Small-Scale Dairy Farming Manual

Volume 1

Technology Unit 3

Milk Quality Control

Technical Notes

Numbers in brackets refer to illustrations in the Extension materials.

Introduction

Milk in the udder of healthy animals has very little bacteria. It is only after leaving the udder that the milk can be contaminated with bacteria if proper hygenic handling is not undertaken. Sources of contamination include:

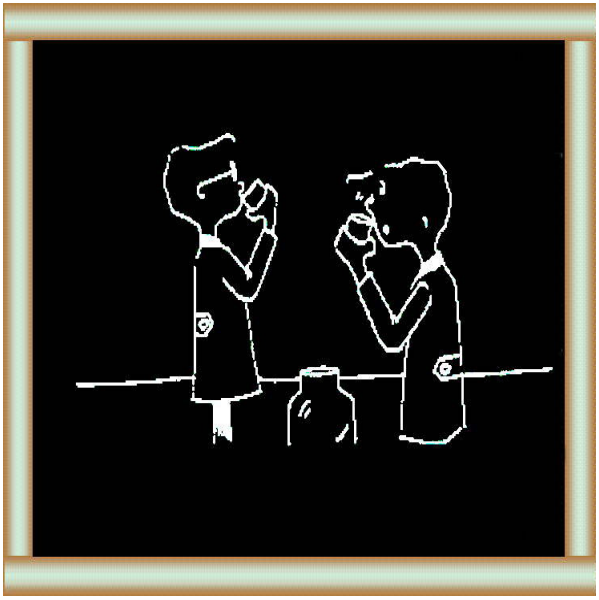
Milking Utensils
The milker
The air
The skin of the animal
Inflammed udders

Extension Materials

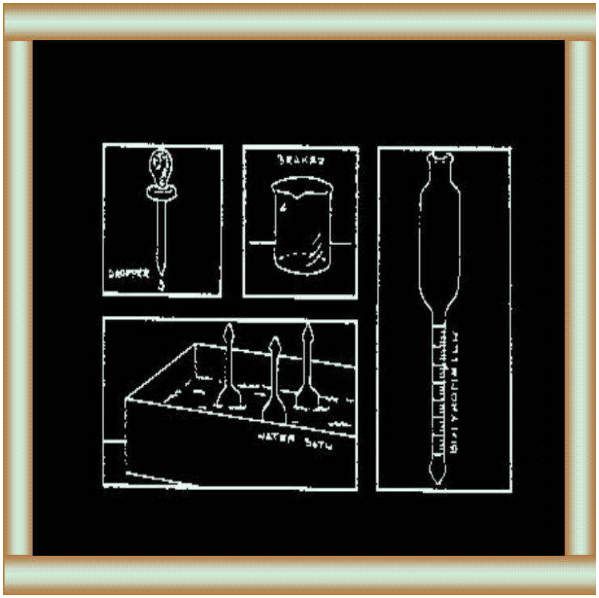
What should you know about milk quality control ?

1 How does the milk collecting centre control the quality of milk ? (4-6)

They visit your farm and



- hygiene and physical properties
- animal health and bacteria
- composition and suitability for processing.



3 How do they test your milk ? (7-24)

They have special equipment for each test.

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How does the milk collecting centres control the quality of milk ?

4 Workers from the milk collecting centre visit your farm and keep records.

5 They test your milk on delivery to see if it is suitable for processing. If it is not suitable, they will reject it!

6 The milk collecting centre or factory control the quality of milk to make sure it tastes good and is safe to drink.

Testing for Hygiene

The Sediment Test (8)

During the milking and handling of the nilk all kinds of dirt can get into the milk, such as straw, dust, hairs, flies etc. By filtering a representative sample of the milk through a white disc (The Sediment Test) these dirt particles become visible.

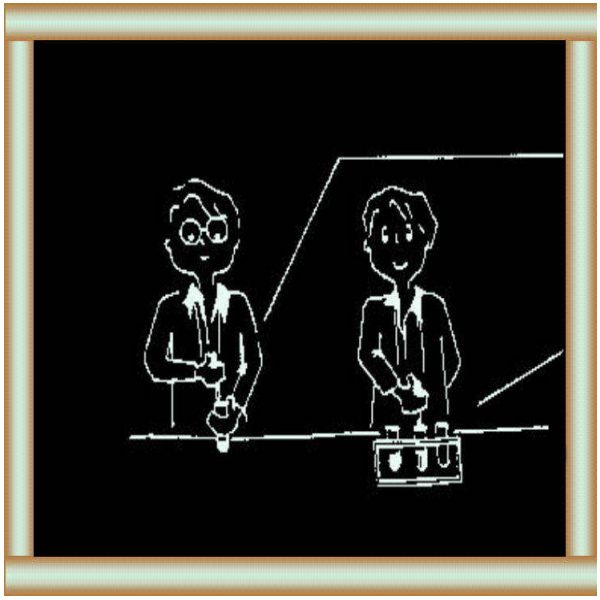
This test gives a very good indication of the cleanliness of the milk with respect to visible dirt. The test is also useful when training farmers in clean milk production and can also be used for the classification of milk (milk payment). It is obvious that a high amount of visible dirt also indicates high bacteria content.

How do they test for hygiene ?

7 They visit your farm and look at your
- buildings
- equipment
- cows
- working methods
- and you
to make sure you keep everything clean and your cattle are healthy.

8 On delivery, they check the empty containers and filter your milk to see how much dirt there is.

9 They test one sample of



your milk before accepting it to make sure it is suitable for processing and they take other samples for laboratory tests.

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Testing for Physical Properties

A bad smell or taste in the milk can be caused by bacterial growth, chemical reactions and by flavours being absorbed in the milk.

Flavours which are usually absorbed by milk are:

feed flavours, medicine flavours, chemical flavours and unclean flavours. Silage flavour is easily absorbed by the milk either directly or indirectly via the cow. However, if the silage is well-preserved and fed in reasonable quantities there will be no problem with silage flavour. Flavours from onions and certain weeds may be absorbed via the cow.

Unclean flavours are often due to unclean sheds and animals. Keeping the milk too long in an open container in the milk shed may also cause unclean flavour. Medicine and chemical flavours usually come from medicine used to treat the cows and from detergents and disinfectants which have not been properly rinsed off the milking utensils. (11)

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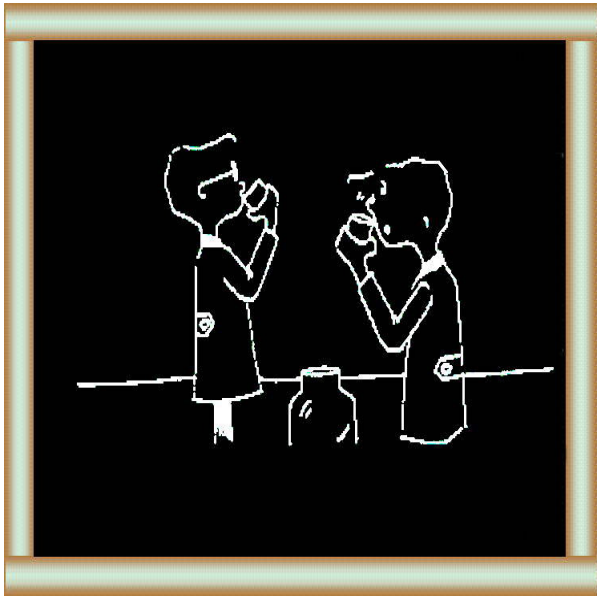
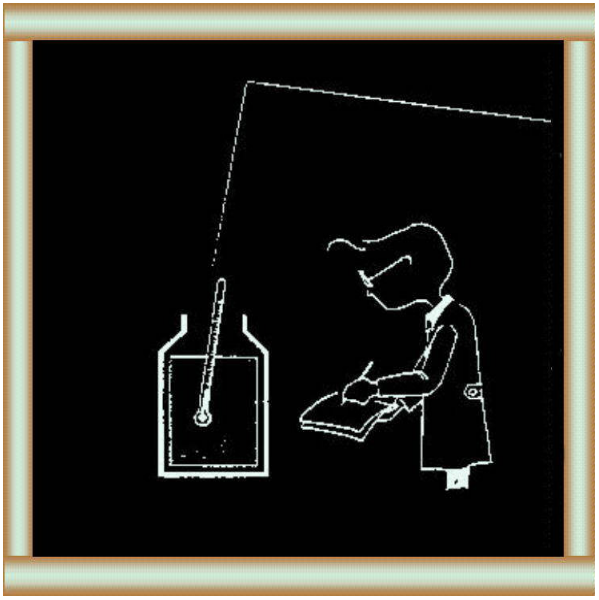
How do they test the physical properties of your milk ?



11 They smell your milk and taste it. Bad smell or taste shows low quality of milk.

12 They measure the temperature of your milk upon delivery. To store very clean milk for 24 hours, you need a temperature of less than 10 C. Less clean milk needs lower temperatures.



Testing for Healthy Animals

The cell count can be undertaken by means of a microscope or automatic cell counter. The cells consist of leucocytes, lymphocytes and epithelium

cells. Milk from healthy cows/udders normally contains from 100,000 to 300,000 cells per ml. If an udder is diseased (Mastitis) the number of cells (leucocytes and lymphocytes) will increase. The age of the cow and the stage of lactation will also influence the number of cells. (13)

In the case of diseased cows, blood clots may get into the milk. (14)

Milk containing antibiotic residues cannot be used for dairy products. This is particularly true for products which have to be fermented by lactic acid producing bacteria, as this will be inhibited by the antibiotics. (15)

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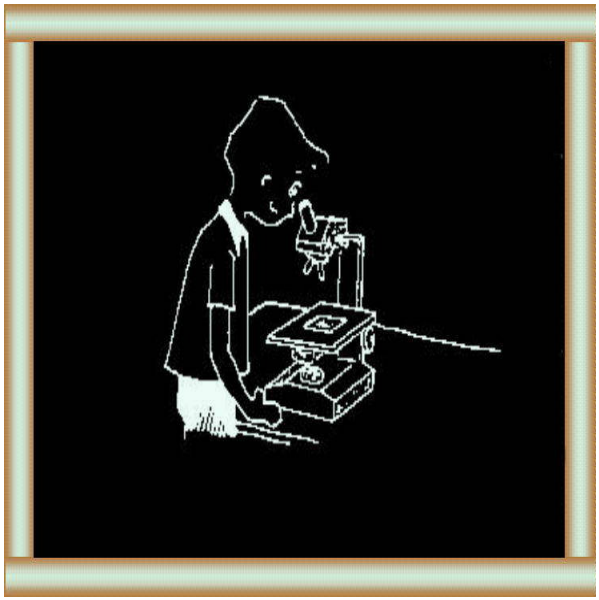
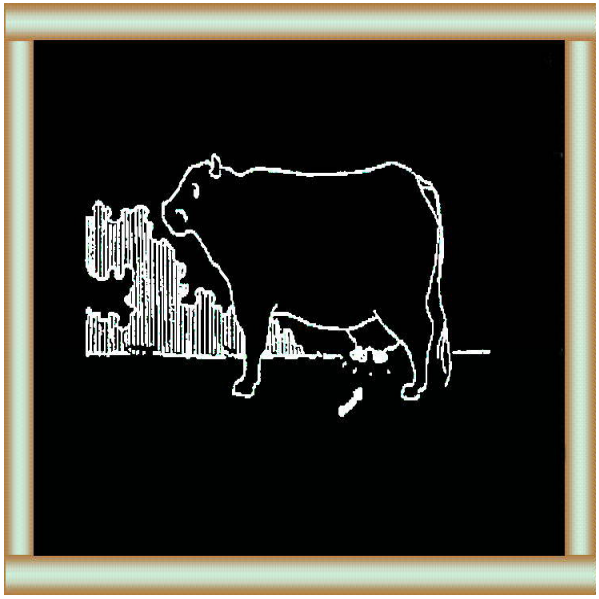
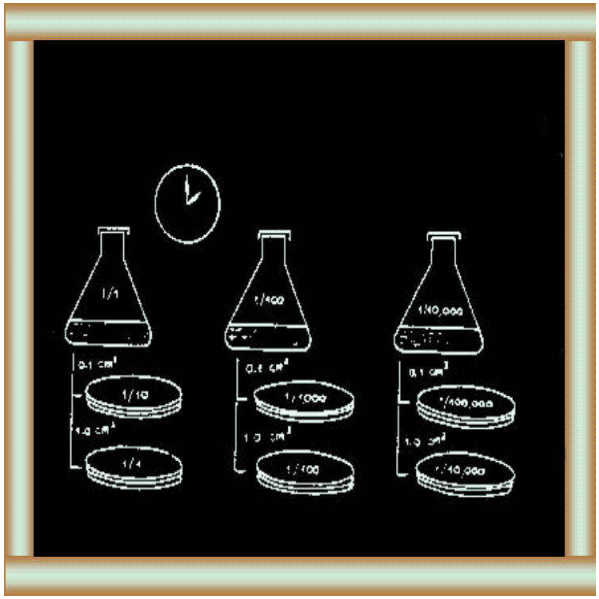
How do they test for healthy animals ?



13 They count the number of cells in your milk and check for blood.



14 Many cells or blood in the milk shows that your cow has mastitis or another disease.



15 They incubate your milk with a special bacteria to check if antibiotics are present.

Testing for Bacteria

Dye Reduction Tests (16-17)

The two most common dye reduction tests are the Methylene Blue Test and the Resazurin Test. These dyes will, when added to milk which is incubated at 37 C, be chemically reduced if there is microbial activity in the milk. Generally, the time required to change the colour of the dye is shorter if there is high bacterial activity in the milk (many bacteria) and longer if there is low bacterial activity (few

bacteria).

Dye reduction tests do not indicate anything about the kind of bacteria in the milk, they only indicate the number of bacteria.

Plate Count Test (18)

The plate count method is used for determining total number of bacterial colonies per ml sample. A measured amount of milk is placed on agar plates and the number of colonies are counted after incubation.

Microscope Count Test (18)

To obtain the amount of single bacteria present in milk, a direct count must be carried out, using a microscope.

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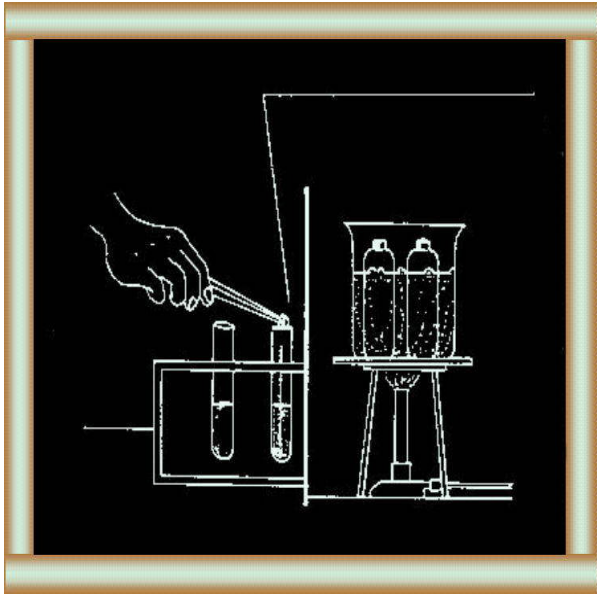
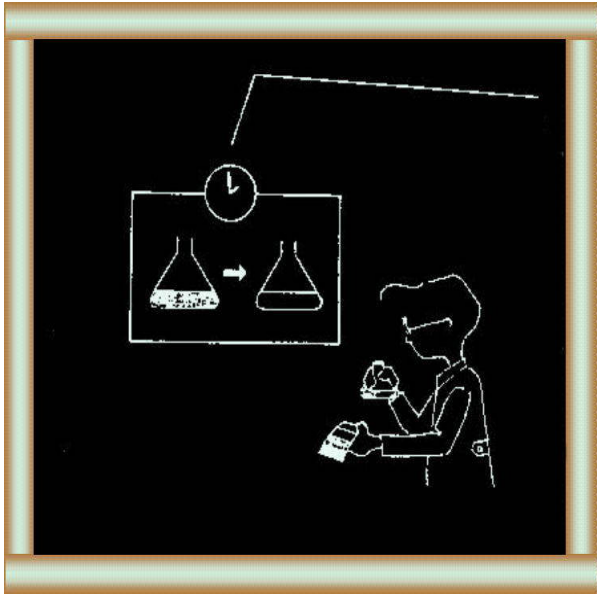
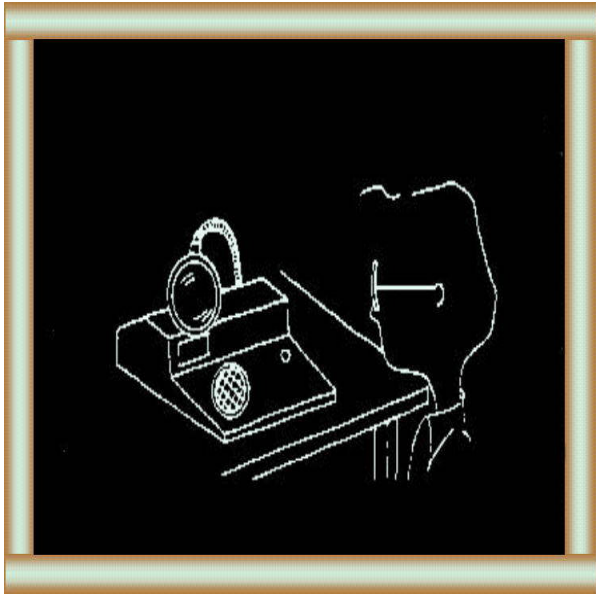


16 For a quick test they add a dye to your milk.



17 Then they check the time for the colour to disappear. The shorter time, the more bacteria.



18 For an accurate test, they count the number of bacteria in your milk.

the freezing point of water owing to dissolved components (mainly lactose and salts). The freezing point, being one of the most constant physical characteristics of milk, is used to detect adulteration of milk with water.

The freezing point of cows milk varies between -0.53 C and -0.59 C with -0.54 C being the average value. Values below -0.53 C usually indicate extraneous water.

A cryoscope is used for determination of the freezing point.

Measuring density (20)

Another method to detect adulteration with water is by measuring the relative density of the milk. The method is not as reliable as detection by determination of freezing point but is easier to carry out and requires less sophisticated equipment. The density of milk normally varies between 1.028 and 1.034 g per ml at 15^{O}C depending on the composition.

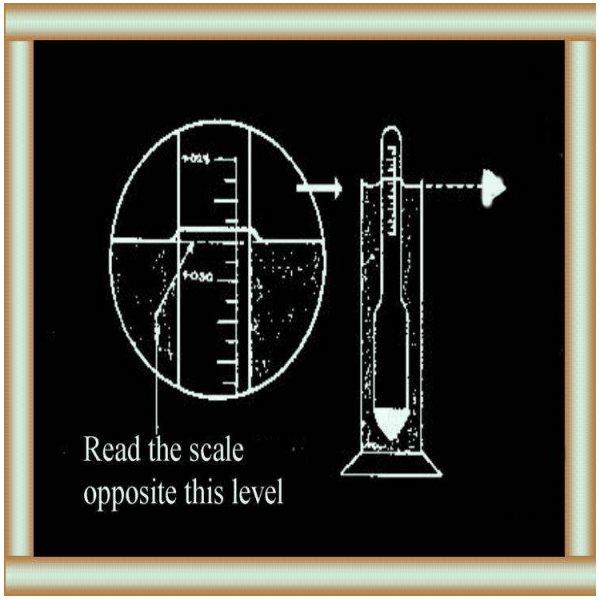
The density of water is 1.0 g per ml. A lactodensimeter and glass cylinder are required for the test.

Measuring fat content (21)

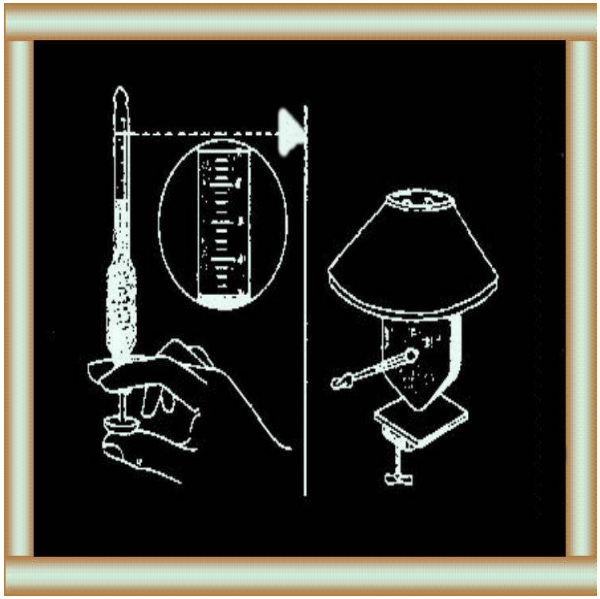
For small to medium scale operations the Gerber test is used for determination of fat content in the milk. The test is a volumetric method in which fat is separated from skimmilk by centrifugal force. Sulphuric acid is used to dissolve the protein that forms the membrane around the fat (fat globules) and amyl alcohol is added to improve the separation of fat from protein.

How do they test for composition ?

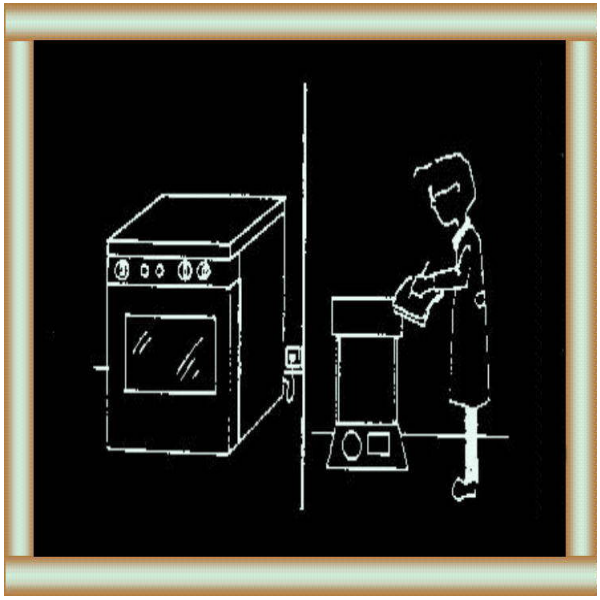
19 They measure the freezing point, if it is abnormal, your milk may contain excess water, detergents or other substances.



20 They measure the density of your milk with lactometer. If it is abnormal, perhaps:- some one added water or another substance- some one removed the cream- your milk is colostrum.



21 They separate the fat from the skim milk and measure how much fat your milk contains.



22 They may dry the milk and measure the total solids content.

Testing Suitability for Processing

The titratable acidity test is carried out in order to check whether milk contains a large amount of lactic acid which will reduce the heat stability and thereby the suitability for processing. The milk will clot when it is heated. Different procedures are employed to test the acidity, however the principle is the same: A dye which changes colour at a specific pH is added to the milk which is then titrated with a base (added little by little) until the colour changes. By recording the volume of base required and the volume of the milk sample, the amount of lactic acid can be calculated. This test is also used for testing fermented products. The lactic acid is produced by bacteria in the milk. The milk becomes sour.

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How do they check if your milk is suitable for processing ?

is not suitable for pasturization.
This may show:
- bacteria (acid production)
- mastitis
- residues (e.g. detergents)
- colostrum.

What do you know about milk quality control ?

How to control milk quality

How to test for hygiene

How to test physical properties

How to test for animal health

Small-Scale

Dairy Farming Manual

Volume 1

Technology Unit 4

Milk Preservation

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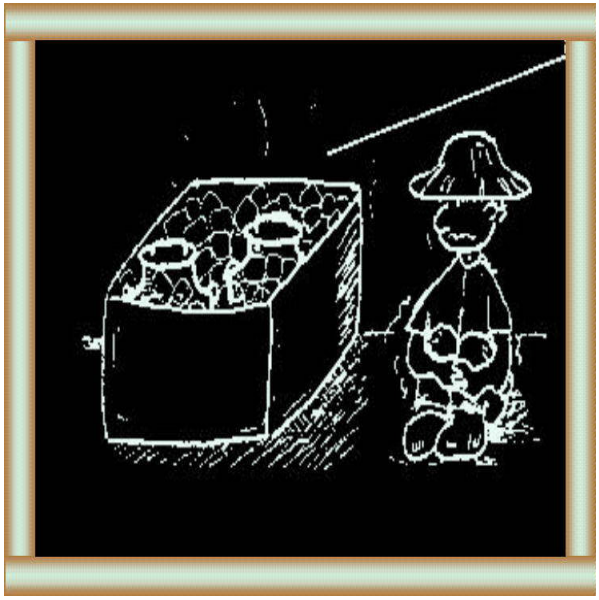
Extension Materials

What should you know about milk preservation ?

What is important in preserving milk ? (5-7)

1 It is important to make sure that your milk is:
- clean
- cool
- delivered quickly



Why cool your milk ? (8-25)

2 Keeping your milk cool reduces damage.

Why heat treat and process your milk ? (26-29

3 Heat treatment kills bacteria and your milk keeps longer. Processed products like cheese keep longer too

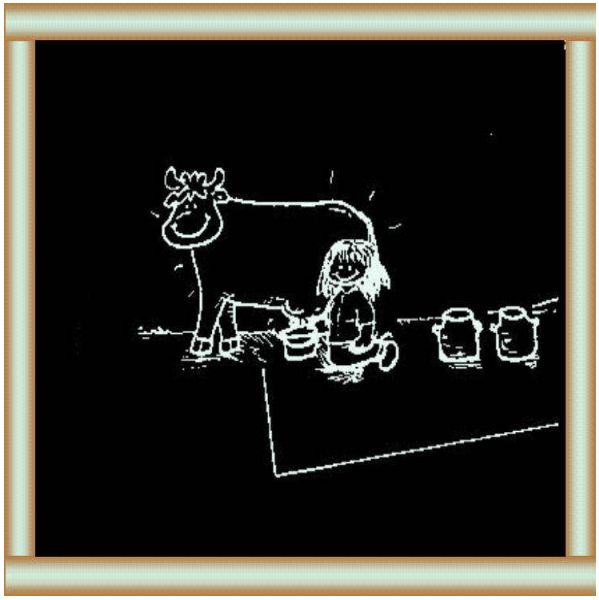
Can you use chemicals to

preserve your milk ? (30-49)

4 Yes, but you must ask your extension worker

or milk collecting centre for advise

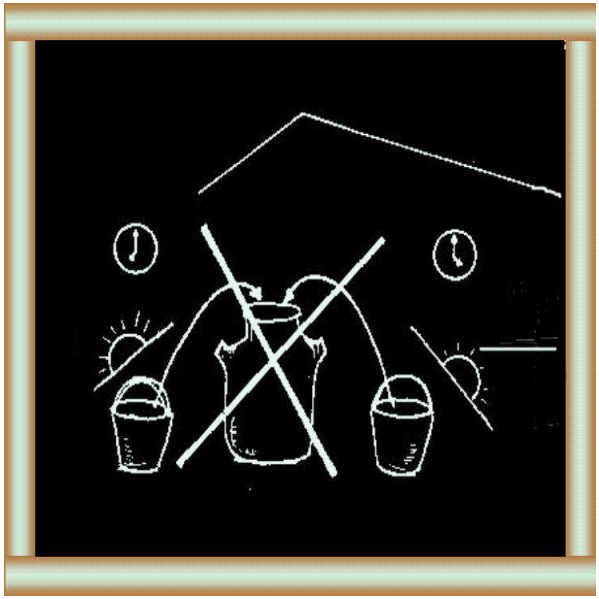
What is important in preserving milk ?



5 All of the ways of preserving milk depend upon the initial hygenic quality of your milk.

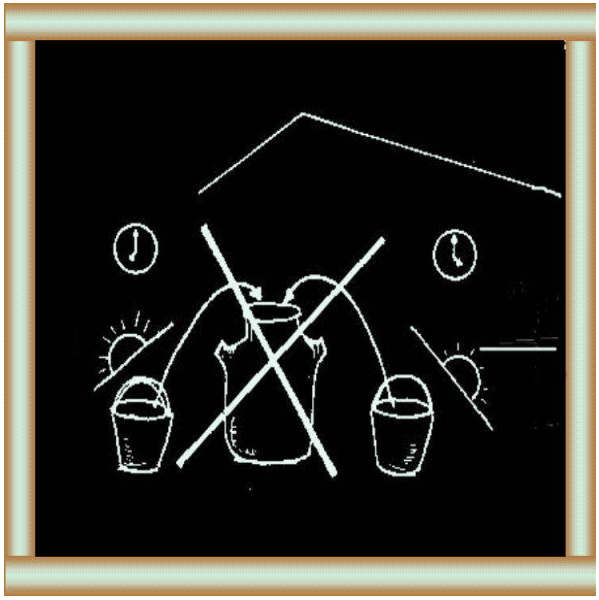
Make sure everything is clean and you cattle are healthy.

6 Do not mix warm (morning)



milk
with cool (evening) milk.

Keep it separate for the collecting centre or cool warm milk before mixing.



7 Whatever method of preservation you use, plan with farmers near you and your collecting centre to deliver the milk in the shortest time possible.

Why cool your milk?

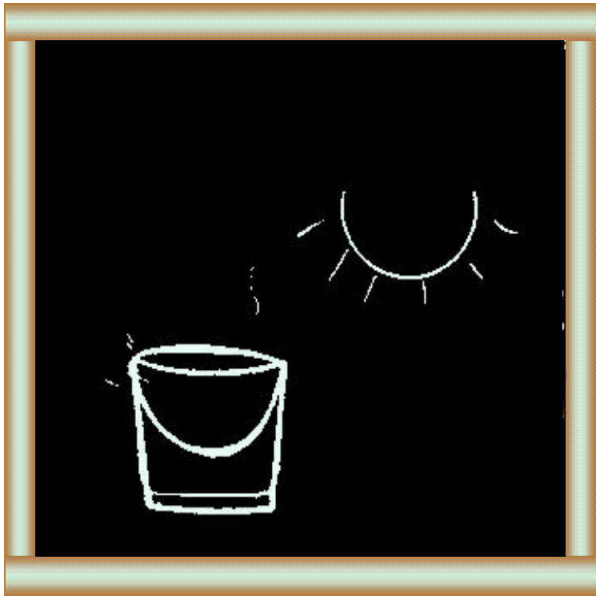
8 If everything is clean and you and your cow are healthy, your milk will be:

- fresh

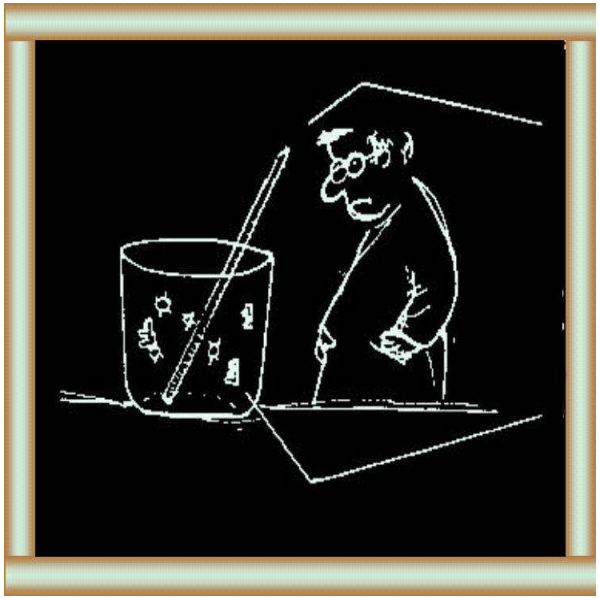
- good quality

- quite stable.

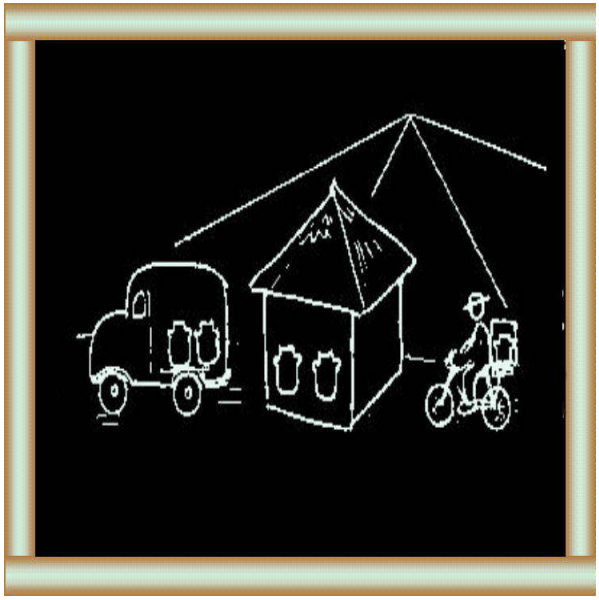
9 When you store or transport your milk many things can damage it:
- **chemicals**
- **bacteria**
- **bad handling.**



10 If your milk is warm,
there will be more damage
from chemicals,
bacteria and bad handling.



11 Temperatures between 15-40 C are bad for milk. There is high enzyme activity and bacteria multiply quickly.



12 Keeping your milk cool reduces damage.

About 4 C is the best temperature to keep milk.

13 If you can deliver your milk

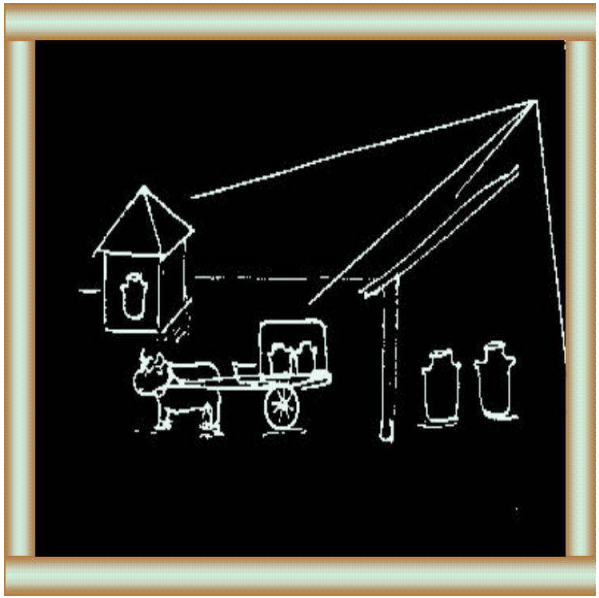
within one to two hours
and the milk collecting centre
has good cooling facilities,
cooling your milk at home is
not essential.
How long can you keep your
milk?

14 This depends on the:

Temperature and hygiene

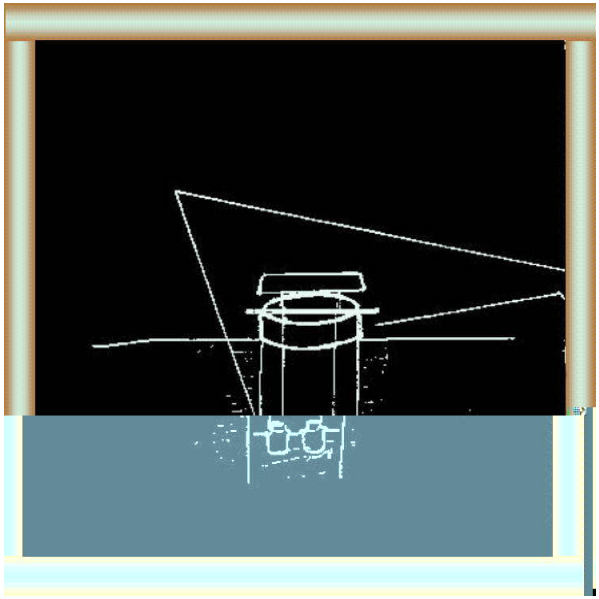
oC	Very clean milk	Clean milk	Dirty milk
4	good quality	good quality	poor quality
10	good quality	bad quality	very bad quality
20	poor quality	turned bad	turned bad
35	bad quality	turned bad	turned bad

How can you cool your milk?



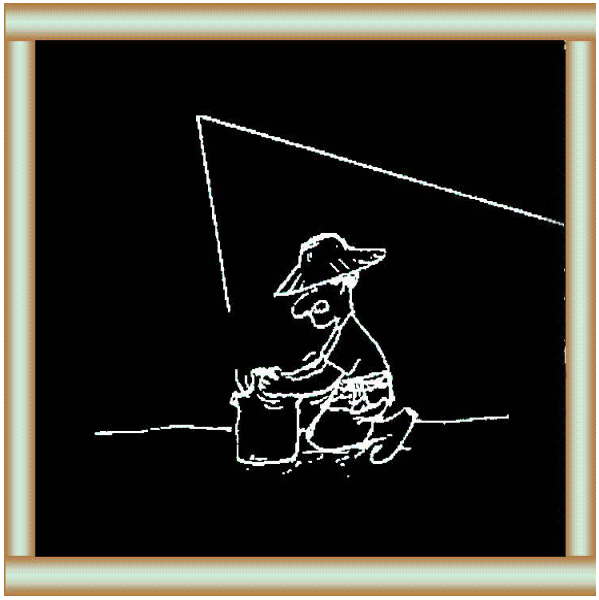
15 You can keep your milk

in the shade or
in a dark, well-ventilated place.



16 You can put your milk cans in a well.

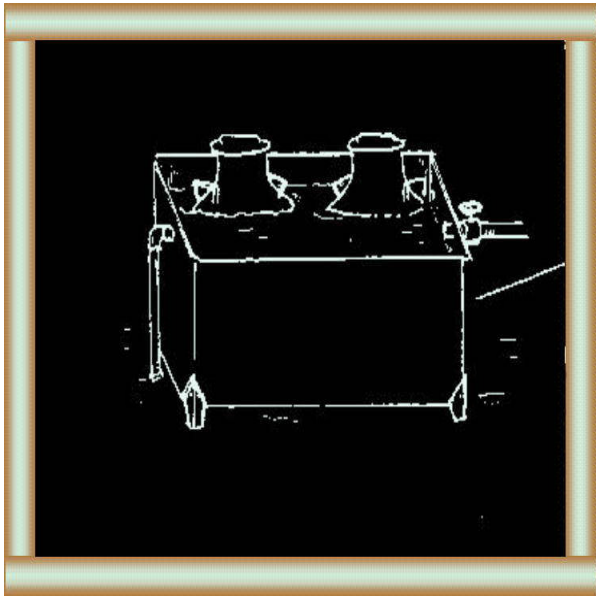
If you use the water for drinking, be careful it does not become dirty.



17 Make sure the tops are tight or cover with cloth so that water from the well does not get into your milk.

You can use cooling tanks

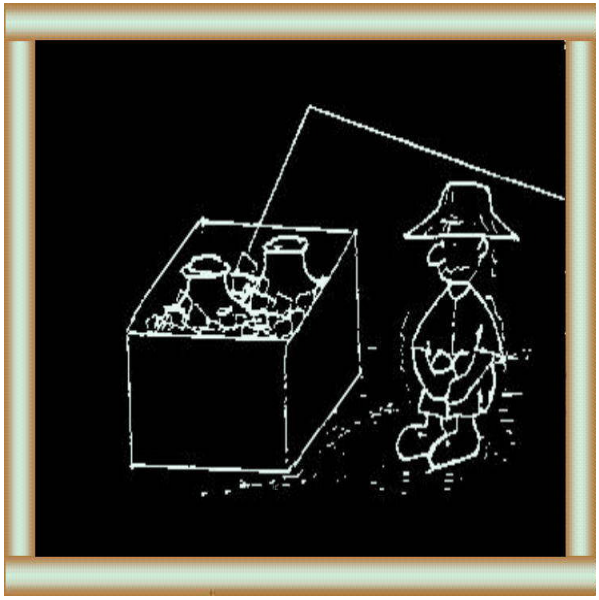
18 If you have a good supply of water, put your cans into a cooling tank.
The temperature of your milk



is 3-5 C above the temperature of the water (after some time in the water).

Milk ^{o}C	Water ^{o}C
7	3
10	6
13	9
16	12

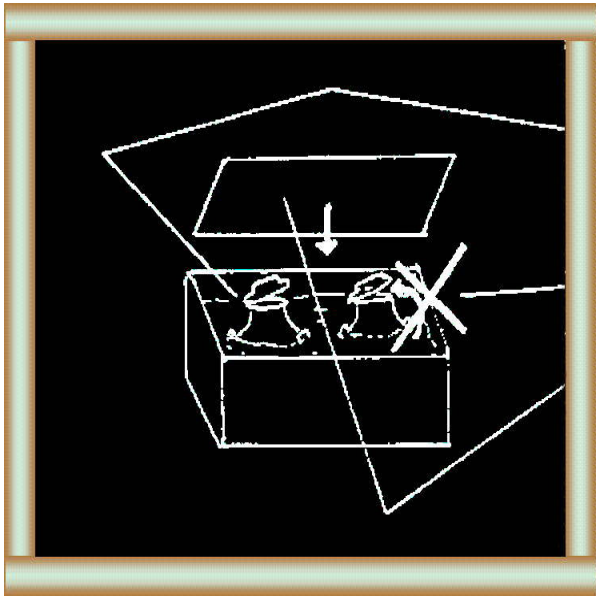
19 For large quantities of milk,



20 If ice is available,

you can use it for cooling your milk.

21 Loosen the lids of the cans

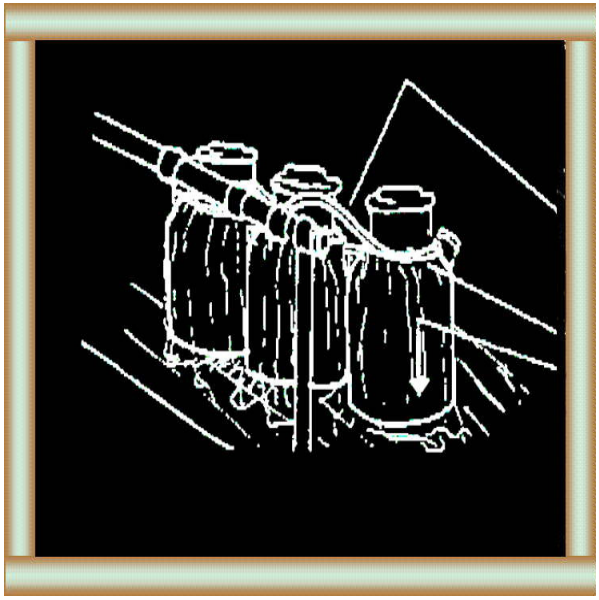


to allow the air to escape.

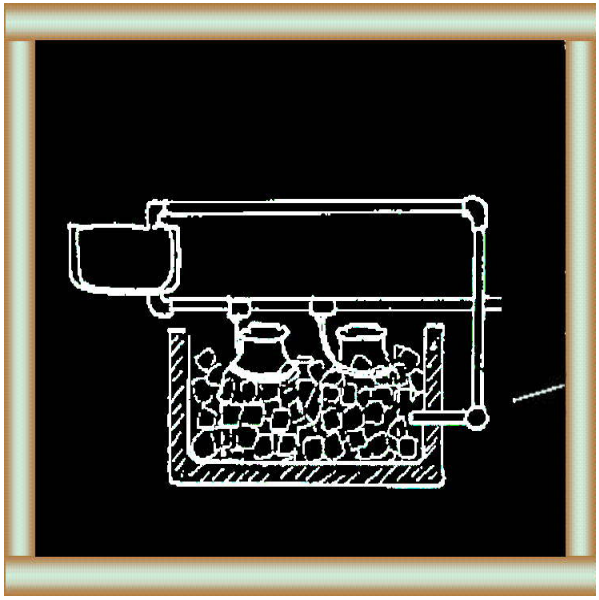
Make sure no water gets into the milk.

Cover the cooling tank with a lid to protect the milk from insects and dust.

You can use cooling rings



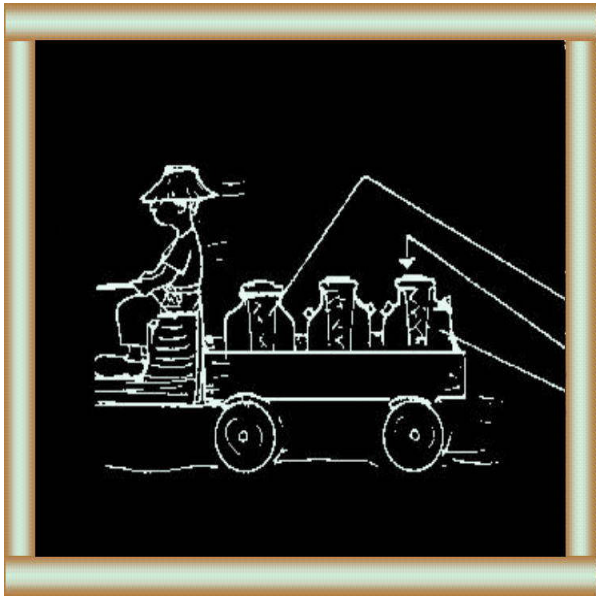
22 If cool (10 C or less) running water is available, you can pass it through a perforated ring so that it flows over the cans.



23 If you have a big farm (400-500 l milk/day), use a mechanical farm

cooling tank which runs on electricity.

You can use ice cones



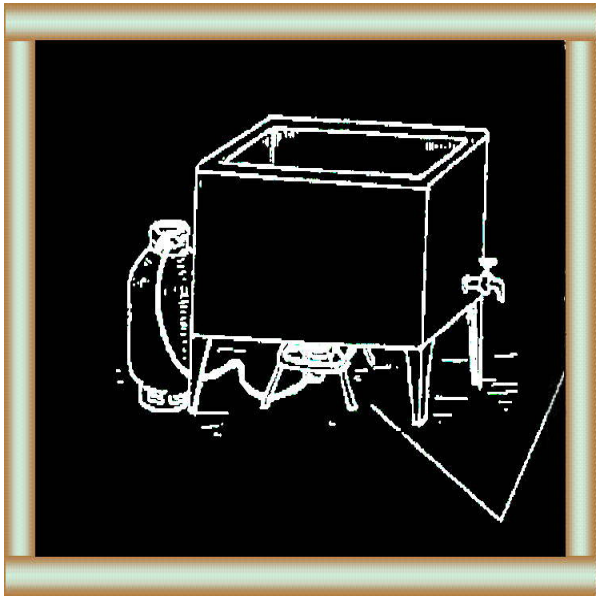
24 If you send small amounts of milk
a long way,

you can use ice cones.

Fill the cones with crushed ice
and place in the milk.

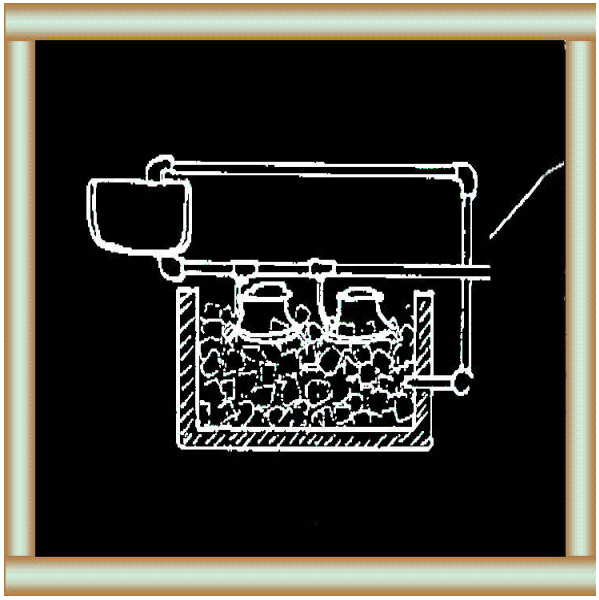
25 Clean the cones carefully after use and again before use.

Why heat treat your milk?



26 If you heat your milk before storing, you kill many bacteria, so you can keep your milk longer.

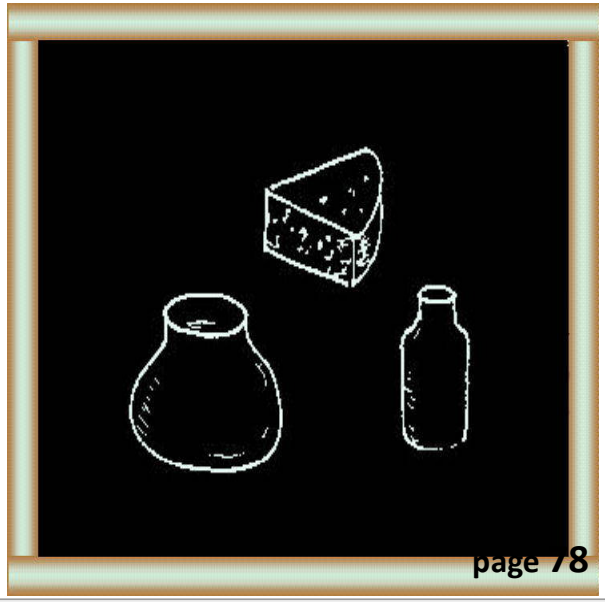
27 Thermatisation



28 Then cool down
as fast as possible
to under 10 C.
(See T.9 Milk Treatment)

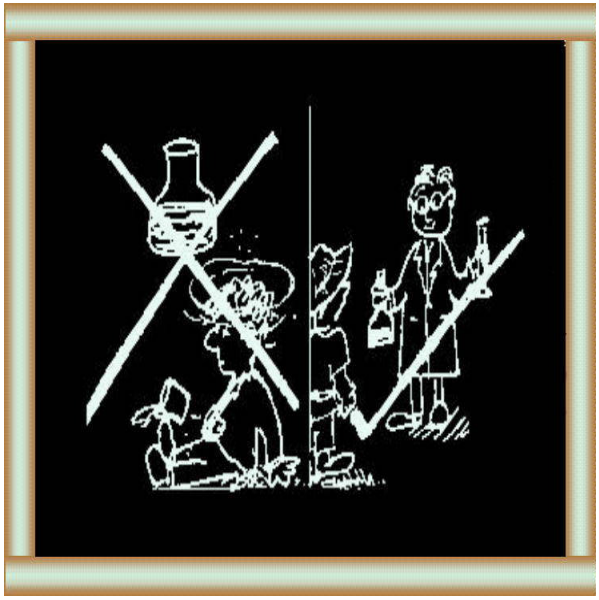
Why process your milk?

29 For quick local
consumption,

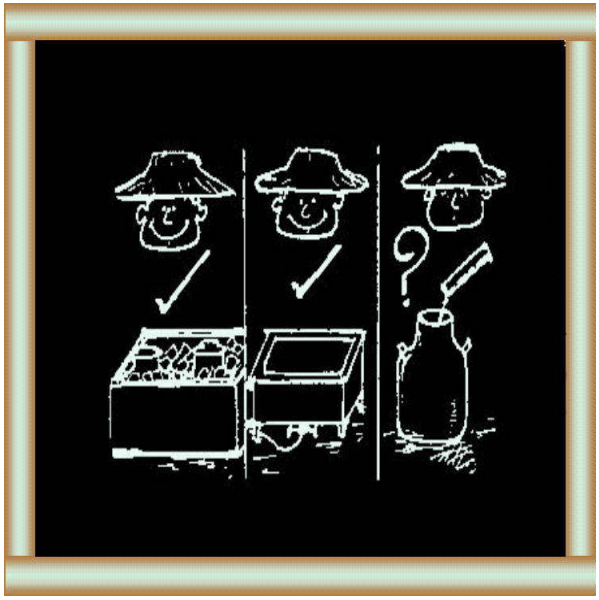


you can preserve your milk
by processing it into products
such as:
- cheese
- curd
- pasteurized milk
- yoghurt.
(See T.10 Milk Production
Manufacture)

Can you use chemicals to preserve your milk?



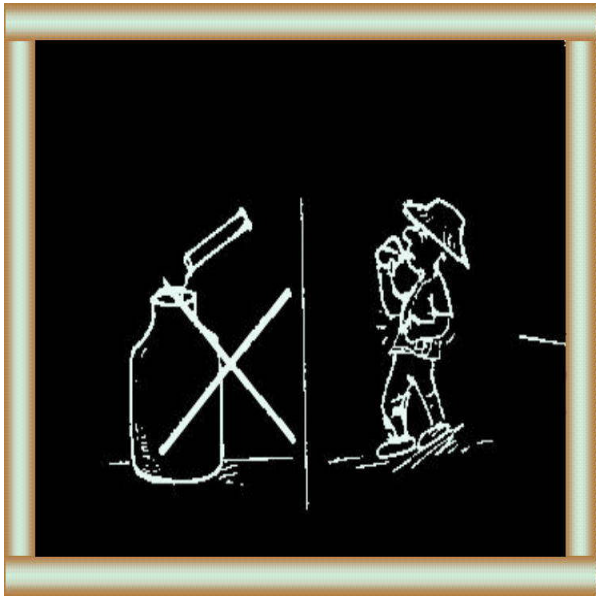
30 Yes, but the milk collecting centre should advise you because you need to use the correct types and amounts of chemicals.



31 Only use chemicals in your milk if you cannot cool it.

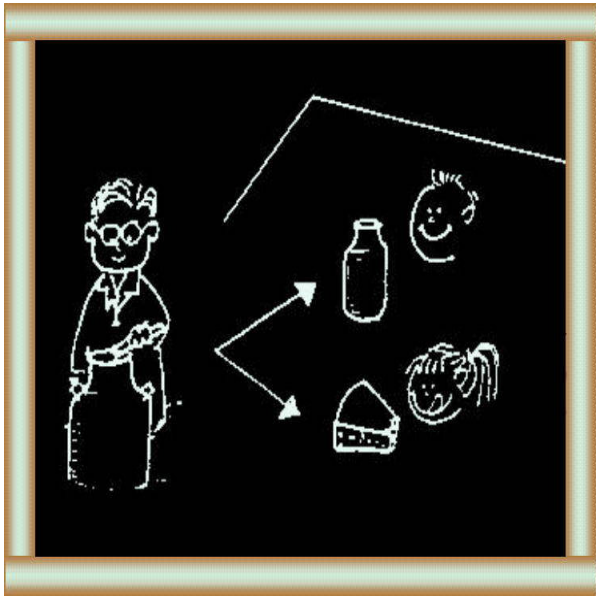
Heat treat your milk or deliver to a collecting centre quickly after milking.

32 Only use chemicals



in the milk you deliver
to a dairy plant.

Do not use chemicals
if you drink your own milk or
if you deliver your milk to
anywhere but a dairy plant.



33 The dairy plant will

process your milk
so that the chemicals
are not harmful.

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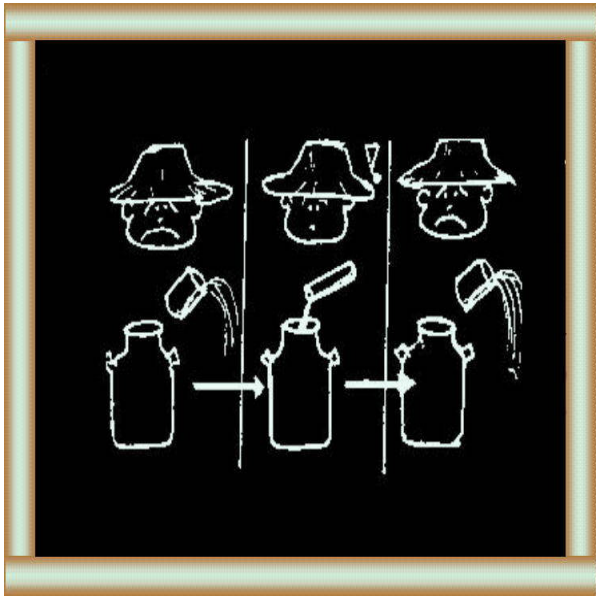
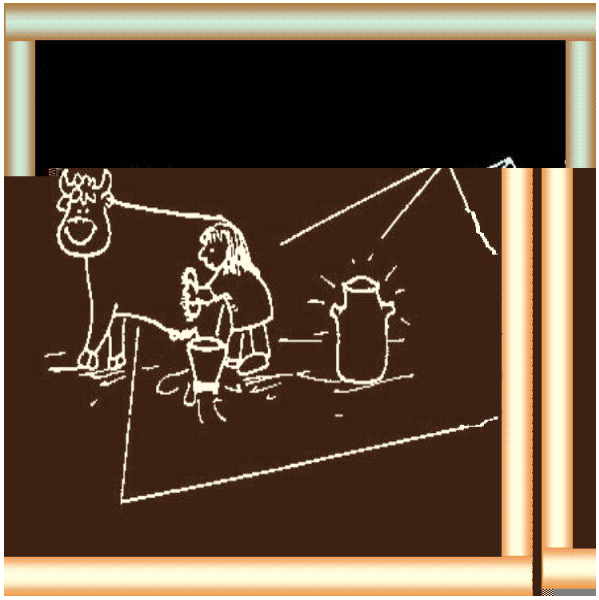
Is it legal to use chemicals?

