Milk Quality

Why is it Important?
- to the cow
- to the producer
- to the consumer

Why is Milk Quality Important?

- Mastitis reduces the profitability of our industry
  - Most costly disease of dairy cattle is mastitis
  - Subclinical mastitis cost alone is >1 billion annually
  - Maximize price & minimize cost
- Consumers expect milk to be produced from healthy cows
- There is lots of room for milk quality to improve
## Somatic Cell Count and Relationship to Milk Losses

### NMC chart

<table>
<thead>
<tr>
<th>Linear Score</th>
<th>First Lactation</th>
<th>Older Cow</th>
<th>First Lactation</th>
<th>Older Cows</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-2</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>3</td>
<td>0.6</td>
<td>1.3</td>
<td>200</td>
<td>400</td>
</tr>
<tr>
<td>4</td>
<td>1.3</td>
<td>2.6</td>
<td>400</td>
<td>800</td>
</tr>
<tr>
<td>5</td>
<td>2</td>
<td>3.9</td>
<td>600</td>
<td>1200</td>
</tr>
<tr>
<td>6</td>
<td>2.6</td>
<td>5.2</td>
<td>800</td>
<td>1600</td>
</tr>
<tr>
<td>7</td>
<td>3.3</td>
<td>6.6</td>
<td>1000</td>
<td>2400</td>
</tr>
<tr>
<td>8</td>
<td>3.9</td>
<td>7.9</td>
<td>1200</td>
<td>2400</td>
</tr>
<tr>
<td>9</td>
<td>4.6</td>
<td>9.2</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### The Impact of Mastitis

The Impact of Mastitis Extends Beyond Somatic Cell Bonuses and Decreased Milk Production
SCC and Product Quality

- Injury to secretory cells reduces synthesis of lactose, fat & protein
- Increased permeability of cell membranes allows leakage of blood components into milk
- Reduced shelf life

Schallibaum, NMC 2001

Slide: Courtesy of Dr. Pam Ruegg

**Influence of Raw Milk Quality on Fluid Milk Shelf Life**

Milk does not have a standard shelf life. Better quality milk (low SCC and low preincubation bacteria counts) has a longer shelf life.

Shelf life is established at the plant using standardized tests that they refer to at the processors as "stress tests".

Longer shelf life milk is more profitable for the processor because **two additional days of shelf life decreases returns by 10 to 15%**.

This is the key reason that milk quality is so important to vertically integrated producers who own the milk all the way to the consumer and retailers such as Kroger's who process their own milk.
Clinical Mastitis/Prior to 1st Service
Effects on Reproduction

Oliver, University of Tenn.

Mastitis & Reproduction
(subclinical before service, clinical after)

Oliver, University of Tenn.
**Mastitis and Conception Rates**

- 8-15% lower conception rates
- 19-25 more days open.

**FIGURE 1**

The Effect of Mastitis on Reproductive Performance in Early Lactation Cows

<table>
<thead>
<tr>
<th>Study</th>
<th>Parameter</th>
<th>Mastitis</th>
<th>Uninfected</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ketton, et al. 2001*</td>
<td>Conception Rate†</td>
<td>30%</td>
<td>40%</td>
</tr>
<tr>
<td>Strick, et al. 2001**</td>
<td>Days to First Service</td>
<td>77.3 ± 2.7</td>
<td>67.8 ± 2.2</td>
</tr>
<tr>
<td></td>
<td>Days Open</td>
<td>110 ± 6.9</td>
<td>95.4 ± 5.8</td>
</tr>
<tr>
<td></td>
<td>Services per Conception</td>
<td>2.1 ± 0.2</td>
<td>1.6 ± 0.2</td>
</tr>
<tr>
<td></td>
<td>Conception Rate†</td>
<td>49%</td>
<td>63%</td>
</tr>
<tr>
<td>Frigo, et al. 2004***</td>
<td>Days Open</td>
<td>107 ± 5</td>
<td>88 ± 2</td>
</tr>
<tr>
<td></td>
<td>Services per Conception</td>
<td>2.1 ± 0.1</td>
<td>1.6 ± 0.1</td>
</tr>
<tr>
<td></td>
<td>Conception Rate†</td>
<td>48%</td>
<td>63%</td>
</tr>
</tbody>
</table>

* Based on clinical mastitis event within 30 days post-insemination
** Based on clinical mastitis before first service
*** Based on clinical mastitis cases
† Conception Rate = Pregnonacies/Services (Inverse of Services/Conception from trial data)


**High SCC before breeding**

- Cows with a linear score of greater than 4.5 (300,000) before breeding were twice as likely to lose their embryo by days 35 to 41 compared to cows with linear scores of less than 4.5.

