



Dairy Goat Milking

Handbook for Farmers

**A Step-by-Step
Guide**



Competitiveness and sustainability
of **agricultural chains** for food
security and economic development



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IICA 2018



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Inter-American Institute for Cooperation on Agriculture (IICA), 2018



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Preface

As the specialized agency of the Inter-American System for agricultural and rural development, the Inter-American Institute for Cooperation on Agriculture (IICA) focuses on making agriculture competitive, inclusive and sustainable in its 34 member states. This Dairy Goat Milking Handbook for Farmers, was initiated as part of a collaboration with the Trinidad and Tobago Goat and Sheep Society (TTGSS), under the IICA Flagship program ‘Sustainability and Competitiveness of Agricultural Chains’, to develop and promote the local dairy goat industry. The handbook focusses on increasing the knowledge, skills and best practices in the production of quality goats’ milk from farm to table and complements the *Trinidad and Tobago Dairy Goat Manual Vol II: Comprehensive Guide to Goats’ Milk Production and Handling*.

IICA acknowledges the strategic importance of the Chains Project for its active role in developing the dairy goat sector in tandem with the TTGSS and other stakeholders.

Gregg C. E. Rawlins

Representative,

IICA Delegation in Trinidad and Tobago

Contributors

The Handbook is the effort of the TTGSS Executive and the Dairy Goat Stakeholders Committee who guided the process. The step-by-step guide was developed as a stand-alone, easy to use reference for dairy goat farmers to use during the milking and handling process. Support for the production of the guide was obtained from the Inter-American Institute for Cooperation on Agriculture (IICA) with resources from the Chains Project.

The invaluable contributions of the following persons were key to preparation of the handbook:

- Ravi Renie (chief contributor of the information)
- Khristy Beharry
- Management and staff of Up the Hill Farm, Moruga

Photos: Courtesy TTGSS



Introduction

1.1 Background

The Trinidad and Tobago Goat and Sheep Society (TTGSS) is currently embarking on a value chain model that would include small scale farmers producing milk and the TTGSS purchasing the milk from the farmers. The TTGSS would be responsible for collecting, testing, pasteurising, bottling, labelling and marketing the final product to local supermarkets. The creation of this value chain would result in farmers having a ready and reliable market for all the milk produced while creating a sustainable business model.

This handbook seeks to outline standard operating procedures for each step of the value chain to ensure the production of a high quality finished product. It can also serve as a practical guide to farmers, processors and consumers when producing, handling and consuming goats' milk.

Diagram 1: The TTGSS Goat Milk Value Chain



In Trinidad and Tobago, the rearing of dairy goats and the milking routine vary among farms, and this results in an inconsistent quantity and quality of milk. The major goal of this handbook is to aid in the standardisation of the milking routine on local farms resulting in the consistency and high quality of milk produced on the farms.

1.2 Required approvals for your farm before starting

Table 1: Approvals required for operating a Dairy Goat Farm¹

ENTITY	PURPOSE	Contact Information
Environmental Management Authority	Certificate of Environmental Clearance Environmental Impact Assessment	Tel: 628-8042 www.ema.co.tt
Town and Country Planning	Approval for Land use for farm	Tel: 612-9700 Ext: 2700
Ministry of Health Regional Corporation	Risk assessment to Human Health. Conformity to development plans/taxes	www.health.gov.tt
Water and Sewage Authority (WASA)	Clearance Certificate Application for connection	Tele: 662-2302/7 www.wasa.gov.tt
Ministry of Agriculture Veterinary Services Veterinary Public Health	Application for import permits Advise and veterinary service Inspection and Certification	www.agriculture.gov.tt
Trinidad and Tobago Electricity Commission	Certificate of Completion Application for connection	www.ttec.co.tt
Fire Services Police Service	Compliance to OHS Acquaintance / patrols	www.ttfireservice.gov.tt www.ttps.gov.tt
Chemistry Food and Drug Division (CFDD)	-Label examination of finished product -Certificate for sanitation -Certificate for export of goods -Certificate for sale of goods in Trinidad and Tobago (Free Sale Certificate) -Certificate for destruction/disposal of goods -Technical Advice	Tel: 623-5242 800 CFDD www.health.gov.tt

¹ Trinidad and Tobago Dairy Goat Manual Vol II: Comprehensive Guide to Goats' Milk Production and Handling, 2018.



