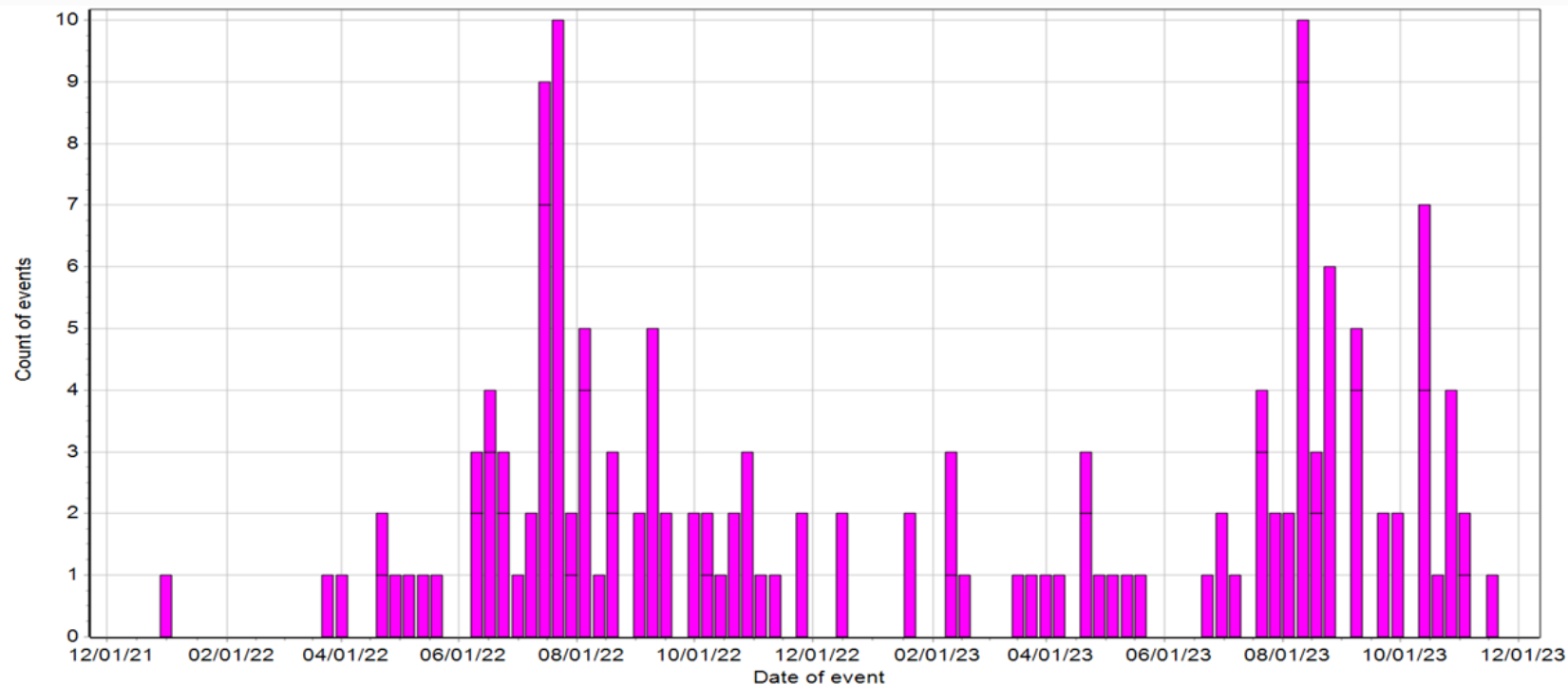
Environmental isolation sites

- Moist, humid environments
- Ample decaying organic matter
- Dairy farm sites include: feces, drinking troughs, manure piles, sewage ponds, standing water puddles, bedding and silage



Prototheca mastitis

- Environmental pathogen capable of contagious transmission
- Chronic, non-responsive, subclinical, and clinical mastitis
- Intermittently shed
- Seasonal effect



Prototheca
Diagnostics

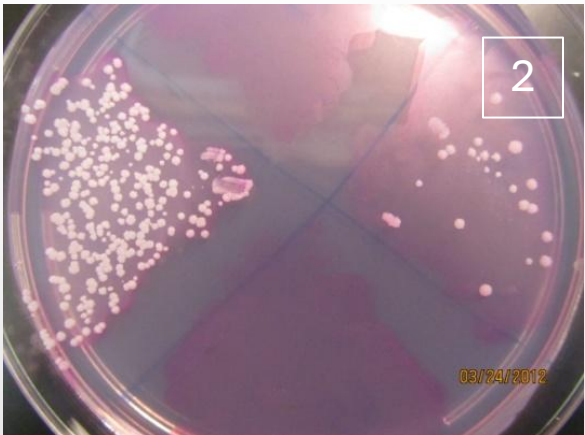
Colonial Morphology Trypticase Soy Agar with 5%
Sheep Blood and Prototheca Isolation Media (PIM)

Colonies on blood agar, after 48 h of incubation are small white-grayish, dull, granular and pasty (1). The colonies are small at 24 hrs. and may be overlooked. They are much larger at 48 hrs. On PIM are small and whitish (2).



Blood Agar media
Prototheca bovis

48 hour growth



Prototheca Isolation Media (PIM)

APPLIED MICROBIOLOGY, Oct. 1973, p. 648-649
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Selective Medium for the Isolation of *Prototheca*

R. SCOTT PORE

Department of Microbiology, West Virginia University School of Medicine, Morgantown, West Virginia 26506

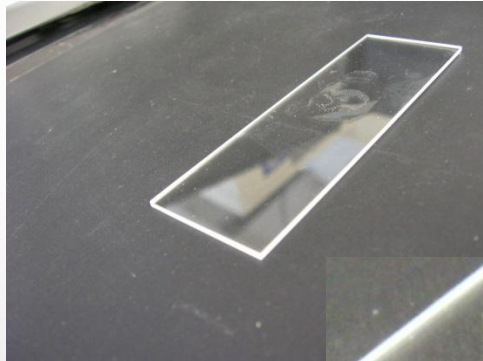
Received for publication 21 May 1973

A medium was devised which permitted the selective isolation of *Prototheca* spp. from nature.

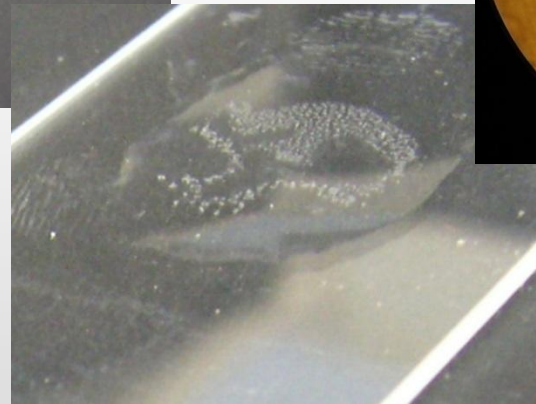
TABLE 1. Chemical constituents of <i>Prototheca</i> isolation medium (PIM)	
Constituent	Grams/liter
Distilled water	
Potassium hydrogen phthalate	10.0
Sodium hydroxide	0.9
Magnesium sulfate*	0.1
Potassium hydrogen phosphate*	0.2
Ammonium chloride*	0.3
Glucose*	10.0
Thiamine hydrochloride*	0.001
Agar	20.0
5-fluorocytosine (5-FC),	0.25
pH 5-5.2	
* Essential nutrient.	

Prototheca diagnostics

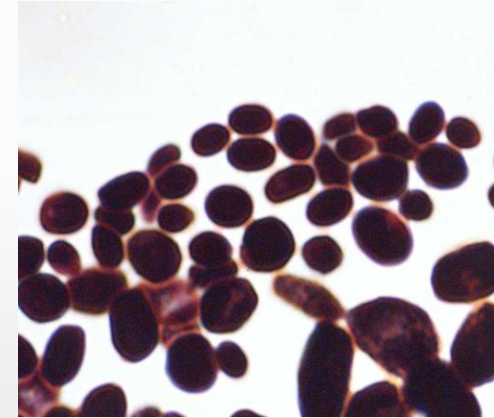
Microscopic
Confirmation



Wet Mount



Wet Mount



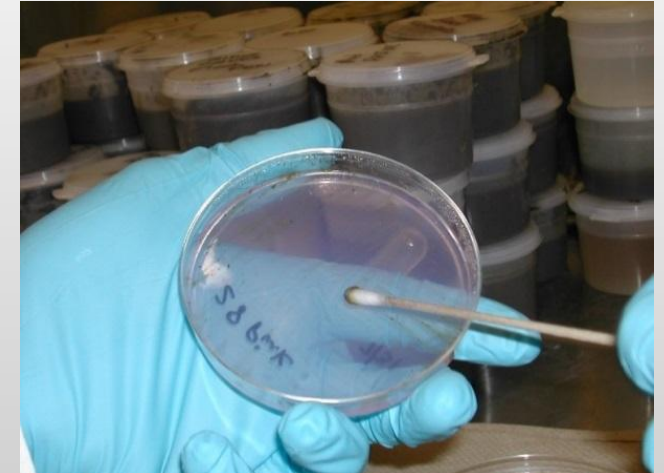
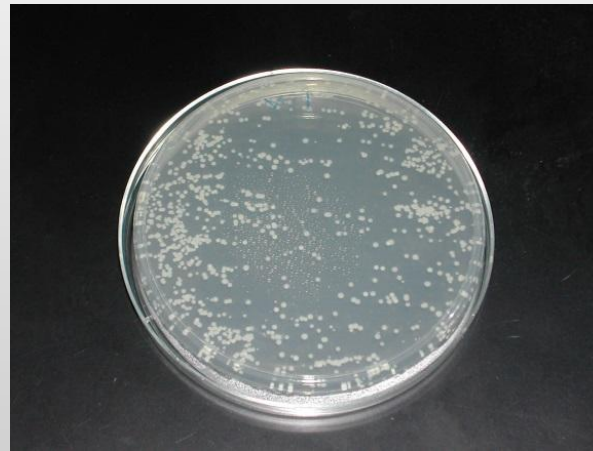
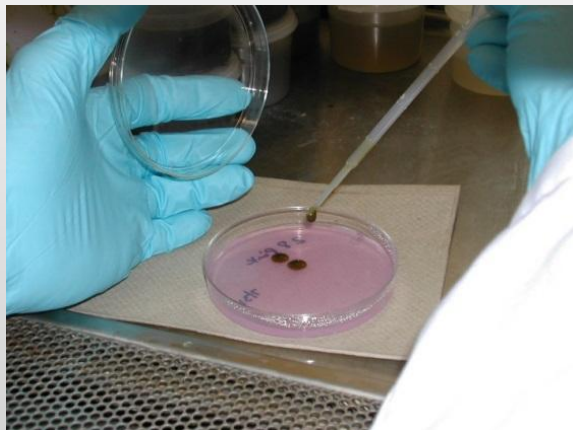
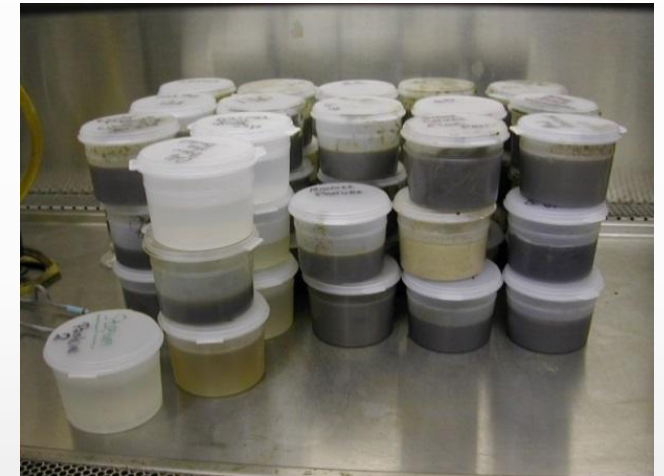
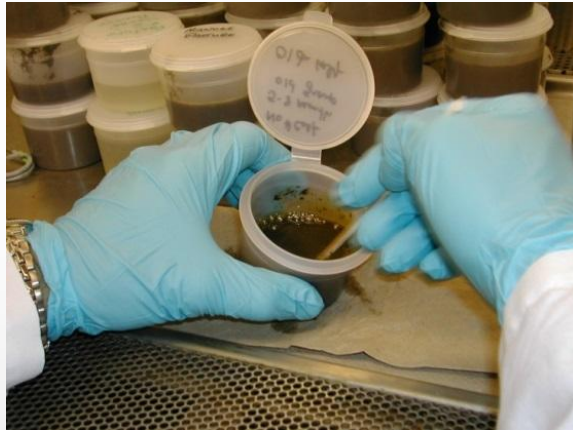
Gram stain



Crystal violet

Prototheca diagnostics

Environmental Cultures



Case Report: Ultra-Pure Chlorine Dioxide

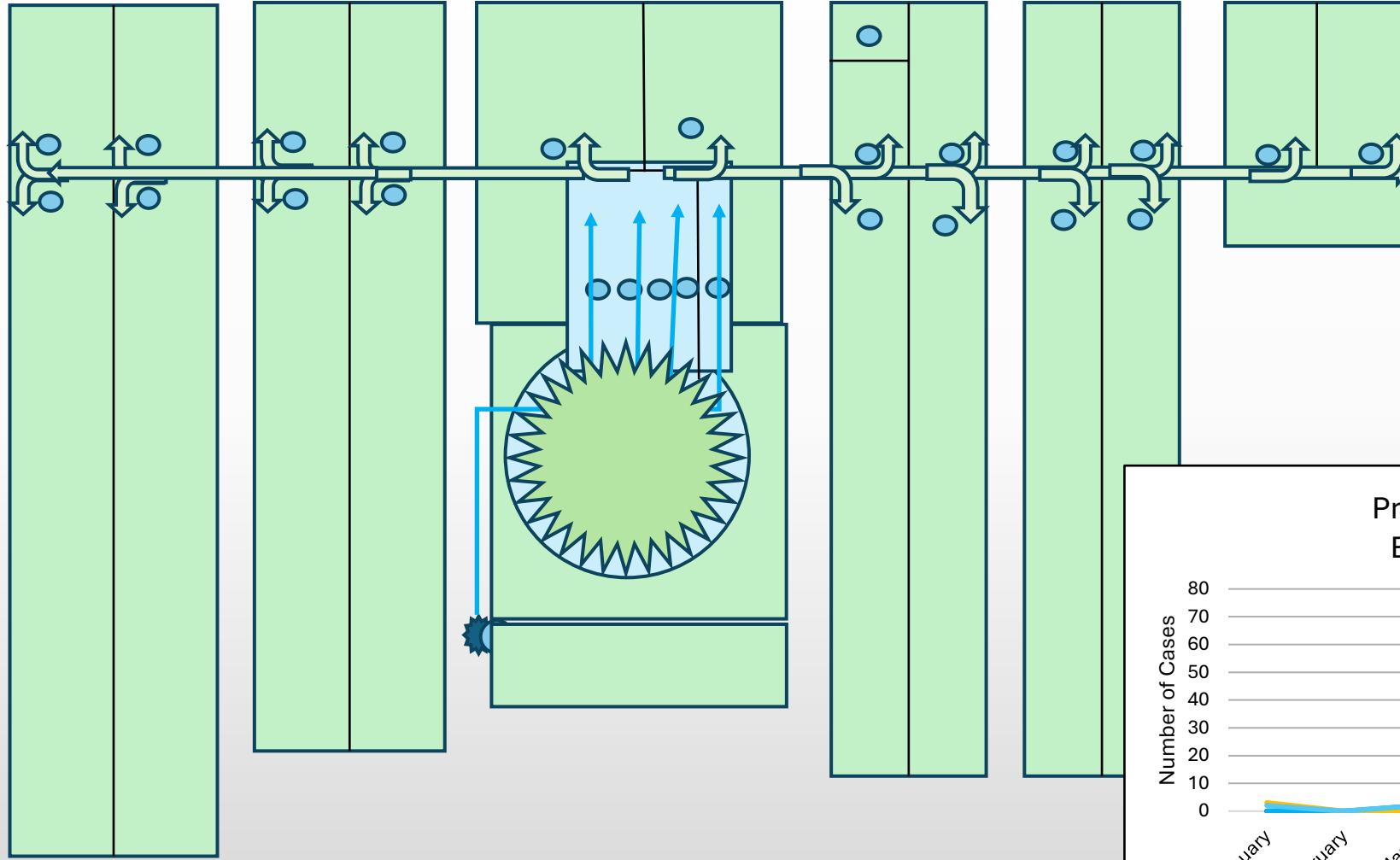
Date Finalized	Organism and ATCC	SPC (cfu/ml)	Run	DIP: Virus Shield Chlorine Dioxide 5ppm		DIP: Virus Shield Chlorine Dioxide 20ppm		DIP: Virus Shield Chlorine Dioxide 50ppm	
				seconds	% reduction	seconds	% reduction	seconds	% reduction
3/30/2023	Streptococcus uberis ATCC 700407	5.0 x 10 ⁵	1	15	>99.99	15	>99.99	15	>99.99
				30	>99.99	30	>99.99	30	>99.99
				60	>99.99	60	>99.99	60	>99.99
			2	15	>99.99	15	>99.99	15	>99.99
				30	>99.99	30	>99.99	30	>99.99
				60	>99.99	60	>99.99	60	>99.99
3/30/2023	Staphylococcus aureus ATCC 25923	3.4 x 10 ⁶	1	15	97.79	15	>99.99	15	>99.99
				30	98.82	30	>99.99	30	>99.99
				60	99.68	60	>99.99	60	>99.99
			2	15	98.21	15	>99.99	15	>99.99
				30	99.38	30	>99.99	30	>99.99
				60	99.91	60	>99.99	60	>99.99
3/30/2023	Escherichia coli ATCC 25922	9.3 x 10 ⁶	1	15	>99.99	15	>99.99	15	>99.99
				30	>99.99	30	>99.99	30	>99.99
				60	>99.99	60	>99.99	60	>99.99
			2	15	>99.99	15	>99.99	15	>99.99
				30	>99.99	30	>99.99	30	>99.99
				60	>99.99	60	>99.99	60	>99.99
3/30/2023	Prototheca zopfi field strain	8.5 x 10 ³	1	15	89.41	15	95.29	15	>99.99
				30	98.82	30	>99.99	30	>99.99
				60	>99.99	60	>99.99	60	>99.99
			2	15	85.88	15	97.65	15	>99.99
				30	88.24	30	>99.99	30	>99.99
				60	>99.99	60	>99.99	60	>99.99

Ultra-Pure ClO₂ is produced by mixing sodium chlorite (NaClO₂) with a powdered acid. This chemical reaction is controlled via a patented semi-permeable membrane that allows only water and ClO₂ to pass through. This results in ClO₂ gas in the solution. The gas remains in the solution until it is applied when the gas is released and acts as a disinfectant by penetrating and destroying the cell membranes of pathogens and removing biofilms.

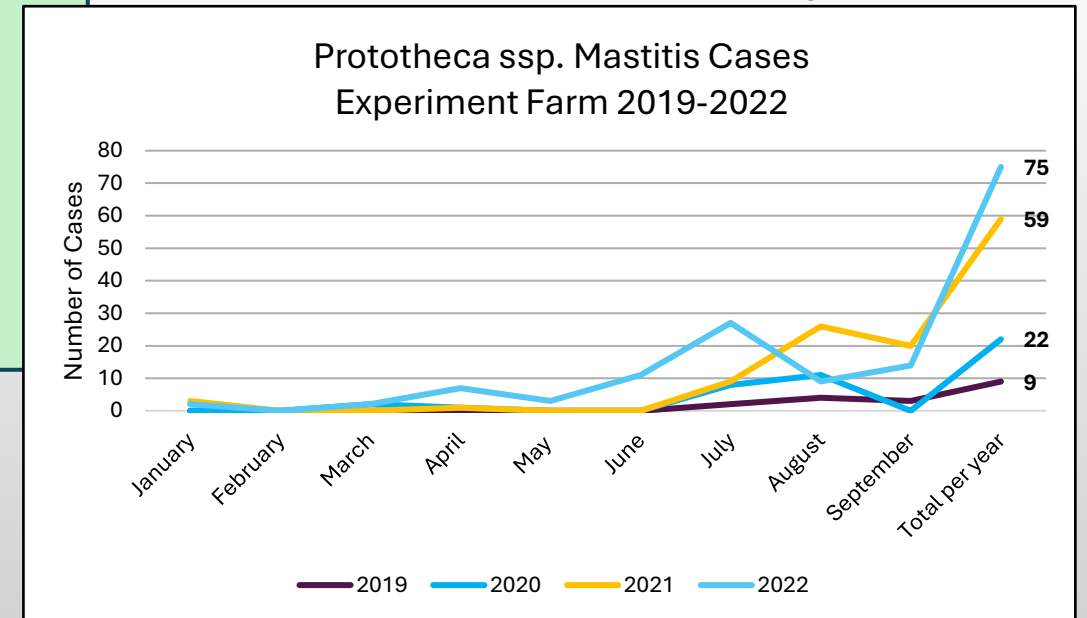


info@vsbiosciences.com

Case Report: Project Farm



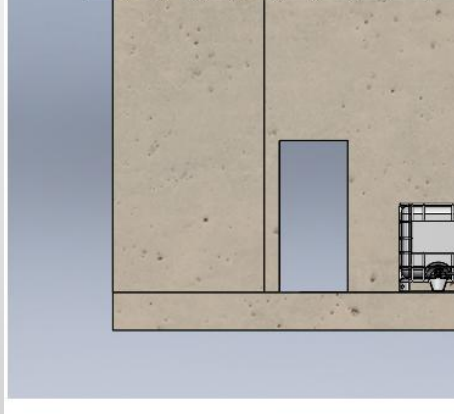
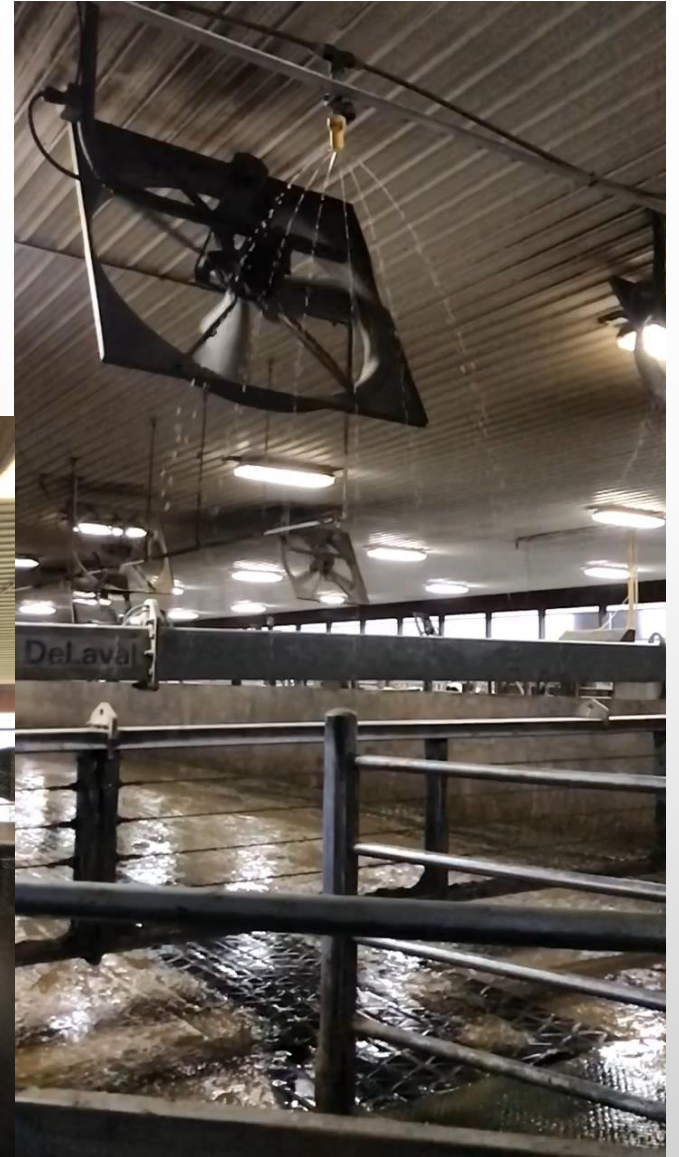
- 3400 cow dairy
- 72 stall rotary parlor
- Milking 3x
- Well managed
- Clinical mastitis cultures
- Fresh cow cultures
- Flush water system



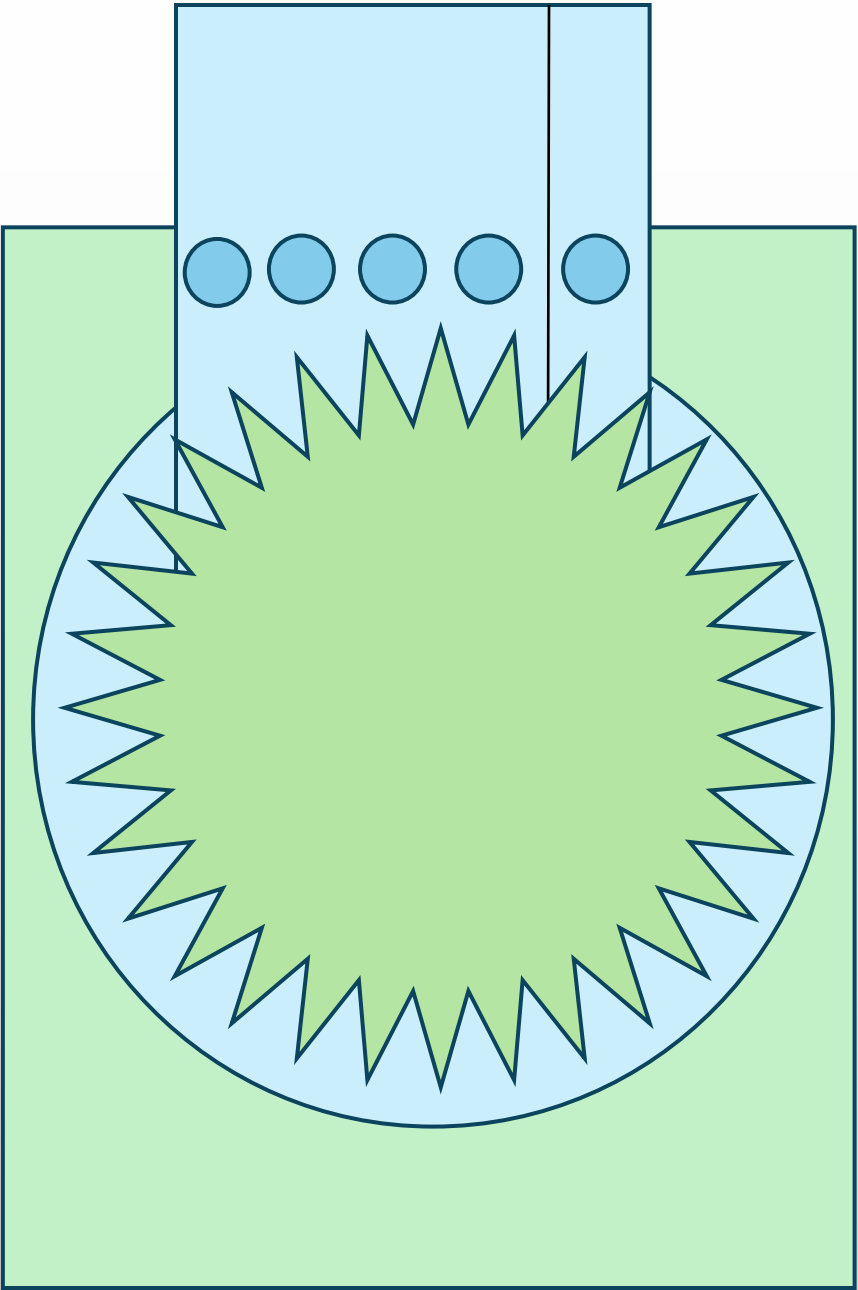
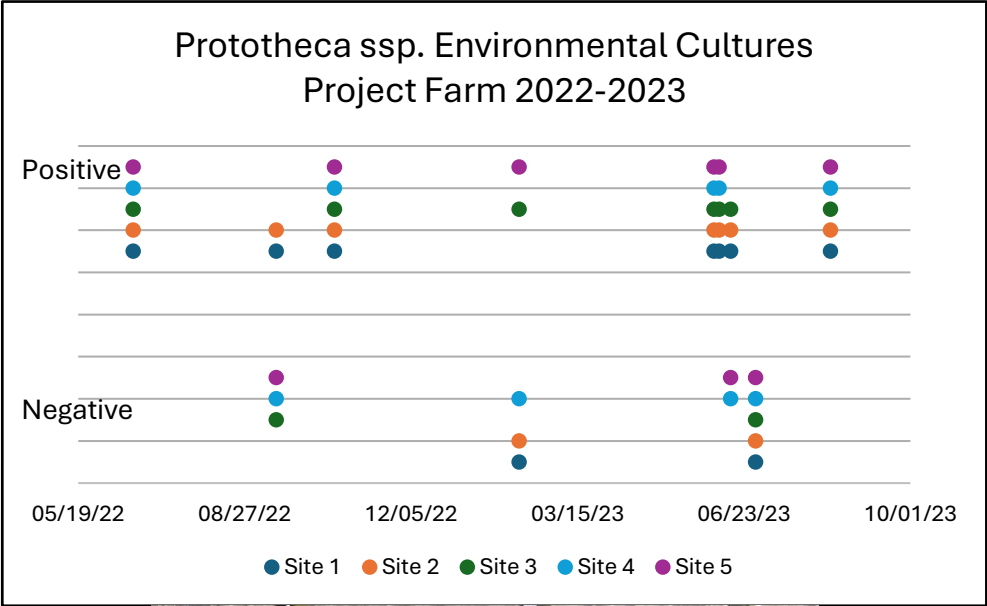
Case Report: Experiment 1- ClO_2 Spray System



- 30 second delay after completion of the flush water system.
- Activated for 30 seconds.
- Nozzle size and spray duration dispersed 2.1L (0.5 gal) of chlorine dioxide (100 ppm) in zone 1 and 0.89L (0.24 gal) in zone 2.



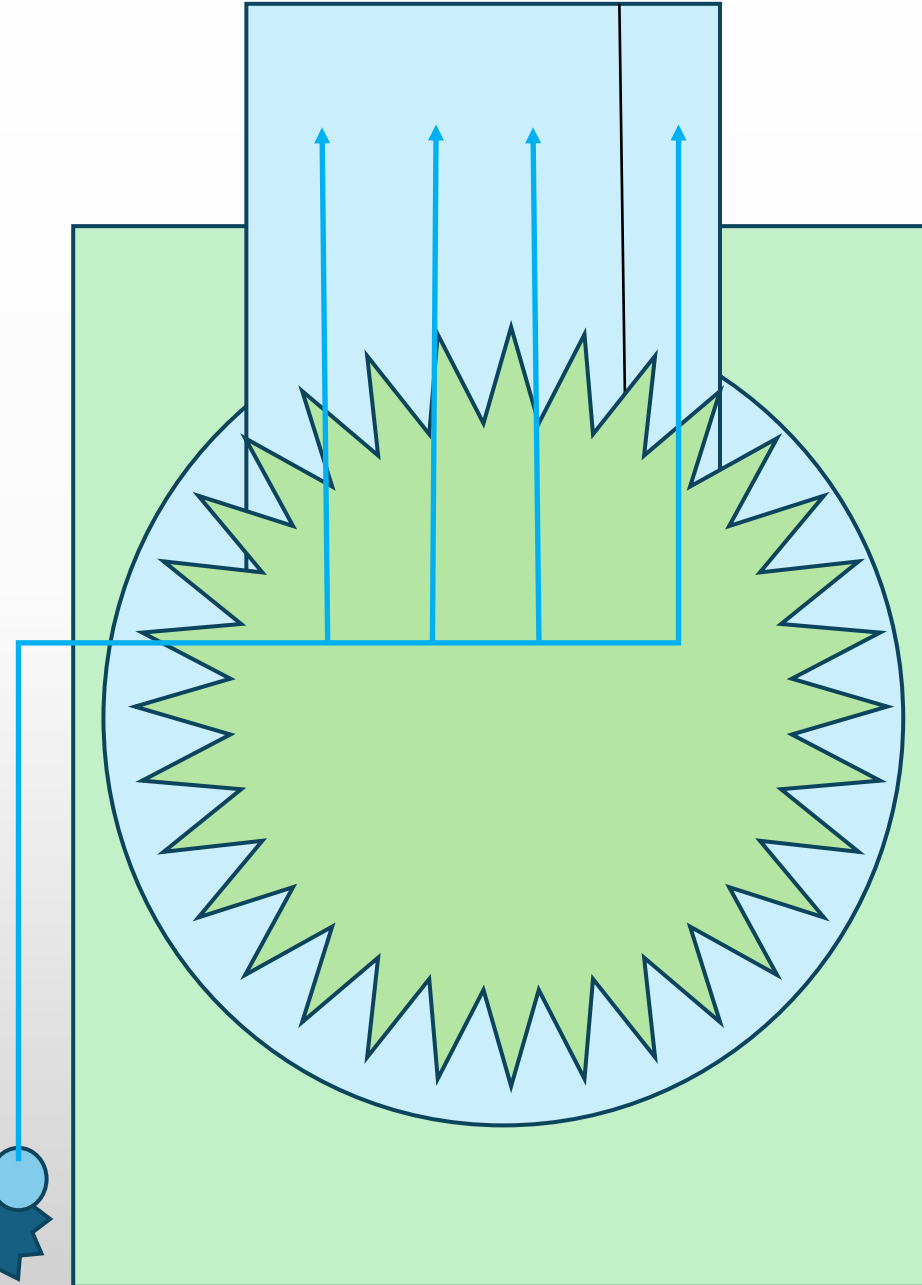
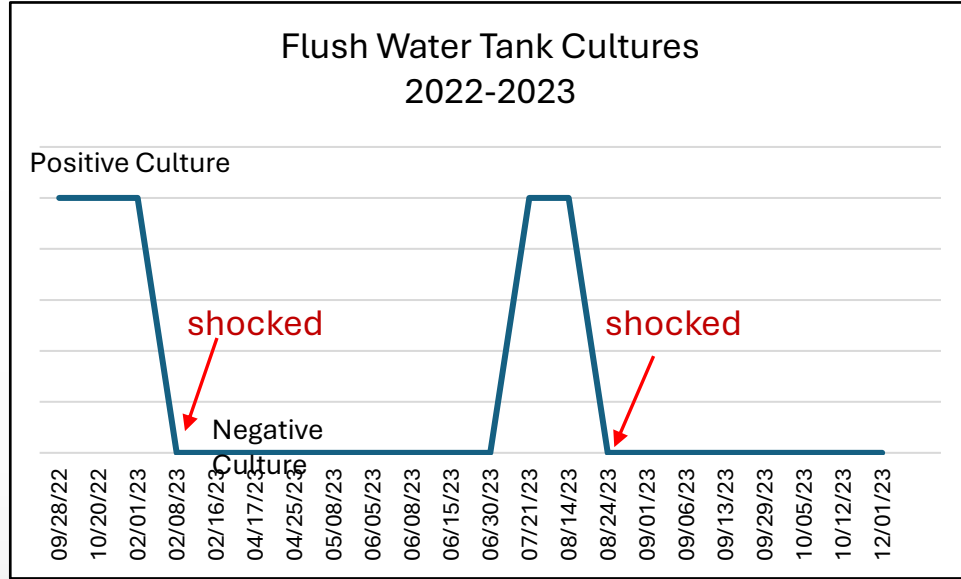
Case Report: Experiment 1: ClO₂ Spray System





Case Report: Experiment 2- Flush Water Tank

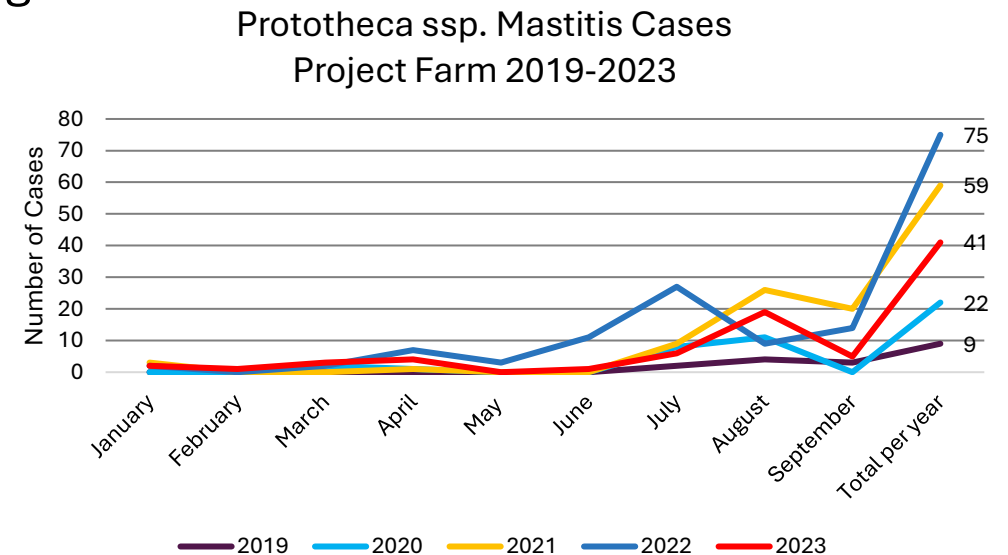
ClO₂ Shocking

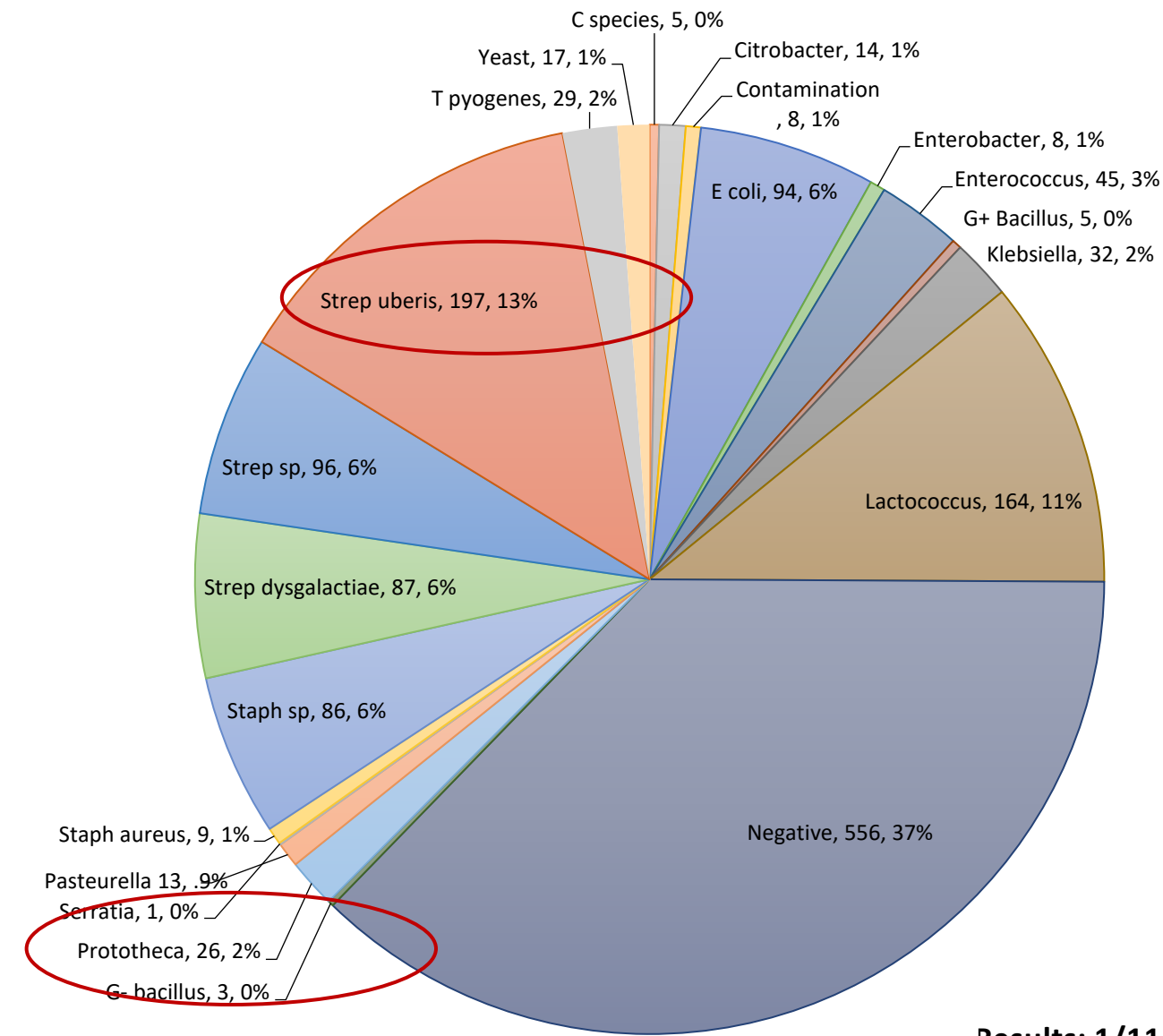


Case Report: Results and Conclusions

- We observed a 66% reduction in the presence of *Prototheca* ssp. in the flush water after shocking the flush water tank. The tank was negative for *Prototheca* for five months after initial shock.
- A minimal change (1% reduction) in *Prototheca* positive environmental samples was observed.
- Slime layer/biofilm presence in the less trafficked areas and flush water tank was noticeably reduced.
- During March to July 2023 *Prototheca* mastitis cases dropped from 50 cases in 2022 to 14 cases in 2023 (70% reduction).