Moore, et al JAVMA, VOL 226, No. 7, April 1, 2005
High SCC = Risk Factor For Abortions

Moore (1991) revealed a negative correlation between clinical mastitis caused by Gram-negative mastitis pathogens (generally environmental) and reproduction:

- due to altered inter-estrous intervals and decreased luteal phase length.
- Irregular cycles would cause increased variability in hormones essential for establishing a pregnancy.


**Figure 2**

Effect of Mastitis on Fetal Losses in Lactating Cows

Control vs Mastitis: P<0.01

- Control = no clinical mastitis
- G1 = first clinical mastitis prior to first postpartum A.I.
- G2 = first clinical mastitis between first postpartum A.I. and pregnancy diagnosis
- G3 = first clinical mastitis post pregnancy diagnosis

Mastitis Negatively Affects Reproduction
DMAST>0 vs. DMAST=0

Time to 50% Pregnant
135 DIM with no mastitis
vs
187 DIM with a case of mastitis

University of Missouri

- days open = 124 – no mastitis (n~7000)
- days open = 142 - with a case of mastitis (n~2200)
- P<.05
- days open = 118 – no mastitis (n~21000)
- days open = 136 - with a case of mastitis (n~7000)
University of Missouri

- Culling data
  - ~ 50,000 cows with no clinical Mastitis
    - 25.0% cull rate
  - ~ 15,000 cows with clinical Mastitis
    - 40.8% cull rate

Benefits of Quality Milk

Consumer

Cow

Producer

Processor

Dairy Wellness Makes a Difference
What Business Are We In?

We are in the Food Business.

Why Should We Be Concerned About Milk & Beef Quality?

Our Future Depends on Consumer Confidence

- The Consumer signs our paycheck;
- They purchase what they trust;
- Consumer trust and confidence is the basis of the future of our industry and the future of our children.
Food Safety . . .
Pfizer’s Commitment

Program of Food Chain Outreach

Pfizer Animal Health

It’s all Context with Consumers

• Food with a story: Embrace this at the farm level
• Communicate a health plan with the appropriate protocols in place that protect animal health and food safety.
  – Treat when sick or high risk
  – Ensure veterinarian involvement in medicine decisions
  – On label use: FDA - approved use still means something
  – Adhere to withdrawal times and prove it!
  – Test for residues and prove it!
  – Third party audits will likely be key in the future
Primary Research Objectives

• Understand how exposure to facts affects perceptions of medicine use and food quality/safety
• Identify safeguards that improve consumer confidence in dairy, beef and pork products

Baseline Confidence in Wholesomeness

- Dairy: 6% 33% 37% 24%
- Beef: 15% 37% 32% 17%
- Pork: 16% 38% 30% 16%
Baseline Confidence in Safety

Baseline Confidence in High Quality
Cows are raised by a team of people committed to the animals’ health and creating wholesome, high quality food for consumers. From the beginning of cows’ lives, veterinarians have a very important role in overseeing their health. As a part of their care, vaccines are oftentimes administered to cows to protect them from various illnesses.

As with any animal or human, cows can sometimes get sick over the course of their lives. In these situations, FDA-approved medicines, like antibiotics, are used to treat sick dairy cows under the supervision of licensed veterinarians.
If an antibiotic is administered to help a sick cow, then that cow’s milk is not allowed to enter the food supply until the antibiotic has sufficiently cleared the animal’s system. During this “withholding period”, the cow’s milk is discarded. The withholding period, which is established by the FDA for each approved antibiotic, ensures that the antibiotic does not end up in the milk and dairy products found in grocery stores and markets where you make milk and dairy purchases.

There is also an extensive testing system in place to ensure that no traces of antibiotics are in milk and dairy products. For instance, every load of milk sold by a dairy producer is tested multiple times for traces of antibiotics as established and overseen by state and government agencies. If their dairy products, including milk, test positive for any traces of antibiotics, these products are destroyed and the offending dairy producers are faced with steep fines.

