

P-EF-1



Milk Quality and Stall Bedding Management

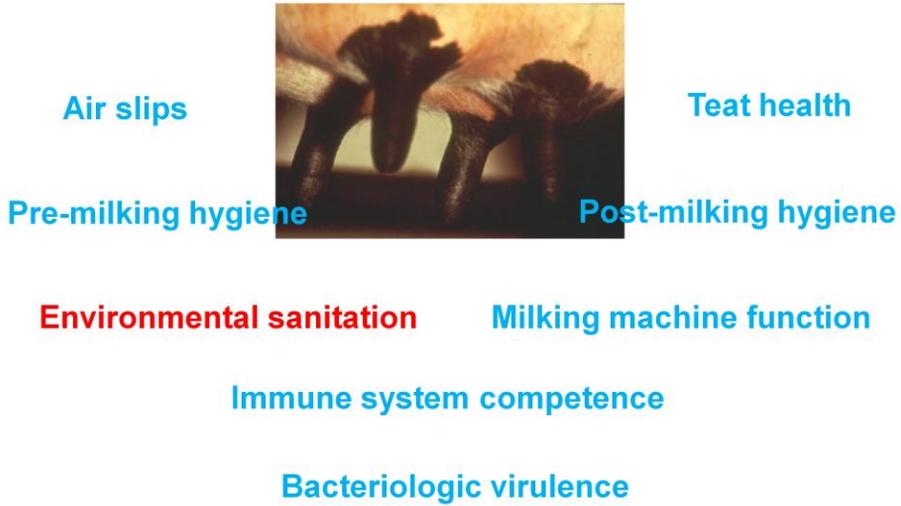
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The QUALITY COUNT\$ program offers us a great opportunity to make a difference in improving milk quality and lower mastitis in Minnesota.

Mastitis is a multi-factorial disease



Mastitis is a multi-factorial disease. Rarely is either a clinical mastitis or high SCC problem caused by a single entity. Hence a systematic problem solving approach is required to find effective solutions.

Purpose of bedding = Clean & comfortable cows




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This Minnesota dairy of 800 milking cows is an excellent example of clean and comfortable cows. The herd produces an average of 27,000 lbs of milk per cow with a SCC 150,000.

Bedding Choices



Depend on:

- **Manure system**
- **Availability**
- **Cost**
- **Low # bacteria**
- **Dust and odor**
- **Desire of dairy to minimize mastitis**

Bedding choices (cont.)

Inorganic bedding

- Sand (gold standard)
- lime



Photo courtesy of IBA Millbury, MA

Organic bedding

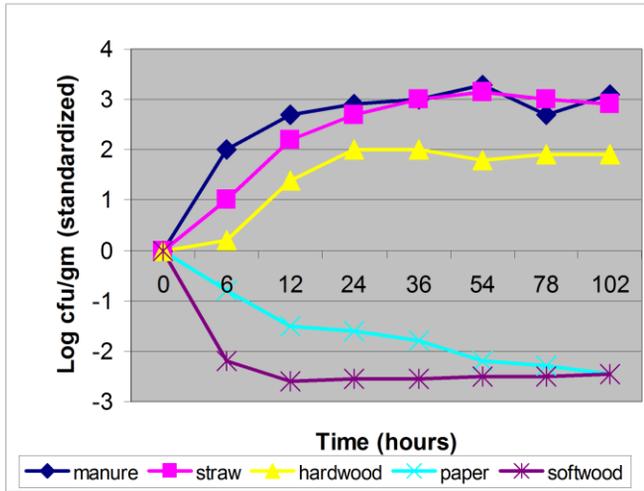
- Sawdust
- Shavings
- Straw
- Soybean straw
- Paper
- Re-cycled sand
- Manure solids
- Corn cobs
- Corn stalks

Inorganic bedding materials like clean sand and lime are characterized by having few if any nutrients required for bacterial growth. Organic bedding materials like sawdust, straw etc. , on the other hand, are characterized by the presence of nutrients needed for bacterial growth.