On Farm - The Milking Routine

Producing goats' milk of a high quality starts on the farm, and is reliant on the farmer following the stipulated systems and procedures that make up the milking routine. The milking routine comprises of five (5) major activities:

Diagram 2: The Milking Routine



Each element of the milking routine has specific procedures and set guidelines that should be followed at all times to ensure the production of high quality milk (Belanger 2010).

2.1 Pre-Milking

The pre-milking procedure focuses on the following key areas:

- a) The milking doe
- b) The milker
- c) Preparing the milking area
- d) The milking line up

2.1.1 The Milking Doe

The milking doe is the centre point of milk production. In order to get the highest quantity and quality of milk, the doe must be properly cared for and maintained.

2.1.1.1 Housing and maintaining the Doe

Milking does should be housed in close proximity to the milking parlour. Pens should be kept clean so as to reduce the build-up of faeces; generally, slatted flooring is recommended. *Refer to the Dairy Goat Manual for specifications on housing the doe.*

Does should be groomed and cleaned regularly. Prior to kidding, tail hair should be clipped to prevent blood from sticking to the tail. After kidding and the passage of the after birth, the doe should be thoroughly cleaned and excess hair from the udder and teats removed (Belanger 2010).

Figure 1: Excess hair of the udder



2.1.1.2 Feeding the Doe

After kidding the nutritional demand of the doe increases to facilitate the production of milk- the greater the milk production, the greater the nutritional requirements. For more specifications on feeding the milking doe refer to the *Dairy Goat Manual*.

2.1.1.3 Doe Health

A healthy doe will ensure optimal milk production. However, there are numerous health issues that can result in reduced milk production and compromise the quality of milk produced. The *Dairy Goat Manual* covers many of these diseases.

2.1.1.3.1 Mastitis²

This handbook will focus on mastitis which arguably, is the most significant disease that negatively impacts dairy goat production. Mastitis is an infection of the mammary gland and can result in:

- Physical and chemical changes in the milk
- Loss in milk production
- Loss in revenues
- Permanent injury to the udder
- May end up in animals being culled or dying

To check for mastitis, the first two squirts (hand-stripping) from the goat's teats should be discarded and checks for mastitis done on the third and fourth squirts. Firstly, check the consistency and temperature of the milk. The temperature can be checked using a thermometer and the normal temperature of milk exiting the udder is approximately 39°C. Use the following guidelines accordingly:

- If the temperature and consistency of the milk is normal proceed to milk and process.
- If there is an elevation in temperature without change in consistency of the milk, the doe can be milked and the milk used for feeding kids. This is an indication of sub-clinical mastitis.
- If there is not an increase in the temperature of the milk, but there are changes in the consistency, the milk should be discarded. This is an indication of clinical mastitis.
- If there is pus, blood or the milk is smelly, strip out and condemn the milk and treat the animal under the supervision / advice of your veterinarian. This milk should be discarded and not even be fed to other animals.

It is crucial when milking to pay attention to any temperature change or physical change in consistency of the milk and to determine the stage of mastitis be it sub-clinical (cannot be seen) or clinical (can be seen). All sub-clinical cases, regardless of the stages, I–IV and clinical stages I–II,

2 Trinidad and Tobago Dairy Goat Manual Vol II: Comprehensive Guide to Goats' Milk Production and Handling, 2018.

can be eliminated and controlled by simple and effective stripping of the affected udder(s). These stages of mastitis require no treatment of any type. However, if ignored or not managed properly it can develop into clinical mastitis. In the clinical stages III and IV, simple stripping will not solve the problem. These stages necessitate the use of intra-mammary infusions and possible antibiotic treatment (intra-muscularly) especially if the animal has a fever. Unchecked or poorly managed, this mastitis can lead to fibrosis (hard lumpy), or even atrophy (death off) or complete loss of the udder. The animal will have to be culled as it will no longer be able to produce milk.