34 You must check
if the use of chemicals
is legal in your country

Do chemicals make your milk clean?



35 No,
you cannot change
poor quality milk
into good quality milk
by using chemicals.



36 Good quality milk comes from

hygiene and

healthy animals.

37

- keeping your milk cool and handling it gently.

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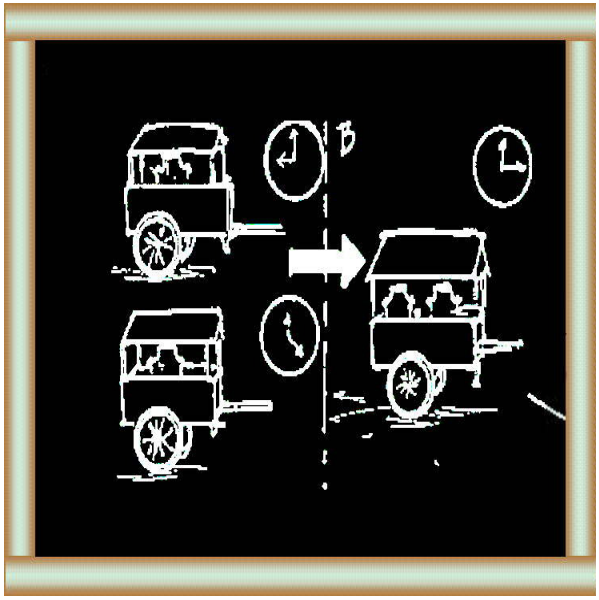
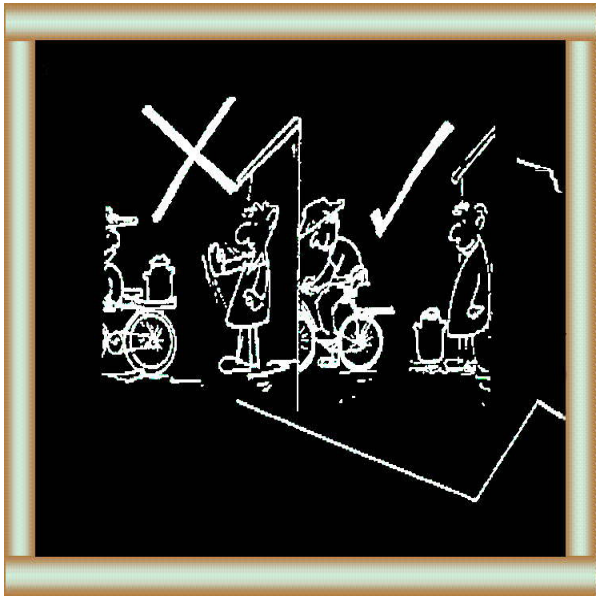
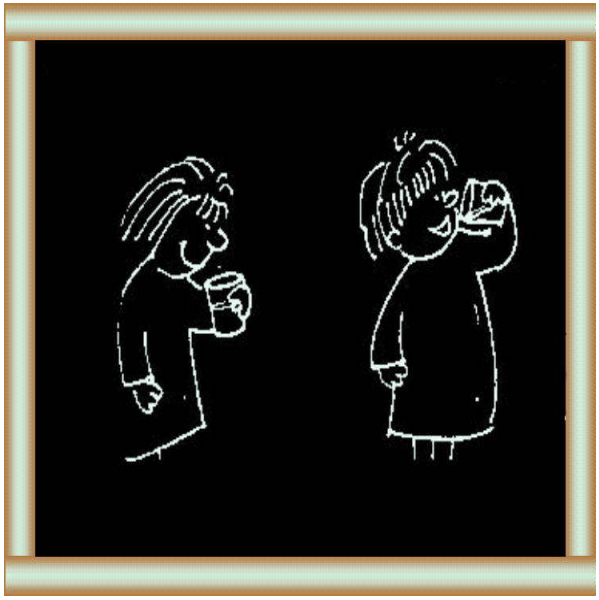
Why use chemicals to preserve your milk?



39 You can keep cooled milk longer and therefore, reduce the numberof deliveries.



40 You can deliver milk which spoils and the dairy plant rejects if you do not use chemicals.



41 If you use chemicals correctly, they have little effect on the physical quality of the milk.

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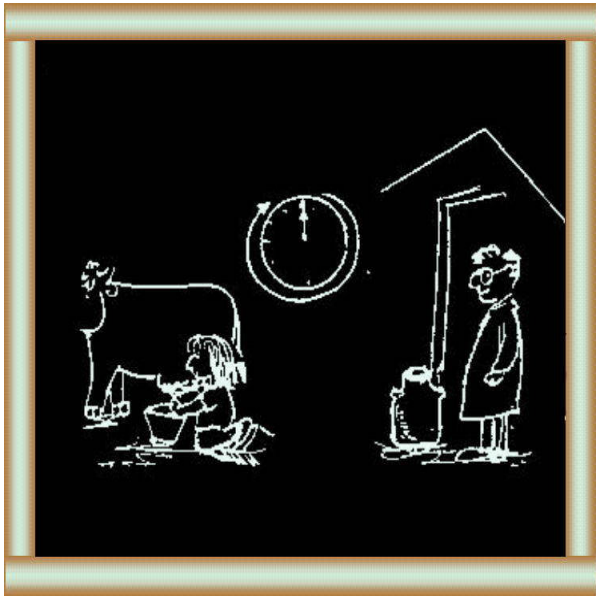
How can you use hydrogen peroxide to preserve your milk?

42 Add the correct amount of liquid hydrogen peroxide or solid carbamide peroxide to your milk.

Important

Ask your extension worker or dairy plant to advise on adding chemicals to your milk.

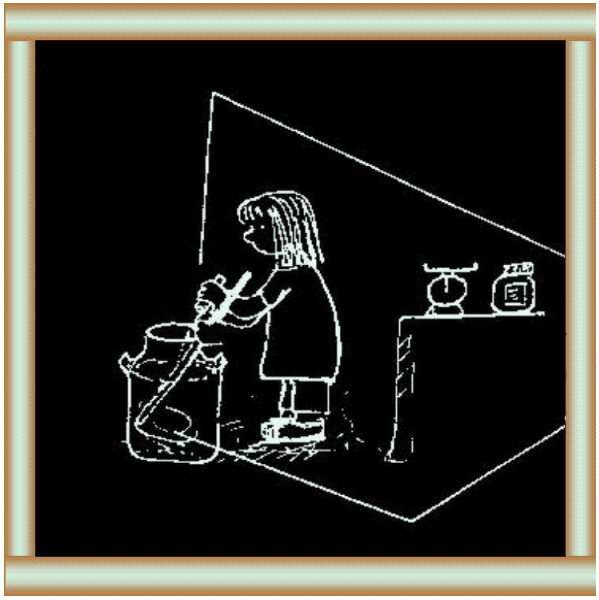
43 The dairy plant gets rid of the peroxide by adding the correct amount of catalase to your milk.



44 You can preserve your milk from 6 to 24 hours in tropical temperatures if your milk is good quality in the first place.

page 82

How can you use the lactoperoxide system to preserve your milk?

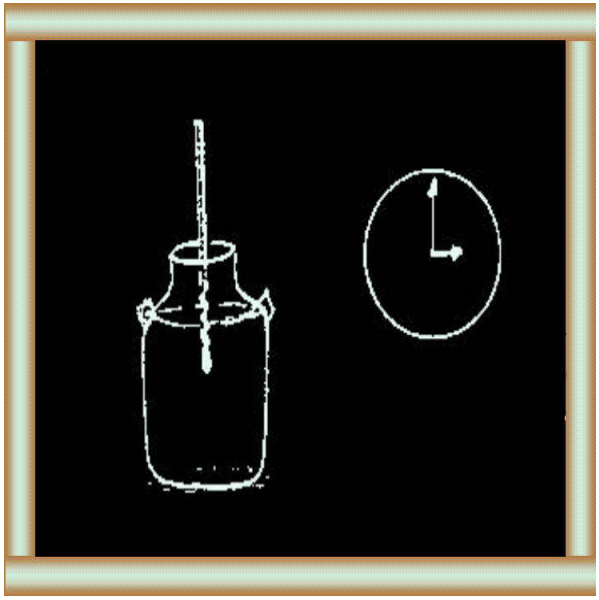


45 Within 2-3 hours of milking:

- add 14 mg of sodium thiocyanate for each litre of milk
- stir well
- add 30 mg of sodium percarbonate for each litre of milk
- stir well.

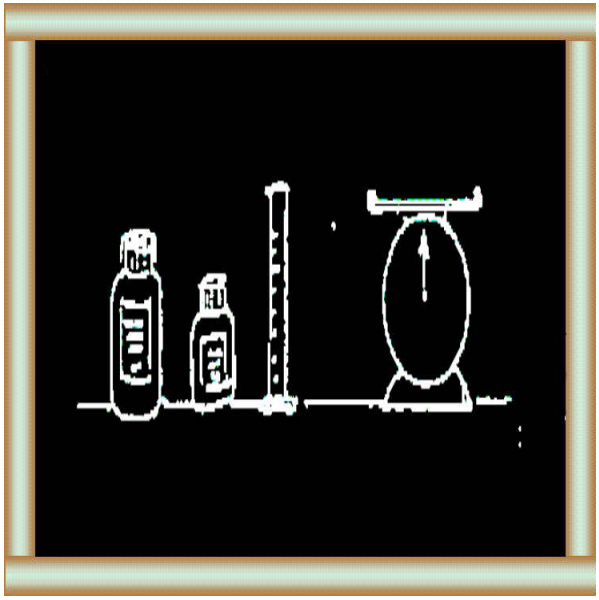
Important
Add the chemicals in the correct order.

46 You can keep your milk for up to the following times:



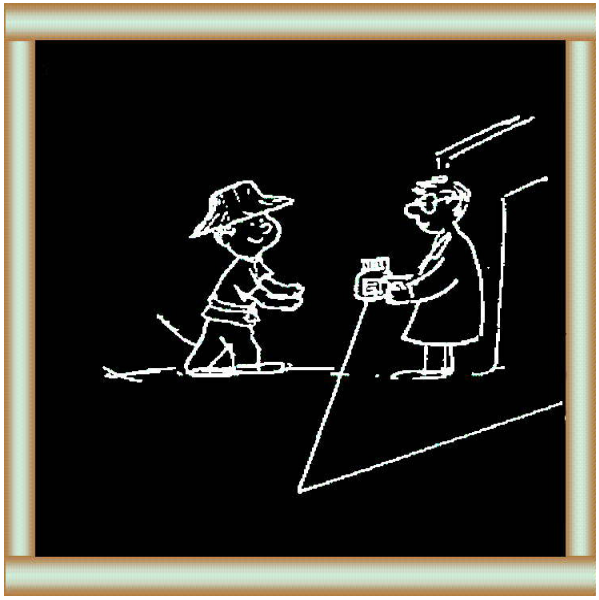
Temperature (C)	Time (hours)
25 - 30	8
20 - 25	12
15 - 20	18
10 - 15	30
4	48

Remember



47 Use only the right amounts of the right types of chemicals.

Consult
your milk collecting centre.



48 Make sure you get

new chemicals often.

Always check
the instructions on the label.

49 Keep all chemicals
out of reach of children
and animals
and away from
food and drinking water.

What do you know about milk preservation?

Important factors

1. **Hygiene** (5)
2. **Temperature** (6)
3. **Quick delivery** (7)

Reasons for cooling milk

Cooling milk reduces:

1. **damage** (10,12)
2. **enzyme activity and rate of increase of bacteria** (11)

Keeping time

Depends on: (14)

1. **temperature**
2. **hygiene**

Methods of cooling milk

1. **Traditional:**
   - **shade** (15)

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Milk Transport

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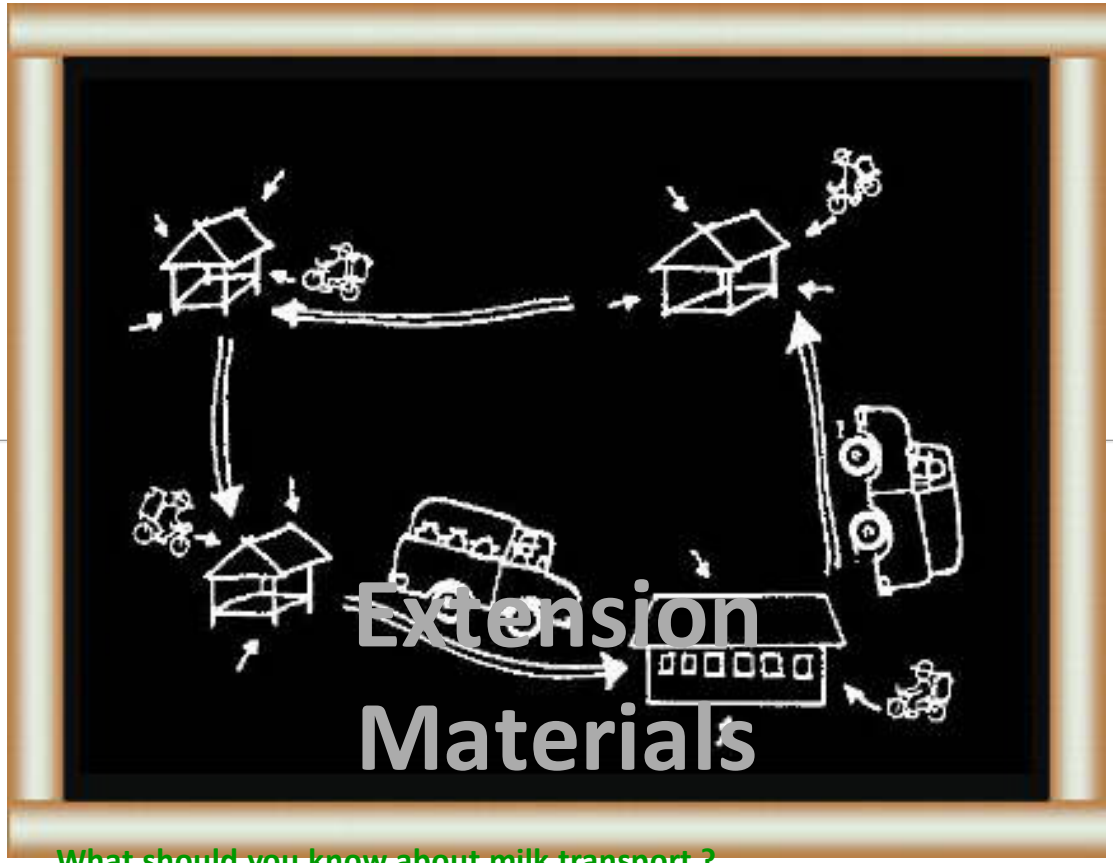
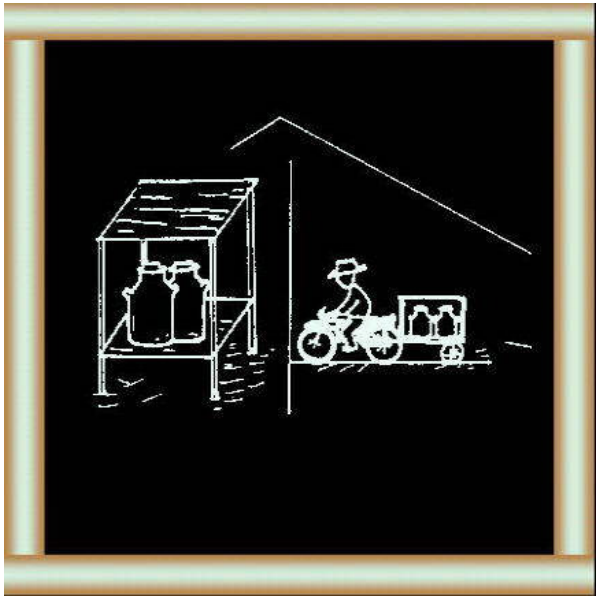
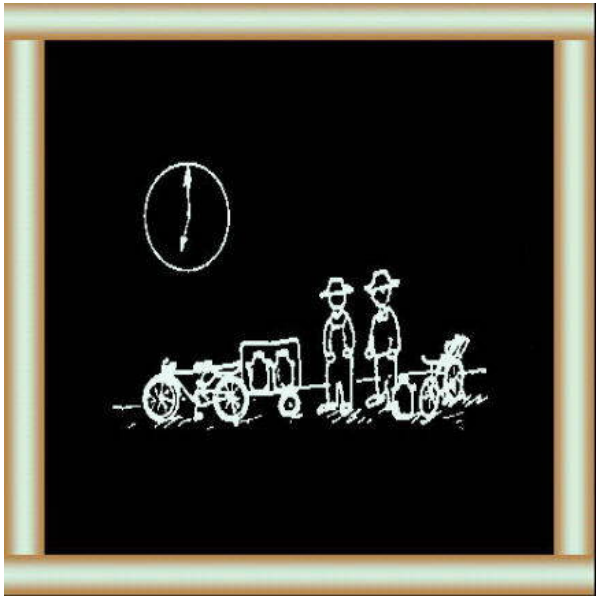


What should you know about milk transport ?



What is important ? (1-4)
Maintaining milk quality by:
- keeping your milk clean and cool
- handling your milk gently
- transporting your milk quickly.



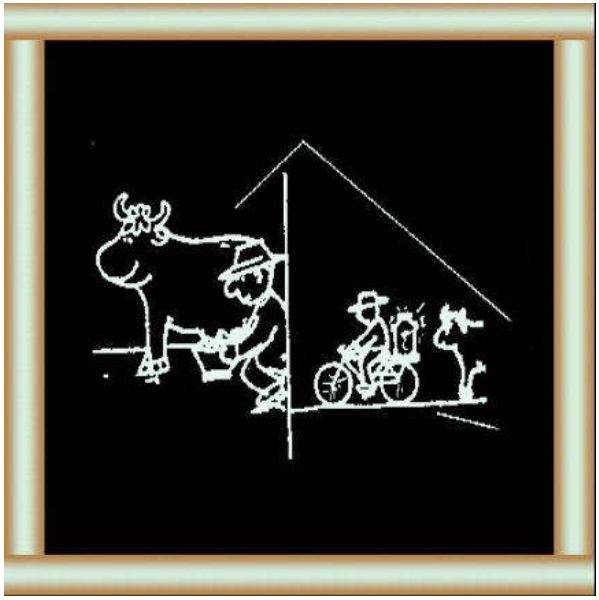
How can we collect milk efficiently ? (5-13)

By co-operating with other farmers and the collecting centre in the timing of milk collection.

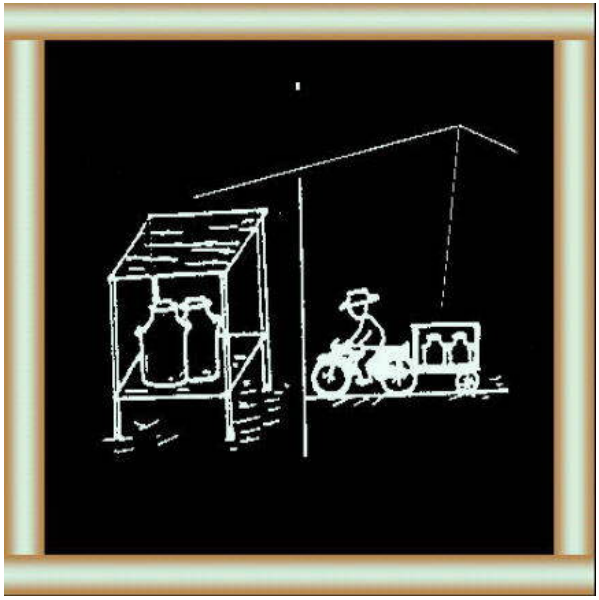
What kind of milk containers should you use ? (14-21)

Good quality can made out of good materials.What kind of milk containers should you use ? (14-21)

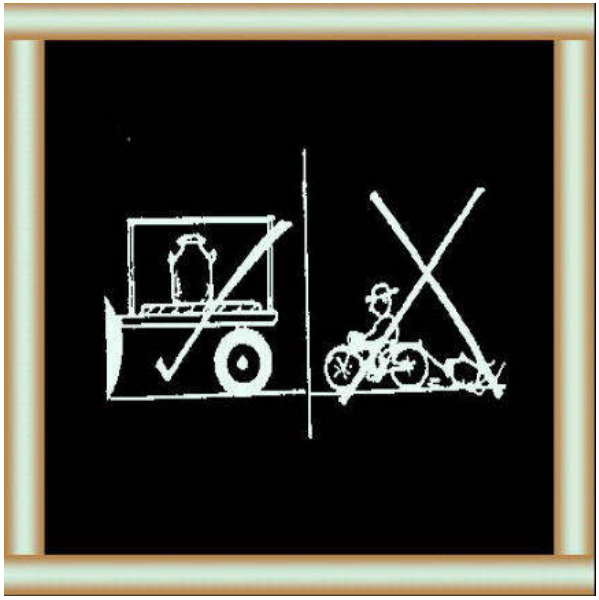
Good quality can made out of good materials.



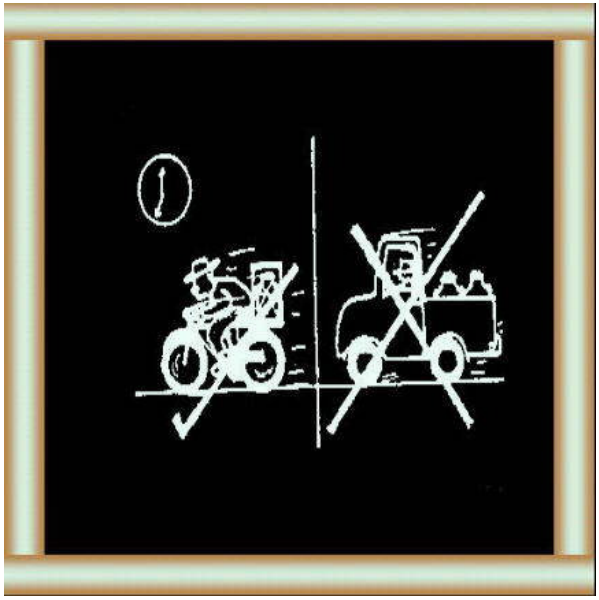
1 Anything which affects the quality of your milk.
Keep your milk clean
- during milking
- during storage
- and during transportation.



2 Keep your milk cool.



3 Handle your milk gently.



4 Transport your milk in the shortest time possible but at low cost.

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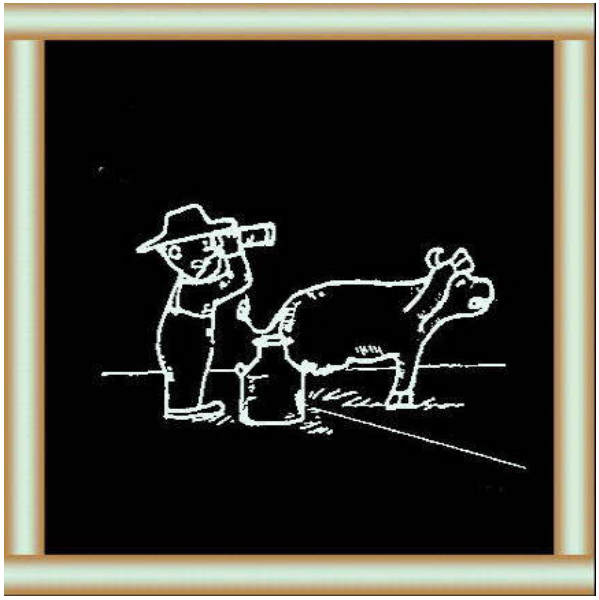
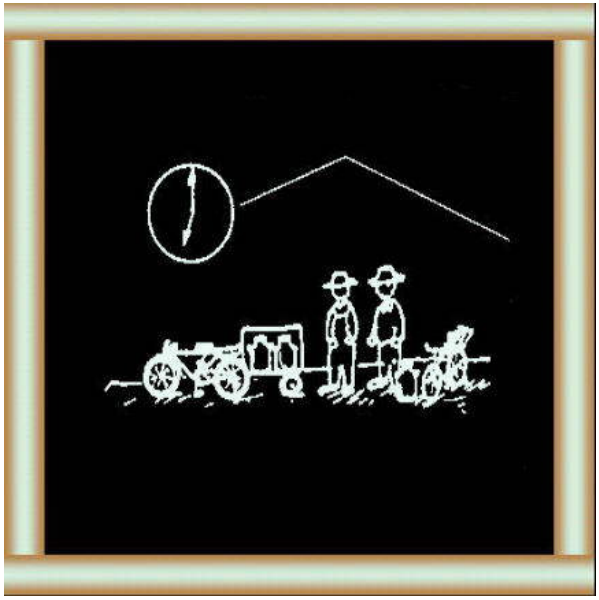
How can we collect milk efficiently ?

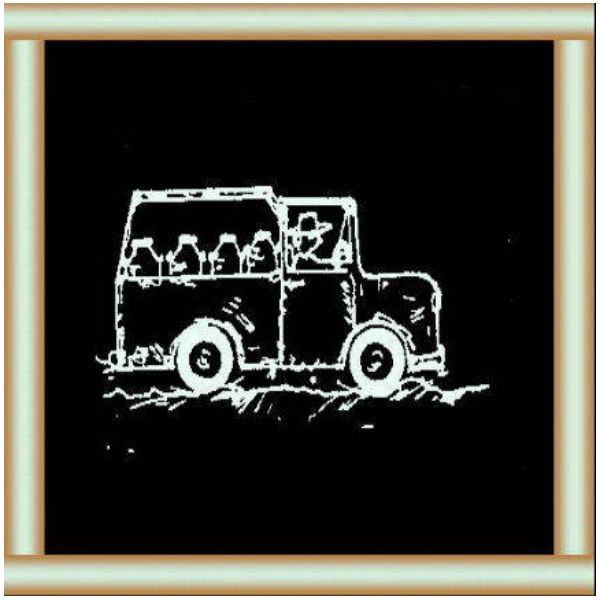


5 Many farmers produce only a small quantity of milk and the dairy plant is far away.

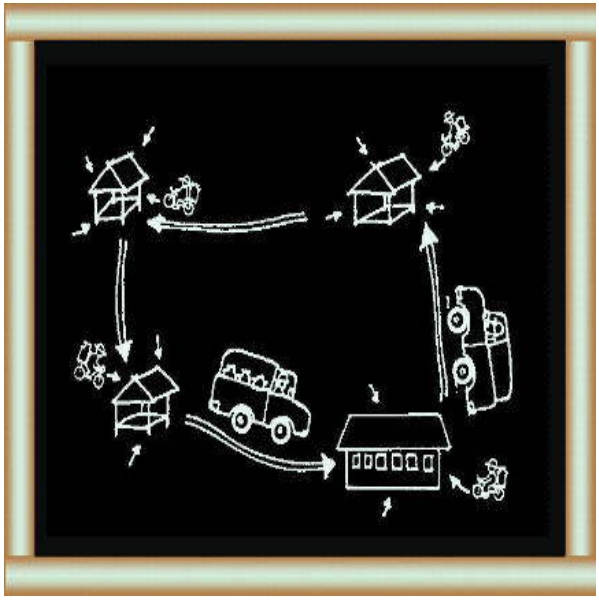
6 The roads are bad and the farmer takes his milk to the collection point by bicycle.



7 Farmers nearby bring their milk. They know what time the truck comes and bring their milk just before.



8 You can plan with the farmers in a co-operative or with the dairy so that good quality milk arrives at the dairy at low cost.



9 This milk collecting system is efficient and low cost. It makes good use of manpower and transport.

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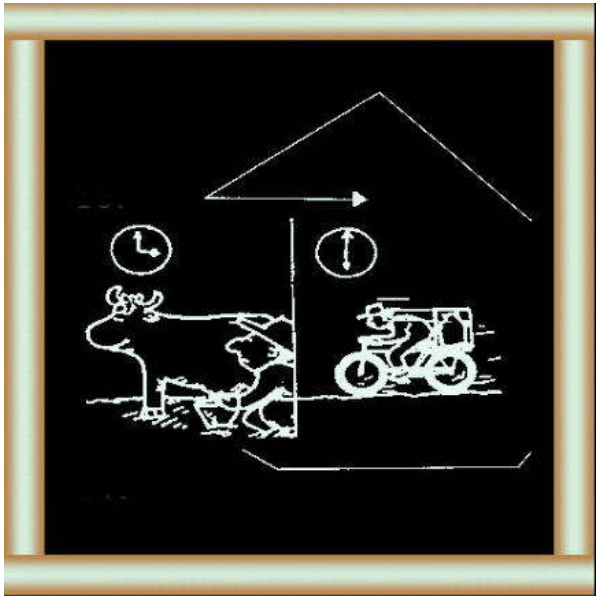
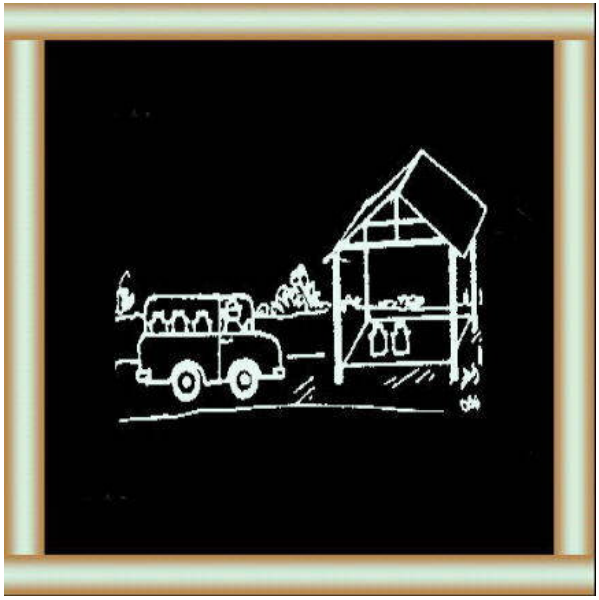
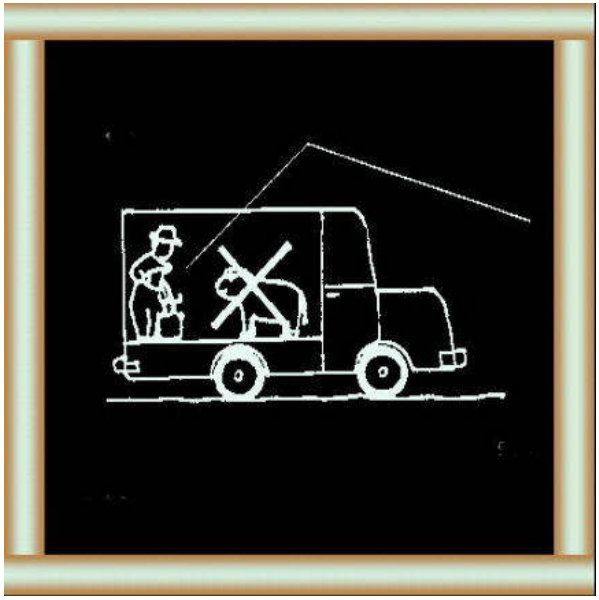


10 If you do not cool or preserve your milk, it must arrive at the dairy within 4-6 hours. milk your cow just before sending it to the collection point just before the collection by the truck.



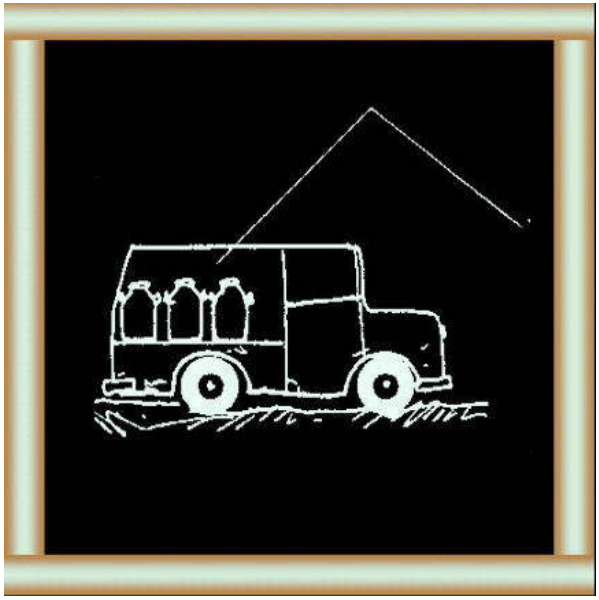
11 Protect your milk from light and temperature. Keep it cool.

12 Keep everything clean and sanitize your equipment.

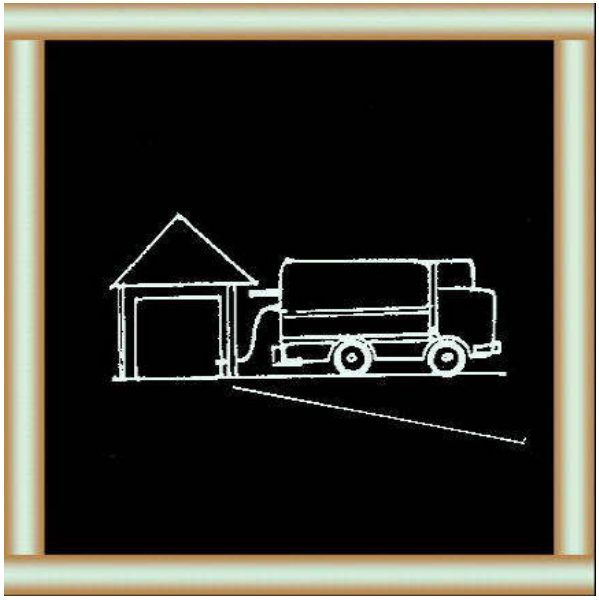


13 Always use clean, disinfected filters when you stratin milk. Never carry animals or dry things with your milk.

What kind of milk containers should you use ?

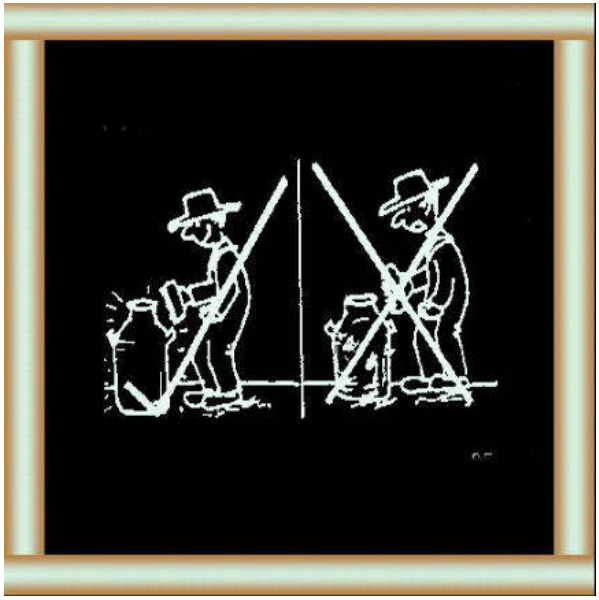


14 For small qualities of milk, you should use cans.

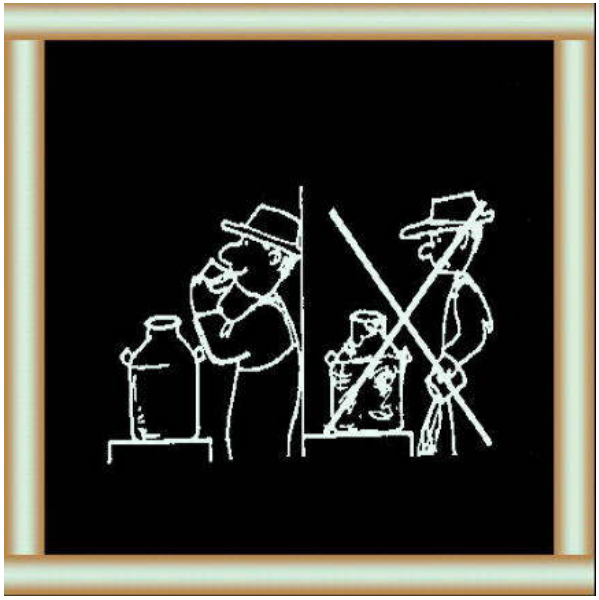


15 Bulk tanks use pumps. They are extensive and need maintenance to avoid spoilage of milk.

16 Choose your cans carefully.

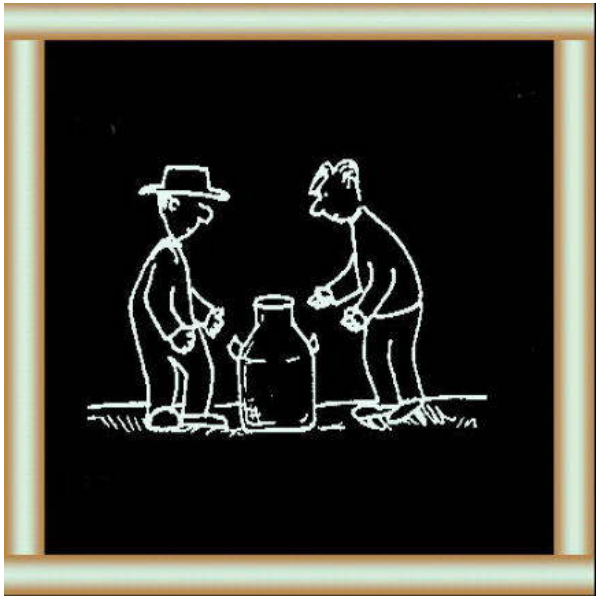


17 Materials for cans should be non corrosive such as stainless steel, aluminium or plastic.



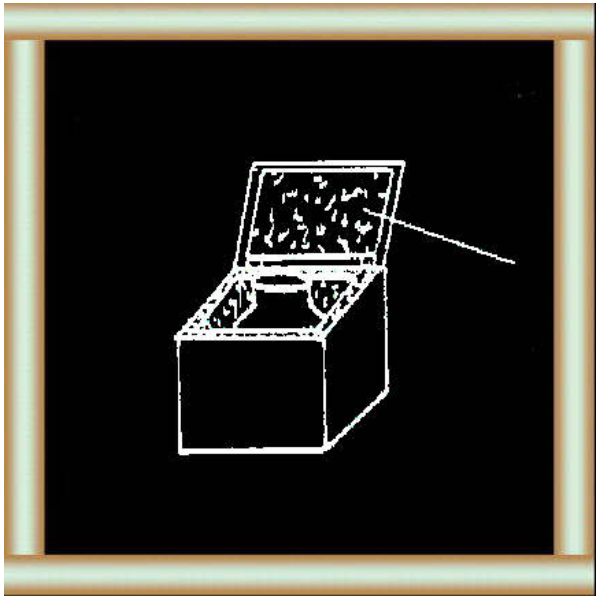
18 They should not give any flavour to the milk. Do not use containers which have contained pesticides or other chemicals.

19 They should be light but strong and with a smooth surface (easy to clean).



20 Consult your extension worker about the best type of container to use.

\



21 You may construct a box with insulating foam inside (polystyrene) to avoid temperature increase during transport.

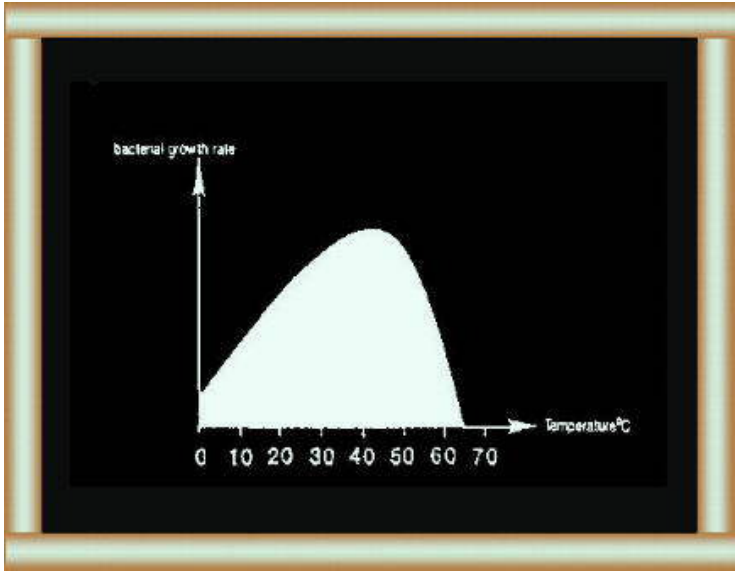
Avoiding Problems

During Transport (22-24)

Rancid taste and smell in milk comes from free fatty acids, FFA (22). The enzyme Lipase is responsible for the chemical reaction (Lipolysis) that frees the fatty acids from the glycerides. However, before the enzyme is able to attack the butter fat the membrane around the fat (fat globule) has to be broken. Damage to the membrane can happen if the milk is handled roughly i.e. shaking, stirring, sloshing. Lipolysis is encouraged by high storage temperatures.

Metallic (oily, tallowy) flavour comes from acidation of the butter fat (230. The presence of iron and copper salts light and dissolved oxygen trigger the reaction. When bacteria grow in milk they use the oxygen thereby reducing the possibility of fat acidation. Milk can contain more dissolved oxygen at low temperature than at high temperatures (the solubility of oxygen is higher at low temperature). Bacteria are not so active at

low temperatures. Metallic flavour, therefore, is often found in milk that has been cooled for a long time. The problem should not be solved by storing the milk at higher temperatures so that the bacteria are more active as this will only cause more problems. see Figure 1.



is a chemical reaction in the protein (oxidation of an amino acid) which gives the sweetish flavour.

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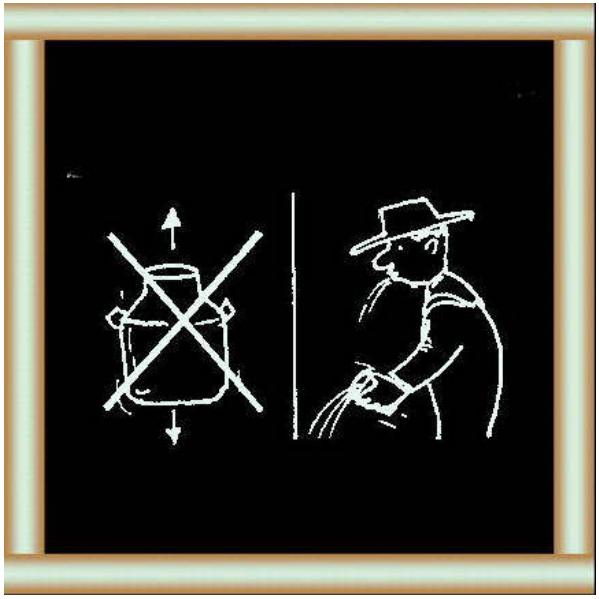
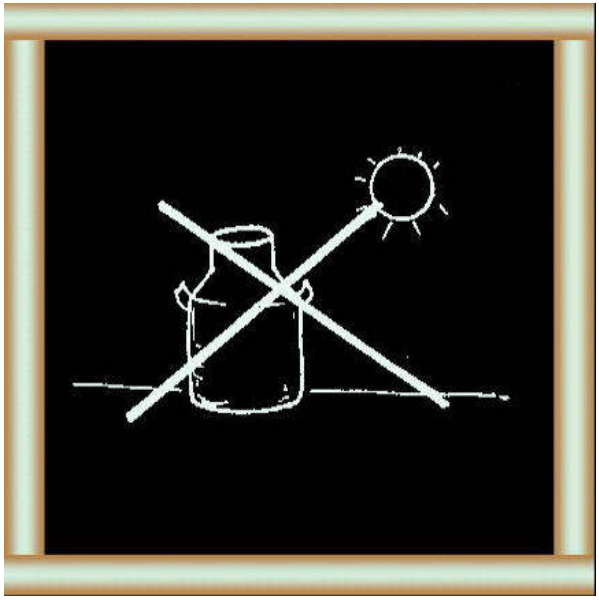
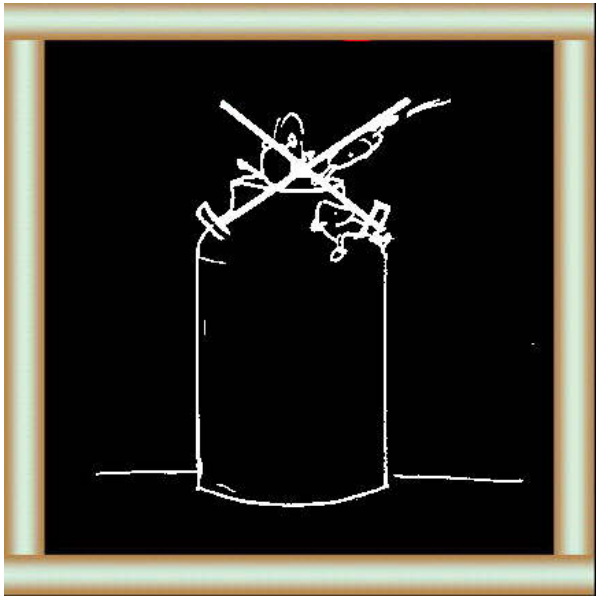
How can you avoid problem during transport ?



22 Do not
- shake up your milk
- freeze it
- expose it to rapid change in temperature
(especially 15-30 C)
The fat globules may break down and your milk may get rancid flavour.



23 Do not
- use containers and any equipment with copper or iron
- leave your milk in direct light or sun light.
Your milk may get metallic or sunlight flavour.



24 Do not
- allow bacteria to develop quickly.

Keep your milk cool and clean and send it to the collecting centre quickly.

What do you know about milk transport ?

Important points in transport

Efficient milk collection

Selecting milk containers

Small-Scale

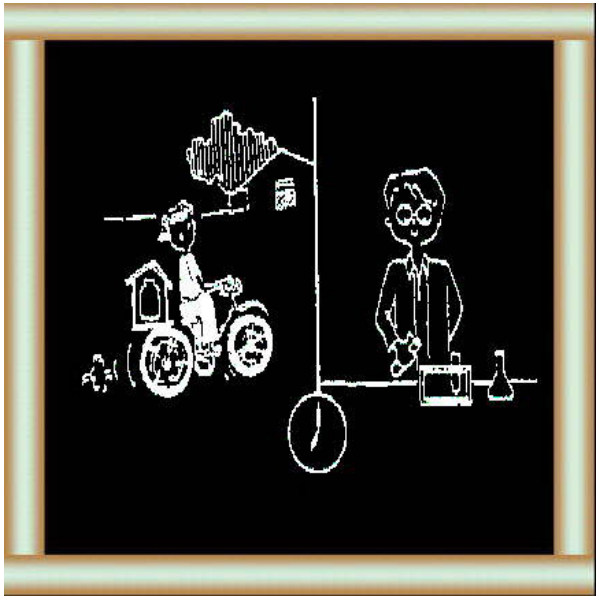
Dairy Farming Manual

Volume 1

Technology Unit 6

Milk Collecting Centres

What should you know about milk collecting centres ?

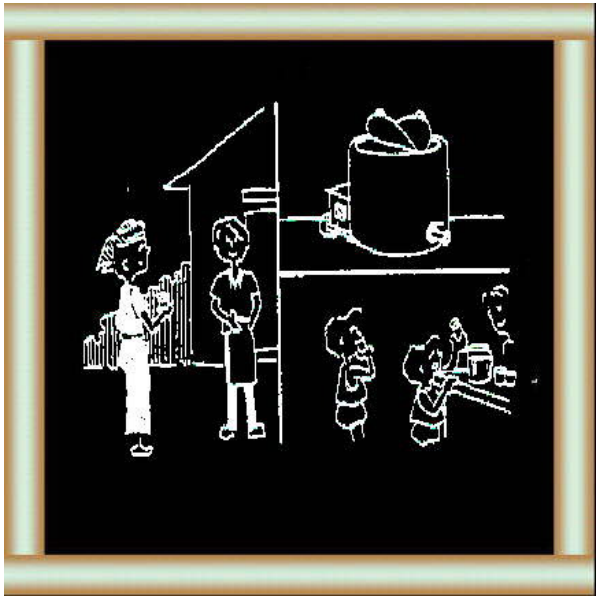


1 What is important in milk collection ? (5-7)

- delivering your milk quickly and at a low cost

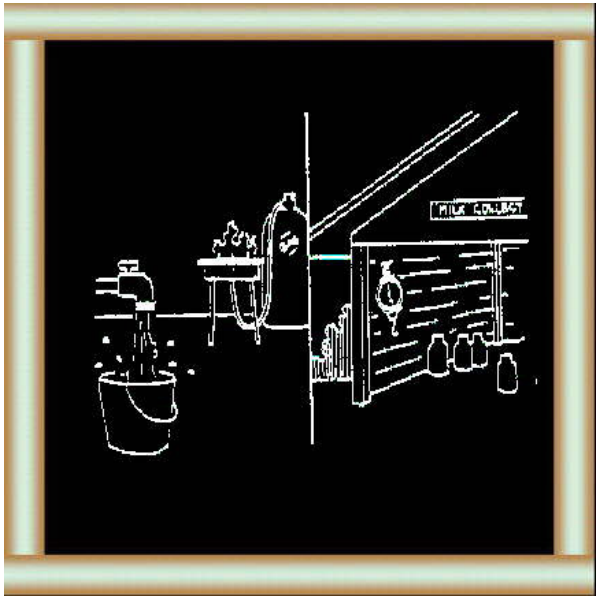
- testing your milk.

2 What does the milk collecting centres do ? (8-19)



If your milk is good quality, the centres:
- recieves your milk
- keeps it in good condition
- dispatches your milk and arranges for payment

3 What is important in the location of milk collecting



necessory ? (21-41)

A centre needs:
- water and energy supply
-the right buildings and equipments.

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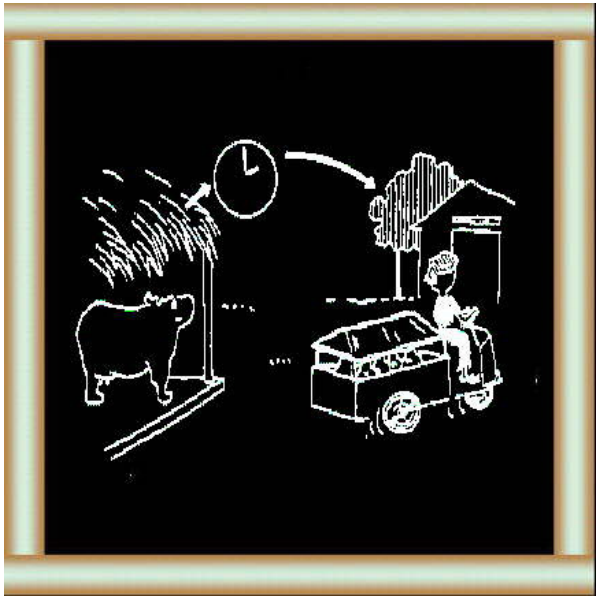
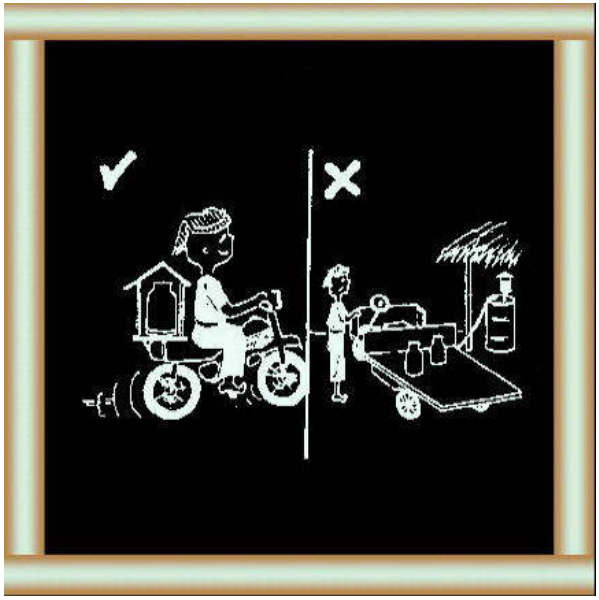
Note: (The numbers in brackets refer to illustrations in the Extension Materials)

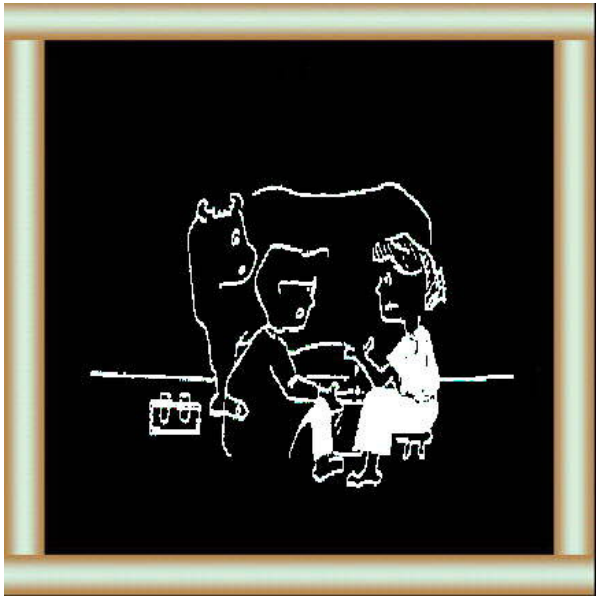
What is important in milk collecting ?



5 Getting milk to the collecting centre in the shortest time.

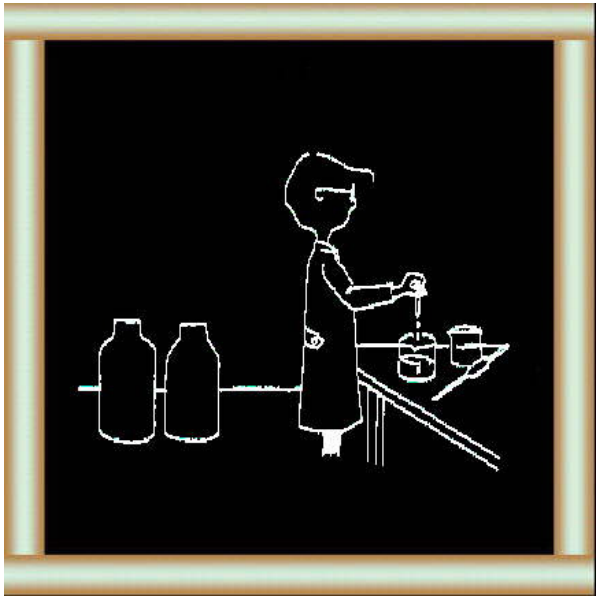


6 Getting milk to the collecting centres at low cost



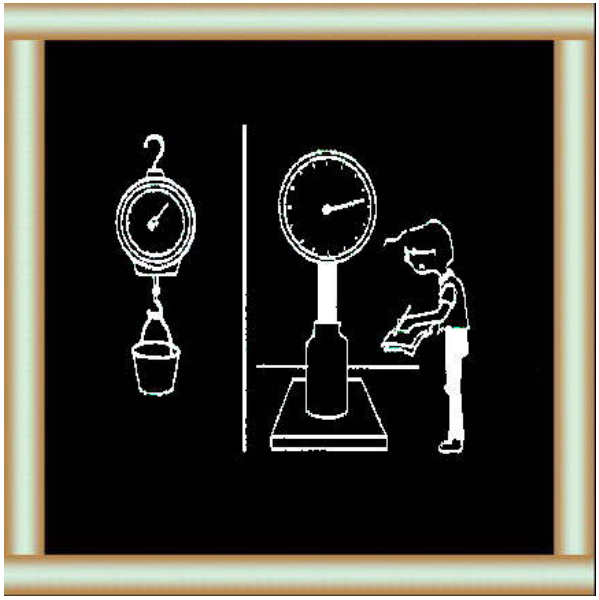
7 When and how to test the quality of milk.