Factors affecting bacterial growth in bedding material

- ✓ **Moisture**
- ✓ **Adequate nutrients**
- ✓ **Compatible pH**
- ✓ **Favorable temperatures**
- ✓ **Stall Cleanliness**





Growth of Klebsiella bacteria in five bedding materials (Zehner et al JDS 1986)

Management factors affecting rate bacterial growth in bedding material



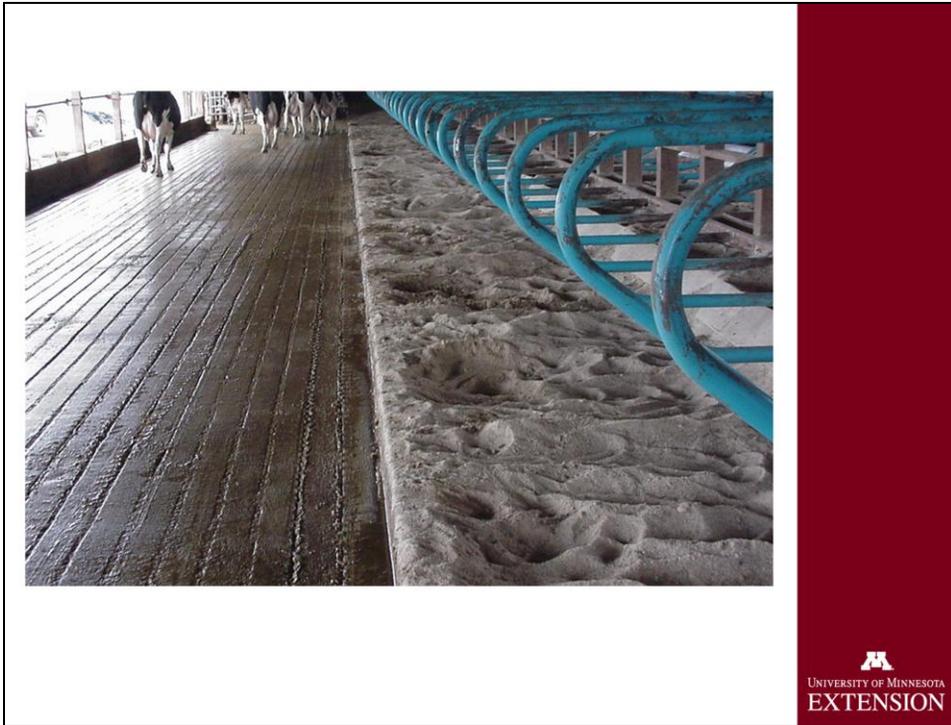
- ✓ Bedding type
- ✓ Alley scrapping
- ✓ Stocking rate
- ✓ Stall design
- ✓ Barn ventilation
- ✓ Ambient temp/humidity
- ✓ pH
- ✓ Frequency of change



**One gram of cow feces contains
1,000,000 coliforms**

Fecal and urine contamination of bedding is the most important factor for high bacteria counts in bedding.

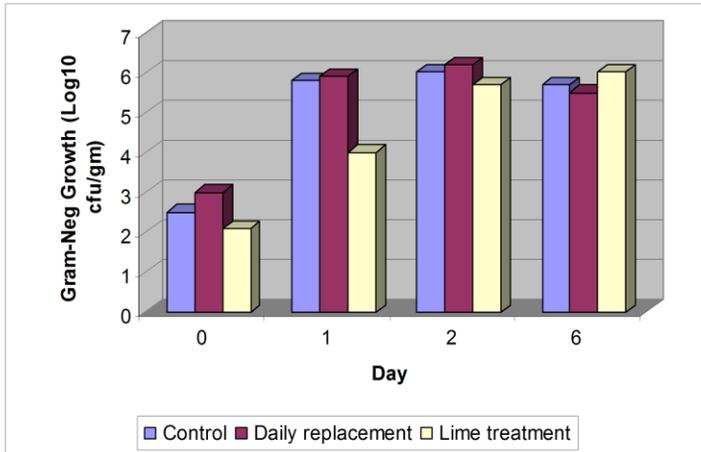
- **The average cow will shed about 115 pounds of manure over 24 hours.**
- **This will contain an average of 22,031,594,789 coliform bacteria per day.**
- **Add to this a similar number of environmental strep bacteria as well as other common environmental pathogens like staph species.**



