Milk Quality and Quality Milk

John Swain
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References – Charles Hutchinson LSU
Larry Fox WSU

Quality Milk is a Function of:

- Healthy Cows
- Clean environment (housing and milking equip.)
- Proper milking procedures and protocols
- Personnel who management and implement

Healthy Cows

- Cows free of mastitis and other diseases and .................

- .........on a good plane of nutrition.
Healthy Farms

• Employ practices to keep cows healthy:
  – Maintenance of milking equipment
  – Milking system cleaning

Good Housing

• Loafing area clean
• Bedding Clean and Dry
• Ventilation adequate

Why Worry About Quality

• Pasteurized Milk Ordinance
• Profit
  – Premiums
  – Milk Yield
The PMO (Pasturized Milk Ordinance)
1. Regulate all milk that is produced in this country
2. The trade of milk that passes interstate lines
3. Be developed by the NCIMS and FDA
4. To effect only the processors
5. To effect only the dairy producers

Contamination from Outside

- “Chemicals”
  - Disinfectants
- Bacteria
- Dirt and debris
- Water
NDA Quality Program

<table>
<thead>
<tr>
<th>ITEM</th>
<th>NDA QUALITY STANDARDS</th>
<th>PRICE ADJUSTMENT IF STANDARDS ARE EXCEEDED</th>
</tr>
</thead>
<tbody>
<tr>
<td>Raw Bacteria</td>
<td>10,000 or less</td>
<td>-5 cents</td>
</tr>
<tr>
<td>Preincubation</td>
<td>50,000 or less</td>
<td>-5 cents</td>
</tr>
<tr>
<td>Sediment</td>
<td>#1 or #2</td>
<td>-5 cents</td>
</tr>
<tr>
<td>Water</td>
<td>Normal</td>
<td>-5 cents</td>
</tr>
</tbody>
</table>

LEUCOCYTE ADJUSTMENTS FOR PNW ORDER:

<table>
<thead>
<tr>
<th>ITEM</th>
<th>NDA QUALITY STANDARDS</th>
<th>PRICE ADJUSTMENT IF STANDARDS ARE EXCEEDED</th>
</tr>
</thead>
<tbody>
<tr>
<td>Under 150,000</td>
<td></td>
<td>+12 cents</td>
</tr>
</tbody>
</table>

Contamination from Outside

- “Chemicals”
  - Disinfectants

- No PMO regulations- but concern
  - Halides
    - Organic compounds- zero tolerance?
    - Not a major issue….anymore?
Contamination from Outside

- Bacteria - Generally Equipment source
- and dirty cows

SPC - specific plate count (raw or total count)
LPC - Lab Pasteurized count
PI - Preliminary Incubation Count
Coliforms (lactose and gram neg rods)

Standard Plate Count
(Raw Sample Count)

37°C
48 Hours

Standard Plate Counts

- One measure of milk quality is the bacteria content of raw milk. This is often termed the raw count or the Standard Plate Count (SPC). The SPC determines the total number of bacteria in a milk sample that can grow and form countable colony forming units on a Standard Methods Agar plate when 1 ml of milk is incubated aerobically at 90°F for 48 hours.
Psychrotrophic Bacteria
Preliminary Incubation Count - PI

Raw Sample

(Shortcut: Hold sample for 18 h, 13 C, then plate on agar)

Preliminary Incubation Counts

• Another measure of milk quality is the Preliminary Incubation Count (PI count or PIC). To determine PIC, a sample of milk is incubated for 18 hours at 55°F followed by the SPC procedure. The PI count is based on the theory that the normal microbial flora of the cow will not grow very well when incubated at this combination of time and temperature.

• However, other microorganisms present in milk due to poor sanitation, cooling and milking practices CAN grow to significant levels at these times and temperatures. These microorganisms are called psychrotrophs or cold-loving bacteria. Psychrotrophic bacteria will continue to grow at temperatures below 45°F. These organisms and the enzymes they produce are associated with off-flavors, milk spoiling and short shelf-life.
Preliminary Incubation Counts

- This has led some people to believe that PIC is the best measure of raw milk keeping quality and sanitation practices on farms. Currently there is not a legal limit for PIC. A PIC of below 50,000 is acceptable, but a goal of 25,000 or less should be achievable. Many can have a PIC of 10,000 or less just like the SPC if sanitation, cooling and milk procedures are done properly and monitored.

