

P-MR-1



Who Needs Cow Prep?

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Who needs cow prep? The answer to this rhetorical question is easy.....all dairies need consistently effective pre-milking cow prep procedures to assure high quality low bacteria and SCC milk and to reduce mastitis.

Why Optimize Pre-Milking Cow Prep?

- Increase milk yield
- Decrease machine-on time
- Improve udder health
- Improve milk **quality & safety**

Cow Readiness?



Photo courtesy of
IBA Millbury, MA

Clean, Stimulated, and Calm



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Routine removal of long hair from the udder



Photos courtesy of IBA Millbury, MA



- **Decrease clinical mastitis**
- **Decrease SCC**
- **Improve microbiological milk quality**
- **Decrease prep time**
- **Increase effectiveness of prep**



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Adverse effect of fear on milk yield and behavior

Rushen, J. et al, JDS:
82, 720-727, 1999



Staged photo courtesy of
IBA Millbury, MA

- **Cows avoided adverse handler**
- **10% less milk when adverse handler present**
- **2 times more residual milk when adverse handler is present**


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Milker Readiness ?

- On time
- Clean clothing
- Gloved hands
- Std procedures
- Routine training



Photo courtesy of IBA Millbury, MA



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Definitions

Milking Routine = Sequence of cow prep events used to facilitate optimum prep time and prep-lag-time.

Cow prep = Procedure used to clean and sanitize teat surfaces, stimulate milk let down, apply and align milking units.



Definitions (cont)

Prep time = time taken using tactile stimulation to clean teat surfaces and properly prep the cow for milking

Optimum 10-20 seconds

Prep-lag time = Time from the initial tactile stimulus during cow prep to application of the milking machine

Optimum 60-120 seconds

Contact time = time allowed for teat pre-dip sanitizer to kill bacteria before being dried off

Optimum is 30 seconds



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Milking is not a track meet!



Reality of Milking Time Pressures

Over 50% of dairy farm labor is used for milking cows

Greatest investment \$ for large dairies = milking parlor

Time needed to get all the cows milked on large 3X dairies especially with high ratio of cows to size of milking parlor thus requiring higher throughput speed

Time needed for a smaller labor force to complete other work on small dairies



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Ideal milking procedure

- **Minimizes water use**
- **Focuses attention on teat surfaces only**
- **Uses a sanitizer (pre-dip)**
- **Assures complete pre-dip coverage**
- **Allows pre-dip 30 seconds contact time**
- **Provides milk letdown with 10-20 seconds of tactile stimulus by cleaning teats and/or fore-stripping**

Ideal milking procedure

- **Provides a prep-lag time of 60-120 seconds**
- **Removes all dirt and manure from teats**
- **Minimizes variation between milkers**
- **Minimizes “machine-on” time**
- **Does not slow down milking**

See QCF- 11 Ideal Cow Prep Fact Sheet



Oxytocin Response & Autonomic Local Reflex

10-20 seconds of manual stimulation

Autonomic local reflex

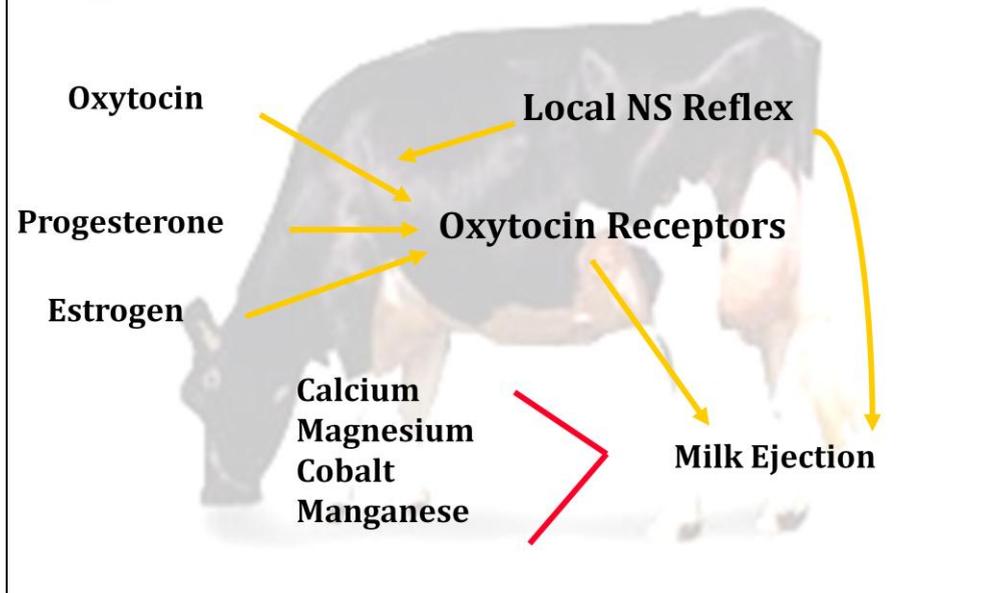
- Relaxes teat sphincter and milk ducts
- Increases mammary blood flow
- Decreases response threshold of myoepithelial cells to oxytocin