This picture highlights well managed alleys and the sand free stall surfaces are kept clean. However, small stall size, a high brisket locator, low neck rail and impaired lung space make it difficult for cows to easily get up and down and use the stall space properly thus cow comfort is compromised.

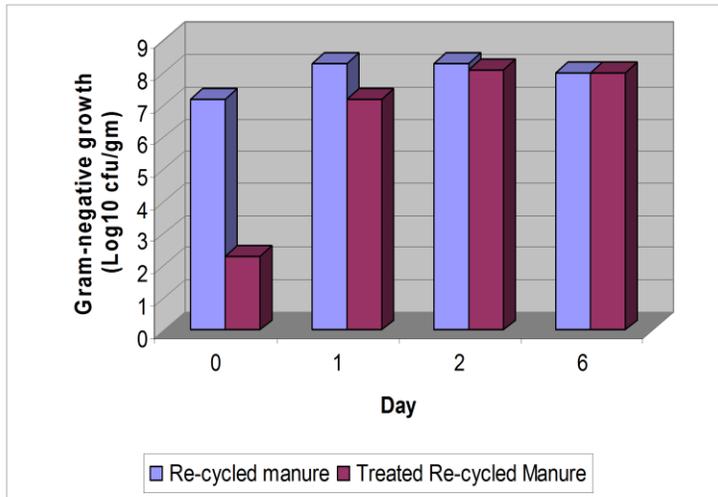


On the other hand, this slide shows stalls that are sized properly to provide excellent cow comfort, however, alley scrapping was being done so hastily that manure was being splashed into the sand bedded free stalls. One needs to remember that for every gram of manure splashed into the stall there will be approximately 2 million environmental mastitis causing bacteria.



Gram-negative bacterial growth in sawdust bedding

Hogan & Smith JDS 1997



Gram-negative bacteria growth in re-cycled manure solids

Hogan et al JDS 2007

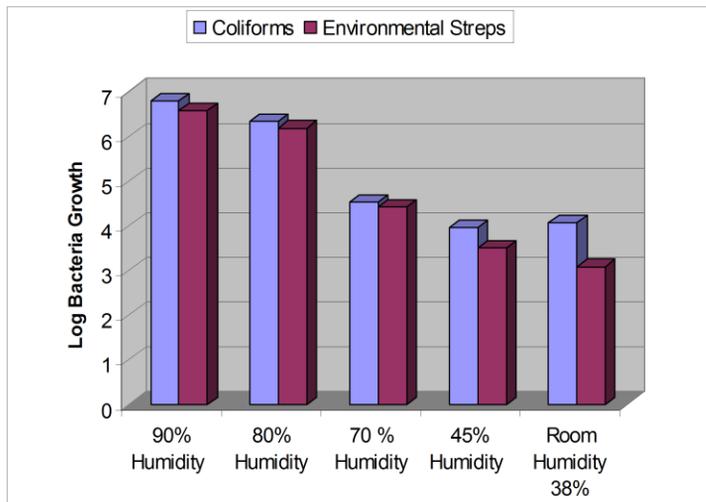
Bacteria populations on teat ends of dairy cows housed in free stalls.....(Zdandiwicz et al JDS 2004)

- ✓ **Env Streps and Gram negative pathogens peaked in counts ~24-48 hrs after bedding placed in stall.**
- ✓ **Pos correlation between bacteria in bedding and bacteria on teats.**
- ✓ **Dirtier stalls had higher bacteria counts.**
- ✓ **Stalls with higher moisture in bedding had higher bacteria counts.**

TAKE HOME MESSAGE # 1

- ✓ # bacteria in bedding peaks ~ 24hrs after placed in stall
- ✓ # bacteria in bedding correlates to # bacteria on teats.
- ✓ # bacteria on teat ends correlated to # mammary infections.