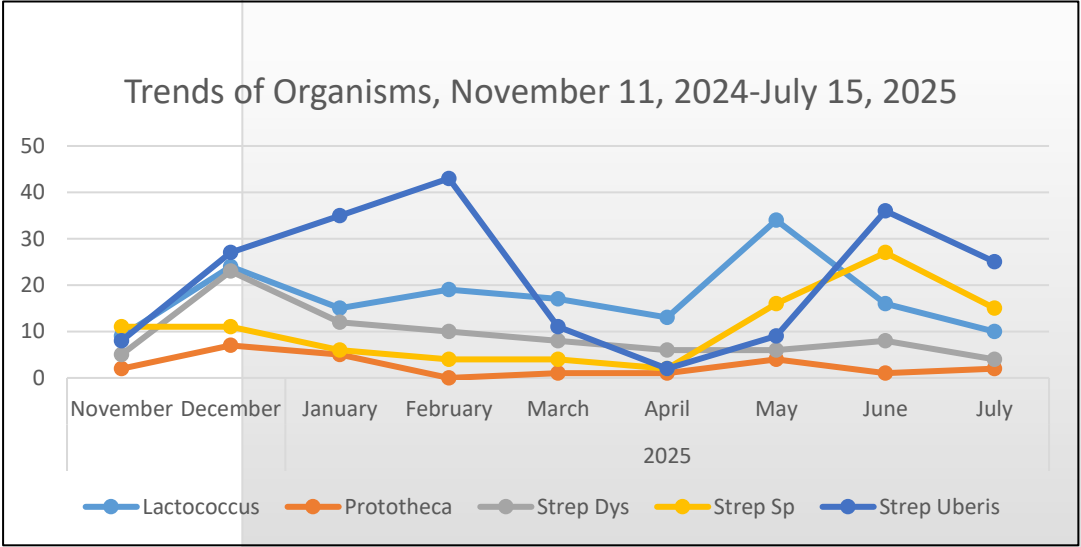
- Routine CLO₂ shocking (weekly) of the flush water tank is necessary during the warmer months May-September.
- Treating the environment with disinfectants such as chlorine dioxide along with traditional, good dairy environment management practices can reduce mastitis cases of *Prototheca* and other environmental pathogens.

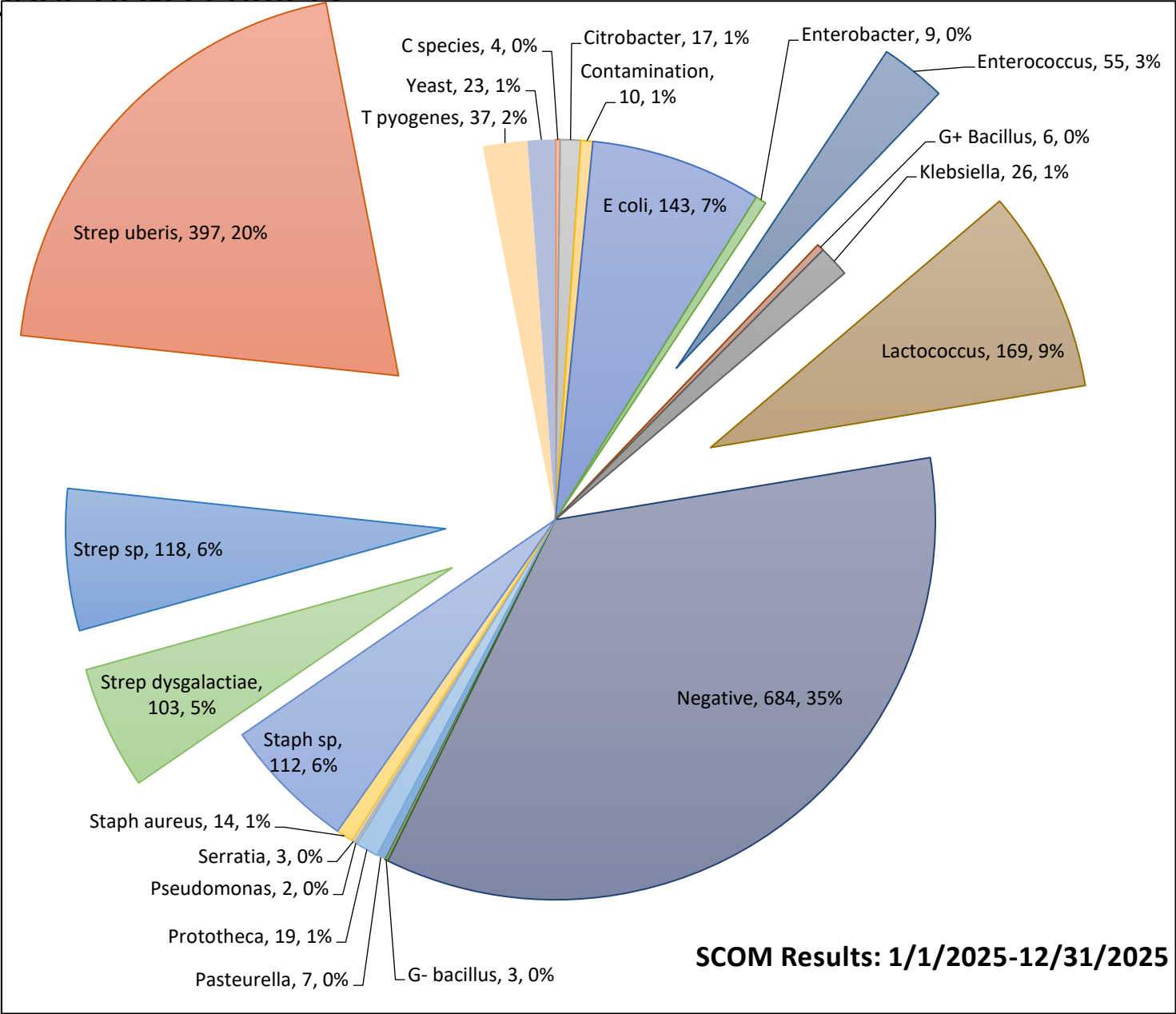




Results: 1/11/2024-7/15/2025

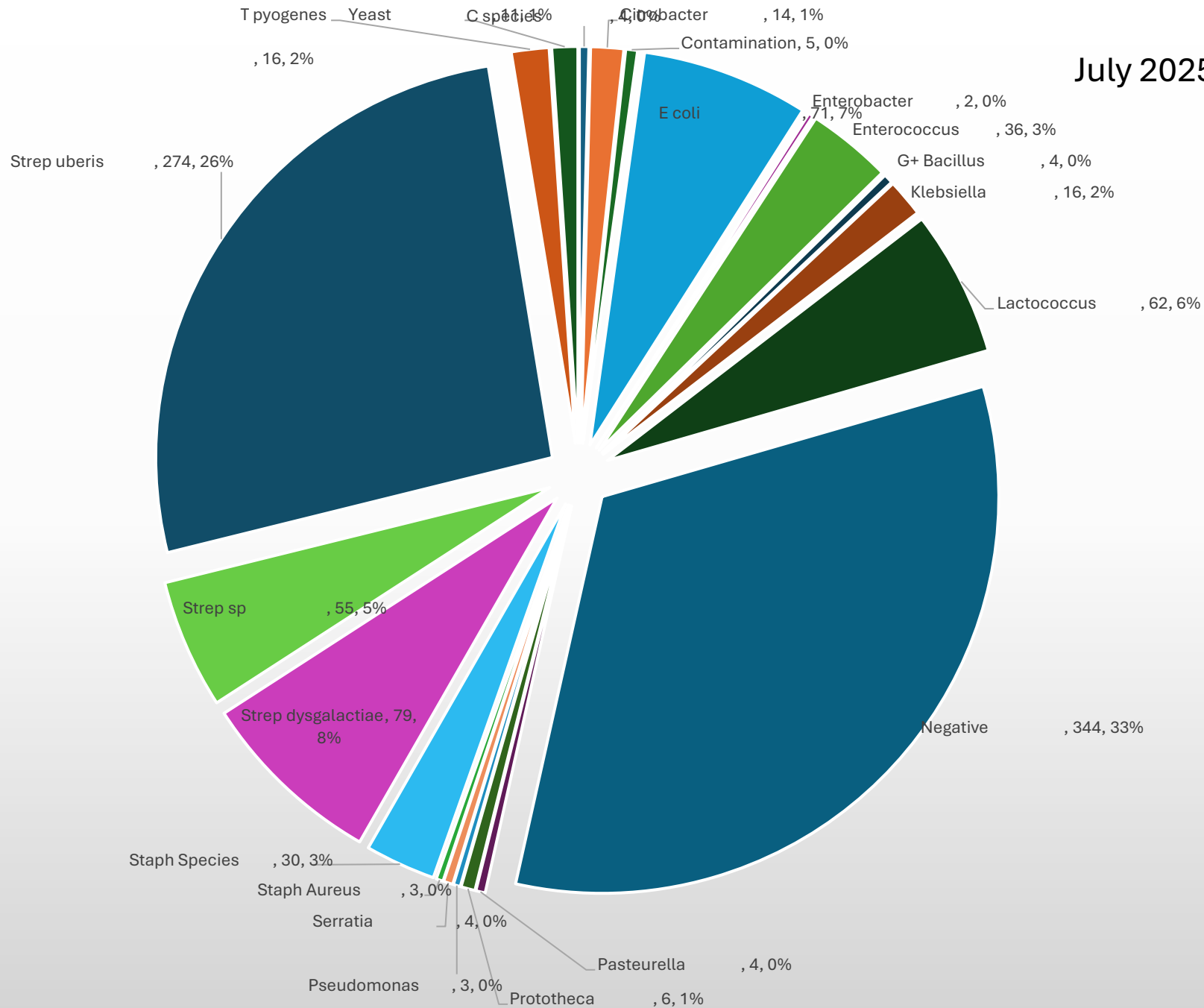
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Strep and Strep-like pathogens=43%

July 2025-March 2026



Strep and Strep-like pathogens=48%

QUALITY MILK PRODUCTION SERVICES

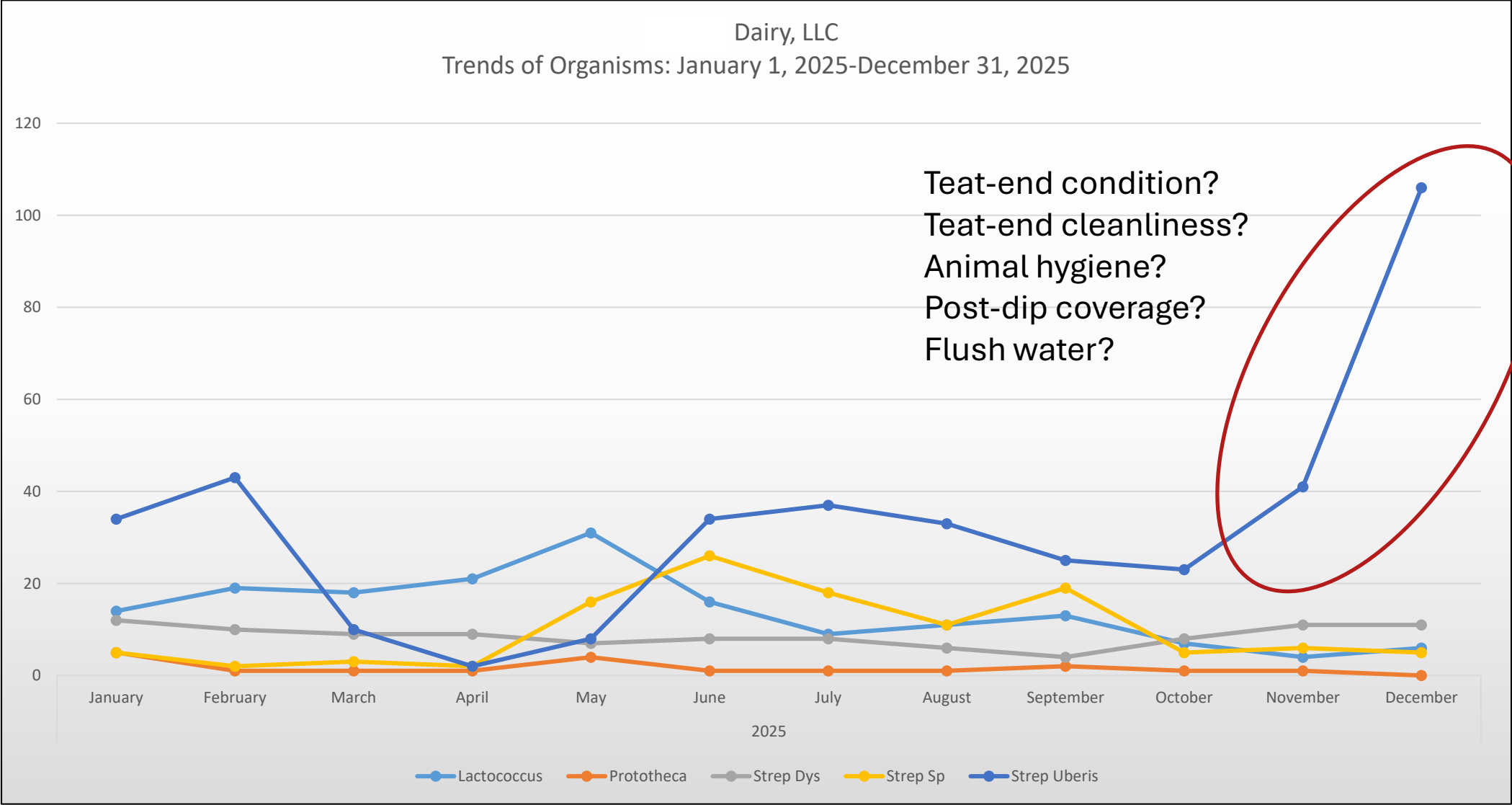
Case Report: Chasing *Streptococcus uberis*



Mike Zurakowski, DVM
Quality Milk Production Services
Eastern Laboratory
518-255-5681
Mjz6@cornell.edu



Dairy, LLC
Trends of Organisms: January 1, 2025-December 31, 2025



Chasing *Streptococcus uberis*

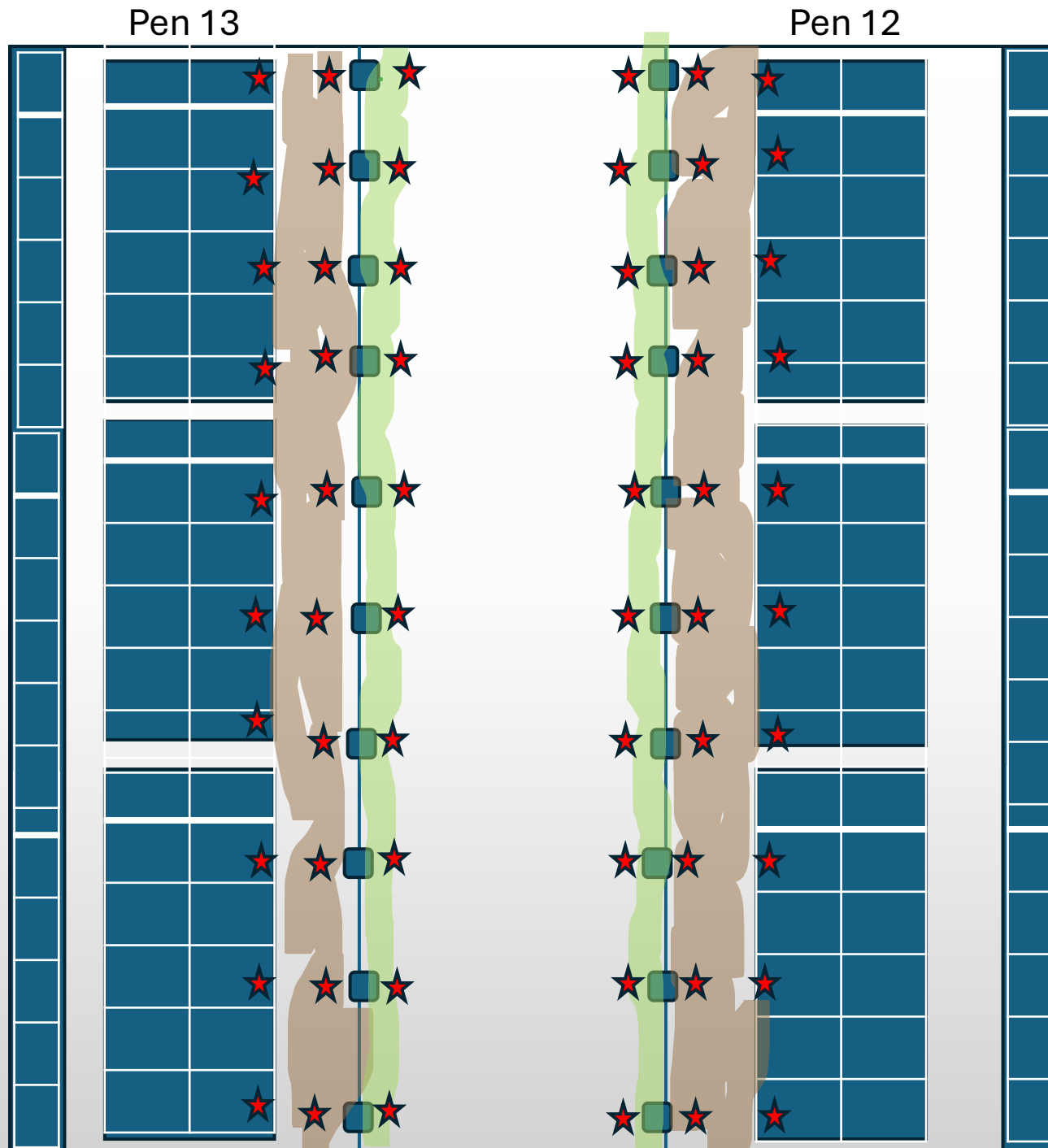


plate code	date collected	pen	type	total strep	TOTAL CFU/G	MALDI	CFU	MALDI
2	G	7/16/2025	na	clean towel		78,875	Micrococcus luteus 9.638	Macrocococcus caseolyticus 9.014
3	C	5/15/2025	13	feed composite	1,000,000	6,380,952	Lactococcus lactis sibsp cremoris	
4	F	5/15/2025	12	feed composite	20,000,000	4,476,190	Enterococcus faecalis	30 cfu Lactococcus lactis
5	C	6/2/2025	13	feed composite	29,703	74,257	Aerococcus viridans	1 Enterococcus faecalis
6	F	6/2/2025	12	feed composite	1,425	332,542	Enterococcus casseliflavus	
7	C	6/23/2025	13	feed composite	1,173,594	161,369	Enterococcus faecalis	2 Enterococcus faecium
8	F	6/23/2025	12	feed composite	203,310	2,836,879	Lactococcus garvieae	13 Enterococcus faecium
9	C	7/16/2025	13	feed composite	171,838	2,100,239	Enterococcus faecalis	13 Enterococcus faecium
0	F	7/16/2025	12	feed composite	239,024	2,634,146	Enterococcus saccharolyticus	10 Lactobacillus farciminis
1	C	8/4/2025	13	feed composite	753	211,765	Enterococcus gallinarum	10 Enterococcus faecium 3 Enterococcus faecalis
2	F	8/4/2025	12	feed composite	5,140	364,486	Enterococcus faecium	5 Enterococcus casseliflavus Aerococcus viridans
3	C	8/27/2025	13	feed composite	261,905	6,619,048	Enterococcus faecalis	3 Enterococcus hirae 15 Enterococcus faecium
4	F	8/27/2025	12	feed composite	27,273	1,244,019	Enterococcus faecalis	Enterococcus gallinarum Enterococcus faecium
5								
6	B	5/15/2025	13	manure composite	77,272,727	139,393,939	Enterococcus aquimarinus	4 cfu Enterococcus italicus
7	E	5/15/2025	12	manure composite	28,930,818	110,691,824	Aerococcus sp	2 cfu Enterococcus saccharolyticus
8	B	6/2/2025	13	manure composite	4,739,336	53,080,569	Aerococcus viridans	1 Lactococcus garvieae
9	E	6/2/2025	12	manure composite	2,264,151	47,798,742	Lactococcus garvieae	
0	B	6/23/2025	13	manure composite	28,402,367	137,278,107	Lactococcus garvieae	10 Enterococcus italicus
1	E	6/23/2025	12	manure composite	13,669,065	176,978,417	Lactococcus garvieae	25 Enterococcus aquimarinus
2	B	7/16/2025	13	manure composite	29,787,234	127,659,574	Globicatella sanguinis	7 Lactococcus garvieae
3	E	7/16/2025	12	manure composite	47,852,761	101,840,491	Streptococcus suis	
4	B	8/4/2025	13	manure composite	7,142,857	31,746,032	Aerococcus viridans	
5	E	8/4/2025	12	manure composite	8,227,848	30,379,747	Aerococcus viridans	1 Lactococcus garvieae 6 Streptococcus lutetiensis
6	B	8/27/2025	13	manure composite	35,211,268	76,056,338	Aerococcus viridans	Lactococcus garvieae
7	E	8/27/2025	12	manure composite	44,585,987	90,445,860	Aerococcus viridans	
8								
9	A	5/15/2025	13	sand bedding composite	5,197,505	118,087,318	Lactococcus lactis	10 cfu Enterococcus sacchararolyticus
0	D	5/15/2025	12	sand bedding composite	6,458,333	77,500,000	Lactococcus garvieae	9 cfu Strep lutetiensis
1	A	6/2/2025	13	sand bedding composite	3,340,292	78,826,722	Lactococcus garvieae	4 Enterococcus italicus
2	D	6/2/2025	12	sand bedding composite	4,338,843	56,198,347	Lactococcus garvieae	6 Enterococcus italicus
3	A	6/23/2025	13	sand bedding composite	8,351,178	53,533,191	Lactococcus garvieae	13 Enterococcus saccharolyticus
4	D	6/23/2025	12	sand bedding composite	9,583,333	52,083,333	Lactococcus garvieae	16 Enterococcus saccharolyticus 2 Streptococcus lutetiensis
5	A	7/16/2025	13	sand bedding composite	10,147,992	52,854,123	Lactococcus garvieae	6 Enterococcus saccharolyticus 10 Streptococcus lutetiensis
6	D	7/16/2025	12	sand bedding composite	7,073,955	53,590,568	Lactococcus garvieae	5 Streptococcus lutetiensis
7	A	8/4/2025	13	sand bedding composite	1,851,852	42,181,070	Lactococcus garvieae	5 Aerococcus viridans Enterococcus casseliflavus
8	D	8/4/2025	12	sand bedding composite	6,073,298	52,356,021	Aerococcus viridans	Streptococcus suis Lactococcus garvieae
9	A	8/27/2025	13	sand bedding composite	6,584,362	51,440,329	Lactococcus garvieae	2 Aerococcus viridans Streptococcus fallolyticus
0	D	8/27/2025	12	sand bedding composite	4,123,711	32,164,948	Aerococcus viridans	3 Lactococcus garvieae
1								

Chasing
Streptococcus uberis
in flush water

Organism	Plate Type	Score	Date	Source	
Strep Parauberis	Edwards	9.3	3/6/2026	Flush	
Strep Parauberis	Edwards	9.419	3/6/2026	Flush	
Strep Parauberis	Edwards	9.458	3/6/2026	Flush	
Strep Parauberis	Edwards	7.27	3/6/2026	Flush	
Strep Parauberis	Unknown	9.162	Feb-26	Flush	
Strep Parauberis	Unknown	5.842	Feb-26	Flush	
Strep Parauberis	Unknown	9.244	Feb-26	Flush	
Strep Parauberis	Inulin	6.539	Feb-26	Flush	
Strep Parauberis	Inulin	8.849	Feb-26	Flush	
Strep Parauberis	Edwards	9.245	3/23/2026	Dump	
Strep Parauberis	Inulin	7.692	3/23/2026	Dump	
Strep Parauberis	Edwards	9.022	3/23/2026	Dump	
Strep Parauberis	Inulin	9.423	3/6/2026	Flush	
Strep Parauberis	Inulin	9.377	3/6/2026	Flush	
Strep Parauberis	Inulin	9.047	3/6/2026	Flush	

Date	Source	Organism	Plate Type
3/6/26	Flush	Strep Parauberis	Edwards
3/6/26	Flush	Strep Parauberis	Edwards
3/6/26	Flush	Strep Parauberis	Edwards
3/6/26	Flush	Strep Parauberis	Edwards
2/1/26	Flush	Strep Parauberis	Unknown
2/1/26	Flush	Strep Parauberis	Unknown
2/1/26	Flush	Strep Parauberis	Unknown
2/1/26	Flush	Strep Parauberis	Inulin
2/1/26	Flush	Strep Parauberis	Inulin
3/23/26	Dump	Strep Parauberis	Edwards
3/23/26	Dump	Strep Parauberis	Inulin
3/23/26	Dump	Strep Parauberis	Edwards
3/6/26	Flush	Strep Parauberis	Inulin
3/6/26	Flush	Strep Parauberis	Inulin
3/6/26	Flush	Strep Parauberis	Inulin

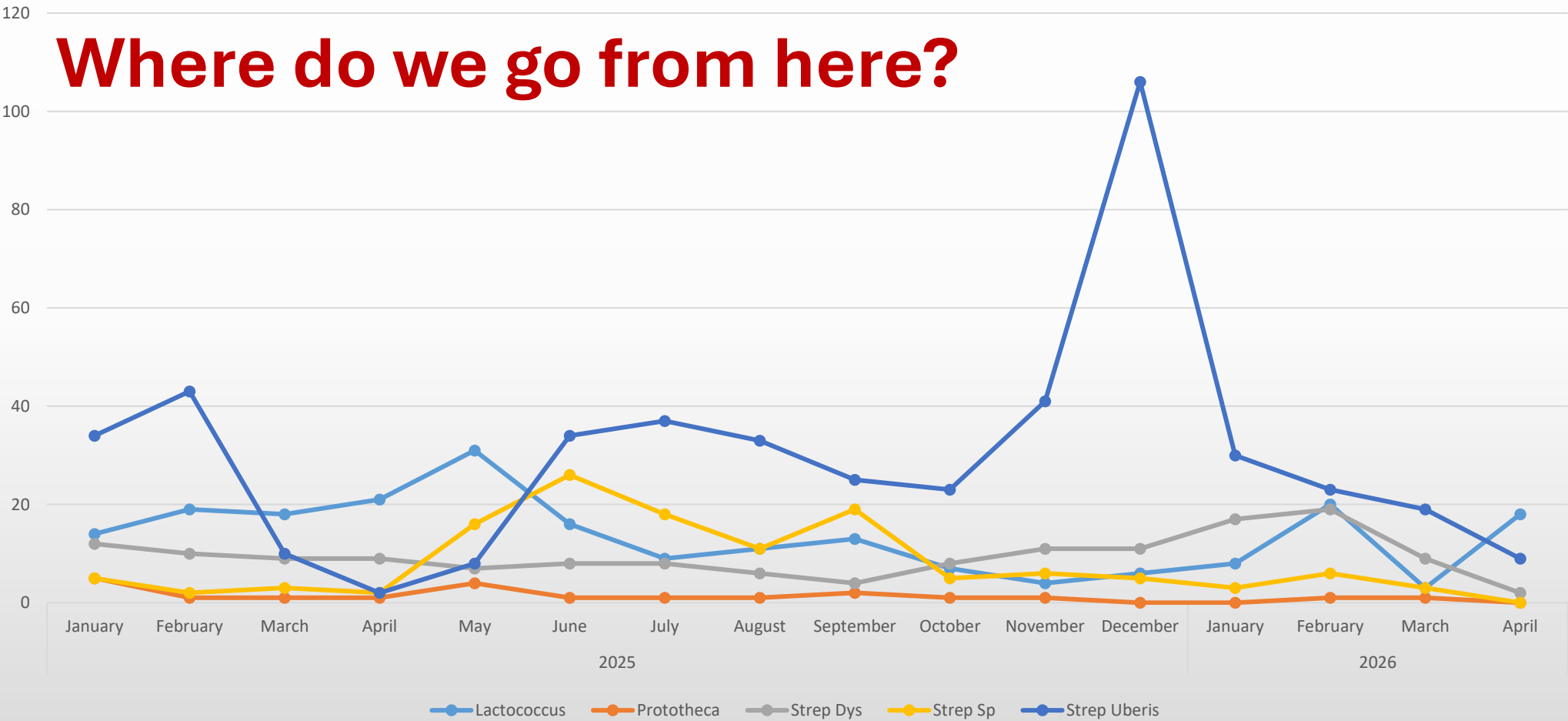
Chasing *Streptococcus uberis* on teat-ends

Spot	Ideal	PreMilk	Post Milk	Flush
A1	Ideal PreMBASW2	Macroccoccus caseolyticus	9.134	
A2	Ideal PreMBASW2	Corynebacterium xerosis	9.109	
A3	Ideal PreMBASW2	Aerococcus viridans	9.521	
A4	Ideal PreMBASW2	Chryseobacterium gleum	9.549	
A5	Ideal PreMBASW2	Corynebacterium sp.	5.356	
A6	Ideal PreMBASW2	Aerococcus viridans	6.805	
A7	Ideal PreMBASW2	Aerococcus viridans	9.253	
A8	Ideal PreMBASW2	Aerococcus viridans	9.275	
A9	Ideal PreMBASW2	Aerococcus viridans	9.29	
A10	Ideal PreMBASW2	Ochrobactrum intermedium	9.68	
A11	Ideal PreMBASW2	Aerococcus viridans	7.76	
A12	Ideal PreMBASW2	Aerococcus viridans	6.56	
B1	Ideal PostMEAW	Aerococcus viridans	9.06	
B2	Ideal PostMEAW	Aerococcus viridans	8.574	
B3	Ideal PostMEAW	Aerococcus viridans	9.336	
B4	Ideal PostMEAW	Mycoplasma hominis	4.599	
B5	Ideal PostMEAW	Staphylococcus capitis	9.482	
B6	Ideal PostMEAW	Macroccoccus caseolyticus	9.032	
B7	Ideal PostMEAW	Aerococcus viridans	9.348	
B8	Ideal PostMEAW	Aerococcus viridans	9.172	
B9	Ideal PostMEAW	Serratia liquefaciens	9.719	
B10	Ideal PostMEAW	Streptococcus constellatus	5.629	
B11	Ideal PostMEAW	Lactococcus garvieae	8.097	
C1	Ideal FlushEA2W	Lactococcus garvieae	9.543	
C2	Ideal FlushEA2W	Streptococcus parauberis	9.134	
C3	Ideal FlushEA2W	Streptococcus parauberis	9.117	
C4	Ideal FlushEA2W	Streptococcus parauberis	9.227	
C5	Ideal FlushEA2W	Streptococcus parauberis	9.168	
C6	Ideal FlushEA2W	Lactococcus lactis	9.121	
C7	Ideal FlushEA2W	Rothia endophytica	9.536	
C8	Ideal FlushEA2W	Sphingomonas asaccharolytica	5.117	
H11	Ideal FlushEA2W	Aeromonas caviae	9.272	
H11	Ideal FlushEA2W	Pass the negative QC	---	
A1	Ideal PreMBASW2			
ID	Result	Score		
1	Arthrobact	9.134		
2	Arthrobact	6.437		
3	Glutamicit	6.032		
4	Glutamicit	5.767		
5	Dermacoo	5.402		
6	Arcanobac	5.209		
7	Arthrobact	5.069		
8	Bacillus inf	4.953		
9	Staphyloc	4.918		
10	Glutamicit	4.819		
A2	Ideal PreMBABW2			
ID	Result	Score		
1	Macroccoc	9.109		
2	Macroccoc	7.801		
3	Macroccoc	5.507		
4	Macroccoc	5.37		
5	Staphyloc	5.298		
6	Staphyloc	5.134		
7	Staphyloc	5.07		
8	Staphyloc	5.043		