Oxytocin milk letdown response

- Oxytocin released to bloodstream from pituitary gland
- Oxytocin attaches to oxytocin receptors and causes myoepithelial cell contraction and milk ejection

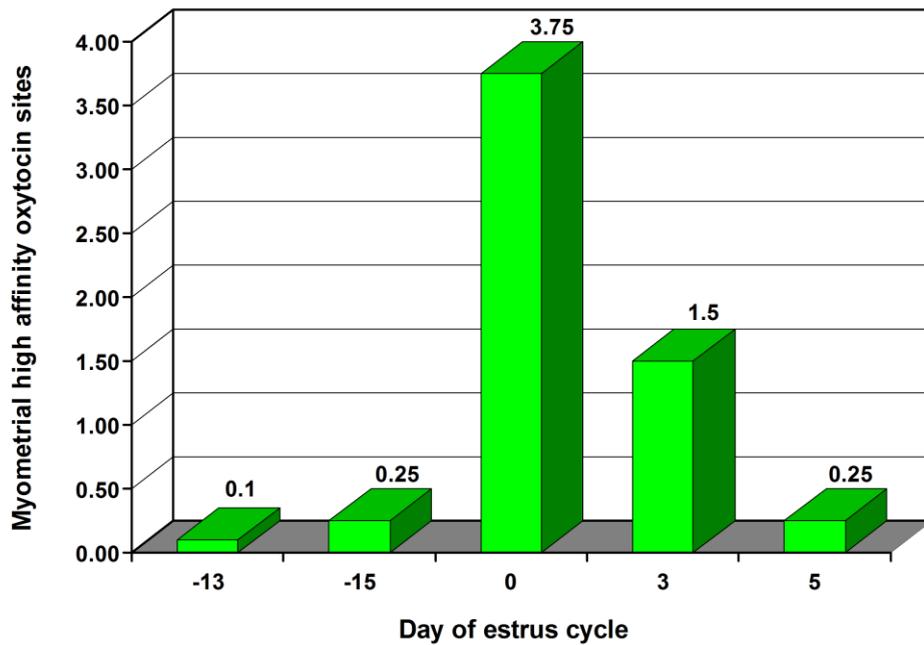


Interaction of milk ejection mechanism with reproductive hormones and dietary minerals