What does a milk collecting centre do ?

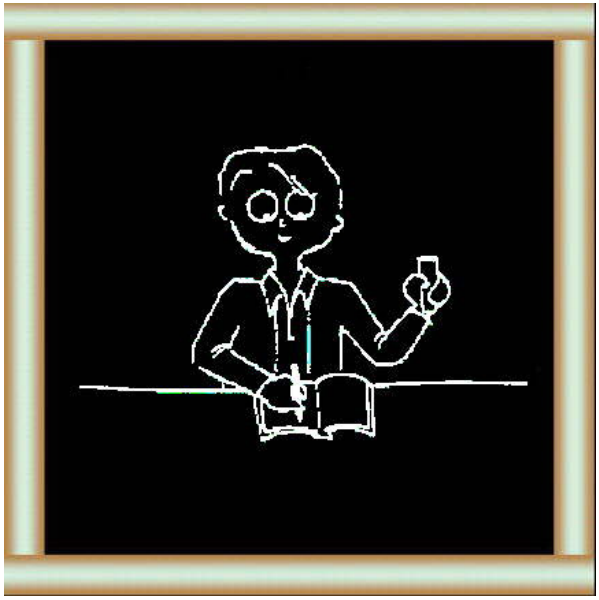


Reception

8 The centre takes samples of milk and
- tests them



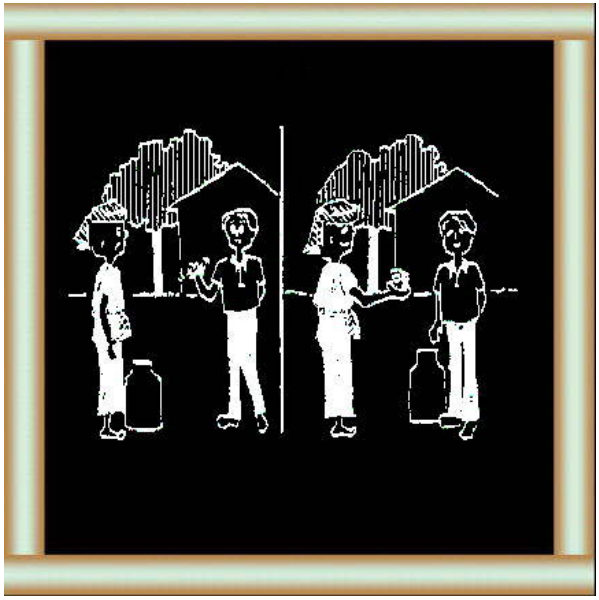
9 - weighs the milk



10 - records the weights and

- tests results

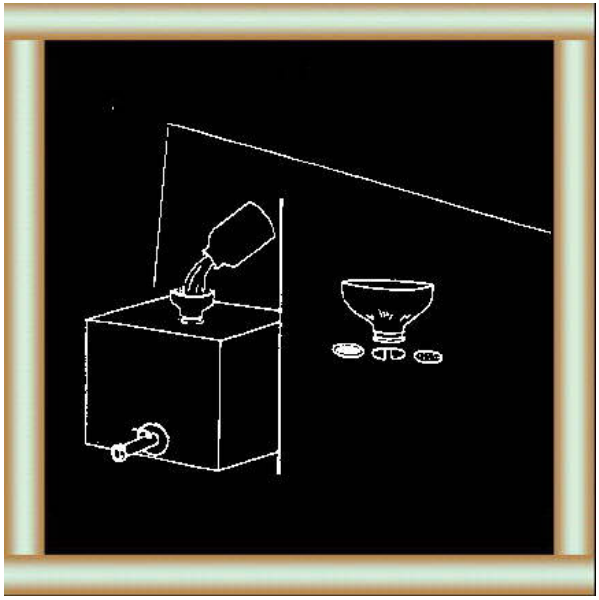
for each delivery



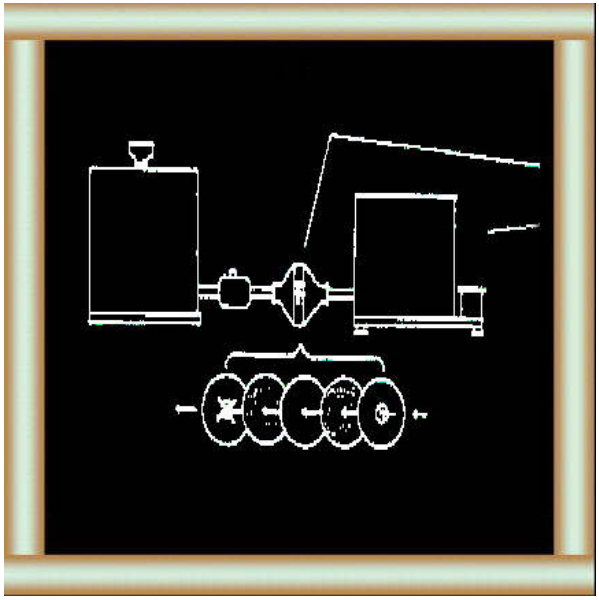
11 - rejects poor quality milk.

Make sure your milk is good quality.

Straining and filtering

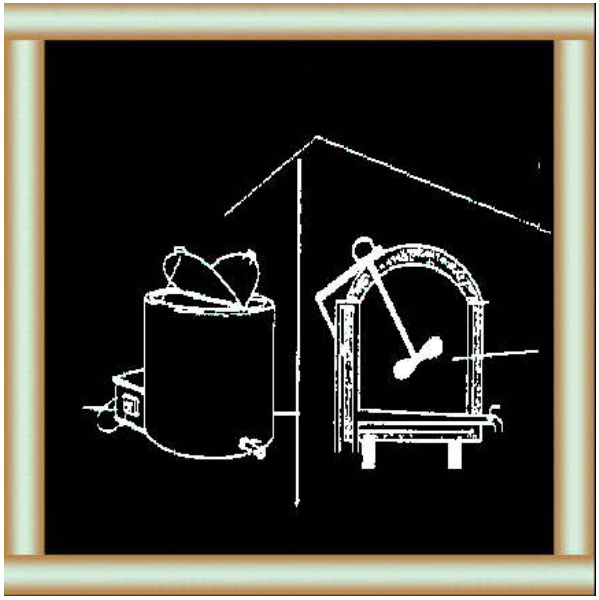


12 The centre strains your milk into a dump tank to remove impurities.

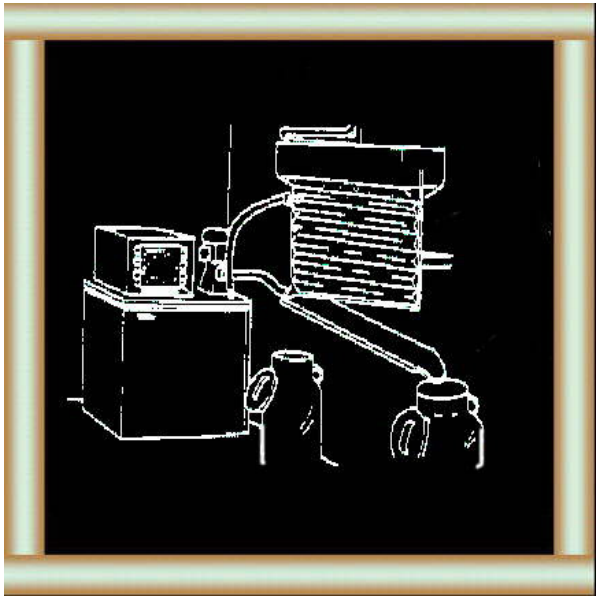


13 From the dump tank, the centre pumps the milk through a filter to a cooling tank.

Cooling and Storing

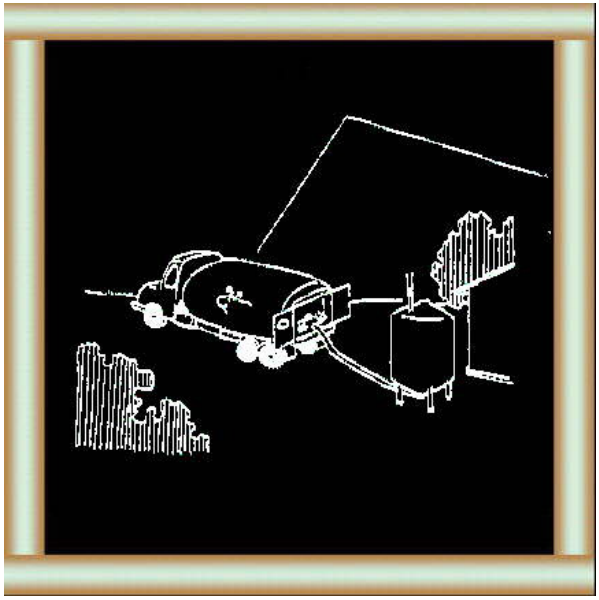


14 The centre cools the milk and stores it in a farm-tank cooler.
The cooler has an agitator to speed cooling and prevent a cream layer forming.



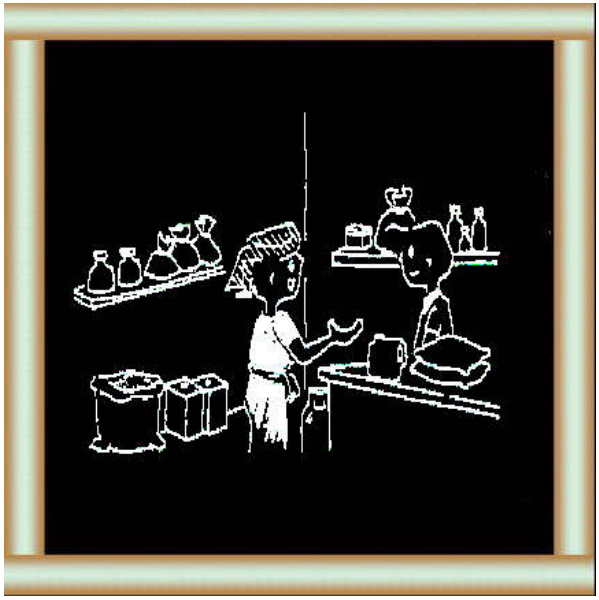
15 Some small centres use a surface cooler. Warm milk enters and the cool milk in cans is ready for transport.

Dispatch and Sales



16 Tanker trucks collect the milk from the centres and send it to the dairy.

17 The centre may sell milk locally



18 and also supplies for the farm such as:

- concentrates

- chemicals

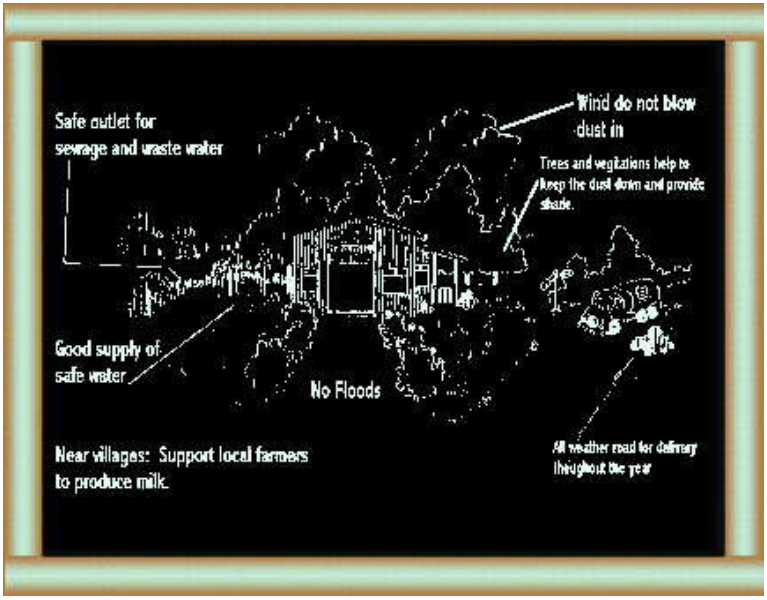
- equipment.

Payment

19 The centre will keep records and accounts and arrange payment for your milk.

---

20. What is important in the location of a milk collecting centre ?



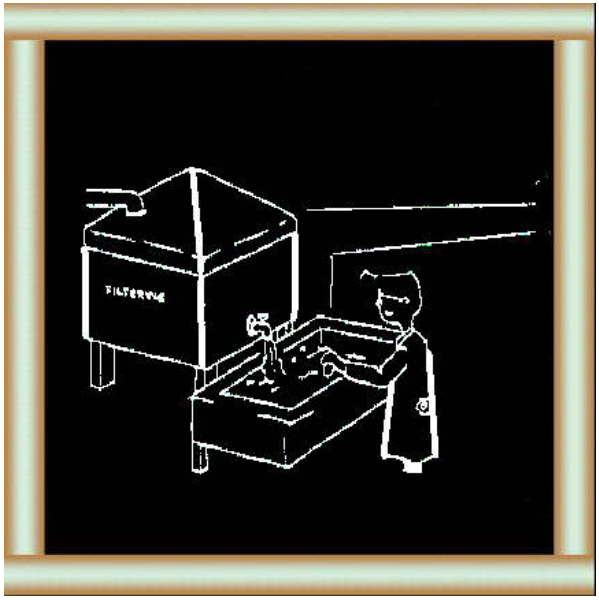
page 108

What utilities are necessory for a milk collecting centre ?

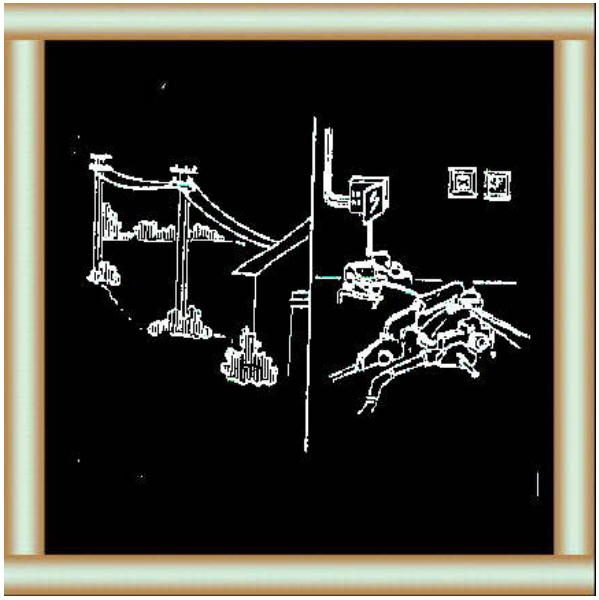
Water

21 If there is no town supply, drill a borehole and use a pump.

22 If a borehole is not possible, use a shallow or rain water attachment.



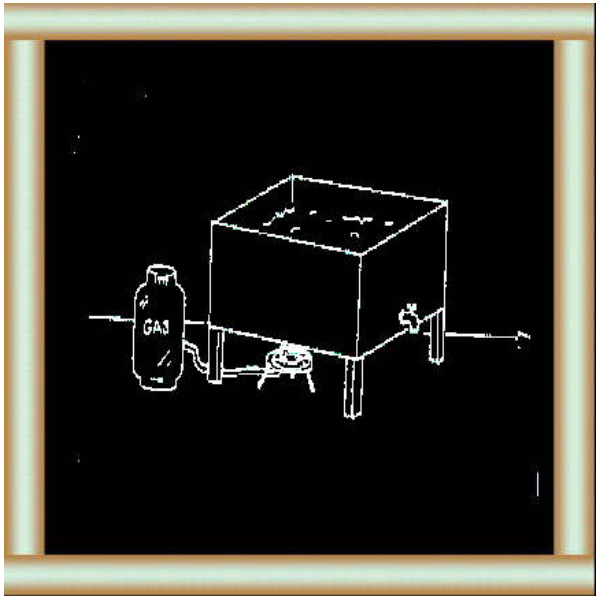
23 Make sure the water is safe by filtering and adding chlorine.



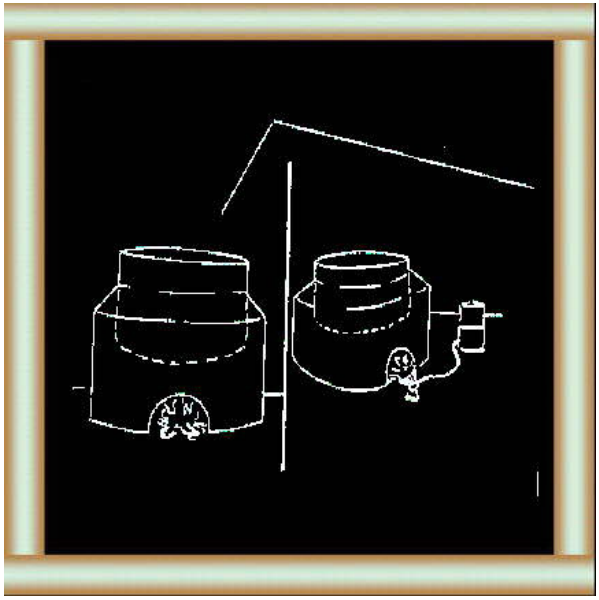
Electricity

25 The centre needs electricity to cool and pump the milk. If there is no mains supply, the centre can use a diesel generator.

Gas

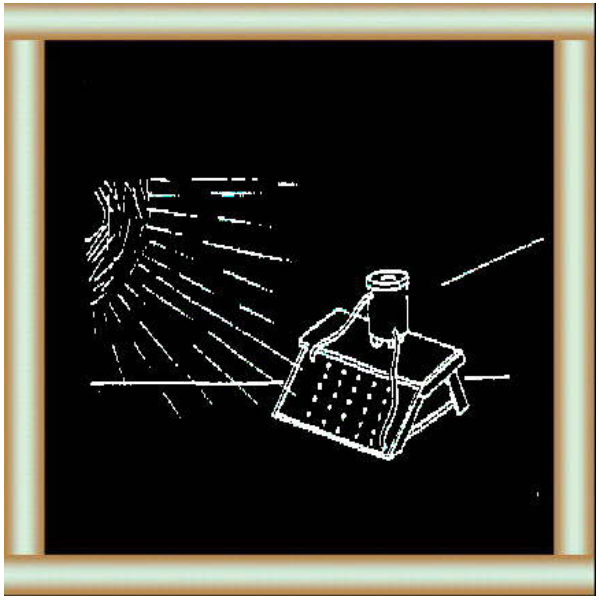


26 The centre can use gas for heating water to clean and sterilize dairy equipment.



27 If no gas is available, the centre may use wood-fired or drip oil-fired boilers.

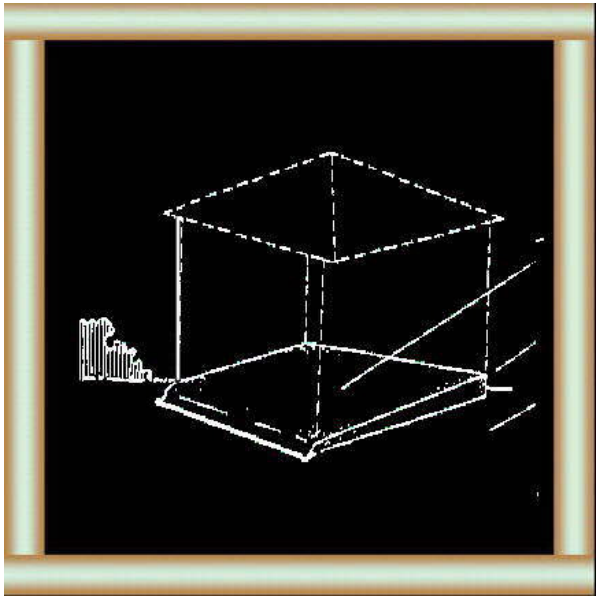
Solar heating



28 This centre collects the sun's rays to heat water in the tank.

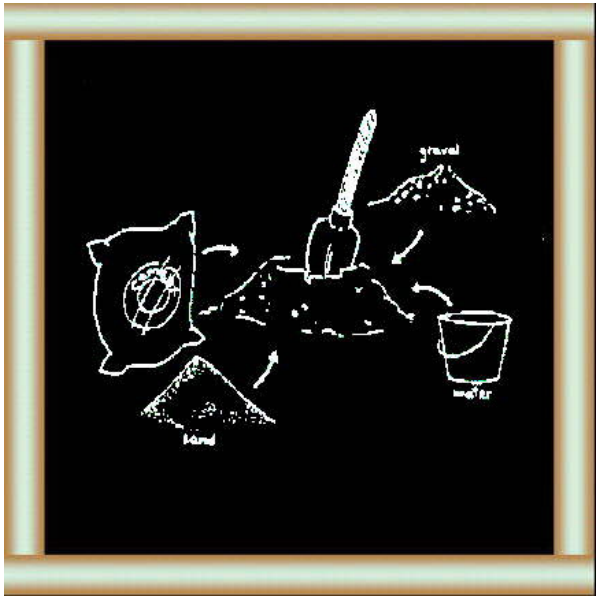
page 110

What type of building is necessory ?

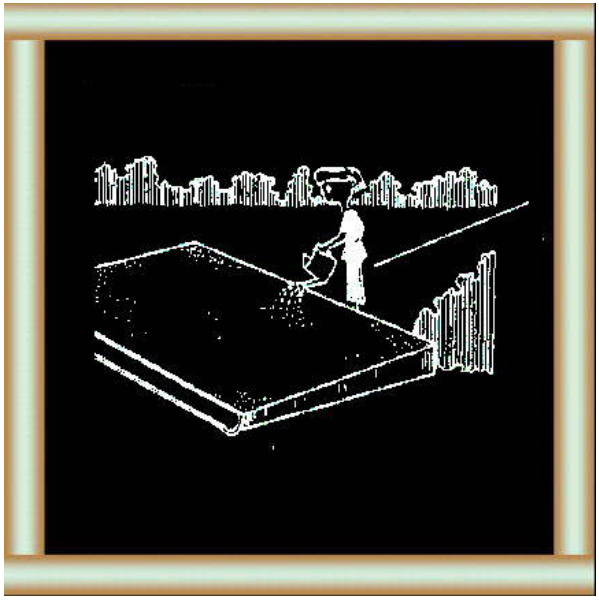


Floor

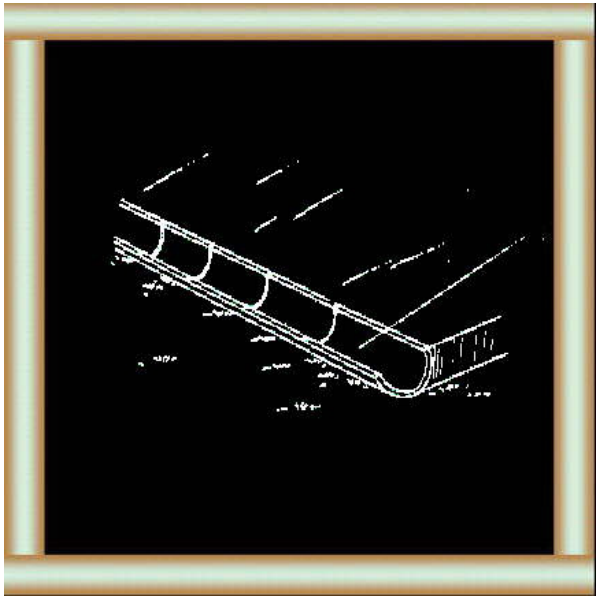
29 The floor should be:
- hard and flat, so that water does not pool
- angled to the drain, so that water runs away
Surroundings should be dry and solid - not muddy.



30 Mix concentrate correctly using cement, sand, gravel and water.



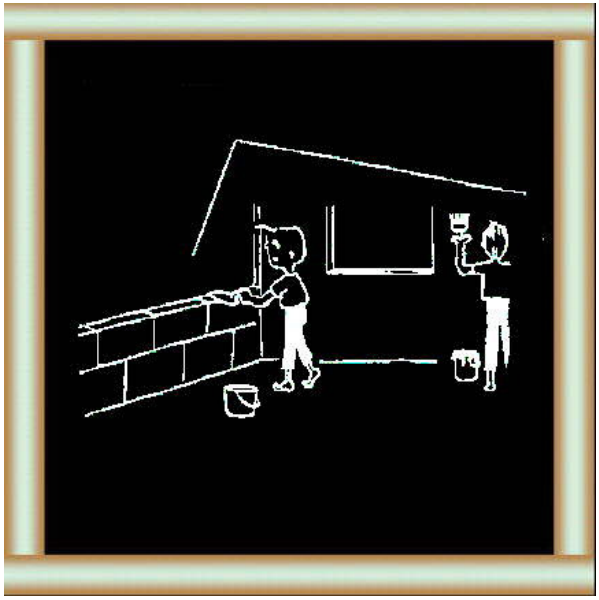
31 Let the concentrate dry slowly and sprinkle with water regularly for 3-4 days to prevent cracks.



Drains

32 Make drains from half sections of glazed tiles.

Walls and Windows



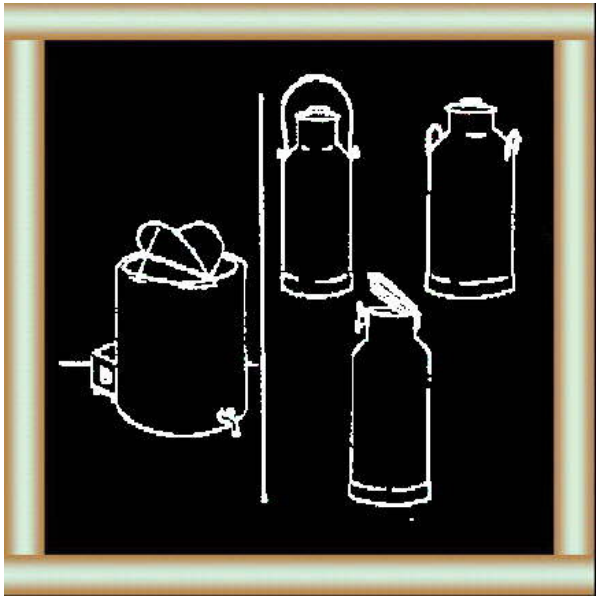
33 Use clay, stone or concentrate blocks for the walls and white wash or tile.

Roof

your building is low cost and safe
- with extension worker, a good layout saves you work
- with the health authorities, good planning for hygiene yields high quality milk.

12

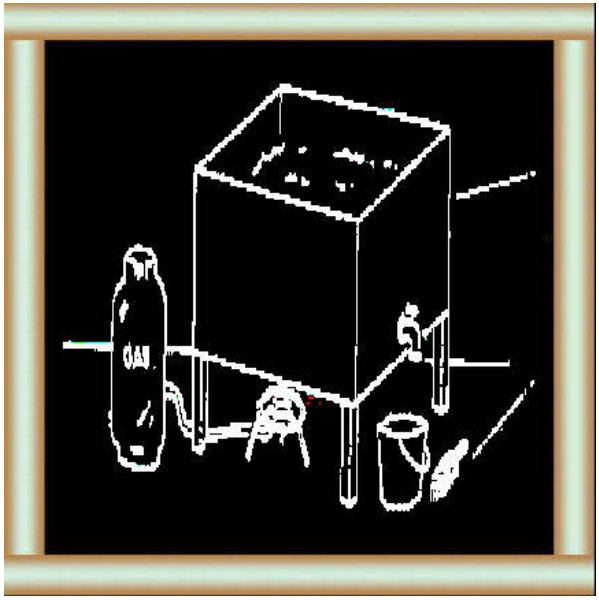
What type of equipment is necessory ?



Cooling and Storage

36 coolers

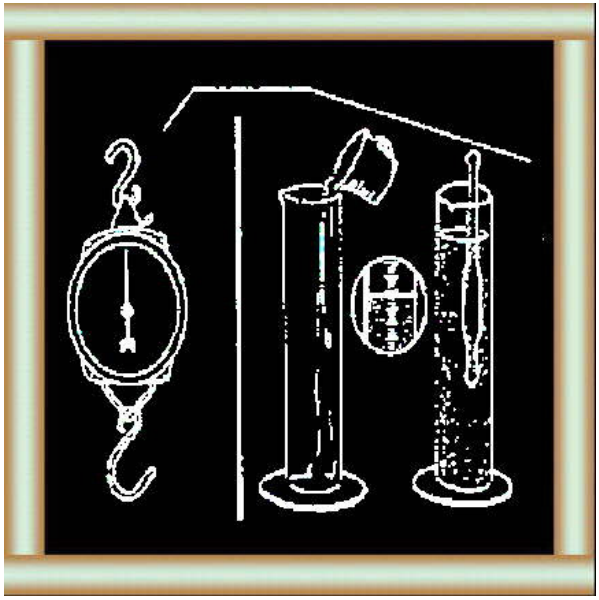
- cans



Cleaning

37 boilers

- brushes



Testing and Measuring

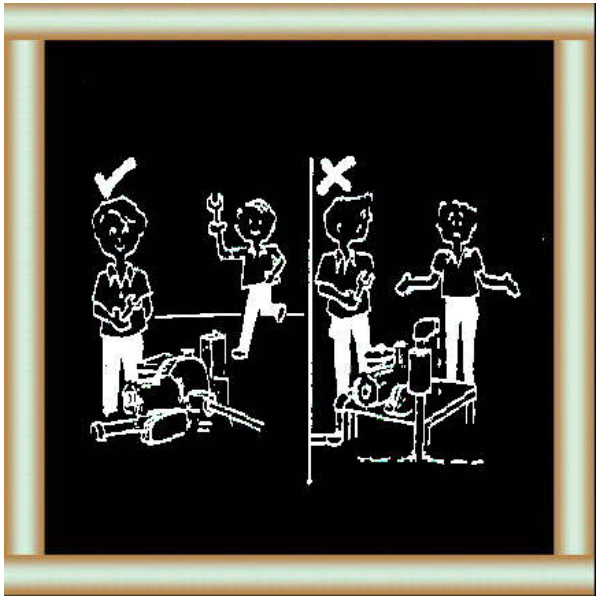
38 scales

- laboratory equipment

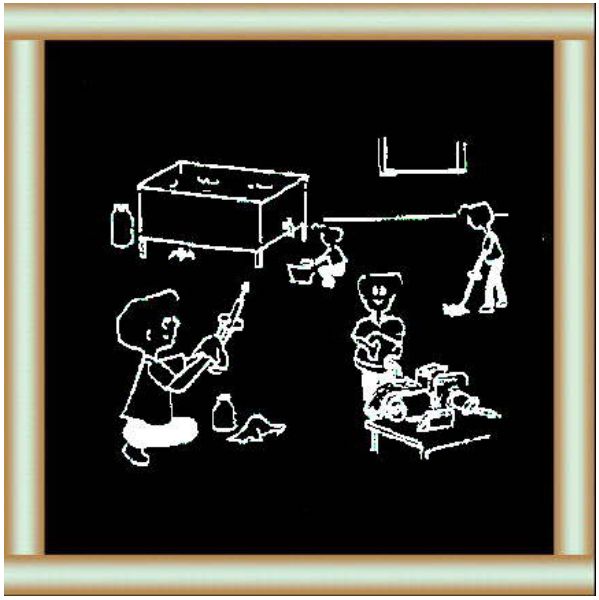
Safety

39 fire extinguishers
- emergency generators
- first aid kit

How to get the best from equipment ?



40 make sure spare parts are easily available.



41 Maintain equipment regularly

- clean everything
- grease bearings
- change oil.

What do you know about milk collecting centres ?

What is important ?

1. **Short delivery time** (5)
2. **Low cost delivery** (6)
3. **Method and timing of tests** (7)

Functions of milk collecting centres

1. **Reception**
   - **sampling and testing** (8)
   - **weighing** (9)
   - **recording** (10)
   - **ensuring quality** (11)
2. **Straining and filtering** (12-13)
3. **Cooling and storage** (14-15)
4. **Despatch and Sales**
   - **transport to dairy** (16)
   - **local sales** (17)

Small-Scale

Dairy Farming Manual

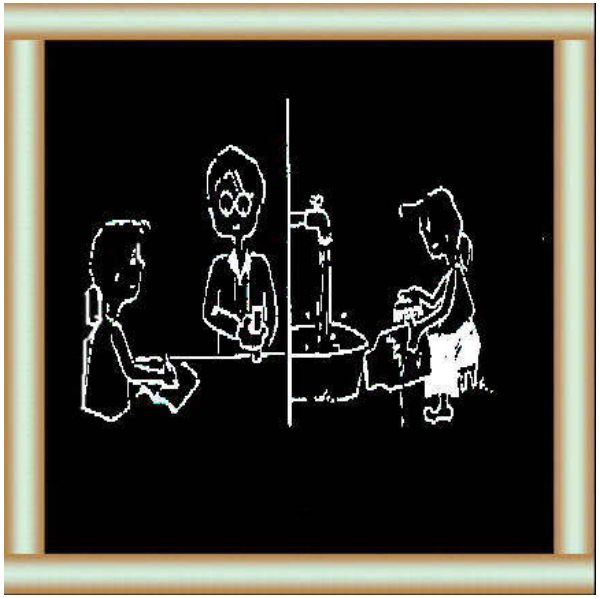
Volume 1

Technology Unit 7

Milk Reception

Extension Materials

What should you know about milk reception ?



1 What is important in milk reception ? (5-9)

- organize well and keep records
- understand what makes good quality milk
- keep everything clean

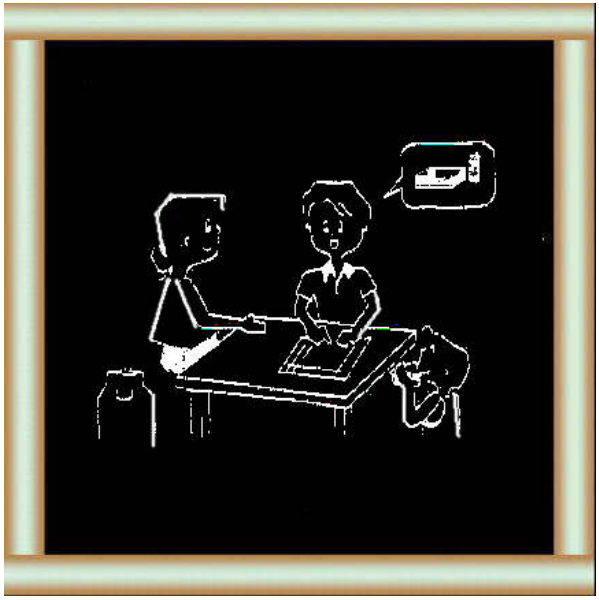
2 How does the centre organize reception and advise farmers? (9-12)

The centre:

- plan the timing of milking and transport

- advise on husbandary and any problems you have

3 How does the centre keep records and make payments ?



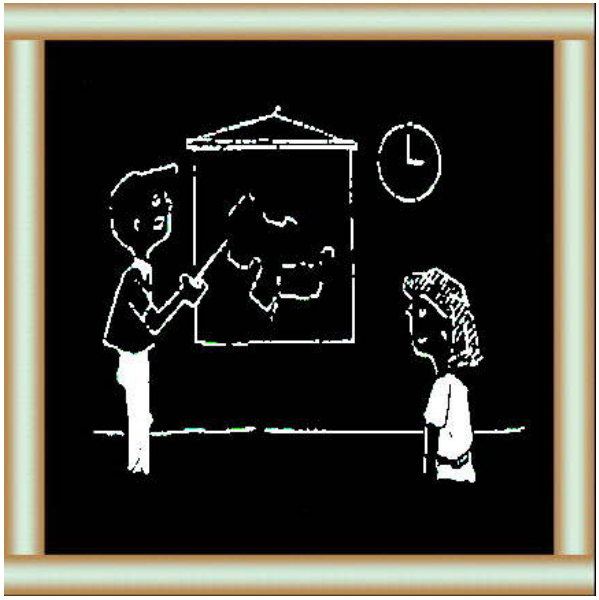
(13-24)
The centre:
- helps you to keep daily and monthly records
- pays you according to milk quality/quantity and transport costs.

4 How does the centre clean

equipment ? (25-31)
The centre cleans equipment by careful:
- rinsing
- sanitizing
- drying

(The numbers in brackets refer to illustrations in the Extension Materials)

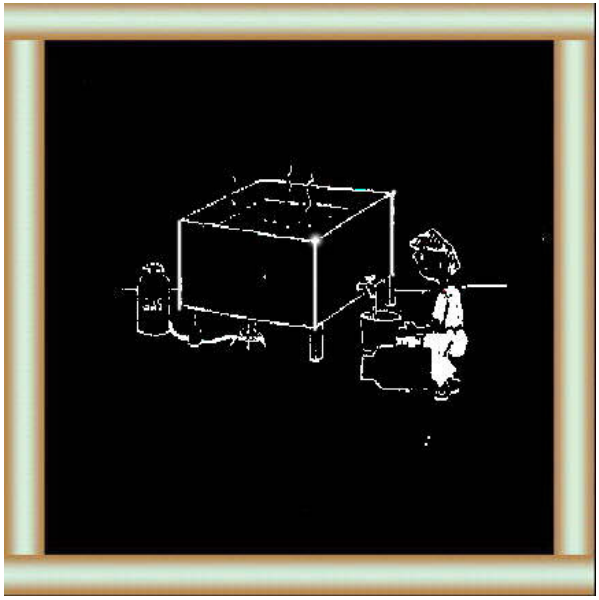
What is important in milk reception ?



5 Organizing milk collection routines for farmers and giving them advice.

6 Keeping records and accounts and making payments.

7 Sampling and testing milk quality



8 Cleaning and sterilizing buildings and equipment.

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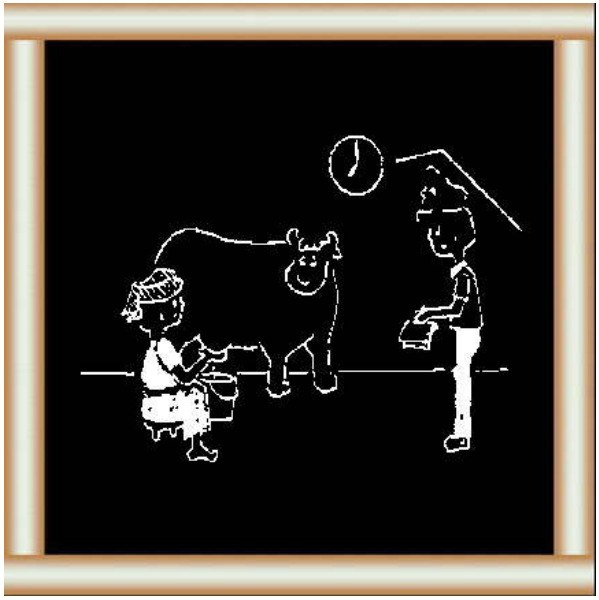
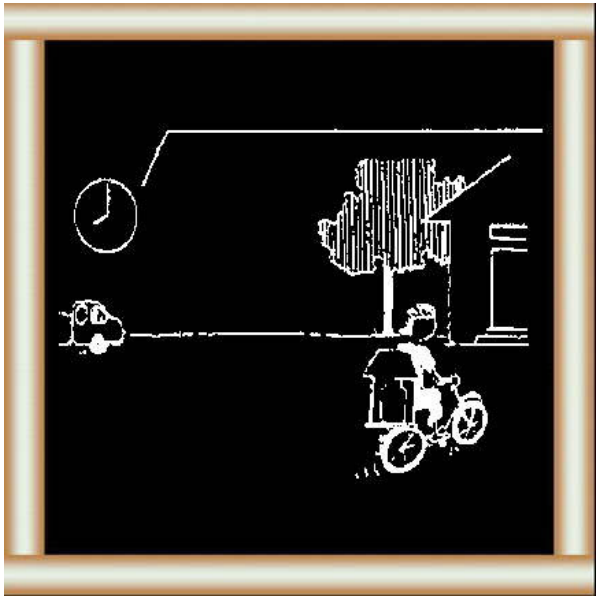
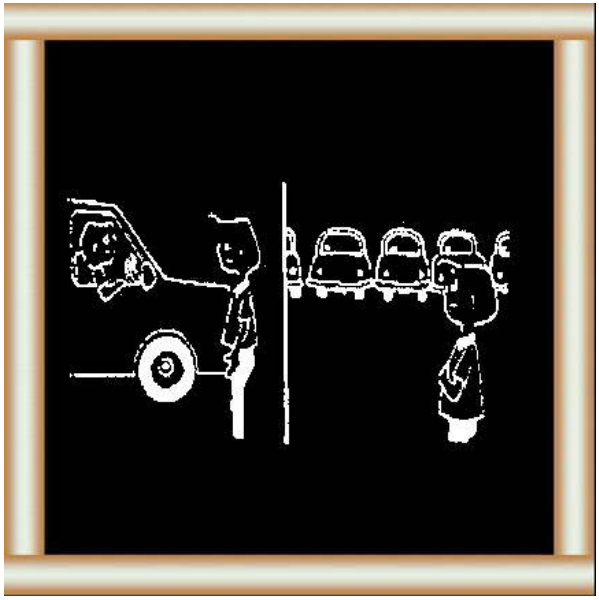
How does the centre organize reception and advise farmers ?



9 The centre agrees with each farmer on when to milk according to the number of his cattle and the distance from the collection point…



10 … so that all farmers in that area bring their milk to the collection point just before the truck arrives.



11 The centre agrees with the truck drivers so that the centre can recieve the milk from one truck before the next truck arrives.

12 The centre makes sure the

How does the centre keep records and make payments ?

13 You have a record for each month:

MEMBER'S PRODUCE RECORDS
Member's Name……
Member's No……..3..
Collection Route……
Month……..19……

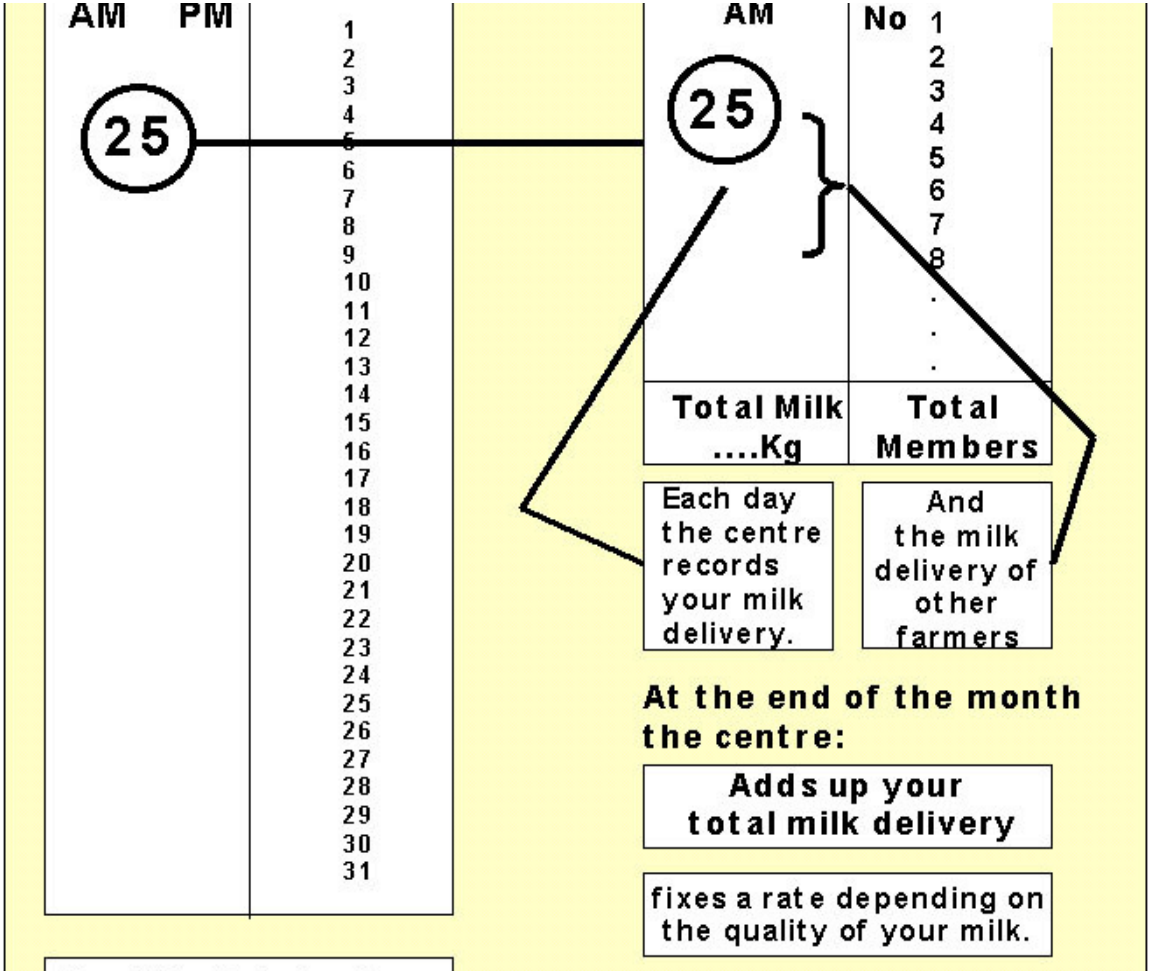
Kgs of Milk	Day of the month

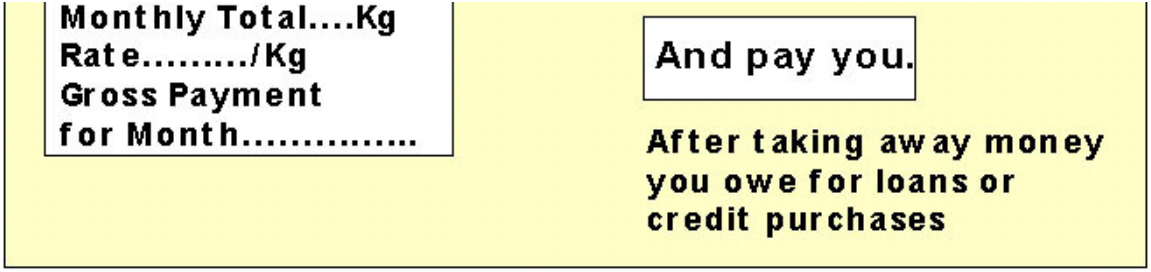
14 The centre has a record for each day:

MILK JOURNAL AM

Vehicle No……
Collection Route……
Date……..19……

Kg of Milk	Member


AM
PM
25
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
AM
No
25
1
2
3
4
5
6
7
8
Total Milk ....Kg
Total Members
Each day the centre records your milk delivery.
And the milk delivery of other farmers
At the end of the month the centre:
Adds up your total milk delivery
fixes a rate depending on the quality of your milk.



If you buy goods for cash:
15 the centre gives you a receipt.

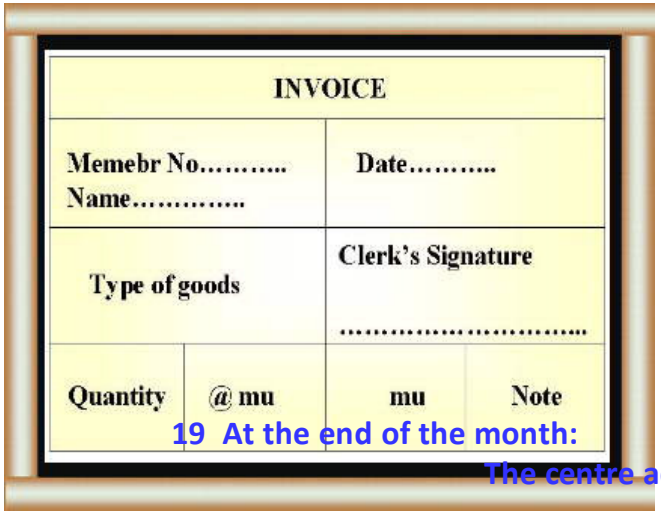
16 and records the cash sale in a journal

CASH SALES RECEIPT			
Memebr No……. Name……		Date…….	
Type of goods		Clerks Signature ……	
Quantity	@ mu	mu	Note

CASH SALES RECEIPT			
Memebr No……. Name……		Date…….	
Type of goods		Member Signature ……	
Quantity	@ mu	mu	Note

If you buy goods on credit:
17 the centre gives you an invoice

18 and records the credit sale in another journal

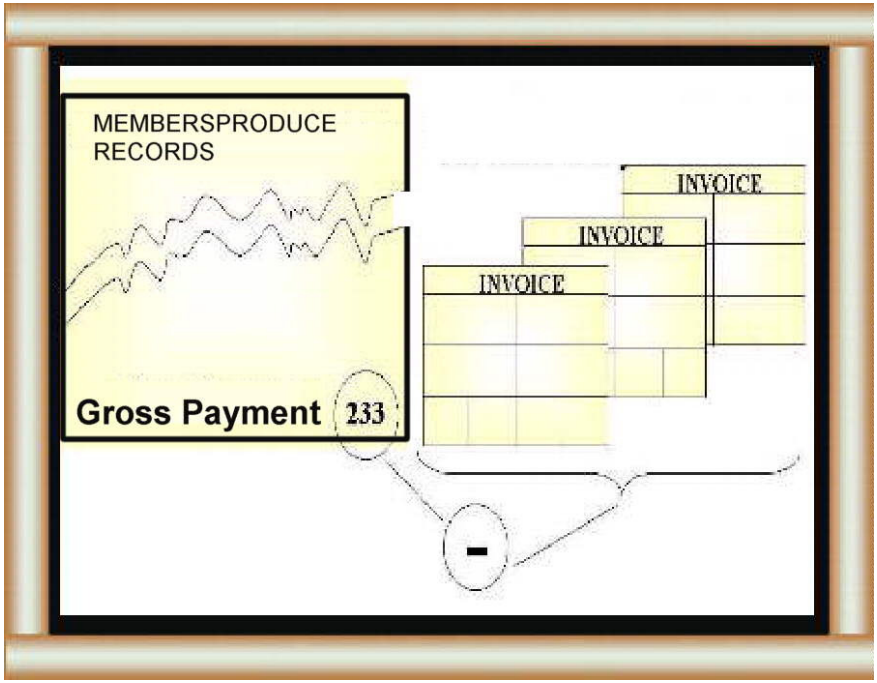


INVOICE			
Memebr No…….. Name……..		Date……..	
Type of goods		Clerk's Signature ……..	
Quantity	@ mu	mu	Note

19 At the end of the month:

The centre adds your invoices

CREDIT SALES JOURNAL			
Memebr No…….. Name……..		Date……..	
Type of goods		Member's Signature ……..	
Quantity	@ mu	mu	Note



and takes them away from your payment.

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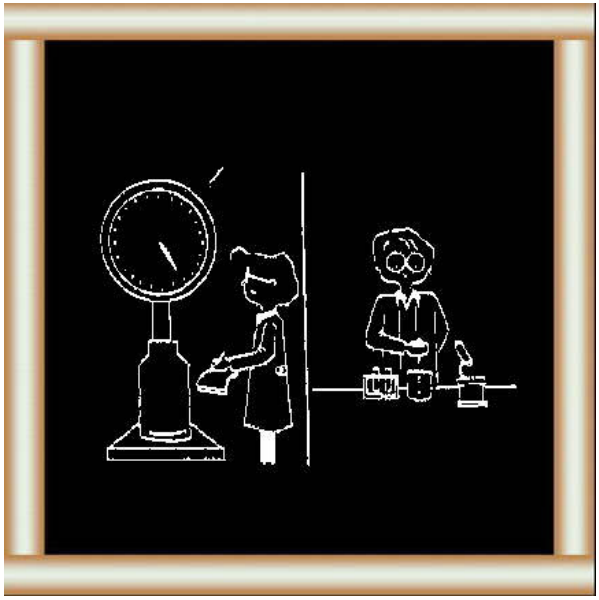
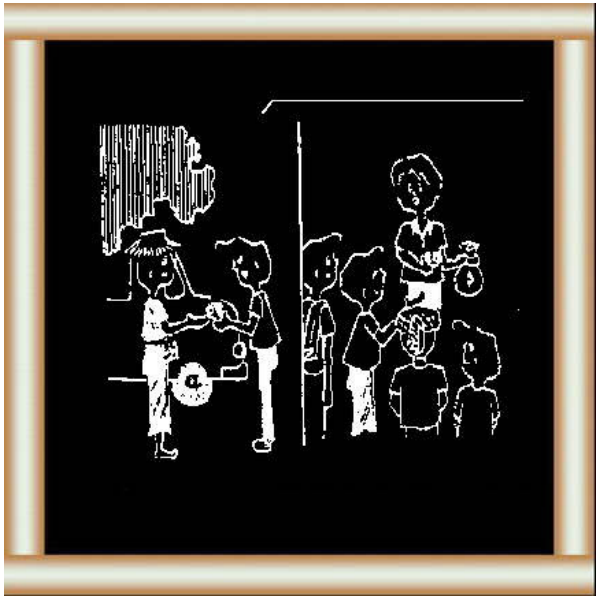
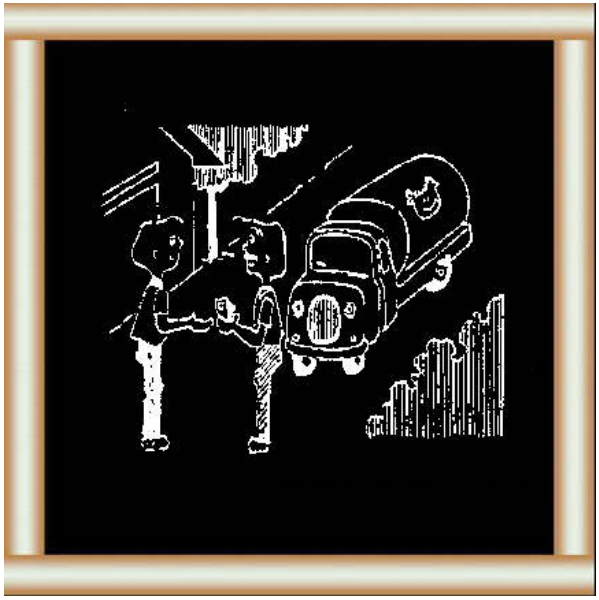
How much does the centre pay you?



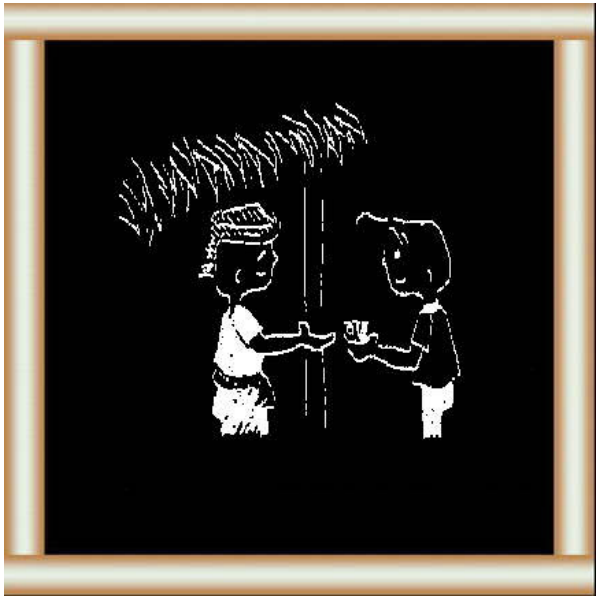
20 The centre pays you for the quantity and the quality of your milk.



21 The centre pays for transport costs and for operating costs such as staff wages and electricity.



22 The centre earns money by delivering good quality milk to the dairy.



23 You get more money from the centre if:
- you deliver more milk
- you deliver better quality milk
- you help the centre keep transport costs low.