Spot	Sample No	Description	Result	Score
88	Ideal swab blood 0 (4)	Macroccoccus caseolyticus	6.067	6.067
89	Ideal swab blood 0 (4)	Staphylococcus simulans	6.683	6.683
810	Ideal swab blood 0 (4)	Staphylococcus aureus	8.229	8.229
811	Ideal swab blood 0 (4)	Staphylococcus aureus	9.386	9.386
812	Ideal swab blood 1 (5)	Staphylococcus aureus	9.352	9.352
C1	Ideal swab blood 1 (6)	Staphylococcus aureus	9.16	9.16
C2	Ideal swab blood 1 (6)	Curtobacterium citreum	4.877	4.877
C3	Ideal swab blood 0 (2)	Staphylococcus haemolyticus	6.656	6.656
C4	Ideal swab blood 0 (2)	Corynebacterium amycolatum	4.67	4.67
C5	Ideal swab blood 1 (3)	Staphylococcus haemolyticus	8.889	8.889
C6	Ideal swab blood 1 (1)	Brachy bacterium aquaticum	7.491	7.491
C7	Ideal Just Liquid edwi	Streptococcus parauberis	9.274	9.274
C8	Ideal Just Liquid edwi	Streptococcus parauberis	9.134	9.134
H11	negative control	---	---	---
B8	Ideal swab blood 0 (4)	yellow		
ID	Result	Score		
1	Macroccoc	6.067		
2	Staphyloc	5.137		
3	Bacillus sin	5.117		
4	Saccharop	5.067		
5	Bacillus sin	4.905		
6	Capnocytc	4.815		
7	Ruminoco	4.784		
8	Breoghani	4.749		
9	Neosartori	4.644		
10	Streptococ	4.535		
B9	Ideal swab blood 0 (4)	white		
ID	Result	Score		
1	Staphyloc	6.683		
2	Staphyloc	5.851		
3	Staphyloc	5.742		
4	Staphyloc	5.654		
5	Staphyloc	5.481		
6	Staphyloc	5.441		
7	Staphyloc	5.306		
8	Staphyloc	5.163		
9	Staphyloc	4.918		
10	Fusobacte	4.912		
B10	Ideal swab blood 0 (4)	small white		
ID	Result	Score		
1	Staphyloc	8.229		
2	Staphyloc	7.649		
3	Alistipes o	5.304		
4	Neurospor	5.019		
5	Bifidobact	4.915		
6	Lactobacill	4.891		
7	Neurospor	4.797		
8	Neurospor	4.737		
9	Thermoact	4.734		
10	Porphyron	4.731		
L	Ideal swab blood 0 (4)	small white		
ID	Result	Score		
1	Staphyloc	8.229		

Ideal Dairy, LLC
Trends of Organisms: January 2025-April 2026

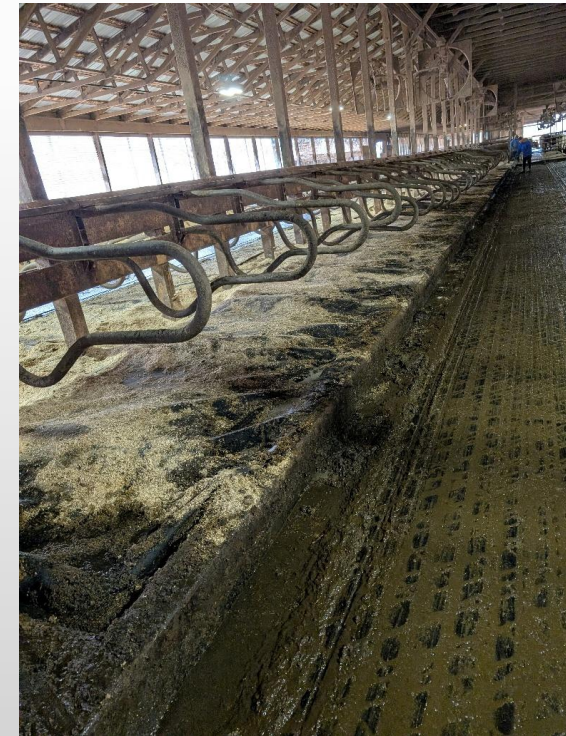
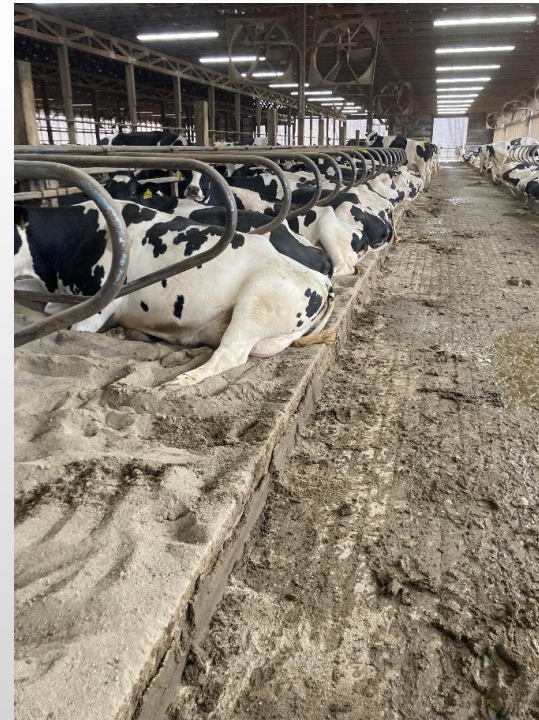
Where do we go from here?



Barn Evaluation

Environmental Assessment

- Walk through of all pens including prefresh and dry
- Record the following:
 - Stall cleanliness
 - Bedding level
 - Cow positioning in stall
 - Areas of manure accumulation





- Cow positioning was good with 89% of the 786 cows that we scored positioned correctly although there is variation by pen and within pen by row of stalls.
- Stall cleanliness is good with 96% scored as clean.
- Bedding levels showed 100% of the stalls having adequate bedding.

Dry-Off Procedure Assessment

- Watch all employees who perform the dry-off procedure
- Score with an OSCE type score sheet
- Observe how cows are sorted, where dried off, and when they were milked last

Future Plans

- We will keep you on the schedule for approximately every 4 months to perform this type of analysis. This provides you and all your advisors an excellent set of data that can be used to evaluate changes that are made and also assess the progress toward the goal of better milk quality.

Discussion topics

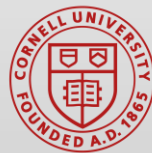
- Calf hygiene audits?
- Flush water culture?
- Dry teat swabs and culture?



Ruby-2023

Thank you

Mike Zurakowski, DVM
Quality Milk Production Services
Eastern Laboratory
Cobleskill, New York
MJZ6@Cornell.edu



College of
Veterinary Medicine



QUALITY MILK PRODUCTION SERVICES

Microbiologist Approach to Mastitis

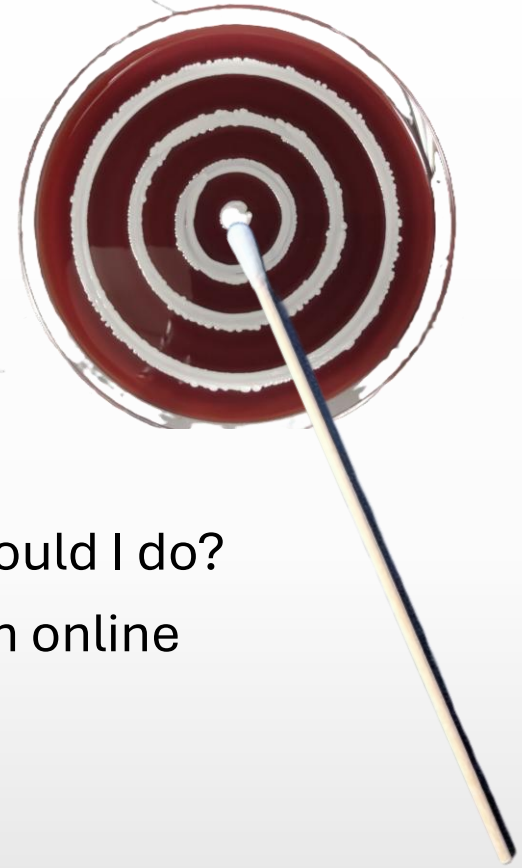
Using On-farm and In-clinic Mastitis Pathogen Detection Systems

An Online Approach

Mike Zurakowski, DVM
Quality Milk Production Services
Eastern Laboratory
Cobleskill, New York
MJZ6@Cornell.edu

Objectives

- Why should we detect pathogens?
- It all starts with a good sample.
- Setting up a lab-things to consider
- Most common question with clinical mastitis-What should I do?
- Extending pathogen-based management reach through online education
- Other mastitis detection systems



Pathogen-based Management Decisions for Clinical Mastitis

Why consider this?

**Make More Money
while not compromising animal health**

- **Save money on treatment tubes and labor**
- **Decrease risk of antibiotic residues in the tank**
- **Public health/consumer concern**
 - **Someone tells you that you have to**
 - **Mitigate risk of antibiotic resistance**

Sell more milk

Economic comparison of immediate blanket treatment versus a delayed pathogen-based treatment protocol for clinical mastitis in a New York dairy herd

M. Capel, DVM¹; D. V. Nydam, DVM, PhD²; A. Vasquez, DVM²; S. Eicker, MS, DVM³;

¹Perry Veterinary Clinic, Perry, NY 14530

²College of Veterinary Medicine, Cornell University, Ithaca, NY 14853

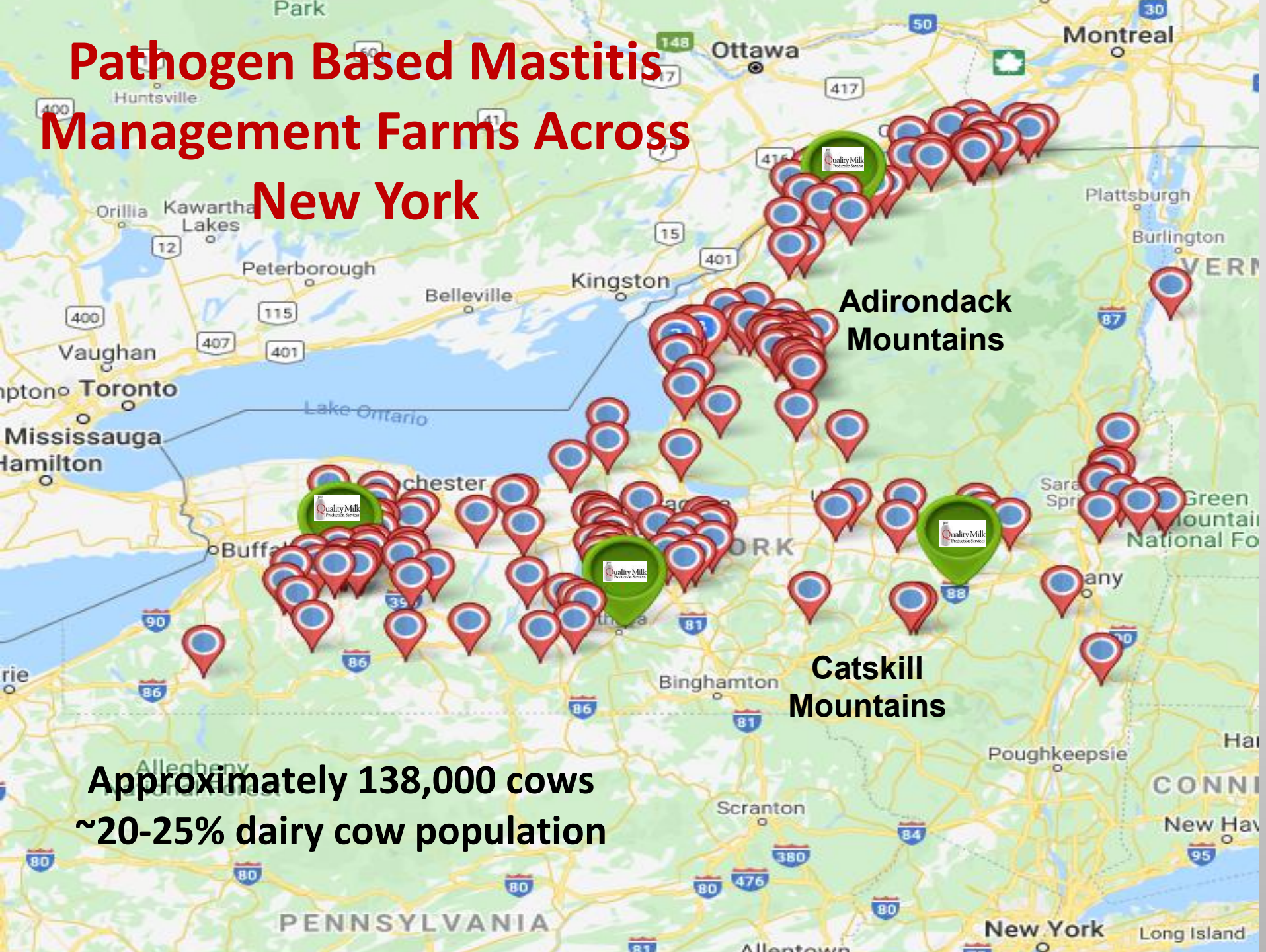
³Valley Ag Software, Tulare, CA 93274



Significance:

The use of culture-based therapy to guide the treatment of clinical mastitis resulted in reduced treatment costs, increased volume of saleable milk, and allowed for a 67% reduction in IMM antimicrobial use with no impact on therapeutic success resulting in an increase in cash flow of over \$30,000 per 1000 COWS.

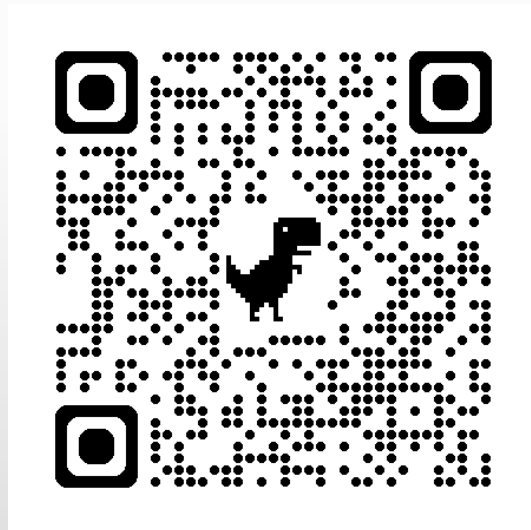
Pathogen Based Mastitis Management Farms Across New York



Limitations to pathogen-based mastitis management

- Good quality samples
- Movement of samples to the lab
- Ensuring farms are properly using culture results

Good Cultures Start With a Good Sample



<https://www.milker-training.com/english>



Listen to podcast



Watch a video



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Immediate impact.

I am in. Let's go.

<https://www.milker-training.com/english>

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Choose what you learn

Every farm is unique.
Select the topics most
relevant for your farm.
In just **2** minutes, you'll
sharpen the skills that
matter most for
consistent routines,
udder health, and milk
quality.

Choose your preference

-  Listen to a podcast
-  Watch a video
-  Use a quick guide
-  Listen to Ana & José

I'm in. Let's go!



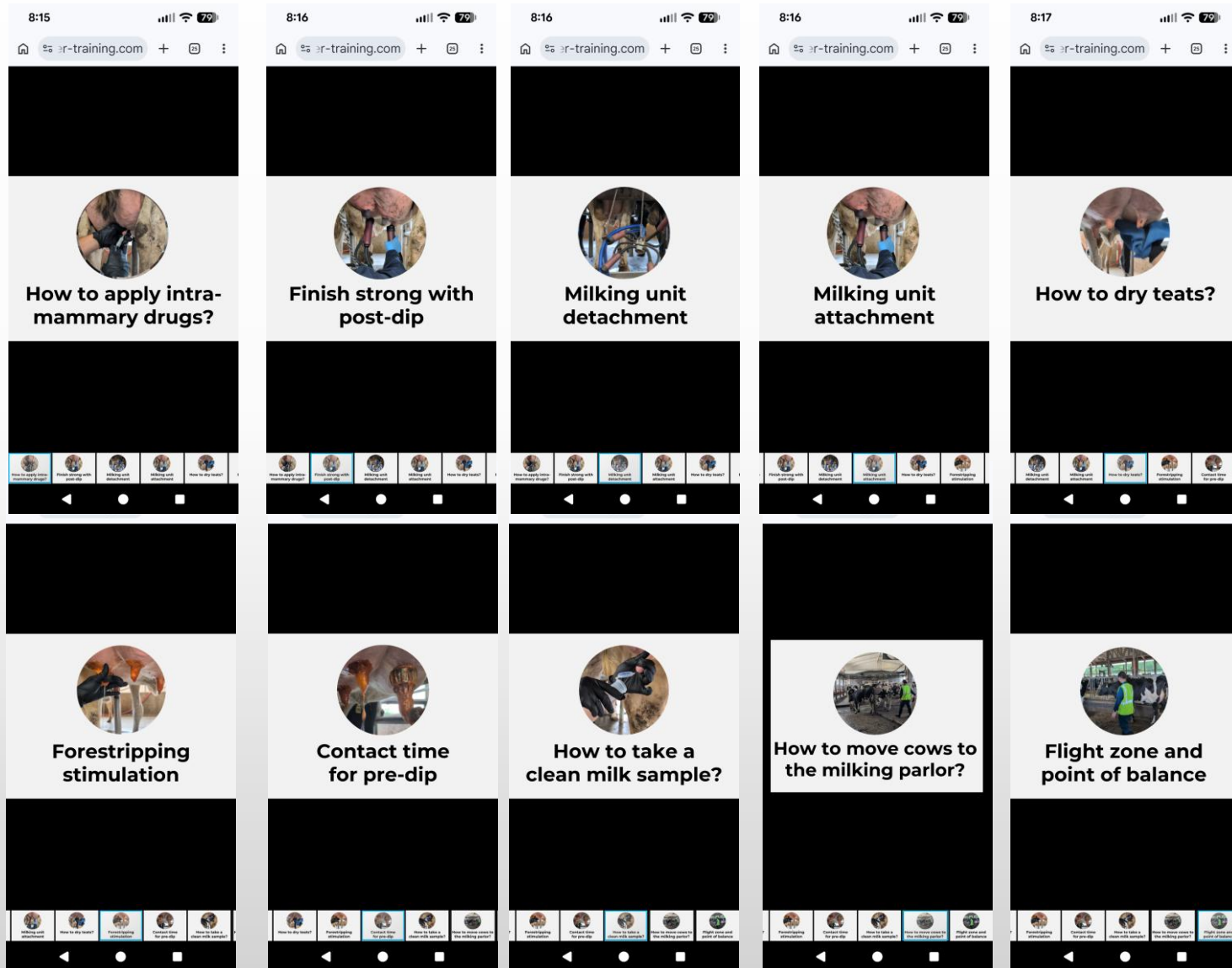
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+1-607-280-4314

QUALITY MILK

PRODUCTION SERVICES

Cornell
Animal Health Diagnostic Center



QUALITY MILK PRODUCTION SERVICES

11:41 @ @ • 92

my.visme.co/vie + 41

How to collect a clean milk sample?

Step by step guide



1

Materials



- Gloves (Nitrile or latex)
- Test dip
- Paper or cloth towels
- 4x4 Gauze pads soaked in alcohol
- 70% ethanol or isopropyl alcohol
- Sterile sample vials (no preservative)
- Waterproof marker
- Ice packs



Back



Next 2

Label vials



- Cow ID
- Quarter (LF, LH, RF, RH)
- Date



Back



Next 3

Check if gauze is clean



gauze is not clean gauze is clean

Gauze should be clean after wiping. If not, use another gauze to wipe again



Back



Next 11

11:43 @ @ • 91

my.visme.co/vie + 41

Do not hold vials by their lids



Holding the vial by its lid can contaminate the sample



Back

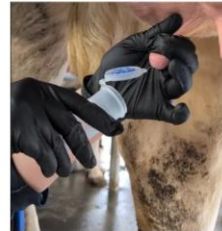


Next 13

11:43 @ @ • 91

my.visme.co/vie + 41

Sample collection



Collect 1-3 streams of milk



Back



Next 15

11:44 @ @ • 91

my.visme.co/vie + 41

Sample storage



Chill milk samples immediately after collection in a refrigerator or on ice to prevent sample contamination.



Back



Next 18

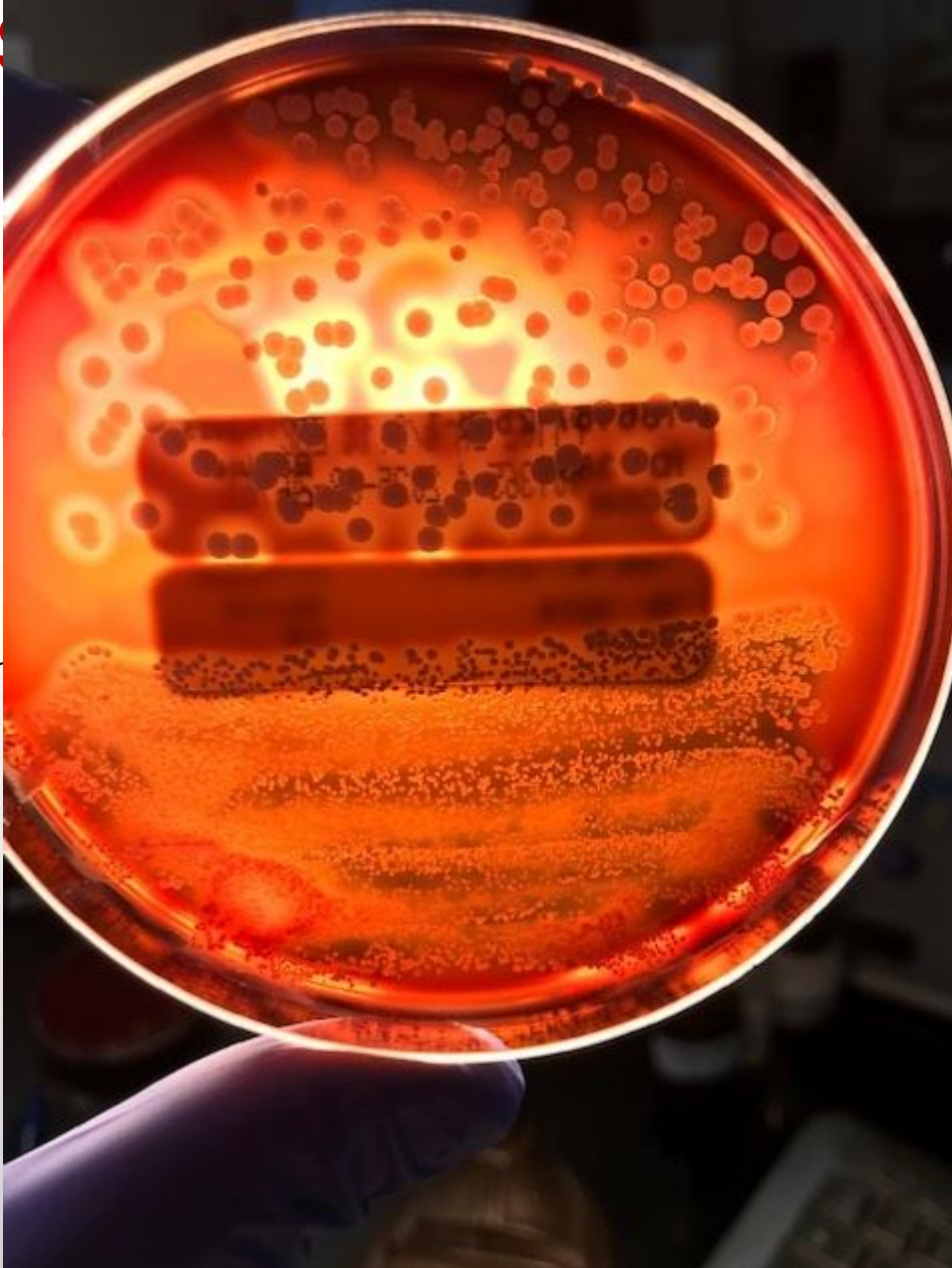
Cornell
Animal Health Diagnostic Center

Sources of contaminants in milk samples

- Teat canal
- Teat orifice
- Teat lesions
- Udder skin
- Sampler's hand
- Cow environment
- Laboratory?



Implementing an On-Farm Quality Assurance Program



A clean dedicated space



On-farm Culture Supplies

<https://www.vdl.umn.edu/submission-guidelines/packing-shipping/supplies>

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Home > Submission Guidelines > Packing & shipping

Supplies

Submission forms

Best practices

Packing & shipping

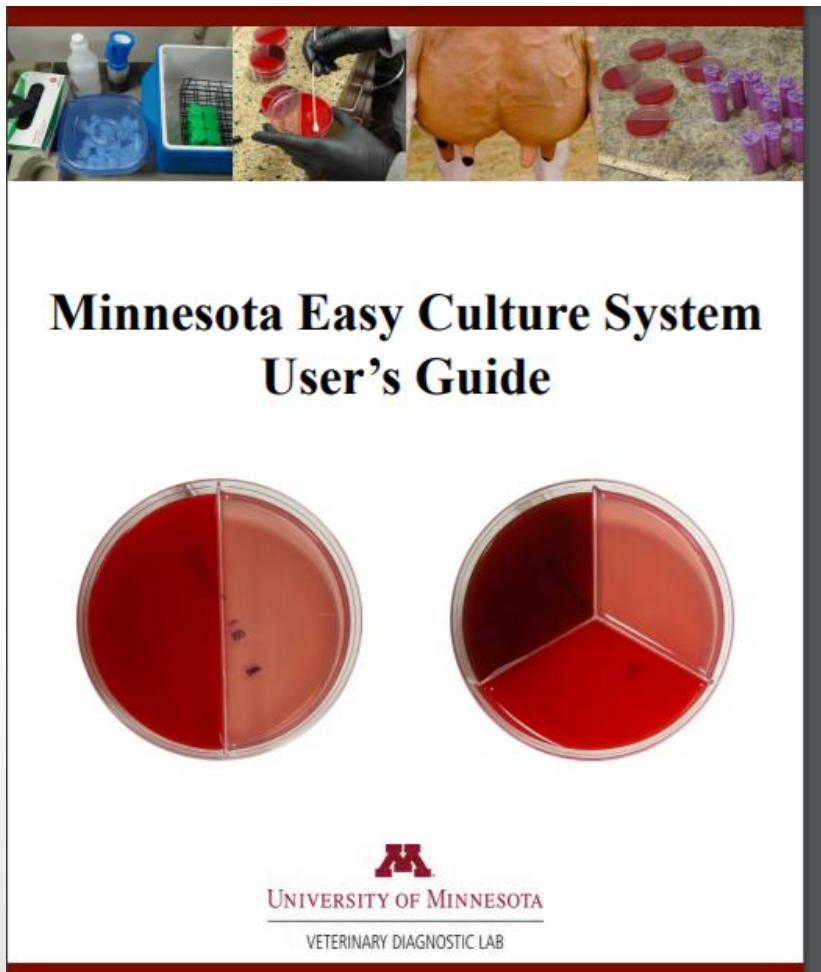
Supplies

UPS Shipping Program

*Prices listed below do not include shipping charges, which will be billed once the supplies are sent

General supplies	Unit price (\$)	How to order
Insulated Shipper: New Box	13.00	Download receiving order form By email: vdirecv@umn.edu By phone: 612-625-7095
Insulated Shipper: New Foam Inside	7.35	
Insulated Shipper: New Outer Box	5.65	
Blood Tube Rack	No charge	
Blood Tube Mailer	No charge	
CWD Collection Cups (pack of 10)	No charge	
Johne's Collection Cups, 2oz	No charge	
Tritrichomonas and campylobacter culture media	No charge	
Campylobacter Transport Media, 3ml	No charge	
Campylobacter Transport Media, 5ml	No charge	
Udder health lab supplies		
2 oz Milk Vials	.30	 By email: mastlab@umn.edu By phone: 612-625-7053 Download Udder Health order form Download Easy Culture Manual: English Spanish
Factor plate	1.75	
Focus plate	1.75	
Blood plate	1.20	
MacConkey plate	1.20	
Tri-plate (F-MTKT - Mac)	3.15	
Bi-plate (F-Mac)	2.00	
Bottle of 15ml coagulase	32.00	
Coagulase tube kit (makes 30 individual tubes)	35.00	
Easy Culture System Handbook (English or Spanish)	No charge	
Pack of 100 sterile swabs	1.50	

<https://www.vdl.umn.edu/services-fees/udder-health-mastitis/farm-culture>



<https://vdl.umn.edu/laboratories/laboratory-udder-health-luh/minnesota-easyr-culture>

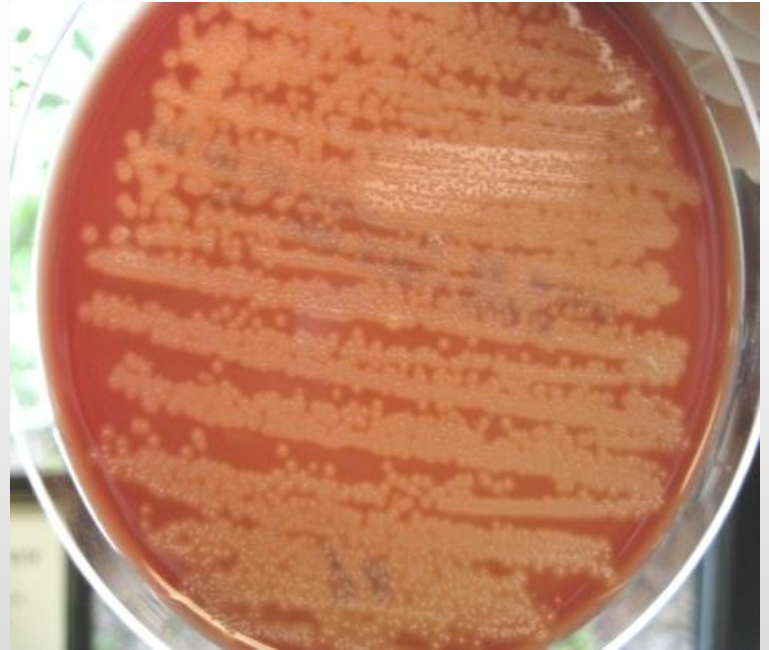
English: https://drive.google.com/file/d/1Nno-yw1qzmKXo_CYIVl3xh1JEsZga4K/view

Spanish: https://drive.google.com/file/d/1VsE-4v_DO_7aJlo3YtJ5V1sCE9dRkkSD/view



Quality Assurance

- Sampling
- Submission
- Media
- Inoculation
- Incubation
- Confirmation

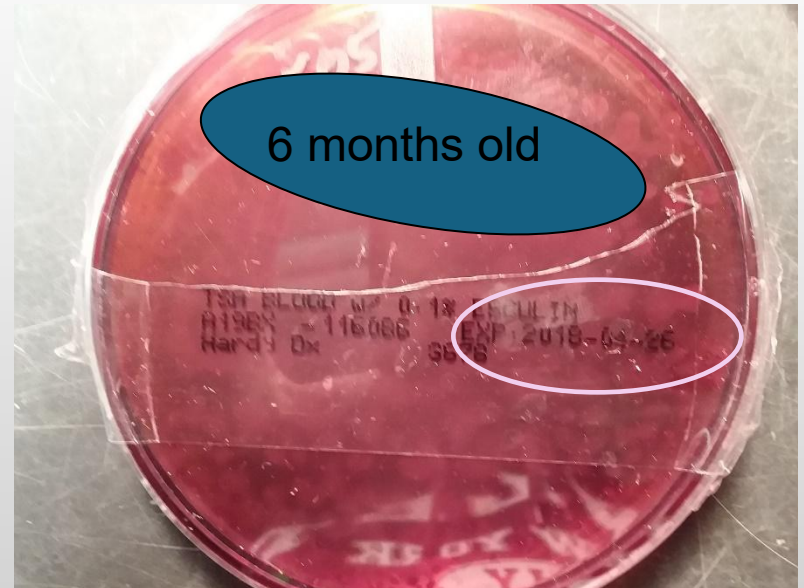


Quality Assurance



- Sampling
- Submission
- Media
- Inoculation
- Incubation
- Confirmation





rm	Northern Laboratory 34 Cornell Dr. Canton, NY 13619 Phone: 315-379-3930 877-645-5523 Fax: 315-379-3931	 006994-17 01/17 Items-5	
		Condition(s) per sample type: Page <u>1</u> of <u>1</u>	
Frozen Cold Room Temp Warm		Received By: <u>ALG</u> Date: <u>1/17/17</u>	
of QMPS.			
inarian	N/A		

Sample Submission



qmps general submission form



AI Mode **All** Images Shopping Videos Forums Short videos More Tools

Cornell University College of Veterinary Medicine
<https://www.vet.cornell.edu/sites/default/files/QMPS%20General%20Submission%20Form.pdf>

QMPS General Submission Form

Samples submitted to QMPS and organisms isolated from them become the property of QMPS. Owner. Veterinarian. Account No. Account No. Address. Address. City/ ... [Read more](#)
2 pages

Cornell University College of Veterinary Medicine
<https://www.vet.cornell.edu/sites/default/files/QMPS%20General%20Submission%20Form.pdf>

QMPS General Submission Form

Feb 10, 2021 — Samples submitted to QMPS and organisms isolated from them become the property of QMPS. Owner. Veterinarian. Account No. Account No. Address. [Read more](#)

Cornell University College of Veterinary Medicine
<https://www.vet.cornell.edu/submission-guidance>

Submission Guidance

Please complete and return the QMPS General Submission Form · Milk samples should be placed on ice or refrigerated immediately for transport to the laboratory. [Read more](#)

DocHub
<https://www.docub.com/FormsLibrary>

Cornell diagnostic lab submission form: Fill out & sign online

It includes sections for the submitting veterinarian's and owner's information, clinical history, animal identification, and requested tests. The form ... [Read more](#)

Cornell University College of Veterinary Medicine
<https://www.vet.cornell.edu/programs/quality-milk-pr...>

Quality Milk Production Services

Quality Milk Production Services supports high-quality milk and consumer trust through improved management, udder health and reduced antibiotic drug use, ...



QMPS General Submission Form

Quality Milk Production Services
/animal-health-diagnostic-center/programs/quality-milk-production

Central Laboratory
240 Farmer Rd.
Ithaca, NY 14853
Phone: 607-255-4332
877-645-5522
Fax: 607-253-4000

Eastern Laboratory
111 Schenectady Ave.
Cohoes, NY 12015
Phone: 518-255-5881
877-645-5524
Fax: 518-255-5682

Western Laboratory
36 Center St. STE A
Warren, NY 14550
Phone: 518-255-5881
877-645-5525
Fax: 518-255-5682

Northern Laboratory
34 Cornell Dr.
Canton, NY 13611
Phone: 315-379-3930
877-645-5523
Fax: 315-379-3931

Condition(s) per sample type: Page ____ of ____
Frozen Cold Room Temp Warm
Received By: _____ Date: _____

Samples submitted to QMPS and organisms isolated from them become the property of QMPS.