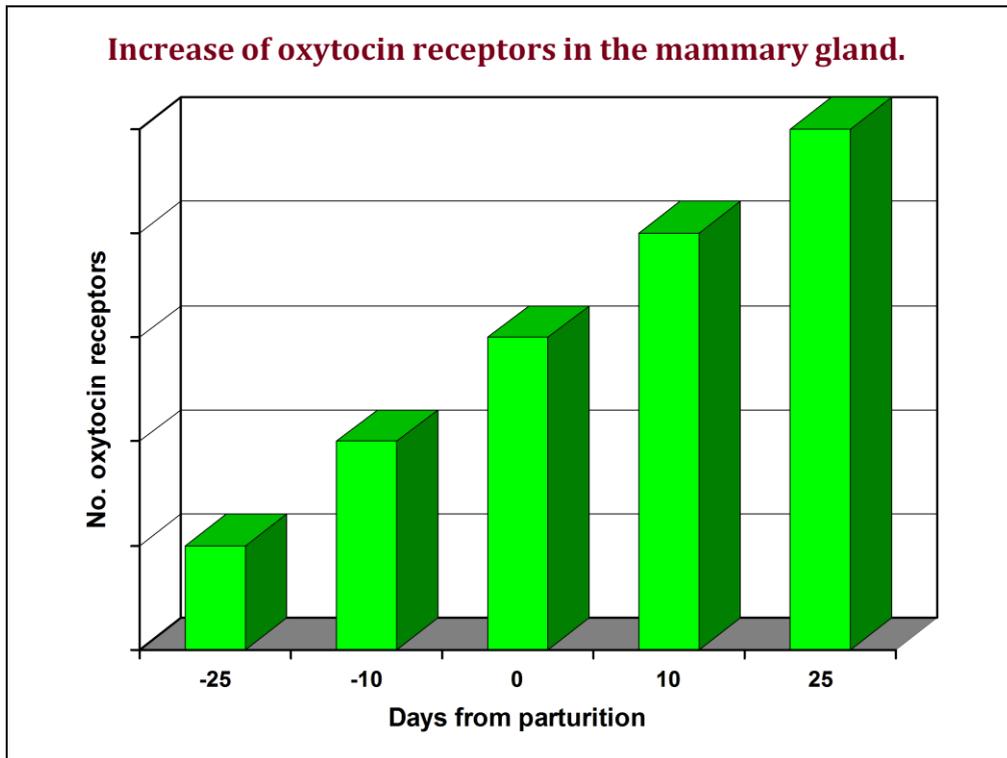


Teat stimulation causes release of oxytocin from the pituitary which flows to the mammary gland via the blood attaching to oxytocin receptors on the smooth muscle myoepithelial cells surrounding each milk secreting alveolar cell in the mammary gland (also to the myometrial cells of the uterus). This will cause smooth muscle contraction resulting in milk ejection. The tactile teat stimulation also stimulates a local autonomic reflex response relaxing teat sphincters and increase mammary blood flow thus augmenting oxytocin delivery to the mammary gland. Under the influence of the hormone estrogen not only are there more oxytocin receptors present but they also have an increased sensitivity to the presence of oxytocin resulting in greater smooth muscle contraction. Progesterone, on the other hand reduces both oxytocin receptor numbers and sensitivity. Therefore in late lactation during pregnancy when the influence of progesterone predominates cows are not as responsive to oxytocin and thus may require a greater stimulus and longer prep-lag interval to consistently achieve complete milk ejection. Diet can also influence the intensity of smooth muscle contraction. Calcium, magnesium, cobalt and manganese need to be supplied by the diet in adequate amounts to assure fully functional smooth muscle contraction.

Myometrial oxytocin receptors in relationship to the estrus cycle.



This slide demonstrate the effect of estrogen in increasing the oxytocin receptor site affinity for oxytocin during the estrus cycle thus explaining the physiological reason for the increased smooth muscle tone in the uterus during estrus. Producers who do AI on their cows will be familiar with the increased uterine muscle tone at the time of breeding when a cow is in "heat".



Note here that in response to the increasing circulating estrogen at the end of gestation and during early lactation that the number of oxytocin receptors in the mammary gland increase. This partially explains the reason eliciting a milk let-down in an early lactation cow is easier than in a late lactation pregnant cow where the more dominant reproductive hormone is progesterone which not only reduces the number of oxytocin receptors it also reduces the sensitivity of oxytocin receptors to oxytocin. Therefore in mid-late lactation achieving consistent milk let-down response will require a greater amount of tactile stimulation than in early lactation.

Prep Time Is Important

Less than 10 seconds does not provide adequate milk letdown stimulation

10-20 seconds is adequate for all stages of lactation in American Holstein cows

Rasmussen et al.
JDS 75:2131 1992



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Prep Time Is Important

Fore-stripping is a powerful milk letdown stimulus and should be used early in the cow prep procedure

Rasmussen et al.
JDS 75:2131 1992



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Purpose of fore-stripping

- ✓ Early detection for clinical mastitis
- ✓ Creates a strong milk letdown stimulus
- ✓ Assures teat canal is open



Photo courtesy of IBA Millbury, MA



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Pre-milking cow prep

- 10-20 seconds tactile stimulation for optimal milk letdown response
- 20-30 seconds pre-dip contact time
- Remove all dirt & manure (bacteria) from teat surfaces