25 They rinse with cold water.

26 They scrub inside and out with a brush, warm water and a cleaning agent, then they clean again with a sanitizer.

The centre may let you clean your own milk cans.
Cleaning agents you can use are:

Detergents Quick and effective action against fat and protein matter.

Soaps Do not use perfumed soaps.

Caustic Soda Effective, especially if mixed with suitable phosphates. (Sodium Hydroxide)

Note:

1 Use only weak solutions for hard washing.

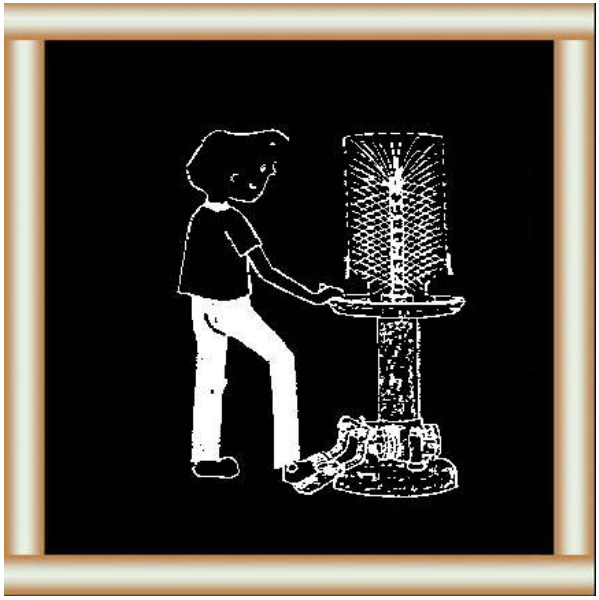
2 Corrosive for tinned surfaces and aluminium.

Washing Soda (Hydrated Sodium Carbonate)

Cheaper and less corrosive than caustic soda for manual washing, use 5 cc in 10 l of water.

Wetting Agents Effective but expensive.

How does the centre sanitize (disinfect) equipment?



27 Bigger centres use steamto kill micro-organisms left after cleaning

28 but you can also use boiling water

29 or chemicals.
Make sure:

- they are not toxic
- they do not bring taste

or smell to the milk
- they are effective and cheap
- you follow the directions
- you rinse thoroughly with clean water.

Chemicals you can use are:

Chlorine

Follow the directions on the packet of sodium or calcium hypochlorite. The strength of the solution should be 1 cc per 5 litres of water.

Quaternary Ammonium Compounds

These dairy sterilizers are effective and easy to use.

Follow the directions on the packet or bottle.

Note: Residues of quaternary ammonium compounds in milk will make it unsuitable for making fermented products e.g. yoghurt and cheese.

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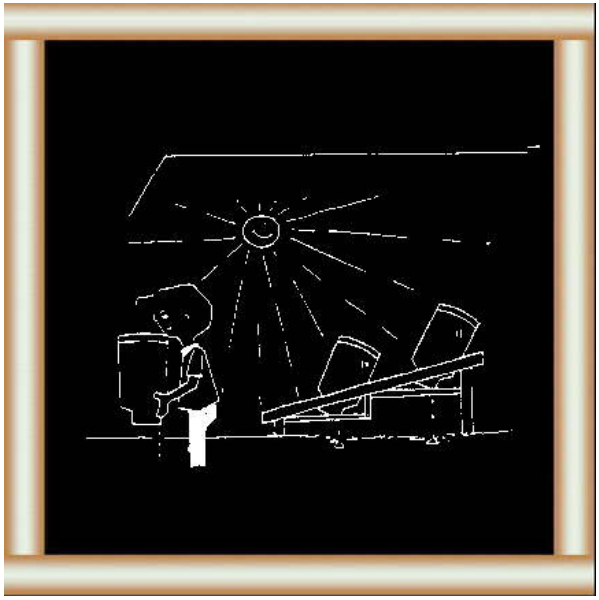
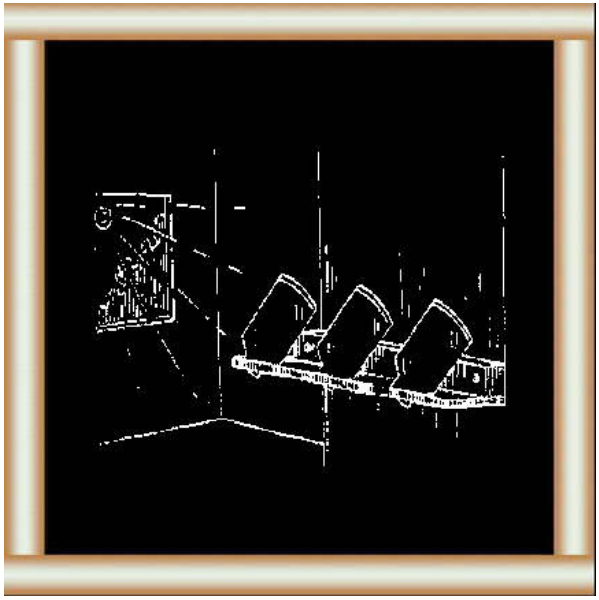
30 After cleaning and



sanitizing, drain the equipment and dry it in sunlight.



31 Store up-side-down without lids on racks in a dust-free, well-ventilated room.

Disinfect just before use.

What do you know about milk reception?

Payments

Hygiene

Small-Scale

Dairy Farming Manual

Volume 1

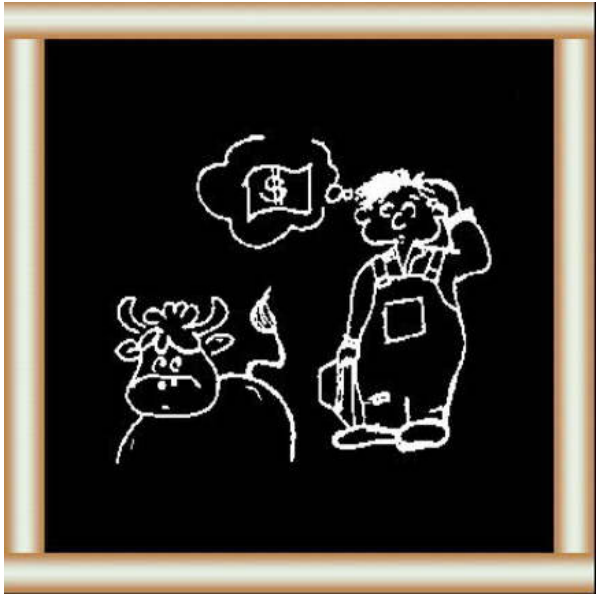
Technology Unit 8

Milk Payment

Extension

Materials

What should you know about milk payment?

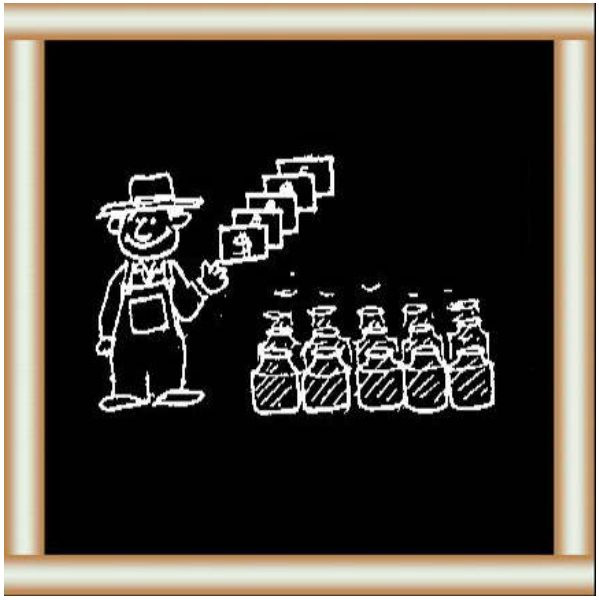


How much money does the dairy pay for your milk? (1 - 6)

The dairy pays according to:

- quality

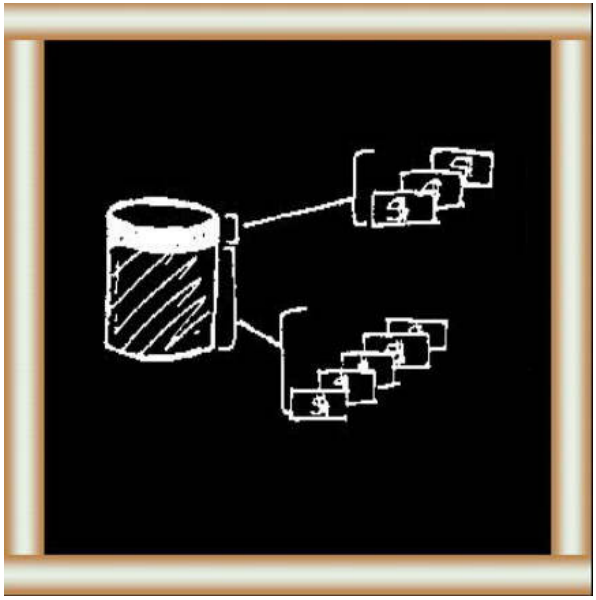
- quantity.



How does the dairy pay for quantity? (7 - 11)

The dairy pays for quantity if your milk is high quality.

How does the dairy pay for



quality? (12 - 35)

The dairy pays according to:

- composition quality

- physical quality and hygiene.

Milk Payment

(Numbers in brackets refer to illustrations in the extension materials)

Payment for Quantity and Quality (1-6)

The basic points to be considered in a milk payment system are

Quantity of the milk

- **Volume**
- **Weight**

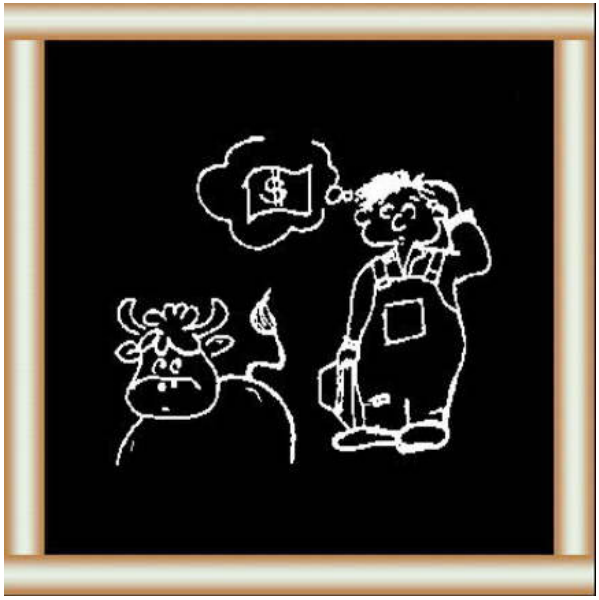
Quality of the milk

- **Compositional**
- **Microbiological**
- **Physical**
- **Hygienic**

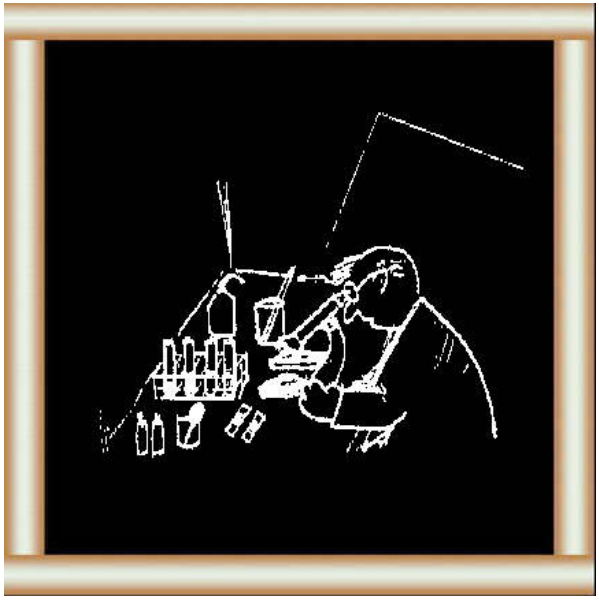
Dairies use one or more of these for milk payment all over the world. Other conditions such as quotas, contracts or subsidies fit into milk payment systems to satisfy interest groups of dairy farmers or national dairy policies.

If only the quantity payment is used, milk producers may adul-terate the pure milk. If quantity payment goes with quality payment, adulteration does not pay back the transportation cost of the extra volume and the inferior quality. This, and fines or punishment, make adulteration tests unnecessary in countries with quality payment.

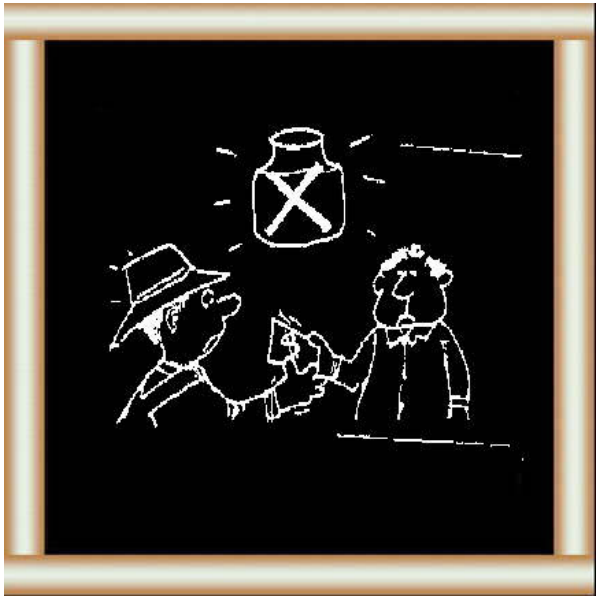
Milk of poor quality makes poor quality dairy products, even with heat treatment or other quality preserving operations. It is advisable to lay down regulations for a premium/deduction system based on tests such as the resazurin test, the methylene-blue test or the alcohol/alizarin test.



1 How much money does the dairy pay for your milk?



2 The dairy tests your milk and pays you according to the quality.

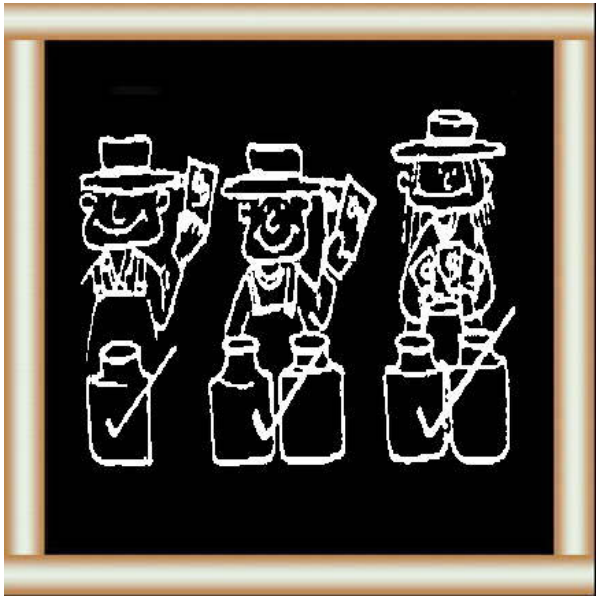


4 If your milk is low quality
the dairy pays you less money.

A payment system based on microbiological quality encourages dairy hygiene on the farm. Tests of foreign matter in milk are unsuitable as a basis for

milk payment. The sediment test can, however, be used as a valuable advisory test. Special conditions require quality tests, for example, in countries where low cooling on the farm and 2-3 times weekly milk deliveries per farm encourage a microflora of psychrophilic protein digesting bacteria. A normal resazurin or methylene-blue test would give false results if carried out on such deep cooled milk samples. To sort out inferior deep cooled milk the organoleptic test is used and for payment purposes individual milk samples are grown on selective substrates. The number of colonies counted after a predetermined period gives the basis for a payment premium or deduction.

5 If your milk is very low quality the dairy rejects it.



6 These farmers all produce high quality milk.

The dairy pays the same for each can according to quantity.

Payment for Quantity

There are in general two different ways of measuring milk.

1. Volumetric measurement (litres/gallons)

(1) Dipstick method

The dipstick method uses a graduated stick which can only measure the content in containers of equal size. One dipstick with graduations can measure the content of 40 litre cans, but the same stick cannot be used for measuring the content of other types of containers.

The most secure method has a special matching container. Measure all milk with the dipstick in the special con-tainer.

The dipstick method is mainly used for large quantities of milk in containers such as stationary tanks, rail tankers and road tankers.

(2) Container method

The container method is mainly used for sales of milk to consumers and for internal work in the dairy.

Containers are made either to hold definite quantities of milk such as 1/2 litre, 1 litre or they are made with inside graduations, from which the milk level in the container can be read.

(3) Flow-meter method

In modern road tankers the milk is measured by a flow-meter i.e. volumetric measurement. The tanker is usually equipped with a deaerator which removes air that may have entered the milk during pumping etc. High air content will result in increased milk volumes. Before payment to the farmer litres can be converted into kilos : litres x specific gravity = kilos.

2. Gravimetric measurement (kilos/pounds)

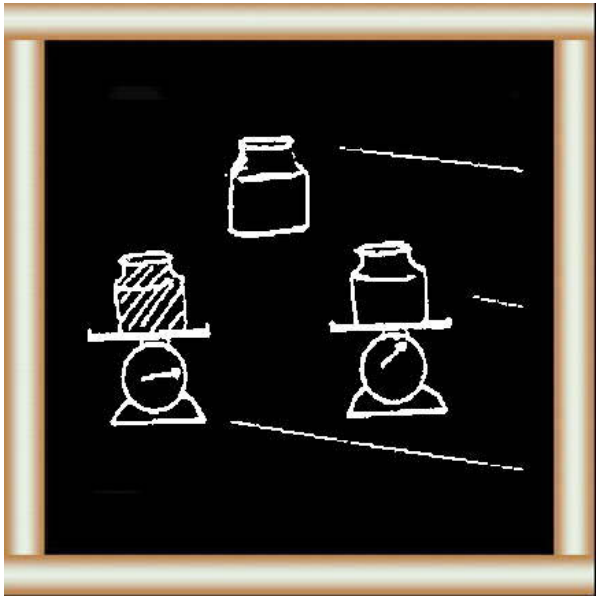
The most common method for measuring milk from

farmers is the gravimetric method. A wide variety of weighing machines and scales are used for this purpose.

Small cooperative societies usually use a spring balance. This is not completely reliable and can easily give wrong readings. Frequent adjustments even on the same day may be necessary. As all farmers are treated equally and have their milk quantities weighed by the same scale, this method is good enough in the early stages of dairy development. Later on, better weighing equipment is necessary. Milk reception plants normally have suitable weighing scales, weighing exactly the quantities of milk received.

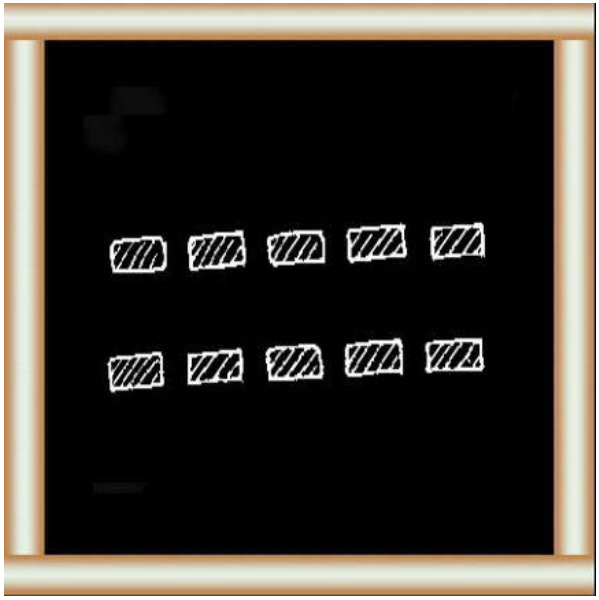
How does the dairy pay for quantity?

7 If your milk is high quality the dairy pays you for the quantity you deliver.



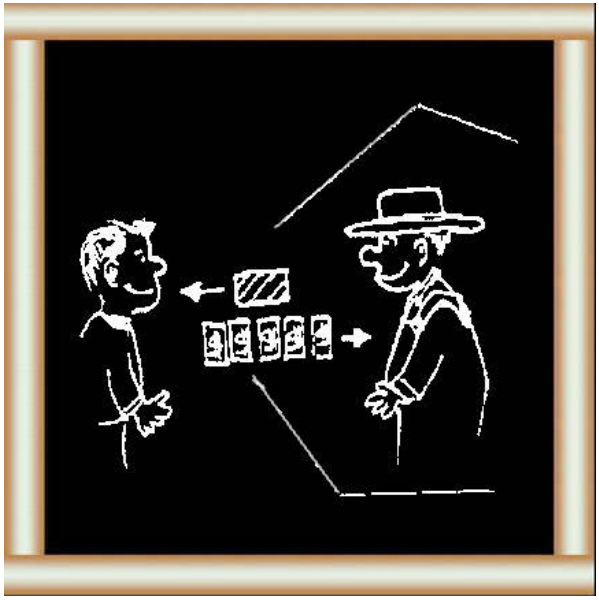
8 This farmer's milk can contains about 10 L.

Full of milk it weighs 12 kg.
Empty, it weighs 2 kg.



9 The quantity of milk is

12 - 2 = 10 kg



10 For each kg of high quality milk he receives 5 mu.

Therefore, for 10 kg he receives:
10 x 5 = 50 mu

In the following methods, 2 farmers delivering similar amounts of milk with differing composition and microbiological quality are paid according to different

payment methods.

INFORMATION		METHODS (see descriptions below)	
		1 to 6A	6B
Farmer 1 class	:100 kg milk 6 % fat	1st class	3rd
Farmer 2 class	:100 kg milk 3 % fat	3rd class	1st

Price : Butter price : 60 mu/kg
Fat consumption : 85 fu/kg of butter

(fat units)

Skim milk price : 2 mu/kg
Whole milk price : 5 mu/kg
Premium for 1st class milk : 1 mu/kg
Deduction of 3rd class milk : 1 mu/kg

Fat price : Butter price x 100 = Fat price

Fat consumption

: 60 x 100 = 70.5 = 70 mu/kg
85

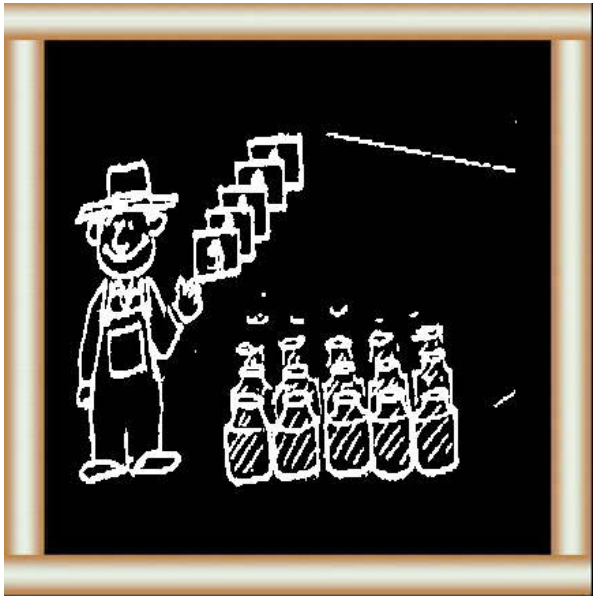
1st Method: Payment according to quantity

Farmer No.	Kg milk	mu/kg	Total price
1	100	5	500
2	100	5	500
Total	200	10	1000

Example

11 Two farmers produce 100 kg of milk each. If the dairy pays them by **quantity only,** they get the **same** money.

100 kg milk @ 5 mu/kg



= 500 mu

100 kg milk @ 5 mu/kg

= 500mu

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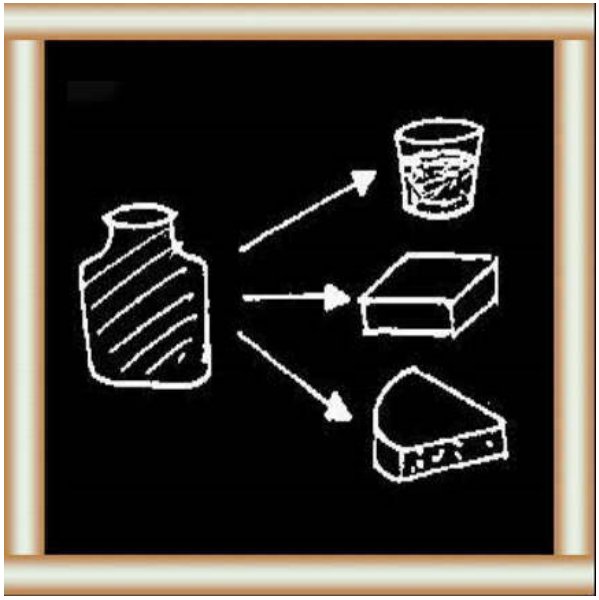
How does the dairy pay for quality?

They use fat for making cream, butter, cheese and other products.



12

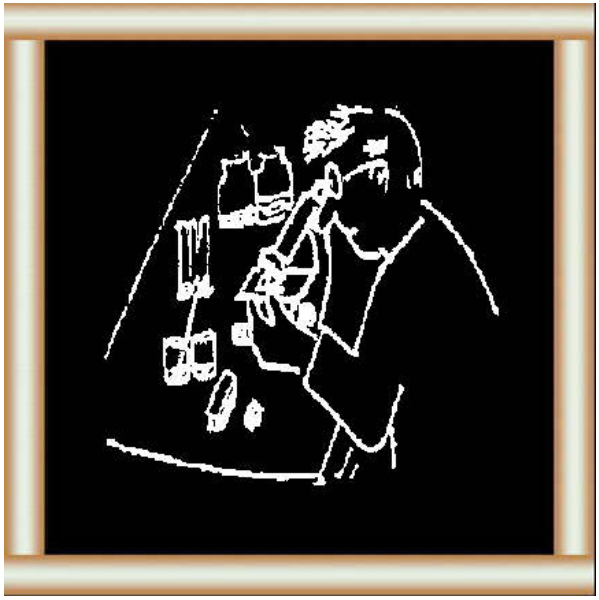
The dairy pays according to three kinds of quality.

Composition
The dairy pays you for the fat in your milk.

Physical appearance

13 The dairy pays you more for milk which has a good appearance and taste.

Cleanliness



14 The dairy pays you more for milk which is clean and contains few bacteria.

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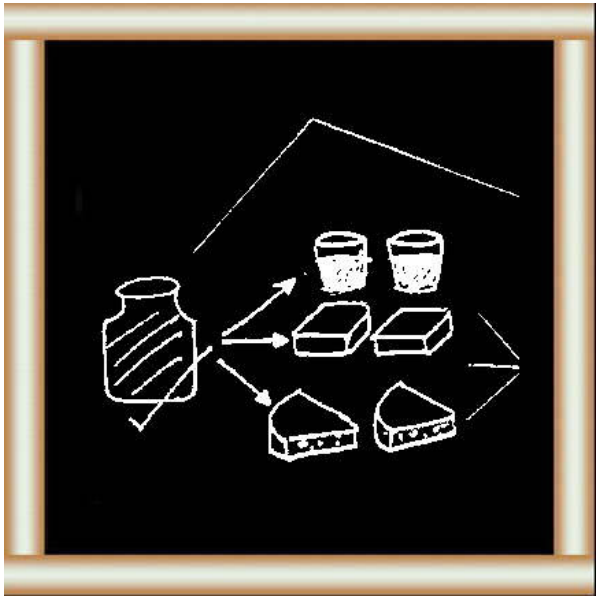
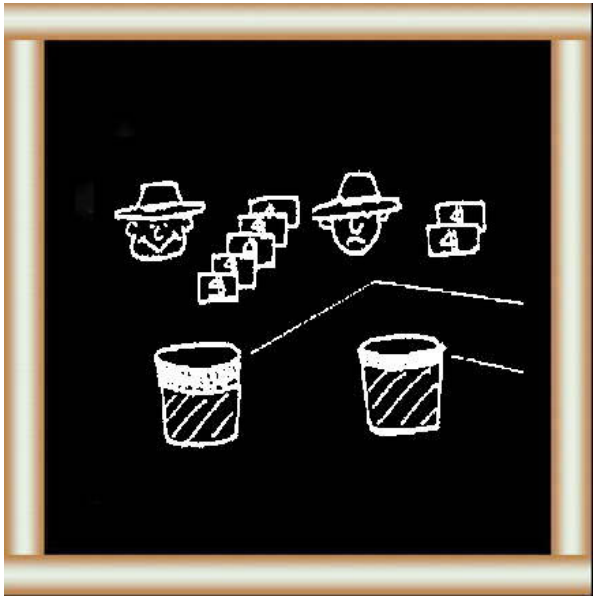
How does the dairy pay for composition quality?

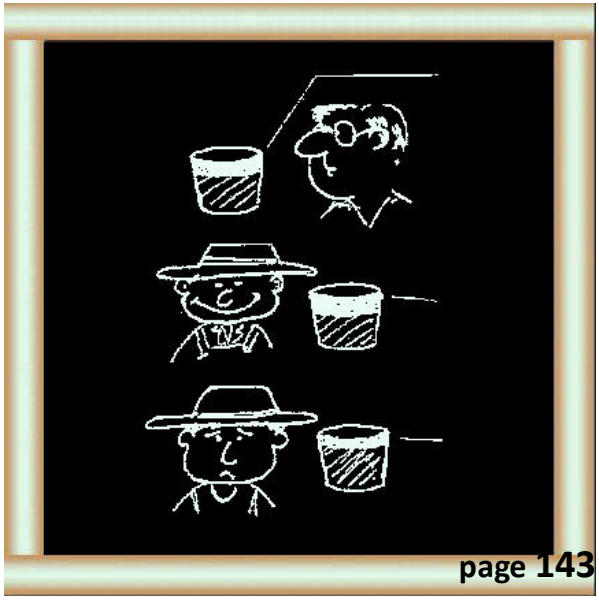


15 If your milk has high fat content the dairy can make more milk products.



16 The dairy pays more for milk with high fat content than for milk with low fat content.

17 The dairy may set a minimum fat content e.g. 3 %



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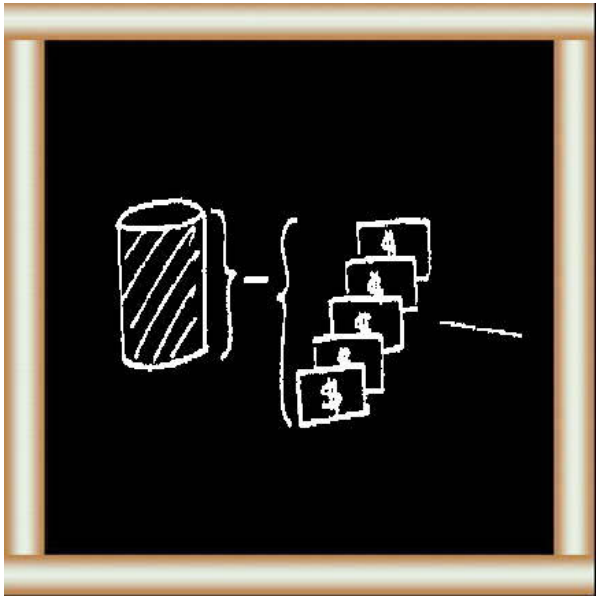
fat.

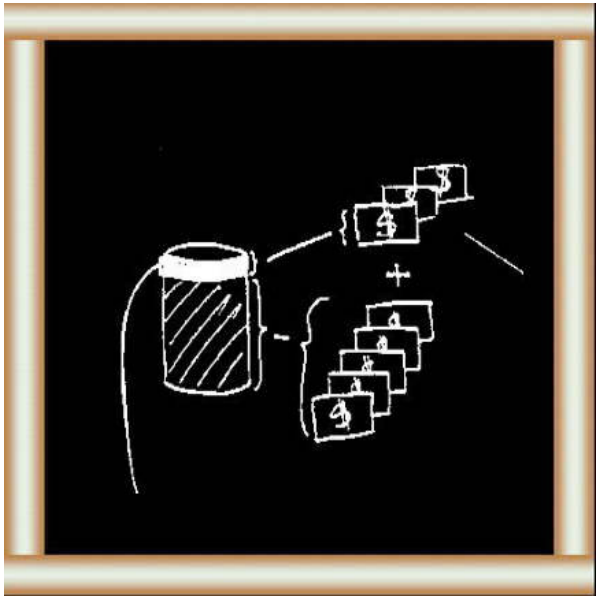
If the fat content is above the standard you get more money.

If the fat content is below the standard you get less money.

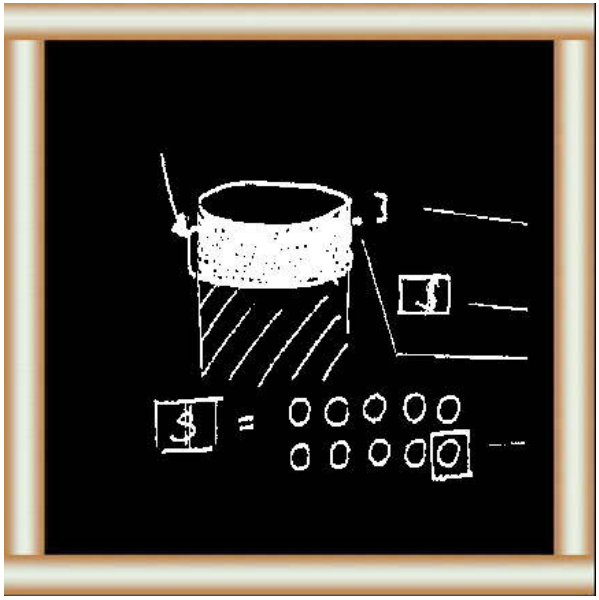
Here is an example from one country



18 This farmer receives 5 mu/kg milk.

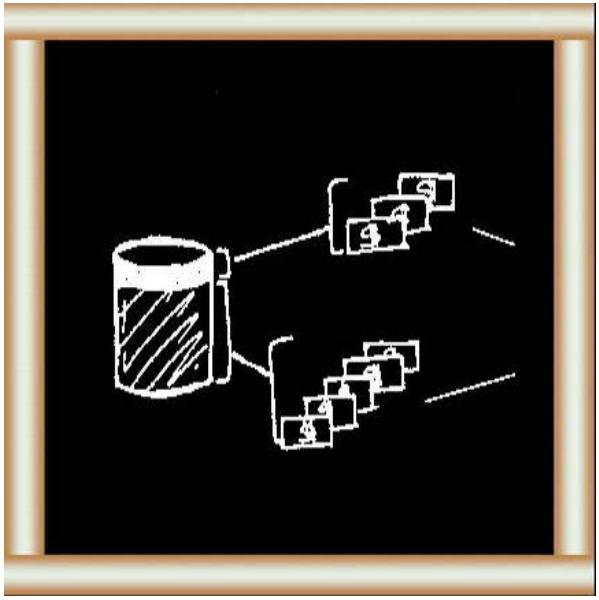


19 For the minimum of 3 % fat, he receives 3 mu/kg milk.



20 For each 1 % of fat over the 3 % minimum, he receives 1mu.

For each 0.1 % fat over the 3 % minimum he receives $^{1}/_{10}$ mu.



21

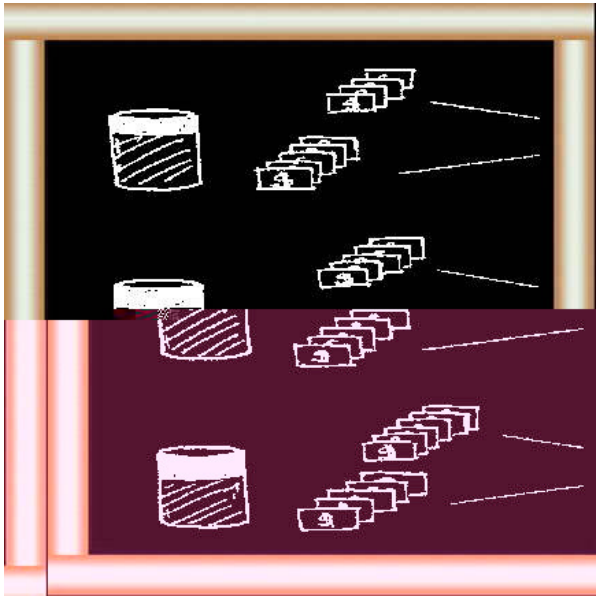
For 3 % fat milk, he receives:
3 mu for the fat

5 mu for the milk

= 8 mu

22

For 4 % fat, he receives:



4 mufor the fat
5 mu for the milk = 9 mu
For 5 % fat, he receives:
5 mu for the fat
5 mu for the milk = 10 mu
For 6 % fat, he receives:
6 mu for the fat
5 mu for the milk = 11 mu

More fat gives more money.

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Example:

These two farmers produce 100 kg milk each. The dairy pays them by quantity and composition.

23 The dairy pays

70 mu/kg for fat and

2 mu/kg for skim milk.

2nd Method: **Payment according to quantity and composition. Fat paid according to the above information and skim milk according to skim milk supplied**

Farmer	Kg milk	Fat %	Fat units	Kg fat	Fat price	Fat pay	Kg skim	Skim price	Skim pay	Total pay

			(fu)		(mu)		left	(mu)	(mu)	(mu)
1	100	6.0	60	6.0	70	420	94	2.0	188	608
2	100	3.0	30	3.0	70	210	97	2.0	194	404

3rd Method: Payment according to quantity and composition. Fat paid according to the above information and skim milk according to whole milk supplied

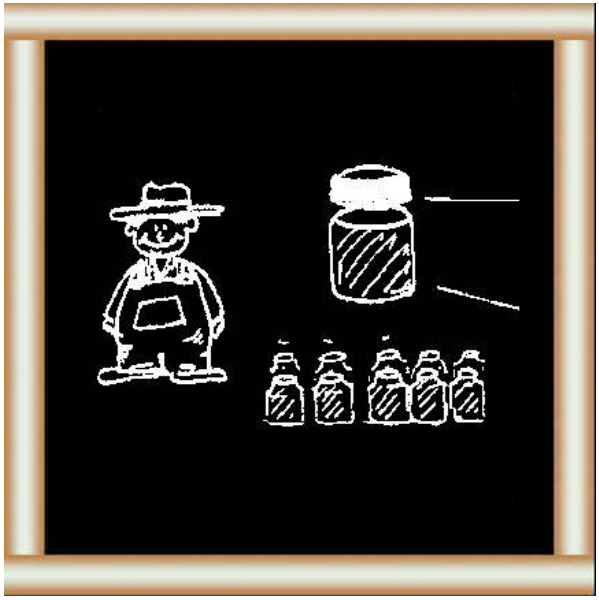
Farme	Kg milk	Fat %	Fat units (mu)	Kg fat	Fat price (mu)	Fat pay	Skim price (mu)	Skim pay (mu)	Total pay (mu)
1	100	6.0	600	6.0	70	420	2.0	200	620
2	100	3.0	300	3.0	70	210	2.0	200	410

4th Method: Payment according to quantity and composition. Fat paid according to the above information and skim milk according to whole milk supplied

	1 kg 6 % milk	1 kg 3 % milk
Fat pay (mu)	4.2	2.1
Skim milk pay (mu)	2.0	2.0
Total price (mu)	6.2	4.1

Farmer	Milk Kg	Fat %	Price/kg (mu)	Total pay (mu)
1	100	6.0	6.2	620
2	100	3.0	4.1	410

Farmer with 6 % fat milk:



Farmer with 3 % fat milk

24
6 % fat
so 100 kg of milk contains
6 kg fat @ 70 mu/kg = 420 mu
+
94 % skim milk
so 100 kg of milk contains
94 kg skim milk @
2 mu/kg = 188 mu

The dairy pays him
for 100 kg milk. 608 mu

25
3 % fat
so 100 kg of milk contains3 kg

of fat @
70 mu/kg = 210mu
+
97 % skim milk
so 100 kg of milk contains 97 kg of skim milk @
2 mu/kg = 194mu

The dairy pays him
for 100 kg of milk 404mu

The density of milk normally varies between 1.028 and 1.034 kilos per litre, but it is wise to test the density locally over a period to find the correct conversion value for that particular area.

The density depends on the content of water, fat and

dry matter. If fat is removed from the milk the density will go up. If the milk contains extraneous water the density will go down. This fact can be used as an indicator for adulteration.

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26 Milk also contains protein which makes your body strong.

Some modern dairies pay according to the protein content of the milk.

27 Never add anything to your milk.

28 The dairy will check the density of your milk.

29 If it is not correct, you will get less or no money for your milk.

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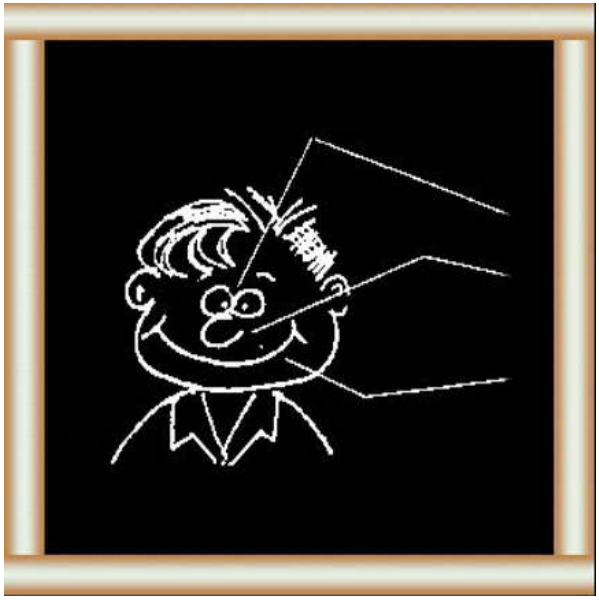
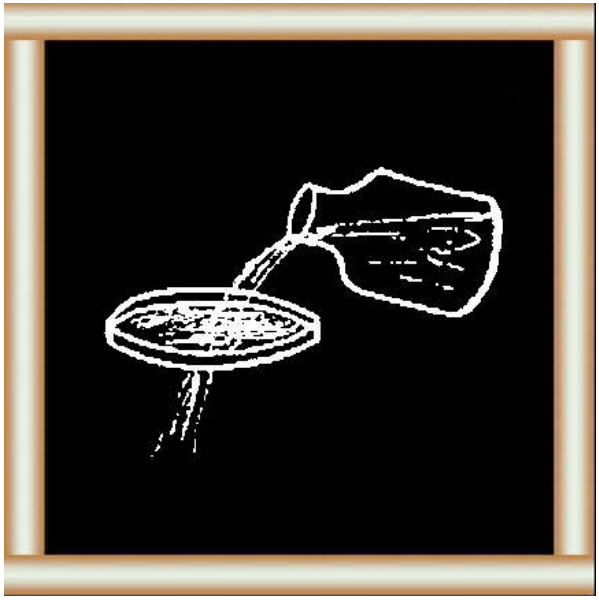
How does the dairy pay for physical quality and hygiene?



30 The dairy will grade your milk in the following way:
- colour
- smell
- taste.

Your milk should look, smell and taste good.



31 Dirt

There should be no dirt.

32 Bacteria Count.

Cell count

The fewer bacteria and cells in your milk the better.

5th Method: **Payment according to quantity and microbiological quality**

Farmer	Milk kg	Price /kg	Total Price	Class	Deduct -ion kg	Premium kg	Pay (mu)	Total pay

			(mu)					(mu)
1	100	5	500	1st	-	1	+100	600
2	100	5	500	3rd	1	-	-100	400

6th Method: Fixed kg price as Method 4 and microbiological quality

A: Farmer 1 1st class milk; Farmer 2 3rd class milk

Farmer	Milk kg	Fat %	Price /kg	Total Price (mu)	Class	Deduct -ion kg	Premium kg	Total pay (mu)
1	100	6.0	6.2	620	1st	-	100	720
2	100	3.0	4.1	410	3rd	100	-	310

B: Farmer 1 3rd class milk; Farmer 2 1st class milk

Farmer	Milk	Fat	Price	Total	Class	Deduct	Premium	Total

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In the above payment methods no expenditures, depreciation costs, bonuses, or other deductions are considered. Before paying the milk producer for his deliveries, it is very important, especially in a

cooperative, to make these deductions. When the farmer is paid for his milk, it is very difficult to extract any funds from him to pay eventual overspending again.

7th Method: Fixed kg price including some general deductions

Item	100 kg 6 % milk	100 kg 3 % milk
Fat pay	**420.0**	**210.0**
	+	**+**
Skim milk pay	**200.0**	**200.0**
	= 620.0	**= 410.0**

Less

Expenditures and running costs	5.0	**5.0**
	+	**+**
Depreciation of equipment and	**0.5**	**0.5**

buildings		
	+	**+**
Deduction of bonus payment	**1.5**	**1.5**
	+	**+**
Extension fund	**5.0**	**5.0**
	+	**+**
Deduction for price pool	**1.0--> 13.0**	**1.0--> 13.0**
Milk price per 100 kg	**607.0**	**397.0**

Farmer	Milk kg	Fat %	Price /kg (mu)	Total Price (mu)	Class	Deduct -ion (mu)	Premium (mu)	Total pay (mu)
1	100	6.0	6.07	607	1st	-	100	707
2	100	3.0	3.97	397	3rd	100	-	297

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Example:

The dairy pays the two farmers for:
- quantity and composition
- physical/hygienic quality

34 Farmer with 6 % fat milk:

100 kg | 6% Fat
94% skim milk
608 mu | + | ○ Grade 1
100 mu premium

= 708 mu

35 Farmer with 3 % fat milk:

100 kg	3% Fat 97% skim milk 404 mu	+	◯ Grade 3 100 mu deduction	= 304 mu

The first farmer gets more than double for the same quantity of milk because his milk has:
- higher compositional quality (fat

content)
- higher physical and hygienic quality
(cleaner, fewer bacteria).

What do you know about milk payment?

Payment for your milk

1. Payment according to milk quality (1-4, 6)
2. Rejection of low quality milk (5)

Payment for quantity

1 Payment according to quantity if quality high (7-10)

Small-Scale

Dairy Farming Manual

Volume 1

Technology Unit 9

Milk Treatment

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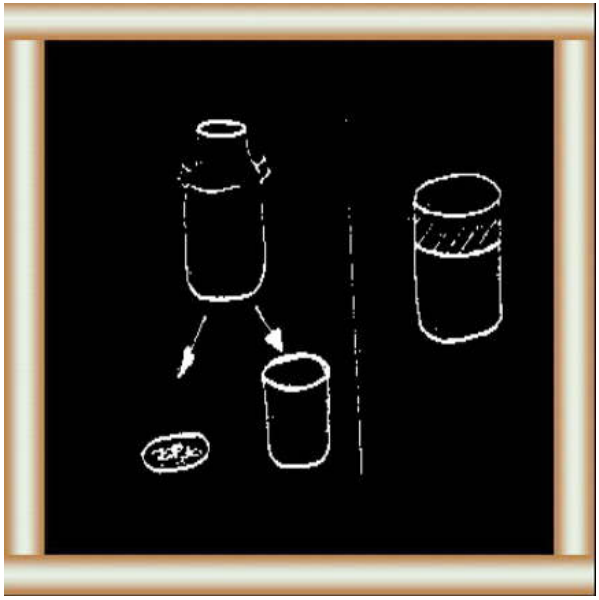
Extension
Materials
What should you know about milk treatment?
You should know about the four main methods:



2 Separation (5-8)

- to remove dirt

- to separate cream from skim milk.

3 Standardization (9-21)

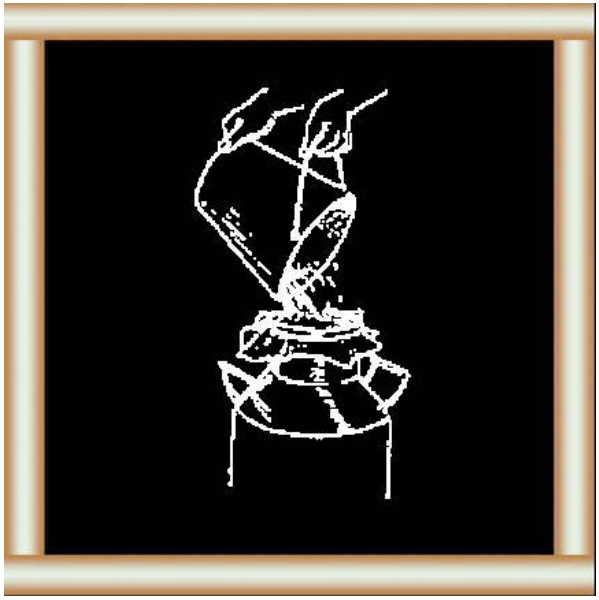
- to obtain the correct percentage of fat

- to obtain the correct percentage of total solids.

4 Heat treatment (22-42)

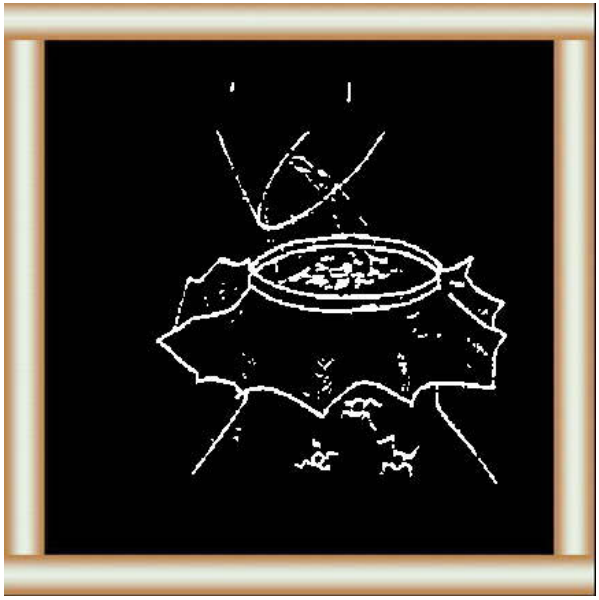
- to kill bacteria which spoil the milk (see 43-58 for large scale heat treatment).

How can you treat milk on a small scale?

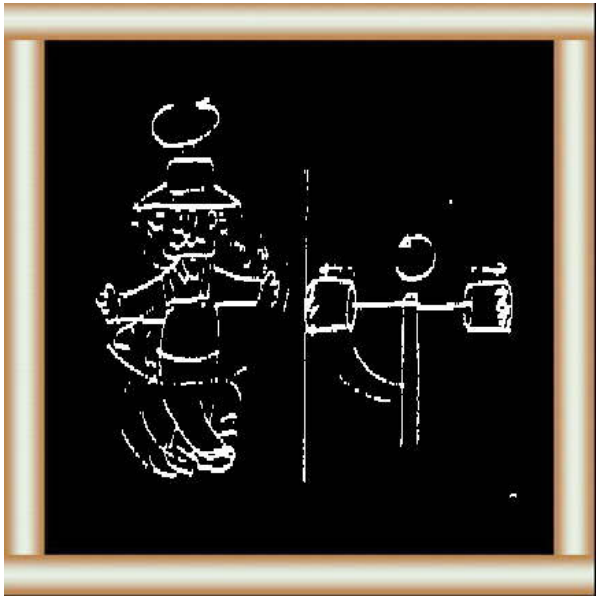


Separation

5 You can filter milk to remove large dirt particles



6 but more milk passes
through the dirt and dissolves
some of it
and carries bacteria to the milk
already filtered.



7 By using a separator you can separate cream from skim milk. Heavier particles (skim milk) move to the outside.

8 You can work this separator by hand.
It treats 60-200 l of milk per hour.

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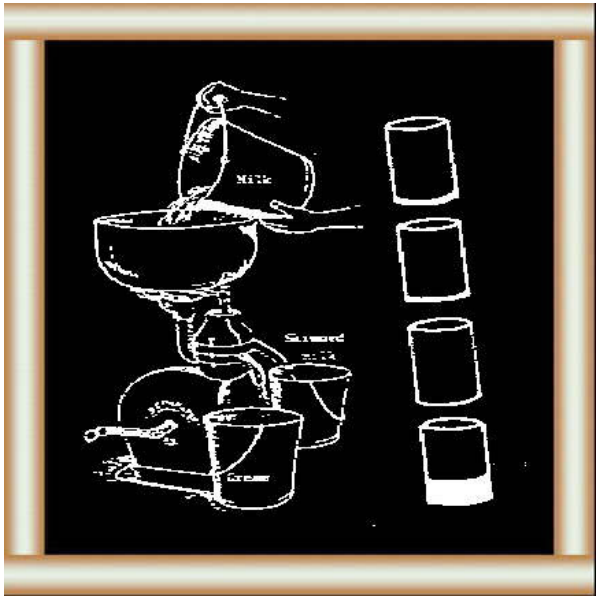
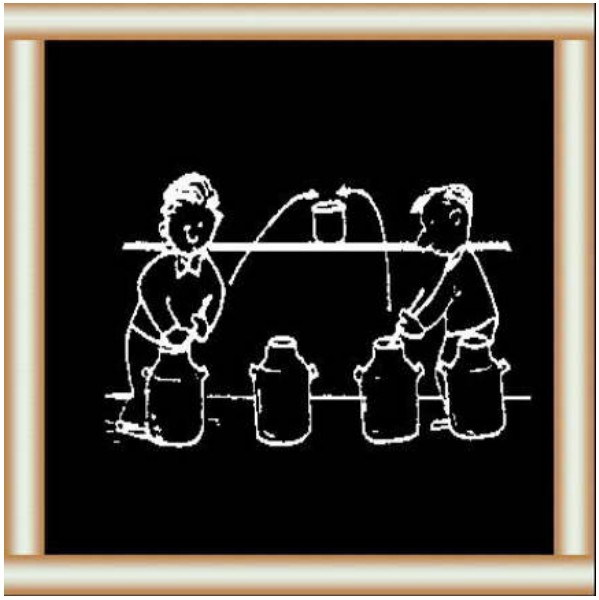
Standardization

What is standardization?



9 Standardization is a method of controlling the fat content of milk.
Whole milk has a fat content of 3-5 % (buffalo milk may have 7-8 % fat).
Low-fat milk has a fat content of 1.5-1.8 %.
Skim milk has less than 0.1 % fat.
Cream has 35-70 % fat.

10 After separation, you can

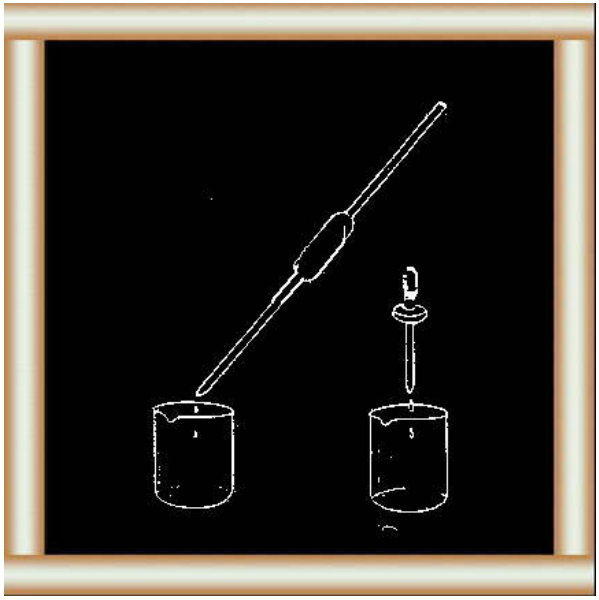


12 In milk reception, you weigh, filter, test the density of your milk.

You may make other tests.