Other on farm testing includes the use of the California Mastitis Test (CMT) or use of the Draminski Mastitis Detector. Laboratory testing involves use of the Total Aerobic Plate Count (TAPC).

Figure 2:
California Mastitis Test (CMT)



Sub-clinical testing for mastitis is most commonly done using the CMT, this involves using the CMT reagent and a paddle (follow the instructions for the use and dilution rate of the CMT reagent). Strip 1-2 squirts of milk into the paddle from each teat, hold at a 45-degree angle to drain off excess milk. Now hold the paddle flat and put one squirt of the reagent in the milk and swirl gently observing for changes if any in the colour and consistency of the mixture. This is a rapid test and requires some practice to develop your interpretive skills. The test is based on the reaction between the CMT reagent and the somatic cells.

Table 2: Possible readings observed with the CMT test

CMT Score	Observation on the paddle	Result	Average ,000 scc/ml
0	No Reaction. No change in colour or consistency	Negative	>60 < 100
Trace	Slight change in colour and consistency. Slight slime	Trace	> 250 < 300
1	Definite change in colour and consistency-thickened slime	Slight	> 750 <1000
2	Gel-like formation floats around with swirling action	Serious	>2500<2750
3	Gel-like with an elevated surface- sticks to paddle	Bad	>10,000

Figure 3: Draminski Detector



The Draminski Mastitis Detector is more expensive but gives a more rapid result on testing. Like the CMT test the device gives a number on the screen which must be compared to laboratory findings over time to develop a range for the SCC level. **Usually a reading of 300 is acceptable.** Values above 300 indicates better quality milk and below 300 indicates poor quality milk that has sub clinical mastitis and is heavily contaminated. Like the CMT test, this device cannot distinguish between bacterial

cells and normal udder cells. Breed types will also give a different reading as Saanen milk gives a higher reading than Anglo milk. The older the animal, the more cells slough off, so pay attention to breed and age when testing.

Table 3 shows possible readings from performing the Draminski test.

Table 3: Possible readings observed from doing the Draminski test

READING	Interpretation on the Quality of Goat Milk	SCC / ml
750	Excellent quality-comparable to pasteurized milk	< 50,000
500	Good quality milk	< 200,000
300	Milk acceptable- of average standard	< 500,000
260	Poor quality milk-indicative of subclinical mastitis	>1,000,000
< 200	Severely contaminated milk—should be discarded	>10,000,000

2.1.2 The Milker

The person(s) involved in the milking of the goats need to follow strict guidelines as shown in Table 4

Table 4: Rules for milking staff

DOs	DONTs
Be on time	No perfume/ cologne
Well-groomed hair	No smoking
Clean and trimmed finger nails	No coughing, sneezing and spitting
No jewellery	Staff should report to their supervisor if they have had symptoms of diarrhoea, vomiting, nausea, abdominal cramps or fever.
Wear clean clothing and footwear	Cuts or sores should be covered with waterproof plasters.

2.1.3 The Milking Area

The milking parlour should be kept clean at all times before, during and after milking. Before milking, the area should be cleaned using unscented cleaning solutions. During milking, care should be taken to ensure that the area stays as clean as possible. After milking the area should be thoroughly cleaned and sanitised. All equipment and items needed for milking must be prepared and laid out before milking starts. Table 5 lists the key items needed for milking.

Table 5: Key items needed for milking

Rags
Buckets
Iodine
Cleaning solutions
Milking machine
Stool
Rope
Feed
Strip cup
Milk testing equipment
Napkins



Items should be laid out in designated areas for easy accessibility during milking. All equipment should be cleaned and sanitised before milking and kept clean during the process. The milking machine should be started before animals are led in.

2.1.4 The Milking Line-up

When does are taken out of the pens, there should be a small coral that the animals can be led into, to wait for milking. The animals should be calmly handled and not forced into the milking parlour; a calm animal will tend to milk faster and give more milk than an agitated animal. Animals should be milked in a carefully developed order following the criteria shown in Table 6.