Owner	Veterinarian
Account No.	Account No.
Address	Address
City/State/Zip	City/State/Zip
Phone	Phone
Fax/US Mail (Circle)	Fax/US Mail (Circle)
Email	Email
DC305	Species: ☐ Cow ☐ Goat ☐ Sheep ☐ Other
Bill To:	☐ Owner ☐ Veterinarian ☐ 3 rd Party (LIMS#)

Notes:

Sample Type:
CS = Composite, LH = Left Hind, LF = Left Front, RH = Right Hind, RF = Right Front.
OTHER: BED = Bedding, C = Colostrum, I = Isolate, T = Towel, S = Seab, F = Filter, TD = Test Dip, W = Water, B = Brush

Reason:
CM = Clinical
SUB = Sub-clinical
F = Fresh
HTO = Hospital Take-out

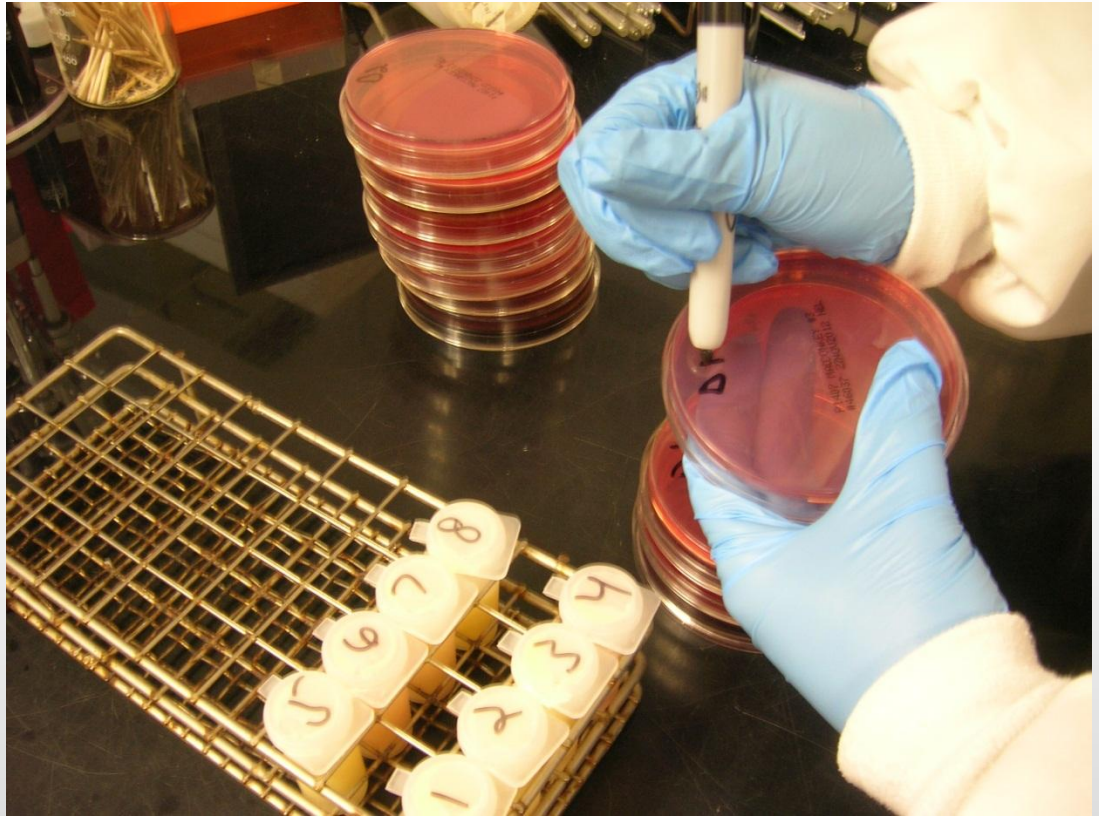
Test:
A = Aerobic Culture, M = Mycoplasma, MP = Myco Pool
SCC = Somatic cell count, AB = Antibiotic Susceptibility, BT = Bulk Tank Culture, Q = Quantification (bacteria counts)

No.	*Sample ID	LH	LF	RH	RF	CS	Other	*Sample Date	CM	Reason	Test(s)	No.	
										SUB	F	HTO	
1													1
2													2
3													3
4													4
5													5
6													6
7													7
8													8
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Ship Monday-Thursday

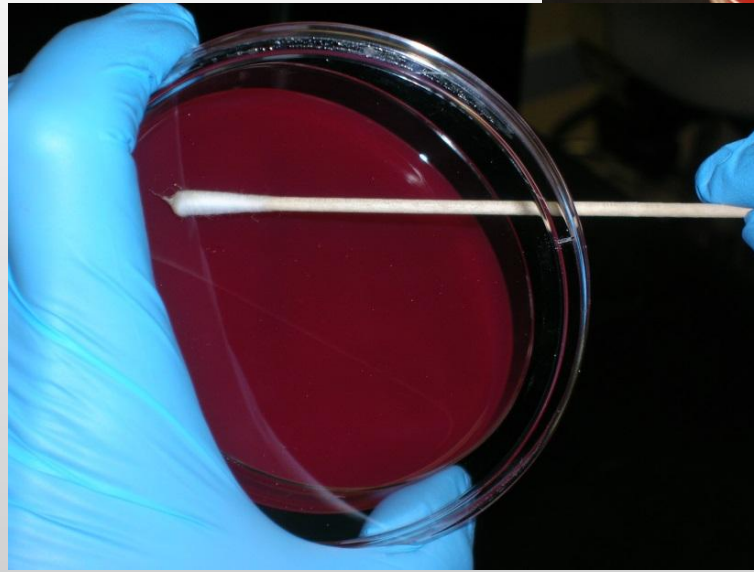
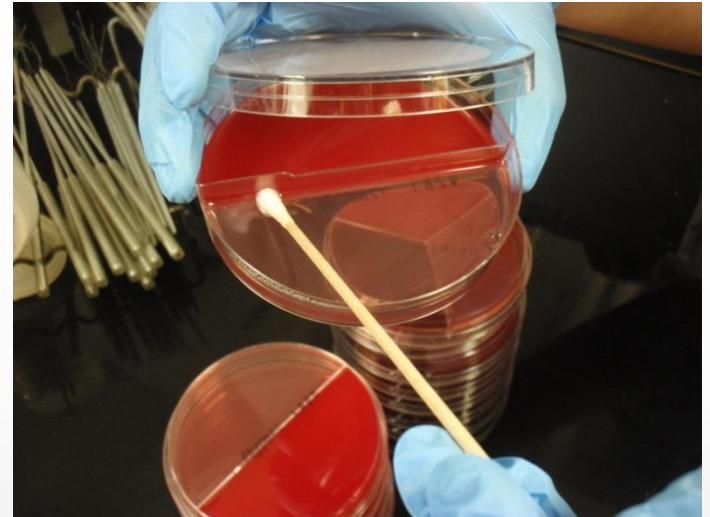
Inoculating Culture Media

Label bottom of
plate with cow
identification,
date, & time



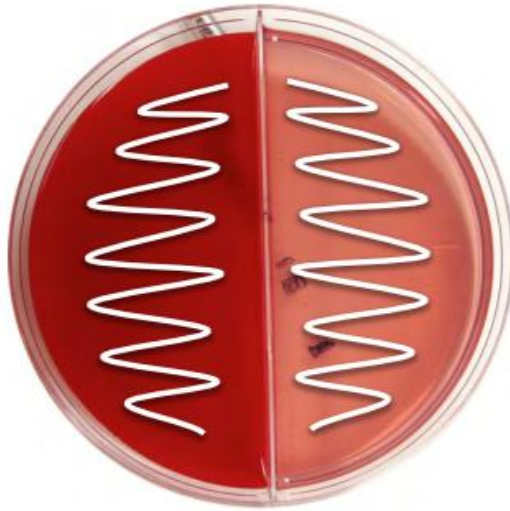
Inoculating Culture Media

- Partially open plate
- Swab milk onto plate



Bi-Plate:

1st swab Factor Media



2nd swab MacConkey Media

Inoculation Patterns

Tri-Plate:

3rd swab MTKT Media



2nd swab MacConkey Media

1st swab Factor Media

Incubating Culture Media

Incubate at 37°C



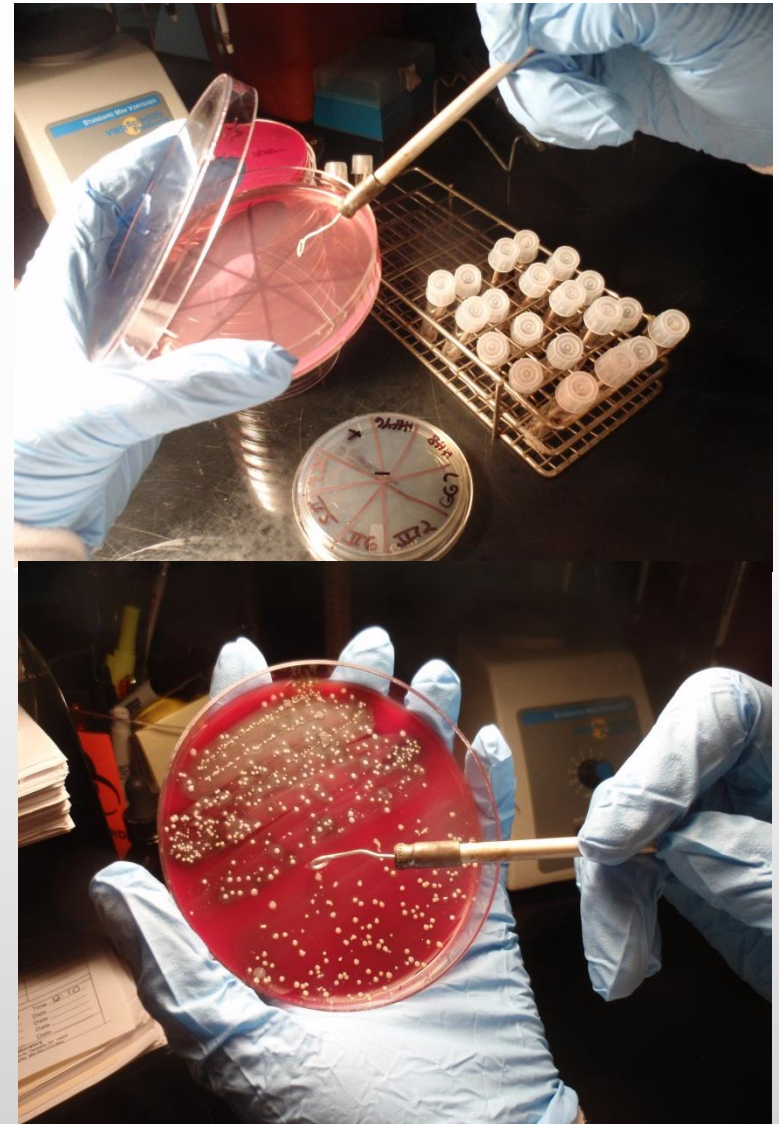
Incubation Quality Assurance

**How do we know if
conditions are appropriate
for bacterial growth?**



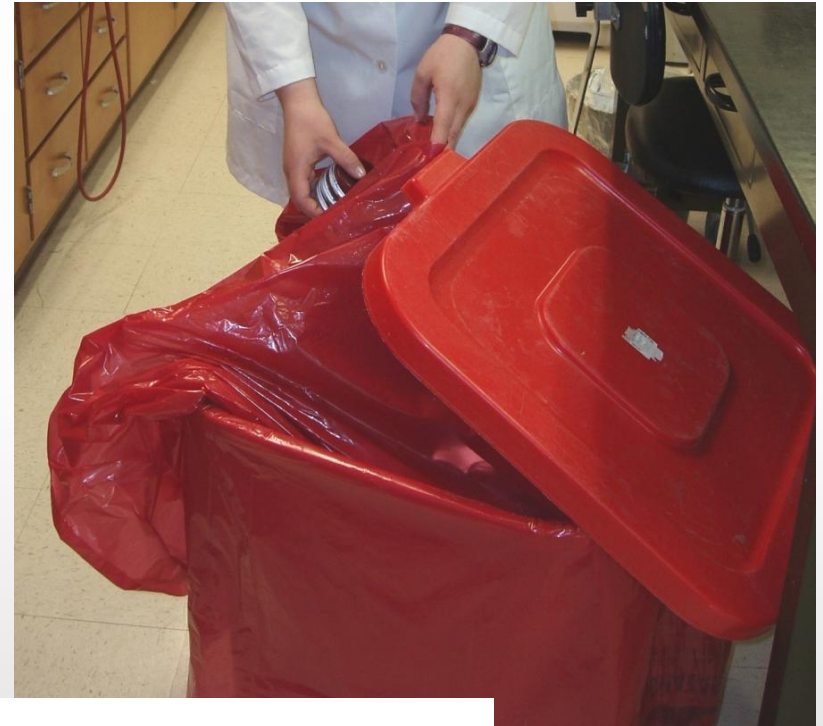
Interpreting Culture Media

- After 18 – 24 hours, set-up tests
- After 48 hours, final identification



Inoculation Quality Assurance

Dispose of
contaminated
waste properly

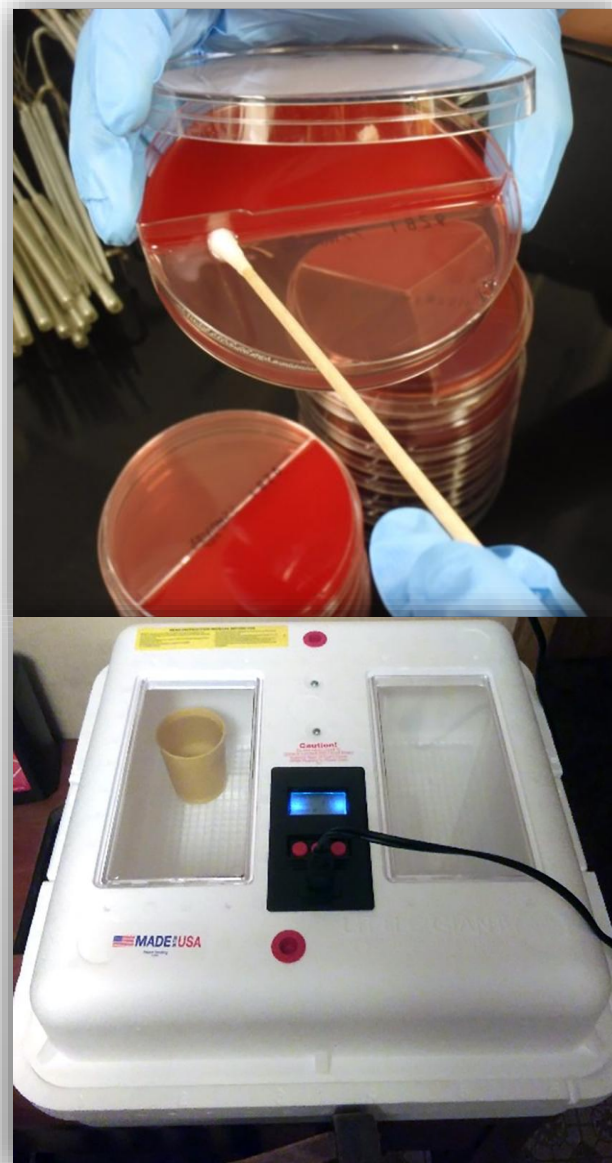
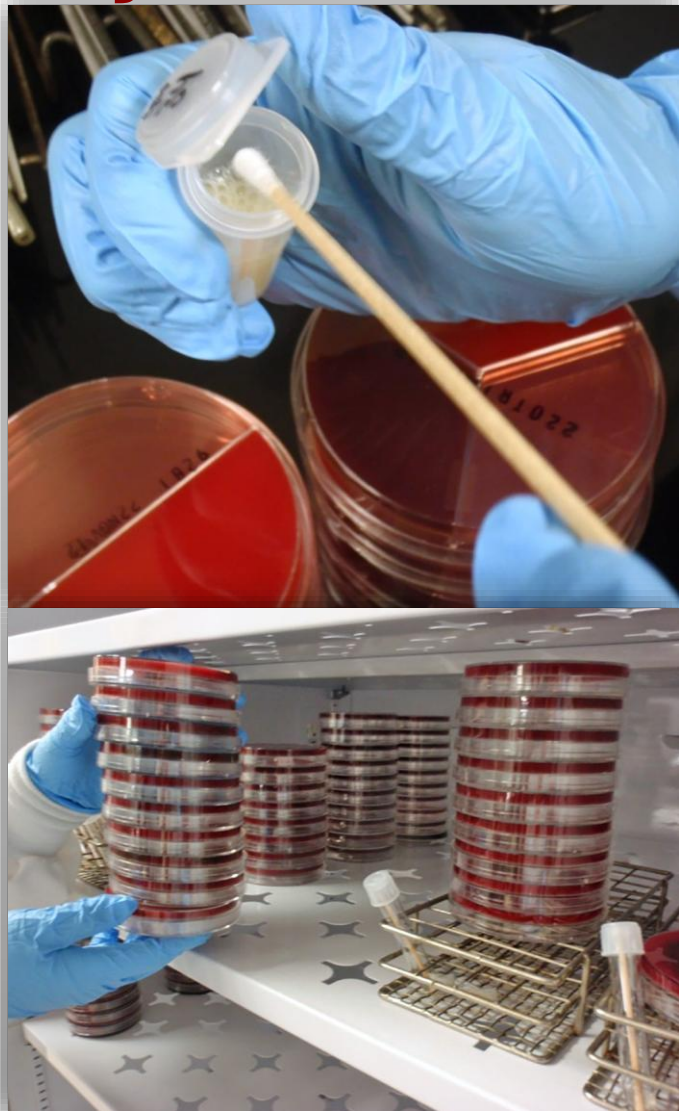


Specific Case Examples (2023-2025)

- **\$100,000 - \$125,000+**: Various firms were fined in 2024-2025 for non-compliance with hazardous waste disposal, including penalties for failing to comply with environmental protection orders.
- **\$13,000 - \$17,500**: Lower, yet substantial, fines for smaller-scale illegal storage or transport violations.

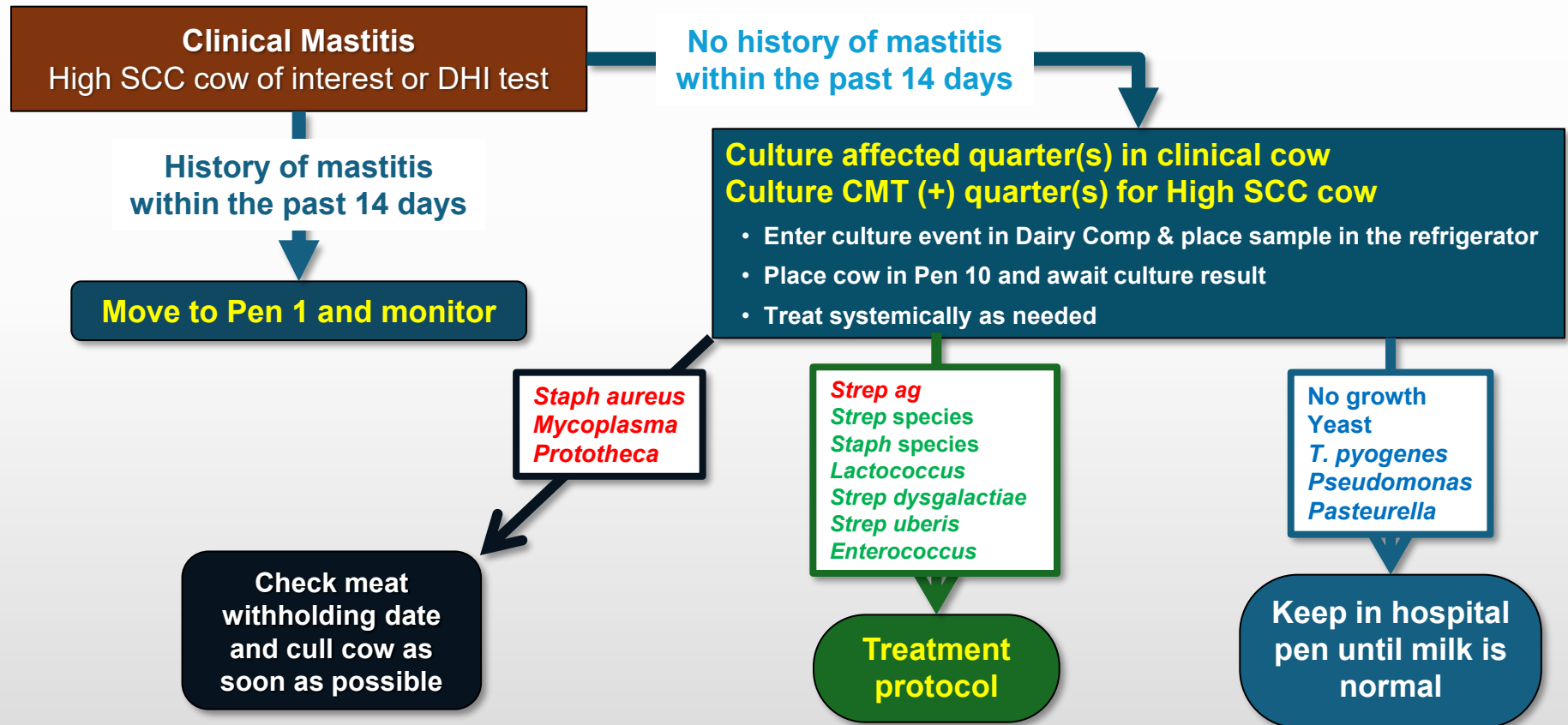
The new penalties will range from \$1,000 per day for less serious violations to \$100,000 per day for the most serious violations, and apply to both open and closed [landfill sites](#) with an approved capacity of 40,000 m³ or more.

Which Mastitis Detection System Should You Use?



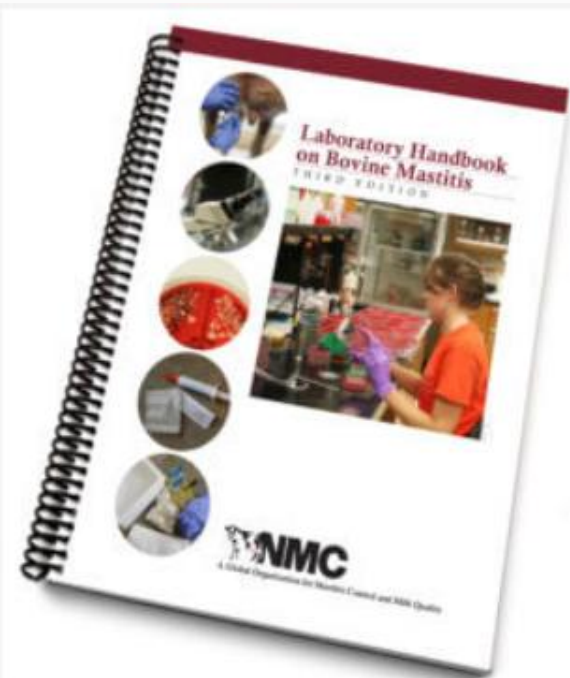
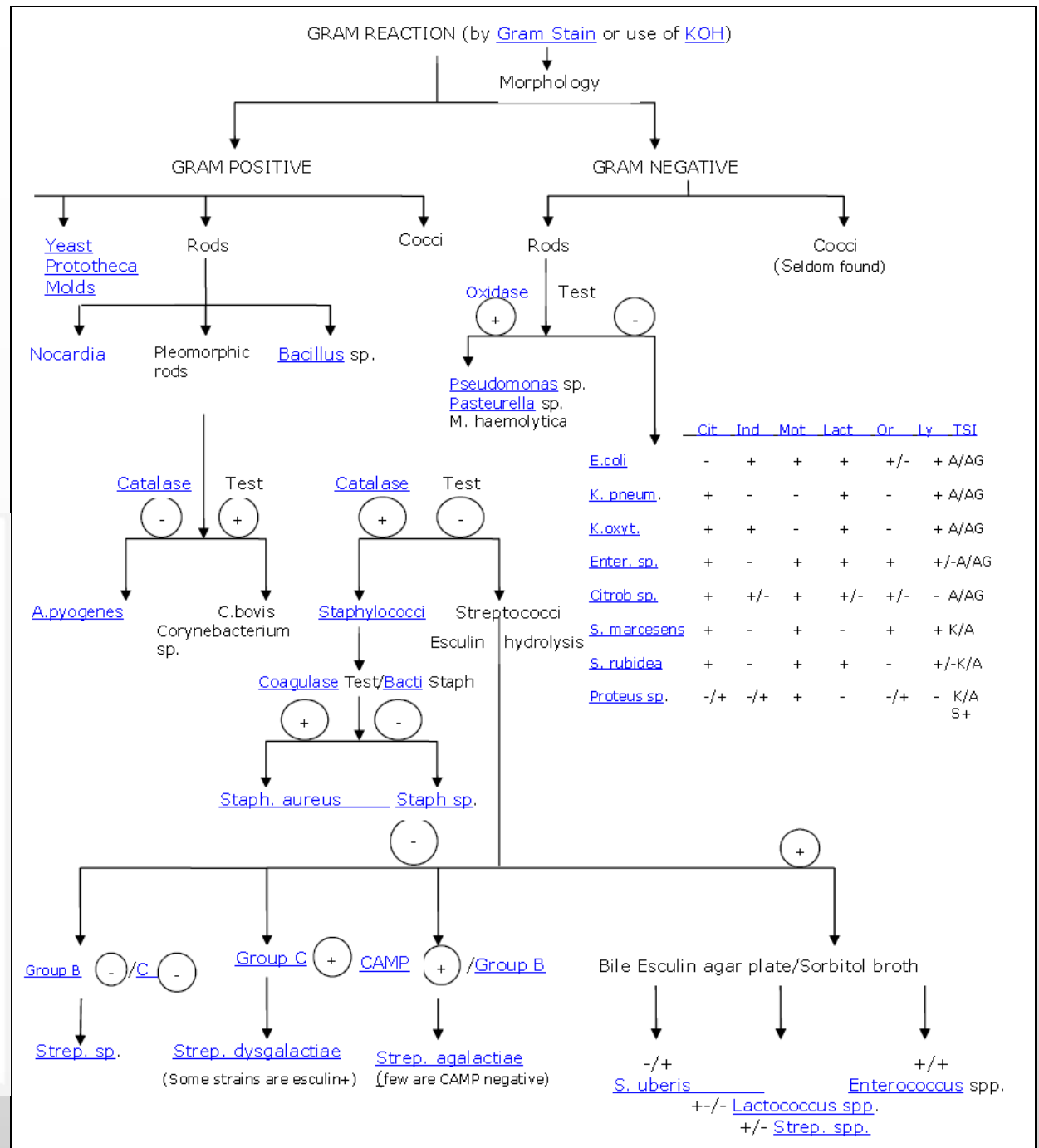
Sample Mastitis Management Protocol (from herd veterinarian)

Based on Milk Culture Results: Contagious, Environmental, and Other Pathogens



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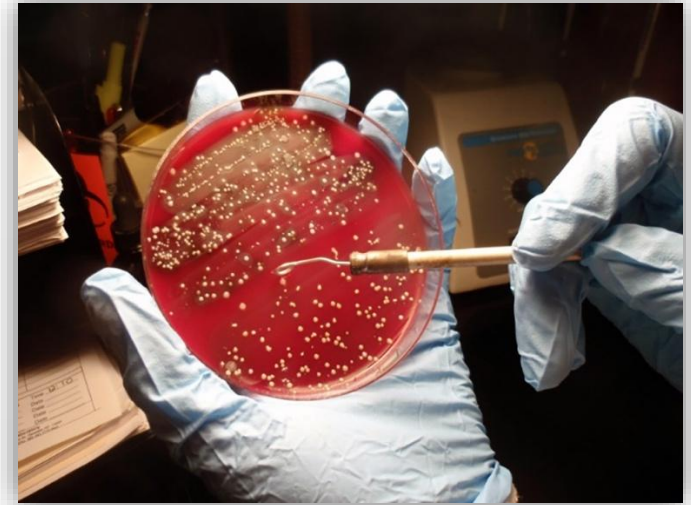
NMC Method



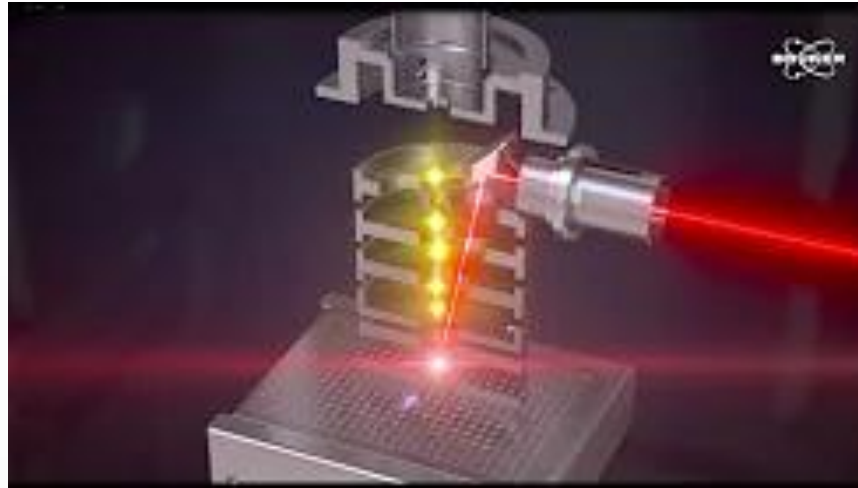
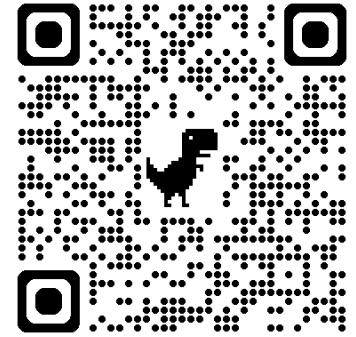
Mastitis Pathogen Confirmatory Methods

Mastitis pathogens can be identified by:

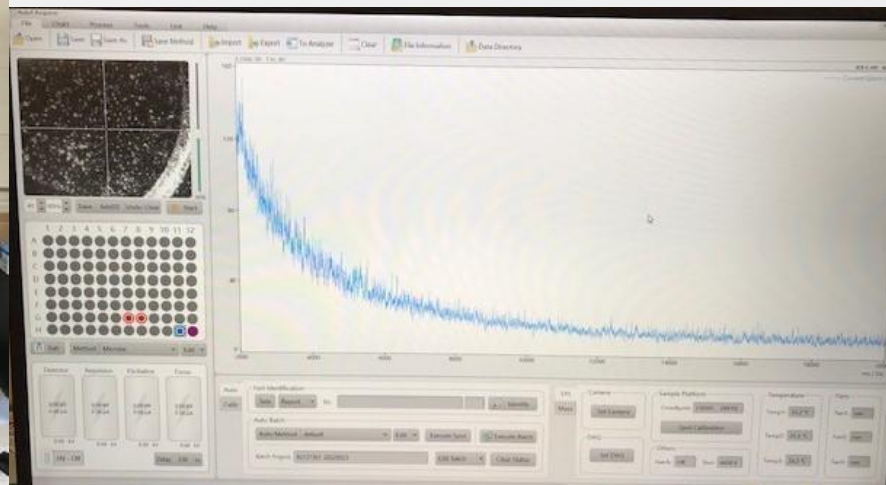
- **Morphology**
colony characteristics on blood agar
and selective media
- **Microscopic observation**
 - Gram stain
 - Wet mount preparations
- **Testing biochemical characteristics**
 - Enzymes reactions
(catalase, oxidase, decarboxylase,
etc.)
 - Fermentation of sugars
- **Immunological tests**
- **MALDI-TOF**



MALDI-TOF

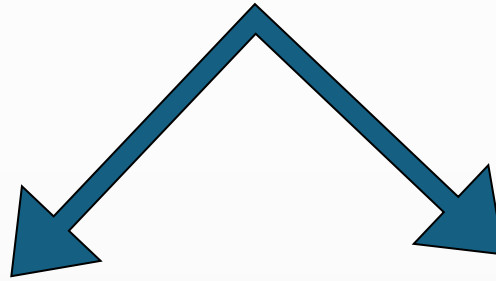


<https://www.youtube.com/watch?v=0jeFpXHZ8W0&list=WL&index=1&pp=gAQBiAQB>

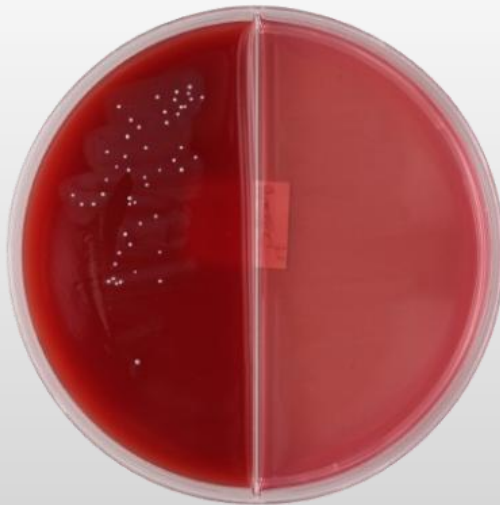


What question are you trying to answer?

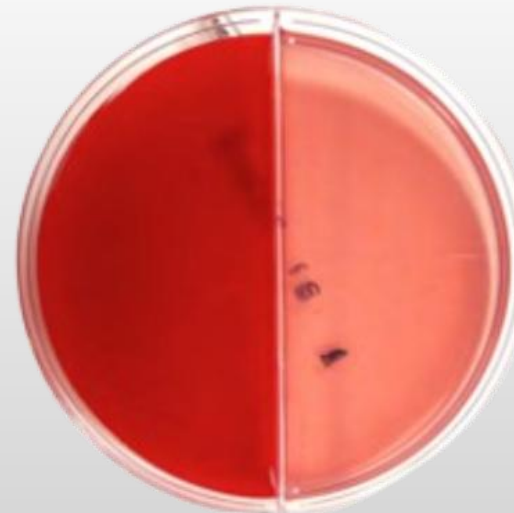
What do I do with this case of mastitis?