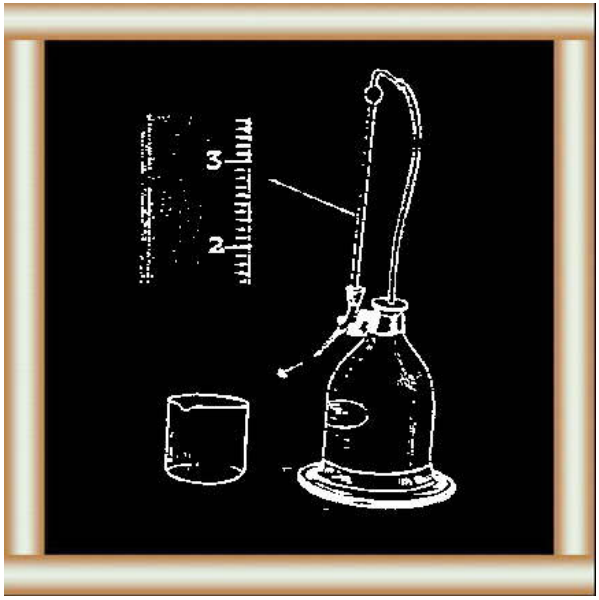
Then you take a sample of milk from each can and mix together.

13 You test the mixed sample for milk acidity.



You:
- put 20 ml of the milk sample into a glass with a pipette
- add 8-10 drops of phenolphthalein with a dropper.

14 With the burette, you:
- add NaOH 0.1N solution drop by drop into the glass until the



solution has a stable pink colour.
The number of 0.1N NaOH used is multiplied by 5 to give ml per 100 ml of milk.
Normal milk will have a value between 17 and 21 ml per 100 ml milk. If higher the milk is sour.

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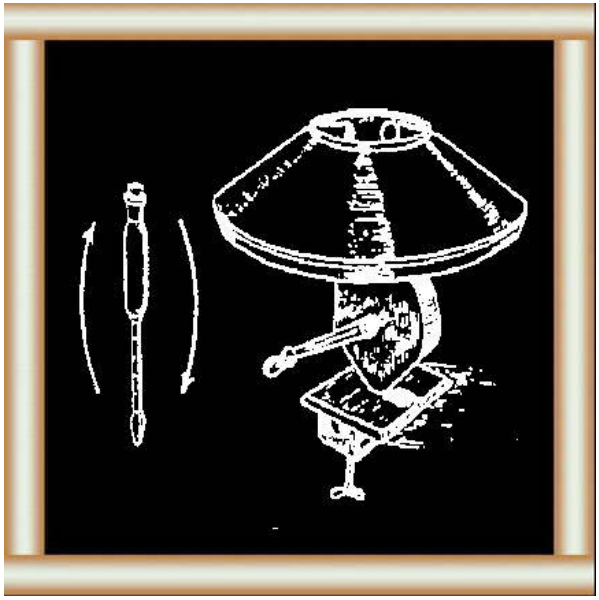
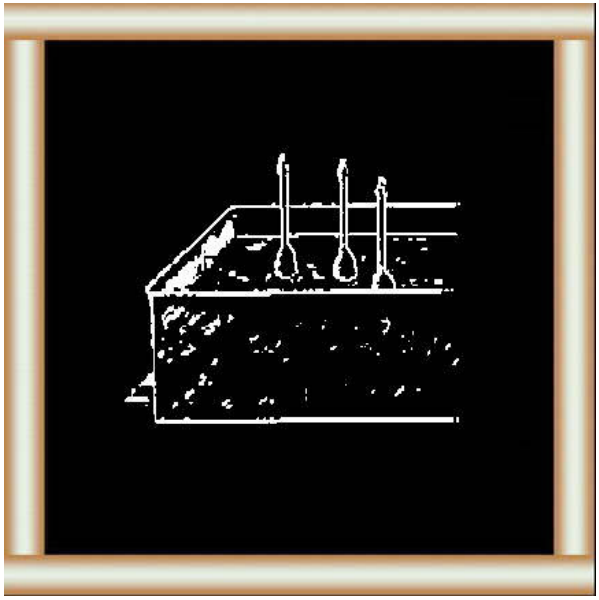
15 You also test the mixed sample for fat content.
You:
- put 10 ml of sulphuric acid in the butyrometer
- add 11 ml of milk from the average sample
- add 1 ml of amyl alcohol



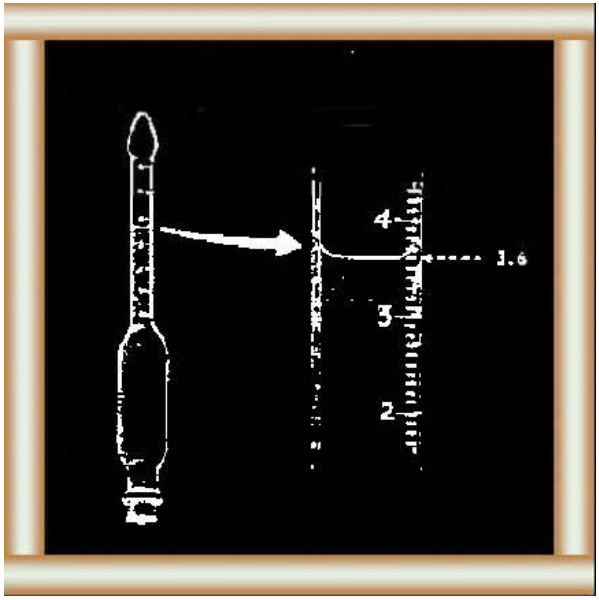
16 - cork the butyrometer and shake well to dissolve the milk elements (use a cloth to hold - hot!)
- put the butyrometer in the centrifuge
- centrifuge for 5 minutes



17 - put the butyrometer cork down into a water bath (60 - 70 C)

- leave for 5 minutes.

18 Make sure:



- the butyrometer is vertical

- You read at eye level.

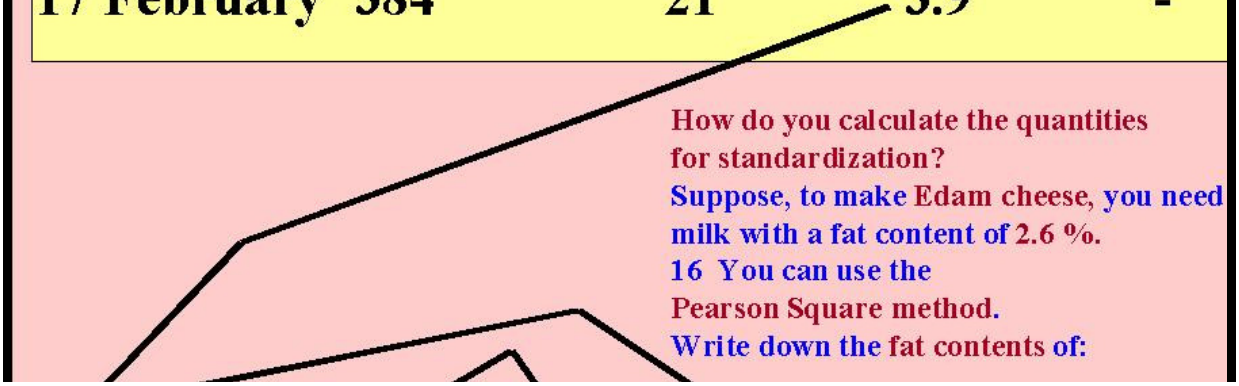
The sample here contains 3.6 % fat.

---

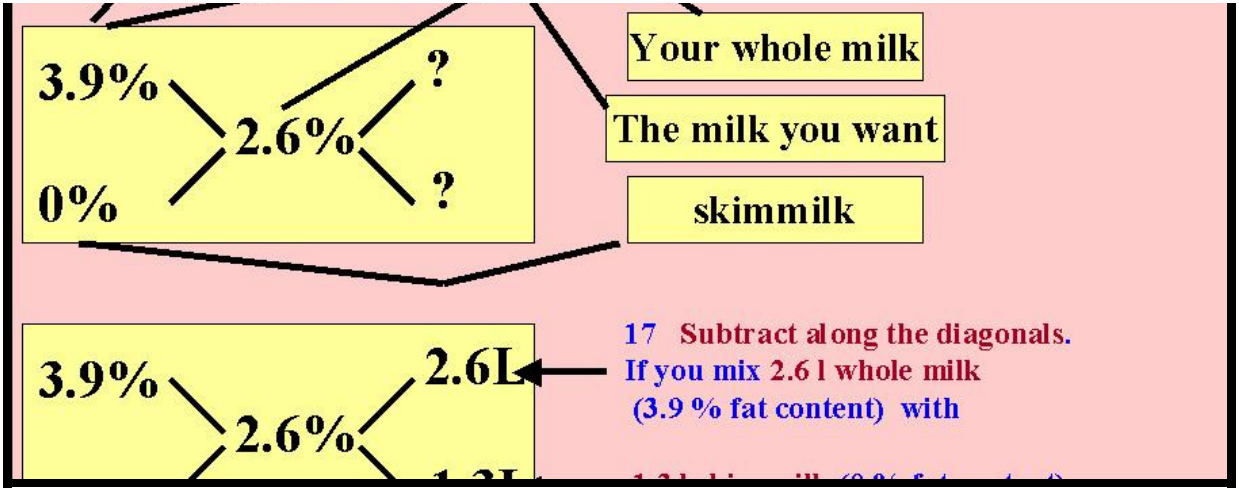
19 You record the results in a milk analysis note book:

Date	Quantity of Milk Received	Acidity 0.1 N ml NaOH	Fat Content	Obser-vation

	Received	NaOH per 100 ml milk	%	vation
12February	385	22	3.6	-
13 February	405	21	3.7	-
14 February	395	21	3.6	-
15 February	372	20	3.8	-
16 February	387	20	3.7	-
17 February	384	21	3.9	-



How do you calculate the quantities for standardization?
Suppose, to make Edam cheese, you need milk with a fat content of 2.6 %.
16 You can use the Pearson Square method.
Write down the fat contents of:



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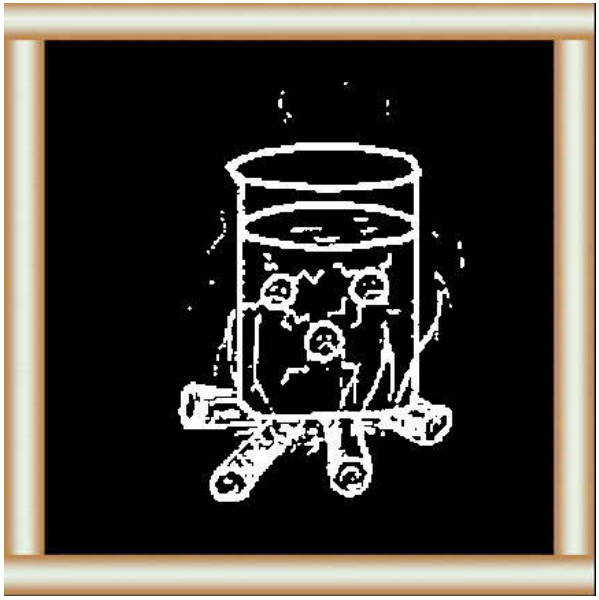
Small scale heat treatment

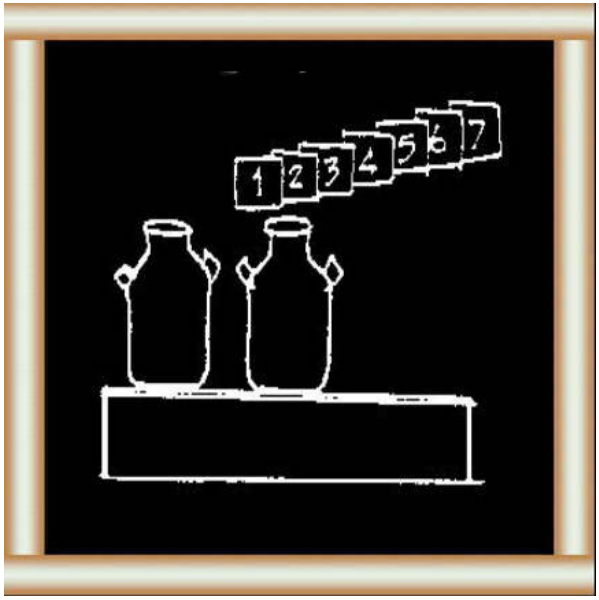
Why heat milk?



22 Heating milk kills most bacteria and other micro-organisms.

Pasteurization is heating with controlled temperature and time.

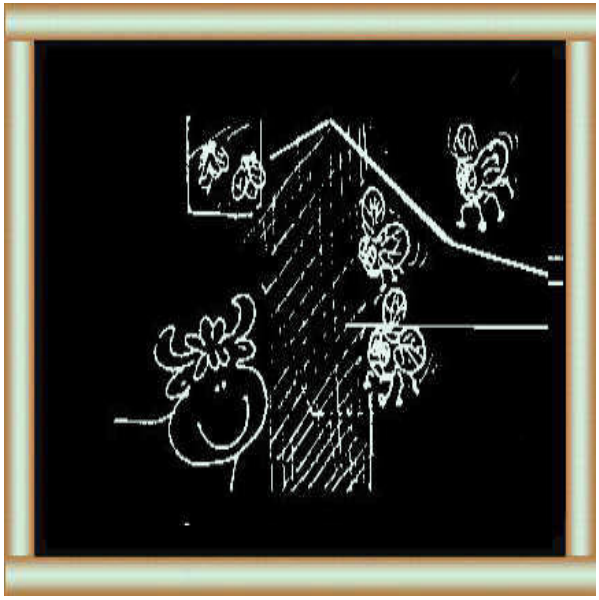
There are different combinations of temperature and time.



23 After you cool the milk you can keep it longer.

Important

24 Use a thermometer to heat to the correct temperature.
For small scale processing, heat to 65 C and keep for 30 minutes.
Stir the milk regularly to keep even temperature throughout the milk.



25 Never drink milk which has not been heated.

It can make you sick.

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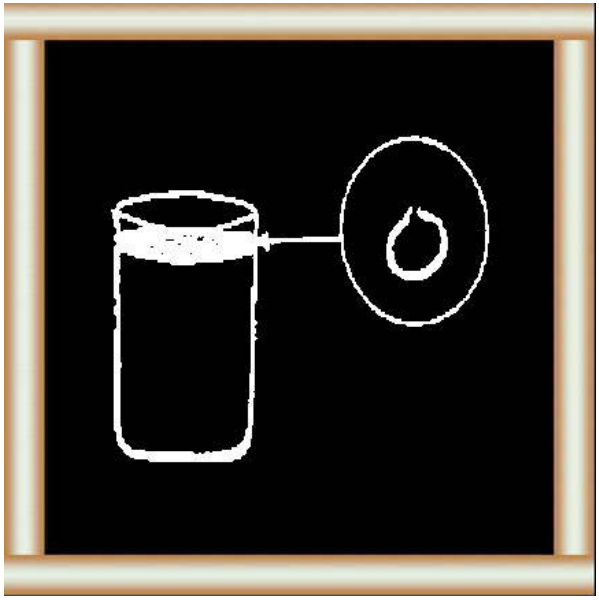
What are the effects of heat treatment on milk?



Fat

26 Only high temperatures change fat, but pasteurization melts fat so that rough treatment easily breaks the membrane.
Then, enzymes can oxidize the fat.

Proteins and enzymes

27 If milk is good quality, normal pasteurization:
- does not change proteins
- does not usually change enzymes from bacteria.
Pasteurization coagulates sour milk.

Lactose

28 Very high temperatures cause:
- browning of milk
- change in flavour.
Normal pasteurization does not cause browning.

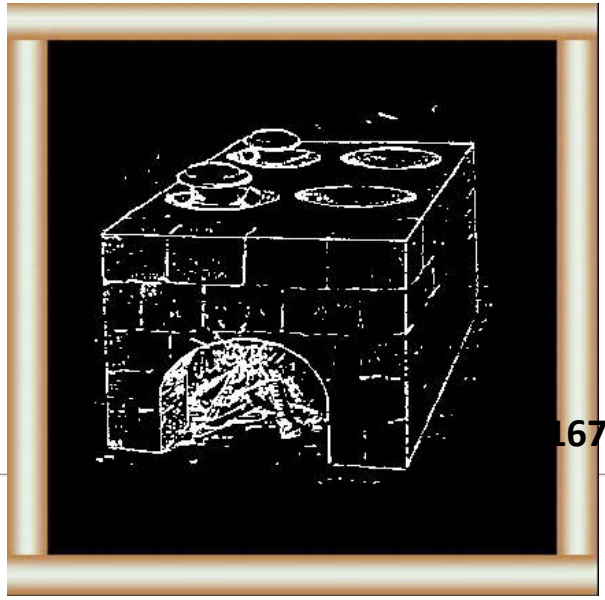
Minerals and vitamins

Normal pasteurization does not change minerals.
Heat treatment can destroy water soluble vitamins. Normal pasteurization destroys about 5-20 % Vitamin C.

What is important in heat treatment?

29 Make sure you:
- measure temperature accurately

- stir the milk throughout the heat treatment



65 C for a short time.
This boiler/water bath uses peat or wood for energy.
Important
Use thermatization only if you cannot pasteurize the milk within 24 hours of delivery to the plant.

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Pasteurization

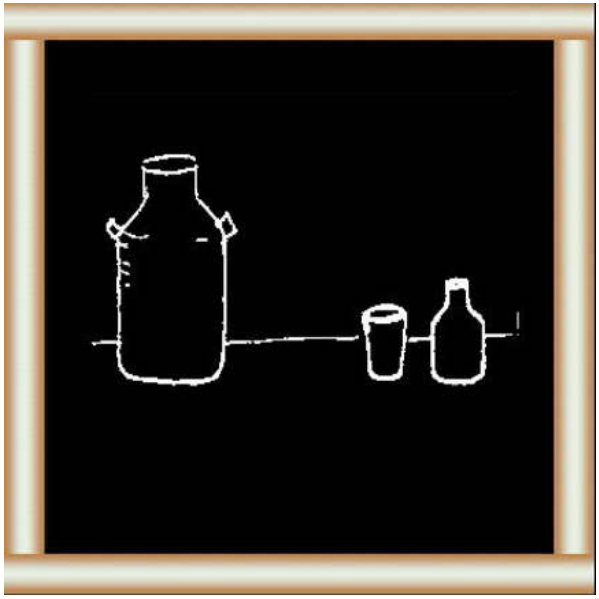
32 The temperature range for pasteurization is 63 C to 100 C. This kills most harmful bacteria.
This is a wood-fueled metal boiler with a jacket.

33 This is a gas-fuelled metal boiler.

You can pasteurize at different times and temperatures.

Time	Temperature
30 minutes	63^{O}C
3 minutes	68^{O}C

20 seconds	$73^{o}C$



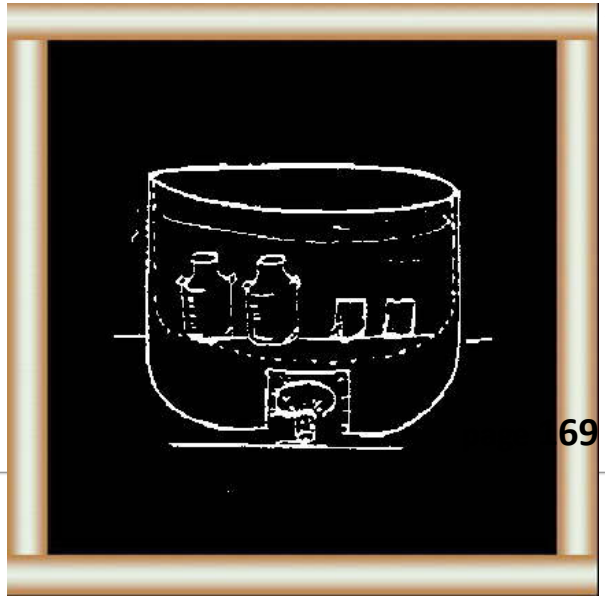
34 Use:
- lower temperatures for market milk

- higher temperatures for yoghurt and fermented products.
Important

Sanitize the stirrer before use.

Stir continuously.

35 You can also heat treat in containers, bottles or packets of milkunder water.



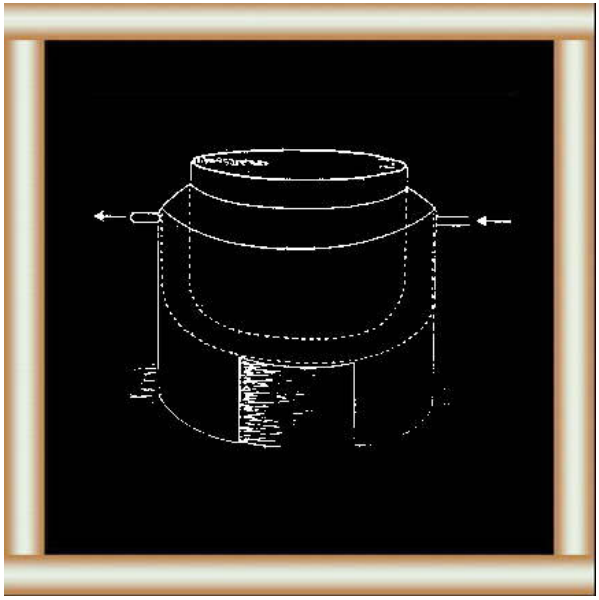
This reduces the chances of reinfection after treatment.
Important
Allow longer times than above to warm up the containers.

Bottles : 80 C for 10 minutes
Bags : 80 C for 5 minutes.

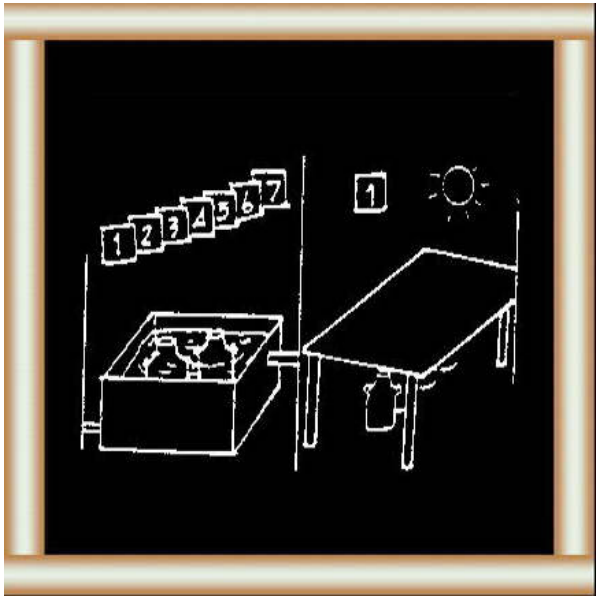
69

36 You can cool the milk with running water in a vat.

Use ice if available, in the water not in the milk!

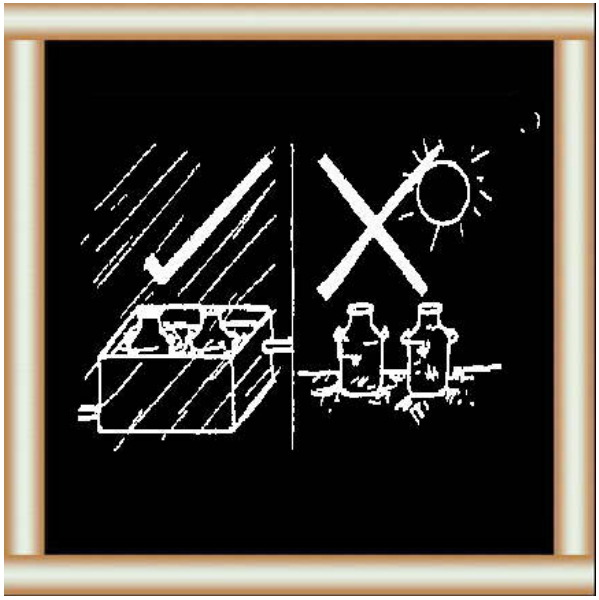


37 You can also cool the milk by running water through a jacket.



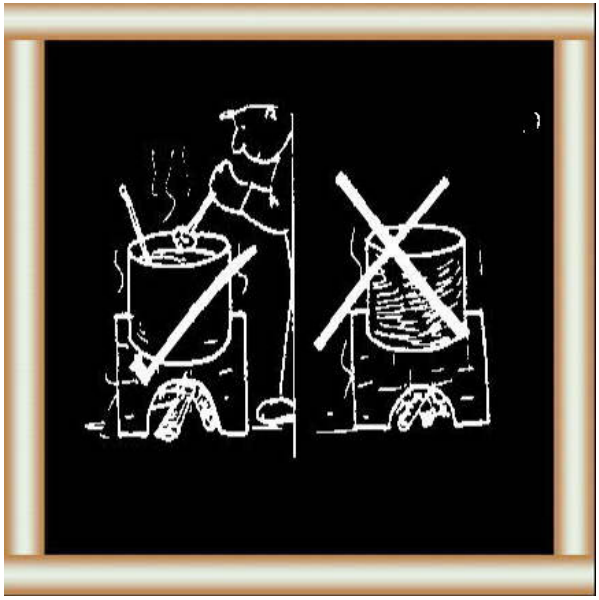
38 You can keep pasteurized milk for up to a week if you keep it cool and not reinfected.
If your milk is not cool, keep it for only 1 day.

Important in all milk treatment:



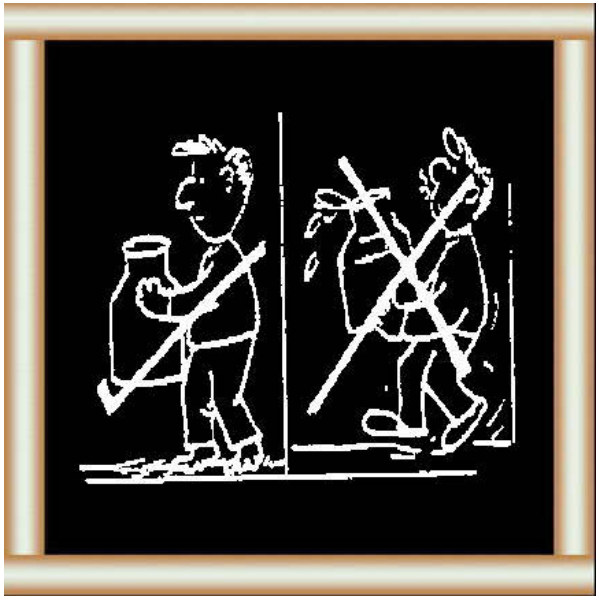
39 - keep everything clean

- store milk in a cool place away from sunlight.



40 - use a thermometer and stirrer

- do not use copper equipment, it may start unwanted chemical reactions in the milk



41 - treat milk gently

- do not whip air into it

42 - never drink milk or products which you do not heat treat.

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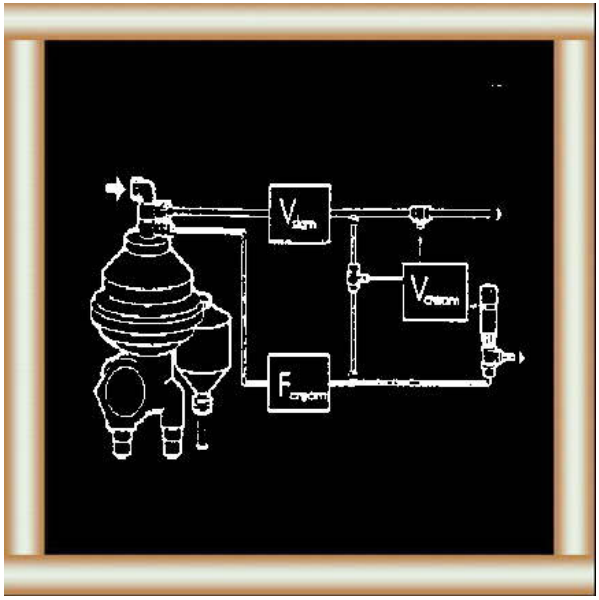
How does the dairy plant treat milk on a large scale?

44 A centrifuge separates the cream from the skim milk.

Some separators also remove dirt.



45 The plant automatically standardizes the milk by adding part of the cream to the skim milk flow.

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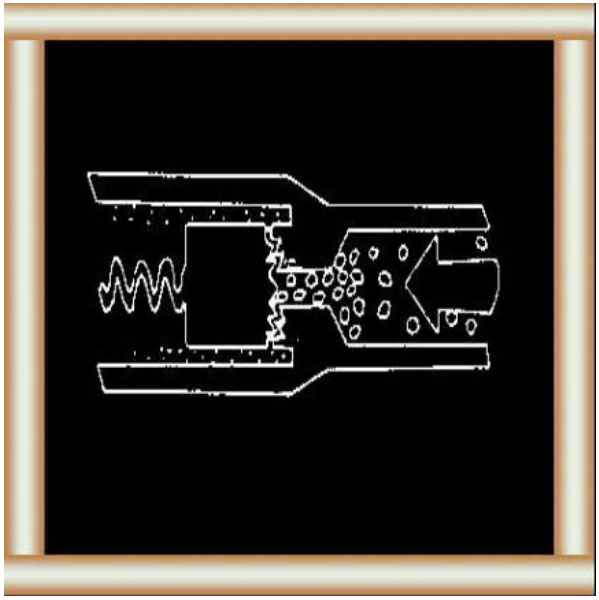
46 Next, the plant homogenizes the milk.
This changes the milk to have:

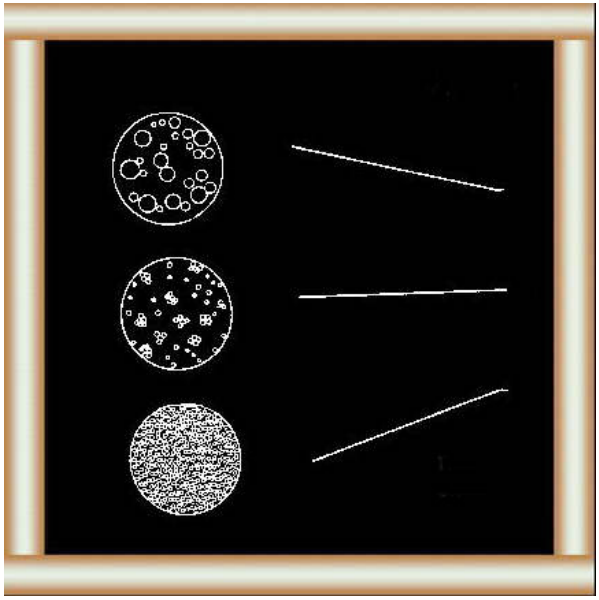


- smaller fat globules
- lower creaming ability

so the milk has:

- no cream line
- a whiter, more appetizing colour
- less oxidation.

47 At different degrees of homogenization, the fat globules are different sizes:



- not homogenized
- partially homogenized (viscolized)
- totally homogenized (micronized).

Homogenization may also have some disadvantages:

- cannot separate easily
- flavour becomes metallic quickly in sunlight
- lipase attacks easily

- low protein stability.

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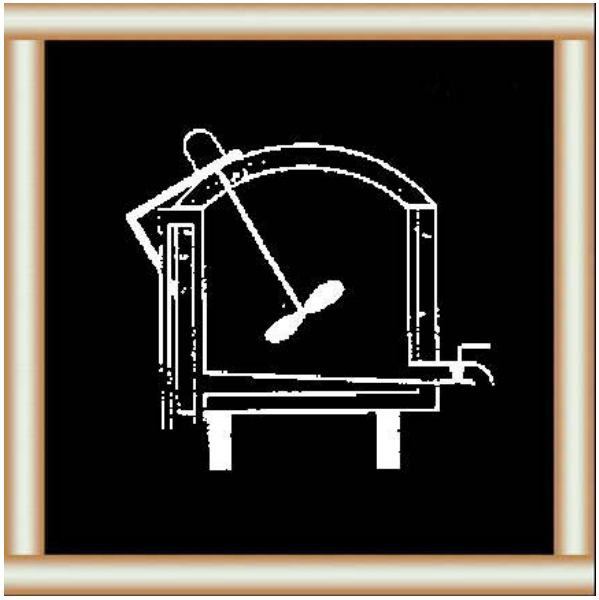
Large-scale heat treatment systems
What large-scale heat treatment systems are there?

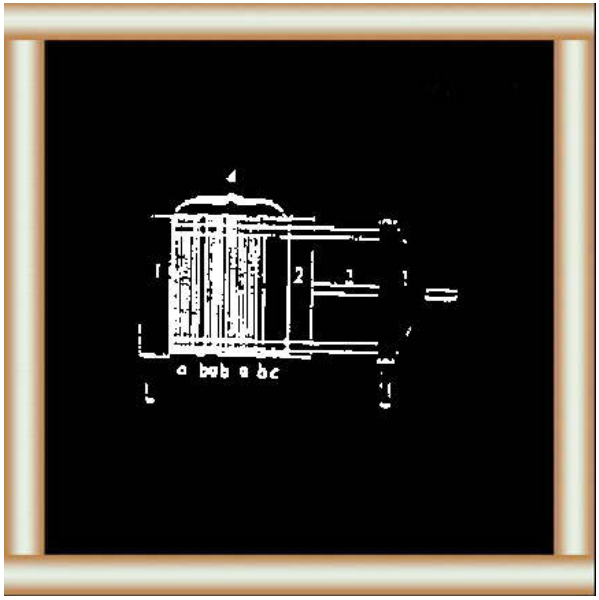
Holder system
There are two types of holder



system.

48 This plant heat treats and cools milk in a vat (batch pasteurizer)

49 and then puts the milk in:



Continuous flow system

50 This plate heat exchanger can heat treat milk and then cool it.

Advantages

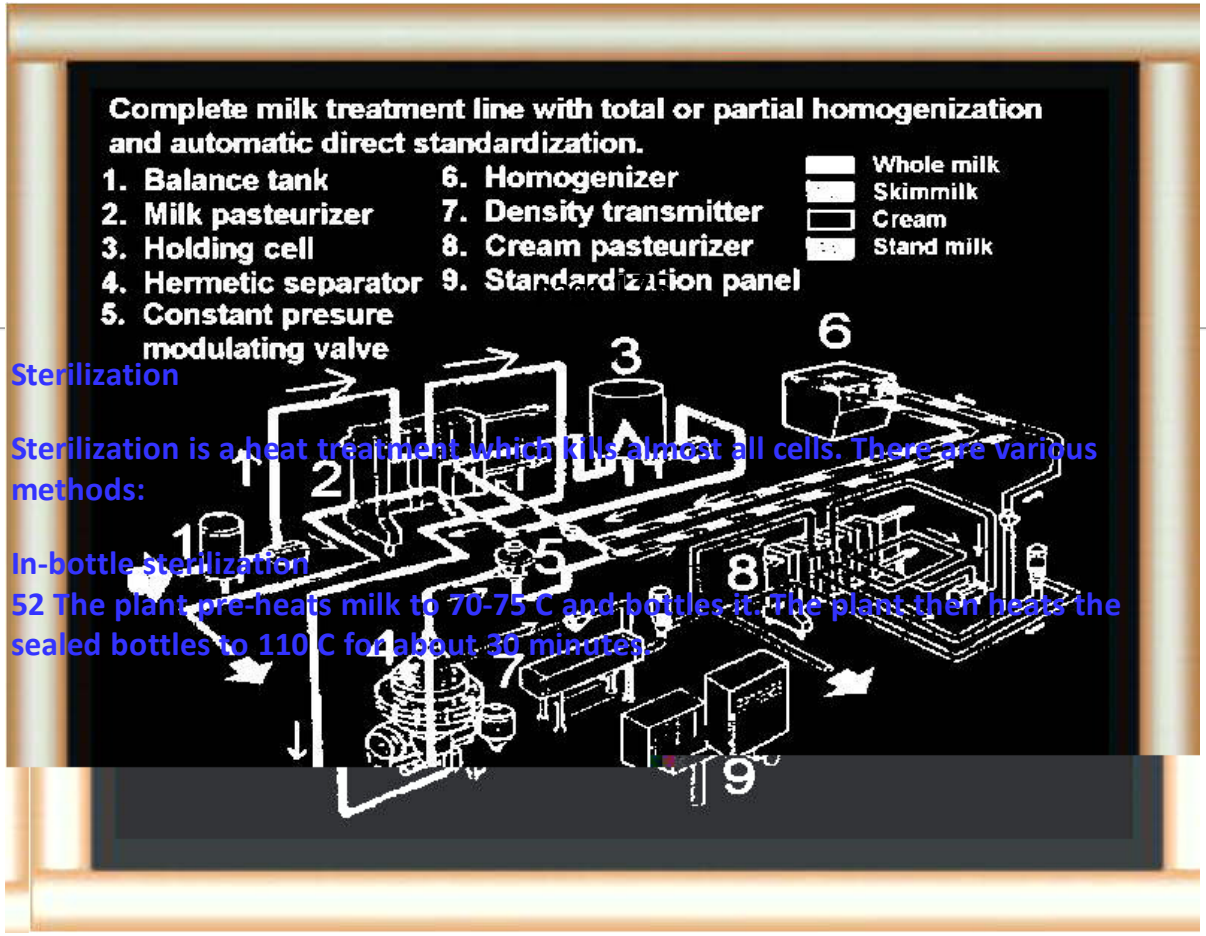
- strict control over large volumes
- little effect on taste
- low processing cost
- automatic cleaning
- uses little space to another
- fixed heat treatment time

Disadvantages

- minimum economic use: 3 hours/day
- high investment cost
- cannot add flavour or other ingredients
- cannot change easily from one product

Continuous flow pasteurization

51 In the HTST (high-temperature short-time process) the plate heat exchanger heats the milk to 72 C for 15 seconds:

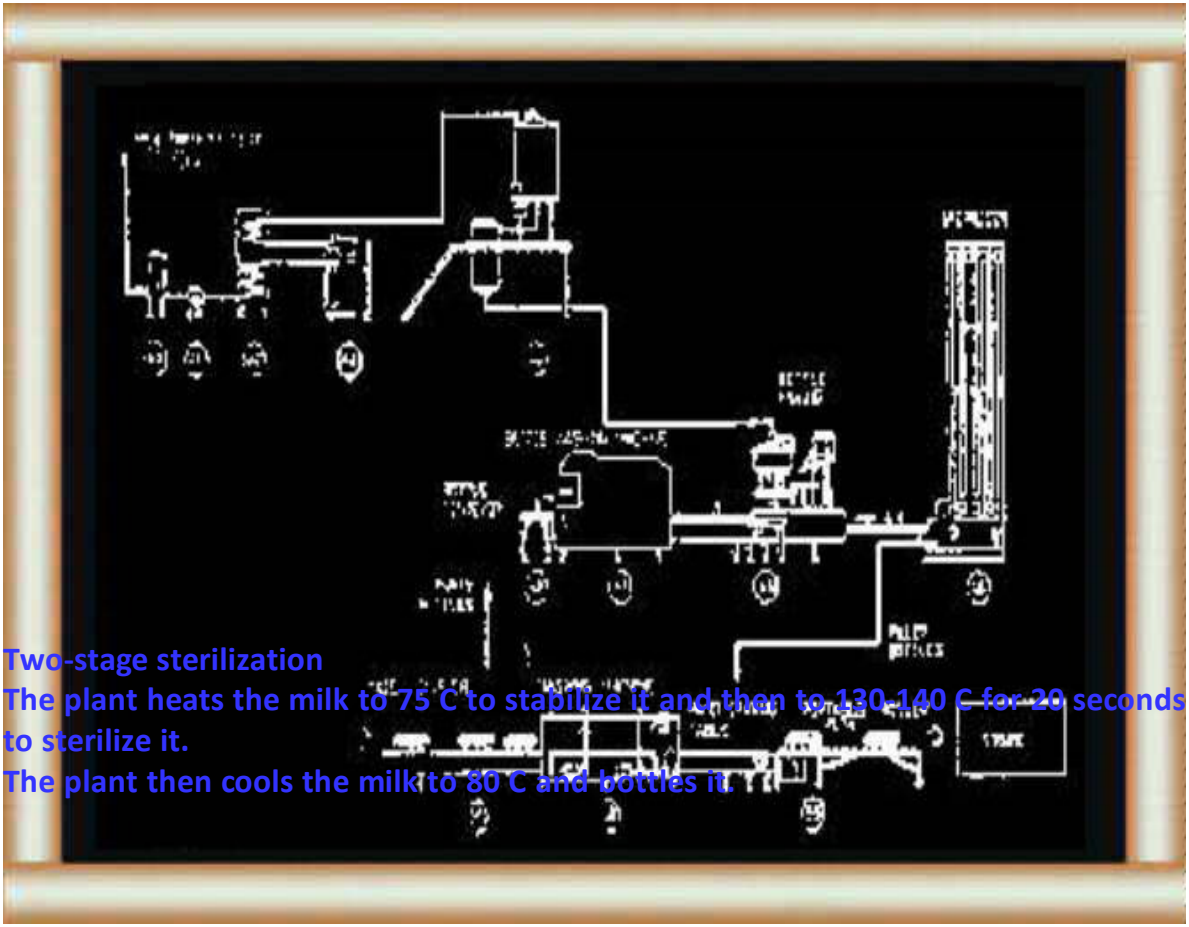


Sterilization

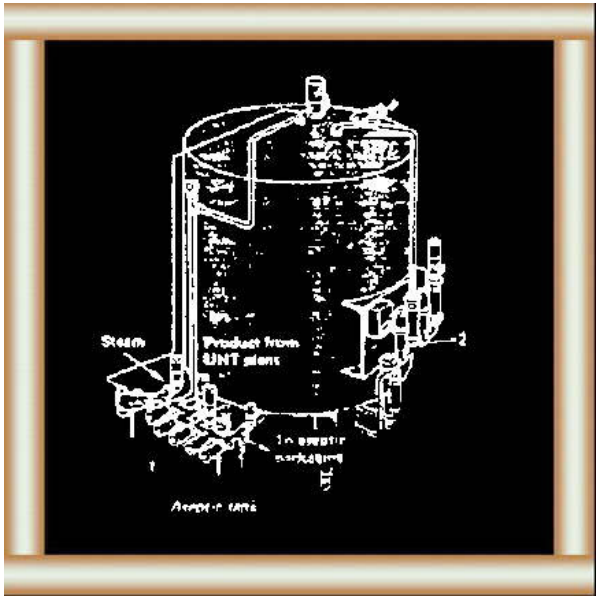
Sterilization is a heat treatment which kills almost all cells. There are various methods:

In-bottle sterilization

52 The plant pre-heats milk to 70-75 C and bottles it. The plant then heats the sealed bottles to 110 C for about 30 minutes



Two-stage sterilization
The plant heats the milk to 75 C to stabilize it and then to 130-140 C for 20 seconds to sterilize it.
The plant then cools the milk to 80 C and bottles it.



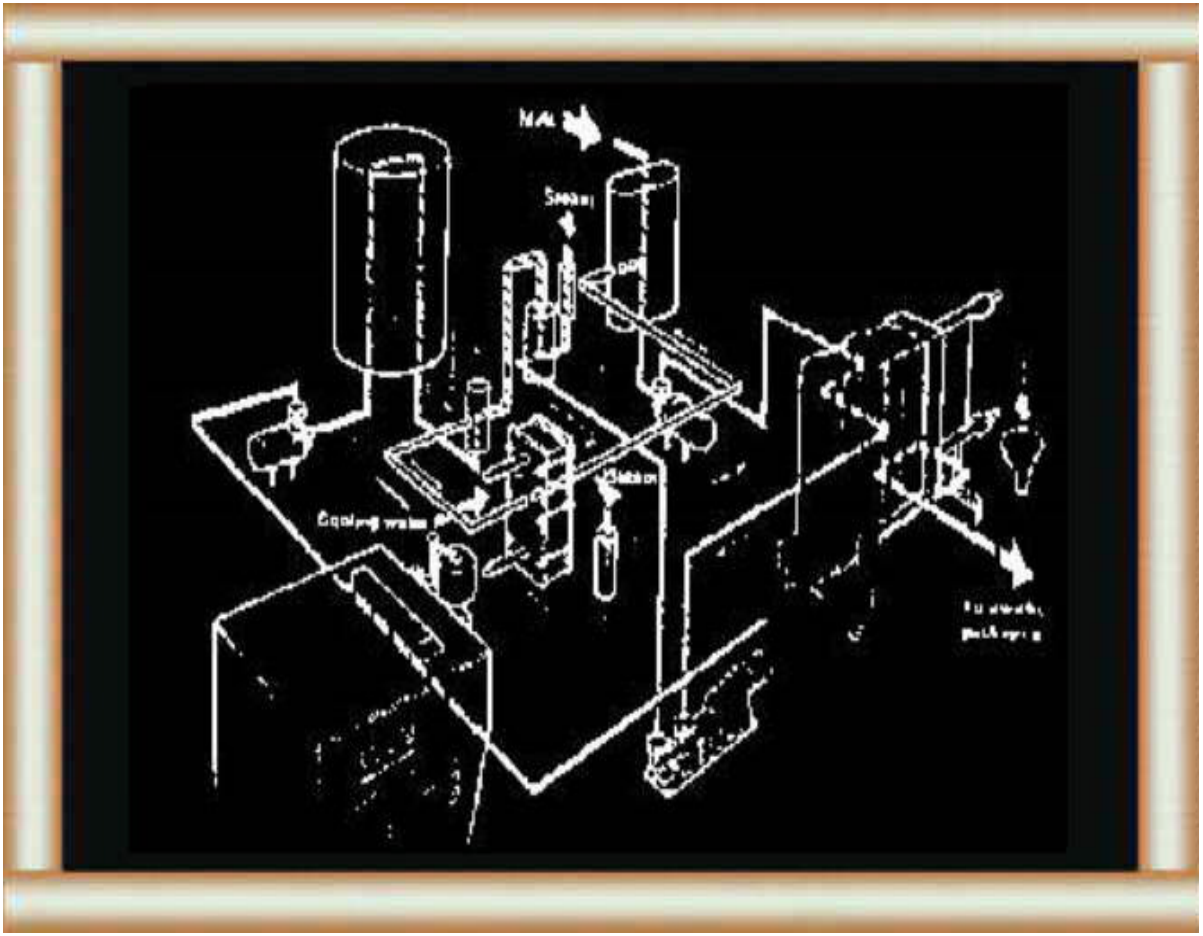
Continual sterilization

53 Equipment used for continual sterilization.

UHT treatment
There are two main methods of UHT treatment:

Direct heating

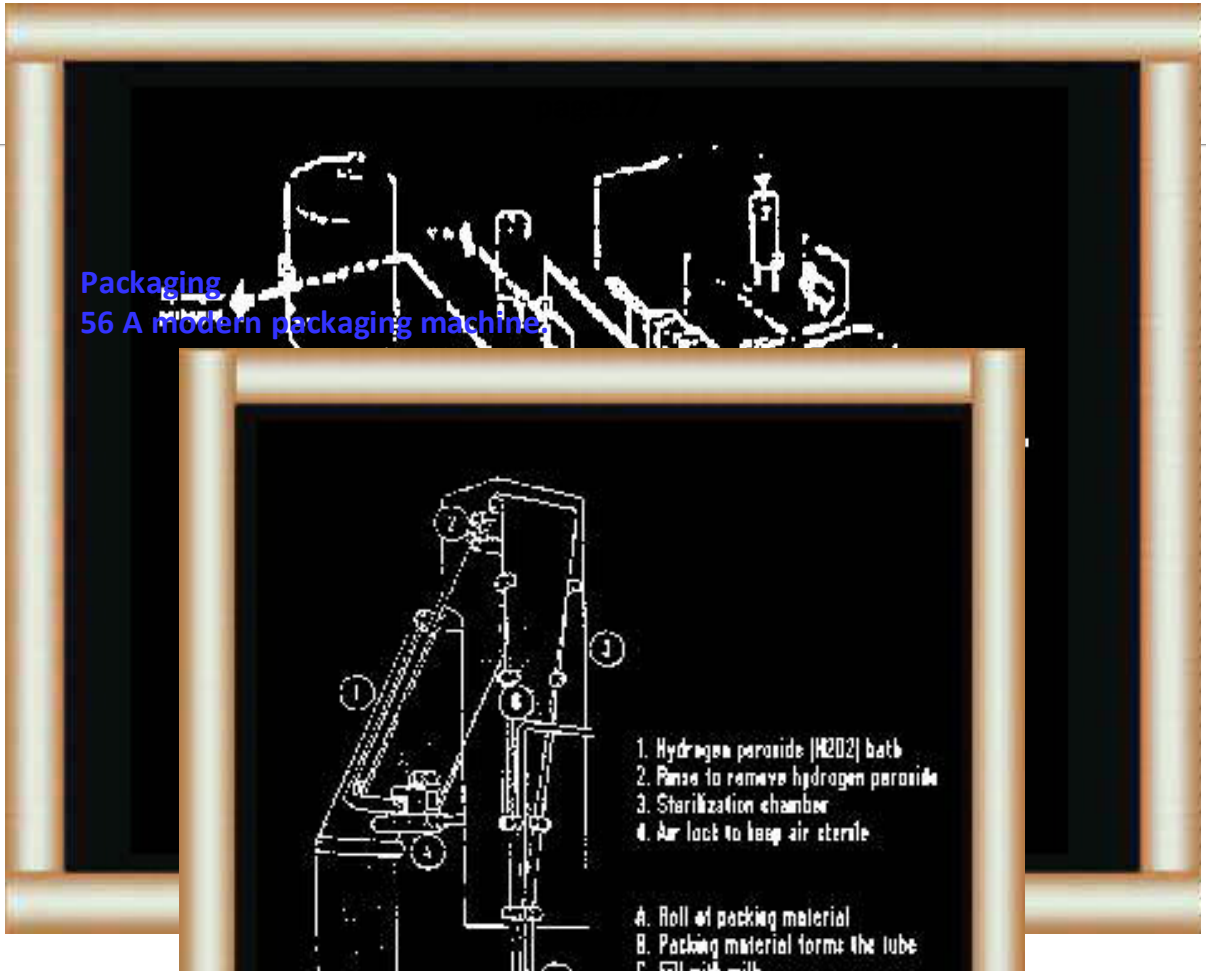
54 The steam passes into the milk and directly heats it to 140 C. Remove excess

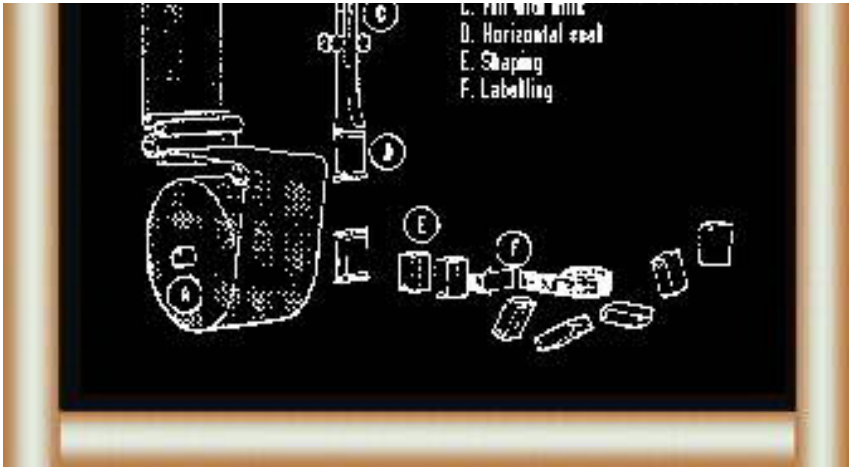

NAL
Cooling water

Indirect heating

55 Steam heats water which passes through a plate heat exchanger. The water indirectly heats the steam to 137 C

Packaging
56 A modern packaging machine.





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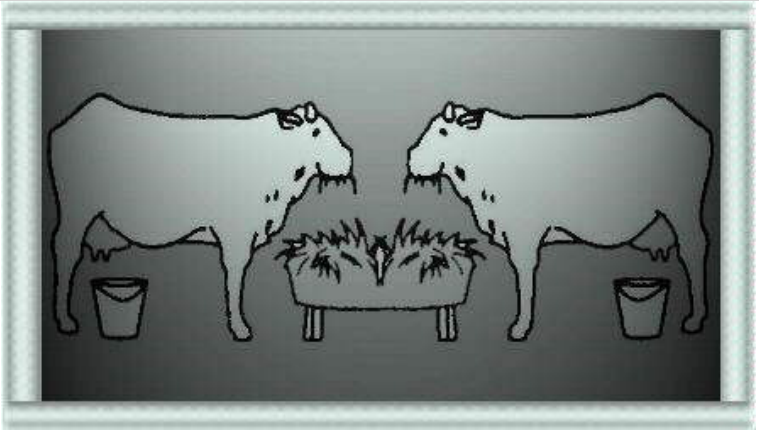
What do you know about milk treatment?

Small scale milk treatment



Small-scale dairy farming manual

Volume 2

Husbandry
Units 1 to 3

**Regional Dairy Development and Training Team
for Asia and Pacific
Chiangmai, Thailand**

**Regional Office for Asia and the Pacific
Bangkok, Thailand**

**FOOD AND AGRICULTURAL ORGANIZATION OF THE UNITED NATIONS
Rome, 1999**

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territory, city or area of its authorities, or concerning the delimitation of its frontiers or boundaries.

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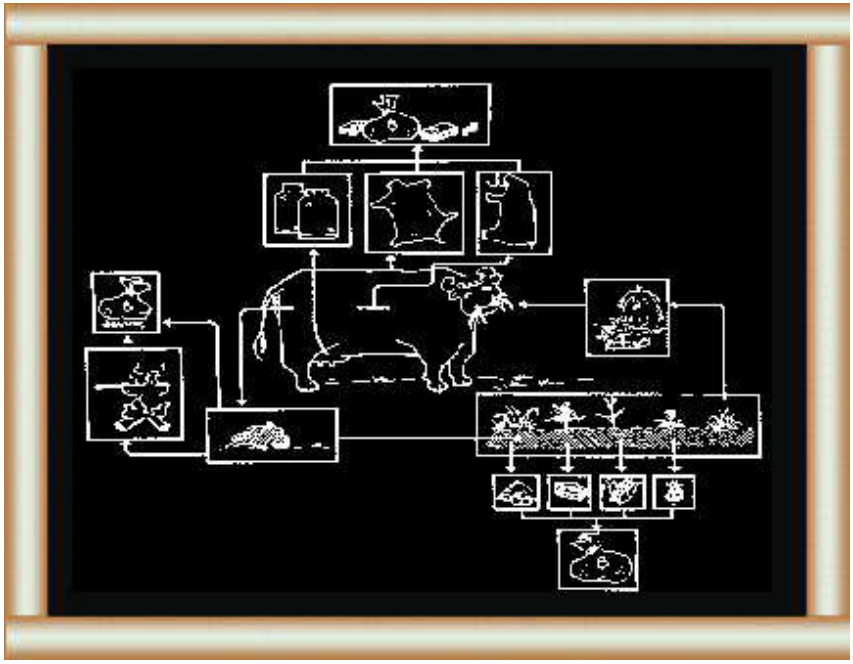
DAIRYING AS PART OF INTEGRATED FARMING SYSTEMS



DAIRYING AS PART OF INTEGRATED FARMING SYSTEMS

Husbandry Unit 1.1:

Technical Notes

Note: Numbers in brackets refer to illustrations in the Extension Materials.

Introduction

In this context, the vast capacity of cattle and buffalo to convert crop residues and by-products into economically useful products has to be used to the best advantage of the small scale producer in particular.

On the other hand, to obtain the best productivity from the land and the animals, fodders and legumes have to be incorporated into the system without adversely affecting the main crops.

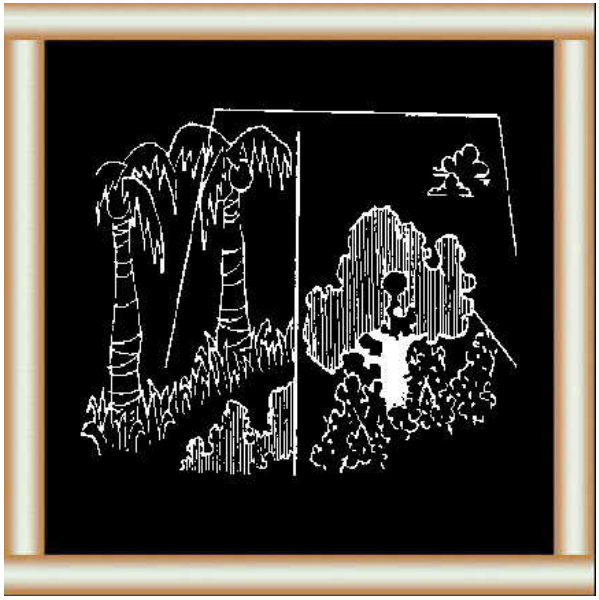
Extension Materials

What should you know about dairying as part of integrated farming systems (IFS)?

