Milk Quality Is More than Somatic Cell Count and Standard Plate Count, It’s Now Shelf-Life

David R. Bray

Department of Animal Sciences – University of Florida

In the past few years the only worries for the dairyman were to keep their Somatic Cell Count under the 750,000 cell/ml limit. For some this has been a problem, but for most our cell count are very acceptable especially with the climate we have in the Southeast.

Changes in milk marketing have changed this and now milk is expected to last for twenty four days. All processors want longer shelf-life and we are expected to provide milk that is acceptable to them.

Components of Good Shelf-life Milk

1. **Cooling**
   Cooling the milk as quickly as possible results in slow growth of bacteria, in the Southeast a chiller based plate cooler’s of the proper size will allow milk to be cooled to as low as 33 – 34°C almost instantly. If milk stays cold until pasteurization it will give the best chance for a long shelf-life. Part of this process is proper agitation while filling and during storage. Many new bulk tanks do not have cooling plates so milk in the tank will never get colder. Tanks that hold more than one milking, commingled milk temperature should not get above 45°C, 40°C is better.

2. **Proper Cleaning and Sanitization of Equipment**
   There are many places for things to go wrong in the cleaning of the milking system. We go from the liners on the teats of cows to the bulk tank and everything in between, the claws, milk hoses, sensors, valves, metering devices, receiver jars, plate coolers and milk pumps. The more components within the system the chances that proper washing action may not take place increases. If surfaces anywhere in the system are not cleaned and or sanitized they may allow solids to build up and this can harbor bacteria that can lead to bacteria and milk quality problems.

3. **Cows**
   Milk from high SCC cows is bound to cause long term shelf-life problems. While it is known that mastitic cows produce milk that lowers cheese yields, there is not much data on high SCC and shelf-life and what study.
   a. **Study 1.** In a Cornell Study (Ma.etal.2000) found that eight cows artificially infected with strep.ag. which caused high SCC milk (600,000-1,000,000) had off flavors after 14 days, and cows with low SCC milk (<100,000) was good for 21 days, since the taste tests were done on days 1, 7, 14 and 21 days we don’t know if the high SCC milk was ok on day 20. The 2% milk was pasteurized and homogenized HTST 165.2°F for 34 seconds. The milk was judged by a trained panel, six sessions of training. The most interesting thing was the milk was heated to 68°F temperatures to make the detection of volatile compounds easier to detect.
b. Study II. It was demonstrated that the number of days before off flavor would be detected in 2% fat milk held at 43 °F increased from 18 to 56 days when the somatic cell count of raw milk was decreased from 1,000,000 cell/ml to 25,000 cells/ml. (Santos et al. 2003).

4. Post Pasteurization

In my early years in the business I learned that what left the processing plant as a high quality product ended up as spoiled milk on a loading dock of some school or store. I believe this is still the case. The following is a quote from Dr. Dave Barbano from his National Mastitis Council talk in 2004 on SCC and Milk Characteristics Needed to Serve Current International Markets. Is this the market Florida wants to be in?

"The ability to maintain flavor stability in dairy products, dairy ingredients, and food products produced using dairy ingredients will be the limiting factor in global marketing and distribution of dairy foods. In healthy dairy herds today, the majority of the cows have milk somatic cell counts of under 50,000 cell/ml. In these herds most of the bulk tank somatic cell count can be contributed by a relatively small number of individual cows. Milk with very low somatic count could be assembled if there was an economic incentive provided by the processor to do this. However, before fluid processors can achieve the full economic benefit of longer shelf-life of very low somatic cell count milk, the processor must be able to achieve very low bacteria counts after processing and maintain low bacteria count during refrigerated storage. If a processor can do this, the true benefits of very low somatic cell count milk can realized by a fluid milk or dairy based beverage processor".