Treat (Growth)

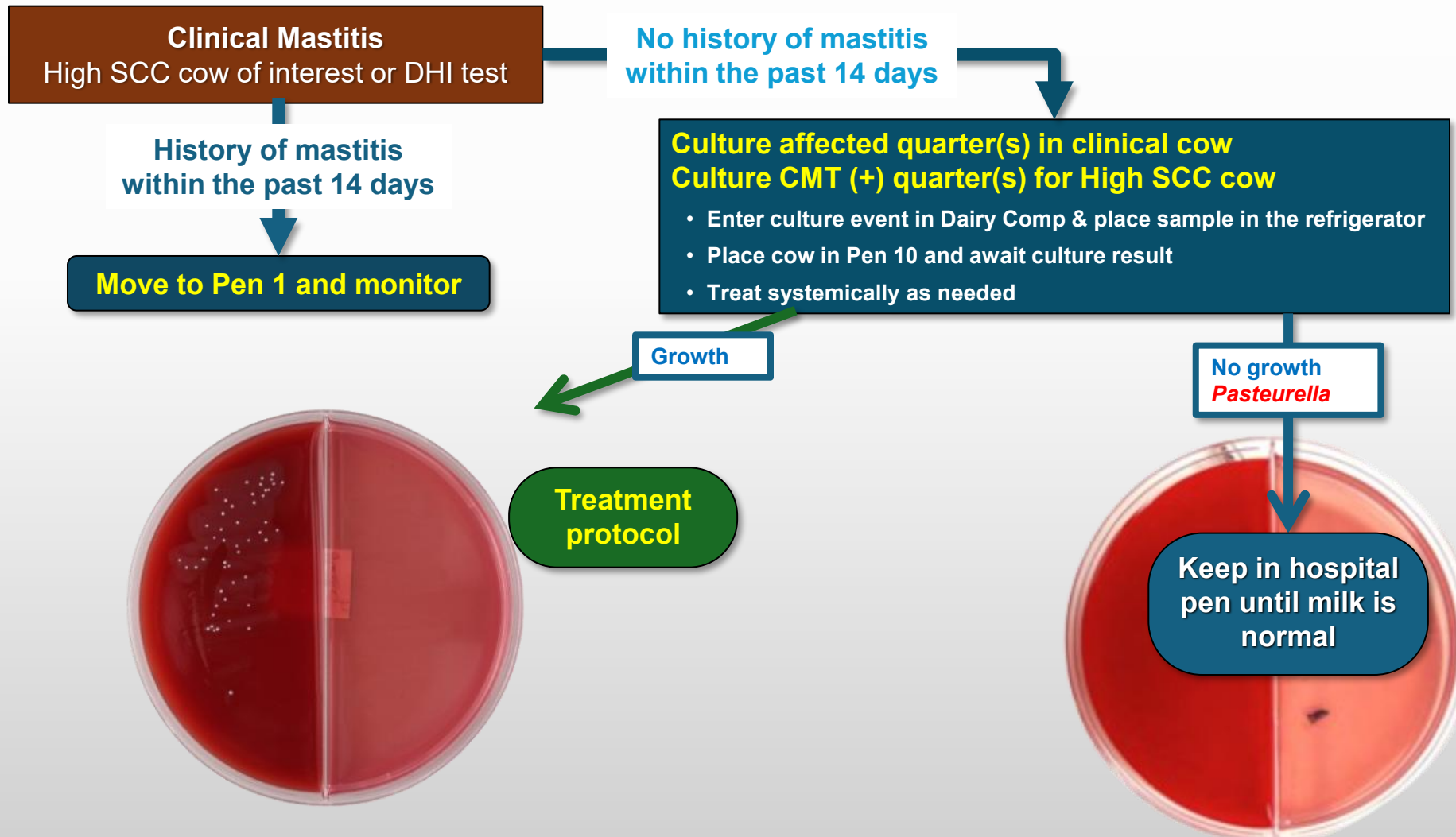


No Treat (No Growth)

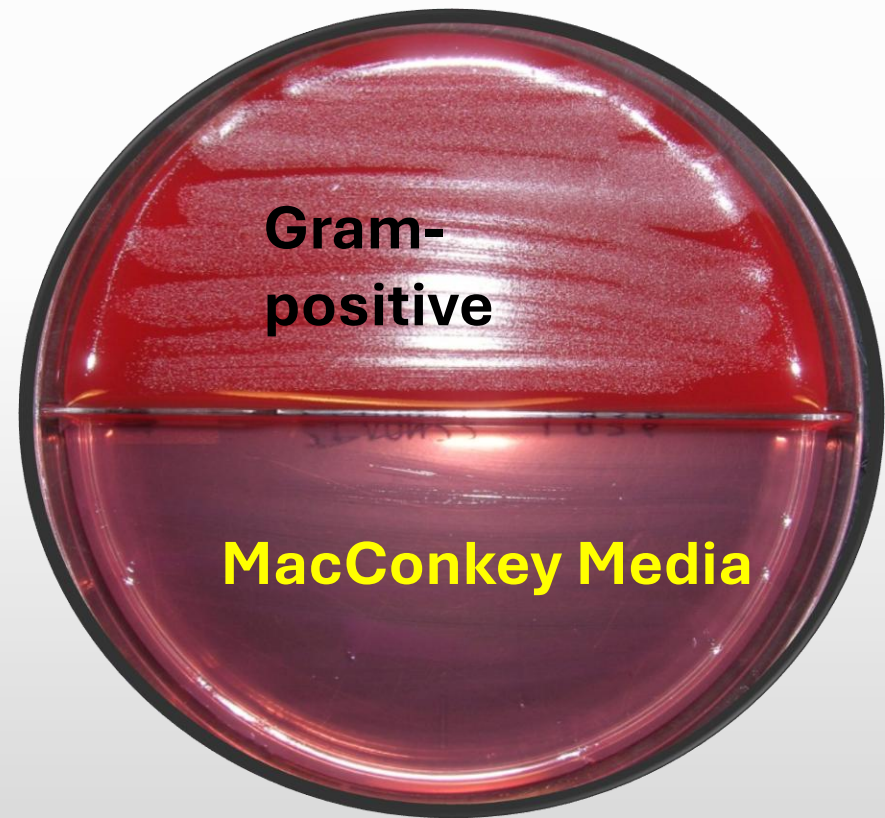


Bi-Plate Sample Mastitis Protocol (from DVM)

Based on Milk Culture Results: Contagious, Environmental, and Other Pathogens

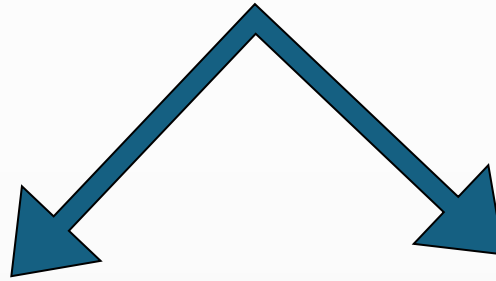


Bi-Plates

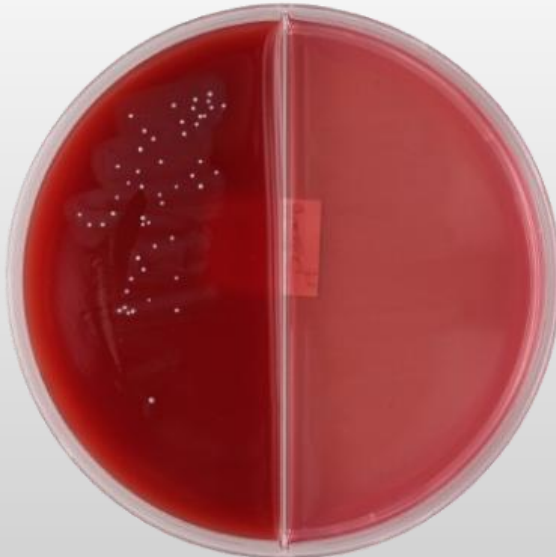


What question are you trying to answer?

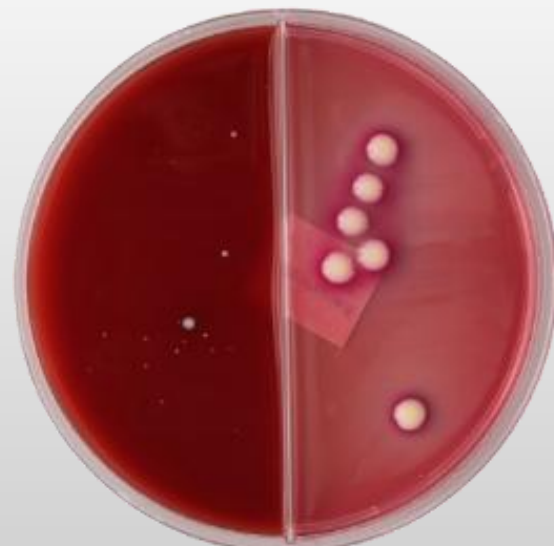
What do I do with this case of mastitis?



Treat Gram-positives

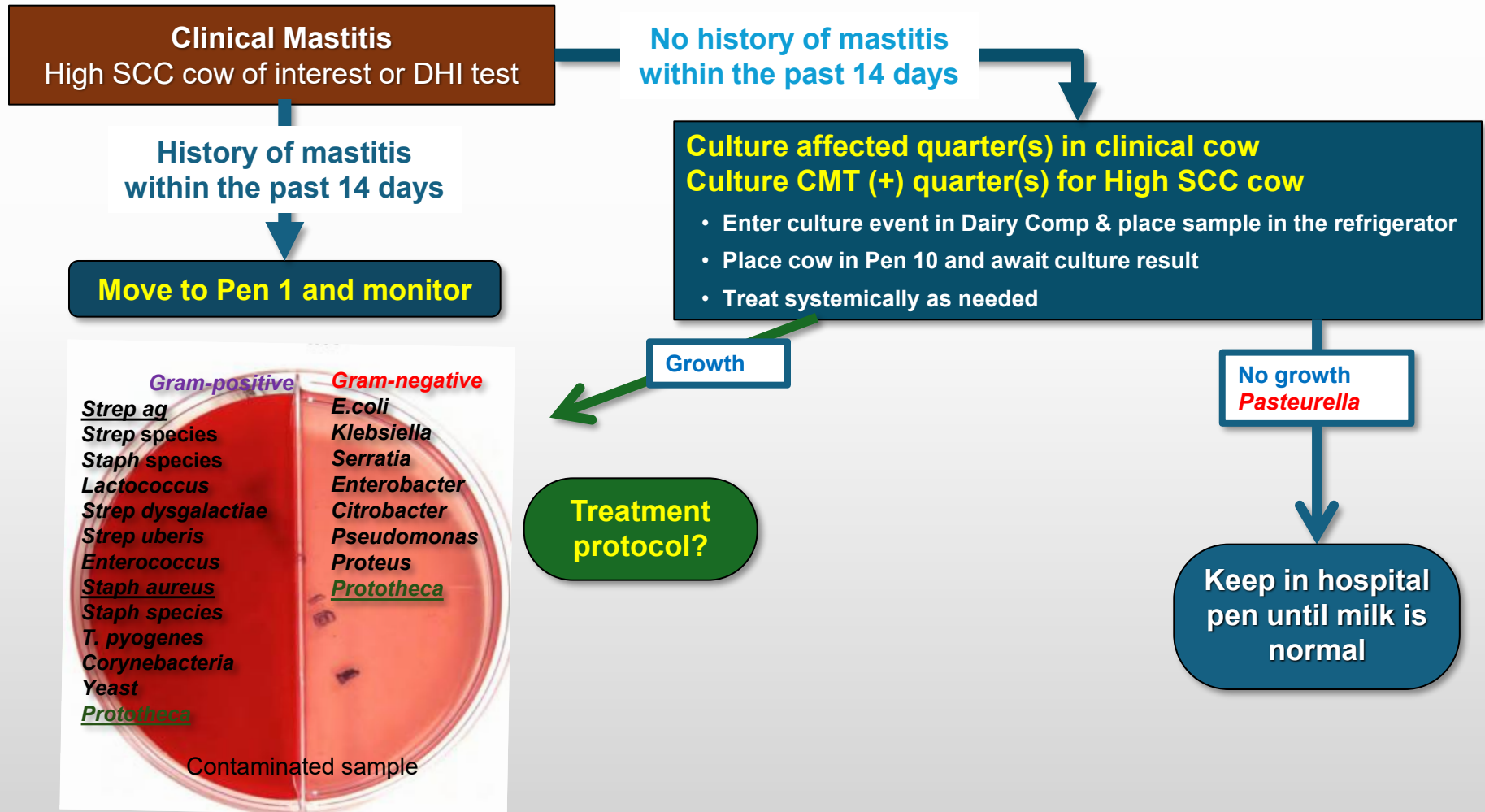


No treat Gram-negatives

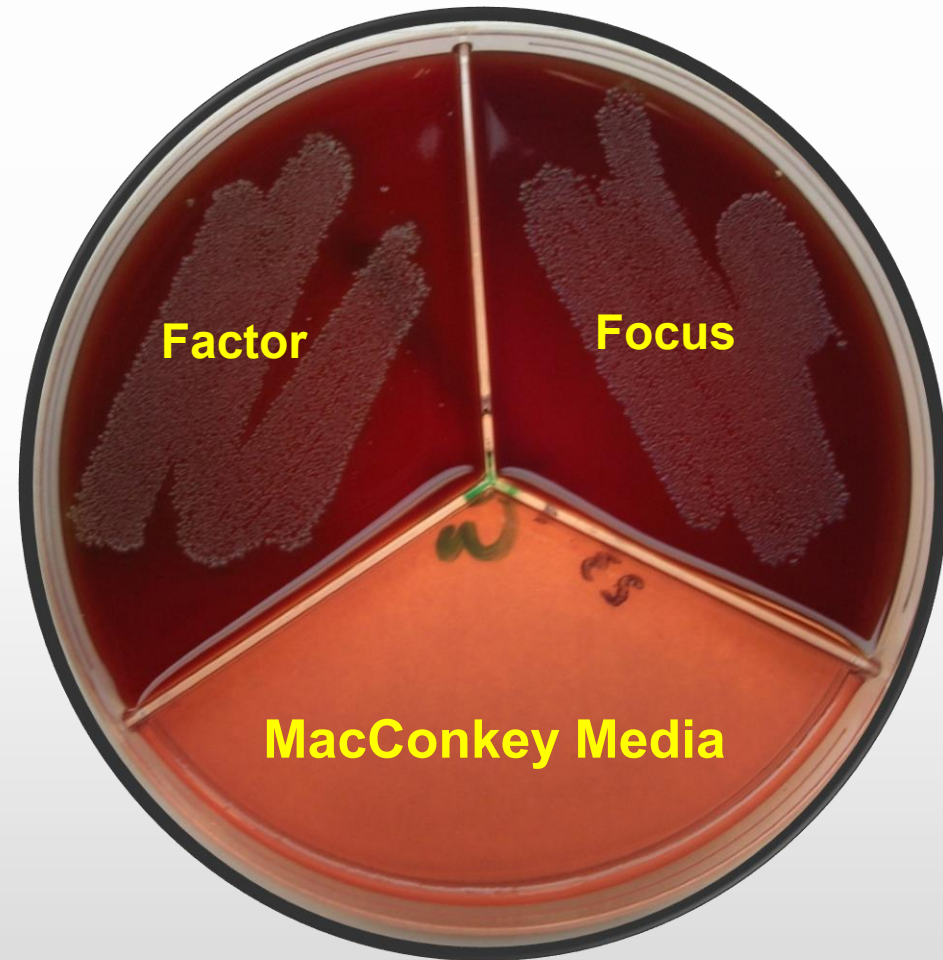
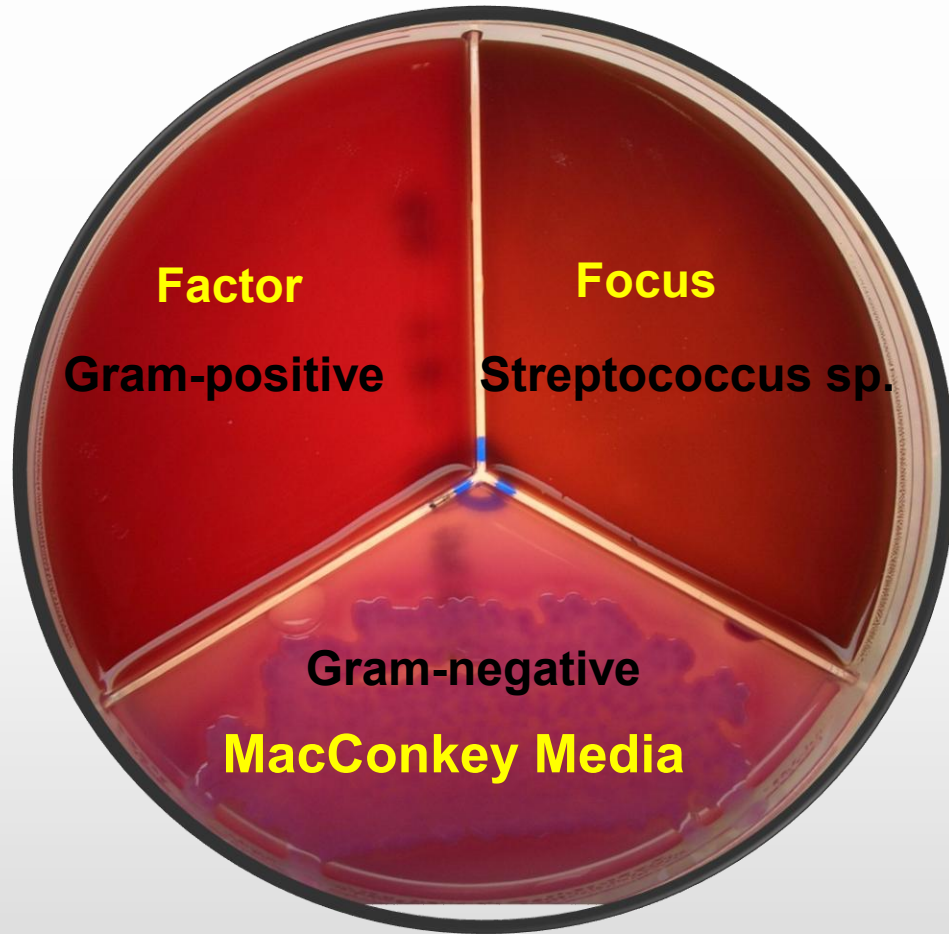


Bi-Plate Sample Mastitis Protocol (from DVM)

Based on Milk Culture Results: Contagious, Environmental, and Other Pathogens

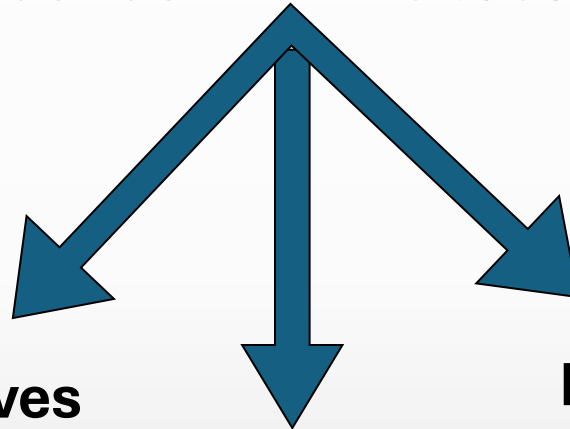


Tri- plates



What question are you trying to answer?

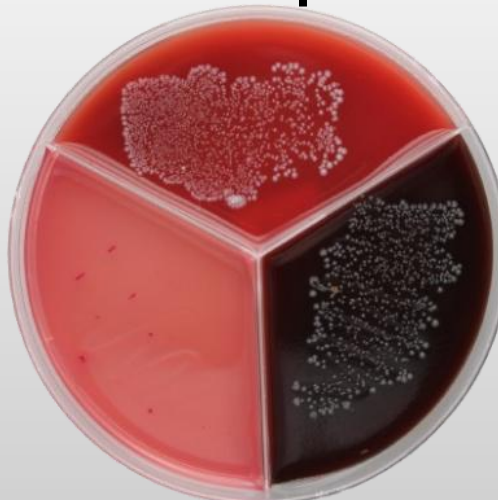
What do I do with this case of mastitis?



Treat some Gram-positives

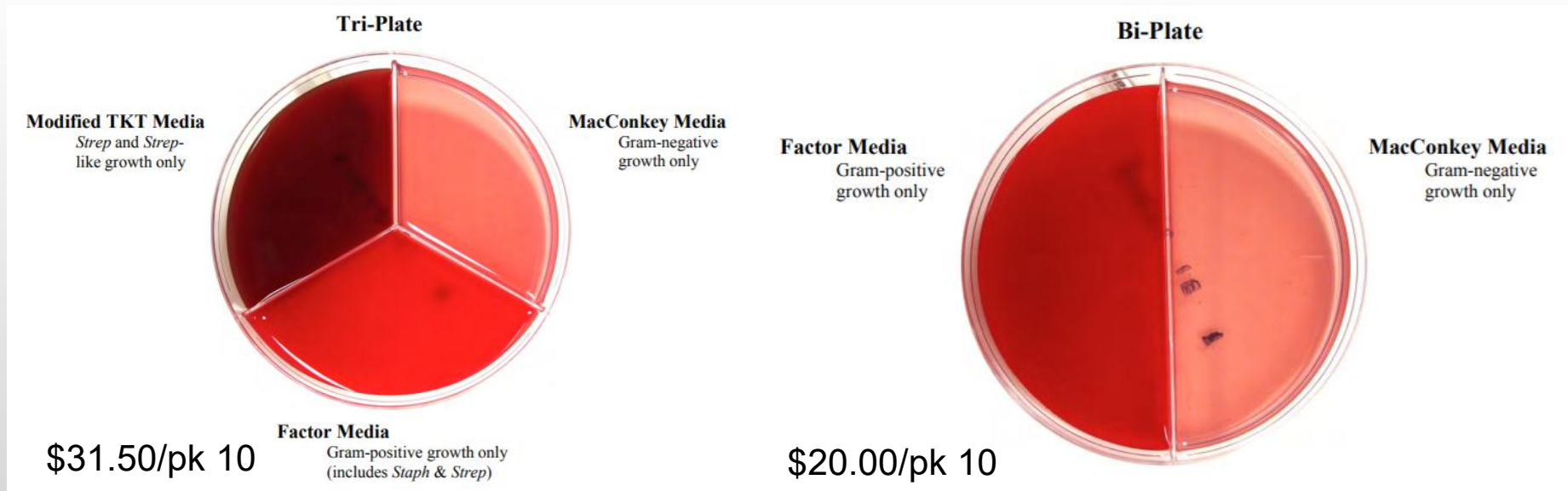
No treat Gram-negatives

Treat Streptococci



On-farm Milk Culture

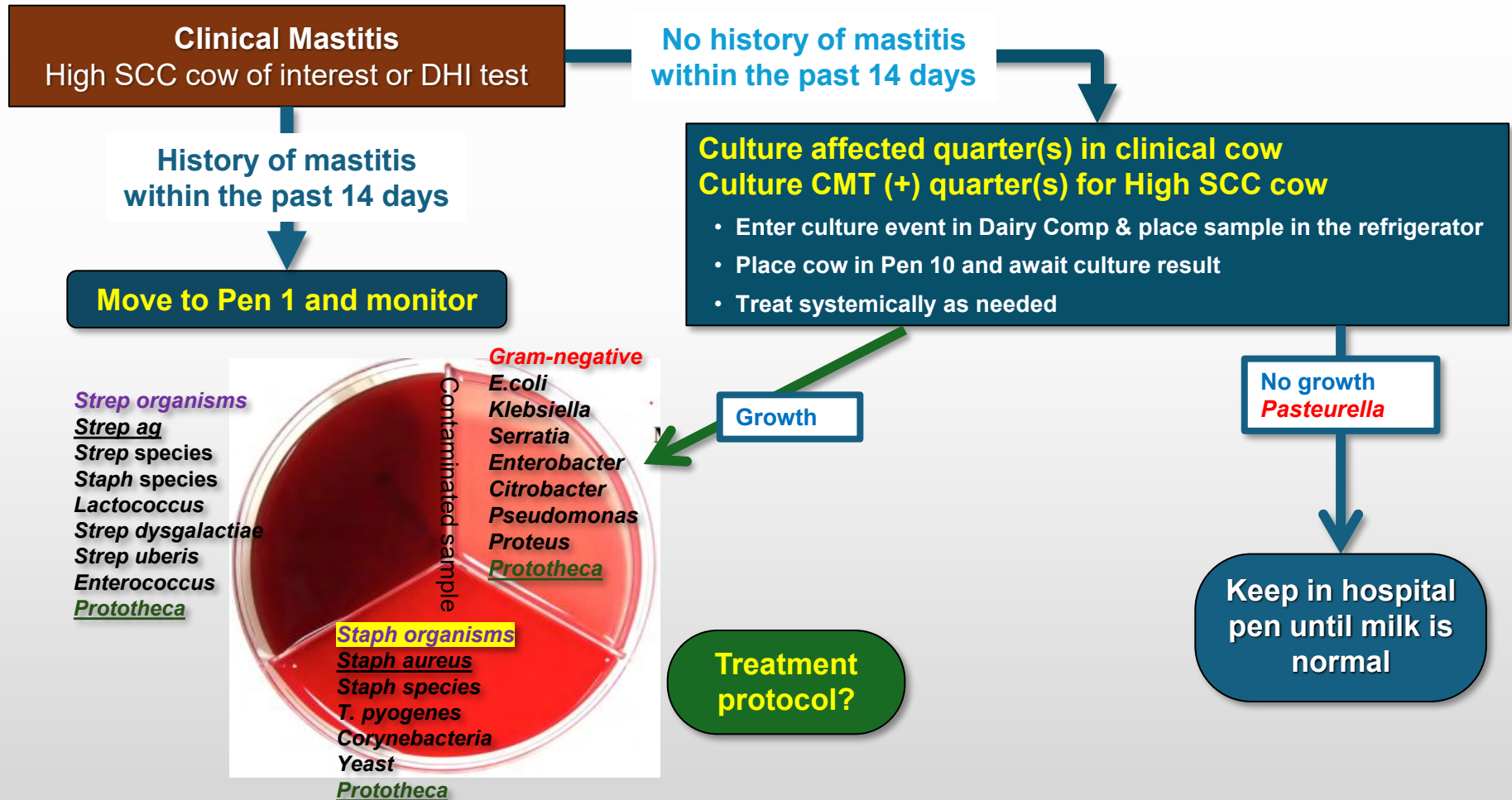
- Timely decision-making for treatment or not
- 24 hour results catered to treatment protocols
 - No growth/growth
 - Gram+/-
 - 78% PPV, 96% NPV (McCarron *et al*)
 - Streps, Staph, Staph aureus +/-



~\$2.00-\$4.00 + labor + supplies + equipment + training

Tri-plate Sample Mastitis Protocol (from DVM)

Based on Milk Culture Results: Contagious, Environmental, and Other Pathogens

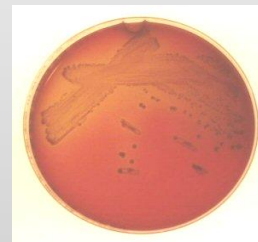


Culture Interpretation Pathogens at 24 hours

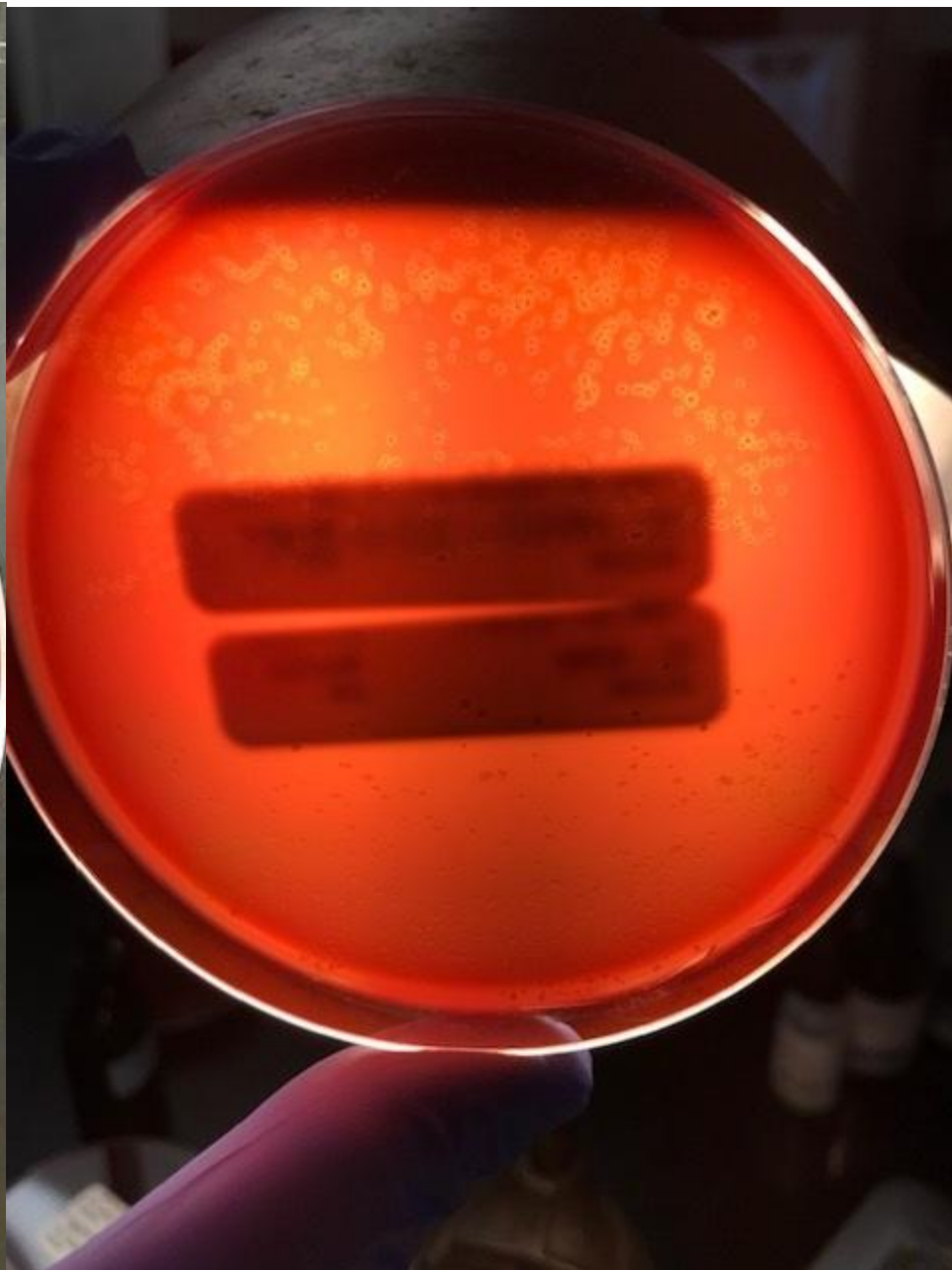
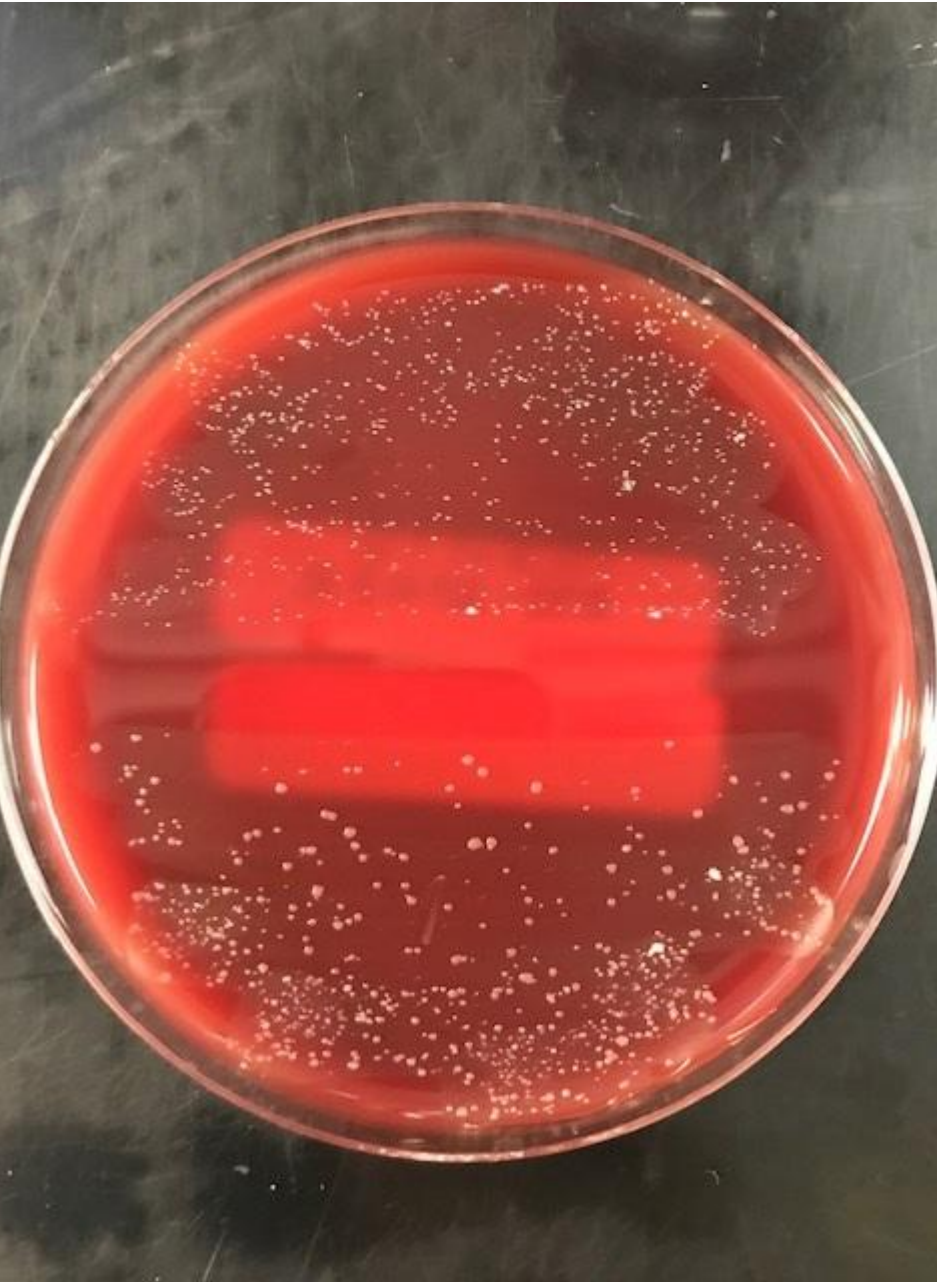
**Observation of colonial characteristics
after 18-24h of incubation**



- Hemolysis type
- Colony appearance (size, color, texture)
- Odor



Culture Interpretation pathogens



On-Farm Culture Training Module

New York Farm Viability Institute

English:



<https://bit.ly/m/OnFarmCulturing>

Spanish:



<https://bit.ly/m/CultivosEnGranjas>

On Farm Culturing



Introduction

Setting up

Storage

Collecting a clean milk sample

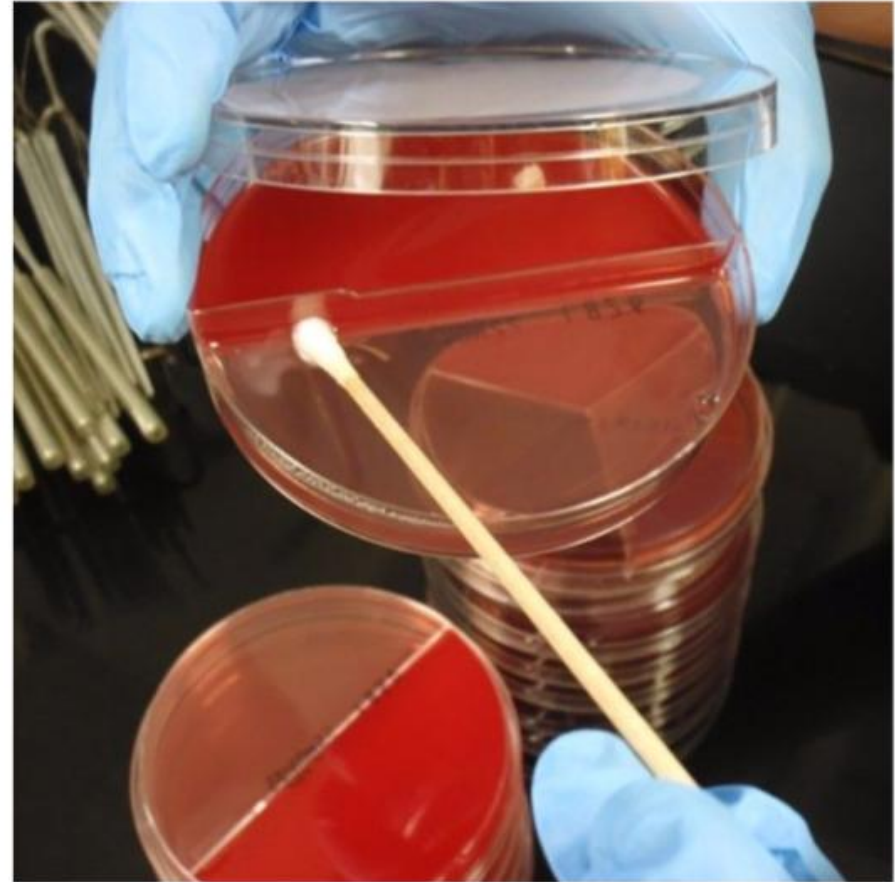
Plating procedure

Management decision: Biplate

Management decision: Triplate

Mastatest

Plating



Prevent contamination by using the top to protect the plate and minimize breathing on the plate

On Farm Culturing



Introduction



Setting up



Storage



Collecting a clean milk sample



Plating procedure



Management decision: Biplate



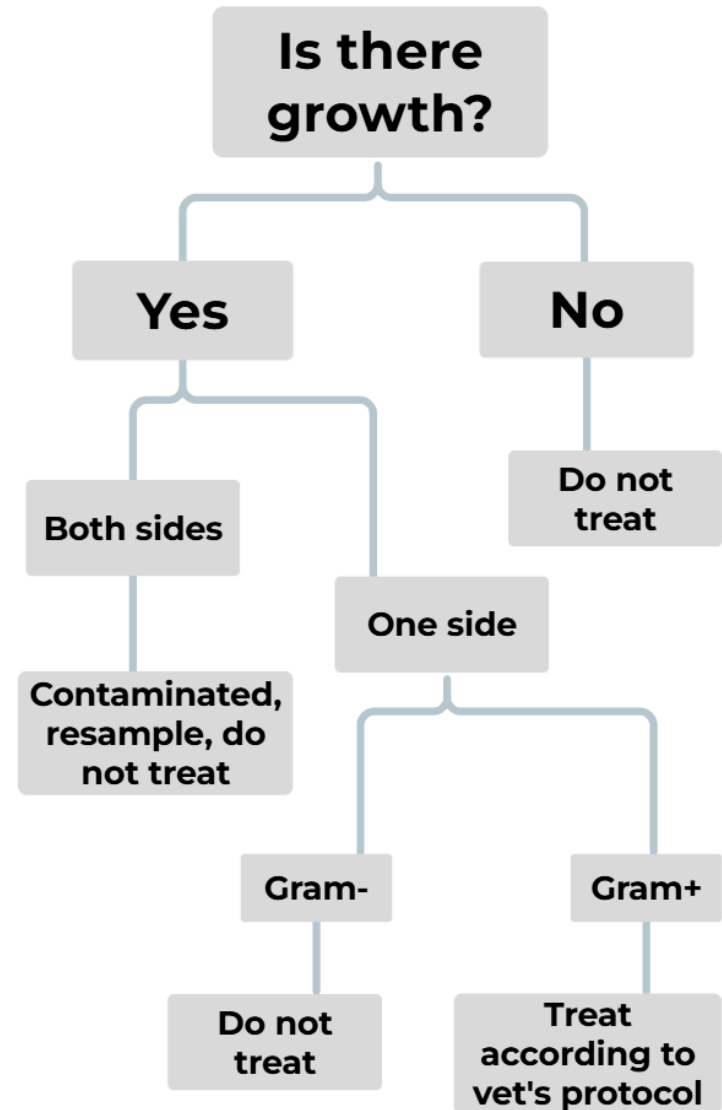
Management decision: Triplate



Mastatest



Flowchart



QUALITY MILK

On Farm Culturing



Introduction



Setting up



Storage



Collecting a clean milk sample



Plating procedure



Management decision: Biplate



Management decision: Triplate



Mastatest



Cornell

Remove Excess Milk

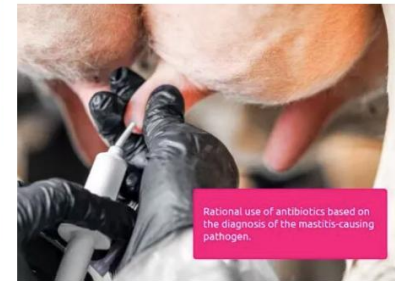


Remove excess milk
sitting on top of the wells.