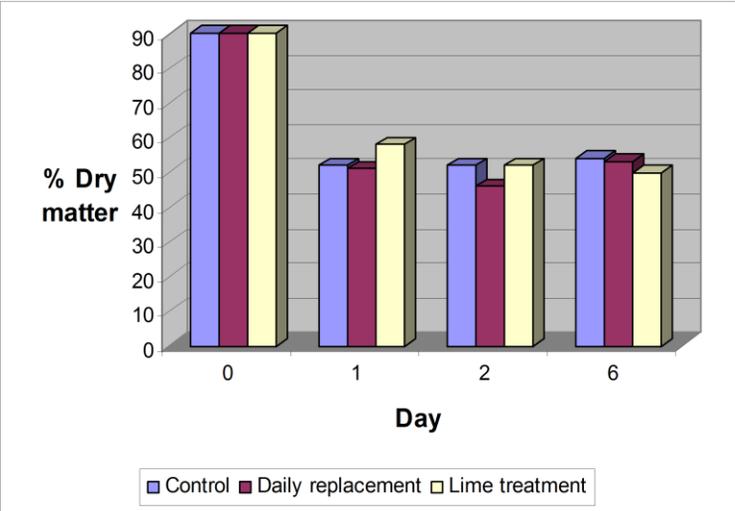


Effect of ambient humidity on bacterial growth in 24 hrs

Russ Bey – unpublished data



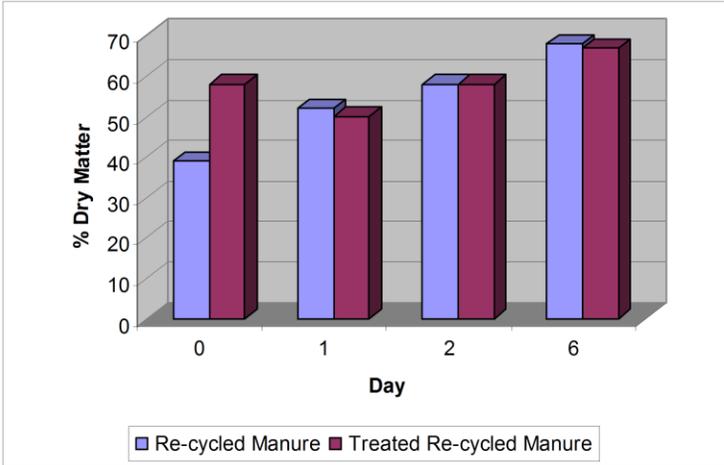
In this study a standardized amount of coliform and environmental strep bacteria were placed in standardized amount of sterilized organic bedding and then incubated at varying levels of humidity. The obvious conclusion is that higher ambient humidity will favor higher rates of bacterial growth.



Effect of ambient humidity on dry sawdust over time

(Hogan & Smith JDS 1997)





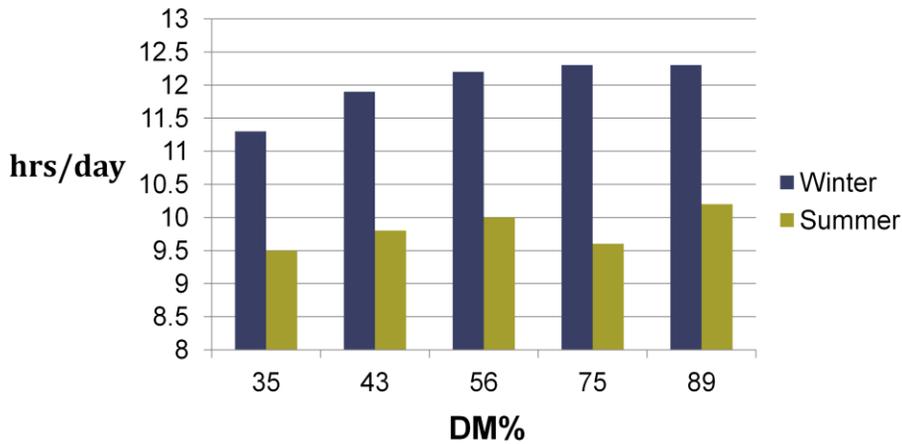
Effect of ambient humidity on re-cycled manure solids