Confidence in Dairy Wholesomeness:

*Top 2 box increase by 46%*

<table>
<thead>
<tr>
<th>Pre-Description</th>
<th>Post-Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>6% 33% 37% 24%</td>
<td>6% 23% 33% 35%</td>
</tr>
<tr>
<td>Mean = 6.9</td>
<td>Mean = 7.4</td>
</tr>
</tbody>
</table>
Confidence in Dairy Safety:  
Top 2 box increase of 36%

Pre-Description  
Mean = 6.9

Post-Description  
Mean = 7.4

Confidence in Dairy Quality:  
Top 2 box increase of 31%

Pre-Description  
Mean = 7.0

Post-Description  
Mean = 7.4
Recommendations

- To bolster customers’ confidence, dairy veterinarians and producers should be making basic facts available to the food chain.
- The research shows that using the core messages below will help:
  - Animals are under the care of licensed veterinarians.
  - Sick animals should be treated with medicines, such as antibiotics, to restore their health as long as protections are in place to ensure that their meat or milk is safe for people.
  - If medicine, such as an antibiotic, is administered to help sick animals, then their meat or dairy products are not allowed to enter the food supply until the medicine has sufficiently cleared the animal’s system.
  - Milk is tested and withdrawn from the human food supply if tests are positive for antibiotic residues.
  - Vaccines are used to protect animals from various illnesses.

Want to Export to Europe?

Meet 400,000 SCC Limit

By Jim Dickrell, editor, Dairy Today

3/31/2010

- Beginning Oct. 1, 2010, any dairy processor exporting to the European Union will need to certify that each farm that supplies milk for those exports must be below 400,000 somatic cell count.
Developing a Complete Milk Quality Program

1. The cows and their environment
2. The milking procedures
3. The milking equipment
4. The monitoring & treatment Program

Minimize bacterial load / maximize immunity

Dry
Clean
Comfortable
Facilities Evaluation

- Cow Comfort Quotient
- Hygiene Scores
- Hock Injury Scores
- Stall contamination rate
- Stall Measurements

Cow Comfort Evaluation
Environmental and Behavioral Factors

- Cow Comfort Quotient (CCQ)
- CCQ = cows lying properly x 100 cows “in” stalls
- Goal is at least 80%
- Cows should be lying down at least 12-14 hours a day
Correlation between Cow hygiene scores and SCC count
(Reneau et al JAVMA 2005)

- 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
Stall Design

Position neck rail as far to rear without interfering with lying down or rising.

Top of Upper Rail
48" Above Curb Level
45" Above Top of Sand

Beveled

9" Max

Worm: 45°-46° On Center

36" Gap

Top of Lower Rail
9" Above Curb Level

1" gap

67"-68" Curb to Brisket Board
at Top of Sand

Brisket Board
60 Degree Angle

65'-66' Curb to Brisket Board on Level

4" Allow

8' or more Total Length (open front)

9'-10'

8'

X = Curb Level Reference Measurement Point

Dairy Wellness Makes a Difference
<table>
<thead>
<tr>
<th>Stall Dimension (inches)</th>
<th>Body Weight Estimate (lbs)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1000</td>
</tr>
<tr>
<td>Total stall length facing a wall</td>
<td>96</td>
</tr>
<tr>
<td>Head-to-head platform length</td>
<td>192</td>
</tr>
<tr>
<td>Distance from rear curb to brisket locator</td>
<td>64</td>
</tr>
<tr>
<td>Center-to-center stall divider placement (Stall width)</td>
<td>44</td>
</tr>
<tr>
<td>Height of brisket locator above stall surface</td>
<td>3</td>
</tr>
<tr>
<td>Height of upper edge of bottom divider rail above stall surface</td>
<td>11</td>
</tr>
<tr>
<td>Height below neck rail</td>
<td>44</td>
</tr>
<tr>
<td>Horizontal distance between rear edge of neck rail and rear curb</td>
<td>64</td>
</tr>
<tr>
<td>Rear curb height</td>
<td>8</td>
</tr>
<tr>
<td>Rear curb width (loose bedded stalls)</td>
<td>6</td>
</tr>
</tbody>
</table>

### Hock Injury Score Definitions

- **Score 0**: Normal
- **Score 1**: Hair loss, no swelling
- **Score 2**: Swelling, no hair loss
- **Score 2**: Swelling, hair loss
Parlor Evaluation

- Milking routine
- Prep-lag time
- Teat end swab scoring
- Teat end scoring
- Strip yields
- Milk sock test

The GOALS of Milking Management

“Milkability & COWsistency”

- Faster Milking
- More Milk Production
- Better Quality Milk

Attach to a:
- Clean
- Dry
- Well-Stimulated Teat
Milking Procedures

Teat end swab test
Teat Cleanliness Scoring System

Scoring System
1. No visible dirt or dip
2. Visible dip stain
3. Small amount of dirt or manure
4. Large amount of dirt or manure

The single biggest factor to rapid and complete milk outs.