Photo courtesy of IBA Millbury, MA



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Prep-lag time

- Time from first tactile stimulation to machine attachment
- 2X milking 60-90 seconds
- 3X milking 90-120 seconds
- Never longer than 3 minutes



Photo courtesy of IBA Millbury, MA



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Summary Milking Procedure Steps



Pre-milking teat dipping



Cleaning teat ends



Fore-stripping



Drying teats



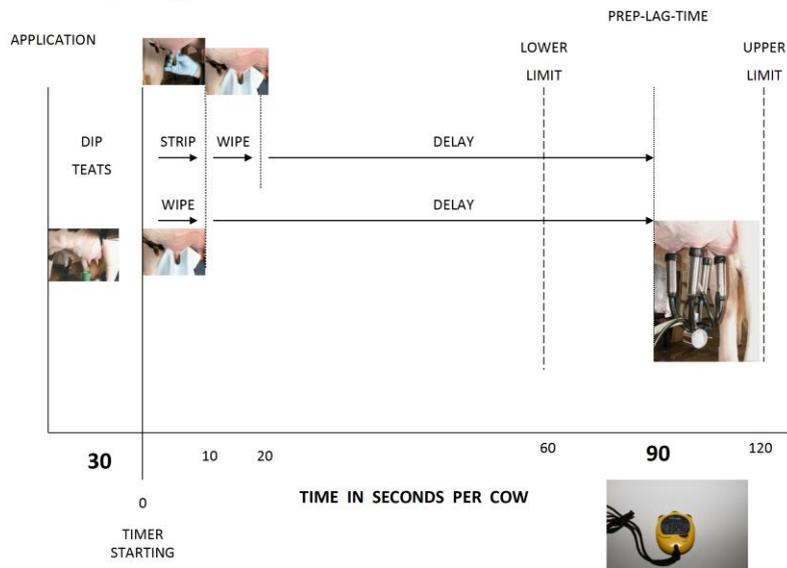
**Applying machines
with 60-120 sec
prep-lag-time**



**Post-milking teat
dipping**

Photos courtesy of IBA Millbury, MA

Pre-Milking Procedures



There are many combinations of the pre-milking cow prep procedures that will meet the criteria of an “ideal milking procedure”. Below are listed a couple of examples:

Assumptions:

- pre-dip 4 teats takes ~ 3-5 sec per cow
- gloved hand wiping sides & teat ends + fore-stripping 2 squirts from each teat takes ~ 10-12 sec per cow
- drying including teat ends takes ~ 10 sec per cow
- applying machines including alignment takes ~ 5-7 sec per cow
- transit time between cows ~ 2-3 sec

Criteria:

10-20 sec min tactile stimulation needed (cleaning, fore-stripping, drying)
30 sec pre-dip contact time
60-120 sec prep-lag time range

Examples:

- Pre-dip 6 cows, return to first fore-strip + dry + attach 6 cows = ~ 80-90 sec PLT
- Pre-dip + clean & fore-strip 4-6 cows, return to first cow, dry + attach 6 cows = 60 – 110 sec PLT
- Get a stop watch and design a protocol that fits your farm and meets “ideal milking procedure” criteria.

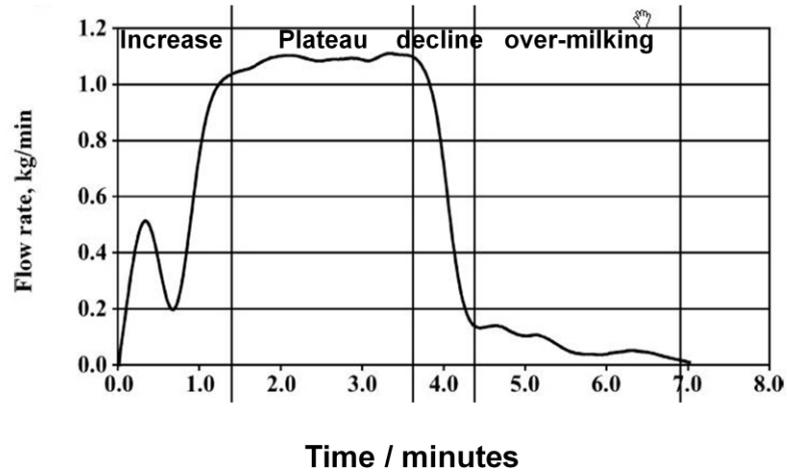
The point of the Pre-milking procedure diagram in the previous slide is not to prescribe a dogmatic milking procedure but rather to display milking procedure steps in the context of the timing criteria needed to establish a procedure that optimizes milk let down stimulus, pre-dip contact time and prep-lag time in order to minimize machine-on-time, maintain healthy teats/udder and achieve high quality milk production.