(Hogan et al JDS 2007)



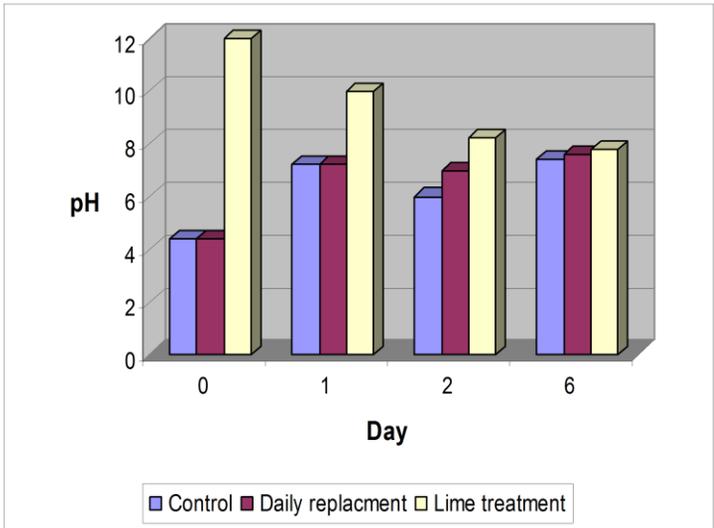
Effect of sawdust DM on lying behavior

Reich et. Al., JDS, 2010



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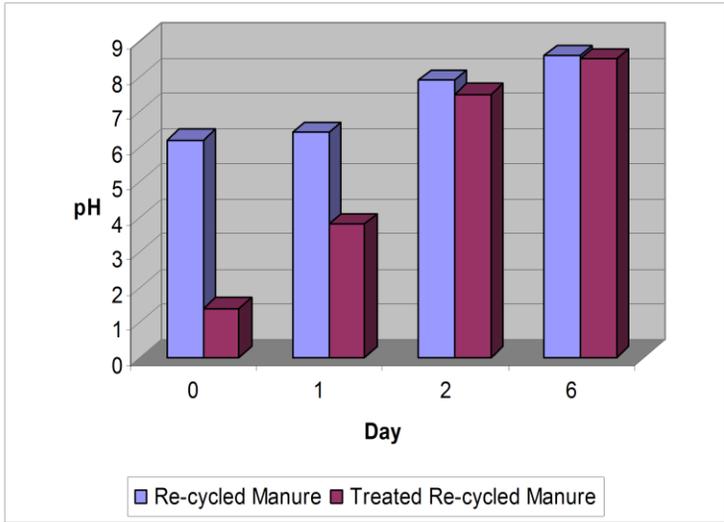
Not only is dry bedding important to keeping bacterial growth low British Columbia study of cow stall preferences with varying bedding DM% shows that cows prefer dry bedding. Lying time varied with season and DM%. These data indicate that from the standpoint of cow lying behavior that access to dry bedding is important to cows. Fregonesi et al in an earlier study (JDS 2007) demonstrated that cows would lie on dry sawdust (86.4% DM) 5 h/d longer than wet bedding (26,5% DM).