**GOAL ~ 90 - 120 SECONDS**

(Fore Strip to Unit Attachment)
Teat End Scoring

TEAT END SCORING (Score 20% cows in each pen)

Score:  Color: R (Red) B (Blue) Black (Bl) and Mouthpiece mark at teat base (M)

1. Dip Teats, Don’t Spray
2. Clean Dipper and Fresh Dip
3. Cover 90% of the Entire Teat
4. Use an Approved Teat Dip
Successful Dipping
Complete coverage of the teat

Teat Dipping
Splash and Bang Method
Monitoring Primary Parameters for Milk Quality

- BMSCC over time (set goals and action points)
  Influenced by:
  - New infections (driver of SCC dynamics)
  - Chronic infections
  - Fresh cow/heifer with high SCC
- Treatment of treatable infections.
- Manage the untreatable.

<table>
<thead>
<tr>
<th></th>
<th>New</th>
<th>Chronic</th>
<th>Fresh</th>
</tr>
</thead>
<tbody>
<tr>
<td>Top</td>
<td>≤5%</td>
<td>≤5%</td>
<td>≤10%</td>
</tr>
<tr>
<td>Ok</td>
<td>~8%</td>
<td>~8%</td>
<td>~15%</td>
</tr>
<tr>
<td>Not ok</td>
<td>10+%</td>
<td>10+%</td>
<td>20+%</td>
</tr>
</tbody>
</table>
Analyze high SCC

<table>
<thead>
<tr>
<th>Contribution of individual cows</th>
</tr>
</thead>
<tbody>
<tr>
<td>Few Cows (&lt;2%) responsible for high counts</td>
</tr>
<tr>
<td>More than 2% of cows are responsible</td>
</tr>
</tbody>
</table>

* New | Chronic | Fresh |
--- | --- | --- |
Top | ≤5% | ≤5% | ≤10% |
Ok | ~8% | ~10% | ~15% |
Not ok | 9+% | 10+% | 18+% |

New infections >8%*

- Segregate
- Culture
- Treat
- Dry
- Cull

Chronic infections >8%*

- Hygiene
- milking procedures
- Purchased cattle
- Segregation
- Days in milk / Dry
- Seasonality
- Pen/barn specific effects

Scc Patterns: Hefers vs cows: High SCC Cows

- Segregate
- Treat
- Cull/dry

Dry off | In Lactation

Clinical Mastitis Event

Clinical Mastitis Management

1. Take milk sample, culture and/or freeze
2. Grade infection according to these guidelines:
   - Grade 1 = Cow not sick/udder not swollen
   - Grade 2 = Cow not sick/quarter swollen
   - Grade 3 = Cow systemically sick
3. Use decision tree below to select proper treatment

Clinical Mastitis Protocol

Take milk sample: Cultured and/or freeze
Relative Occurrence of of Mastitis Grade

<table>
<thead>
<tr>
<th>Grade</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grade 1</td>
<td>70%</td>
</tr>
<tr>
<td>Grade 2</td>
<td>20%</td>
</tr>
<tr>
<td>Grade 3</td>
<td>10%</td>
</tr>
</tbody>
</table>

Dr. Dawn Morin, U of IL

“The Cost of Cure”
The Economic Equation

- Efficacious – Does it really work?
  - (clinical vs. bacterial cures?)
- cost of drug / day
- cost of milk discard
- milkings at risk for an adulteration
- Relapses & SCC
### Choice of Route for Antibiotic Administration

<table>
<thead>
<tr>
<th>Grade 1 = Localized to Mammary Gland</th>
<th>Grade 2 = Mastitis with Mild Systemic Disease</th>
<th>Grade 3 = Mastitis with Severe Systemic Disease</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intramammary Infusion</td>
<td>Intramammary Infusion</td>
<td>Parenteral Antibiotics</td>
</tr>
<tr>
<td></td>
<td>+/- Parenteral Antibiotics</td>
<td>Appropriate supportive therapy</td>
</tr>
</tbody>
</table>

---

### University of Tennessee Research

**Extended Antibiotic Therapy for Treatment of Subclinical & Clinical Mastitis in Dairy Cows**

**S. P. Oliver**  
Department of Animal Science &  
Food Safety Center of Excellence  
The University of Tennessee  
Knoxville, TN
Extended Therapy
Cows with Subclinical Mastitis - Gillespie 2002