Somatic Cell Counts on Shelf Life

The goal for SCC is <300,000 CFU/ml. While high SCC milk will have a big effect on shelf-life of processed milk it is not the only cause and trying to select or reject milk for long shelf life by SCC will be a hit or miss situation. High SCC milk should be rejected, but low SCC milk may have short shelf-life because of high bacteria, improper cooling etc.

Conclusions

Public health standards for bacteria and somatic cell counts of raw milk are designed to protect public health not to maximize dairy product quality and shelf-life. The ever increasing demands from the evolving structure and strategies of both national and international food retailing and food service present new challenges, but also new business opportunities to milk producers and dairy product manufacturers. A stronger partnership between milk producers and milk processors to equitably share the costs and benefits of improved milk quality provides an opportunity for expanded marketing and increased dairy product consumption for the future.

Milk Quality Tests

In my opinion bacteria counts will have more effect on shelf-life so we need to start with these:
Standard Plate Count (SPC) < 10,000 Colony Forming Units/ Milliliters (CFU/ml) is the Goal

The SPC is the total quantity of visible bacteria in 1 ml of raw milk expressed as CFU/ml. These bacteria are counted but not identified. Bacteria may come from cows with mastitis, Strep Uberis and Strep Ag. Cows can sometimes add high numbers of bacteria; most other organisms do not influence SPC. Other sources are milking wet dirty udders, dirty milking equipment, and lack of proper pre milking sanitation.

Lab Pasteurized Count (LPC) <200 CFU/ml is the Goal

I believe this test is the one that affects shelf-life more than any of the others. It has the most influence for long shelf-life. This test determines how many bacteria are present that survive pasteurization at 145°F for 30 minutes. These bacteria are typically found in the soil. They are often spores (bacillus) and coliforms. These are resistant to many sanitizers that normally kill growing bacteria quickly. If they enter the bulk tank they may survive the normal pasteurization process and cause post pasteurization problems like decreased shelf-life. Their entrance into the milk supply is due to milking wet dirty udders, chasing milk into the receiving jar with a rubber hose. Rubber hoses over 1 year of age are full of Pseudomonas and Coliforms and since this happens after sanitizing of the pipeline and the bulk tank you now have a pile of bacteria in the bulk tank. If chlorine sanitizer is used it should be done within 2 hours before the start of milking. Some acid sanitizers can be done at longer intervals. Be sure to read and follow directions. Old milk hoses, liners, and gaskets can also harbor bacteria and cause high LPC counts because these bacteria survive pasteurization.

Wash water dump temperature should be above 120°F, improper slugging during wash cycles, faulty or no air injectors to provide the slugging, and of coarse improper chemical and soap concentrations during wash up and sanitizing. It is important to reset concentrations when new chemicals are used.

Most mastitis organisms in cow’s milk are killed during pasteurization and will have little effect on shelf-life post pasteurization. It is possible in herds that use sand bedding and do not use a floor mounted cow washer to have a build up of sand and fecal matter in the liners. Usually coliforms will end up in the bulk tank. If that is the case a 30 second wash in the was pen will remove the sand, other wise pre dipping should be employed and care taken to remove all sand and teat dip to milk clean teats and keep liners free of sand.

Coliform Counts Goal <100 CFU/ml

These are basically fecal bacteria and if present in milk indicates manure or contaminated material have gotten into the milk supply. Milking wet dirty udders is a big cause of high coliform counts. Rubber wash hoses for washing udders, or filling wash vats, bulk tank’s water from cleaning and sanitizing also cause elevated counts, especially if sanitizing is not done early before milking. Coliforms
do not usually live in udders for any length of time, so it’s not an internal coliform problem, but a external problem – wet udders.

**Preliminary Incubation Count Goal <10,000 CFU/ml**

The PIC count measures bacteria that grow at refrigerator temperature (Psychrotrophs). Psychrotropic bacteria continue to grow at temperature below 45° F. These organisms and enzymes they produce are associated with off flavors, spoilage and short shelf-life. The count itself is not as important as the relationship to SPC. If the PIC count is 3x that of the SPC there is a potential problem. If SPC is 20,000, and PIC is 30,000 there is no problem because it is not 3x that of the SPC. If the SPC is 100,000 and the PIC 110,000 you have a SPC problem, PIC in not your problem.