Table 6: Criteria for the milking line-up

Primary Milkers	Secondary Milkers	Tertiary Milkers
Healthy Animals	Healthy Animals	Recent Kidders
Top producers	Low producers	Sick Animals
		Animals treated with drugs e.g. antibiotics

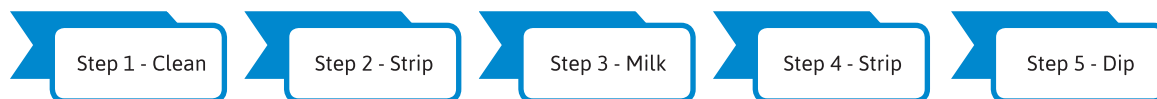
According to the above criteria, the healthiest and best producing does should be milked first, followed by healthy low producing does and lastly, animals that recently gave birth, sick animals (for instance those with mastitis) and animals treated with drugs that require a withdrawal period.

Note: Tertiary milkers should be hand milked and the milk should be fed to kids and not processed or consumed by humans.

2.2 The Milking Procedure

The milking procedure comprises of five (5) major steps shown in the figure below.

Diagram 3: Five steps of the milking procedure



Step 1 - Cleaning

- This step involves sanitising the teats and lower udder of the animal.
- Firstly, use a damp cloth to wipe the teats and lower udder to remove any visible debris.
- Secondly, sanitise the udder with unscented soap or bleach.
- Thirdly, rinse the area using a damp cloth to remove any soap residue.
- Finally, dry the area with disposable napkins.



Figure 4: Cleaning the teats

Step 2 - Strip - Mastitis testing

This step requires the handler to be extremely vigilant since the following activities will aid in early identification of mastitis and lower the incidence of milk contamination.

Firstly, the teats and udder area should be closely inspected to identify any redness/ discolouration, any bruises, if the area is hot or has any swellings, these can be some signs of mastitis.

Strip milk from the first teat discarding the first two squirts. The next two squirts should go into the strip cup and examined for lumps, clots and discolouration. Repeat for next teat. Any additional testing using the CMT or Druminski can be done at this time.



Figure 5: Strip testing



Figure 6: Examining milk

Note: A clean cloth and disposable paper should be used for each animal. Do not reuse on more than one animal.

Step 3- Milking

Hand Milking

Start milking as soon as step 2 is completed. Quickly but gently milk the animal. The milk should be milked into a sterile stainless-steel bucket.

Once the milking process has finished, the milk should be immediately transferred to a sealed churn/bucket before starting to milk another animal.

Machine Milking

Turn on vacuum and attach sanitised clusters to teats. Care must be taken to prevent clusters from coming into contact with the ground and legs of the animal. If contamination occurs the clusters should be re-sanitised.

Once the clusters are attached, constantly monitor to ensure they are firmly attached. Be sure to also monitor the pressure gauge in the machine. Once milk flow ceases release the pressure and gently remove the clusters. Place the clusters into a bucket with a cover.



Figure 7: Attaching clusters



Figure 8: Clusters attached and being monitored



Figure 9: Pressure gauge

Note: The recommended pressure for machines when milking goats is 0.4 bars and the pulsator should run at 90 clicks per minute

Step 4 - Stripping

After milking, manually strip any milk that has remained in the teats. This is an important control to minimise the risk of mastitis.

If animals have excessive milk after machine milking it might be an indication that the milking machine is not functioning properly (Luciana Bava 2017).



Figure 10: Stripping

Step 5 - Teat dip

The teats of the animal should be dipped in a 3% iodine solution. This aids in reducing the incidence of mastitis by killing any bacteria that might be present (Luciana Bava 2017).



Figure 11: Teat cup

Figure 12: Teats dipped in iodine after milking



2.3 Post Milking

2.3.1 The Does

After milking, each doe should be calmly led into a clean holding paddock and allowed to stand for at least 1/2hour. This reduces the incidence of mastitis. After milking, the teat canal temporarily remains open and if the animal comes in contact with bacteria, it can easily infiltrate the teat and cause infection (Belanger 2010). The animals can be returned to their pens until the next milking.

