

MILK AND CHEESE TESTS FOR ARTISAN AND FARMSTEAD CHEESEMAKERS

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MILK AND CHEESE TESTS

Lactofermentation (early gas) Test¹

The majority of gas that is produced within 10 days of making cheese originates from problems with hygiene and sanitation prior to cheesemaking. Coliform bacteria and yeasts are the cause of early gas in cheese. It is often difficult to figure out if the cause of gassy cheese is related to the quality of the milk. The lactofermentation test is a simple, definite, inexpensive way to determine the quality of the milk at any moment in the process from milking up to adding starter culture. When the results are known, you can backtrack to find out if the milk was at fault.

Materials needed:

- ladle for taking the sample
- test tubes
- test tube brush
- sterile cotton
- water bath or incubator set at 86-98 °F

Methods:

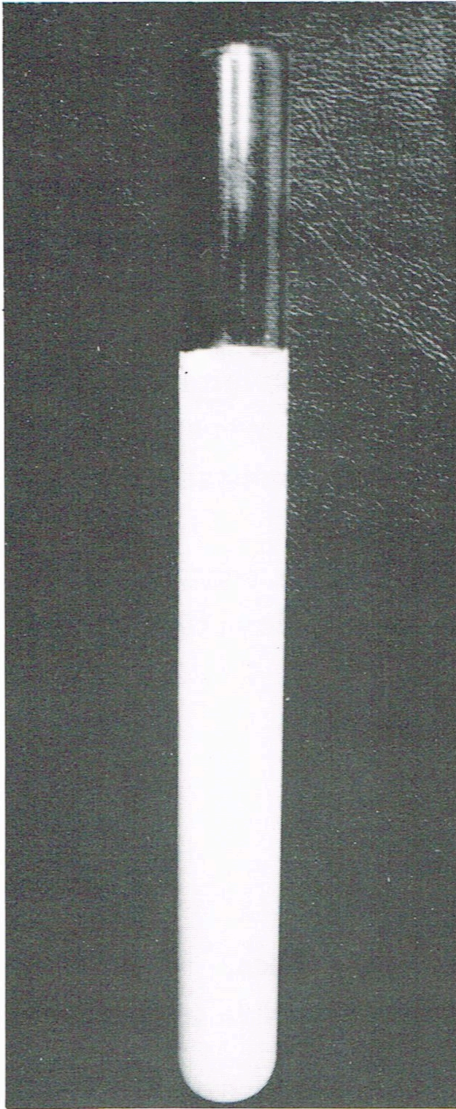
- Clean and rinse the test tubes and ladle
- Boil the test tubes and ladle to sterilize them
- Deposit the milk sample into a test tube
- Put on a sterile stopper
- Incubate the samples at 86-98 °F
- Wait for a curd to form in 24 hours for cow and goat milk and 48 hours for sheep milk

Using the Results:

During milking, storage and up to the beginning of cheesemaking the milk can become contaminated from improperly sanitized milking equipment, transferring milk, and storing the milk for too long or at too high a temperature. To get the right information, you can take samples at the following points:

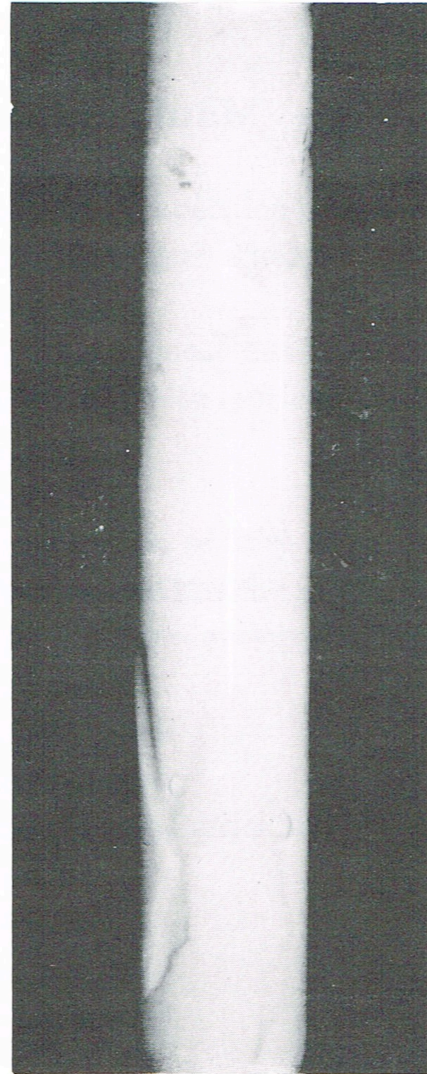
- when milk is coming by hand or from the machine into the bucket or pipeline
- when the milk is poured or pumped into the bulk tank
- when the milk is emptied from the bulk tank
- when the milk is poured or pumped into the cheese vat.