The assumptions are estimates based on the authors experience in observing properly done milking procedures on farms where quality milk is consistently produced.

The criteria are based on and supported by considerable research on lactation physiology of milk let-down response, teat sanitation procedures and milking efficiency.

Milk flow phases in kg/min

Tancin et al., JDS 2006



8-10 seconds prep, **No prep-lag**, 10 month study
n = 19,300 udder milk flow curves

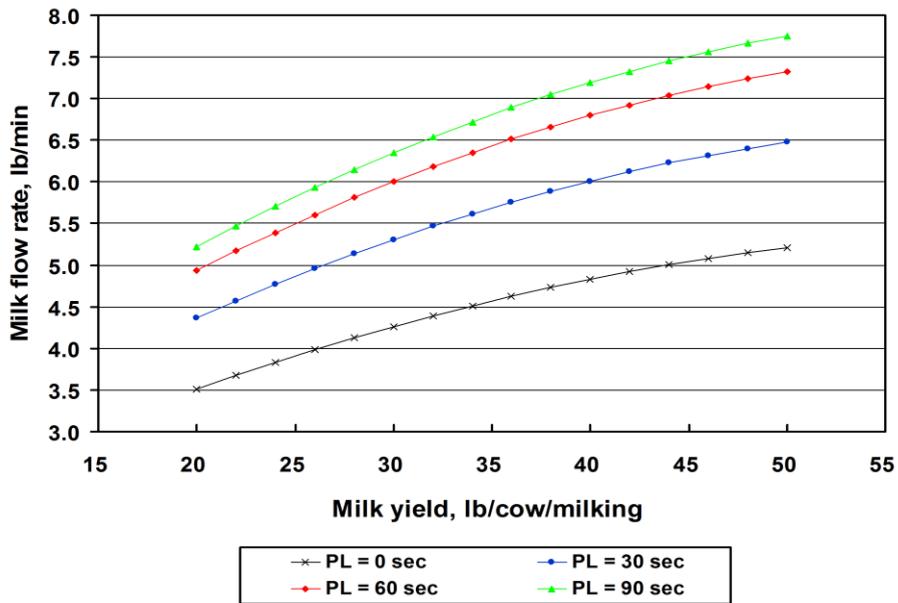
Factors effecting milk flow characteristics

(Tancin et al 2007)

- **Increase phase**
 - Cow prep time / intensity
 - Prep lag time
- **Plateau phase**
 - Prep lag time
 - Amount of milk
 - Milkability
- **Decline phase**
 - Release alveolar milk to cistern
 - Oxytocin/prep-lag
- **Over-milking phase**
 - Front quarters
 - ATO settings
 - Manual override use
 - Machine stripping

Machine alignment affects all aspects of milk flow and may also effect teat health

Variation of expected milk flow rate based on PLT.



www.ansci.umn.edu/dairy/dairyupdates.htm

Timing of Machine Attachment (prep-lag time) Is Important!

- **60-120 seconds acceptable range**
- **2X milking optimum 60-90 seconds**
- **3X milking optimum 90-120 seconds**
- **Less than 60 seconds not desirable**
- **Long delays of greater than 3-4 minutes may impair complete milk ejection**

Rasmussen M. et al., JDS 75:2131, 1992.
Shehaden, K. & Bruckmaier, R., JDR 78:97, 2011.
Waters, R. et al., JDS , 2011.