2.3.2 The Raw Milk

The raw milk from all the animals should be in the bulk milking bottle attached to the milking machine or in the covered churn in the case of hand milking. Upon breaking the seal of the milking bottle attached to the milking machine, it should be immediately covered. The milk from the milking bottle should be emptied into a sterile churn, and a strainer should be used when emptying the milk (Luciana Bava 2017).



Figure 13: Temporary cover on milking bottle



Figure 14: Straining milk

The milk should be then cooled either in a freezer or a cold water bath. It is important to cool the milk as quickly as possible in order to reduce the microbial growth. Processing of the milk will be dealt with in the next chapter.



Figure 15: Milk in churns being cooled after milking

In the case of a centralised processing programme, the following procedures would apply:

- a. At the end of each milking a 100 mL sample of raw milk should be prepared and placed in a sterile sample cup labelled with the date and farm information. (This sample would be stored at 4°C or less).
- b. All the milk produced for that particular day will be stored at 0°C or less in a sterile churn or container labelled with the date produced and the farm details.

For on- farm processing of milk, the procedures in Chapter 4 should be followed.

2.3.3 Cleaning of Parlour and Equipment

2.3.3.1 Cleaning the Parlour

After milking and the movement of milk from the parlour to the processing area, it is important to thoroughly clean the entire area as well as all equipment. Faeces, hair and all other debris should be removed from the area. The milking ramps, sanctions and feeding troughs should be thoroughly cleaned and sanitised (Belanger 2010).

2.3.3.2 Cleaning the equipment

2.3.3.2.1 General Cleaning

All used buckets, covers, containers, and tools should be washed, sanitised and stored in a dry clean place. The rags used to clean the animal's udders should be washed in a bleach solution and dried.



Figure 16: Filling hot water to wash the milking machine



Figure 17: Warm water rinse

2.3.3.2.2 Cleaning the Milking Machine

The external parts of the milking machine should be cleaned daily. To clean the internal components of the machine the following procedure should be followed:

- a. Rinse the churn after the milk is emptied, then re-position on the machine.
- b. Start the machine and allow 5 gallons of water at 38°C to run through the system. Discard contents in the churn.
- c. Run a mixture of liquid non-scented soap and hot water 60°C (5 gallons) through the system. Discard contents in the churn.
- d. Do a 5-gallon warm acid wash to remove any milk residue and milk stones. Discard contents in the churn.
- e. Remove and wash the rubber seal over the churn and allow to drip dry in a clean area.
- f. Every week the machine should be dismantled and thoroughly cleaned with specialised brushes and tools.
- g. Cover teat cups and store machine in a clean, dry area.
- h. At the beginning of the next milking session, the machine should be rinsed with 5 gallons of warm water (Luciana Bava 2017).



Figure 18: Emptying milking bottle after rinsing



Figure 20: Storing machine after cleaning



Figure 19: Soap water rinse



Milk Collection and Transportation

This section outlines the systems and procedures for collection and transportation of raw milk from the farm to the processing facility. In cases where milk is being pasteurised in a centralised facility, the farmer would store the raw milk on the farm at 0 degrees Celsius or lower in bulk churns. Each day's production will be stored in a separate churn and the processing agency for example, the Trinidad and Tobago Goat and Sheep Society would be responsible for testing, collecting, processing and distributing the final product.

In cases where milk is collected from the farm on specific days, the milk would be pasteurised on the day of collection and delivered to the supermarklets on the following day. A chain of custody form will be used to track the milk collected on the farm to the time it is processed at the processing facility. See Appendix 1.

3.1 Definition of milk

In Trinidad and Tobago, the constitution does not define goats' milk, however according to the TTGSS, goats' milk is defined as the mammary secretion from a mother goat (*Capra spp.*) not less than 3 days after giving birth and that the milk must not be decomposed or contain any added substances including colostrum.

3.2 Raw milk collection on farm

On the day of collection, the individual collecting the milk will fill out the Chain of Custody form and conduct the following tests on the farms:

- a. Organoleptic testing i.e. assessing the appearance, taste and smell of milk
- b. Ethanol testing i.e. mixing 5 ml of milk and 5 ml milk of ethanol

Table 7: Criteria for rejecting or accepting milk on the farm

Name of Test	Passed Milk	Rejected Milk
Organoleptic Testing	Milk has no off appearance, taste or smell	Milk has off appearance, taste or smell
Ethanol Testing	Consistence of solution remains the same	Presence of flakes or clumps

Note: 1. Section 2.32 outlines how the farmer will prepare the milk for collection and testing. 2. Milk should be transported in a frozen state.