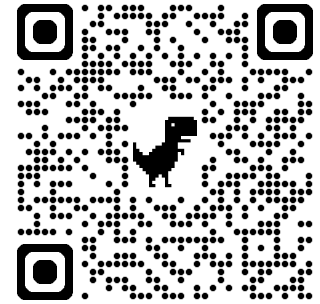
Other Mastitis Detection Systems



Starter Package - AccuMast & AccuStaph
\$700.00



Mastatest



<https://www.mastatest.com/>

Test ID	Test start	Animal ID	Quarter	Bacteria c	Benzylpen	Cloxacillin	Ceftiofur	Cephapirin	Reference	Treatment	Comment	Client nam	Account n	Product	Lapbox ID
334923	16-07-202	6	FL	E. coli / Unspecified Gram-								German G	Granados	MAST1	10012.4
334922	16-07-202	6	n/a	E. coli / Unspecified Gram-								German G	Granados	MAST1	10012.4
334919	16-07-202	34	n/a	Strep. species			1 >4.0	<=0.06				German G	Granados	USP2	10012.3
334918	16-07-202	1682	FL	Strep. species								German G	Granados	MAST1	10012.2
334917	16-07-202	1682	n/a	Strep. species								German G	Granados	MAST1	10012.2
334916	16-07-202	1896	RR	CNS			4	1	0.25			German G	Granados	USP2	2239.4
334915	16-07-202	5 Derek &	n/a	E. coli / Unspecified G	>4.0		0.5	>4.0				German G	Granados	USP2	2239.3
334913	16-07-202	4	n/a	Other Gram+								German G	Granados	MAST1	2239.2
334912	16-07-202	34	n/a	E. coli / Unspecified Gram-, Strep. species								German G	Granados	MAST1	2239.2
334911	16-07-202	1904	RR	No bacteria detected	N/A		N/A	N/A				German G	Granados	USP2	10012.1
334907	16-07-202	5	n/a	No bacteria detected	N/A		N/A	N/A				German G	Granados	USP2	2239.1

<https://www.mastatest.com/how-mastatest-works>

AccuMast

<https://feraah.com/>

<https://www.youtube.com/watch?v=nwDU163CNAg>



CnFarm



Udder Health

Calf Health

You've already saved

\$660,00



ID - 211722294823 | Cornell University

Quick Releases



Launch Culture



Read Results



Charts



Reports



Synchronize



OnFarmers
Community



Tank TBC Analysis



Cow Record



Diagnostic res

#211722294823 - Cornell

Creation mzurakow... Updat



Result **Positive**

Agents: **Enterococcus spp**

SAVE DIAGNOSIS



Cow

reserved.

tion

São Paulo,

Acknowledgements

- New York Farm Viability Institute
- Mastatest-Olaf Bork
- Fera Animal Health
- FutureCow SmartLab-Shaun Hardtke
- Dr. Wolfgang Heuwieser
- Dr. Paul Virkler
- Dr. Daryl Nydam
- Dr. Anay Ravelo
- Ms. Katie Keller
- Mrs. Chelsea Koelbl
- Mrs. Deb Pawloski



Questions?



Tie stall carts of New York

Mike Zurakowski, DVM
Quality Milk Production Services
Eastern Laboratory
Cobleskill, New York
MJZ6@Cornell.edu



How long is long enough? Longevity and extended lactations

Stephen LeBlanc



**In 2004, a young(ish) professor was invited
to give a talk:**

**Reproduction and
its impact on cow survival
and replacement**

Stephen LeBlanc

ADSA Discover conference

October 4, 2004

Nashville, IN

GET
PREGNANT
OR
DIE

The major
reproductive
disease of dairy
cattle is semen
deficiency

In 2023...

- That same professor, embracing his own longevity, was invited to give another talk:

Health aspects of survival of dairy COWS

*ADSA Discover Conference on Food
Animal Agriculture:*



**Dairy Cattle Lifespan: New
Perspectives**

October 23-26, 2023

**Disease
kills.**



**Disease kills
(sometimes).
It depends...
on milk and
pregnancy**

How should we measure reproductive performance?

- The key outcome is pregnant cows
- We wish to measure the efficiency of making open cows pregnant
- Pregnancy rate is the best single measure of current herd performance
- Conception risk only tells part of the story
- Most traditional measures (calving interval, herd average days open, services per conception) do not accurately measure performance

Is there something wrong with our cows or our management?

- High metabolic rate is associated with lower circulating progesterone & estrogen, and decreased expression of heat

(Sangsritavong et al, 2002; Lopez et al , 2004)

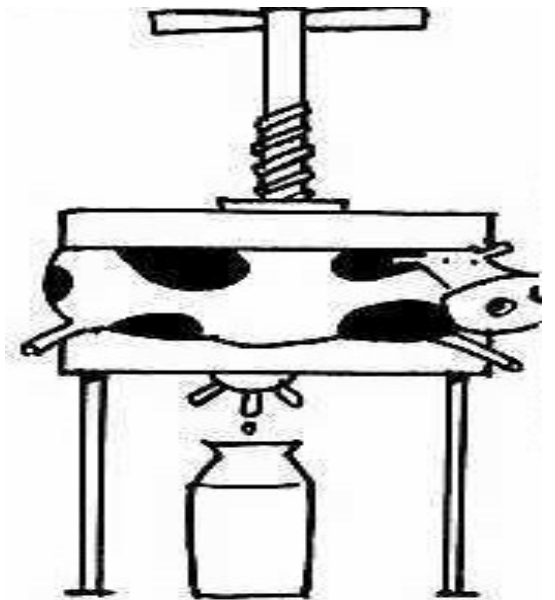
- Severity and duration of negative energy balance are associated with delayed ovulation

(Butler & Smith 1989; Butler, 2003)

- BUT – should we feed cows less, or only breed low producers?

Is “high” production a problem?

- Biology vs. management effects
- Measured at the herd or cow level?
- High producing cows will be bred more times and for longer than low producing cows
- Low producing cows will be given fewer chances before being culled
- Therefore, high producing cows may have longer intervals to pregnancy



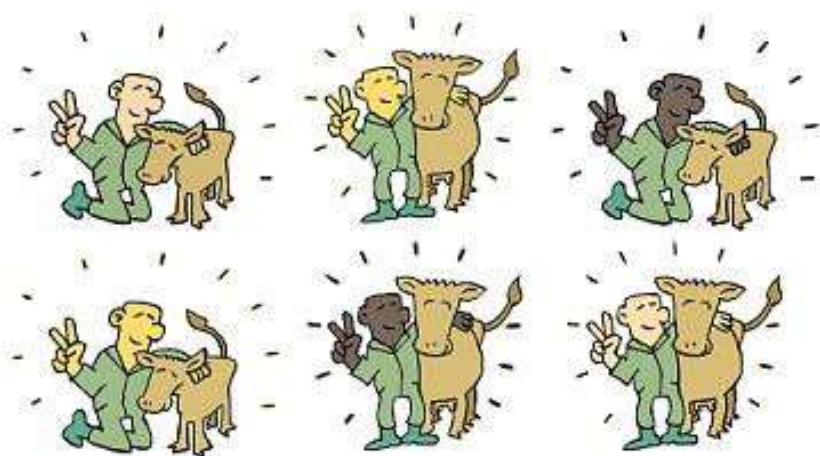
Framing the question

- **Fertility** = the biological capacity for reproductive function
 - Cyclicity (ovulation)
 - Expression of estrus
 - Fertilization
 - Pregnancy maintenance
- **Reproductive performance** = probability, timing, and efficiency of pregnancy
 - Estrus detection
 - Management program compliance
 - AI technique
- **Prior health interacts with both**

Is this the goal?

Two more lactations, everywhere!

CowSIGNALS[®]
TRAINING COMPANY



LONGEVITY
annual herd 3rd+ lactations:
100 points



Longevity is calculated through the annual average percentage of cows in the herd on test day that are in their third or greater lactation. It is a measure of good management in regards to cow comfort, herd health, productive life, and a 'problem free' herd.

Increased **longevity** allows for higher production, decreased animal replacement costs, and excess animals to sell as replacements.

What is the goal?

- “Breaking” cows is bad because it diminishes
 - Welfare
 - Social license
 - Realizing economic potential
- Quality vs quantity of life
- Environmental impact/GHG footprint
 - Per cow
 - Per hectare
 - Per calorie
 - Per kg of protein or essential AA

Is this the right perspective on cow longevity?

“A shortened cow lifespan is recognized as evidence of reduced animal welfare. The natural lifespan of dairy cattle is approximately 20 years. Analysis by DeVries indicates that the economically optimal lifespan should be about 7 years of age, but currently in the US it is about 5 years of age. Few people would be satisfied to live in a society where the life expectancy was only slightly past puberty. As such, this shortened lifespan would appear to violate the last of the Farm Animal Welfare Committee’s 5 freedoms, which is to have the freedom to express normal behaviors.”

Bartlett JAVMA 2025

Career enders

- Non-pregnancy
- Low milk
- Chronic mastitis/high SCC
- Chronic lameness

Premises

- Culling is an economic decision*. Sell a cow when her net present value is $<$ an available replacement animal
 - * Or a decision to override economic rationale
- Poor health will reduce productive lifespan, but longevity is a poor measure of health or welfare
- Ethics and social license require quality of life for cows, not quantity
- 'Metabolic athletes' live demanding, not distressed lives

*Do you have ≥ 40 kg of milk per
cow tank average?*

*Do you have ≥ 40 kg of milk per
cow tank average and consistently
< 20% annual culling?*

Do you have ≥ 40 kg tank average and consistently 20% annual culling?

If not, is it because

- a) high production is the result of “pushing” cows with the collateral damage of “breaking” cows

Do you have ≥ 40 kg tank average and consistently 20% annual culling?

If not, is it because

- a) high production is the result of “pushing” cows with the collateral damage of “breaking” cows
- b) A supply of (on average) genetically superior heifers increases selection pressure for production and health

Do you have any below-average cows in your herd?

- Are there cows in the herd now that you be better-off without?
 - Chronic lameness
 - Repeated mastitis
 - High SCC
 - Open > 150 d

2023 to ... ? plot twist

Change in US dairy herd and related factors			
Year	Milk cows	Replacement helpers	Dairy cows culled
% change during year			
2021	-0.7	-2.7	2.1
2022	0.3	-2.4	0.0
2023	-0.5	-6.4	-0.8
2024	0.3	-3.5	-11.9
2025	2.0	-0.1	-3.0

Hoard's April 2026

- > \$1500+ beef-on-dairy calves
- → substantial reduction in supply of dairy replacements
 - → retention of cows
 - → increasing average age of lactating cows

So...

Keeping cows for longer

a) Is evidence of improving health and welfare?

b) Will increase profits by increasing lifetime production per cow?

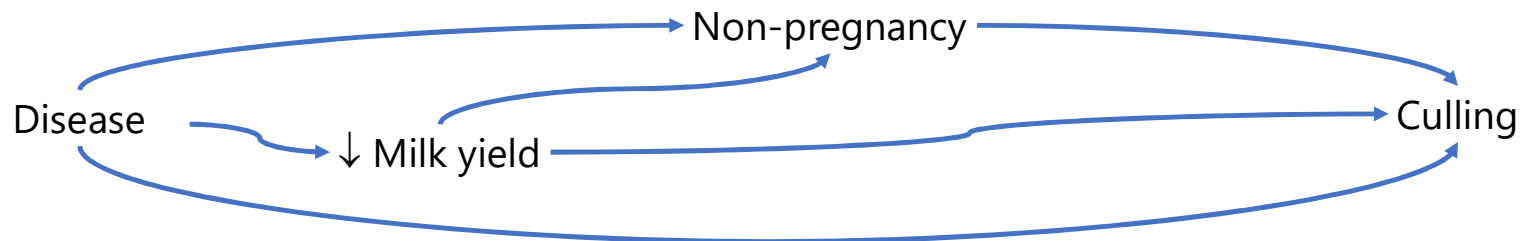
c) Means more heifers will "pay for themselves"?

The relationship of health with survival is complex

Disease → Death

Disease → ↓ Milk yield → Culling

Disease → Non-pregnancy → Culling



Transition health problems are common But healthy cows have good fertility

Table 2. Impact of health problems in the first 60 d postpartum on pregnancy at first postpartum AI of dairy cows¹

Health status	Prevalence	Pregnant, %	Adjusted OR (95% CI) ²	P
Health problem				
Healthy	56	51.4	1.00	
1 case of disease	27	43.3	0.79 (0.69 – 0.91)	0.001
> 1 case of disease	17	34.7	0.57 (0.48 – 0.69)	< 0.001
Type of health problem ³				
Calving problem	15	40.3	0.75 (0.63 – 0.88)	< 0.001
Metritis	16	37.8	0.66 (0.56 – 0.78)	< 0.001
Clinical endometritis	20	38.7	0.62 (0.52 – 0.74)	< 0.001
Fever postpartum	21	39.8	0.60 (0.48 – 0.65)	< 0.001
Mastitis	12	39.4	0.84 (0.64 – 1.10)	0.20
Clinical ketosis	10	28.8	0.50 (0.36 – 0.68)	< 0.001
Lameness	7	33.3	0.57 (0.41 – 0.78)	< 0.001
Pneumonia	3	32.4	0.63 (0.32 – 1.27)	0.20
Digestive problem	2	36.7	0.78 (0.46 – 1.34)	0.38

5719 cows in 7
US herds

Transition health problems are common

Downloaded from <http://injuryprevention.bmj.com/> on March 24, 2015 - Published by group.bmj.com

Brief report

Economic burden of time lost due to injury in NHL hockey players

Laura Donaldson,^{1,2} Bing Li,³ Michael D Cusimano^{1,2}

► Additional material is published online only. To view please visit the journal online (<http://dx.doi.org/10.1136/injuryprev-2013-041016>).

¹Division of Neurosurgery and Injury Prevention Research Office, St. Michael's Hospital, University of Toronto, Toronto, Ontario, Canada

²Canadian Brain Injury and Violence Research Team, Toronto, Ontario, Canada

³Institute of Health Policy, Management and Evaluation, University of Toronto, Toronto, Ontario, Canada

ABSTRACT

Objective To determine the economic burden of salary costs lost due to injury in the National Hockey League (NHL).

Methods All NHL players who engaged in at least one regular season game during the 2009–2010 to 2011–2012 seasons comprised the study population. We performed a retrospective cross-sectional analysis of publically available media sources to collect injury and salary data. Outcome measurements were games missed during regular season play due to hockey-related injury and lost salary.

Results A total of 50.9% of all NHL players missed at least one game within a season of play, and injuries represented a total salary cost of approximately US\$218 million per year. Concussions alone amounted to a salary

Data collection

Data sources

Full rosters and the number of games participated in by each player were obtained from the NHL website (<http://www.nhl.com>). Injury data were obtained from [nhl.com](http://www.nhl.com), and official team injury reports. When more information was required, a variety of other publically available sources including The Sports Network (<http://www.tsn.com>), Yahoo Sports (<http://sports.yahoo.com>) and Rotoworld (<http://www.rotoworld.com>) were consulted. Annual player salaries (US\$) were obtained from <http://www.capgeek.com>.

The increasing popularity of fantasy sports has resulted in a huge demand for information on the

Simple associations of health with culling

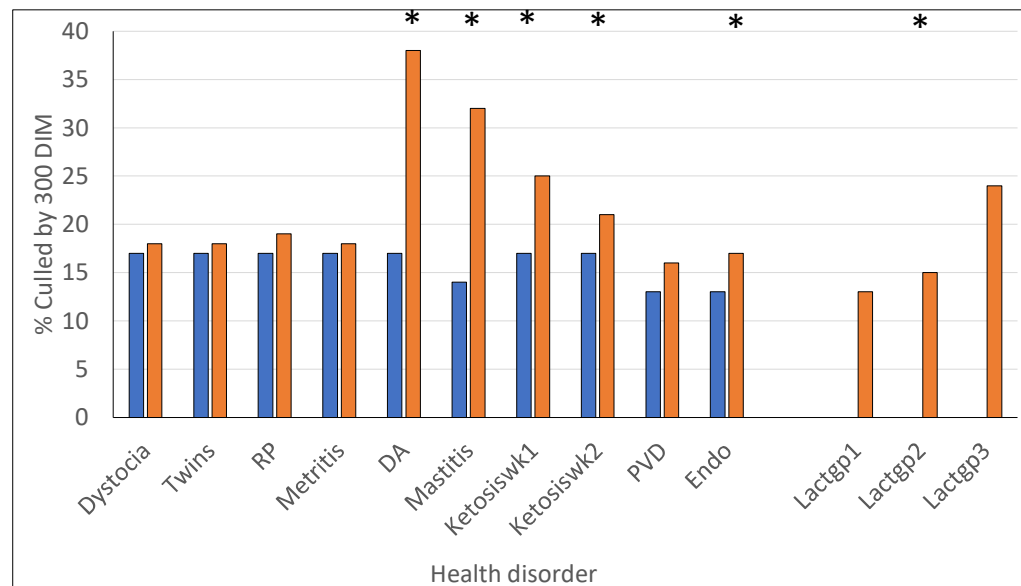
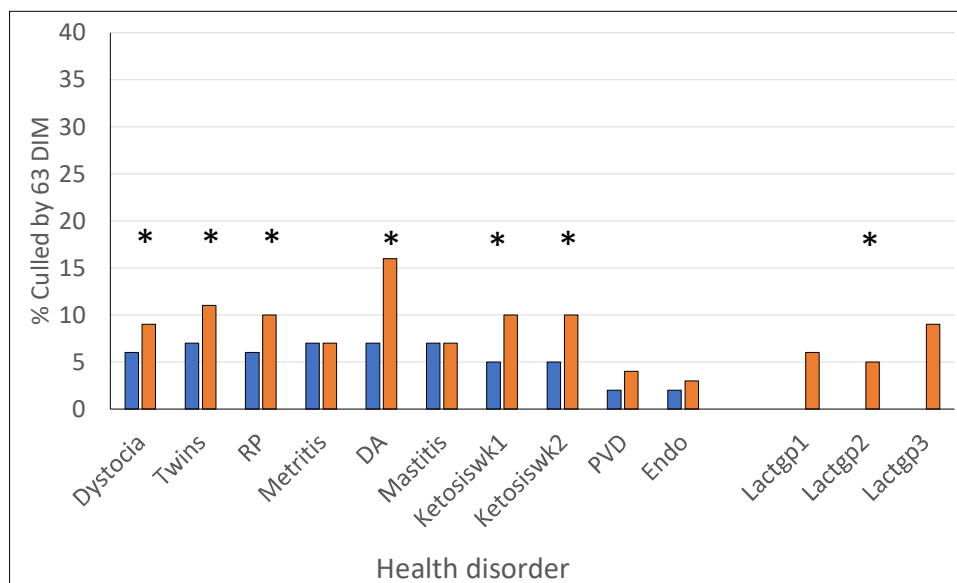


2070 cows from 6 herds in NY and Ontario

Clinical and metabolic data actively collected



No lameness data



Data from Dubuc et al JDS 2011

... but this changes when controlling for other variables

Multivariable model Culled by 63 DIM

Variable	LSM Risk		P
	No	Yes	
DA	3%	8%	0.02
Ketosis wk2	4%	7%	0.06
Milk TD1	-7% lower odds per 1 kg > mean (37 kg)		<0.01
SCC TD1	-1% lower odds per 100 > mean (281)		<0.01

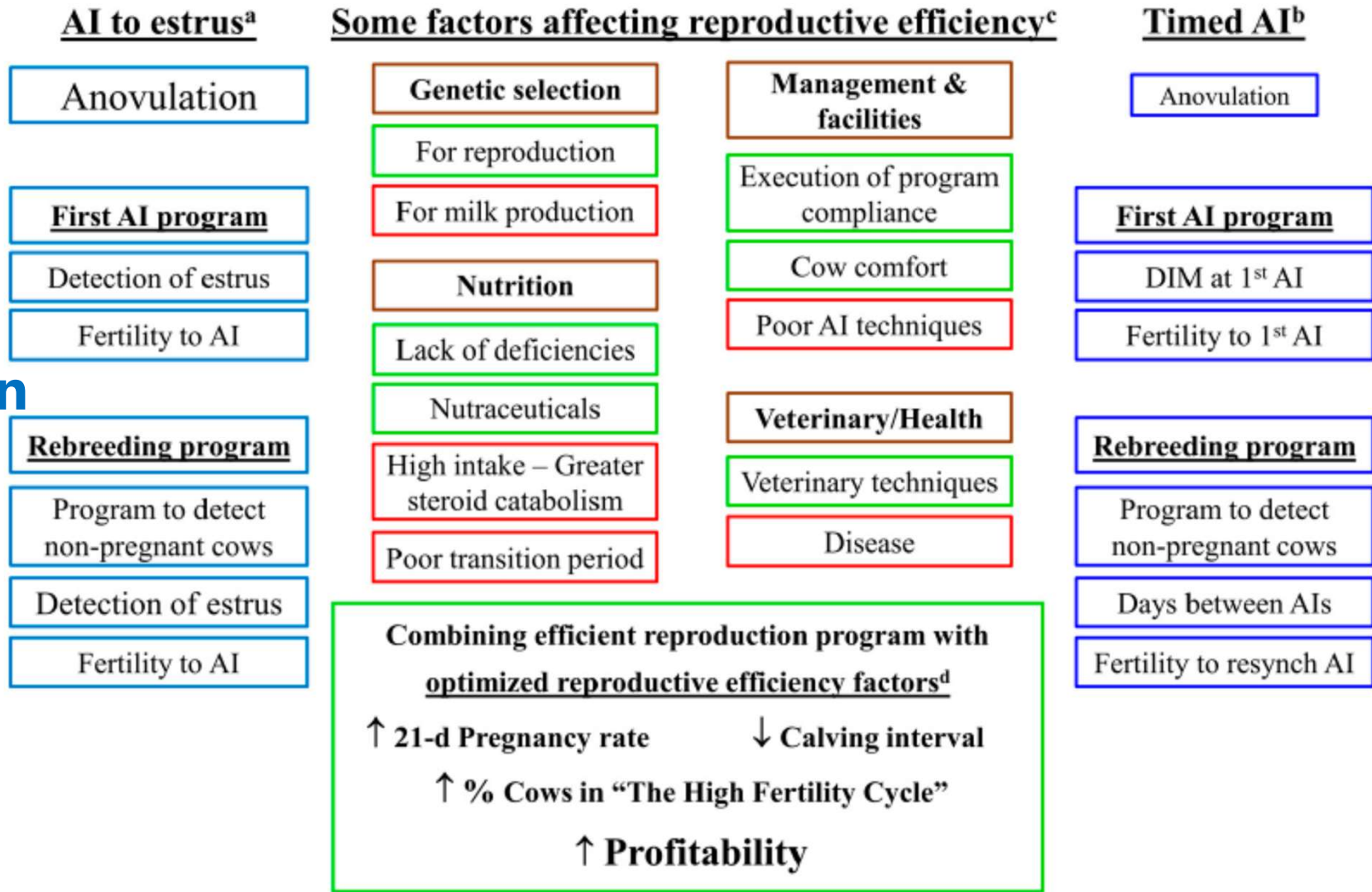
Not different by parity

Multivariable model Culled by 300 DIM

Variable	LSM risk		P
	No	Yes	
DA	10%	40%	<0.01
Mastitis	14%	31%	<0.01
305 projected milk TD 3	-36% lower odds per 1000 kg > mean (11,800 kg)		<0.01
Pregnant	63%	4%	<0.01
Lact1	13%		<0.01
Lactgp2	26%		
Lactgp3	28%		

Data from Dubuc et al JDS 2011

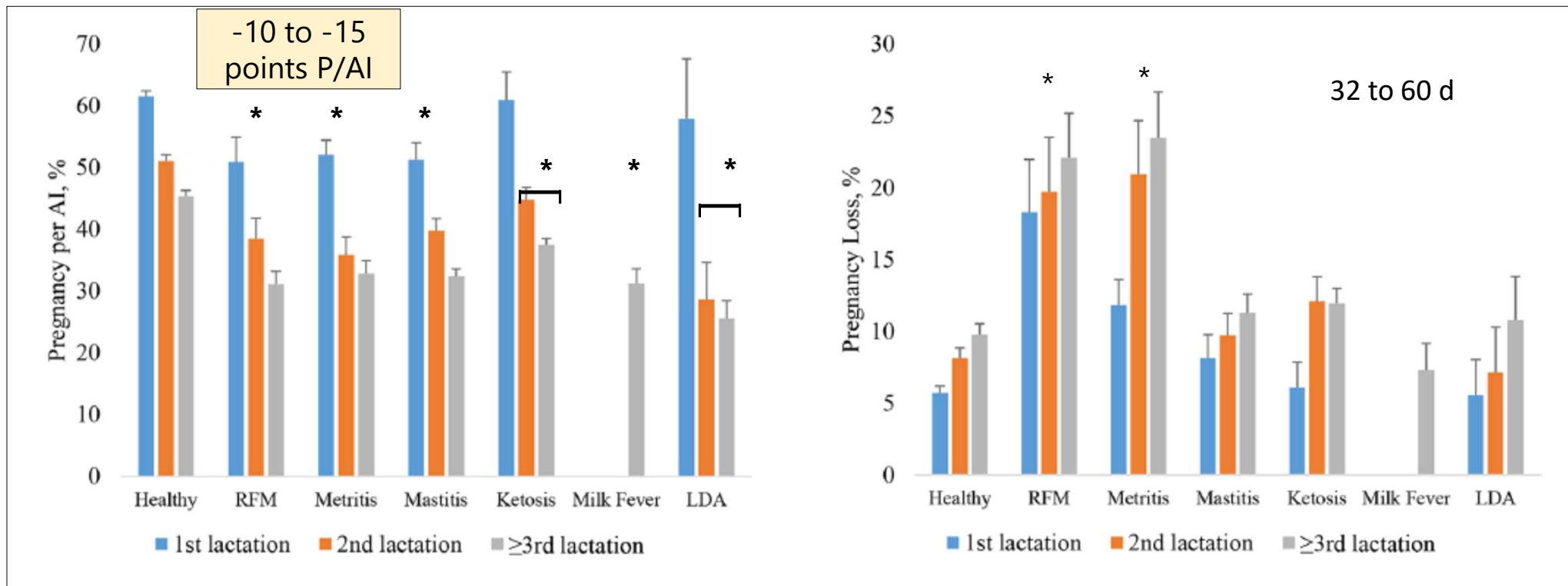
Health is critical no matter how reproduction is managed



Consentini et al Animals 2021
doi.org/10.3390/ani11020301

Transition health affects fertility even with Double Ovsynch

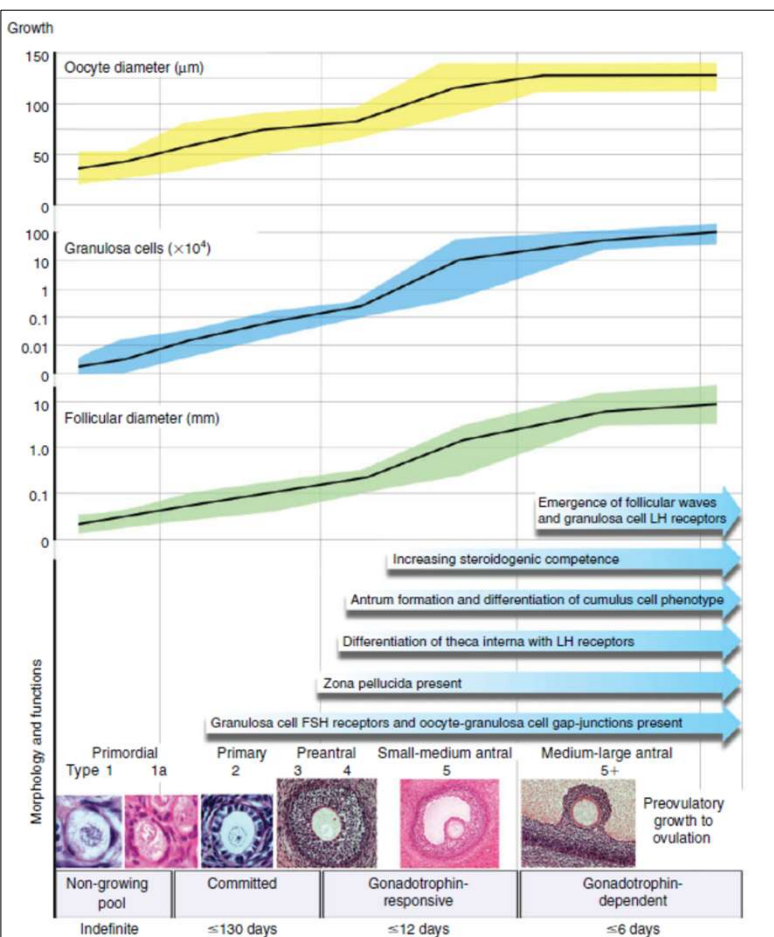
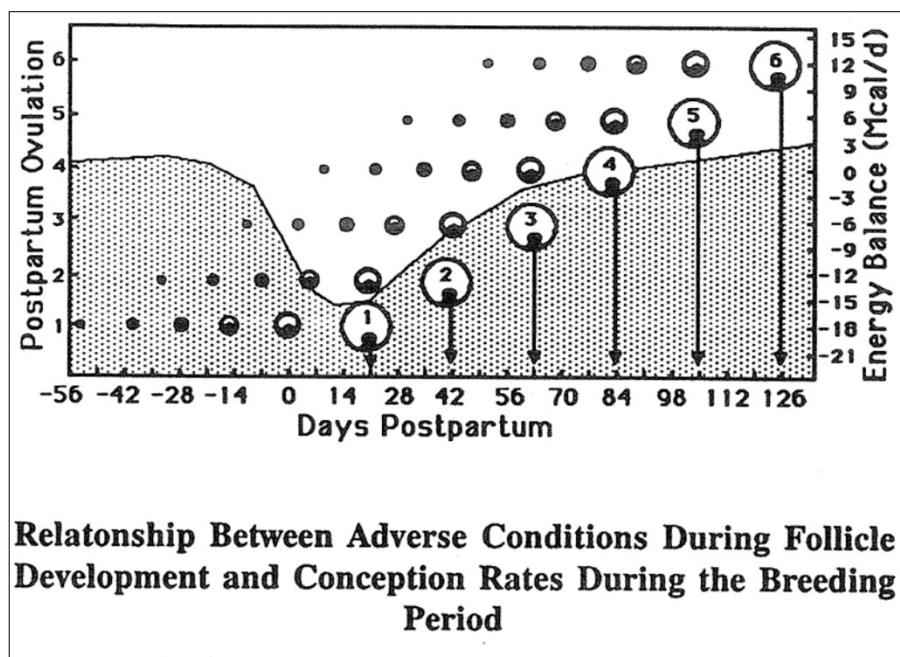
7 y of data from 1 herd in Germany; 15,040 cows; all Double Ovsynch for 1st AI ~ 72 DIM



Frenkel et al JDSC 2024

Follicular development occurs over 2 to > 4 months

Britt hypothesis (1992)

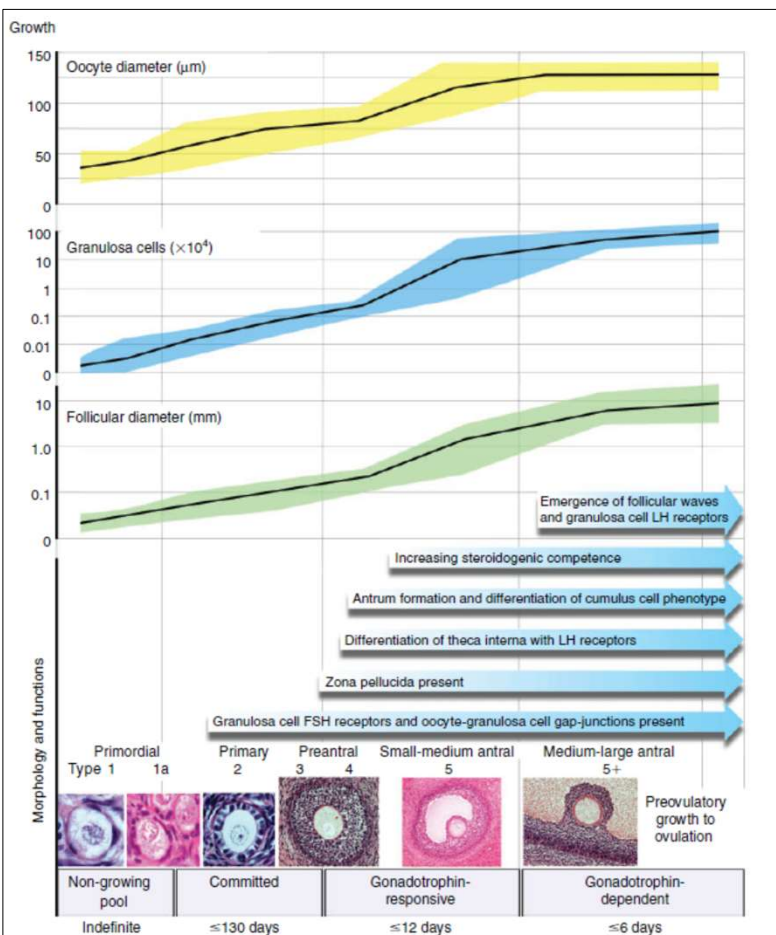


Ewe model - Scaramuzzi et al RFD 2011

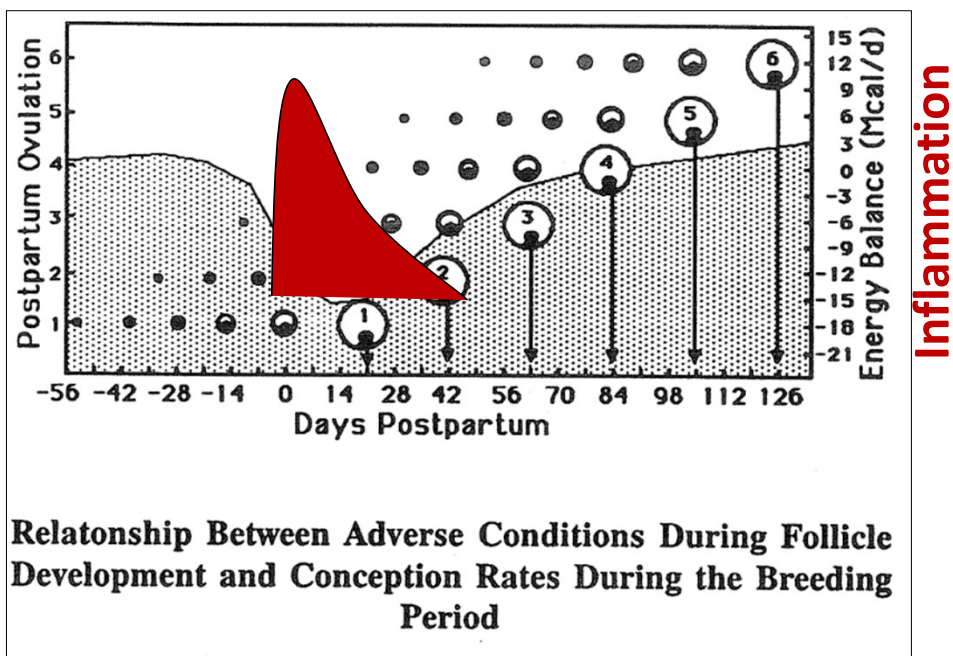
Follicular development occurs over 2 to > 4 months