Effect of time in stall on bedding pH

(Hogan & Smith JDS 1997)





Effect of time/acidic conditioner on re-cycled manure pH

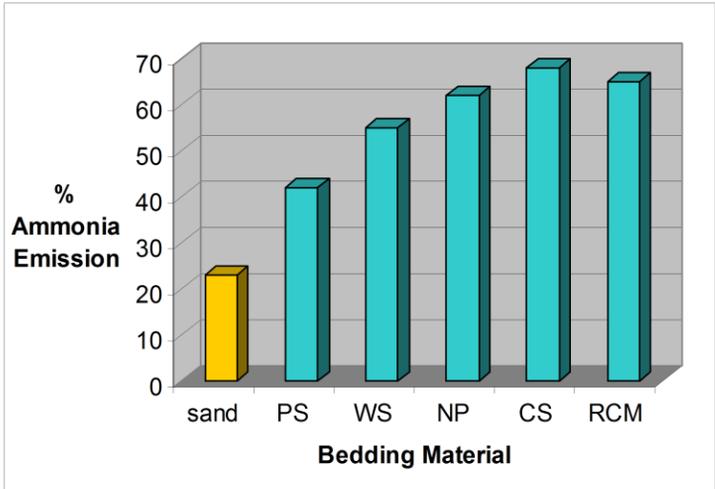
Hogan et al JDS 2007



Particle Sizing Organic Bedding



Bedding incubation count studies show that large particle size bedding materials supported less bacterial growth than fine materials.



Ammonia emissions from different bedding materials

Misselbrook & Powell JDS 2005



Bedding procedure can make a difference: Remember that for each 1 gram of manure there will be approximately 2 million environmental mastitis bacteria. It can be easily seen that at this dairy the sawdust bedding is contaminated with manure and the bedding bacteria counts were very high and the herd SCC was near 400,000. Their bedding procedure was to every other day drag a shovel down the back 1-1.5' of the free stalls and to replace this with fresh bedding. They had been instructed by their veterinary consultant to increase the intensity of their bedding management by cleaning the back of the stalls and replacing bedding every day.



They did comply with their veterinarians advice BUT bedding cultures continued to yield unacceptably high bacteria counts and the high SCC problem was persisting. **What's the problem?**

As you noticed in the previous slide the bedding was highly contaminated with manure and since they were not removing all the contaminated bedding before adding fresh bedding they were in effect feeding bacteria thus resulting in maintaining very high bacteria counts in the back half of the free stall where teat surfaces were being exposed to high levels of environmental mastitis pathogens.

What was the solution for this dairy: Once their veterinary consultant realized what was happening he instructed the herd manager to sweep all the contaminated bedding from the free stalls and begin a procedure of removing all the contaminated bedding in the back ½ half of every stall each day and place fresh bedding in it's place. Then once each week begin a practice of removing all the bedding from the free stalls while maintaining the daily procedure of removing the bedding from the back ½ of each stall and replacing it with fresh bedding.

Results: The bedding counts for this dairy dropped significantly and with a few months time the herd SCC decreased to 200,000.



Fresh Bedding

It is a common practice in many dairies to pile lots of fresh bedding in the front of the stalls and via cows moving in and out of the stalls the bedding is dragged back to cover the whole stall. In addition these dairies usually remove the soiled bedding the back of the stalls and reaching forward drag what looks to be apparently clean bedding from under the front of the cow to the back of the stall. Although a logical procedure how effective is it when it comes to maintaining low exposure of teat surfaces to environmental mastitis pathogens?



To evaluate this bedding procedure we began collecting bedding samples from the front, middle and back of free stalls and running bedding cultures on these samples. This slide shows an example of our typical findings. As cows walk into stalls they will track manure into the stall including into the front of the stall. Over time they incubate the bedding when lying on the stall surface and by the time the apparently clean (or cleaner) bedding is moved by the cow or farm worker to the back of the stall there can be very high numbers of bacteria to contaminate teat surfaces. It is obvious that this (although logical) procedure crates high exposure of teat surfaces to environmental mastitis pathogens.