3.3 Raw milk transportation to Processing Facility

After the milk is tested on the farm it should be transported in coolers back to the processing facility in a timely manner. The vehicle being used for transporting the milk should be clean and in good working order.

Note: Milk should arrive at the processing facility in a frozen or slush state.

3.4 Receiving of Milk at the Processing Facility

When the milk arrives at the processing facility, the Chain of Custody form and the milk will be handed over to the receiving personnel at the facility. Each sample (100 ml) together with the corresponding bulk churns/containers will be inspected. The receiver will carry out the following tests in the presence of the person delivering the milk:

- a. Organoleptic testing i.e. assessing the appearance, taste and smell of milk
- b. Ethanol testing- i.e. mixing 5ml of milk and 5 ml milk of ethanol

(See Table 7 for criteria for accepting or rejecting milk)

The milk in the churns should be stored at 4°C or less while testing is carried out.

Milk testing at the facility

Each sample received will undergo the following tests:

- a. Draminski testing - See Appendix 2
- b. Lactoscan testing - See Appendix 3
- c. Antibiotic testing - See Appendix 4

At each stage of testing, the results will be documented on the Chain of Custody form. The milk will be graded and either be accepted or rejected based on the results. Once the milk samples have met the desired standards, the corresponding milk will be sent to the processing area. Table 8 refers to the TTGSS goats' milk quality standards.

If milk is rejected, the farmer will be notified to collect the corresponding sample within 24 hours otherwise, it will be disposed.

Table 8: TTGSS goats' milk quality standards

Characteristics	Grading Quality		
	Premium	Good	Standard
Protein (%)	>3.7	3.4-3.7	3.1-3.4
Butter Fat (%)	>4	3.5-4	3.25-3.5
Total Solids (%)	>13	12-13	11.7-12



Milk Processing

4.1 Pasteurisation

The pasteurisation process was invented by the French scientist, Louis Pasteur who in the 1860's and 1870's discovered that heating liquids improved its storage. Pasteurisation is the process of heating liquids like milk to a temperature for a specific period of time. The major reason for pasteurising milk is to make milk safer to consume for humans and this is achieved by killing microorganisms that can be harmful to humans (Dairy Council Northern Ireland 2015; Holsinger et al. 1997).

There are different types of pasteurising methods that can be seen in Table 9 below.

Table 9: Pasteurisation types with temperature and time treatments

Pasteurisation Method	Time	Temperature
Low Temperature Long Time (LTLT)	30 Minutes	63°C
High Temperature Short Time (HTST)	15 Seconds	71.7°C
Ultra-High Temperature (UHT)	1 Second	88.3°C
Ultra-Pasteurisation (UP)	2 Seconds	137.8°C

The high temperature short time method is recommended however, considering the local dairy industry and the variability of husbandry practices, it is recommended that local goats' milk be pasteurised at 74°C for 30 minutes as this would kill both pathogenic and zoonotic microorganisms while maintaining the organoleptic qualities of the milk.

4.2 The Pasteurising Process

The area that you intend to use to pasteurise the milk needs to be sterile and have access to running potable water. If possible the room should be air conditioned and sealed off from external contaminants.

Once the milk is cooled to 4°C or less, pasteurisation can occur. There are many types and sizes of pasteurising machines, but the methods used are all similar. Pasteurising is normally a slow process whereby the milk is heated to 74°C for 30 minutes.

Once the pasteurisation process is completed, the milk must be quickly cooled to 4°C or less.