Extended Therapy
Strep. uberis Clinical IMI

Spectramast LC® treatment
Treatment duration

% bacteriological cure

Study

No treatment
2-3 day subclinical
2-3 day clinical
Extended therapy

CLINICAL MASTITIS PROTOCOL, PART 1

TAKE MILK SAMPLE: Culture and/or freeze

COW NOT SICK

QUARTER NOT SWOLLEN (Grade 1)

CULTURE

- NO GROWTH
  - Consult your veterinarian for recommendations

- GRAM NEGATIVE
  - SPECTRAMAS
  - TLC is approved for 2-8 days IMM treatment of E. coli mastitis
  - Consult your veterinarian for current therapy guidelines
  - Evaluate vaccination program

- GRAM POSITIVE
  - Treat for 2-8 days with IMM therapy
  - Follow label directions
  - Consult your veterinarian for recommendations

NO CULTURE

QUARTER SWOLLEN (Grade 2)

- NO GROWTH
- Consult your veterinarian for recommendations

- Follow protocol as for Grade 1
- Also consider anti-inflammatory therapy
- Consult your veterinarian for recommendations

Dairy Wellness Makes a Difference
CLINICAL MASTITIS PROTOCOL, PART 2

TAKE MILK SAMPLE: Culture and/or freeze

COW SICK

QUARTER SWOLLEN (Grade 3)
Physical exam, systemic antibiotic**, other supportive treatments (such as anti-inflammatory, calcium, hypertonic saline)

CULTURE

NO GROWTH
• Discontinue IMI therapy
• Systemic antibiotic**
• Supportive therapy as needed
• Evaluate vaccination program

GRAM NEGATIVE
• SPECTRAMAST LC is approved for 2-8 days IMI treatment of E. coli mastitis
• Systemic antibiotic**
• Evaluate vaccination program
• Supportive therapy as needed

GRAM POSITIVE
• Use appropriate Gram-positive protocol outlined under grades 1 and 2
• Systemic antibiotic**
• Evaluate vaccination program
• Supportive therapy as needed

NO CULTURE
• Systemic antibiotic**
• Evaluate vaccination program
• Supportive therapy as needed
• Consult your veterinarian for recommendations

Subclinical Implementation

• Choose treatment parameters
  – Parity
  – Length of Time Greater than 200,000 SCC
  – Udder Consistency
  – Cow Value
  – Bacterial Culture
• Once a month – DHIA sheet
• Establish SCC threshold with veterinarian
• CMT high cows to identify infected quarter
• Culture infected quarter
**SUBCLINICAL MASTITIS PROTOCOL**

**EVALUATE INDIVIDUAL COW SCC**

<table>
<thead>
<tr>
<th>SCC &lt; 200,000</th>
<th>SCC &gt; 200,000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Continue to monitor monthly</td>
<td>2 consecutive months</td>
</tr>
<tr>
<td>Establish herd appropriate SCC level with herd veterinarian</td>
<td>CMT all quarters to identify potentially infected quarter(s). Quarters with a positive CMT score should be considered potentially infected</td>
</tr>
<tr>
<td>Perform culture to identify mastitis pathogen present in quarter(s) identified as having a positive CMT score.</td>
<td></td>
</tr>
</tbody>
</table>

- **Negative:** No treatment recommended. If SCC continues to be high, culture again (consider *Mycoplasma/Coxiella*).
- **S. aureus:** Extended therapy (consider sensitivity).
- **Strep spp.:**
  - *S. agalactiae:* Therapy with β lactam*.
  - *S. uberis:* Extended therapy (consider sensitivity).
  - *S. dysgalactiae:* Therapy with β lactam*.
- **CNS:** Therapy with β lactam* (if sensitive).
- **E. coli/Klebsiella:**
  - Label treatment: limited data available
  - Consider culling.

---

**Therapy: You Must Define Success**

- Clinical cure – normal milk/udder
- Reduction in SCC - <200,000
- Microbiologic cure – elimination of pretreatment pathogen/no growth
- Clinical/microbiologic cure
- Relapse rate
- When is this assessed? 14-21 days after treatment
- **Records, Records, Records**
Mastitis Therapy Protocols
Choose Wisely……..

It’s not the drugs…it’s how we use them !!!!

Do It right!

Quality Milk Issues

Working Together for Success!

Dairy Wellness Makes a Difference