Britt hypothesis (1992)

LeBlanc hypothesis (2024) 😊



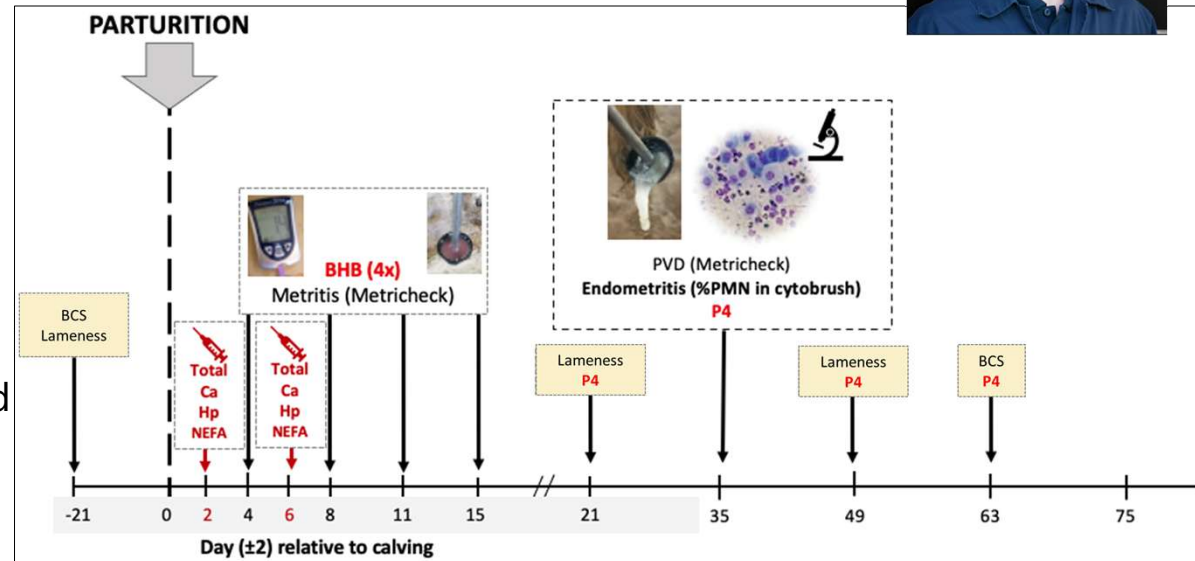
Ewe model - Scaramuzzi et al RFD 2011



Transition health and estrus detection



- Prospective observational study in 2 commercial dairy herds in Ontario, Canada (~450 lactating cows each) from May 2019 to April 2021
- Prepartum Holstein cows (n = 1,357) were enrolled and examined
- 1st AI primarily based on detection of estrus** by AAM from 50 to 75 d, or timed AI thereafter

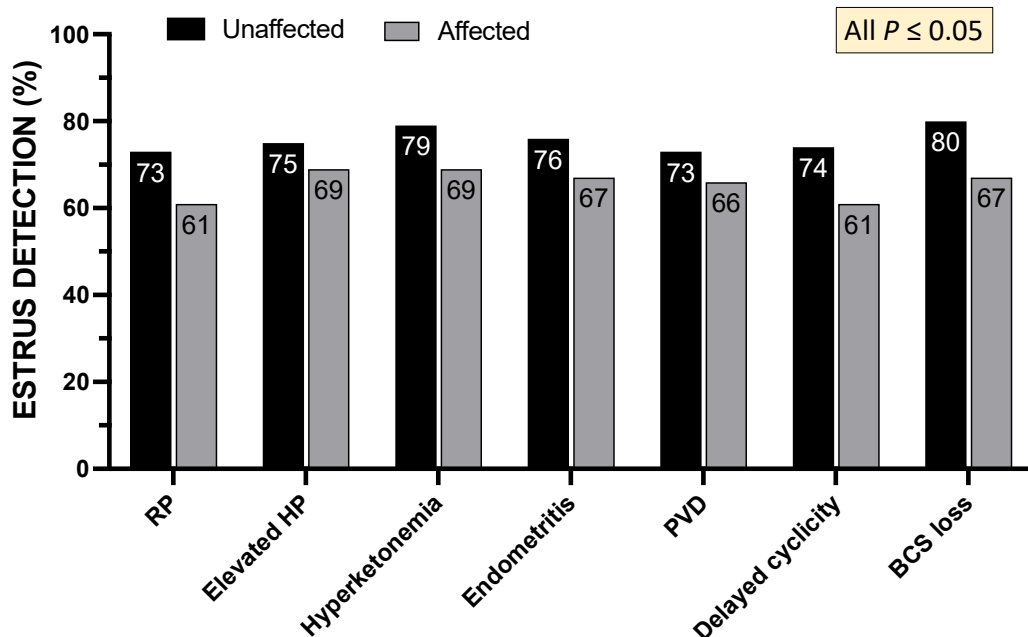


Prevalence of risk factors			
Retained placenta (RP)	10%	Lameness (49 d)	14%
Haptoglobin at d6 (≥ 0.5 g/L)	48%	Acyclic by 49 d	15%
Hyperketonemia (≥ 0.7 mM)	50-55%	BCS Loss (≥ 0.50 point by 63 d)	53%
Endometritis ($\geq 2.4\%$ PMN)	44%	One clinical disease	29%
Purulent vaginal discharge (PVD)	21%	Multiple clinical diseases	18%

Bruinje
et al JDS
2024

Transition health associations with estrus and pregnancy at 1st AI

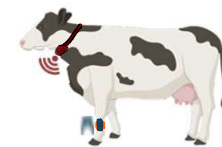
70% of cows detected in estrus by 75 DIM



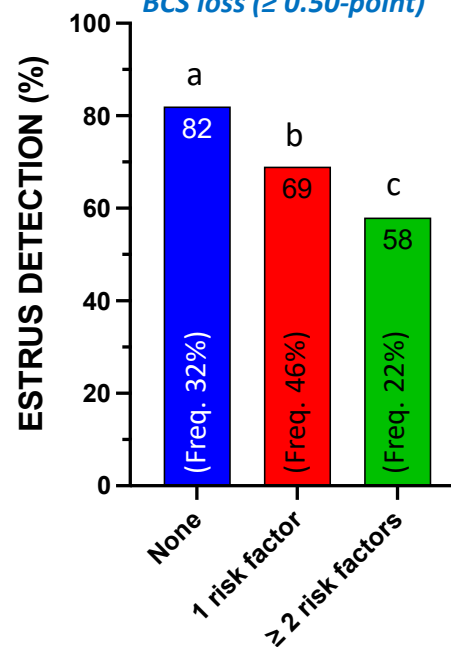
- Elevated haptoglobin (HP): ≥ 0.5 g/L at $6 (\pm 2)$ DIM
- Hyperketonemia: ≥ 2 samples of BHB ≥ 0.9 mM (4 DIM) or ≥ 0.7 mM (8, 11, or 15 DIM)
- Endometritis: $\geq 2.4\%$ PMN at $35 (\pm 3)$ DIM
- Delayed cyclicity: Acyclic by $49 (\pm 3)$ DIM
- BCS loss: ≥ 0.50 -point loss from 3 wk prepartum to 9 wk postpartum vs. no loss

ONLY RISK FACTORS
DIAGNOSED ON FARM

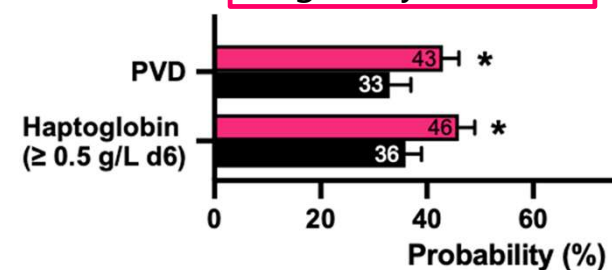
RP, PVD, lameness
BCS loss (≥ 0.50 -point)



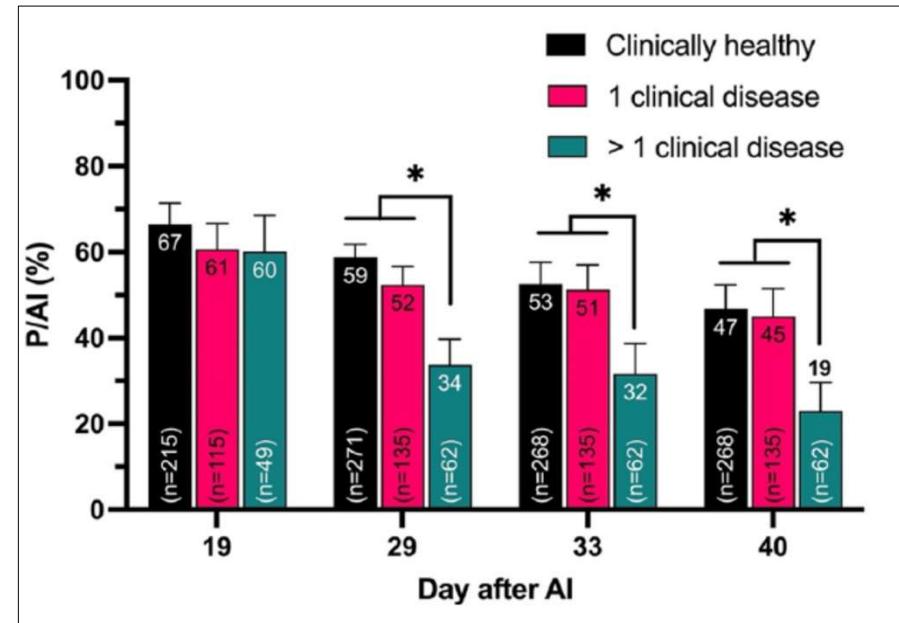
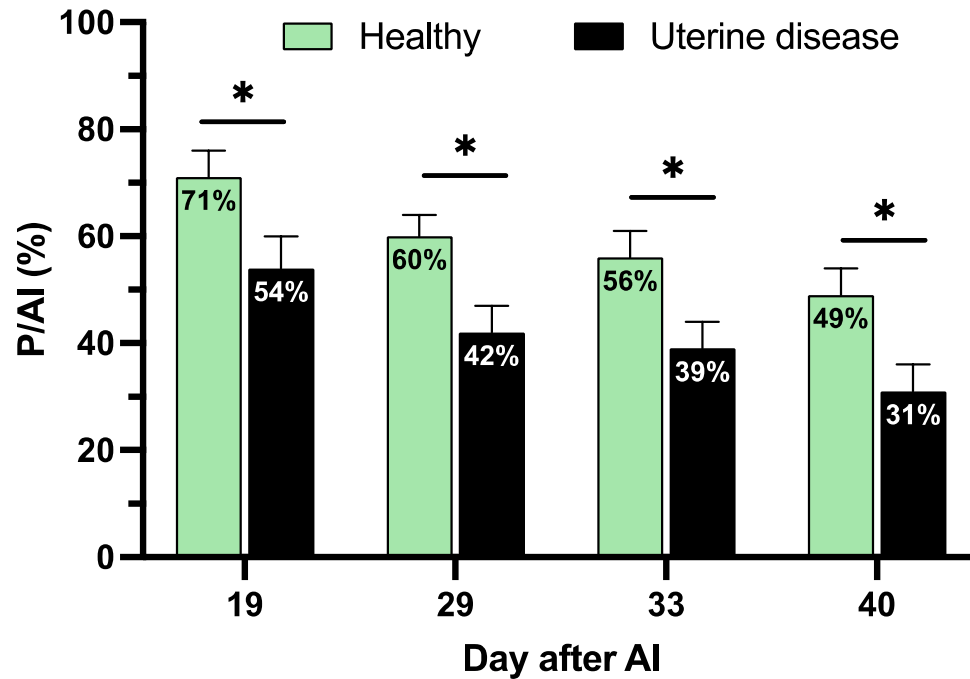
n = 1,210



Pregnancy at 1st AI



Postpartum Health & Pregnancy Loss

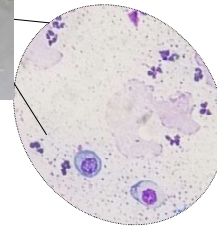
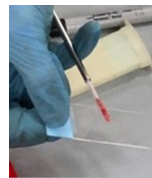


1. RP

2. Metritis

3. PVD

4. Endometritis (cytology)



Bruinje et al JDS 2024

**When do you want cows to
be pregnant?**

Ways to lose money on reproduction – Simplistic view



- **Opportunity cost of days open past ~100-120 DIM**
 - Forgone profit from not having cows spend more of their lifetime in the most profitable part of the lactation curve
 - Approximately \$1-4 cow/day > 100 DIM
- **Culling of otherwise profitable cows due to inability to get them pregnant**
 - $= [(\text{Cost of new heifer} - \text{cull price}) \times \text{remaining proportion of expected herd life}]$

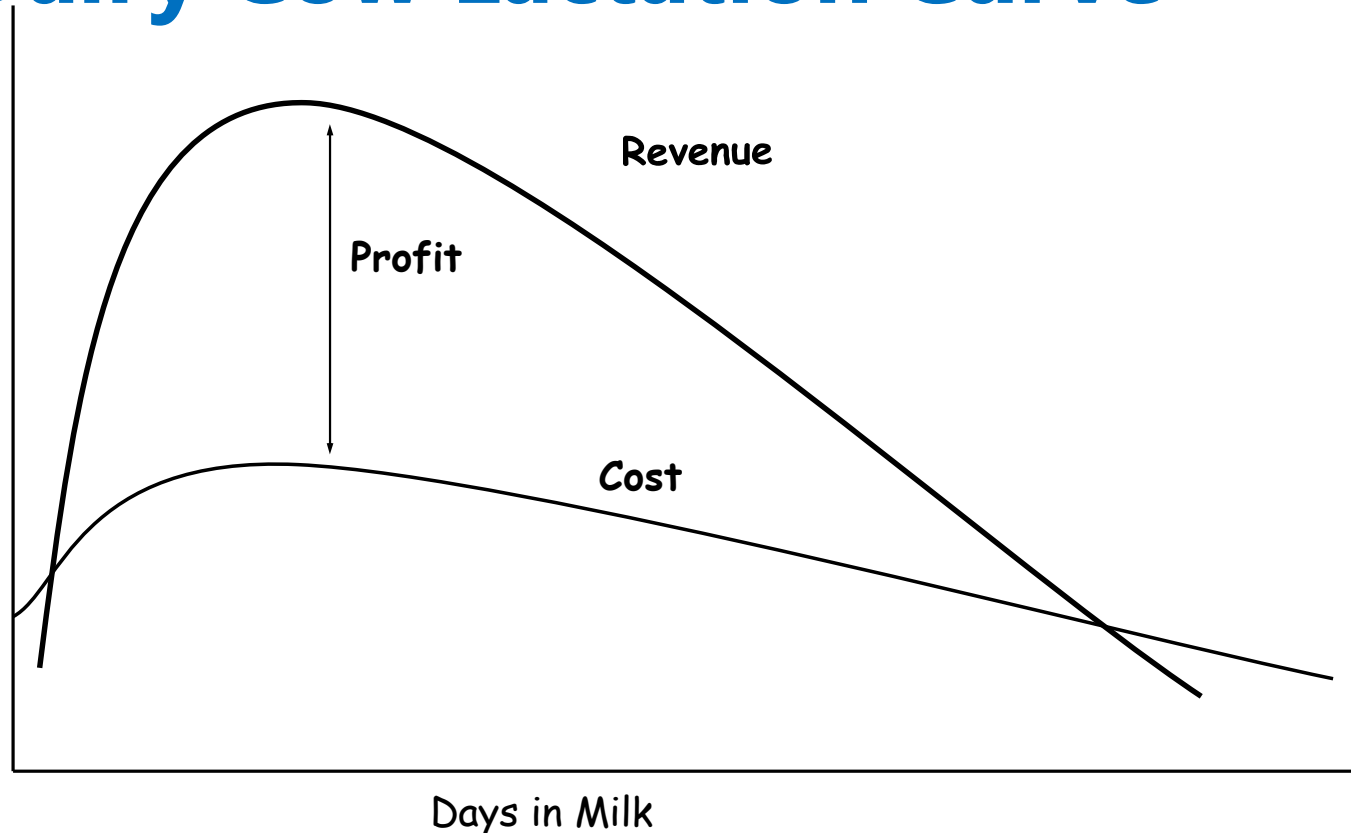
Where does the money go?

- Semen
- Labor
- Drugs
- Vet
- Culling
- **Calf value**
- ***MILK check***

Opportunity cost



Dairy Cow Lactation Curve



The objective is to optimize profit/slot/year by maximizing the proportion of a cow's life in the most profitable stage of lactation

Show me the money

Payback comes from

1. Marginal milk

- a more productive, nearer-peak cow filling the average slot on the farm
- Reflected in lower herd DIM and increased milk/d per cow in the herd (in fact, more milk per slot)

2. More calves

3. More selective culling – as more pregnant cows are produced, tail-end producers can be removed, contributing to more milk per slot as herd distribution shifts
4. Fewer long-DOPN fat cows → better transition

- When pregnancy rate increases

- Cows spend more of their life in early lactation
- Replacement is likely to be more optimum
 - which cows and when



VWP principles

- Economic optimum has been to have cows get pregnant between ~ 85 and 125 DIM based on maximizing lifetime profit
 - Most time spent near peak
 - Optimize profit per 'slot' per year
- Lower end set by biology (and management – transition health)
- Upper end set by economics - Depends on:
 - Milk price
 - Milk yield
 - Persistency
 - Insemination rate and probability of pregnancy/AI
 - Health risk at calving
 - Calf value
- Practice set by low efficiency of insemination and low probability of pregnancy/AI
- Does that change if "100%" of cows are bred by a deadline?
 - With up to 50% (?) P/AI?

Controlled trial in NY (Stangaferro et al 2018)
2426 cows – Double Ovsynch then ED and ReSynch

First AI at 60 or 88 DIM

→ Minimal \$ differences over 18 months

→ Slightly favors 88 d VWP in Lact=1, 60 d in older

What metric(s) should be used to assess whether to extend lactation?

- a) Conception risk?
- b) Milk per cow per year?
- c) Milk per cow per 2 or 3 years?
- d) Milk per expected lifetime?

What metric(s) should be used to assess whether to extend lactation?

- **Profit per most limiting resource**

- Per "slot"
 - Stall
 - Milking space in the parlor or robots
 - Per kg of quota
 - Per acre
 - Per cubic meter of water
 - Per tonne of N or P
 - Per tonne of GHG
-
- Not per cow
 - Not per insemination



J. Dairy Sci. 108:3764–3779
<https://doi.org/10.3168/jds.2024-26055>

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Associations between days open and dry period length versus milk production, replacement, and fertility in the subsequent lactation in Holstein dairy cows

Michael W. Overton^{1*} and Steve Eicker²

¹Zoetis, Parsippany, NJ 07054

²Valley Ag Software, King Ferry, NY 13081

- Data on 109,374 cows from 60 large herds in the US
- Parity group, previous lactation time to pregnancy (PDOPN), previous dry period length (PDDRY) associations with milk, pregnancy, culling to 90 DIM
- Survivorship bias in the data
- Conclusions:
 - Intermediate (conventional) dry period length is optimal
 - Pregnancy at earlier DIM is favourable



Cumulative milk (kg) to 90 DIM



	PDOPN									
	50	80	110	140	170	200	230	260	290	320
20	3424	3398	3373	3347	3321	3295	3269	3243	3217	3192
30	3682	3656	3630	3604	3579	3553	3527	3501	3475	3449
40	3889	3863	3837	3811	3786	3760	3734	3708	3682	3656
50	4045	4019	3993	3968	3942	3916	3890	3864	3838	3812
60	4150	4125	4099	4073	4047	4021	3995	3969	3944	3918
70	4205	4179	4153	4127	4101	4076	4050	4024	3998	3972
80	4209	4183	4157	4131	4105	4079	4053	4028	4002	3976
90	4161	4136	4110	4084	4058	4032	4006	3980	3955	3929
100	4063	4038	4012	3986	3960	3934	3908	3882	3857	3831
110	3915	3889	3863	3837	3811	3785	3759	3734	3708	3682
120	3715	3689	3663	3637	3612	3586	3560	3534	3508	3482

Take-homes

- Culling is an economic decision. Sell a cow when her net present value is $<$ an available replacement animal
- Options for longevity follow control of
 - Transition period health
 - Mastitis
 - Lameness
 - Pregnancy rate
- The transition period is to be managed, not to be avoided
(unless lactation curves change meaningfully)

Take-homes

- Poor health will reduce productive lifespan, but longevity is a poor measure of health or welfare.
 - Because it depends on:
 - Heifer supply and prices
 - Market cow price
 - Milk price
- So far, economic models still suggest that calving every 12-13 months is economically optimal.
 - Albeit many of these models do not account for transition risk
 - The value of calves is presently a bigger driver than lactation curves
- Good nutrition, cow comfort, and attentive management provide the conditions for health, high production, good reproduction, and optimal culling

Using AI to Translate Evidence into Farm Action

Quality Milk Production Services
Wolf Heuwieser

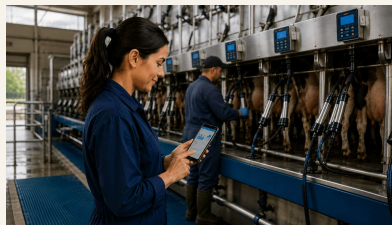


College of
Veterinary Medicine

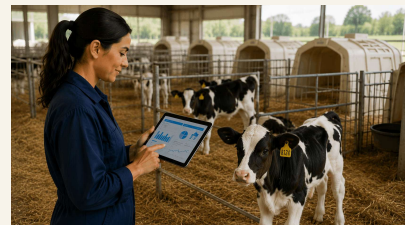
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Scenario

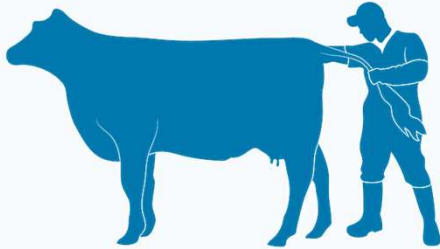


AI Workflow



Use cases

2



Dr. Paul McLoud

Veterinarian in a dairy practice with
4 vets, 45 yrs old

ChatGPT occasionally for emails and
summaries, but not an "AI person"

3

Hi Doc,

"Some producers treat every
mastitis case right away.
Others wait. We are throwing
out milk, spending money on
treatments, and still seeing
repeat cases.

Can you give us something
clearer?"

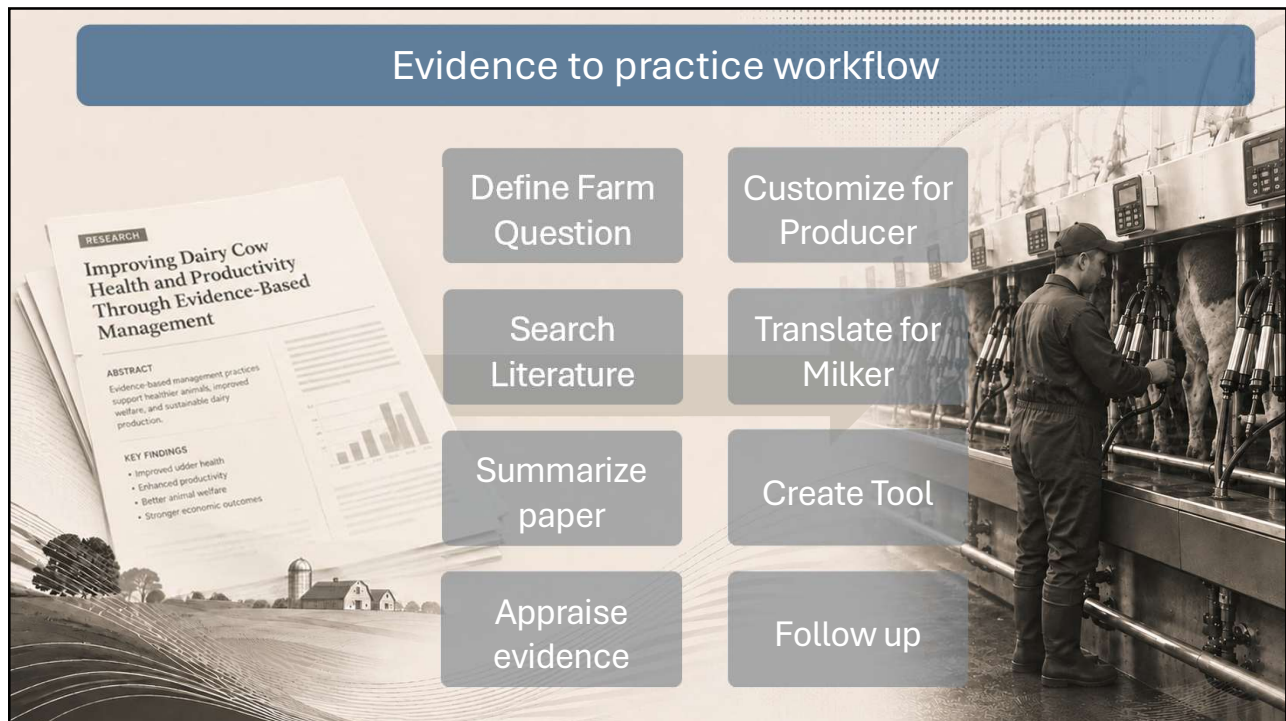
Mike Polan



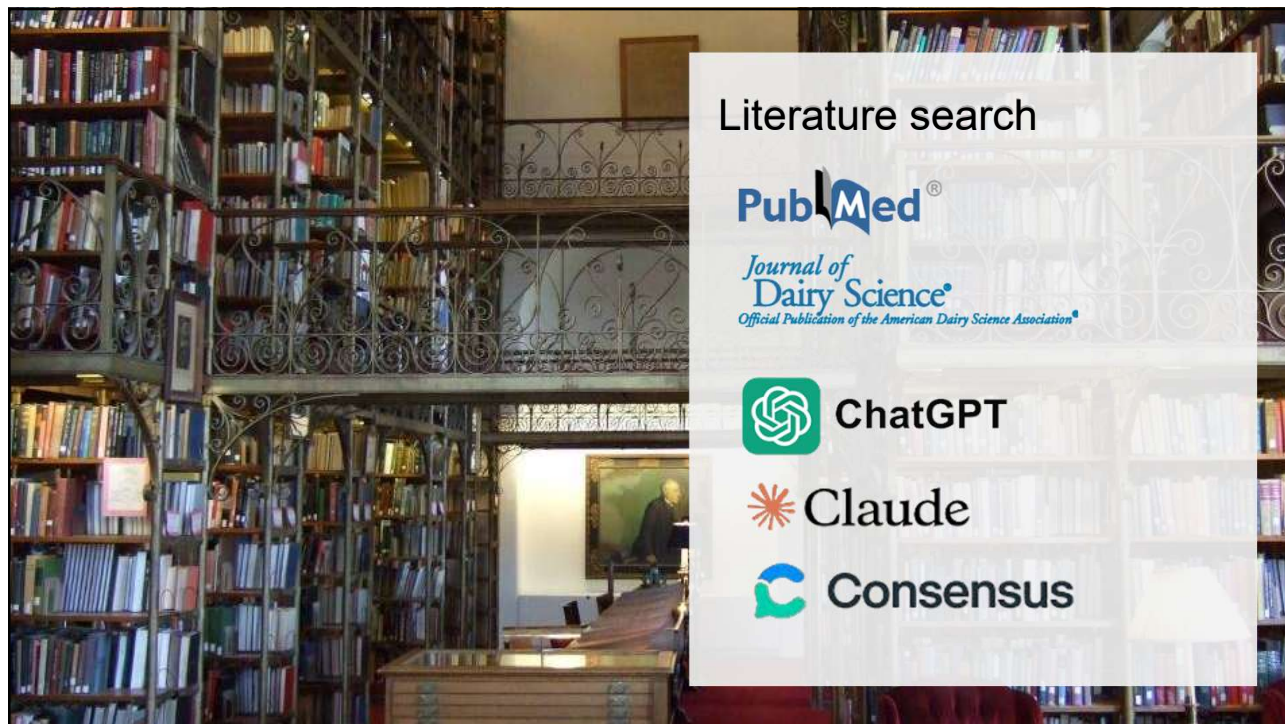
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5



6



7

pubmed.ncbi.nlm.nih.gov/?term=treatment+of+mastitis+in+dairy+cattle&sort=date&filter=datesearch_y_5

An official website of the United States government [Here's how you know](#)

NIH National Library of Medicine
National Center for Biotechnology Information

Log in

PubMed®

treatment of mastitis in dairy cattle

Search

Advanced Create alert Create RSS User Guide

Save Email Send to Sort by: Most recent Display options

MY CUSTOM FILTERS
[Edit custom filters](#)

RESULTS BY YEAR

2021-2026

703 results

Filters applied: in the last 5 years. [Clear all](#)

☐ Bioinformatics approach to identify potential biomarker and drug target for the clinical and subclinical mastitis disease in dairy cattle.

1

Cite Auwul MR.

PLoS One. 2026 May 13;21(5):e0349172. doi: 10.1371/journal.pone.0349172. eCollection 2026.

PMID: 42127079 [Free PMC article](#).

Mastitis in dairy cattle is a serious issue that affects not just the animals but also has broad social, cultural, economic, and human consequences. ...The findings from this study pave the way for pr

Page 1

8

The screenshot shows the ChatGPT web interface. The user's query is: "I am looking for a peer-reviewed publication on pathogen-based treatment of mastitis in dairy cattle. I remember seeing it in one of those peer-reviewed journals, but I cannot find it anymore. Could you please help me locate it?"

The response from ChatGPT is: "I'll search broadly across mastitis, culture-guided/pathogen-based treatment, and selective treatment terms, then narrow to peer-reviewed dairy-cattle papers that match what you likely remember."

Below the response, it says: "Thought for 19s >"

The response continues: "I found several likely matches. The strongest match to your wording is probably this **Journal of Dairy Science** paper:"

The interface includes a sidebar with options like "New chat", "Search chats", "Codex", "More", "GPTs", and "Projects". The user's account is listed as "Wolf Heuwieser Personal account".

9

The screenshot shows the ChatGPT web interface displaying search results. The results are listed as follows:

- 3. Lago et al., 2011 — Part II**
The selective treatment of clinical mastitis based on on-farm culture results: II. Effects on lactation performance, including clinical mastitis recurrence, somatic cell count, milk production, and cow survival. Journal of Dairy Science, 94(9), 4457–4467. DOI: 10.3168/jds.2010-4047.
- 4. de Jong et al., 2023 — Review**
Invited review: Selective treatment of clinical mastitis in dairy cattle. Journal of Dairy Science, 106(6), 3761–3778. DOI: 10.3168/jds.2022-22826.
 This is likely the best recent review if you want the broader evidence base.

A tooltip for the second result shows: "Invited review: Selective treatment of clinical mastitis in dairy cattle - ScienceDirect May 31, 2023".

The interface includes a sidebar with options like "New chat", "Search chats", "Codex", "More", "GPTs", and "Projects". The user's account is listed as "Wolf Heuwieser Personal account".

10

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Journal of Dairy Science
Volume 106, Issue 6, June 2023, Pages 3761-3778

Outline

- ABSTRACT
- Key words
- INTRODUCTION
- PRINCIPLES OF SELECTIVE CLINICAL MASTITIS
- OTHER CONSIDERATIONS
- COW AND FARM OUTCOMES
- ADOPTION OF SELECTIVE CLINICAL MASTITIS

Review

Invited review: Selective treatment of clinical mastitis in dairy cattle

Ellen de Jong^{1,2,3}, Kayley D. McCubbin^{1,2,3}, David Speksnijder^{4,5}, Simon Dufour^{3,6}, John R. Middleton⁷, Pamela L. Ruegg⁸, Theo J.G.M. Lam^{9,10}, David F. Kelton^{3,10}, Scott McDougall^{11,12}, Sandra M. Godden¹³, Alfonso Lago¹⁴, Päivi J. Rajala-Schultz¹⁵, Karin Orsel¹, Sarne De Vliegher¹⁶, Volker Krömker¹⁷, Diego B. Nobrega^{1,2}, John P. Kastelic¹, Herman W. Barkema^{1,2,3} 

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Recommended articles

Effects of 2 intramammary antimicrobial formulations on contr...
Applied Animal Science, Volume 37, Issue 5, 202...
Ahmadreza Mirzaei, ..., Ricardo C. Chebel
[View PDF](#)

Monitoring of antimicrobial susceptibility of udder pathogens...
Veterinary Microbiology, Volume 213, 2018, pp. ...
Anno de Jong, ..., Ed Siegart
[View PDF](#)

The hidden cost of disease: I. Impact of the first incidence of mastitis...
Journal of Dairy Science, Volume ...
[FEEDBACK](#)

11

What are you working on?

DeJong-Mastitis-selective-Treatme...
PDF

Just analyze the abstract of the uploaded PDF. Create a 50-word summary in plain language that is easy to understand. Do not access other materials.

[Create an image](#) [Write or edit](#) [Look something up](#)

ChatGPT

- New chat
- Search chats
- Codex
- More

GPTs

- Dairy Science Editor
- Dairy Sci Summarizer 1.0
- Dairy Sci Editor 2.0
- Key Takeaways
- Dairy Content Editor
- Explore GPTs

Projects

- wh13
- Personal account

12

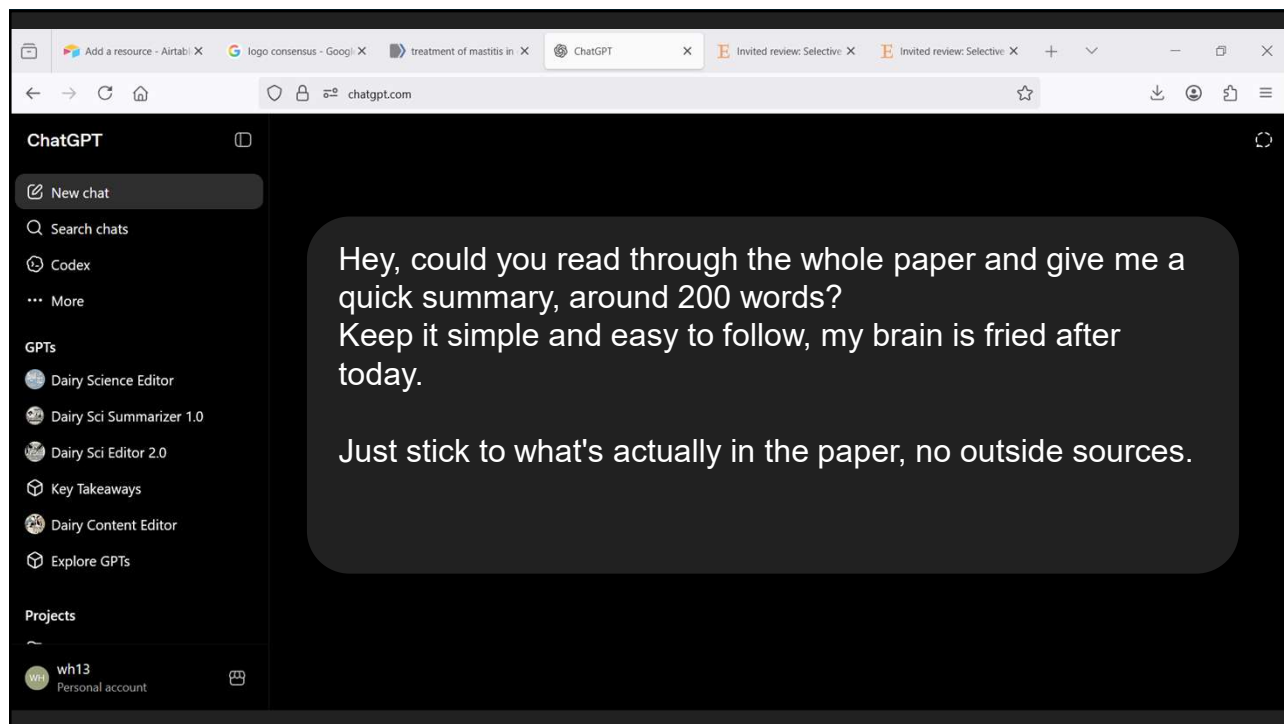
The screenshot shows the ChatGPT web interface. The browser's address bar displays the URL `chatgpt.com/c/6a08eced-3c3c-83ea-807a-87bb72687820`. The left sidebar contains navigation options: 'New chat', 'Search chats', 'Codex', 'More', 'GPTs' (with sub-items like 'Dairy Science Editor', 'Dairy Sci Summarizer 1.0', 'Dairy Sci Editor 2.0', 'Key Takeaways', 'Dairy Content Editor', 'Explore GPTs'), and 'Projects' (with a sub-item 'wh13 Personal account'). The main chat area shows a PDF upload icon and a prompt: 'Just analyze the abstract of the uploaded PDF. Create a 50-word summary in plain language that is easy to understand. Do not access other materials.' Below this, the AI's response is displayed: 'Thought for 6s > Selective mastitis treatment uses rapid tests and cow records to decide which nonsevere cases need antibiotics. Many cases can recover without them, especially when no bacteria or gram-negative bacteria are found. Studies suggest this approach reduces antibiotic use without harming udder health, welfare, or farm economics when properly applied carefully.' A source link 'DeLong-Mastitis-selective-Treat...' is visible. At the bottom, there is an input field with the placeholder 'Ask anything', a dropdown menu set to 'Extended', and a microphone icon. A disclaimer at the very bottom states: 'ChatGPT is AI and can make mistakes. Check important info.'