**Causes of High PI Counts**

1. Poor milking hygiene, dirty conditions.
2. Poor wash up procedures and sanitization of all equipment.
3. Poor cooling
4. Old rubber goods
5. Poor water quality

**Other Tests**

Antibiotic residues should = 0

Sediment count equal or less than 1.5 mg/gal- Milking dirty cows,

Cryoscope reading equal or less than -.530° Hobvet.

**Possible Causes**

Chasing milk
Poor system drainage
Freezing milk in the tank
Greedy

Rancidy-off flavor, high acid degree value (ADV) < 1.0

**Possible Causes**

Pseudomonas, aerobacter and bacillus harbor in the pipeline gaskets, rubber hoses, air leaks in the system lifting milk, late stage lactation cows, weakens the globule membranes protective layer.

**Food for Thought on Long-Shelf Life**

1. Milk clean dry udders and teats
2. Post dip all teats of all cows milked
3. Dry treat all cows going dry with an approved dry treatment or you can also use a teat sealant and make sure you keep it out of your plate cooler.
4. Have a milking system in good repair, change all rubber good when needed 3-6 months for hoses and 1200 cows milking for most liners.
5. Have an adequate vacuum supply for milking and wash up
6. Have adequate and timely cooling, clean compressor fins for efficient cooling. Make sure agitation times are adequate.
7. Use the proper concentrations of chemicals and water volumes in a timely manner.
8. Keep cows in as clean and comfortable environment as possible.

Obstacles to Successful Implementation of Quality Incentives and Compliance Programs

While there are many dairies in the Southeast that produce very high quality milk that are capable of 24 day shelf-life these dairymen have made a personal and monitory commitment to do so and in reality they get no reward for doing this other than pride.

To produce a very high quality product in this climate is a very expensive process, constant milker training and expensive facilities to keep cows clean and comfortable while their milk is equal in quality to other milk producing states, they have and do not get paid the benefits that most milk producing states where cheese makers pay producers extra for quality milk.

We have historically been a fluid market and processors have not paid for quality, fresh cooled milk that is pasteurized the same day and Supermarket owned milk plants have control of the pasteurized milk because they have their own trucks for their distribution to their own stores and shelf-life in not a problem.

Problems in the Southeast Dairy Industry

We are losing our infrastructure; support for the dairy industry is shrinking.
1. Very few dairy equipment dealers
2. Large distances for them to travel increases expenses
3. Fewer suppliers of drugs, vaccines, and feed etc.
4. Erosion of the Extension Service
5. Loss of competition on for supplies and services

Losses of Dairies

With the reduction of dairies in Florida and Southern Georgia the need to go farther North to acquire milk to satisfy processors means we are a large variety of dairies who have different facilities, practices etc., many older less modern dairies.

How are We Going to Get All Producers to Produce High Quality Milk?

If we expect to have a high quality product to sell, all producers that supply us with milk will have to make the same commitment in time and money that our present producers of high quality milk have done. How do we expect to have a supply of high quality milk that will satisfy our processors shelf-life if we don’t know what to do and nobody to tell the producers how to do it?

Looking at one or two milk quality tests and guessing that dairyman X is producing unacceptable shelf-life milk and sending him letter deducting money from his check will not solve anything. We don’t need more milking procedures training; we need to determine the problems with each dairy and what is needed to solve those problems. I have enclosed a Bulk tank Analysis sheet like the one All Florida Vet Lab does, this will pin point all milk quality problems on that dairy that effect shelf life, in this paper the causes of high tests and how to solve this problem. Large dairies should do these weekly, smaller dairies every two weeks or monthly depending on their situation.