What is IFS and why is it important for you? (5-16)

1 IFS is planning and managing inputs and outputs for maximum benefit.

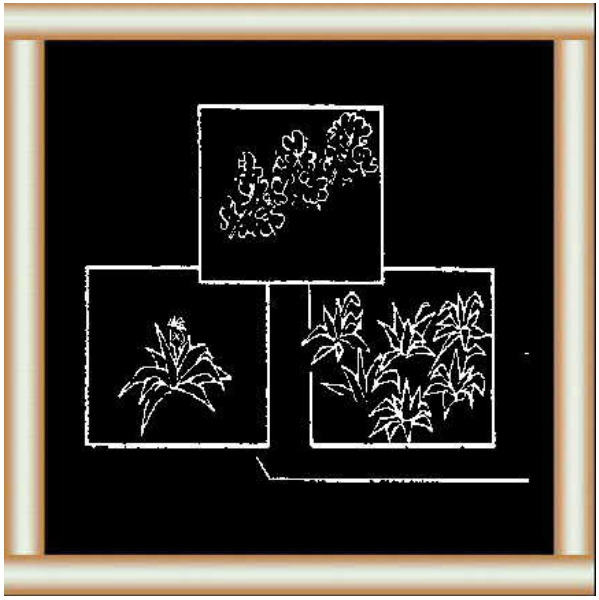
How can you grow fodders,



legumes, grasses as part of IFS? (17-24)

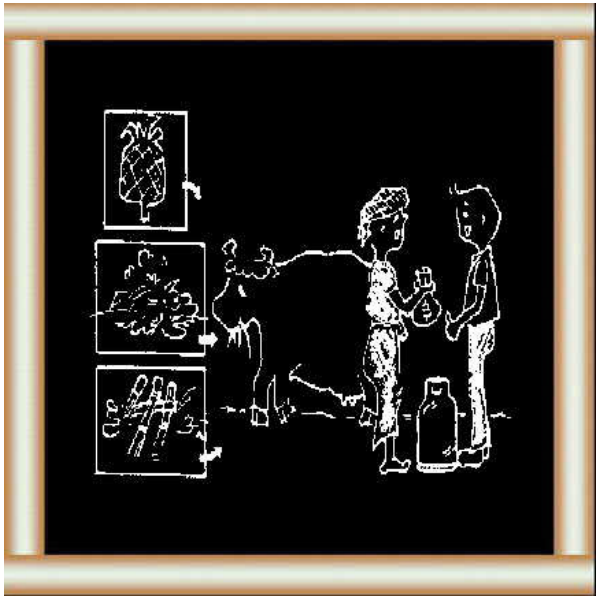
2 You can plan to grow fodders, legumes, grasses:
- to grow with other crops
- to help other crops.

Which crop residues and by-



products can you use for feeds? (25-32)

3 You can use many such as:
- ground nut cake
- pineapple waste
- molasses.



What are the "Six F's" of IFS and how do they fit together? (33-45)

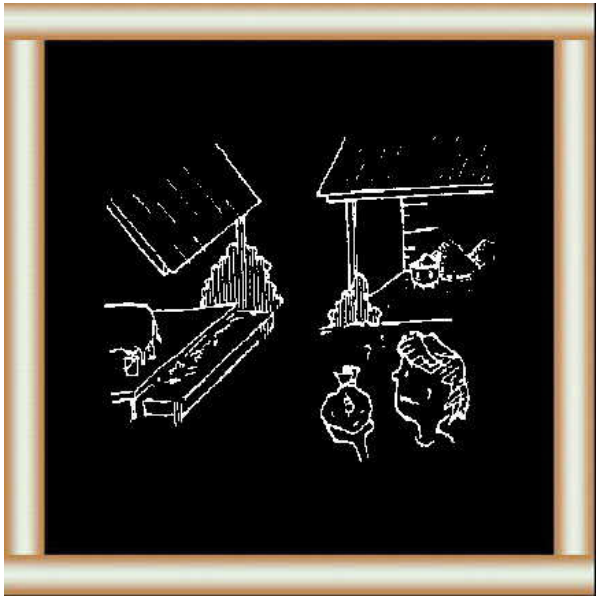
4 The "Six F's" are important things for you to plan and manage on your farm to bring you benefit.

page1

What is IFS?

5 IFS is planning and managing your farm

6 to make the best use of your inputs:
- funds
- fertilizers
- feeds
- labour etc;

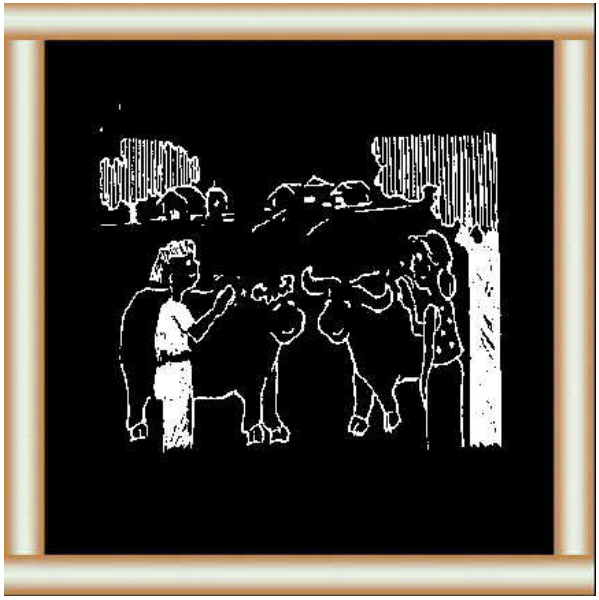


7 and to make the best use and/or to get the best price for your outputs:
- crops
- manure
- milk
- meat etc.

8 You can plan for and manage your dairy cattle and buffalo together with your other farm operations
- IFS.

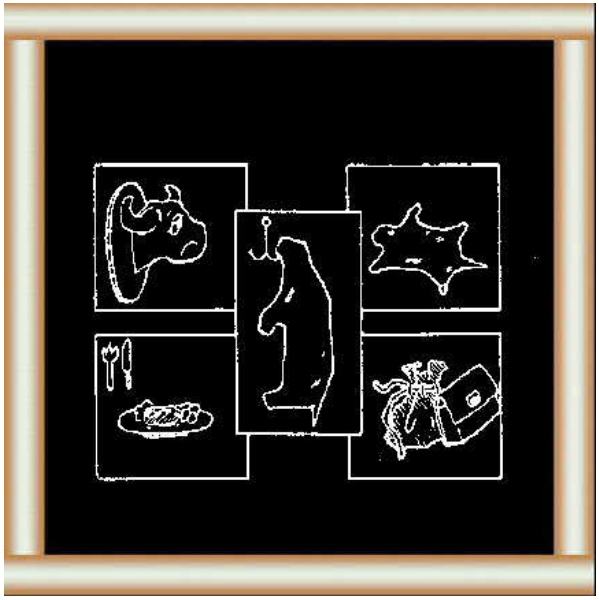
page2

Why is IFS important for you?



9 Cattle and buffalo are important in your farming system and IFS can make the best use of them.

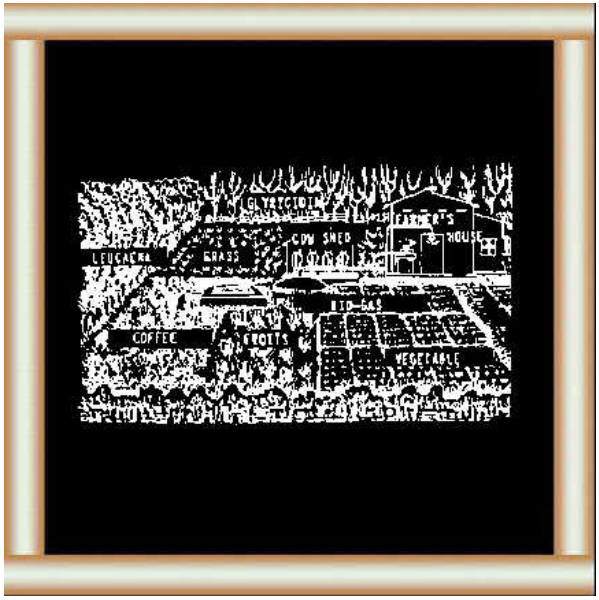
11
- draught power



12
- meat and hides.

page3

13 With IFS you use your land, cattle and buffalo to make more money



14 by growing fodders and legumes with your main crops

15 and by changing crop residues and by-products into things you can sell

16 and use to feed your family.

Incorporation of fodder/legumes into farming systems

Fodders, legumes and grasses can be incorporated in

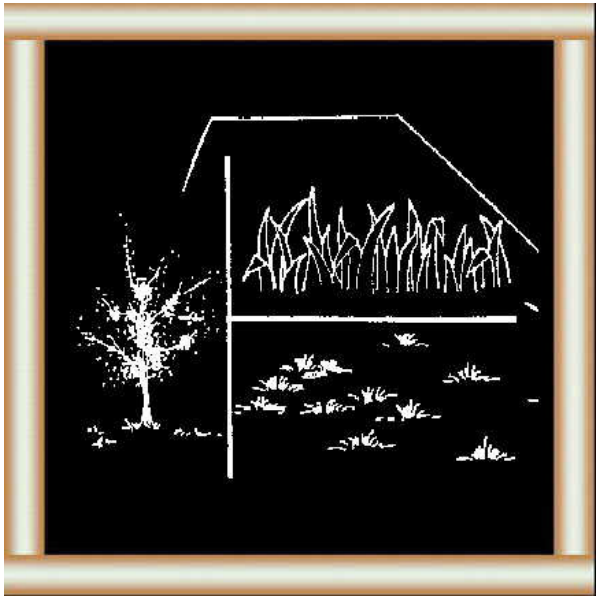
crop farming systems either individually or in combinations. Some methods are to grow them:

- in marginal areas where no other crop can be grown (19)

- along with or under other crops without adverse effects on main crops, e.g. grasses/legumes under coconut, legumes (such as Stylosanthes varieties) on paddy field bunds, legumes along with rice stubble.

page5

How can you grow fodders, legumes, grasses as part of IFS?



17 You can grow
- a fodder
- a legume
- a grass

by itself in your farming system

18 or you can grow all three in combinations.

19 You can grow fodders, legumes, grasses:
- in areas where you cannot grow other crops, e.g. less productive land

20
- with other crops e.g.
- legumes (such as Stylosanthes) on paddy field bunds
- legumes along with rice stubble.

page6

- along boundary fences, e.g. Leucaena and Glyricidia can serve as live fence giving protection to crops in addition to providing roughage.

page 7

21
- underother crops e.g.
- grasses/legumes under coconut

22
- grasses/legumes under Tanol rubber trees

23

- along boundary fences e.g.

- Leucaena or Glyricidia as a live fence.

24 Fodders, legumes, grasses:
- protect crops from animals

- provide roughage.

page 8

Crop residues and by-products

There is a very large number of crop residues and by-products that can be fed to cattle and buffalo corresponding to the varieties of crops grown in the region. Some important ones among them are:

Crop residues:

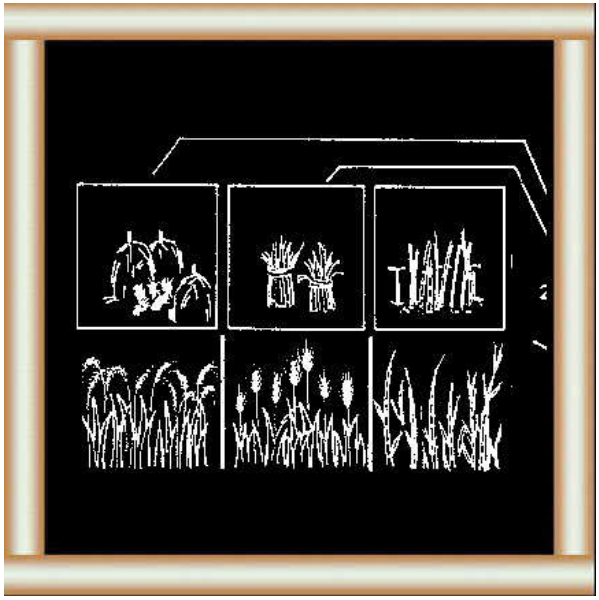
- **rice straw**
- **wheat straw**
- **sugarcane tops**
- **cocoa pods**
- **peanut residue**
- **baby corn**

- soybean hulls
- corn cobs

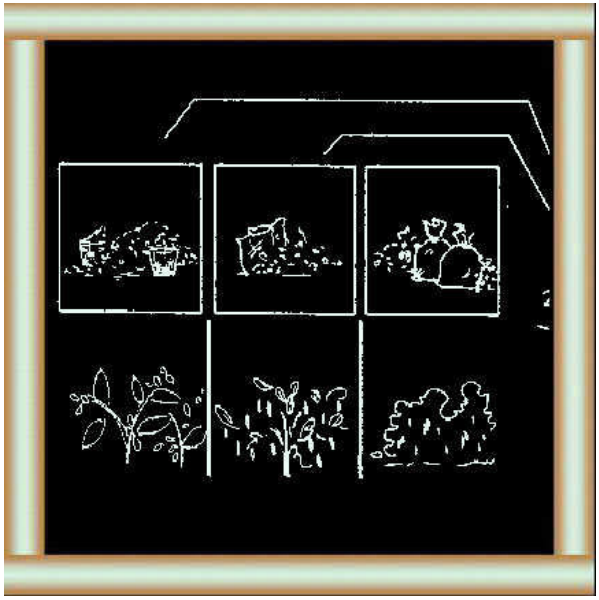
page9

Which crop residues and by-products can you use for feeds?

25 You can feed many different crop residues and by-products to your cattle and buffalo.

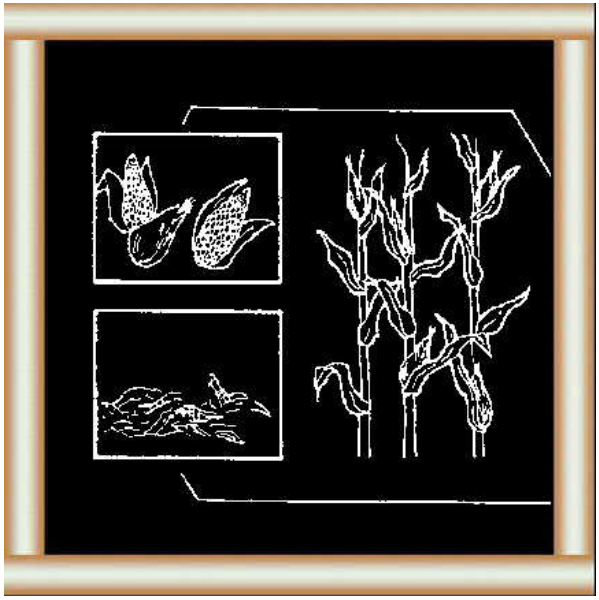


26 Crop residues:
- **rice straw**
- **wheat straw**
- **sugarcane tops**



- cocoa pods
- soybean hulls
- groundnut (peanut) residue

28
- corn residue
- corn cobs



page10

Agricultural by-products:

- rice bran
- wheat bran
- coconut cake
- soybean meal
- palm kernel cake
- sunflower cake
- groundnut (peanut) cake
- pineapple waste
- molasses

There are many residues and by-products which can be (and are being) used for cattle/buffalo feeding in localities where they are available.

page11

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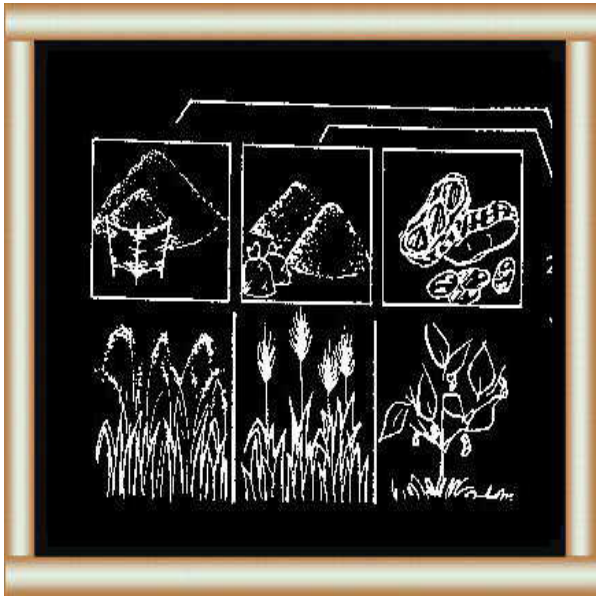
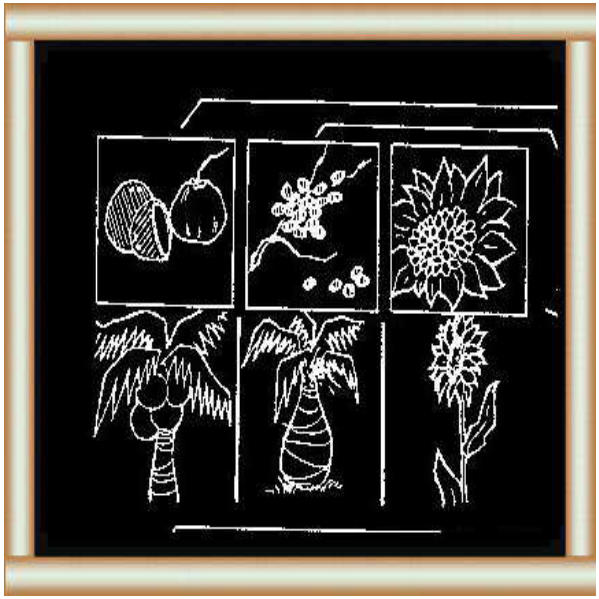
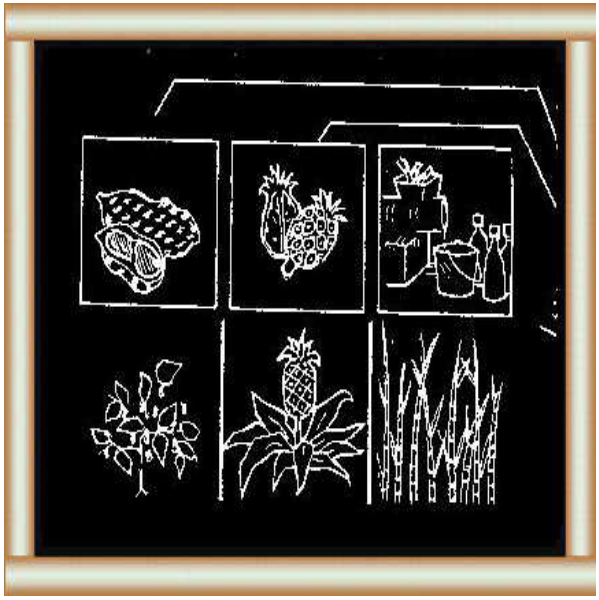
29 Agricultural by-products:
- rice bran
- wheat bran
- soybean meal


WINTER



30
- coconut cake
- palm kernel cake
- sunflower cake



31
- groundnut cake
- pineapple waste
- molasses.

32 There may be other useful residues and by-products in your area. Ask other farmers and your extension worker.

Six "F"s of Integrated Farming

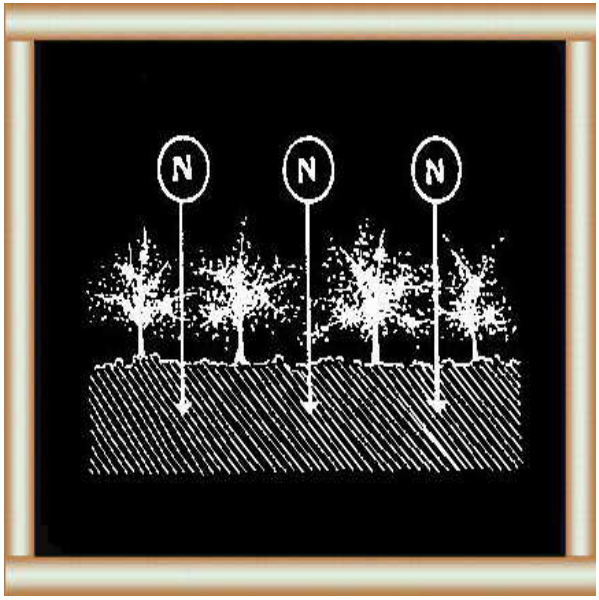
Feed: **Increased roughage availability to cattle and buffalo from the above combinations is clear. (33)**

Fertilizer: **The legume components will add to the soil fertility directly through nitrogen fixation. By converting the extra roughage into dung, cattle and buffalo make a large contribution in the production of organic fertilizer and improved soil fertility (34-35)**

Fence: **The tree fodders and legumes such as Glyricidia and Leucaena can be grown in such a way as to provide live fence or hedge along the boundaries. (36)**

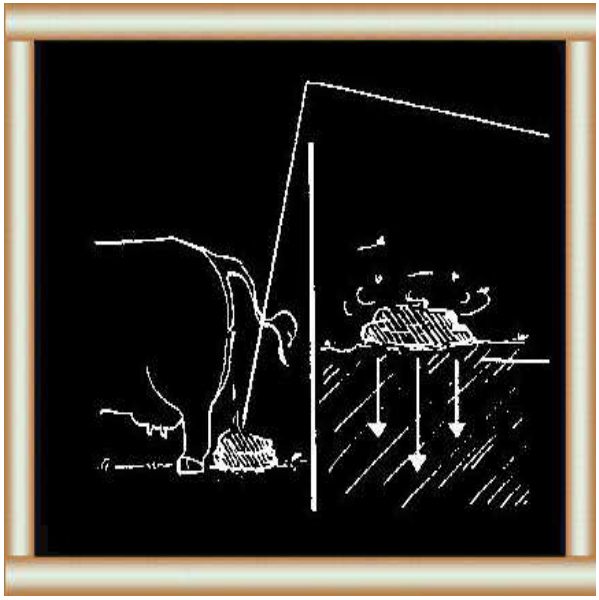
What are the "Six F's" of IFS?

Feed
33 You get more roughage for your cattle and buffalo.



Fertilizer

34 The legumes make your soil more fertile by adding nitrogen.



35 Your animals change the roughage to manure which makes your soils more fertile. (See H. 1.2 Compost Manure)

Fence
36 You can grow tree fodders and legumes (e.g. Glyricidia and Leucaena) as a live fence.

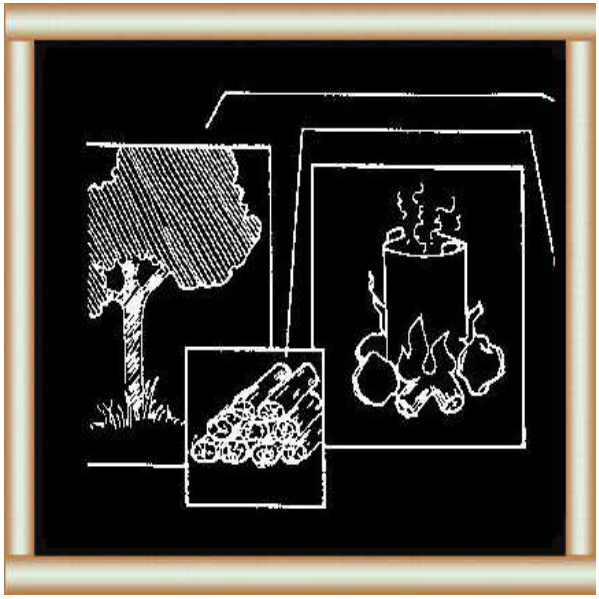
page14

Fuel: **Mature branches from fodder/legume trees can be used as fuel. In some areas dried dung is also used as fuel. A more efficient way, however, is to pass the dung through a bio-gas plant which yields bio-gas as a**

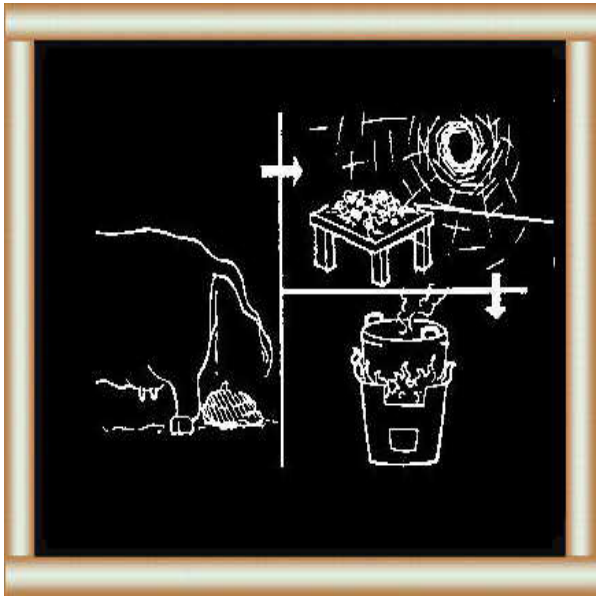
fuel and leaves the slurry for making compost. (37-40)

page15

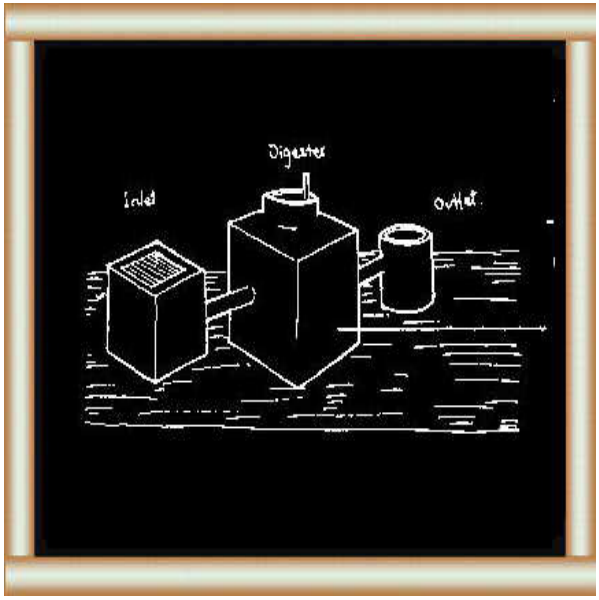
Fuel



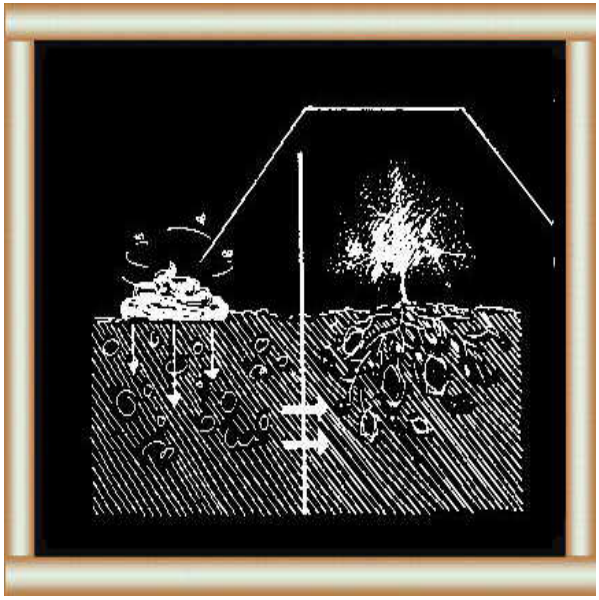
37 You can use:
- mature branches from fodders, legume trees



38
- dried manure



39
- bio-gas from manure in a bio-gas plant.

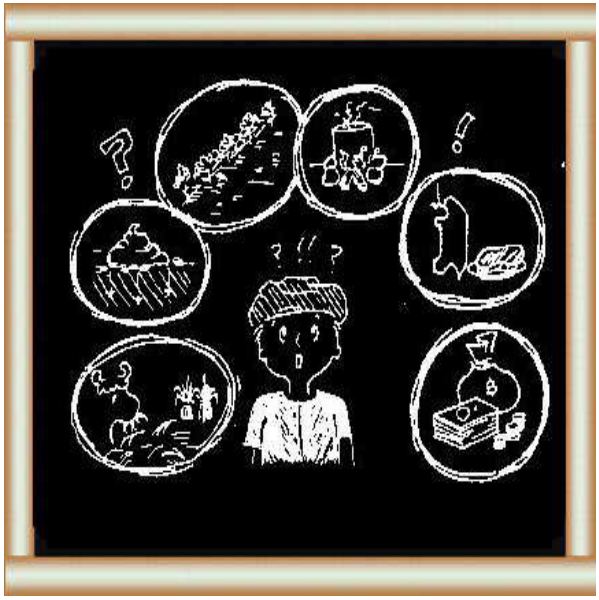


40 This is good because you can use the slurry from the bio-gas plant for making compost.

page16

Food: **Food for the human population by increasing the production of crops, milk and meat. (41)**

Funds: **Higher income for farmers from increased crop production and the sale of surplus milk and animals.**



43 How do the "Six F's" fit together?

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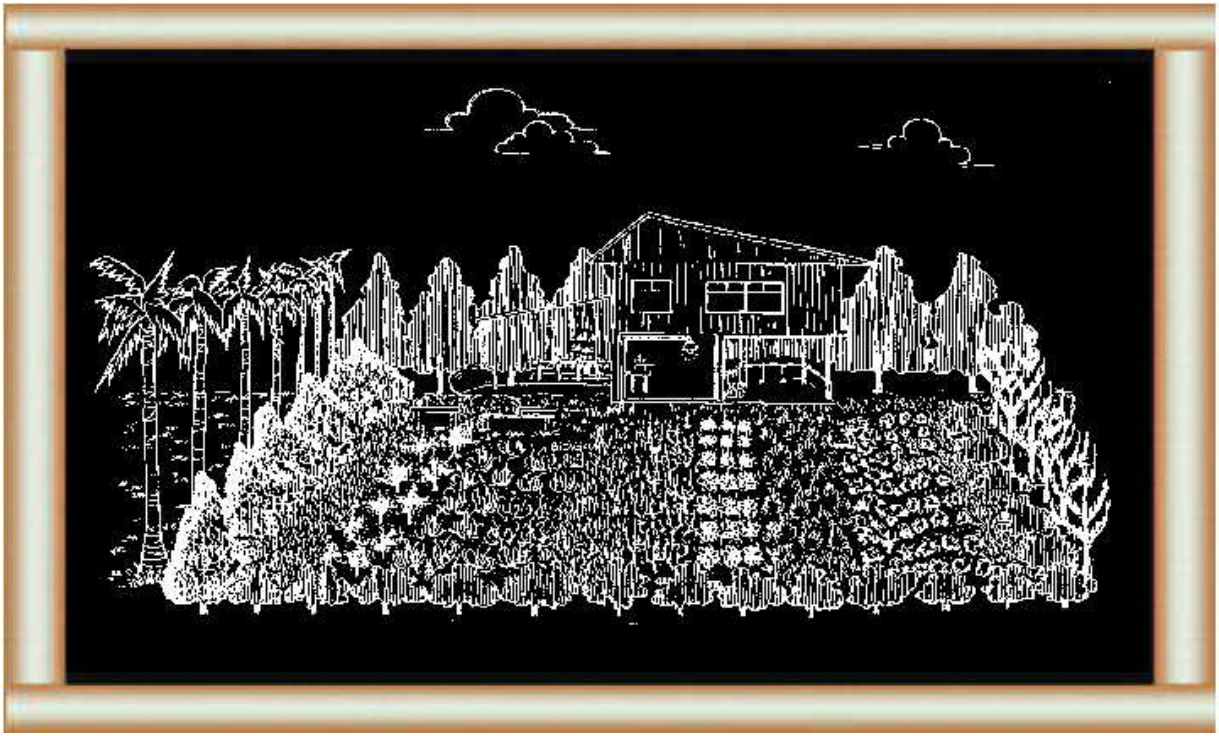
44 Well prepared land for IFS



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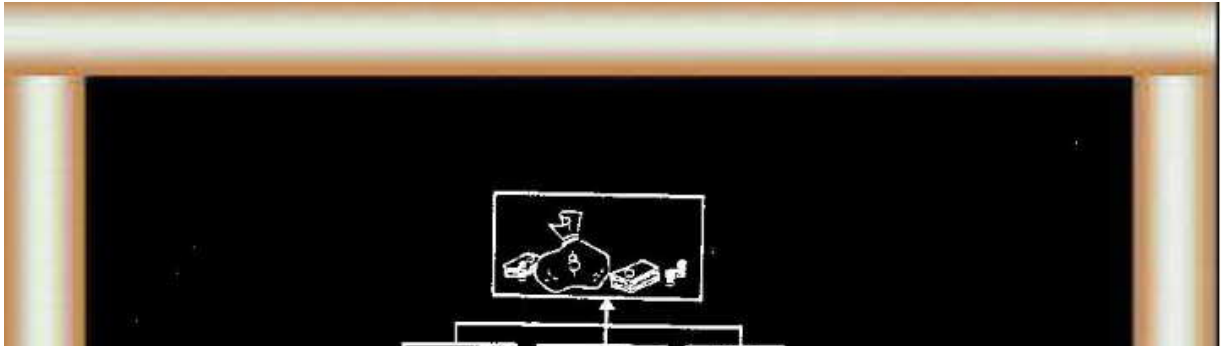
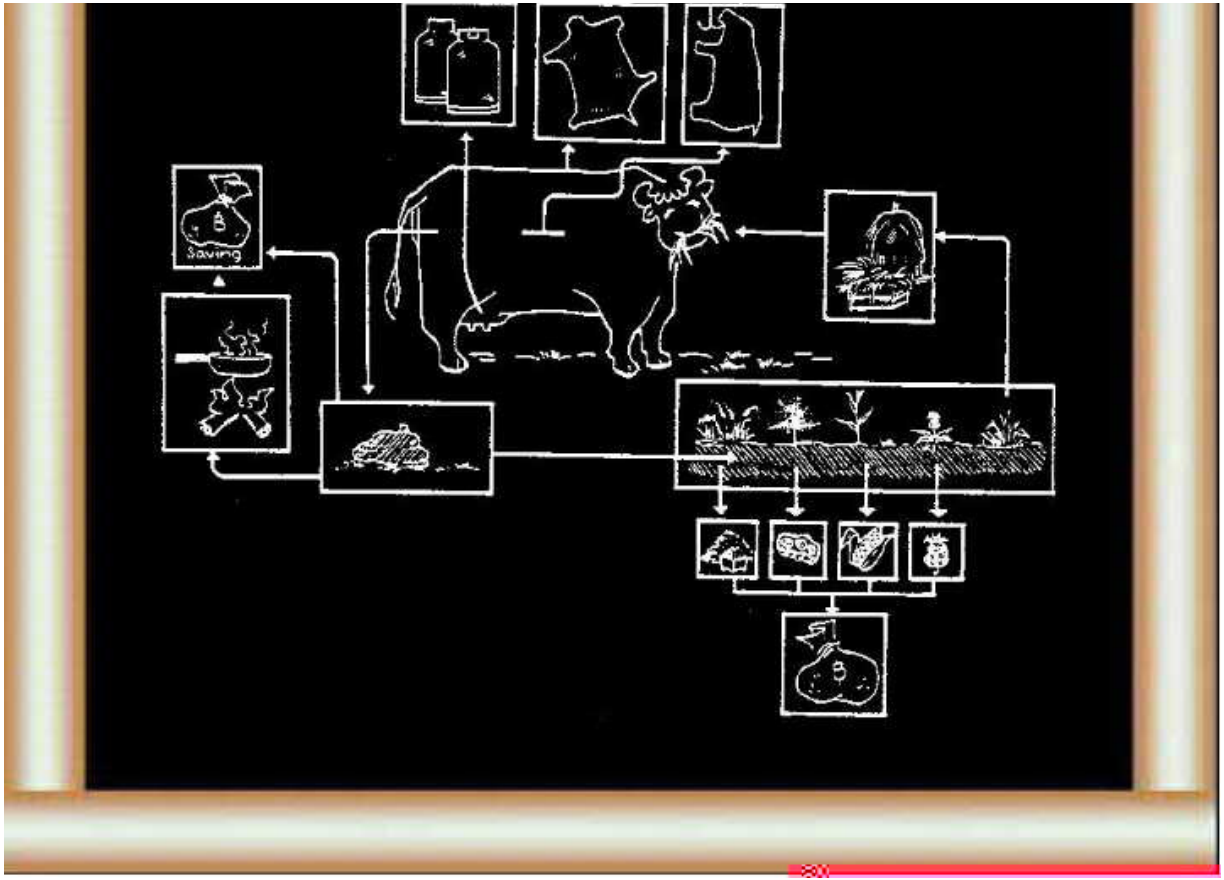
45 Dairy animals in IFS





page20

What do you know about dairying as part of IFS?

What IFS is

Importance of IFS

1 Importance of dairy cattle and buffalo for:

Growing fodders/legumes/grasses as part of IFS

Crop residues and by-products for feeds

The "Six F's" of IFS

Small-Scale

Dairy Farming Manual

Volume 2

Husbandry Unit 1.2

Compost Manure

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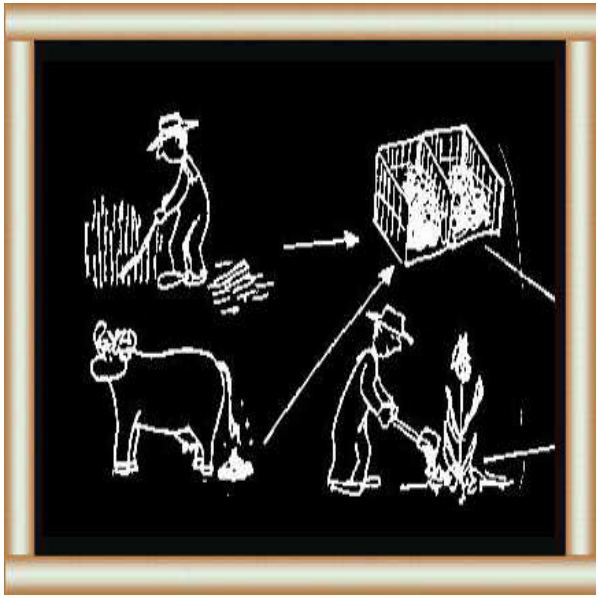
page23

Extension Materials

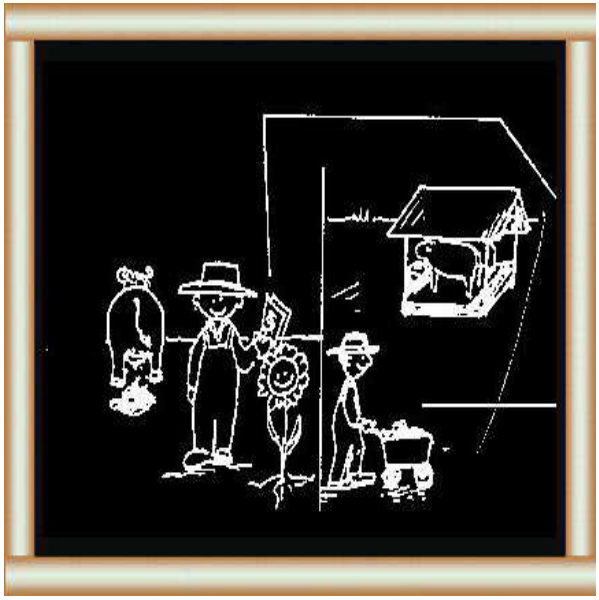
What should you know about compost manure?



What is compost manure? (5-8)

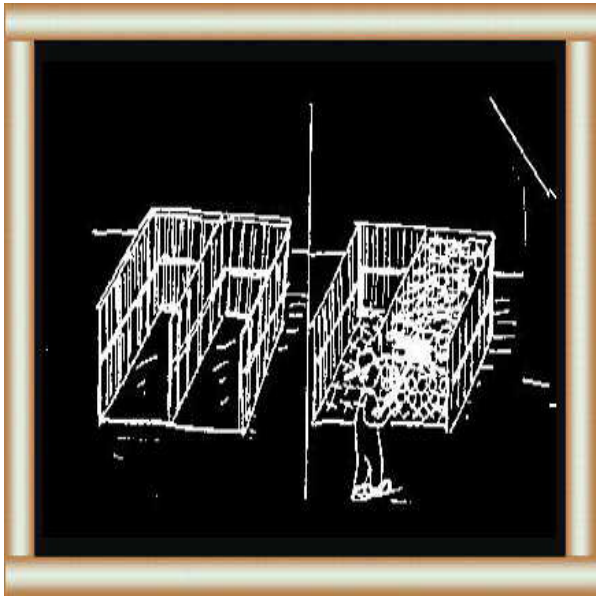
1 You should know:
- what makes compost manure
- its value as a manure for plants.

Why use compost manure? (9-



22)

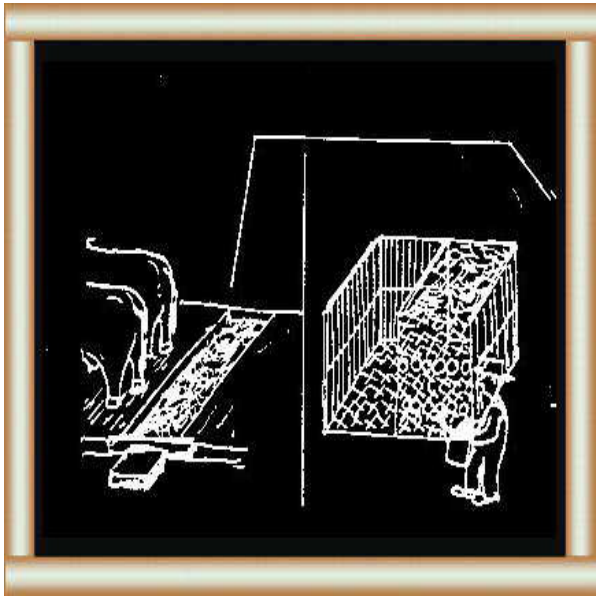
2 Reasons for using compost manure are:
- it provides nutrients but is cheaper than fertilizer
- it is easy to handle and improves health and hygiene on your farm.



How can you make compost manure?(23-30)

3 You should know how to:
- make a frame
- fill it with manure and straw

Important points about

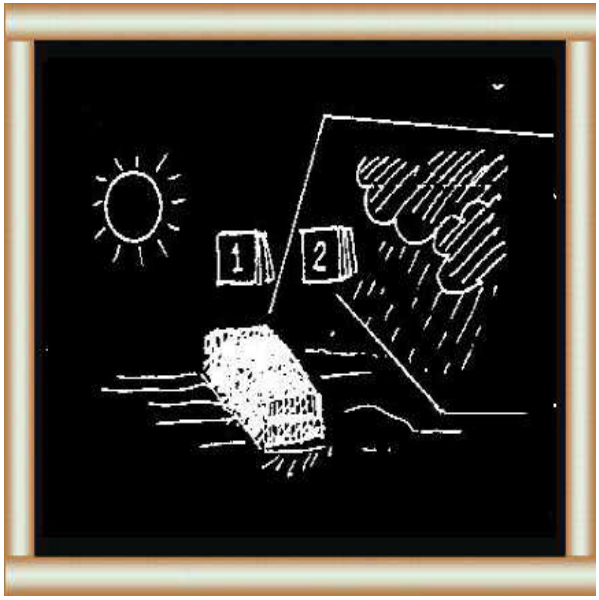


compost manure(31-36)

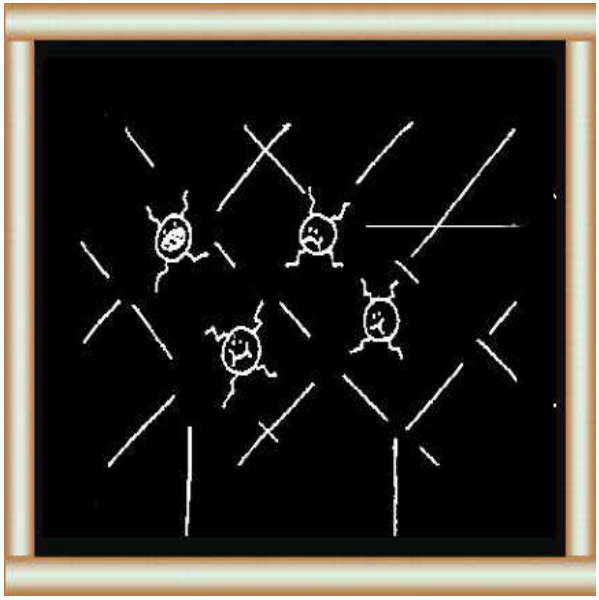
4 You should know:
- how to save urine and manure
- the best mixture for your heap
- when your compost manure is ready for use.

page24

What is compost manure?

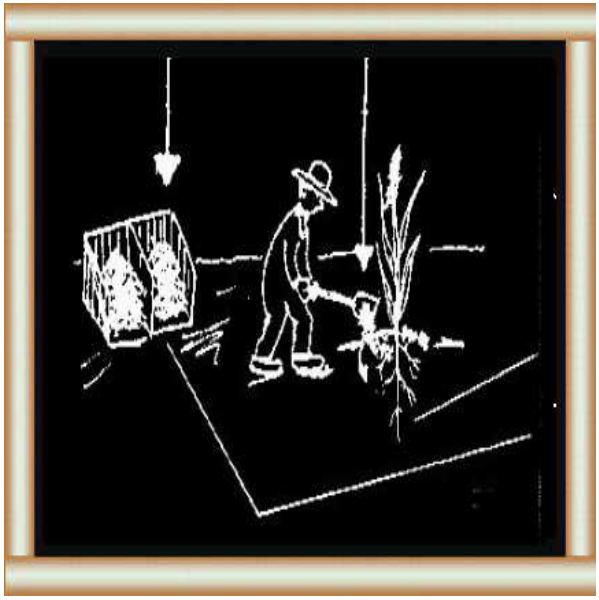


6
- covered with straw to protect against the rain
- left for a few months



7

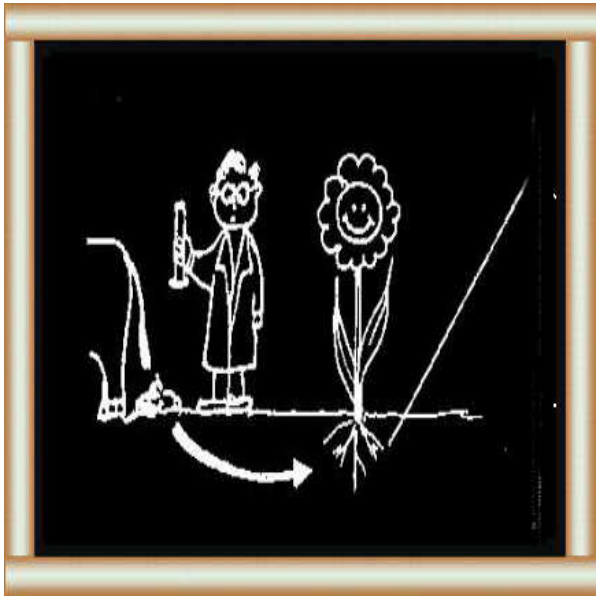
- micro-organisms break down the plant matter and manure and it becomes like humus



8
- and the compost manure gives nutrients easily to plants.

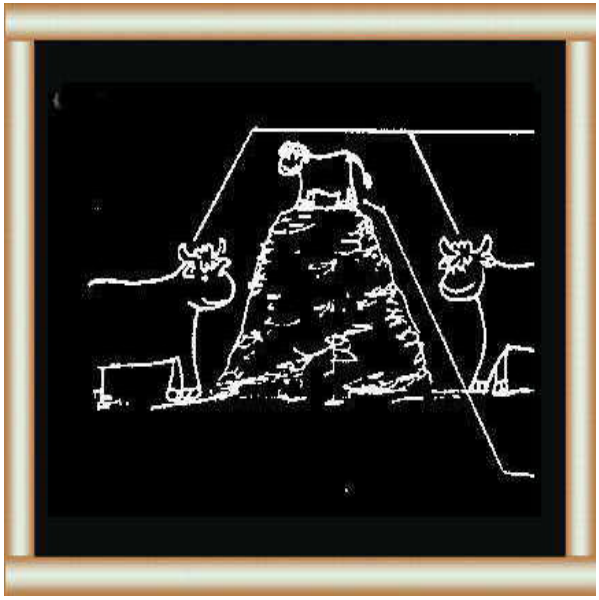
page25

Why use compost manure?



9 Nutrients: it provides nutrients. 10 kg of manure contain:
- nitrogen N : 50 g
- phosphorus P : 25 g
- potassium K : 50 g
It also provides magnesium (Mg), calcium (Ca), sulphur (S) and copper (Cu) and returns organic matter to the earth.

10 If you have 2 cows, you get



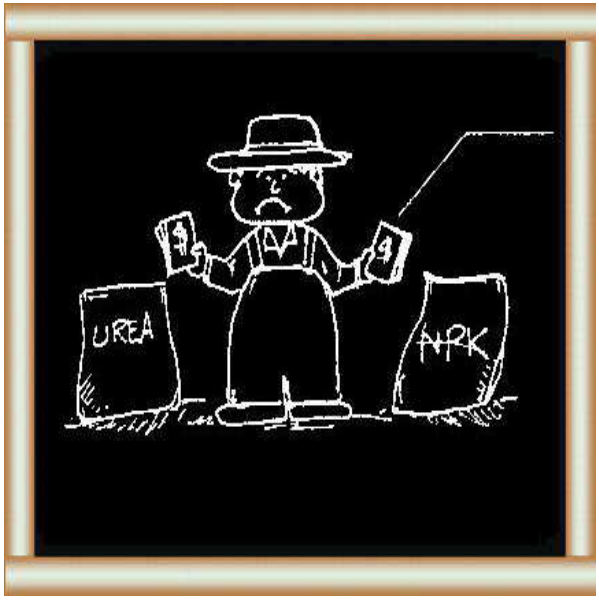
- 50 kg of manure each day (25 kg each cow)
- 1,500 kg of manure each month
- 18,000 kg of manure each year
You also get manure from your calves.

11 This manure contains:
N P K
1 month 7.5 3.8 7.5 kg
1 year 90.0 45.0 90.0 kg

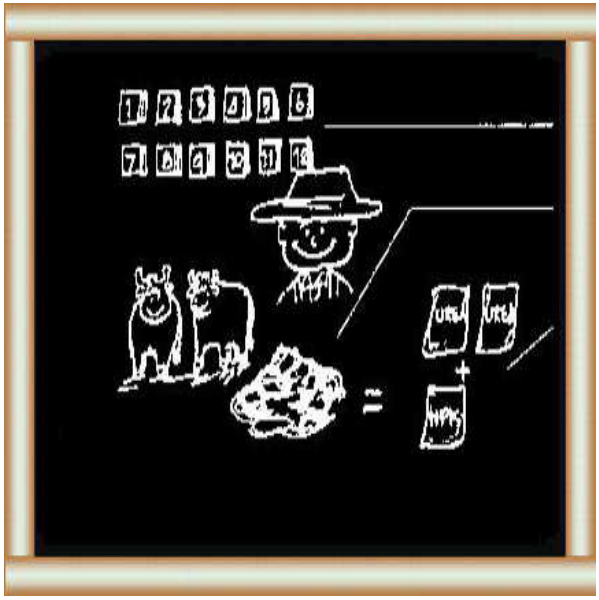
12

- and after mixing and storing with plant matter, more nutrients are available from the broken down plant matter as well.

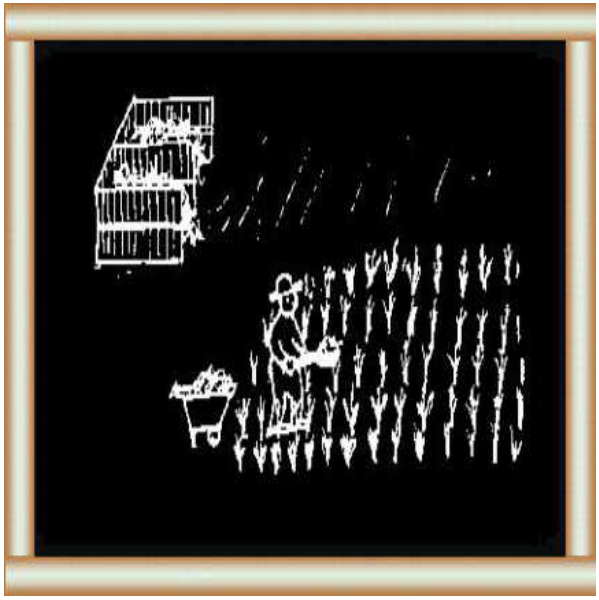
page26



13 Economy: it saves you money. Fertilizers are expensive.
For example:
100 kg of urea cost 500 mu
100 kg of triple superphosphate cost 800 mu



14 In one year, your 18 tons of compost manure from 2 cows has the same nutrients as 200 kg of urea and 100 kg of triple superphosphate.



15 You can spread your compost manure twice a year on 6-7 rai of cash and forage crops:
- you do not need to buy chemical fertilizer.

16 How much money do you save?

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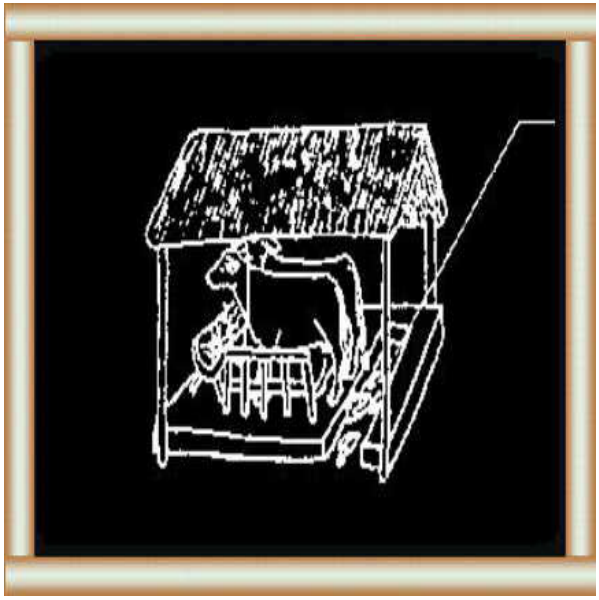
17 Health and hygiene:

It improves hygiene and health. This farmer leaves manure near the milking barn:
- flies and parasites breed, bacteria multiply and it smells bad
- he cannot keep his animals clean and dry
- he cannot produce clean milk.

18 This farmer removes the



manure and makes compost manure:

- he has clean, dry and healthy animals
- he produces clean milk.

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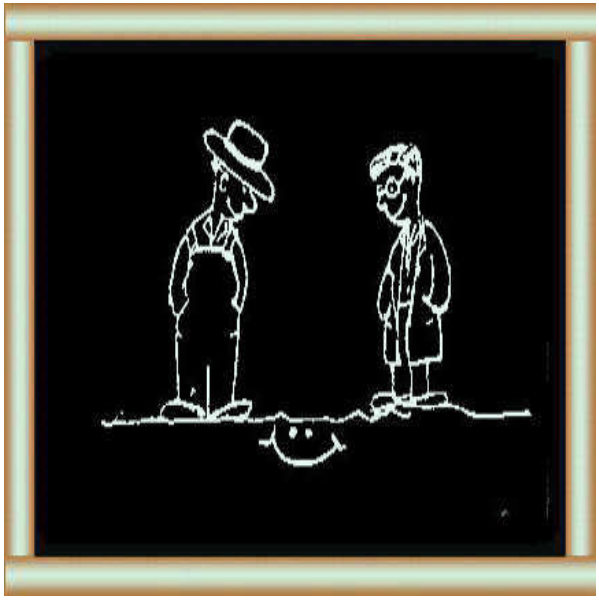
19 Ease of handling:

It is easier to handle than fresh manure and improves the soil. If you use only straw for compost, it is too loose and airy.