Bedding recommendations:

- ✓ **Design stall for cow comfort and sanitation.**
- ✓ **Removed soiled bedding at each milking**
- ✓ **Scrape alleys at each milking**
- ✓ **Remove all organic bedding from back ½ of stalls daily and replace with fresh bedding**
- ✓ **Inorganic (sand) should be groomed daily and fresh bedding added weekly**
- ✓ **Maintain excellent barn ventilation – KEEP BEDDING DRY!**

Design stall for cow comfort and hygiene – the stall dimensions should be sized appropriately for cow size (Nordlund & Cook Flow chart for evaluating freestalls 2004) and are the neck rails and brisket locator are the proper height and appropriately positioned (Tucker et al JDS 2005, Fregonesi et al JDS 2009)

TAKE HOME MESSAGE # 2

- ✓ **Productive, healthy cows need 11-12 hrs rest each day.**
- ✓ **Long durations of rest place teats in direct contact with bedding.**
- ✓ **Effective bedding management is critical to udder health & milk quality**



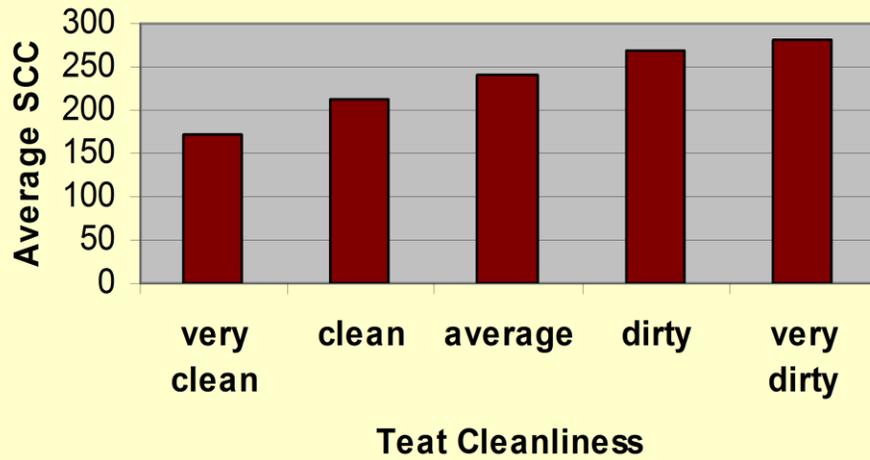
Correlation between cow hygiene scores and SCC count (Reneau et al JAVMA 2005)



100,000-150,000 SCC Difference

- ✓ High correlation between lower rear legs + udder hygiene scores and SCC
- ✓ Improving the average cow hygiene score by one score (scoring scale 1-5) resulted in 50,000 SCC reduction

Teat Cleanliness & SCC on French Dairies



Doumalin, L., 1995. Production Latiere Moderne, fev, Rennes, France



Milker hygiene at the end of milking shift

Some say an easy measure of cow hygiene is milker hygiene at the end of the milking shift. This milker had just finished milking several hundred cows when this picture was taken.

TAKE HOME MESSAGE # 3



- ✓ **Cleaner cows mean lower SCC, lower bacteria counts and longer milk shelf life.**

Last line of defense is Excellent Cow Prep!