Where Are Milk Quality Field Men?
I find it interesting that we want and expect quality products and provide no means to get them. If we are going to have a quality product from all our producers they need to know what to do. Then someone needs to monitor their progress to produce quality milk. A field man is not the dairyman’s buddy but a person of authority who helps the dairyman

**What is a Field Man?**

1. First and foremost they should be trained about milk quality, wash up and sanitizing. Dairy husbandry, microbiology and science
2. Be a member of the National Mastitis Council and attend the annual meeting and take work shops and short courses they provide.
3. Teacher, Trainer, investigator and problem solver

**What Should the Field Man Do?**

1. Monitor the data available to him and take action on the dairies that have indicated problems.
2. Monitor hot and warm temperature and volume
3. Soap and Chemical concentrations and wash times
4. Cooling time and temperatures, plus tank agitation times
5. Monitor milking procedures and mastitis control practices.
6. Have the training and equipment to spot check pulsation, vacuum control and other milking machine problems (not to replace the serviceman, but to problem solve)
7. Monitor truck driver procedures.

**How Can We Assure That Every Dairy Produces High Quality Long Shelf-Life Milk?**

1. Have enough Field Men to be able to spend quality time with every dairyman who needs help on quality and occasionally visit non problem dairies.
2. Every dairy has a bulk tank sample analyzed by All Florida Vet Lab at least monthly large dairies weekly. Many do this now but need to be refreshed on how to use them.
3. Every herd should be on DHIA test and use the SCC option and use the data this program has to offer.

**Show Me the Money**

Who is going to pay the producer for the new hot water heater, bulk tank analysis, DHIA testing, building a new barn to keep cows cool and comfortable?

It seems that if we are expected to produce high quality long shelf-life milk, with out extra payment other than a new market for our milk we might be better off to select the high quality dairies to go to this plant and not try to have the whole region try to have 24 day shelf-life milk. Every steer for market does not have to grade “Prime” to be successful livestock operation.

**References**


## BULK TANK ANALYSIS

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<th>Contagious Bacteria:</th>
<th>Ideal Range</th>
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<tbody>
<tr>
<td>Staphylococcus (Coagulase Positive)</td>
<td>0</td>
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<tr>
<td>Streptococcus agalactiae</td>
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<tr>
<td>Streptococcus dysgalactiae</td>
<td>0-600</td>
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<tr>
<td>Corynebacterium bovis</td>
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<tr>
<td>Mycoplasma (7 day test)</td>
<td>Negative</td>
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<th>Environmental Bacteria:</th>
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<tbody>
<tr>
<td>Streptococcus uberis</td>
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<tr>
<td>Coliforms</td>
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<td>Bacillus</td>
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<th>Milk Quality Tests:</th>
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<tr>
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<tr>
<td>Somatic Cell Count</td>
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<tr>
<td>Standard Plate Count</td>
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<tr>
<td>Preliminary Incubation Count</td>
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<tr>
<td>BULK TANK ANALYSIS</td>
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<tr>
<td>--------------------</td>
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<tr>
<td><strong>Owner:</strong> ____________________</td>
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<td><strong>Date sample received:</strong> ____________</td>
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**Contagious Bacteria:**
- *Staphylococcus (Coagulase Positive)*: ____________ 0
- *Streptococcus agalactiae*: ____________ 0
- *Streptococcus dysgalactiae*: ____________ 0-600
- *Corynebacterium bovis*: ____________ 0-600
- *Mycoplasma (7 day test)*: ____________ Negative

**Environmental Bacteria:**
- *Streptococcus uberis*: ____________ 0-600
- *Coliforms*: ____________ 0
- *Bacillus*: ____________ 0-600

**Other:**
- *Staphylococcus (Coagulase Negative)*: ____________ 0-600

**Milk Quality Tests:**
- *Lab Pasteurized Count*: ____________ 0
- *Somatic Cell Count*: ____________ 0-300,000
- *Standard Plate Count*: ____________ 0-10,000
- *Preliminary Incubation Count*: ____________ 0-10,000, <3X SPC