20 If you use only manure for compost, it is too wet and heavy.

21 Cow manure and straw make a good compost manure and also kitchen waste.

Straw:
-allows air to enter so the micro-organisms can break down the manure
-absorbs urine and helps to keep it in the compost.



22 Good compost manure improves the soil's:
- fertility
- texture
- ability to hold water.

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How can you make compost manure?
You can make compost manure in a **heap.** This is simple but you **waste** a lot of material.
You can also make compost manure in a **shallow pit.** You waste less material but removal of the compost manure is **difficult**.
Make a **frame.**

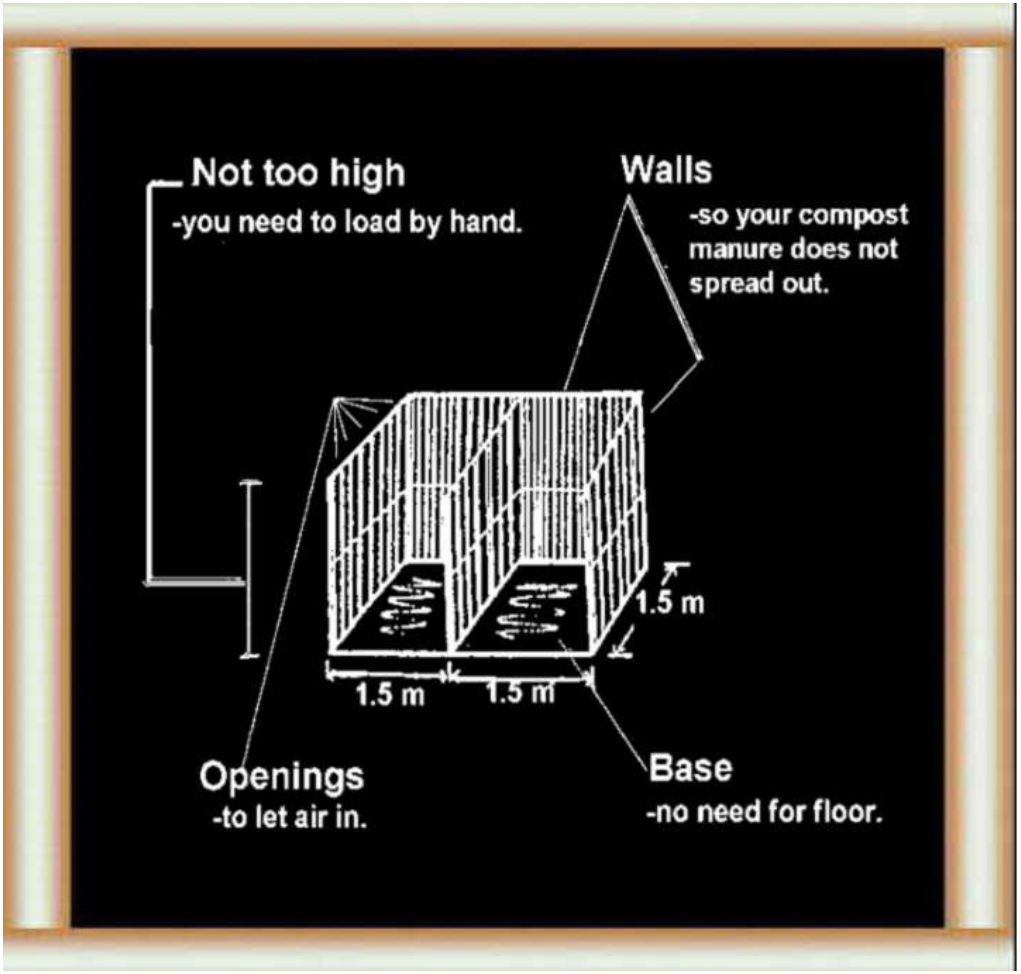
Materials:

1. You need many pieces of bamboo, wood or other building material

- 1.5 m long.

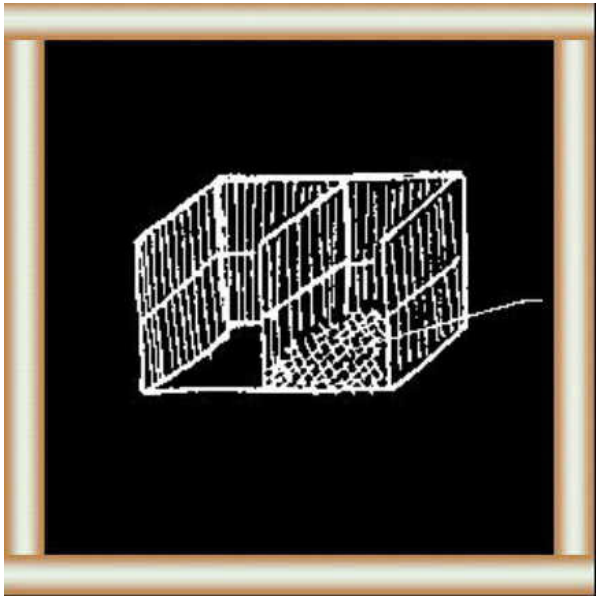
2. Nails or string for fixing.

23

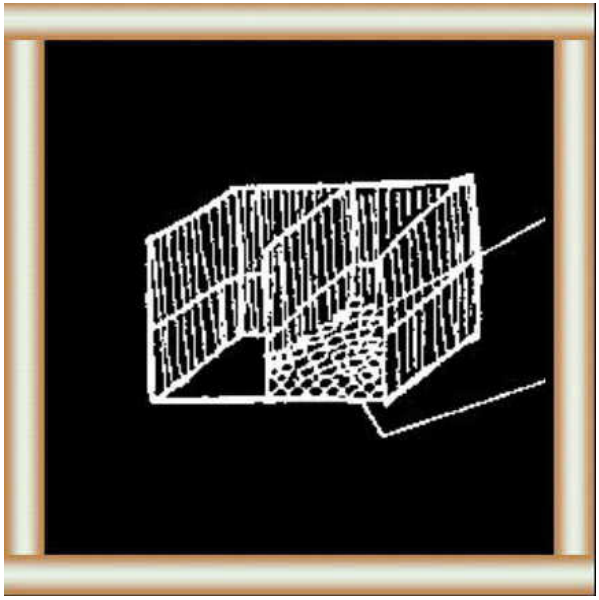

Not too high
-you need to load by hand.
Walls
-so your compost manure does not spread out.
1.5 m
1.5 m
1.5 m
Openings
-to let air in.
Base
-no need for floor.

page 30

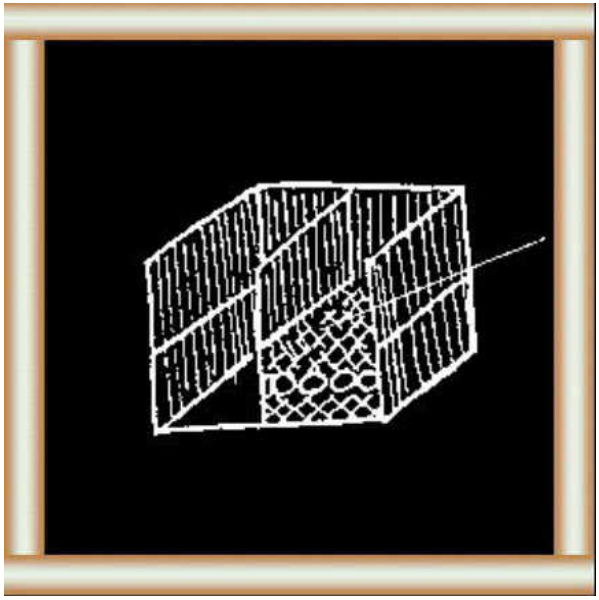
How can you fill the frame?



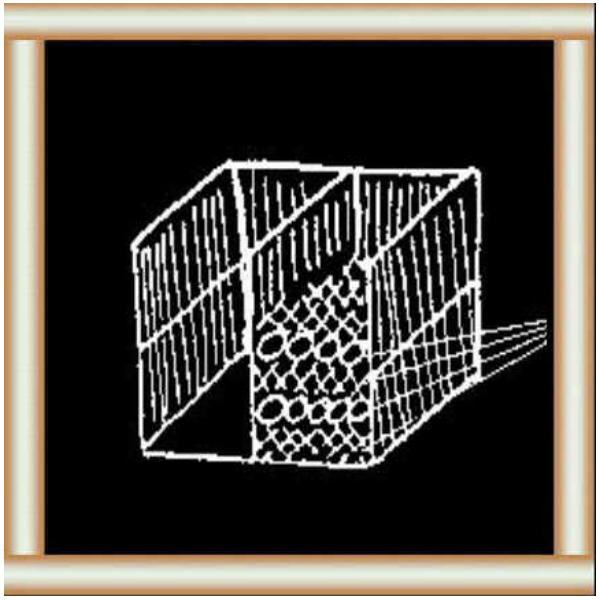
24 Spread a thick layer (25 cm) of straw in the bottom of the first box.



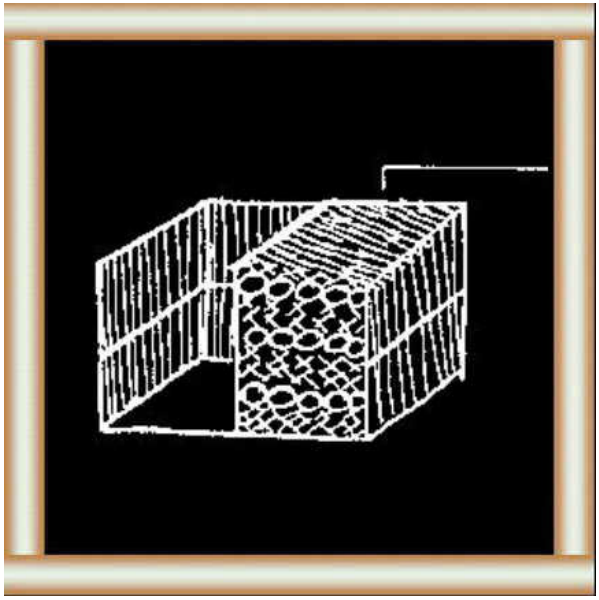
25 Fill manure evenly on top of straw (until the manure covers the straw).



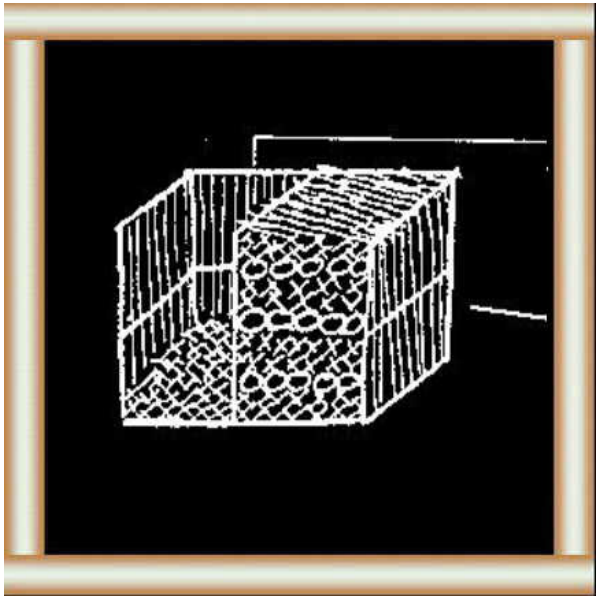
26 Spread a new, thinner layer of straw (10 cm) over the manure again.
Mix the straw by fork into the manure.



27 Keep on filling up the frame with layers of manure and straw.
Make sure there is no thick layer of manure or straw, where the two are not mixed together.

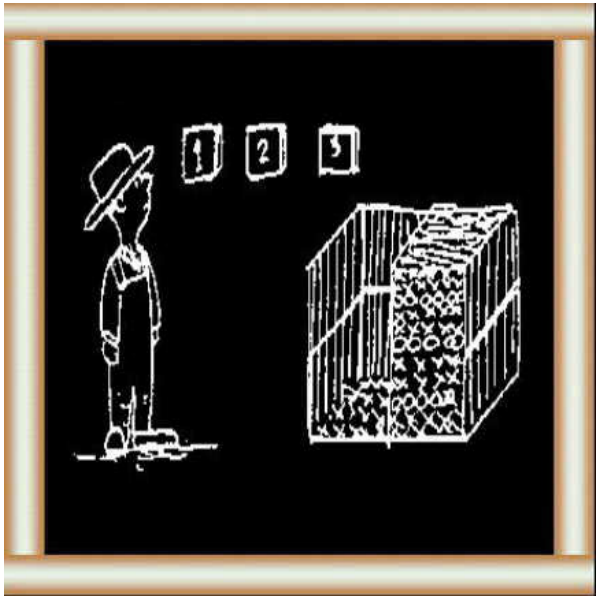


28 You can fill the first box in a few months.
Cover the heap with straw to protect against rain.
Leave for at least 4-6 weeks before using.



29 Fill up the second box in the same way while you use material from the first box.

When can you use the compost manure?
30 The compost manure becomes warm and begins to



break down.
You can use it after 2 months if it is the planting season and you need it as fertilizer.
After 6-8 months it is like humus and this is the best time to use it.
You can use it after 8 months but it gets weaker with age.

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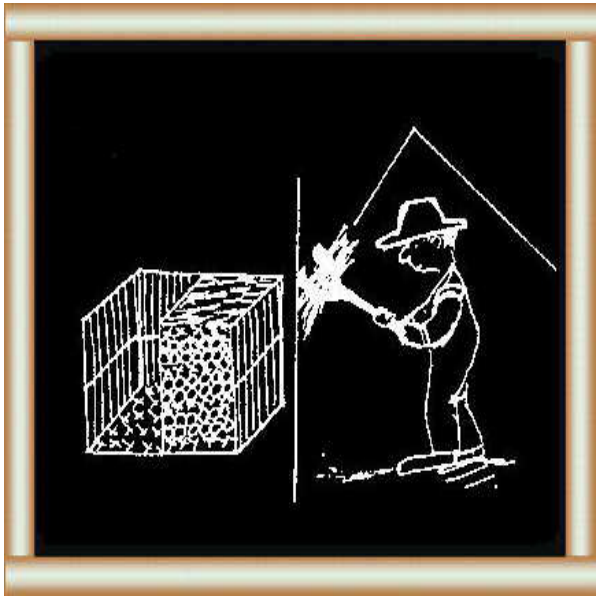
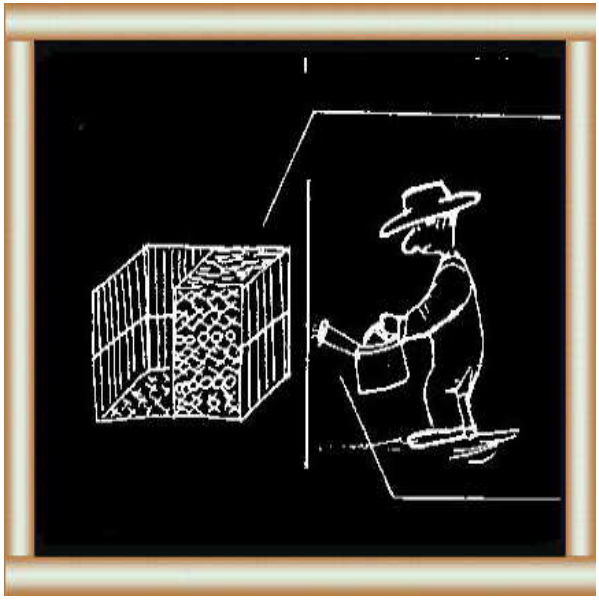
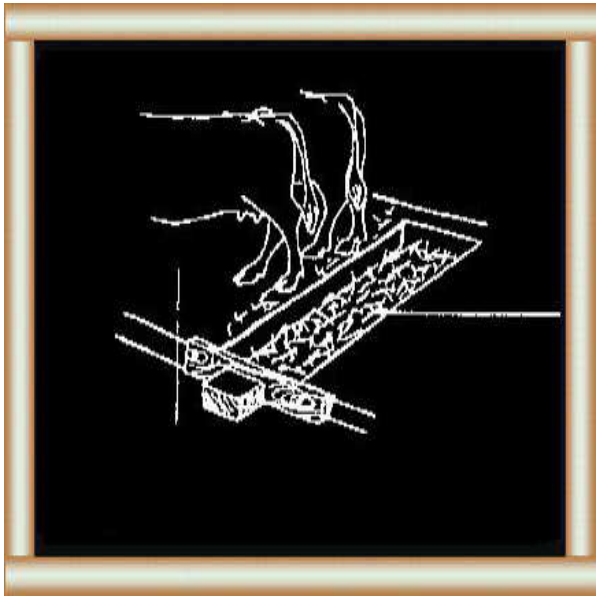
IMPORTANT



31 If the heap is too wet and compact, it will not break down:
- add more straw.



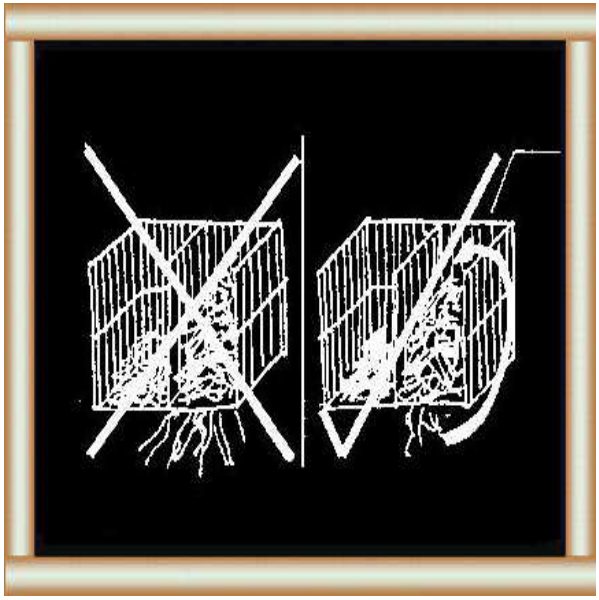
32 If the heap is too dry and loose, it will not break down:
- add water.



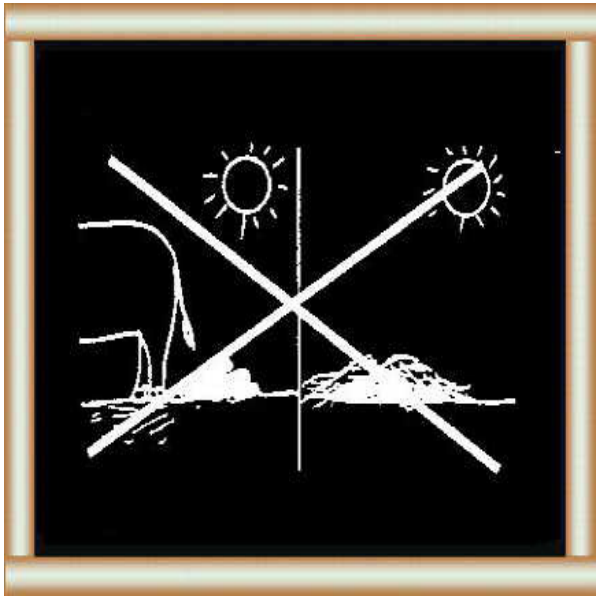
33 If you allow urine to run away, you lose nitrogen and potassium:
- you can put dry straw or dry soil in the gutter to absorb the urine

34
- bring the manure and the soil or straw soaked with urine to the heap

page 33



35
- add the mixture to the top of the heap
- make sure you have enough straw in the heap to absorb the urine



- cover the heap with a layer of straw.
36 Do not leave manure in the air and sunlight:
- it will lose nitrogen.

What do you know about compost manure?

Compost

plant matter
+
animal manure

manure

(5-8)
kept dry
- left for few months

Reasons for using compost manure

plant nutrients (9-12)	Economy (13-16)	Health/hygiene (17-18)	Handling (19-22)
- organic matter - nitrogen - phosphorus - potassium - magnesium -calcium - sulphur - copper	Compost manure from 2 cows yields: - 200 kg urea - 100 kg phosphate	Cleaner milk results from: - cleaner barn - less flies, bacteria and parasites	- easier to handle than fresh manure - better structure for soil

Making compost manure

Frame

1 Prepare materials (23)
- wood/bamboo, nails/string
2 Make frame at correct height

Filling frame	**(24-28)**

Saving urine and manure
Add alternate layers of straw and manure
Mix each layer carefully
Check moisture and looseness
Cover with straw when full to keep dry

Using compost manure

Timing

Use compost manure from one box while filling second	**(29)**
Compost manure is best 3-6 months after making	**(30)**

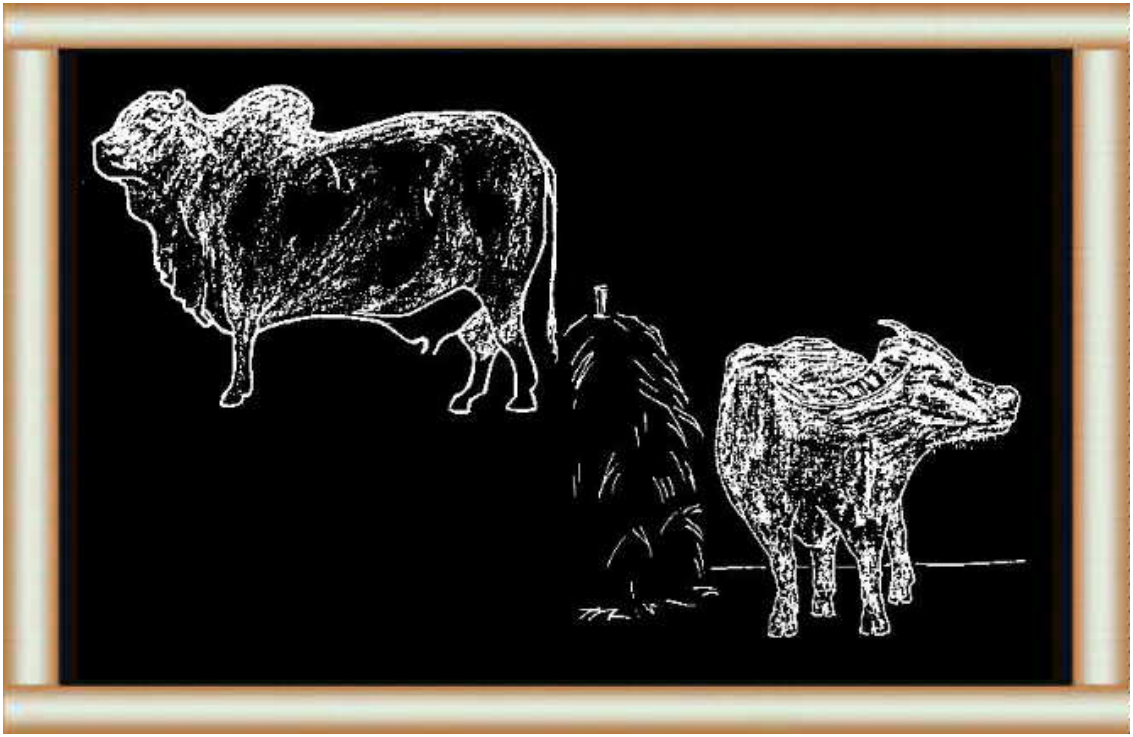
Small-Scale

Dairy Farming Manual

Volume 2

Husbandry Unit 2

BREEDS OF DAIRY CATTLE AND BUFFALO



BREEDS OF DAIRY CATTLE AND BUFFALO

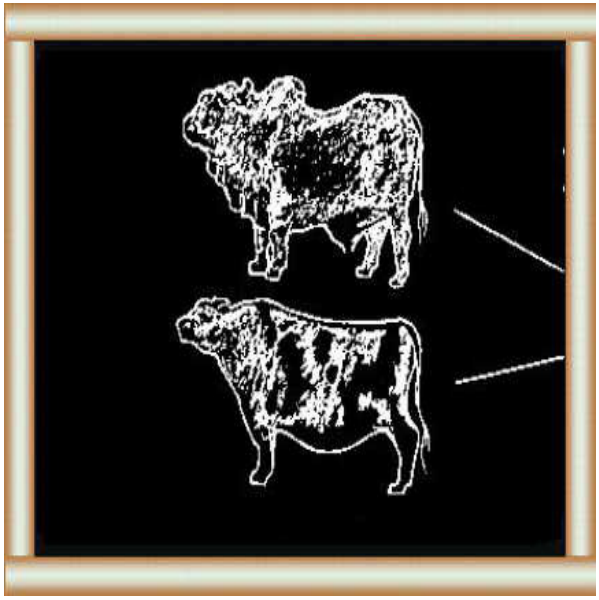
Husbandry Unit 2:

Technical Notes

Note: Numbers in brackets refer to illustrations in the Extension Materials.

Extension Materials

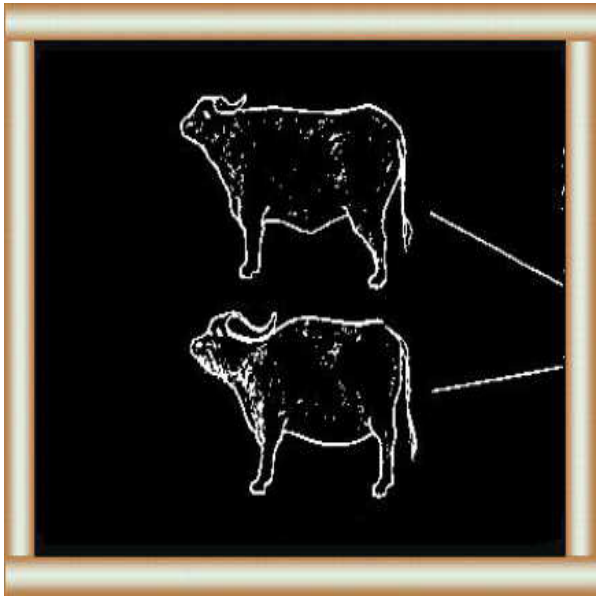
What should you know about breeds of dairy cattle and buffalo?



2 There are two major groups:
- Zebu (Bos indicus)

- European or temperate (Bos taurus).

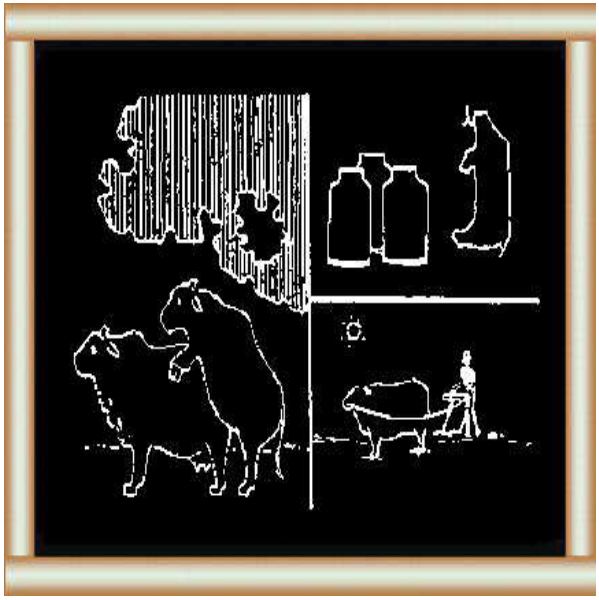
What are the major types of dairy buffalo? (33-46)



3 There are two major types:
- River buffalo

- Swamp buffalo.

What is the purpose of breeding dairy cattle and

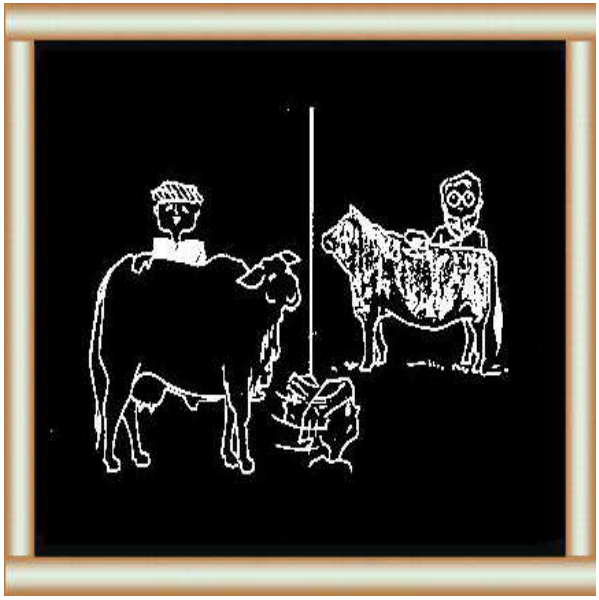


buffalo and how can you do it? (47-68)

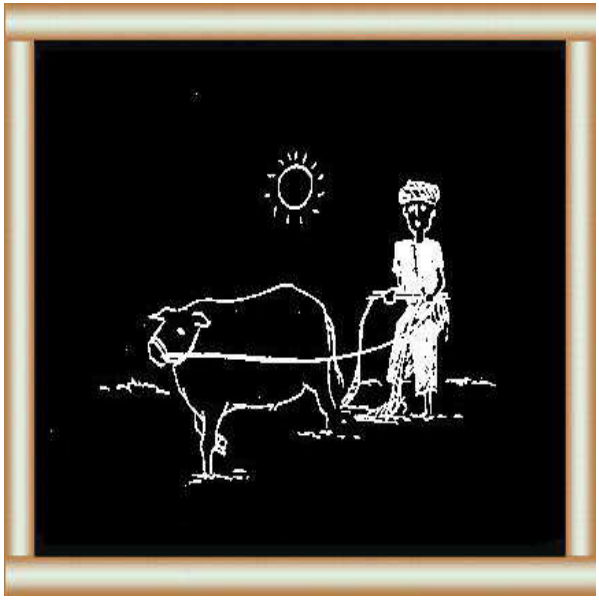
4 To get animals which are:
- happy in local conditions
- have better production through selection and cross-breeding.

page41

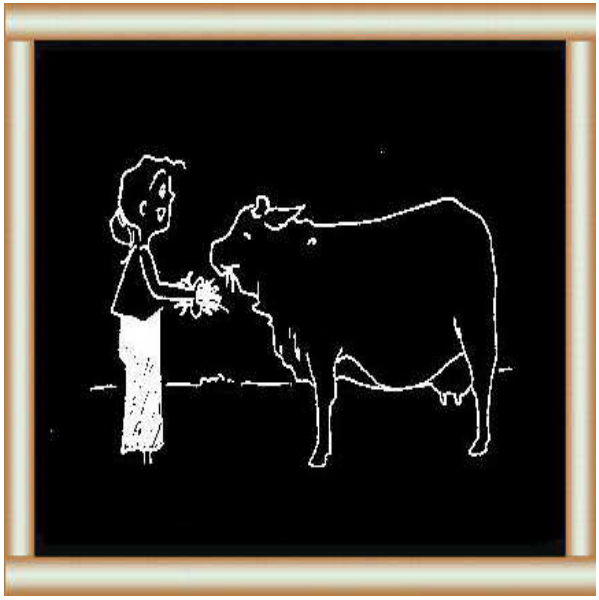
What do you look for in different breeds?



5 You want a breed that:
- does well on your own farm
and gives high milk yields

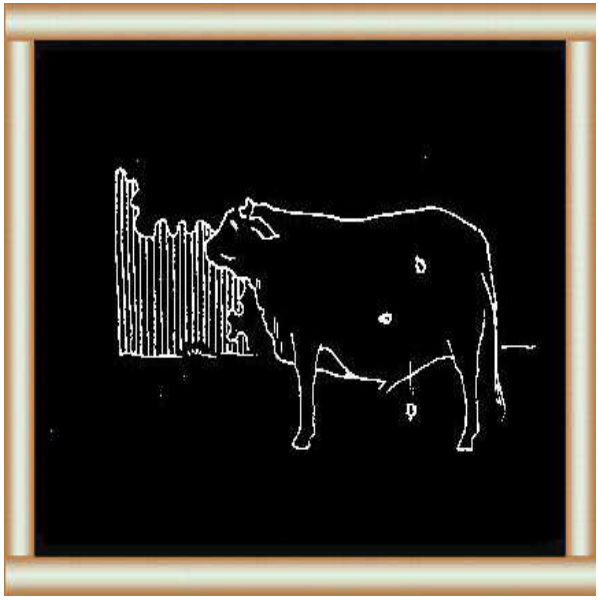


6
- can stand the heat
- is a strong draught animal (if you use for draught as well as milk production)



7

- has low food requirements

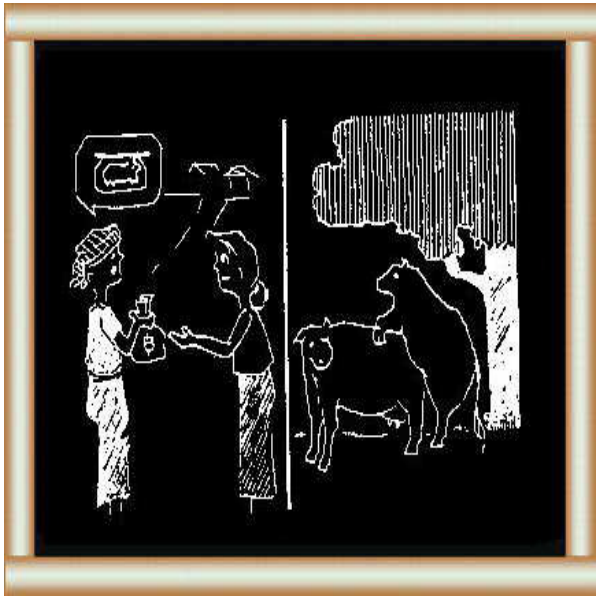


8
- stands disease, especially tick-borne disease.

page42

10
- milk composition

11
- meat production (many countries).



12 You should think about these things:
- when you buy cattle or buffalo
- when you breed them.

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Dairy cattle breeds

Domesticated cattle are normally classified into two major groups, Zebu (Bos indicus) and European or temperate (Bos taurus). Even

though there are substantial physical and physiological differences between the two groups, they can be interbred readily to produce fertile offspring of both sexes. (13-14)

Bos indicus group

This group is also called "the humped cattle". The size and shape of the hump vary by breed, sex and age of animals. Other external features common to most Zebu cattle are narrow body, rather long legs and well developed brisket and dewlap, particularly in the males. (15)

The most important characteristic of this group is its adaptation to the tropical environment. This adaptation derives from three main aspects: (16)

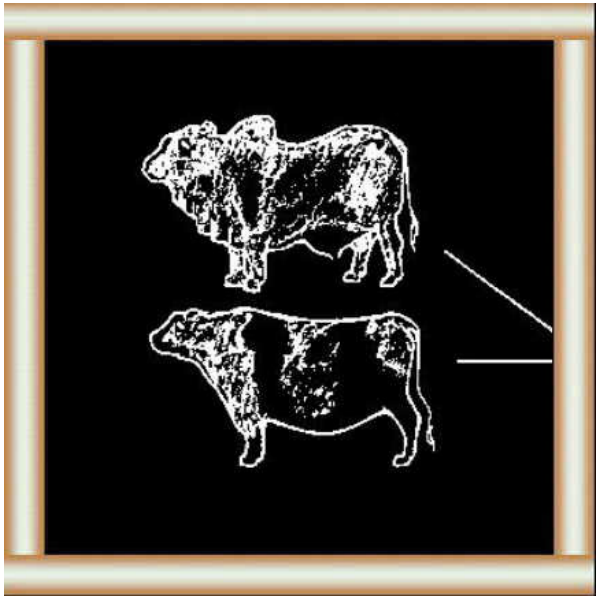
- a high degree of heat tolerance partly due to low heat production (associated with low metabolic rate and low productivity) and partly due to a high capacity to dissipate heat;

- low nutritional requirements, mainly due to low metabolic rate and small size and also possibly to more efficient digestion at low feeding levels;

- a considerable degree of resistance to ticks and also to many tick-borne diseases prevalent in tropical countries.

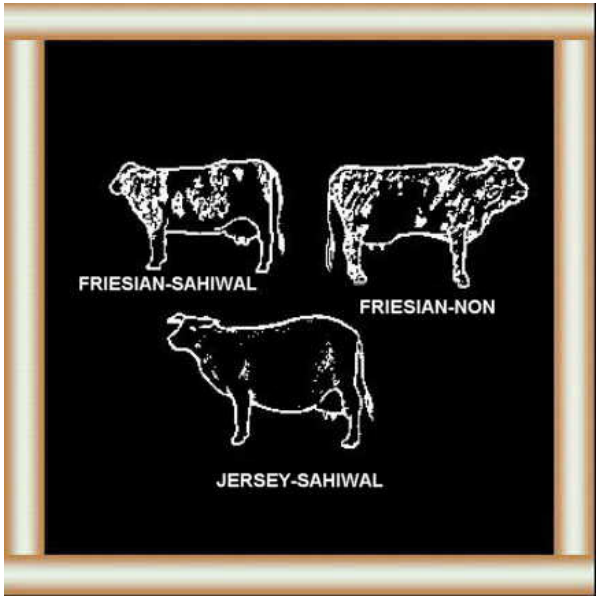
page44

What are the major breeds of



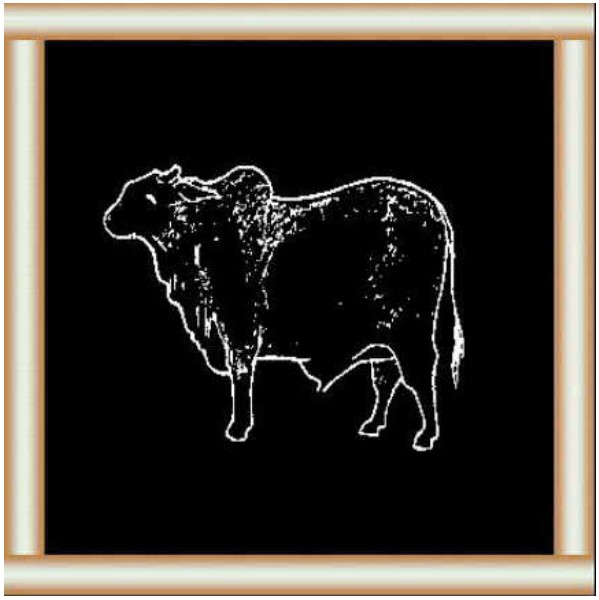
dairy cattle?

13 There are two major groups:
- Zebu (Bos indicus)
- European or temperate (Bos taurus).



14 The groups are very different but cross-breeding can produce fertile offspring of both sexes.Zebu (Bos indicus)

15 Another name for this group

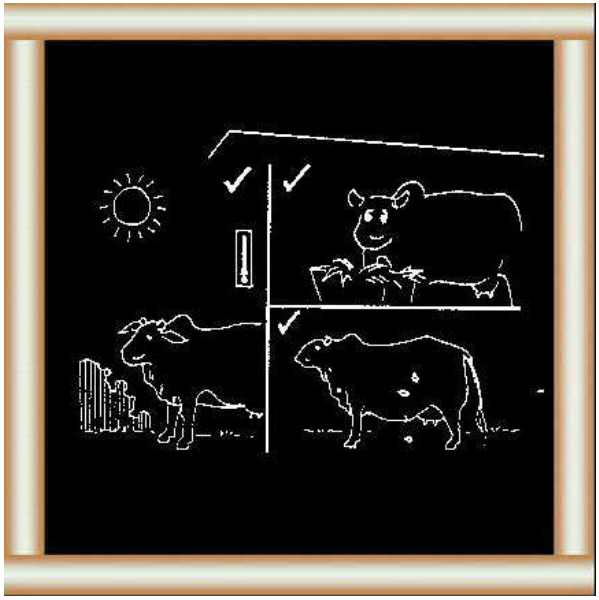


is "humped cattle". The size and shape of the hump depends on:

- breed

- sex

- age.

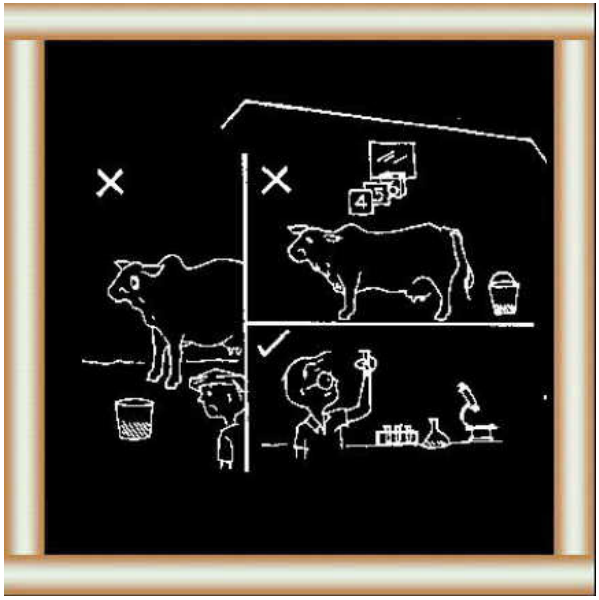


16 Zebu cattle live well in tropical conditions. They can:
- stand heat
- live on little food
- resist disease.

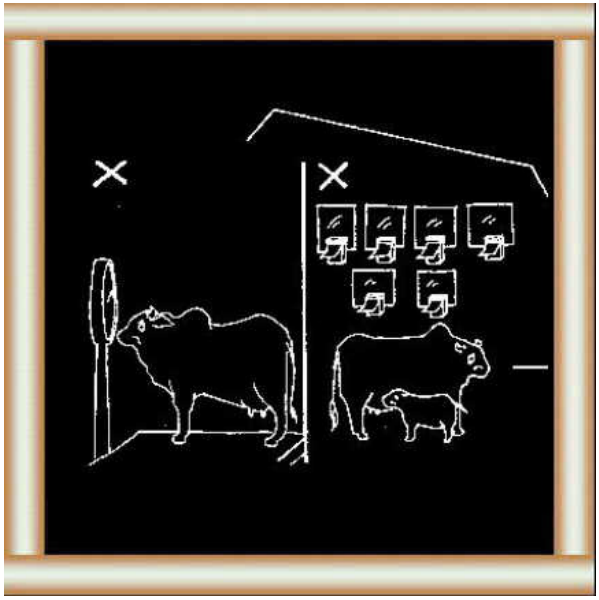
With regard to production traits, this group is characterized by low productivity. The milk yields are low with short lactations. They also have low weight gains and are late maturing with delayed first calving. An important trait is the

higher fat and solids-not-fat content of the milk when compared with the Bos taurus group. (17-18)

page46



17 Zebus have:
- low milk production
- short lactation periods.
But the milk has higher fat and solids-not-fat content than the Bos Taurus group.



18 They have:
- low weight gains
- late maturity and first calving.
Sahiwal especially are selected for improved production.

page 47

A large number of Zebu breeds have been described, each country in the region having one to several breeds. Most of these breeds are of importance only in their home countries.

The more important breeds of Zebu cattle are Sahiwal, Red Sindhi, Tharparkar, Hariana, Kankrej, Gir and Ongole.

Sahiwal, Red Sindhi and Tharparkar breeds (19-24)

All these three breeds have originated in present day Pakistan. Although distinguishing external characteristics have been described for each breed e.g. skin colour (Red Sindhi -reddish brown; Tharparkar - white or light grey; Sahiwal - greyish red or brown), the more recent selection criteria for the Sahiwal have been based on productivity traits.

Identification based on external characteristics is, therefore, quite difficult.

The mature cows of Red Sindhi and Sahiwal breeds have an average weight of about 300 to 350 kg while the Tharparkar is slightly bigger. The average milk yields have been estimated at

2,000 kg per lactation with 5 percent fat. Individual cows of the Sahiwal breed in some herds in Pakistan are reported to have produced about 5,000 kg in a lactation.

Sahiwal is the breed that has been mostly used for breed improvement in countries other than Pakistan, the other two breeds having been used only to a limited extent. It is used both as a pure breed, for upgrading of unimproved cattle and for crossbreeding with European breeds. Sahiwal has made important contributions to most of the new breeds of Zebu x temperate cattle.

Location : Pakistan, India, Africa
Colour : greyish-red or brown
Meat production : poor average good
Draft ability : poor average

good

Values for breeding : 1. upgrading native cattle

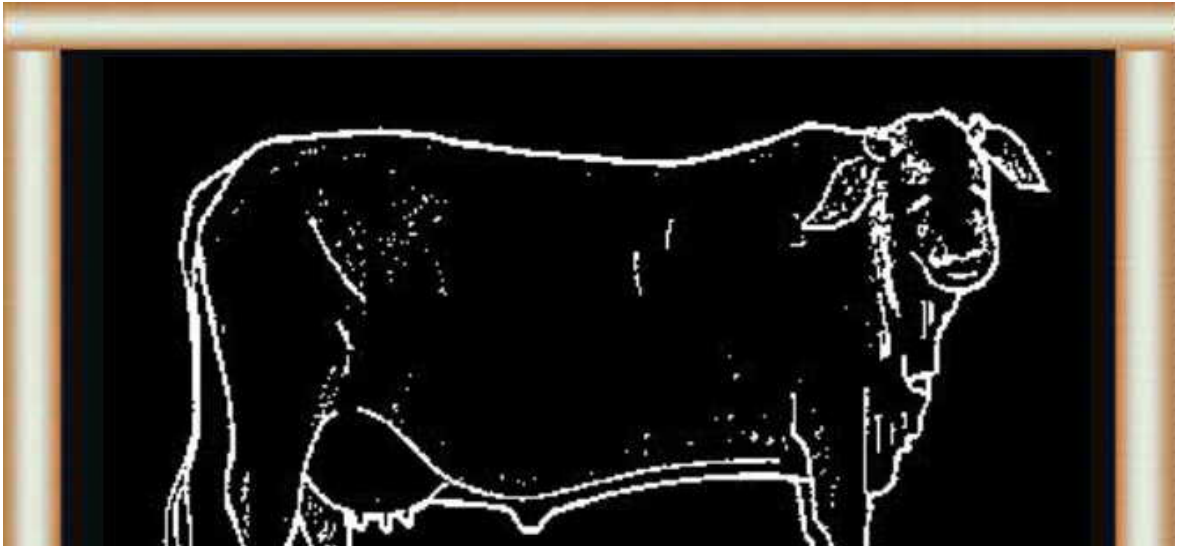
2. cross breeding with European

breeds

19 Male

Average body weight (kg): 300 400 500 600 700

20 Female

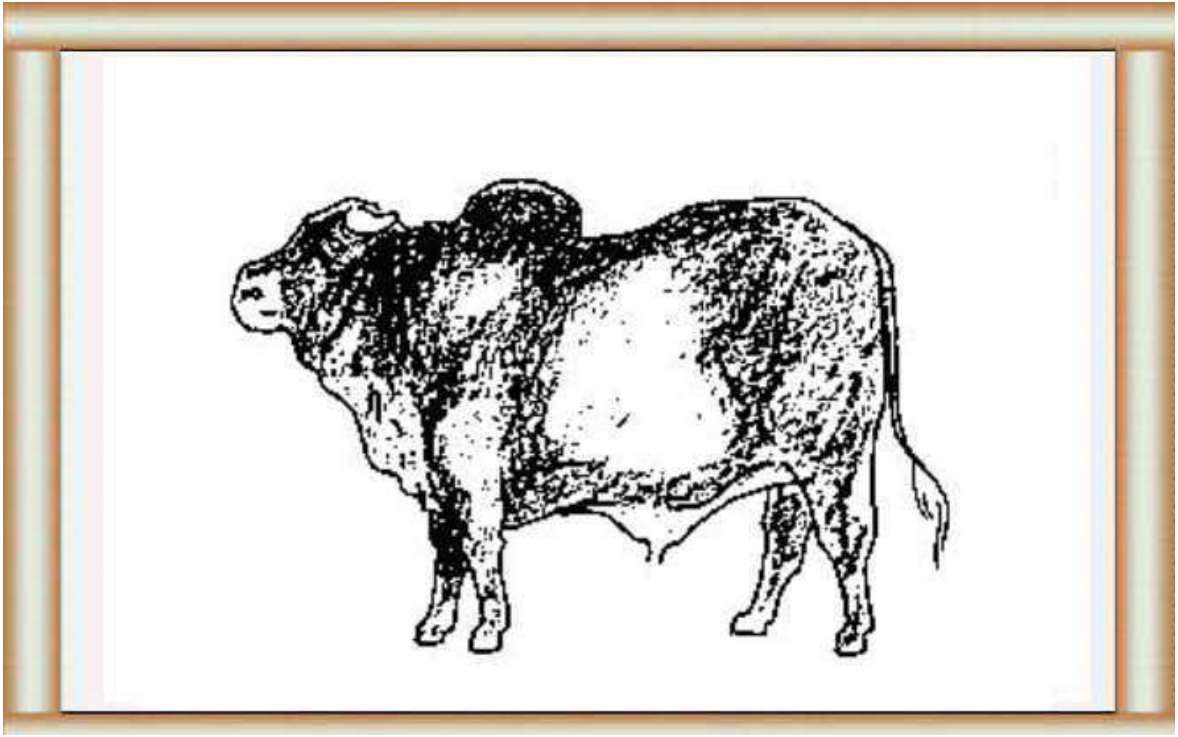


Average:

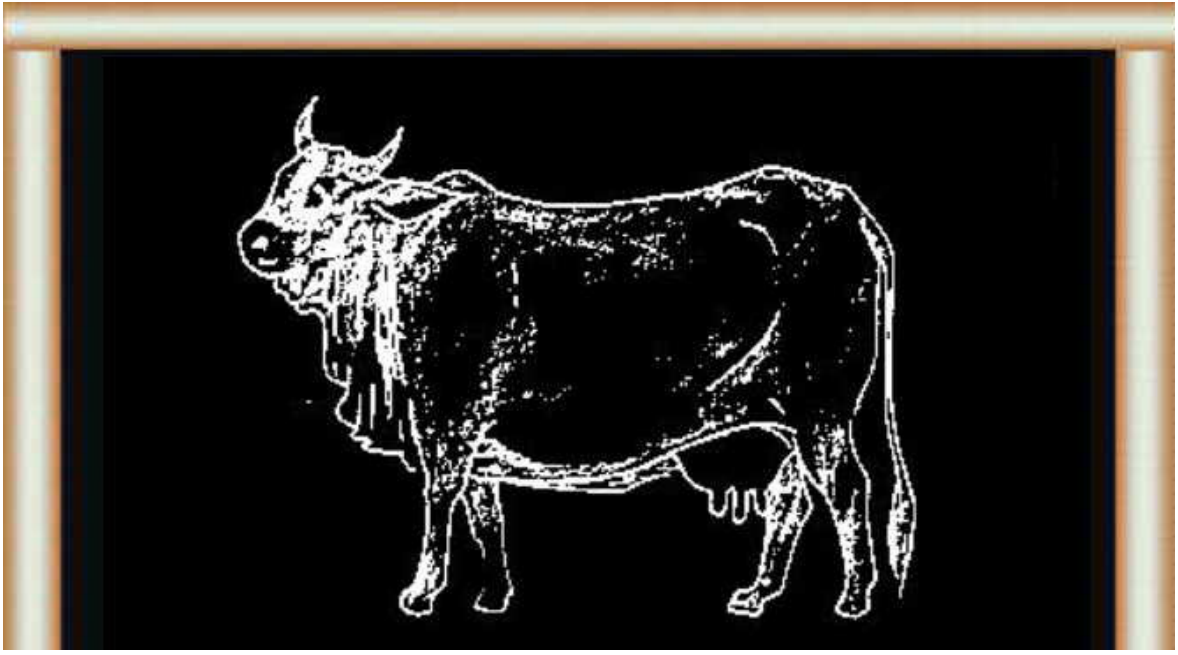
Body weight (kg) :300 400 500 600 700
Lactation period (days) :250 275 300 325 350
Milk yield/lactation (l) :1,000 2,000 3,000 4,000 5,000
Fat content (%) : 3% 4% 5% 6 %
Solids-not-fat content (%) : 8-9 %

Two other Zebu breeds are used to a limited extent:
Red Sindhi

21 Male

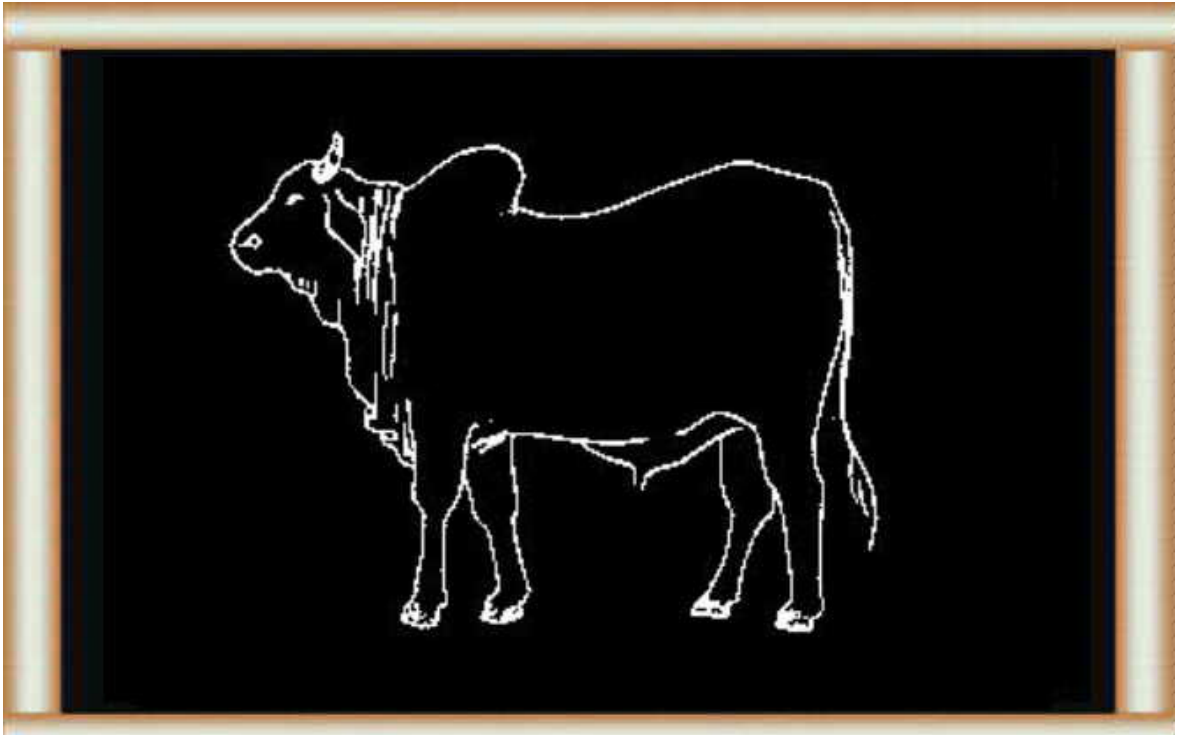


22 Female



Tharparkar

23 Male



24 Female

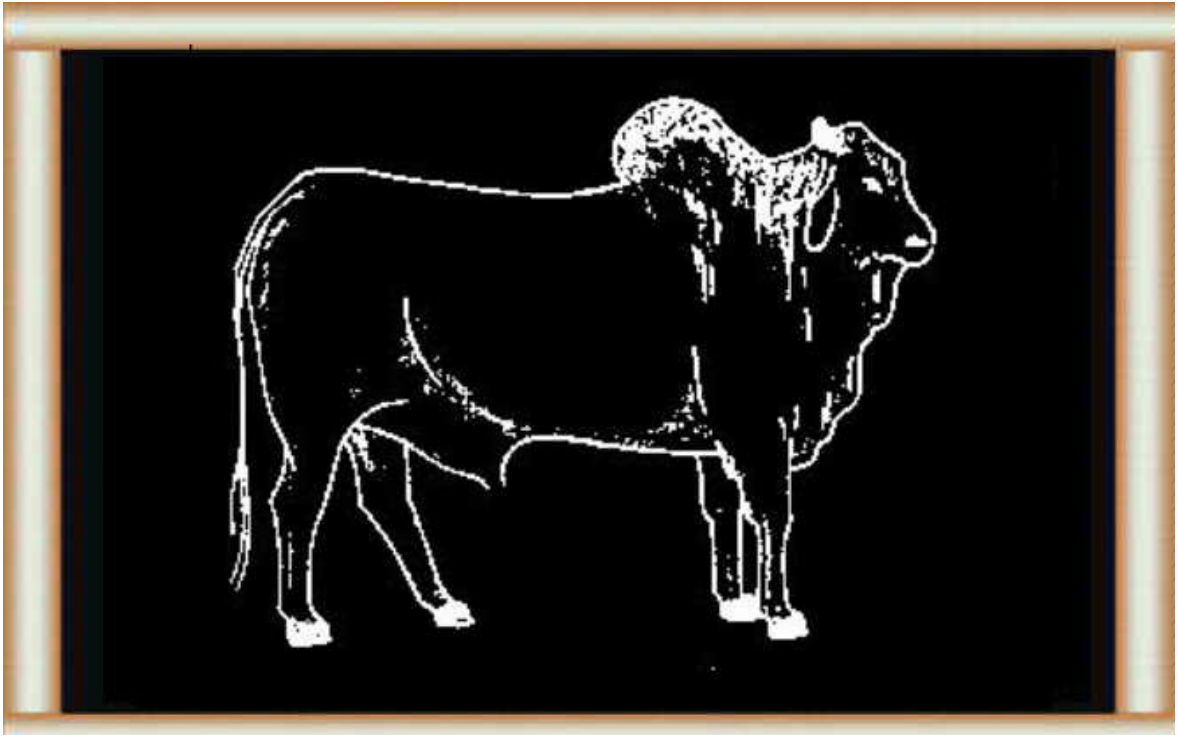
Southern parts of India. They combine very good draught ability with acceptable milk yields. They also have a high potential for meat production.

page51

Other Zebu breeds include:
Hariana

25 Male

26 Female
The bullock is a strong draught animal.



Kankrej, Gir and Ongole breeds are good for draught and meat production and have acceptable milk production.