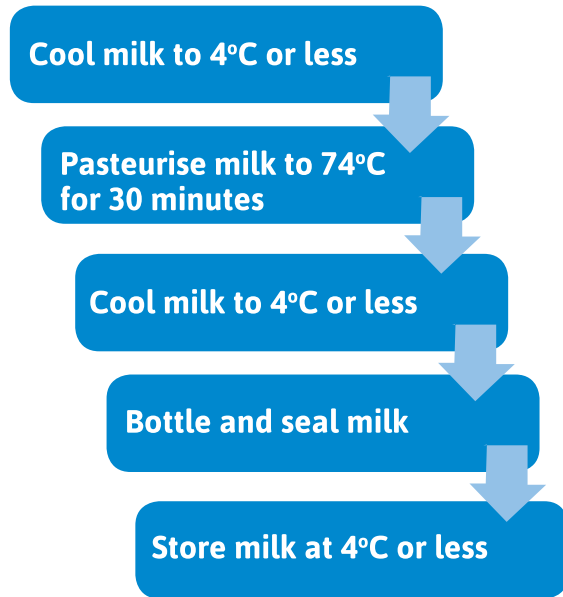


Figure 21: Pouring milk into a pasteuriser

Note: Hot or warm milk should not be bottled. Milk should be cooled to 4°C or less within four hours, if not consider that milk re-contaminated.

4.3 Bottling

It is recommended that the bottles used to package the final product be new bottles and not used bottles e.g. soft drink bottles. Bottles should be sterilised using some type of sterilising solution for example, 10% bleach solution. After the milk is cooled, it should be strained before bottling. Using a sterile funnel carefully bottle the milk and seal bottles immediately after filling.

Note: Don't fill bottle right to the top as it may burst during freezing.



Figure 22: Milk being strained and bottles being filled



Figure 23: Sealed bottle

4.4 Post Pasteurising

After bottling, labels can be applied to the bottles. All bottles should be stored at 4°C until they are ready to be transported to market.

Labels should meet the requirements of the Chemistry, Food and Drug Division (<http://www.health.gov.tt/sitepages/default.aspx?id=93>). Some guidelines for labels include:

- a. The name and contact information of the company producing the product.
- b. The expiry date
- c. Batch number
- d. Storage conditions



Figure 24: Sealed bottle



Figure 25: Finished product stored after processing

Note: Goats' milk when frozen and then thawed separates and may give the consumer the impression that the milk has gone bad.

4.5 Cleaning of Processing Area and Equipment

4.5.1 Cleaning the Processing Area

After milk is processed and removed from the processing area, it is important that the entire area together with all equipment be thoroughly cleaned. No scented commercial cleaners and sanitisers should be used.

4.5.2 Cleaning the equipment

4.5.2.1 General

All used buckets, churns, covers, containers, testing equipment and tools should be washed, sanitised and stored in a dry clean place.

4.5.2.2 The Pasteuriser

The external parts of the pasteuriser should be wiped out and cleaned daily. To clean the internal components of the machine the following procedure should be followed:

- a. Wash and rinse the churn after milk is emptied. Leave to dry.
- b. Empty water from the water bath
- c. Every week dismantle and thoroughly clean the machine with specialised brushes and tools.



Figure 26: Cleaning of processing area after processing



The Market

5.1 Delivery

On the delivery day the milk should be transported in coolers with ice or ice packs. The transportation vehicle should be clean, air conditioned and in good working order. Milk deliveries should be planned and be carried out in a timely manner.

Due to the composition of goats' milk, clumping of the cream is common and should not be mistaken for spoilage.

At the delivery point the milk should be delivered in the coolers and then placed in a refrigerator at 4°C or less. The delivery note and invoice should be supplied to the purchaser and payment arrangements should be made.

5.2 In store storage

In the supermarket, it is important that the milk is stored at 4°C or less at all times.

5.3 Merchandising

It is important that milk in the supermarkets be monitored to ensure adequate storage and sufficient supply of products. Expired milk or milk close to expiration (1-2days) should be removed from the shelves and disposed.



The Consumer

6.1 When Purchasing

When purchasing milk, the consumer should be familiar with the brand, and check the expiry date to ensure that milk is safe to consume. Consumers should carefully examine the milk for any off colours or clumping as these could be an indication of spoilage. Due to the composition of goats' milk, clumping of the cream is common and should not be mistaken for spoilage.

6.2 After purchase

After purchase it is advised that consumers have a cooler in their vehicle to transport milk, the consumer should attempt to refrigerate the milk soon as possible after purchase.

