Unit D: Milk Production and Quality

Lesson 1: Understanding the Factors Related to Milk Quality

Student Learning Objectives:

Instruction in this lesson should result in students achieving the following objectives:

1. Identify the parameters of milk quality.
2. Identify the factors affecting milk quality.
3. Describe management practices that can help inhibit bacterial growth.

Recommended Teaching Time: 1 hour

Recommended Resources: The following resources may be useful in teaching this lesson:

Milk Quality and Factors Influencing the Production of High Quality Milk.
   http://www.moomilk.com/archive/u-health-25.htm
Bacteria In Milk Sources and Control.
   http://digitalcommons.unl.edu/cgi/viewcontent.cgi?article=1486&context=extensionhist

List of Equipment, Tools, Supplies, and Facilities:

- Writing surface
- PowerPoint Projector
- PowerPoint Slides
- Transparency Masters

Terms: The following terms are presented in this lesson (shown in bold italics and on PowerPoint Slide 2):

- Coliform Count
- Lab Pasteurized Count
- Preliminary Incubation Count
- Standard Plate Count
- Mastitis

Interest Approach:

Tell the students, "Anyone who has been associated with dairy farming appreciates that it is tough work with never a day off." Ask the students how the income for a dairy farmer is determined? Answer: the ability to produce and sell a lot of high quality milk. Some processing facilities may offer bonus payments for milk meeting various quality standards. It is important, therefore, to understand milk quality parameters and what factors may interfere with attaining them. Use this information to transition into Objective 1.

SUMMARY OF CONTENT AND TEACHING STRATEGIES

Objective 1: Identify the parameters of milk quality.
Anticipated Problem: What are the parameters of milk quality?

(PowerPoint Slide 3)
   I. There are several parameters of milk quality.
      A. The first parameter is bacteria content of raw milk or ***Standard Plate Count*** (SPC). SPC is a test that all milk processors must conduct according to a standard methodology.
         1. SPC is a determination of the total number of bacteria present in the sample being tested. In most cases, it does not provide the name of the specific bacteria species present.
         2. When all aspects of milk production process are done properly, it is common for the SPC to be at 10,000/ml or lower.
(PowerPoint Slide 4)
      B. The second parameter is ***Preliminary Incubation Count*** (PI count). As this number increases, they can damage the quality of milk, leading to off-flavors and other problems.
         1. This number can be affected by the period of time between milk pick-ups.
         2. Most of these bacteria can be killed by pasteurization, but the enzymes produced by them may survive and continue to damage the milk fat and protein.
(PowerPoint Slide 5)
      C. ***Coliform Count*** is another bacteria test that may indicate a problem. These bacteria are fecal bacteria and their presence suggests that manure has somehow been allowed to enter the milk handling system.
      D. Another bacterial quality measure is ***Lab Pasteurized Count*** (LPC). This is especially a concern in large herds when the milk must sit for long periods of time before transportation to the processor.

Use TM: 1-1 to review the milk quality parameters with the students. Make sure the students understand the need to keep milk as free from bacteria as possible.

Objective 2: Identify the factors affecting milk quality.
Anticipated Problem: What are the factors affecting milk quality?

(PowerPoint Slide 6)
    II. Several factors affect milk quality. Understanding these factors helps to solve or prevent problems in milk production. Bacteria entering raw milk in excessive numbers has several sources that must be determined.

(PowerPoint Slide 7)
    A. **Mastitis** is defined as an inflammatory reaction of udder tissue to bacterial, chemical, thermal or mechanical injury. High quality milk can only be produced by healthy cows, i.e., cows free of udder infection.
        1. Cows with elevated somatic cell counts (SCC) or mastitis are incapable of producing high quality milk until the inflammation and infection in the udder are brought under control.
        2. Because the quality of milk cannot be improved following extraction from the cow, the production of high quality milk requires an effective mastitis control program

(PowerPoint Slide 8)
    B. Skin surfaces: The surfaces of teats, udders, and udder hair have the ability to support significant bacterial growth. These bacteria sometimes enter the milking system and tank. Milking wet, dirty cows increases this risk.

(PowerPoint Slide 9)
    C. Milking surfaces: This includes everything from liners, claws, milk hoses, sensors, valves, metering devices, receivers, coolers, pumps, and tanks. Any surface throughout the service, that is not cleaned properly, may harbor bacteria.

(PowerPoint Slide 10)
    D. Infections: Milk from cows that are infected with different bacteria may have extreme levels of those bacteria. Millions of bacteria/ml from individual cows can result in the bulk tank, where the milk is stored, to have a raw count being elevated to unacceptable levels.

Use TM: 1-2 to review the factors affecting bacterial count. Discuss with the students specific measures dairy farmers should use to control for milk quality.

Objective 3: Describe management practices that can inhibit bacterial growth.
Anticipated Problem: What are some management practices that can help inhibit bacterial growth?

(PowerPoint Slide 11)
    III. Once milk leaves the cow, the retention or preservation of milk quality requires <u>cleanliness</u>, <u>sanitation</u> and <u>careful handling</u>. Maximum benefits are derived only when these traits are applied to all aspects of the milk production system: cows, cow environment, milking system, milking practices or procedures and milk

storage or cooling system. A deficiency in any part of the overall system will result in decreased milk quality.

(PowerPoint Slide 12)
    A. The key words in controlling bacteria in milk are cleanliness, sanitation and cooling. Cleanliness applies to the cow, cow environment, milking area, personnel involved in milking and the milk storage area. Sanitation applies to the milking system and bulk tank or milk storage container. Cooling refers to the temperature of milk after it leaves the cow and how quickly it is cooled.