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Either immediate or delayed (> 3 min) attachment resulted in more “abnormal” teats ends

(Rasmussen 1992)

A scoring system for teat-end condition (Mein et al. 2001)

Score	Description	Illustration
1	<p>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</p>	
2	<p>S Smooth or Slightly rough ring A raised ring encircles the orifice. The surface of the ring is smooth or it may feel slightly rough but no fronds of old keratin are evident.</p>	
3	<p>R Rough ring A raised, roughened ring with isolated fronds or mounds of old keratin extending 1 - 3 mm from the orifice.</p>	
4	<p>VR Very Rough ring A raised ring with rough fronds or mounds of old keratin extending 4 mm or more from the orifice. The rim of the ring is rough and cracked, often giving the teat-end a “flowered” appearance.</p>	

Teat End Condition



SCC DIAGNOSTICS
TOOL BOX



Factors affecting teat condition

- Teat size, shape, position
- Milk production
- Parity, stage of lactation
- # milkings /day
- Pulsation vacuum, liners
- Machine-on time.....**OVERMIKING!**

QCW-7: Teat End Condition Scorecard

Score	Description	Illustration
N 1	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.	
S 2	Smooth or Slightly Rough Ring A raised ring encircles the orifice. The surface of the ring is smooth or it may feel slightly rough but no fronds of old keratin are evident.	
R 3	Rough Ring A raised, roughened ring with isolated fronds or mounds of old keratin extending 1 to 3 mm from the orifice.	
VR 4	Very Rough Ring A raised ring with rough fronds or mounds of old keratin extending 4 mm or more from the orifice. The rim of the ring is rough and cracked, often giving the teat-end a "flowered" appearance.	
5	Open Lesions or Scabs	Not pictured

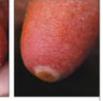
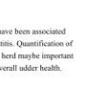
(Adapted from Men, et al., 2001, A Scoring System for Teat-end Conditions)

Maximum of 20% > Score 2



Teat end condition (0.5 scale scoring system)


TEAT CONDITION SCORE

Score	CRACKS				Score
0			Teats with cracks are scored a half point higher. i.e. 1.5 or 3.5		
1					1.5
2					2.5
3					3.5
	Cracked teat ends have been associated with incidents of mastitis. Quantification of cracked teat ends in a herd maybe important to help improve overall udder health.				
					4.5


TEAT SHAPES


ROUND - 1


INVERTED / FLAT - 2


TAPERED - 3

Effect of standardized milking routine

(Rasmussen et al JDS 1990)

Exp protocol	DIM	10 days	100 days	200 days	270 days
Std Prep	Prep-lag Interval	1.2 min	1.2 min	1.2 min	1.2 min
	Unit-on Time	8 min	7 min	6 min	6 min
Control	Prep-lag Interval	4.0 min	2.5 min	2.5 min	2.4 min
	Unit-on time	10 min	8 min	8 min	7 min



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Value of optimized and standardized milking routine

- 5.5% fat corrected milk yield
- Reduction in bacteria and spore counts in milk
- Higher milk flow rates and shorter machine on time
- Improved teat end condition
- Lower SCC





**Keep cows standing immediately after milking
to allow time for teat canal closure**



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Monitor Performance

Mastitis Bulk Tank Culture Report

Sample Description: Bulk Tank 2 - Am

Date Collected:

Type of Bacteria	Colonies/ml	Low levels	Moderate levels	High levels	Very High levels
Strep agalactiae:	0	<50	50-200	200-400	>400
Staph aureus:	45	<50	50-150	150-250	>250
Non-ag Strep:	1,400	500-700	700-1200	1200-2000	>2000
<i>High levels of Non-ag Streps usually indicate the degree of teat contamination at milking time, not infection of the gland. However, these organisms are good indicators for potential of infection with these organisms and/or elevated SCC.</i>					
Coliforms:	30	<100	100-400	400-700	>700
Staph species:	50	<300	300-500	500-750	>750



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Teat hygiene & condition is very important!

Whatever bacteria are on the teat surface when the milking machine is applied will end up in the milk!!!



Photos courtesy of IBA Millbury, MA

Important Take Home Message!


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Summary ideal milking routine

- **Prep-time = 10-20 seconds and teat surfaces are effectively cleaned**
- **Prep-lag time = 60-120 seconds to maximize oxytocin effect**
- **Standardize: every cow is milked exactly the same at every milking for her entire lactation**



Plan of action

- Analyze present milking routine
- Design routine ideal for farm
- Set standards of performance
- Provide regular training
- Monitor results





This 800 cow Minnesota dairy consistently has a BTSCC under 150,000. Quality does COUNT! The picture tells the story better than words.