The following guidelines are provided for consumers:

1. Do not consume milk after the expiry date
2. Milk should be consumed within three days of opening the bottle
3. Milk should be stored at 4°C or less
4. Shake well before consuming
5. If milk is frozen it should be fully thawed before consumption
6. Avoid drinking milk directly from the bottle if all the contents are not consumed at that time

Consumers can contact the Trinidad and Tobago Goat and Sheep Society for any further information.



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8. Appendices

8.1 Appendix 1 Milk Chain of Custody Form

Farm Name _____ Farm ID _____
Farm Address _____ Farm Contact # _____
Date of Collection _____ Time of Collection _____

Amount of Milk Collected

Farm Testing

Test	Result	Comments	Tester Signature	Farmer Signature
Organoleptic Test				
Ethanol Test				

Time of Departure from farm _____

Time of Arrival to Processing Facility

Primary Processing Facility Testing

Test	Result	Comments	Delivery Signature	Tester Signature
Organoleptic Test				
Ethanol Test				

Secondary Processing Facility Testing

Test	Result	Comments	Tester Signature
Draminiski Test			
Lactoscan Test			
Antibiotic Test			

8.2 Appendix 2 Procedure and Guidelines for Draminski Testing

The detector measures changes in the electrical resistance of milk, as development of sub-clinical mastitis (asymptomatic stage) is accompanied by an increase in salt levels in milk, which involves a change in the resistance. This rule is considered to be the most reliable indirect test in diagnosing Subclinical Mastitis.

The test is very simple:

1. Place milk sample into measuring cup
2. Press the button to read the result
3. Pour out the milk and repeat the steps for other quarters

READING	Interpretation on the Quality of Goat Milk	SCC / ml
750	Excellent quality-comparable to pasteurized milk.	< 50,000
500	Good quality milk	< 200,000
300	Milk acceptable- of average standard	< 500,000
260	Poor quality milk-indicative of subclinical mastitis	>1,000,000
< 200	Severely contaminated milk—should be discarded.	>10,000,000

(<http://www.draminski.com> 2017)

8.3 Appendix 3 Procedure and Guidelines for Lactoscan Testing

Milk density is determined not earlier than 2 hours after milking.

- The milk must be within the temperature range of 10 to 25° C. Before determining the density, the milk must be well stirred.
- To avoid foam formation, the milk has to be carefully poured on the cylinder's walls.
- The cylinder must be slightly tilted, placed on an even surface, facing the light, so that the readings could be easily seen.

Parameter	Measure Range	Accuracy
FAT	from 0.01% to 45%	±0.06%
Solids-non-fat (SNF)	from 3% to 40%	±0.15%
Density	from 1015kg/m ³ to 1160kg/m ³	±0.3kg/m ³
Protein	from 2% to 7%	±0.15%
Lactose	from 0.01% to 6%	±0.2%
Added water	from 0% to 70%	±3
Milk sample temperature	from 1°C to 40 °C	±1%
Freezing point	from -0.4°C to -0.7°C	±0.001%
Salts	from 0.4% to 1.5%	±0.05%
pH	from 0 to 14	±0.05%
Conductivity	from 3mS/cm to 14mS/cm	±0.05%
Total solids	from 0% to 25%	±0.17%

(<http://www.lactoscan.com> 2017)

8.4 Appendix 4 Standards for Antibiotic testing

Antibiotic	NEGATIVE	POSITIVE
Penicillin G	0.002	0.004
Ampicillin	0.003	0.005
Amoxicillin	0.003	0.005
Oxacillin	0.005	0.025
Cloxacillin	0.025	0.04
Cephalexin	0.025	0.075
Cephapirine	0.005	0.008
Sulfathiazole	0.02	0.075
Sulfamethazine	0.1	0.2
Sulfanilamide	0.1	0.6
Oxytetracyclin	0.05	0.15
Tetracyclin	0.05	0.15
Erythramycin	0.2	0.4
Tylosin	0.02	0.1
Neomycin	<0.500	0.8

(<http://www.lactoscan.com> 2017)



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