PIC versus SPC

- Another approach for determining the quality of the milk and good practices on the farm is the PIC in relation to the SPC. If the PIC > 3 times the SPC, then there is a potential problem. For example a milk sample has a SPC of 10,000 and a PIC of 11,000, then no substantial increase occurred and the PIC would not imply poor cooling, milking or cleaning practices. If the PIC had been 30,000 or greater, this would imply that procedures on the farm should be checked.

LPC: Lab. Pasteurized Count
Thermoduric Bacteria

- 62.8°C For 30 min

Std Plate Count

- 37°C 48 Hours
Causes of High Bacteria Counts

• If the herd is experiencing an SPC above 10,000 bacteria/ml or a PIC above 25,000 bacteria/ml, the following are some areas to check.

1. Improper cleaning of milking equipment after each milking or neglecting to sanitize equipment before the next milking.
Causes of High Bacteria Counts

2. Wash water temperature should start at 155-170°F and drain at above 120°F.

Causes of High Bacteria Counts

3. Using the wrong amount or type of detergent, acid or sanitizer.

Causes of High Bacteria Counts

4. Gaskets, teatcup liners, rubber parts and hoses need to be clean, free of cracks and deposits and replaced when needed.
Causes of High Bacteria Counts

6. Keep your animals out of the mud! Animals with excessive or long hair on their udders may need their udder hair clipped or singed.

Causes of High Bacteria Counts

7. Poor udder sanitation procedures or excessive water use to wash teats. Teats need to be clean, sanitized and dry before milking.

Causes of High Bacteria Counts

8. Check your bulk tank cooling system. Slow cooling bulk tank or temperature above 40°F. The bulk tank milk temperature should be less than 40°F within two hours of milking and kept below 45°F during milkings.
Evaluating Milk Quality

- Monitoring the milking procedures, equipment cleaning and milk cooling should go a long way in producing high quality milk that is low in bacteria. If you are having a bacteria problem, work with your local county agent and milk company or coop field representative.

Other Tests of Quality

“Added Water”

- Addition of water dilutes salts and lactose
- Tested for using a cryoscope
- Freezing pt. of >-.530 Hortvet indicates that milk composition is abnormal
- Intentional addition of water, poor system drainage, use of excessive water during prep, backflushing units with the vacuum on, rinsing top of bulk tank, freezing bulk tank milk

Ruegg, Univ. WI

Other Tests of Quality

“Rancidity”

- Result of hydrolysis of fatty acids
  - Violent agitation, air leaks or excessive pumping
- Causes objectionable flavors
- Psychrotrophic organism in milking equipment can produce lipases
  - Pseudomonas, aerobacter & bacillus
- Expressed as acid degree value (ADV)
  - Ml of 1 N base required to neutralize acids in 100 g of fat
- Normal value of milk: .25 to .40
  - Not considered abnormal until ADV >1.0

Ruegg, Univ. WI
Other Tests of Quality
“Sediment”

- Required test but frequency of testing is undefined
- Sediment scores on filters
- Excessive udder hair + sand bedding + poor premilking premilking hygiene

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Differential

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<thead>
<tr>
<th></th>
<th>Low Coliform &lt;100</th>
<th>High Coliform &gt;750</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low LPC &lt;300</td>
<td>No problem</td>
<td>Teat Contam Cow Env</td>
</tr>
<tr>
<td>High LPC &gt;500</td>
<td>Machine Cleaning</td>
<td>All</td>
</tr>
</tbody>
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Bacteria can affect milk quality and can be measured by

1. Standard plate count that measures milk before it goes into the Bulk Tank
2. The PI count that measures the psychrotrophs or cold loving bacteria
3. Coliform count
4. Lab Pasteurized count that measures the thermoduric organisms which affect shelf life
5. The PI count that measures the psychrotrophs or cold loving bacteria