(PowerPoint Slide 13)
    B. Management Practices which can help inhibit bacterial growth:
        1. **Personnel--**Dirty clothes and dirty hands increase the risk of contamination of the cow and milking system. Wear clean clothes during milking. Wash hands prior to starting milking and frequently during milking. Be sure to wash hands after handling any cow known or suspected of being infected and after contacting any part of the cow or her environment.

(PowerPoint Slide 14)
        2. **Cow Environment--**A dirty, muddy cow environment, including poorly maintained free-stalls or bedded-pack, will increase both udder infections, i.e., SCC scores, and bacteria counts. The cow environment should be clean, dry and comfortable at all times. Dry conditions inhibit bacterial growth. Poor or inadequate ventilation contributes to poor quality milk through enhanced bacterial growth (high relative humidity), cow immune system depression (stress from any source) and off-flavors (poor air quality in barn and milking area).

(PowerPoint Slide 15)
        3. **Cow Cleanliness--**Clean cows reduce milking time labor, udder infections and bacterial contamination.
        4. **Udder Wash--**Use water and an approved sanitizing product to wash teats prior to milking. (Laundry and dish detergents are not approved udder wash products.) A sanitizer is not a substitute for clean udders. Most, and perhaps all, sanitizers are quickly deactivated by organic matter, such as manure. Select an udder wash that is compatible with your choice of teat dip to minimize the risk of teat irritation.

(PowerPoint Slide 16)
        5. **Dip Teats--**Dipping teats is a known requirement for an effective mastitis control program. Healthy teats will have fewer bacteria present because of greater ease of sanitizing the teat prior to milking. An effective teat dip will dilute or remove the residual milk film from the teat surface. The result is reduced opportunity for bacterial growth and reduced incidence of **new** infections. Dip teats with an effective product after every milking--year-round! Start each milking with a fresh supply of uncontaminated product and a clean dipping device. Teat dip applicators should be washed after every milking.

(PowerPoint Slide 17)
6. **Clean the Milking System—**If using a milking system to milk cows always use a complete wash cycle with appropriate cleansers or chemicals--at the appropriate concentration--after every milking.
7. **Cool Milk Quickly—**In large milking operations that have access to refrigeration, to enhance milk quality, milk from the first milking is cooled to 4.4°C or less within 30 minutes. The blend temperature on subsequent milkings is then kept below 7.2°C. A maximum blend temperature of 4.4°C is better. Milk should be stored at 1.7-2.2°C. Storage temperatures below 1.7°C will lower fat tests and cause rancid flavor due to freezing of a thin layer of milk on the cooling plate.

Have the students discuss how <u>cleanliness</u>, <u>sanitation</u> and <u>careful handling</u> relate to the management practices that can help to inhibit bacterial growth and thus affect milk quality. Use TM: 1-3 to aid in this discussion.

Review/Summary: Focus the review and summary of the lesson around the student learning objectives. Use the questions on **PowerPoint Slide 18** to have students explain the content associated with the objectives.

Evaluation: Evaluation should focus on student achievement of the objectives for the lesson. If the school has access to a cow or there is a dairy farmer in the area demonstrate for the student's proper preparation of the cow for milking. Demonstrate proper milking techniques and how to handle the collected milk. A sample written test is included.

Answers to Sample Test:

Matching

1. D
2. C
3. A
4. B

Fill-in-the-blank

1. Mastitis
2. Bacterial growth
3. Surface
4. Extreme

Short Answer

1. Mastitis, skin surfaces, milking surfaces, infections

2. Personnel, Cow Environment, Cow Cleanliness, Udder Wash, Dip Teats, Clean the Milking System, Cool Milk Quickly

Understanding the Factors Related to Milk Quality

Name: _____

Matching: *Match each word with the correct definition.*

a. Coliform Count
b. Lab Pasteurized Count
c. Preliminary Incubation Count
d. Standard Plate Count

_____ 1. Bacteria count of raw milk.

_____ 2. This number can be affected by the period of time between milk pick-ups.

_____ 3. These bacteria are fecal bacteria and their presence suggests that manure has been allowed to enter the milk handling system.

_____ 4. This is a concern in large herds that the milk must sit for long periods of time before transportation to the processor.

Fill-in-the-blank*: Complete the following statements.*

1. Bacteria may be from within the udders of cows with _____.

2. The surfaces of teats, udders, and udder hair have the ability to support significant _____ _____.

3. Any _____ throughout the service, that is not cleaned properly, may harbor bacteria.

4. Milk from cows that are infected with different bacteria may have _____ levels of those bacteria.

Short Answer*: Answer the following questions.*

1. What are the factors affecting milk quality?

2. What are some management practices that can help inhibit bacterial growth?

MILK QUALITY PARAMETERS

➢ Standard Plate Count

➢ Preliminary Incubation Count

➢ Coliform Count

➢ Lab Pasteurized Count

MILK QUALITY FACTORS

➢ Mastitis

➢ Skin surfaces

➢ Milking surfaces

➢ Infections

MANAGEMENT PRACTICES WHICH CAN HELP INHIBIT BACTERIAL GROWTH

➢ Personnel

➢ Cow Environment

➢ Cow Cleanliness

➢ Udder Wash

➢ Dip Teats

➢ Clean the Milking System

➢ Cool Milk Quickly