RESULTS



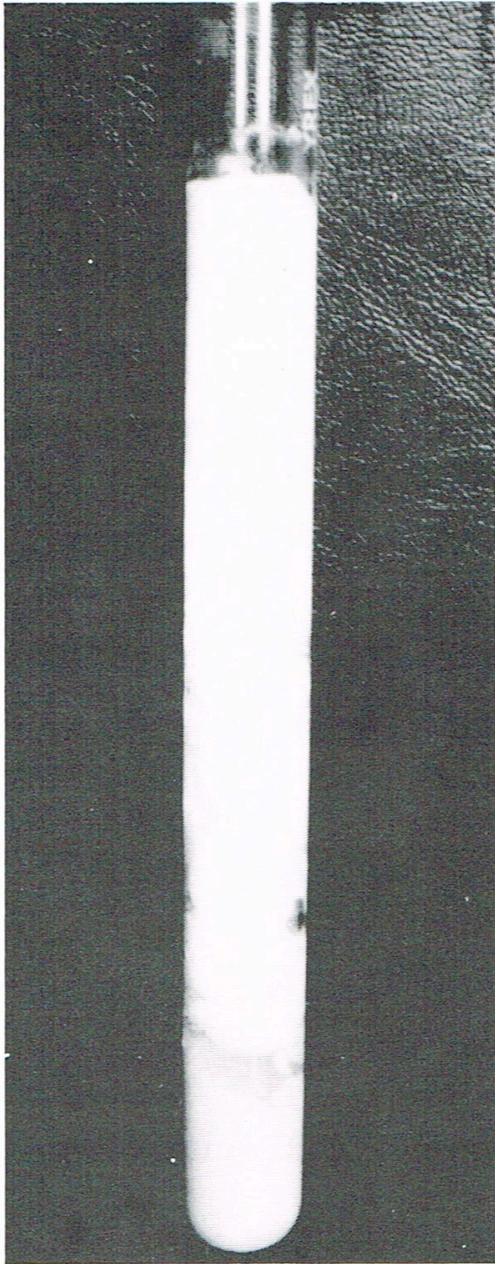
Very Good Milk

The curd is very homogenous, only a few bubbles and cracks at the top of the curd, like yogurt. Not a source of gassy cheese.