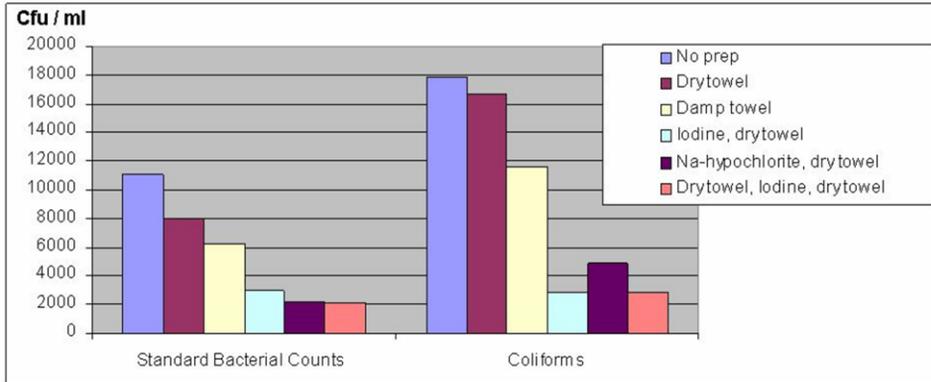
Mastitis Bulk Tank Culture Results

Strep ag	0
Staph aureus	0
Non-ag Strep	175
Coliforms	95
Staph spec	210

**Monthly BT
Culture results
need to look
like these**

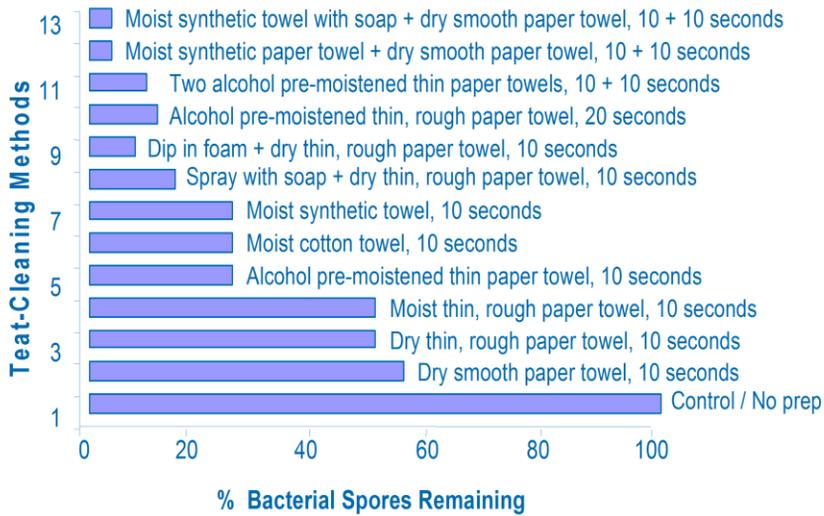
Teat cleaning methods do matter

The effect of udder preparation on bacterial counts in milk



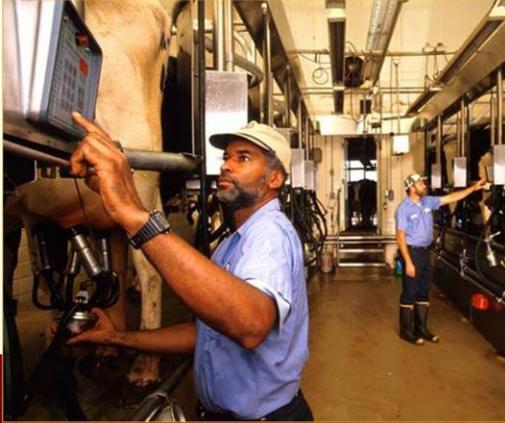
Adapted from Galton et al, 1986, J. Dairy Sc. 69-260-266 (7)

Effectiveness of different methods of cleaning spore contaminated teats (Magnusson et al 2006)



TAKE HOME MESSAGE # 4

- ✓ Excellent pre-milking cow prep is the last line of defense in assuring consistent production of quality milk.





Task sensitive monitors


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Teat swab test



Photos courtesy of IBA Millbury, MA

Task sensitive monitors





Line sampling during milking shift

Mastitis Bulk Tank Culture Report

Sample Description: Bulk Tank 1 - Pm

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:	5	<50	50-150	150-250	>250
Non-ag Strep:	298	500-700	700-1200	1200-2000	>2000
Coliforms:	45	<100	100-400	400-700	>700
Staph species:	45	<300	300-500	500-750	>750

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
<p><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></p>					
Coliforms:	30	<100	100-400	400-700	>700
Staph species:	50	<300	300-500	500-750	>750

Task sensitive monitors



TAKE HOME MESSAGE # 5



Monitoring:

- ✓ Whatever bacteria are left on the teats prior to machine attachment end up in the milk.
- ✓ Use task sensitive measures of people performance.

CONCLUSION:

Stall bedding management is very important for cow comfort, hygiene, health and consistent production of quality milk



Photos courtesy of IBA Millbury, MA

Questions?

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