13

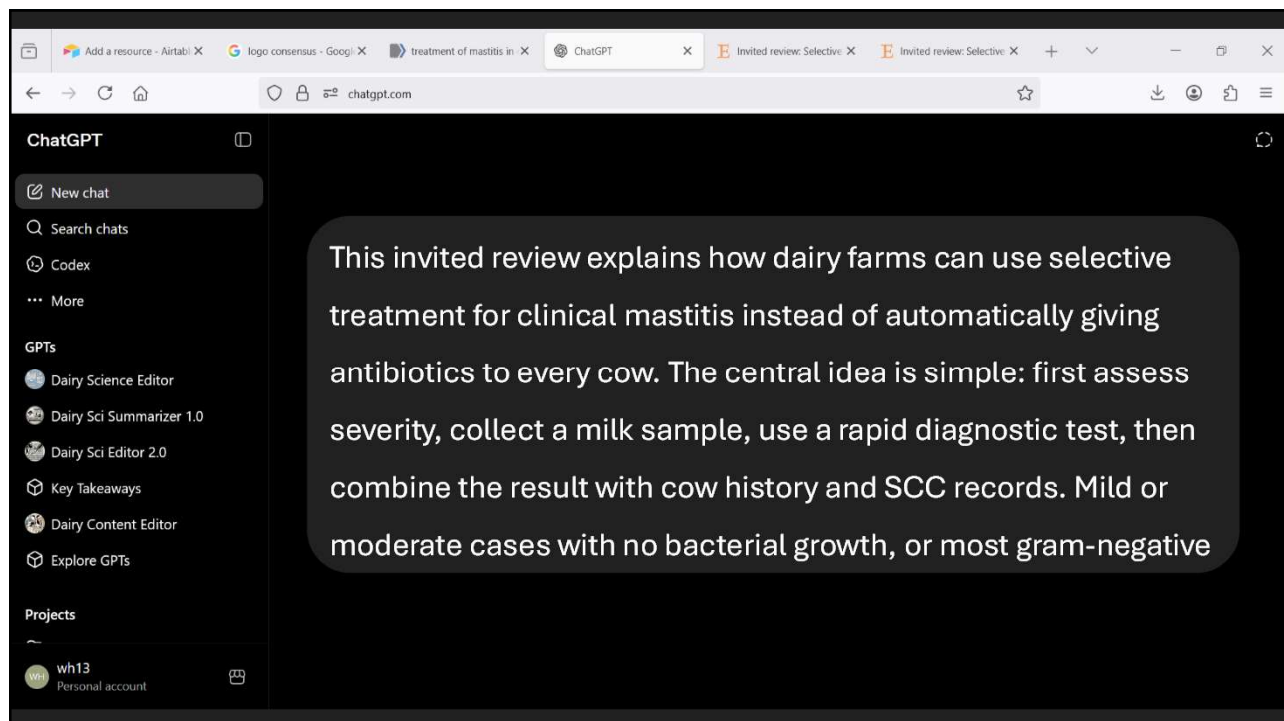


What are the next steps?

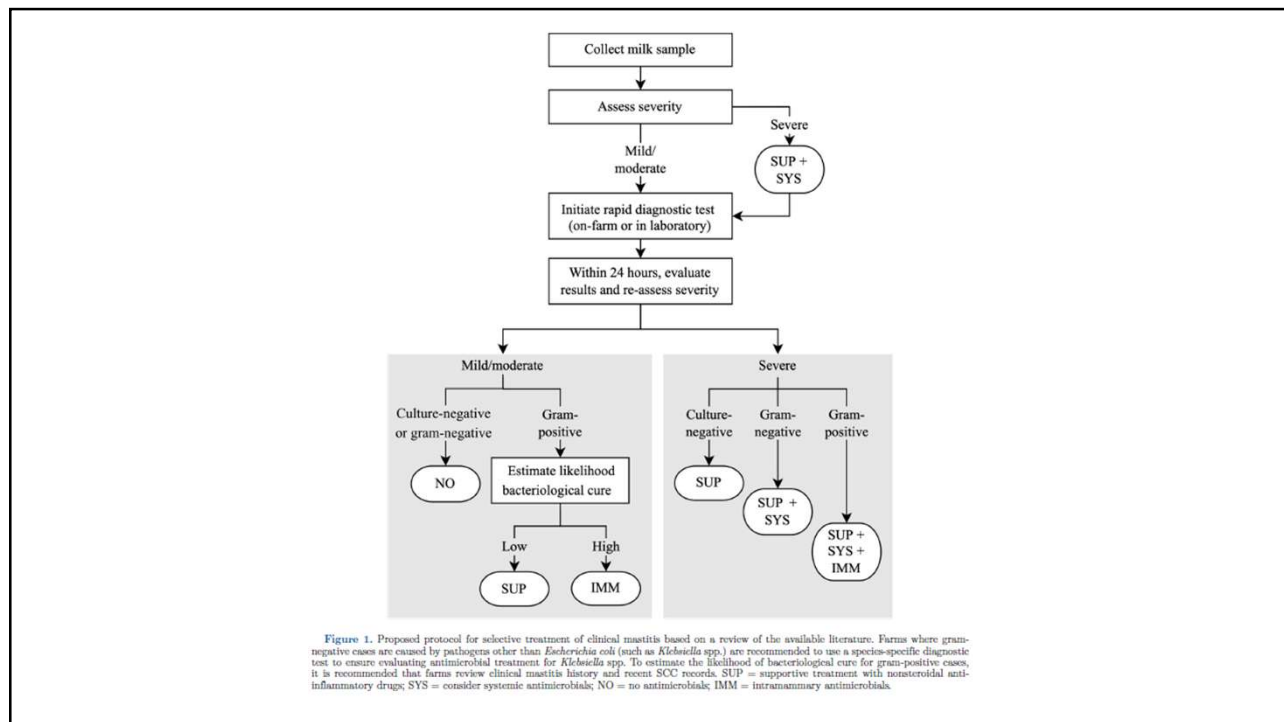
14



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16



17

ChatGPT

New chat

Search chats

Codex

More

GPTs

Dairy Science Editor

Dairy Sci Summarizer 1.0

Dairy Sci Editor 2.0

Key Takeaways

Dairy Content Editor

Explore GPTs

Projects

Wolf Heuwieser

Personal account

Analyze figure 1 of this publication. Do not access outside source. Create an easy-to-understand and visually appealing flow chart for a dairy producer. Do not use acronyms. Utilize the same sepia monochrome style with blue (Hex: #2D5983) and grey (Hex: #80868C), composition, lighting, and professional academic tone of the uploaded PNG. When more information is needed ask me.

Thought for 4m 25s >

I simplified Figure 1 into a producer-facing decision flow: sample first, assess severity, use rapid testing, then match treatment to test result and cow history. I expanded the figure's abbreviations into plain terms such as supportive care, injectable antibiotics, no antibiotics, and udder tube antibiotics.

Download the flow chart here: [Selective mastitis treatment flow chart](#)

+ Ask anything

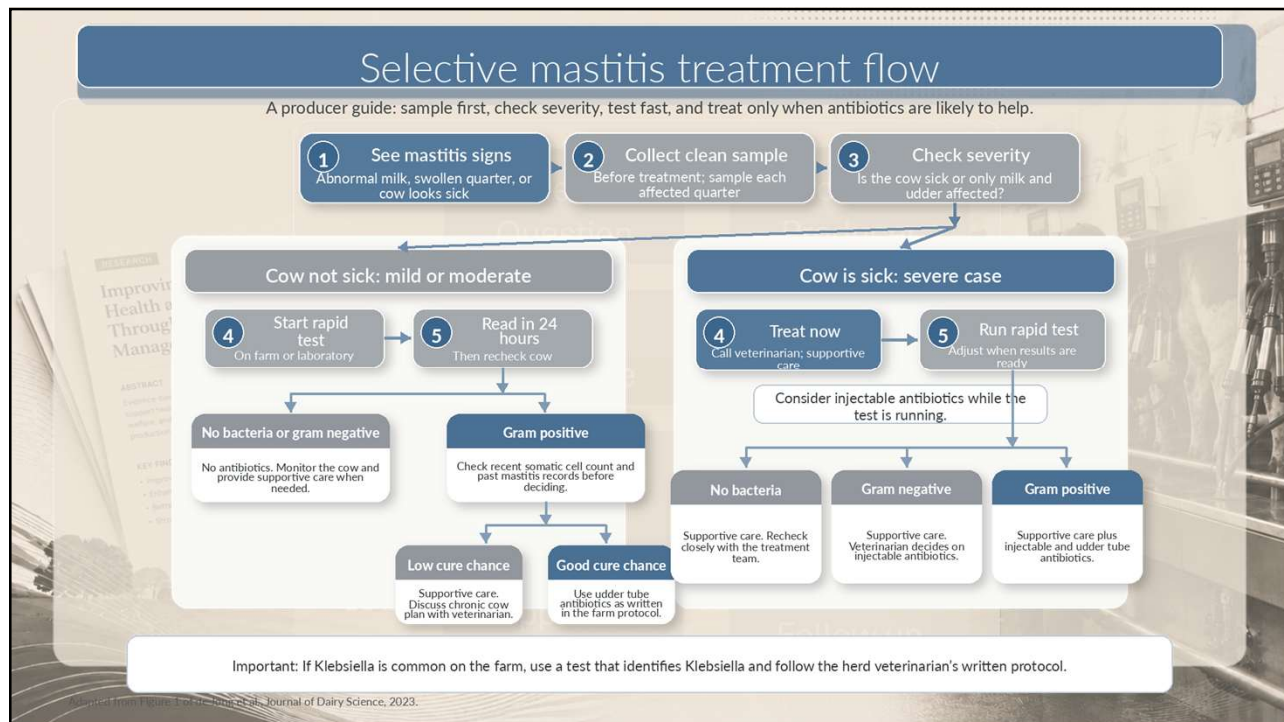
Extended

🔊

ChatGPT is AI and can make mistakes. Check important info.

18

9



19

What is evidence-based?

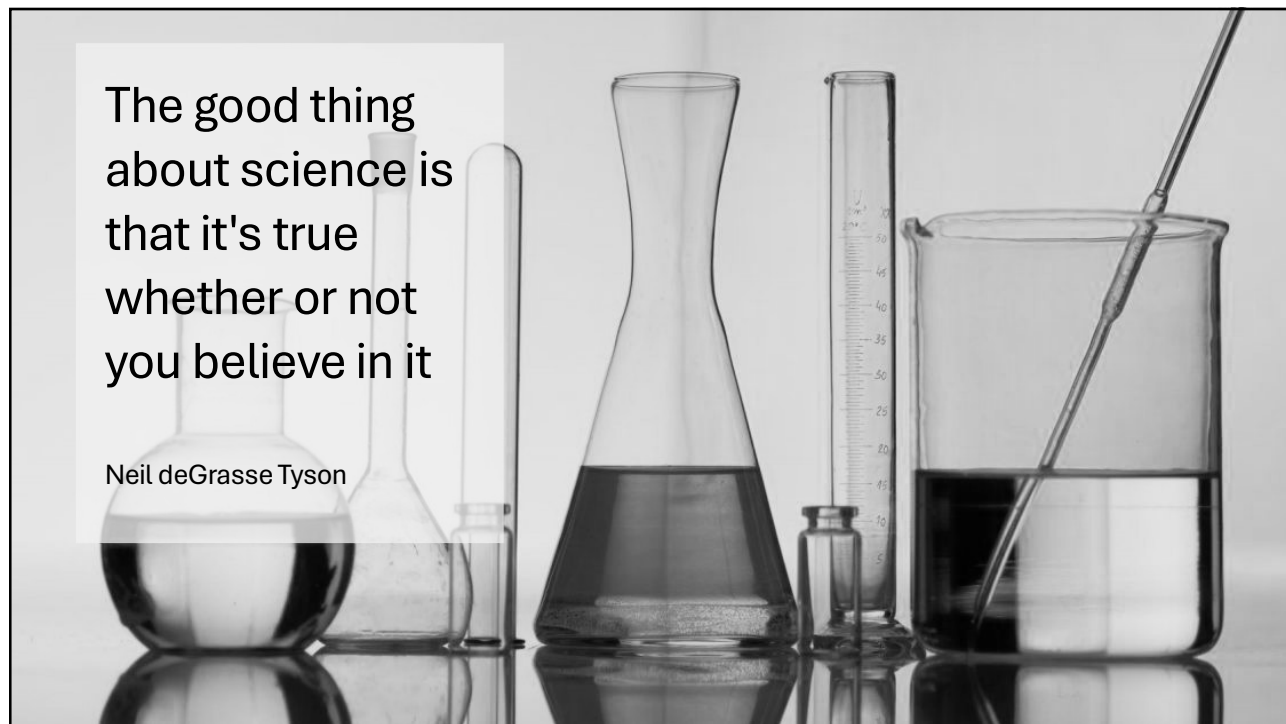
You make medical decisions based on the **current best scientific knowledge**.

You base your decisions on **data from sound studies**.

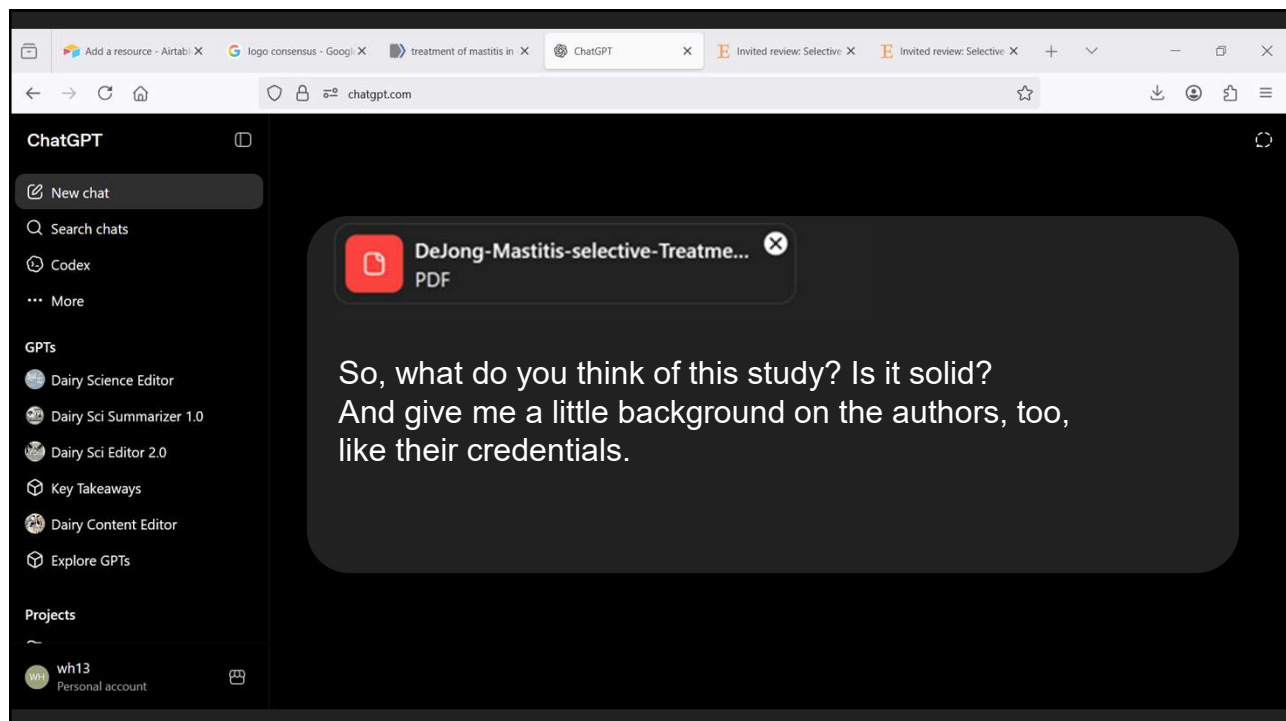
Not (solely) on tradition, experience, or expert opinions.

This ensures that treatments are **effective and safe** for your clients and their animals.

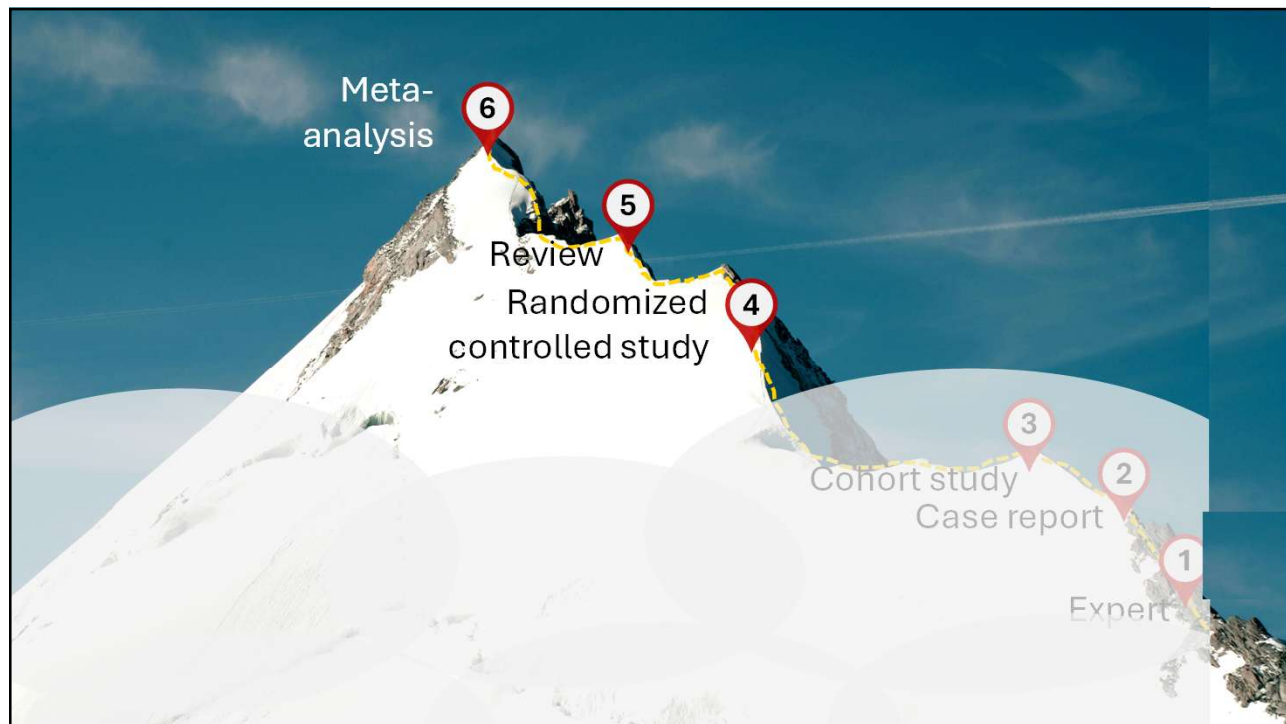
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22



23

One Useful Thing

Ethan Mollick 
@oneusefulting



I am a professor at the Wharton School of the University of Pennsylvania. I study entrepreneurship & innovation and AI. I am trying to understand what our new AI-haunted era means for work and education.

 One Useful Thing  2

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“

AI can produce plausible-sounding outputs that are deeply flawed.

Without expertise, users cannot distinguish between the two.

24

Expertise still matters with AI



1. Recognize errors



2. Ask better questions



3. Integrate into context



4. Exercise judgment

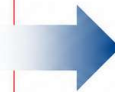
25

How expertise is shifting



Traditional emphasis

- Production
- Creation
- Drafting from scratch



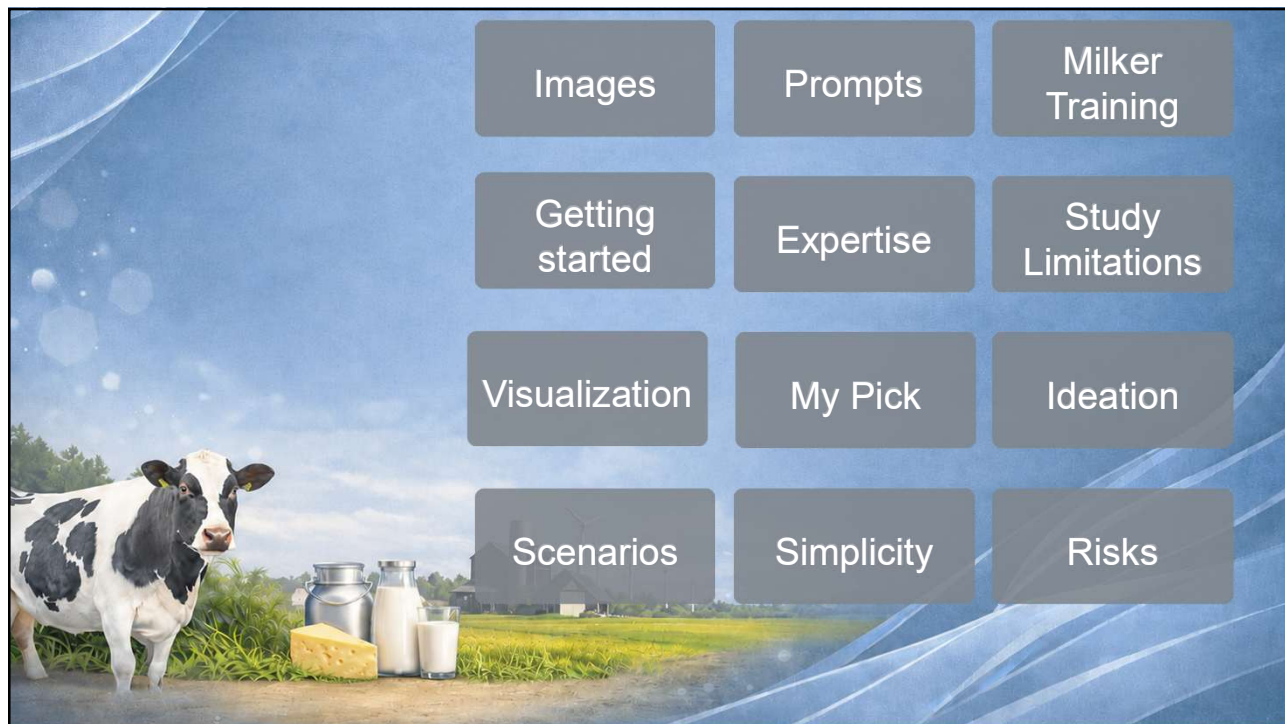
AI-era emphasis

- Evaluation
- Curation and critique
- Quality control and strategic decisions

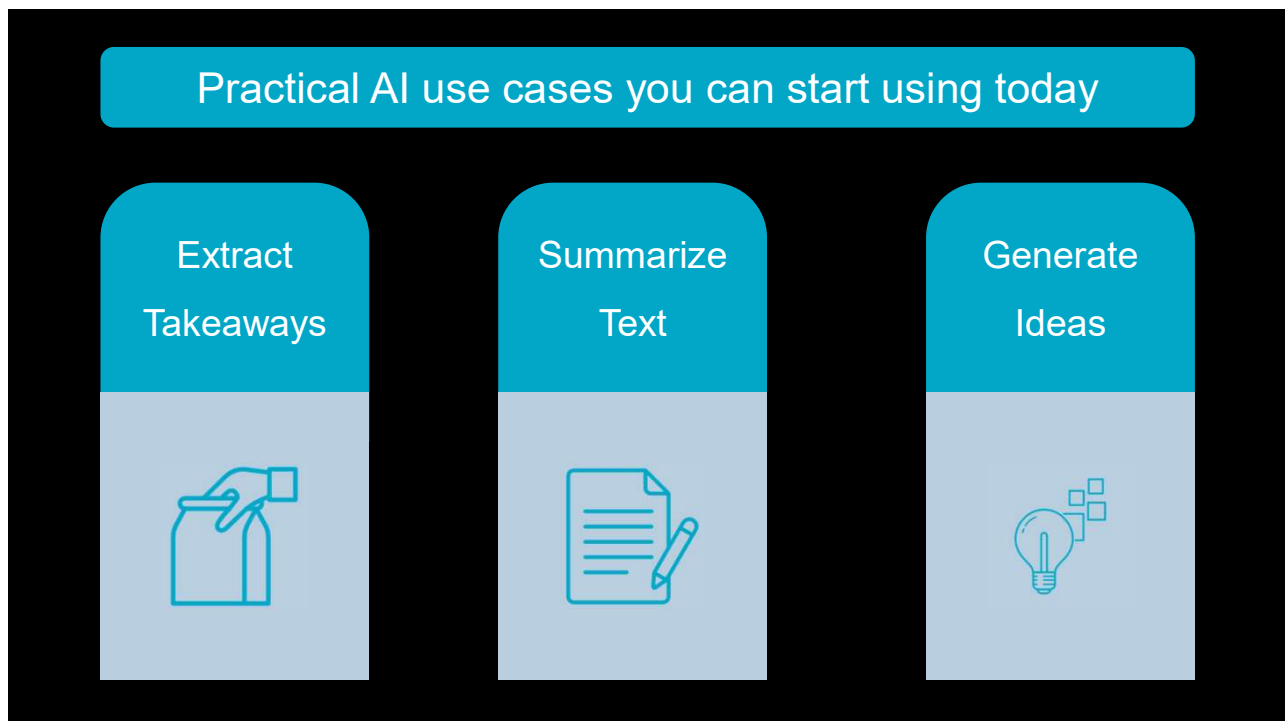


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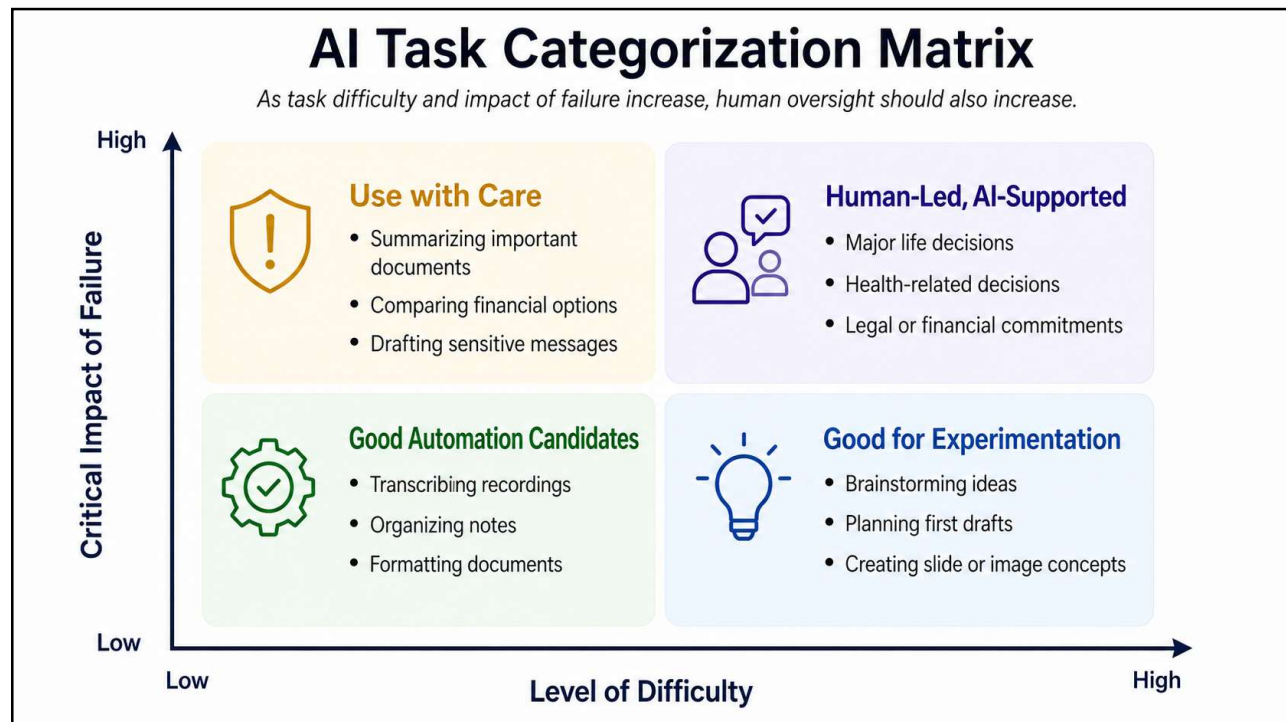
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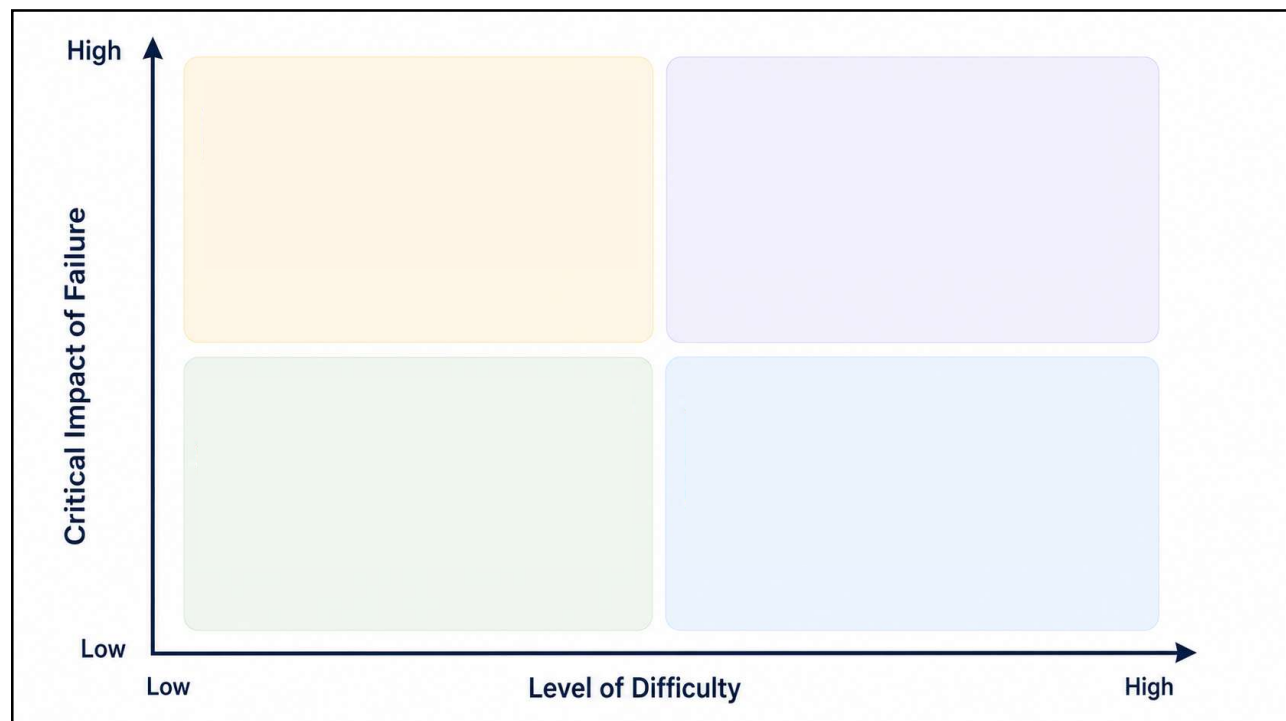
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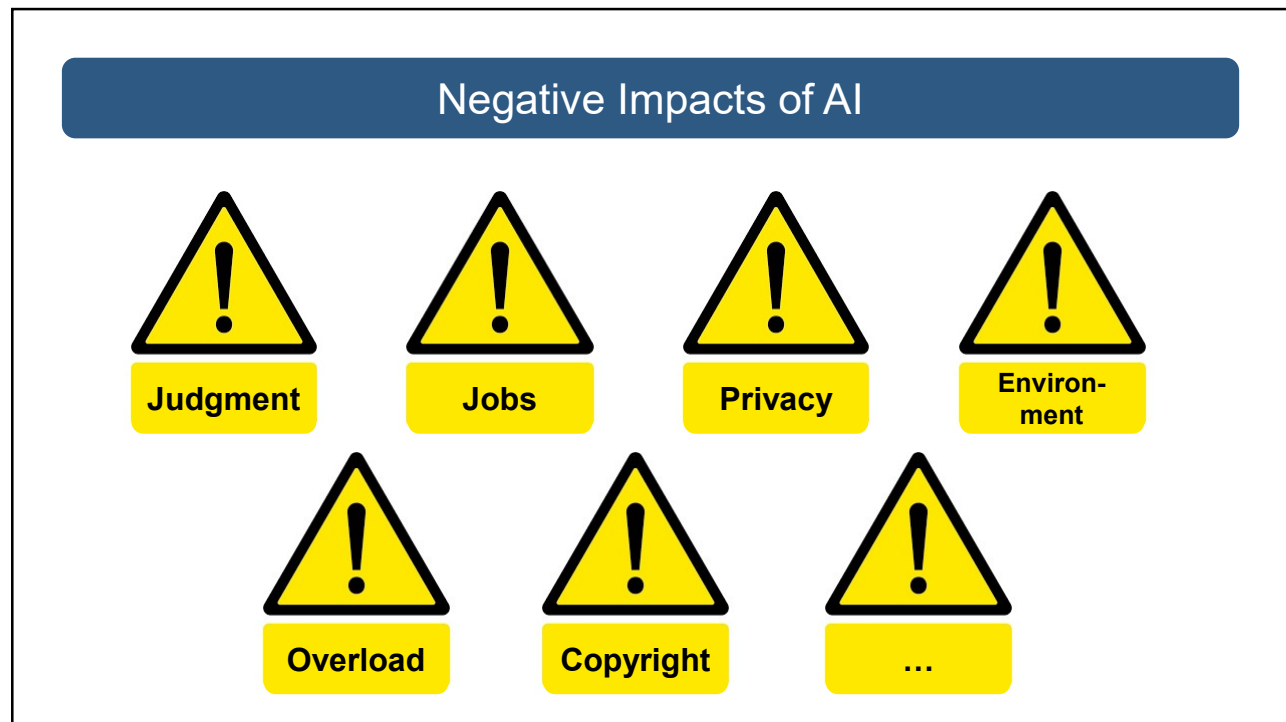
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29



30



31

Contributions by

Alejandra Zapata, Mike Zurakowski
Kaitlyn Lutz, Anay Ravelo,

Tips and resources used in the presentation

<https://bit.ly/m/WolfsAI>

live on June 2nd
wh13@cornell.edu



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