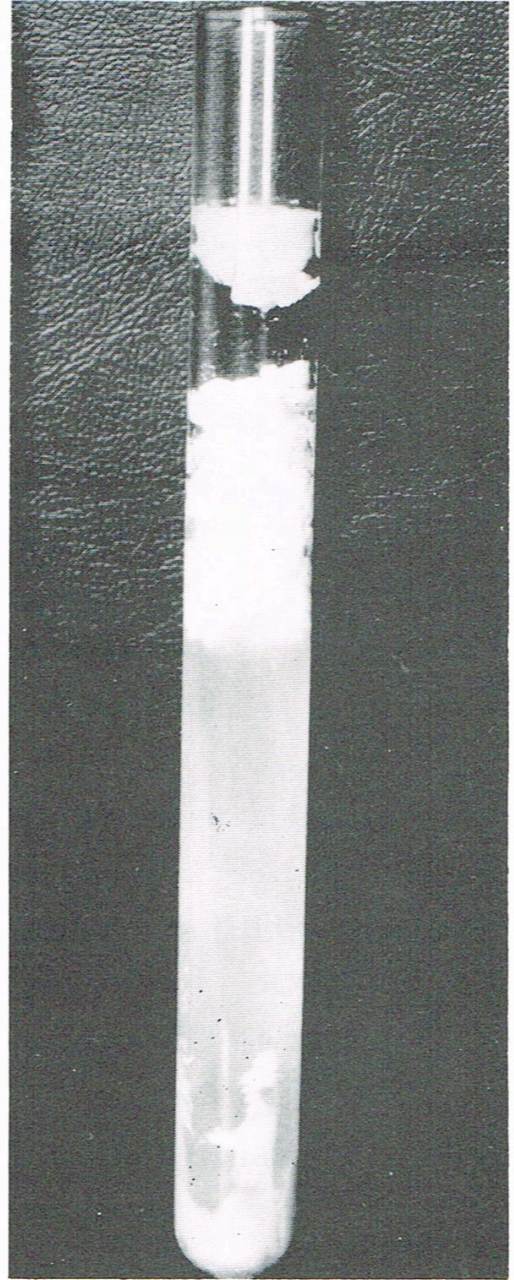
Good Milk

Curd is relatively homogenous, some cracks in the body of the curd and rising bubbles and lines of separation. Very low risk for gassy cheese.



Bad Milk

The curd has a rotten smell and scattered bubbles of various sizes. Significant source of gassy cheese. Sanitation problem.



Bad Milk

Curd has a rotten smell with a large amount of gas and whey separation and floating curds. Maximum risk of gas. Sanitation problem.

Principle:

The appearance of gas in cheese indicates a problem with the equilibrium between two categories of bacteria:

- good lactic acid producing bacteria (some of which produce small amounts of carbon dioxide gas)
- contaminating gas producing bacteria

The contaminating bacteria and the lactic bacteria are in competition for their nourishment. The contaminating bacteria have a better ability to adapt to the milk environment. If large numbers get into the milk then the lactic bacteria are at a disadvantage and their growth will be suppressed. This disequilibrium can be accentuated by poor techniques during cheesemaking, which leads to gassy cheese.

The lactofermentation test is a powerful test that gives the cheesemaker an idea about the potential success of the cheesemaking operation. The test takes into account:

- the bacteria that are capable of growing at temperatures used in the setting step of cheesemaking,
- the physical and chemical qualities of milk,
- the capacity of the bacteria to adapt to the milk environment.

The water bath or incubator is maintained at 86-98 °F, which is the general range for making cheese using mesophilic starter cultures but thermophilic bacteria are also active in this range.

There are three more results that may provide helpful information:

- If the curd takes a longer time to form, say closer to 48 hours then the milk has a low population of lactic bacteria.
- If the curd has a flaky (fleecy) appearance then psychrotroph bacteria are present. The texture is a result of proteolysis.
- The curd may smell yeasty or fruity, which indicates yeast is present.

Since the lactofermentation test is affordable and easy to do, I highly recommend using it. You will be surprised at how it can help you figure out where the gas is coming from. It is always nice to have that sample with a good curd to give you confidence about the potential for good quality. If you get a bad result then you can anticipate some problems with gas during aging. I have seen a cheesemaker in Armenia using this test, which he had learned from a French cheesemaker. I quickly adopted the test and taught all of the cheesemakers I worked with how to set it up and use it.

Clostridia Tyrobutyricum (late gas) Test

This test identifies *Clostridia tyrobutyricum*, which is the bacteria responsible for gas production later on, e.g. after two months, in cheese ripening. Large amounts of gas can be produced by the “butyrics” creating large cracks and fissures in the interior of the cheese. The source of this contaminant is improperly fermented silage and wrapped bales, manure, and the animals. The butyrics come from and spread from the soil. They multiply in certain conditions:

- when the ensiled feed is poorly prepared (there should be less than 100 spores of butyric bacteria per gram of feed),
- after the animals eat the feed the spores are concentrated in their manure,
- udders become contaminated from bedding and other environmental sites.

The butyrics can survive heat treatment and pasteurization by forming spores. Later on when conditions are appropriate (pH > 5.4, low salt, and higher temperatures, e.g., > 50 °F) they will grow very well and cause major problems. These conditions are normal for the affinage of certain cheeses, like Grana and hard Alpine types. Silage and wrapped bales are forbidden for feed to animals making milk for cheeses like Gruyere, Emmenthaler, and Parmagiano-Reggiano because of the inherent risk of butyric contamination.

Wrapped bales are much more commonly used as feed now. I know several cheesemakers that use it. My advice is to monitor the quality of the feed closely. Have some bales tested for spores. If the feed is too wet or in any way compromised then don't feed it to the milkers. I would stay away from it altogether if you are making hard Alpine cheeses.

Materials:

The test uses the same materials as the lactofermentation test.

Methods:

- The milk is pasteurized in the test tube, which means it is heated to 145 °F and held for 30 minutes or heated to 161 °F and held for 15 seconds,
- seal the top of the test tube with a paraffin plug (heat some wax and push it into the top),
- incubate the sample at 100 °F for 12-24 hours,
- watch for the plug to move up in the test tube.

Laboratory Milk Tests

There are two tests that are extremely helpful in locating sources of contamination in raw milk. These can be done by a laboratory, which does routine milk testing. I use the Agri-Mark Central Laboratory in West Springfield, MA. These dairy cooperative labs are set up to analyze milk samples on a regular basis. Send in a raw milk sample at least every other week and have them do a **Coliform Count and a Lab Pasteurized Count (LPC)**. While they are at it, have them test the fat, protein, somatic cell count (SCC), and standard plate count (SPC).

- The Coliform count is an indicator of the quality of hygiene and sanitation; stay below 25 CFU per ml.
- The Lab Pasteurized count measures the thermoduric (spore forming) bacteria and indicates the cleanliness of the equipment; stay below 250 CFU per ml.
- The somatic cell count gives you an idea of the health of your herd; stay below 250,000 for cows and sheep and below 750,000 for goats.
- The standard plate count is also known as the “raw count” and measures all of the bacteria in the milk; stay below 10,000 CFU (colony forming units) per ml.

The following charts will help you to pinpoint sources of contamination.

	HIGH	LOW
Coliform	>100	<25
LPC	>2,500	<250

Troubleshooting High Bacteria Counts in Raw Milk²

LPC	HIGH	LOW	HIGH	LOW
COLIFORM	LOW	HIGH	HIGH	LOW
SOURCE	EQUIPMENT	Animal Hygiene and Environment	All Areas And Incubation	O.K.

Testing for Residual Lactose in Cheese

Thermophilic starter cultures are used to make higher pH cheeses such as hard Alpine types and soft-ripened washed rind varieties. When the starter bacteria metabolize lactose they split it into glucose and galactose. The *Streptococcus thermophilus* and *Lactobacillus bulgaricus* bacteria do not ferment galactose. Therefore, it is possible to have cheeses with some residual sugar in them after the cheese is made. During the early stages of ripening the galactose can be used by other bacteria and yeasts to make acid and carbon dioxide. This “post acidification” can create problems in the ripening process. Cheeses can become harder, gassy, and poorly knit together. Using small amounts of mesophilic starter culture or *Lactobacillus helveticus* can solve the problem of post acidification. To find out if your cheese has residual lactose heat the curd in a microwave until the water is gone. The browner the color of the dry cheese is the more residual sugar is in the cheese.

RESOURCES

The Dairy Practices Council (www.dairypc.org) has several guidelines that are helpful to cow dairy farmers, farmstead cheesemakers and small ruminant dairy farmers. These are some of the offerings.

- Farmers Guide to Somatic Cell Counts in Sheep
- Farmers Guide to Somatic Cell Counts in Goats
- On-Farm and Small Scale Dairy Products Processing
- Food Safety in Farmstead Cheesemaking
- Bacteria Counts (Troubleshooting of Raw Milk)
- Regulation and Quality of Goat Milk

“The Dairy Practices Council is a nonprofit organization of education, industry, and regulatory personnel concerned with milk quality, sanitation, and regulatory uniformity.” Contact the office by tel. 732-203-1947 or email: dairypc@dairypc.org
I recommend checking out this organization because I have found it to be extremely helpful and informative.

¹ Lactofermentation Test was translated and adapted from Fromage Fermiers, by S.I.C.A. CREOM, 64120 Ordiarp, France

² Table from Dairy Pipeline, Wisconsin Center for Dairy Research, U of Wisconsin-Madison