Bos Taurus group

For over two centuries, the temperate breeds of cattle have been subjected to strong selection pressure for improved dairy, beef or dual purpose (dairy and beef) characteristics. Many of these breeds have been used in crossbreeding in the tropical countries. Some of the more important ones are as follows.

Holstein Friesian breed (also called Friesian, Holstein or Black and White) (27-28)

This breed has a characteristic Black and White colour and is the predominant breed in most

developed countries. There are about 70 million Holstein Friesian type cows in the world accounting for about one-third of all dairy cows.

The breed is well known for its high milk yields (with averages of over 6,000 kg per lactation in several countries), but fat and solids-not-fat contents are low. They also have larger weight gains and higher mature weights than other temperate breeds of dairy or dual purpose cattle.

In recent years, Friesians have gained in popularity as the temperate counterpart for crossbreeding of Zebu cattle and in some countries, this is the breed of choice.

Brown Swiss breed (29-30)

This breed has a somewhat lower lactation yield than Holstein, but with a higher fat content. It is slightly better than Holstein in beef potential.

The total world population is in the range of

about 4 million cows (2 percent of all dairy cows).

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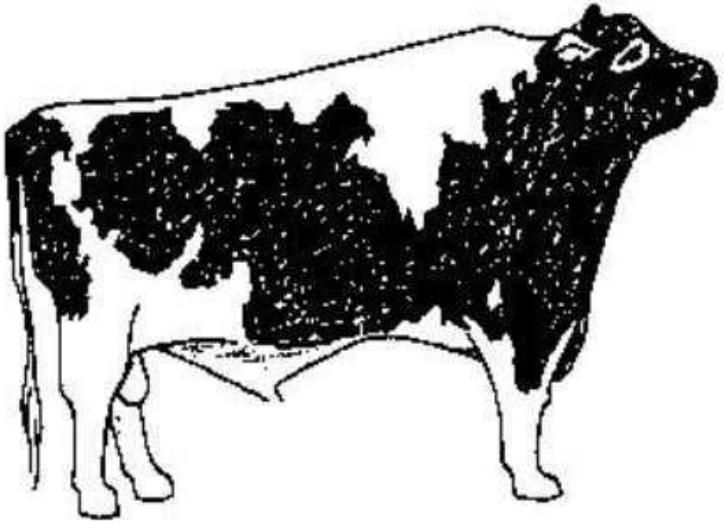
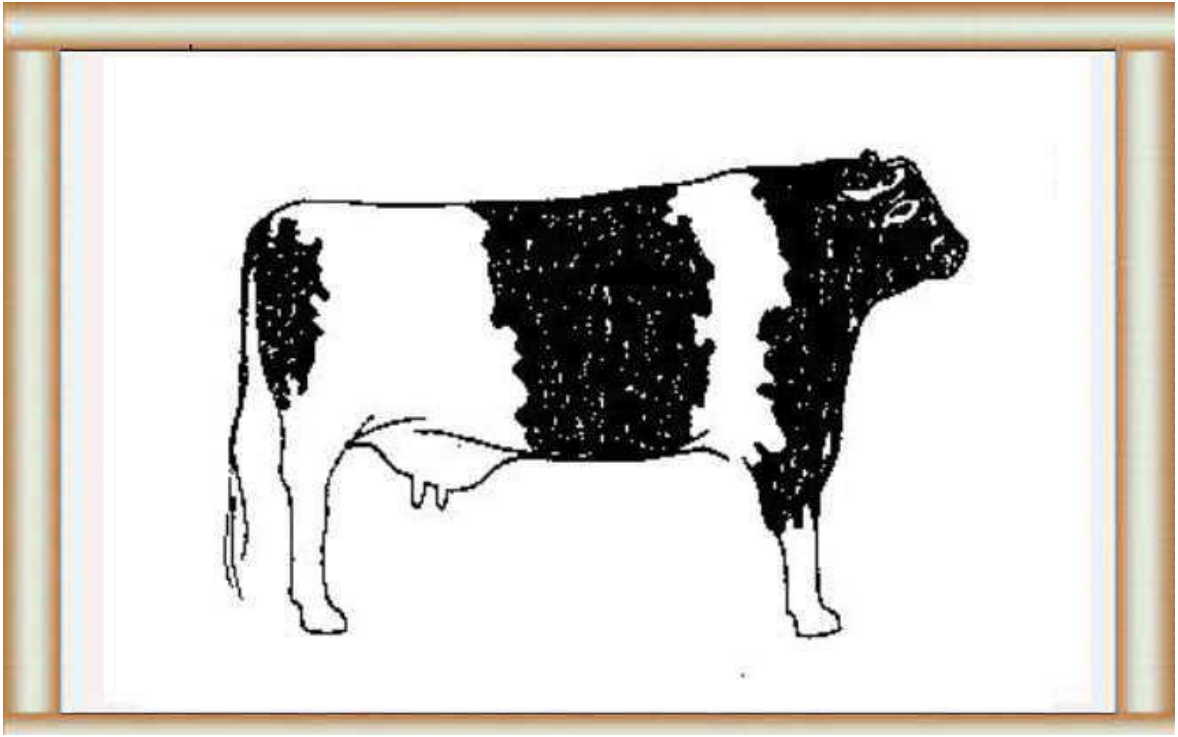
European or temperate (Bos taurus)
Holstein Friesian (Black and White)

27 Male
This breed is the most popular for cross-breeding with Zebu and gives high meat and milk production over 6,000 kg/lactation in several countries.

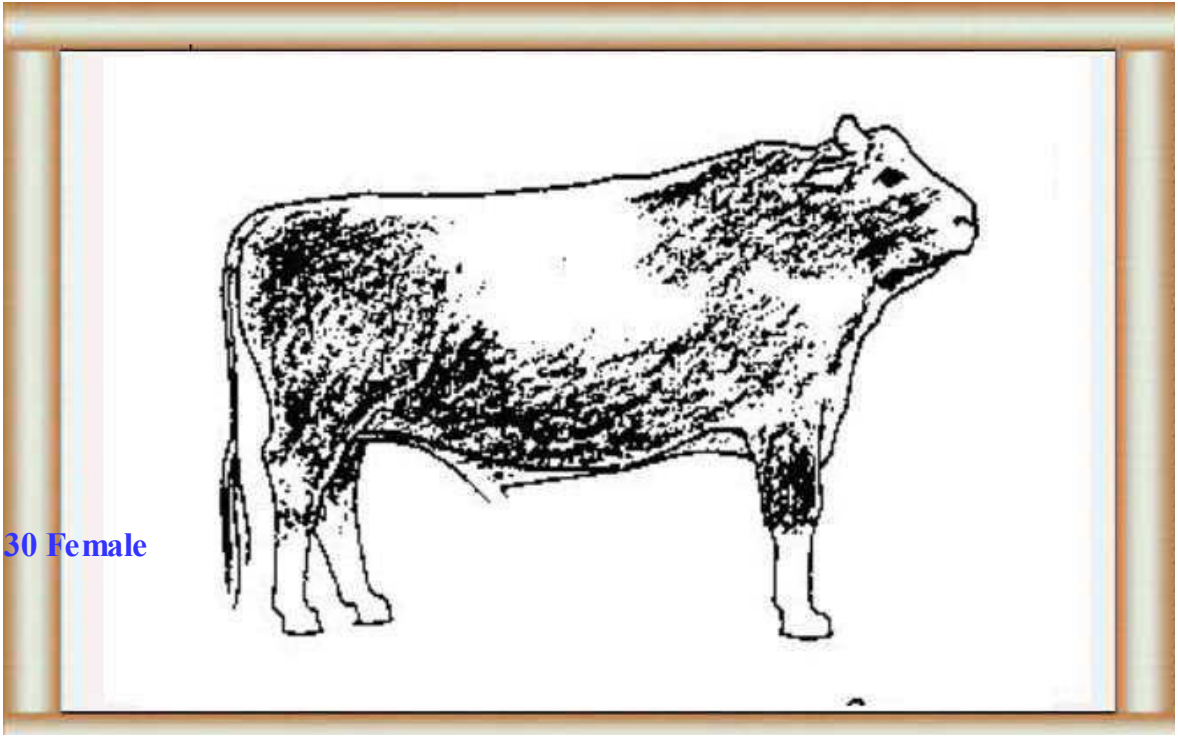
28 Female



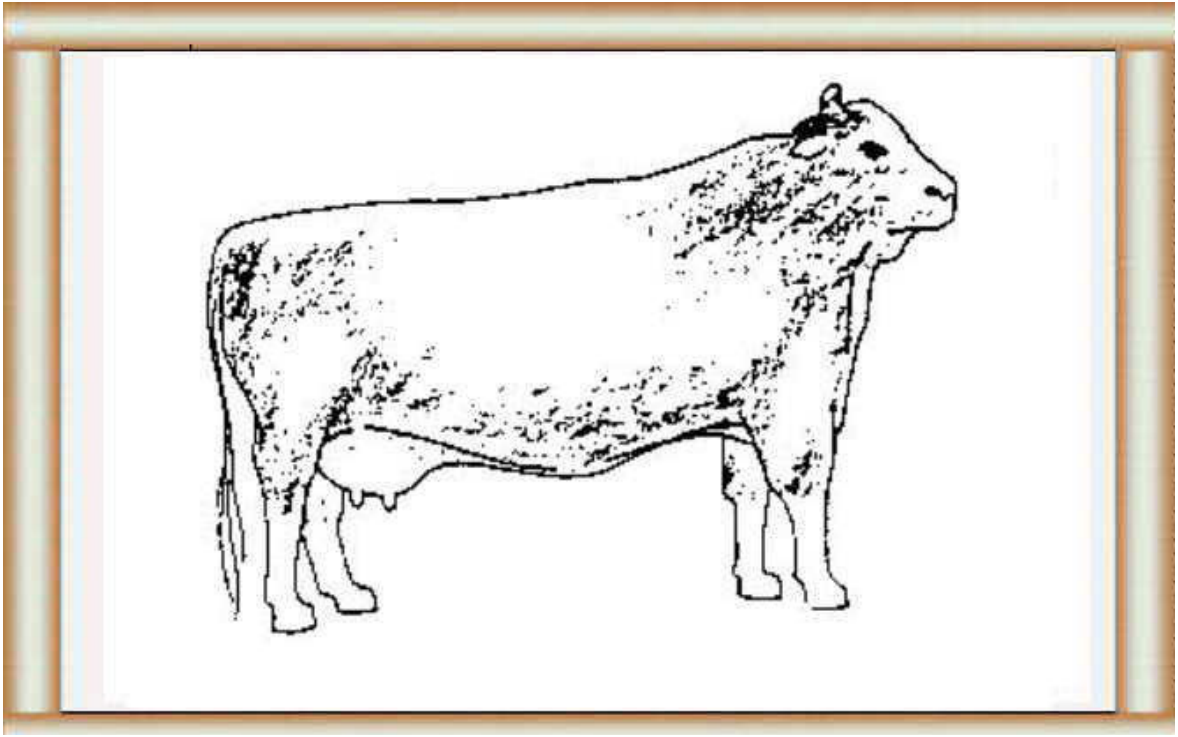


Brown Swiss

29 Male
This breed has:
(1) lower milk yield/lactation
(2) higher fat content
(3) better beef production than the Friesian.



30 Female



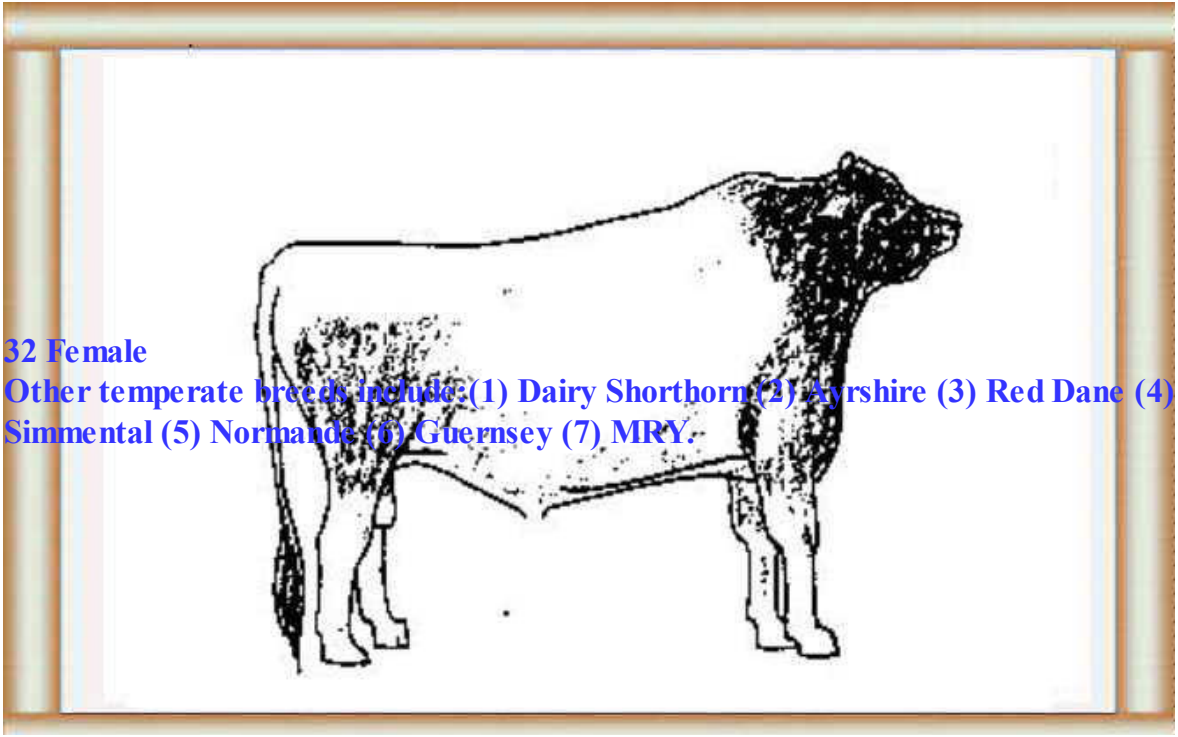
Other breeds

Other temperate breeds such as Dairy Shorthorn, Ayrshire, Red Dane, Simmental, Normande, Guernsey and MRY have also been used in crossbreeding in the tropics but to a limited extent.

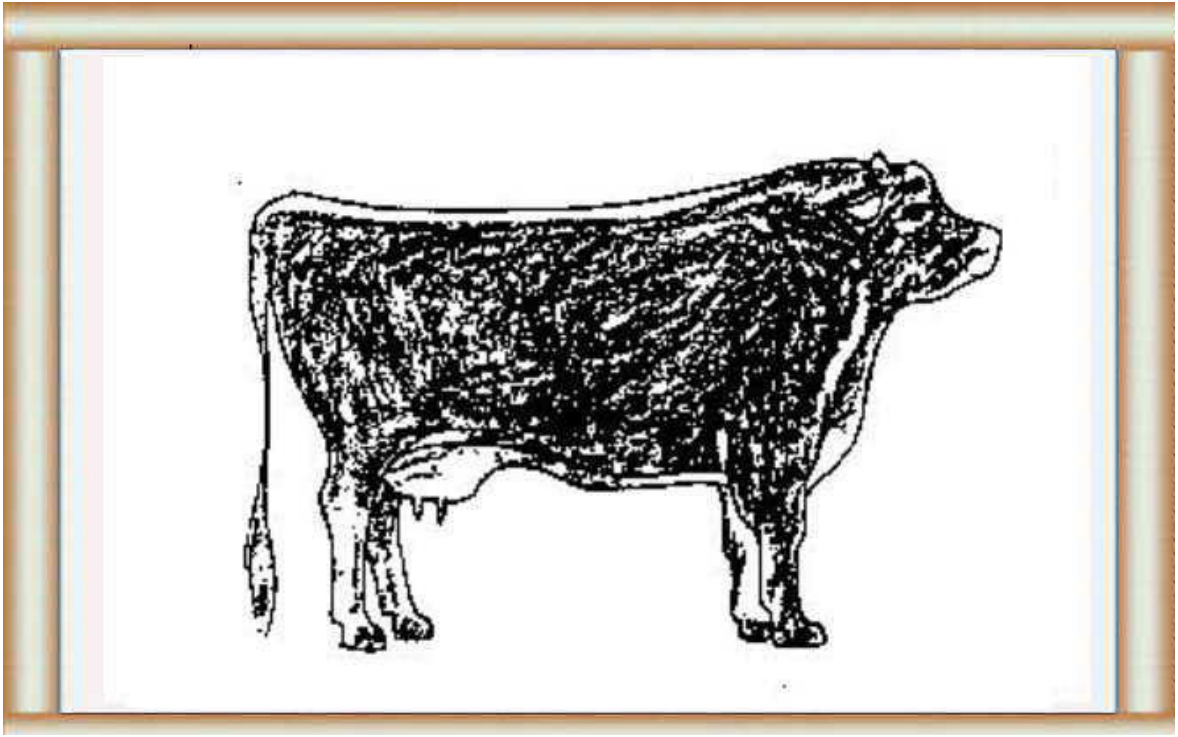
page55

Jersey

31 Male
This breed has:(1) lower milk yield/lactation (2) higher fat content
(3) earlier sexual maturity (4)poorer beef capacity than the Friesian.



32 Female
Other temperate breeds include:(1) Dairy Shorthorn (2) Ayrshire (3) Red Dane (4) Simmental (5) Normande (6) Guernsey (7) MRY.



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Dairy Buffalo breeds (33-36)

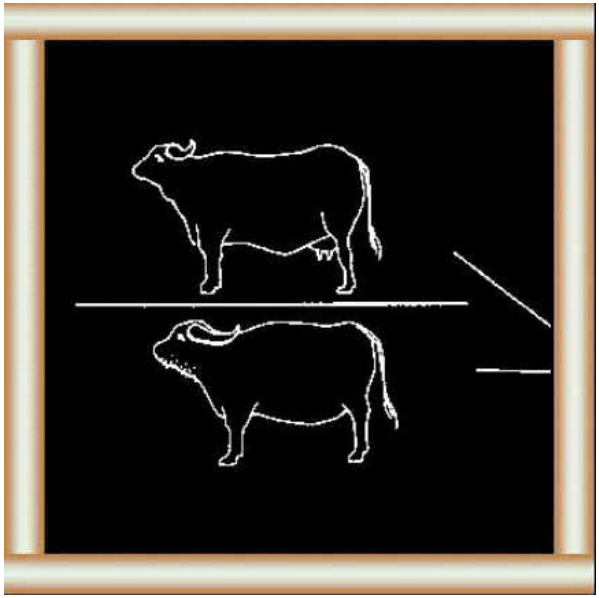
Buffaloes are mainly concentrated in Asia. Two main types are identified: River Buffalo and Swamp Buffalo.

The buffaloes in India and Pakistan belong to the River type. They have been selected for improved milk production. They are also good meat producers and can be used for work as well.

The native buffaloes in other countries in the region belong to the Swamp type. They are used primarily for work and meat. Milk yields are very low. However, in several countries even these low yields contribute to the income of the rural poor.

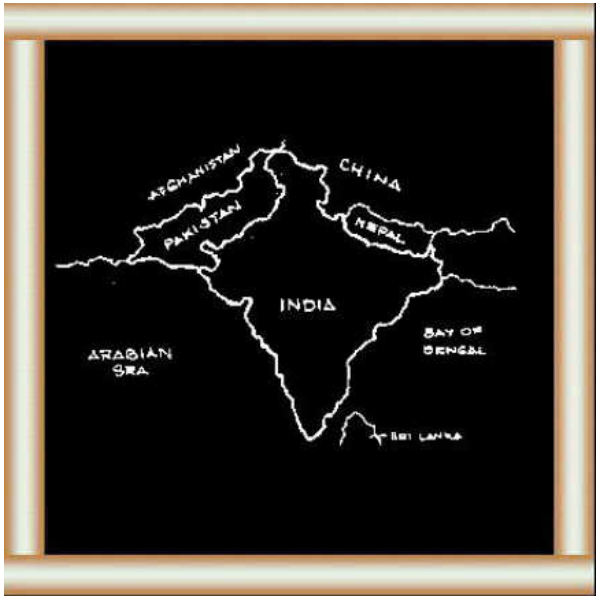
page57

What are the major types of dairy buffalo?

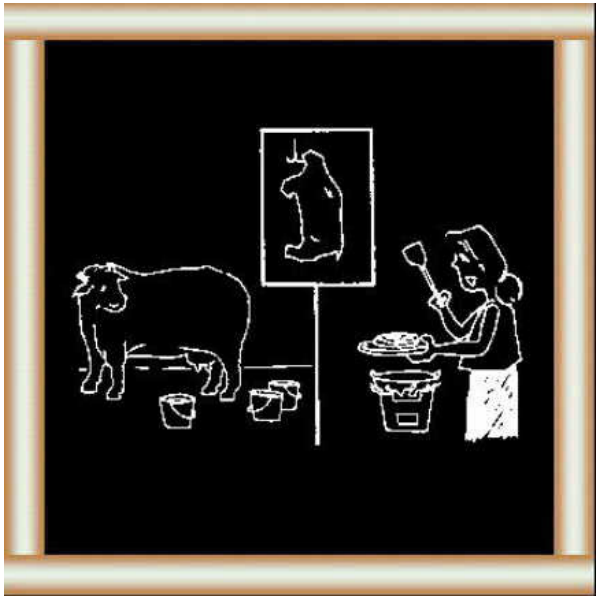


33 There are two major types:

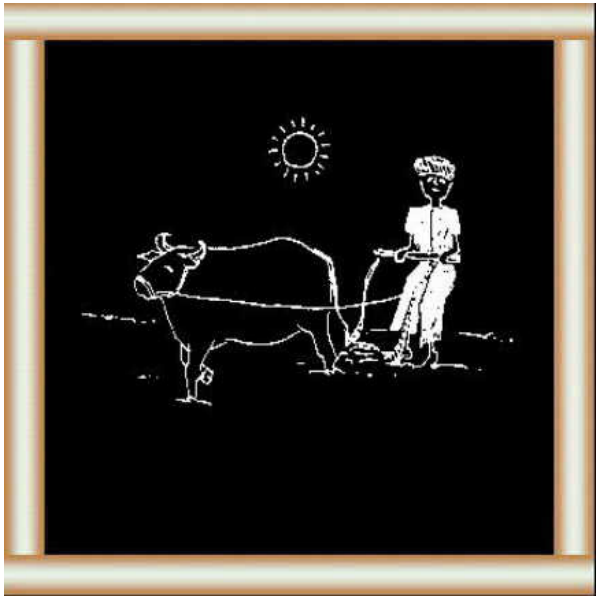
- River buffalo
- Swamp buffalo.



River Buffalo
34 Most buffaloes in India and Pakistan are River buffalo.



35 They have good:
- milk production
- meat production



36 and are good for draught work.

River Buffalo

Murrah (37-38)

The name Murrah was given to the buffaloes having curled horns and producing good milk. The breed originated in Punjab and is found in India and Pakistan. Several other countries of the world have imported these animals.

The animals are heavy with a wide deep frame. The horns are short and tightly curled. The females have a fine clean-cut head and neck whereas the males have a thick neck. The limbs are short, straight and strong with black hooves. The tail is long with a white switch. The udder is well developed with squarely placed teats. The body colour is black but a few brown or fawn grey animals are also seen. The body weight on average is 550 kg for males and 450 kg for females. The milk yield per lactation (between 270 to 305 days) in good herds is 1,500-1,800 litres with 7 percent fat.

Nili Ravi (39-40)

The Nili Ravi breed is found in Punjab.

Previously these were described as two breeds - Nili is found in Sutlej valley (Punjab) and Ravi in Sandal Bar. Both areas are the central Punjab Pakistan. The animals are black coloured, wall eyed, with white head markings. The hooves and switch of tail are white. The body is massive. The head is long and convex and the double chin is conspicuous. The udder is well developed with squarely placed long teats. The milk veins are very prominent.

The average weight of male and female is 600 and 450 kg respectively. Milk production ranges between 1,800-2,000 litres in 250-300 days.

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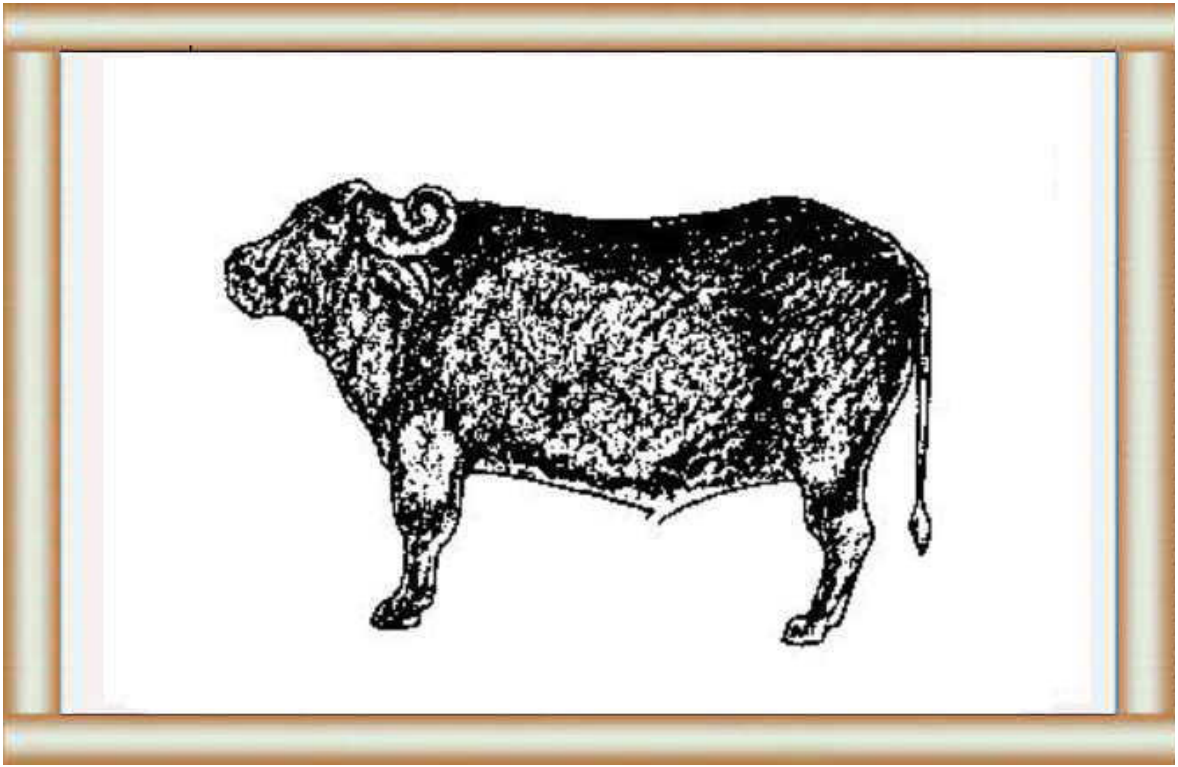
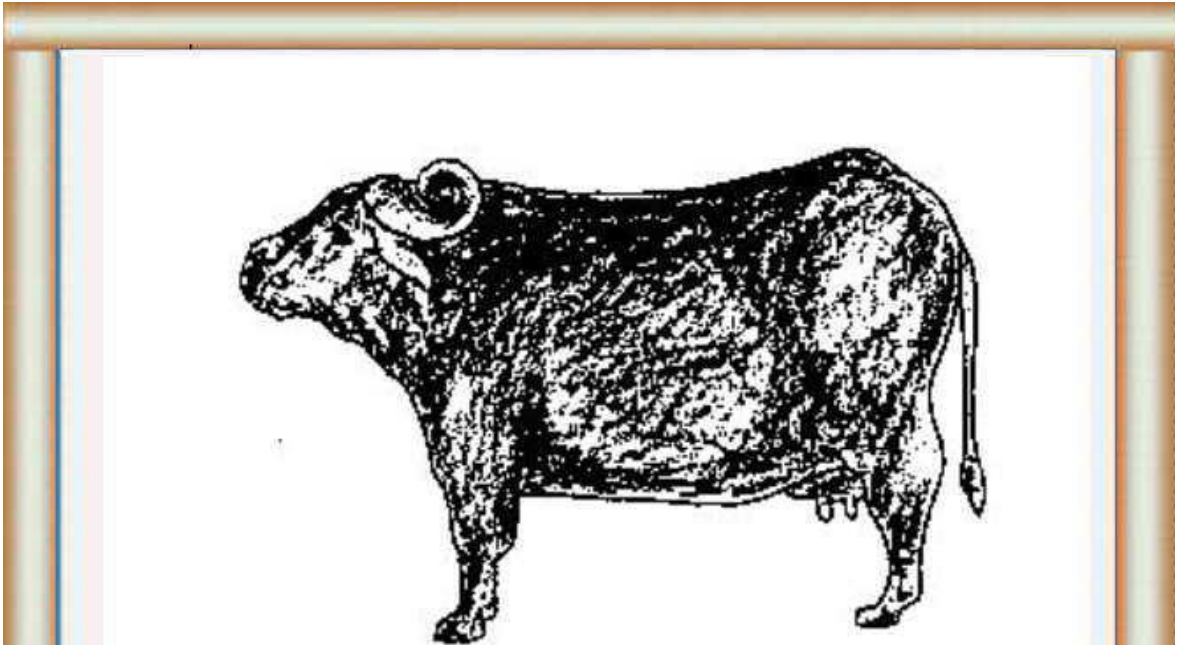
The major River Buffalo breeds are:
Murrah

37 Male

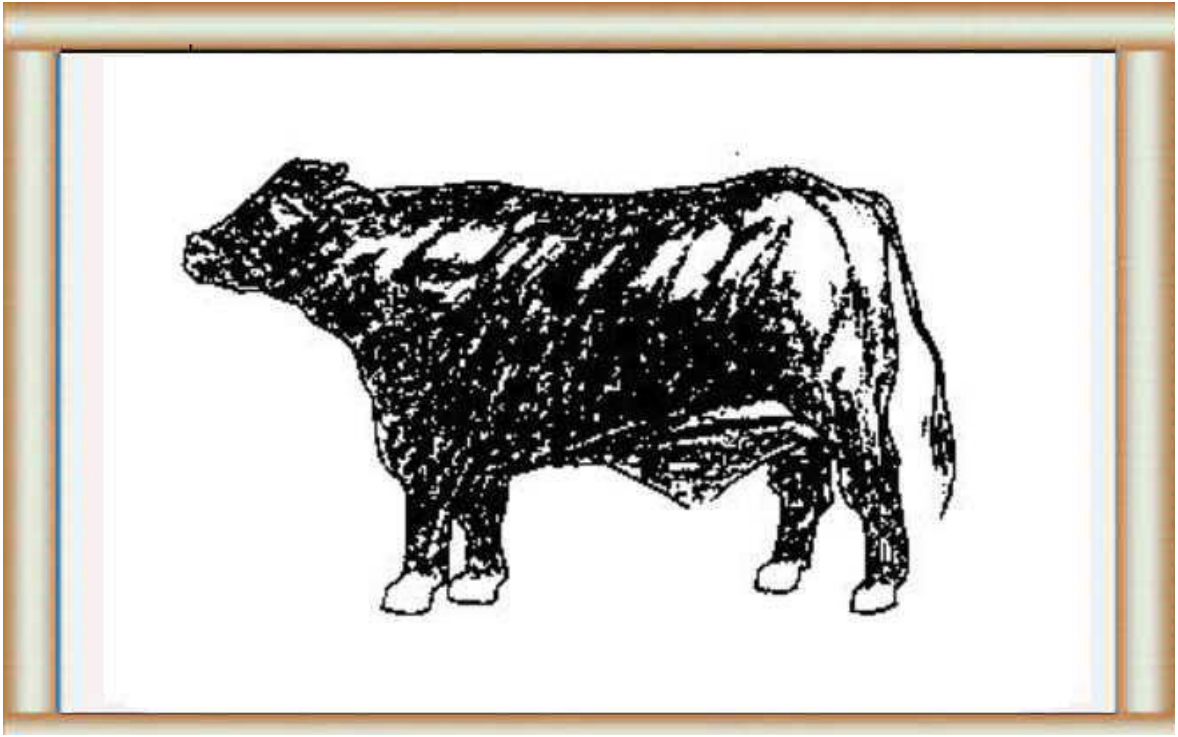


38 Female
The milk yield/lactation is 1,500-1,800 l with 7 % fat.

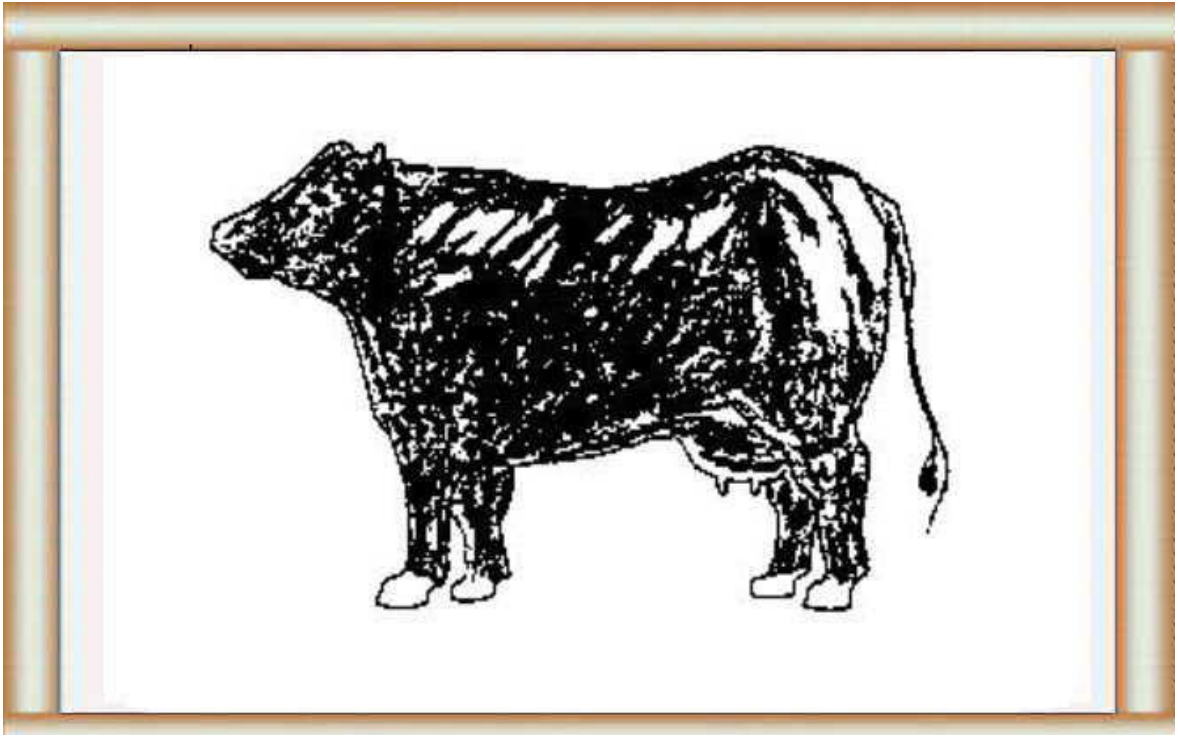


Nili Ravi

39 Male



40 Female
The milk yield/lactation is 1,800-2,000 l.



Kundi (41-42)

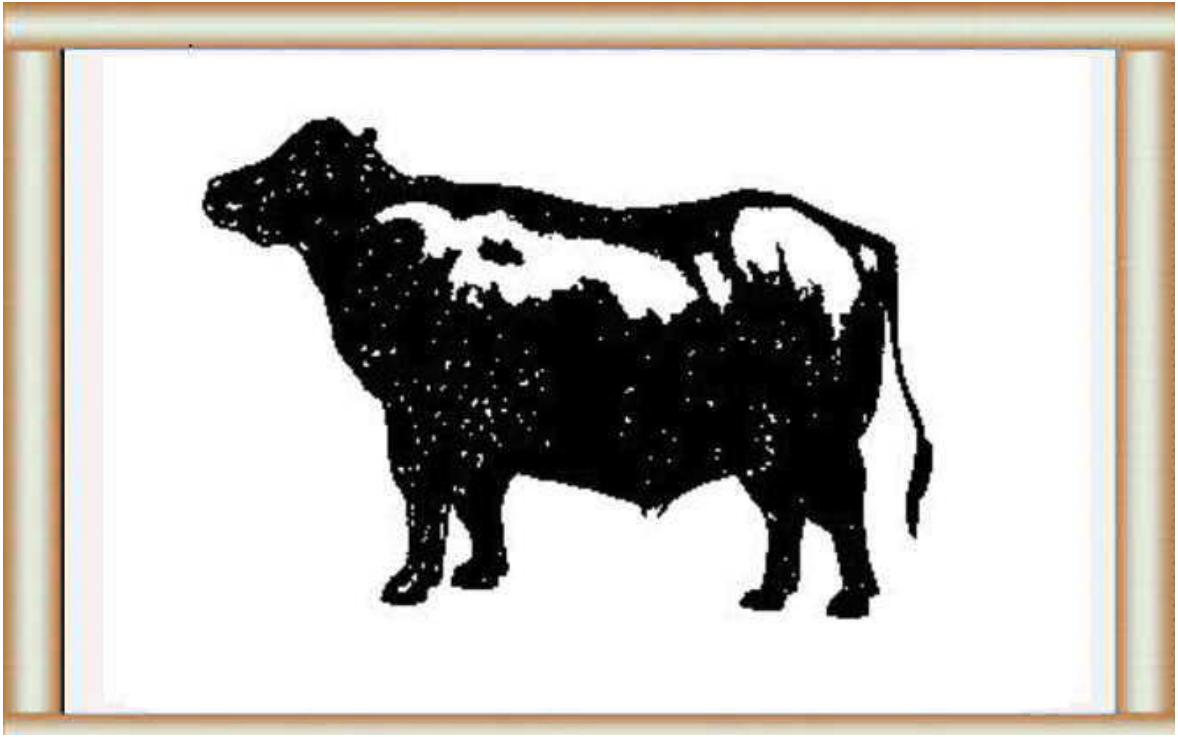
This breed is found in Sind Province of Pakistan around the River Indus. The animal is jet black in colour. Sometimes there is a white star on the forehead and the hooves may be white. The horns are thick at the base inclined backward and upward and end in a tight curl (the name Kundi coming from horns). The udder is well developed with squarely placed teats and the hind quarters are massive.

Animals of this breed are smaller than the Nili Ravi buffaloes and have a liveweight of 320 - 450 kg.

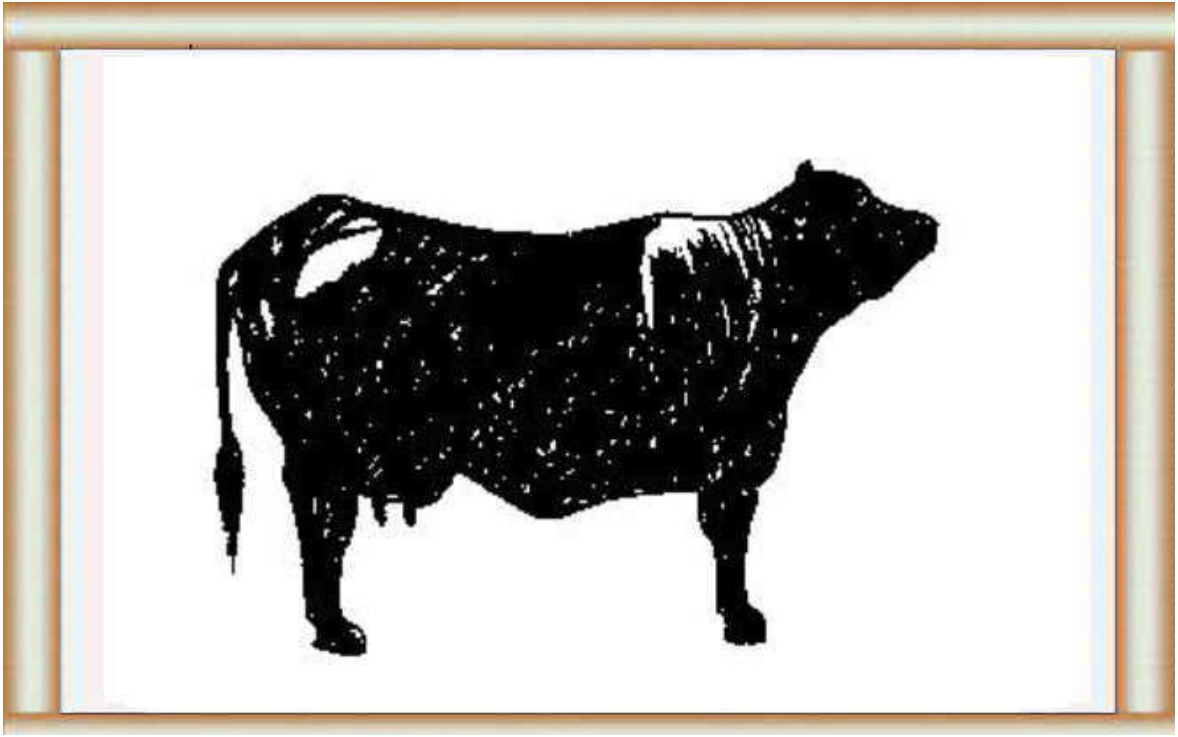
Milk yield varies between 1,500-2,000 litres with 7 percent butter fat.

Surti (43-44)

41 Male



42 Female
The milk yield is 1,500-2,000 l with 7 % fat.

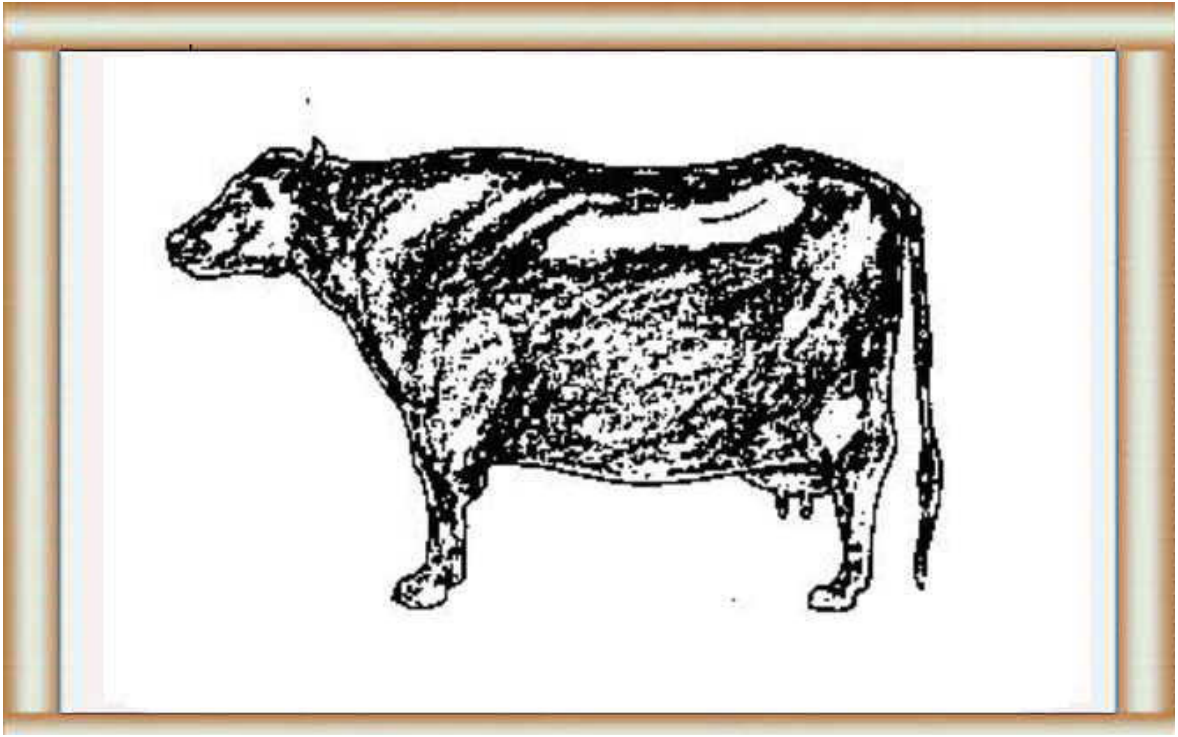


Surti

43 Male

44 Female

The milk yield is 1,500-1,750 l with 8 % fat.



Mehsana

The breed's hometract is Gujarat and parts of Maharashtra States (India). The breed is a cross between Murrah and Surti. The colour is jet black. The horns are coiled (like Murrah) or sickle shaped (like Surti). The animals have a long body, higher limbs and a longer and heavier head. Females have a well developed udder. The teats are fairly thick, long and pliable. Mehsana females are reputed for regular breeding and persistent milking.

The body weight of males and females is 600 and 425 kg respectively. Milk production ranges between 1,300-1,800 litres in a lactation of 300 days.

Jafarahadi/Zafarahadi, Nagpuri, Bhadawari and Taria breeds

These are four of the several breeds with localized importance in India.

Jafarahadi buffaloes are found mainly in Gujarat. They are good milk producers but poor breeders.

The other three breeds are lower milk producers but are good draught animals with good adaptation to the conditions in their local areas.

Swamp Buffalo (45-46)

The name Swamp buffalo arises from their natural habitat in swamp areas. In certain regions the wild herds also move with domesticated buffaloes. Various regional names are also given. (Carabao - Philippines;

Animals like swamp areas. The hottest part of the day is spent in wallows and active grazing is in the morning and evening hours.

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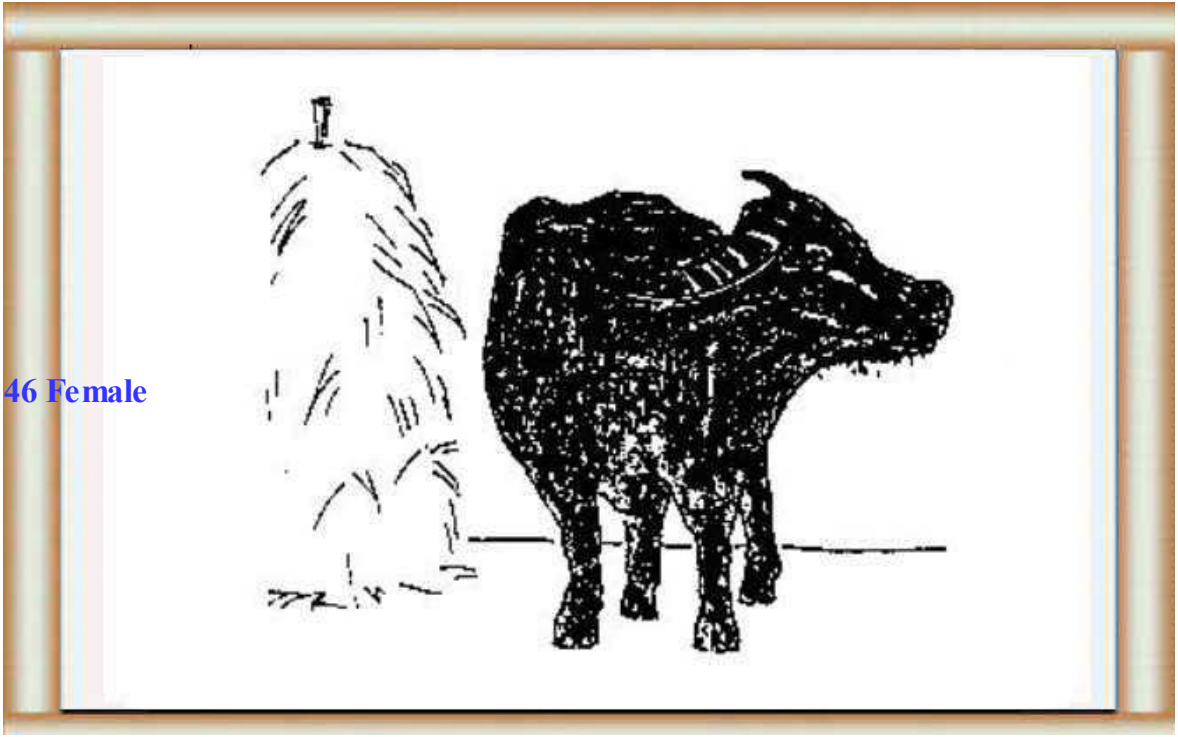
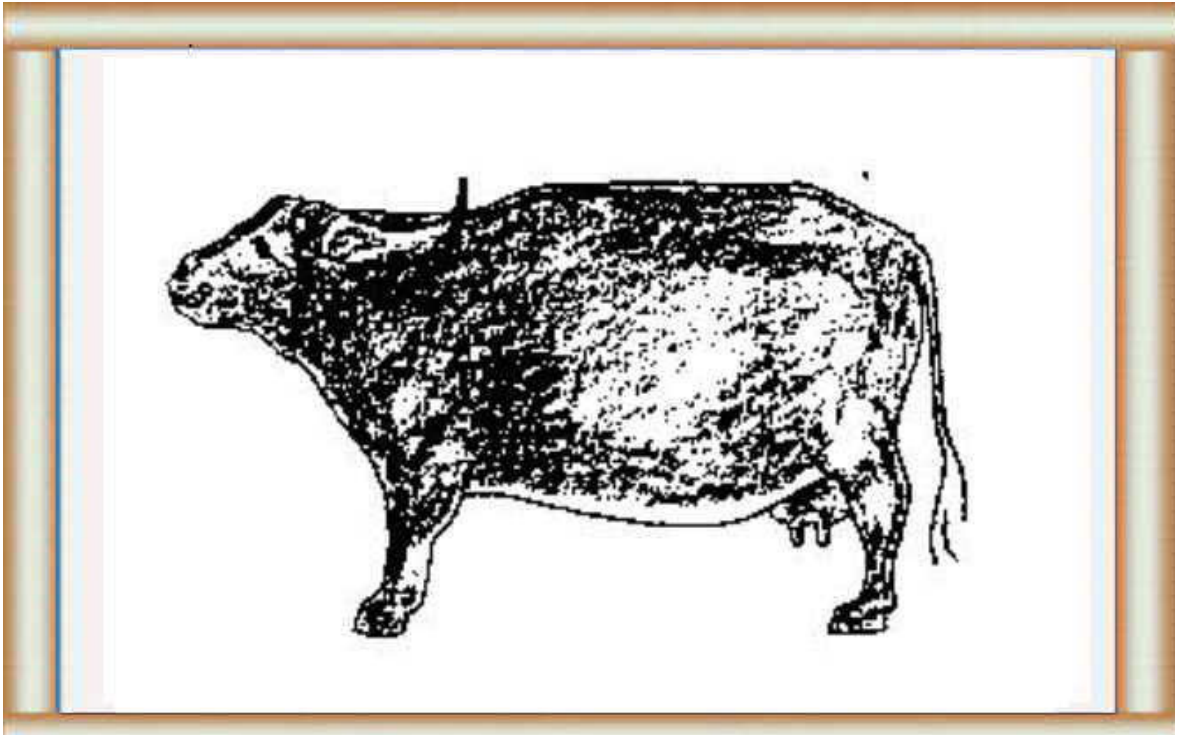
Other River buffalo breeds include:
Mehsana Jafarahadi/Zafarahadi
Nagpuri Bhadawari
Taria.

Swamp Buffalo

45 Male



46 Female



The Swamp buffalo is a good draught animal in rice growing areas.
The milk yield/lactation is less than 500 l.

Dairy cattle breeding

In their pursuit to produce suitable dairy cows, the different countries in the region are adopting various strategies.

The first attempts were aimed at importing pure bred temperate cattle and establishing them in the colder climates of especially the higher elevations. This practice met with little success because of the poor

adaptability of the temperate cattle to the tropical conditions, even though some nucleus herds were maintained to produce pure bred stock, especially bulls and semen, for crossbreeding the local stock. (49-52)

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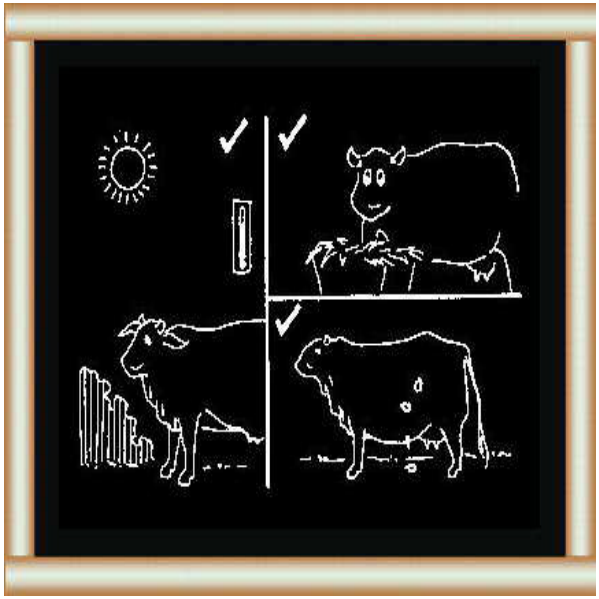
What is the purpose of breeding dairy cattle and buffalo and how can you do it?



47 The purpose is to breed dairy cattle and buffalo which can live happily in local conditions

48 and still have good:
- milk production
- meat production
- draught ability, where they are used for draught.

Dairy cattle breeding

50 but most of the temperate cattle could not live happily in local conditions.

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There are advantages in retaining some genes from the tropical breeds in the dairy cows to maintain their viability in the tropical climate. Crossbred cattle were produced, using different crossbreeding schemes.

These schemes included

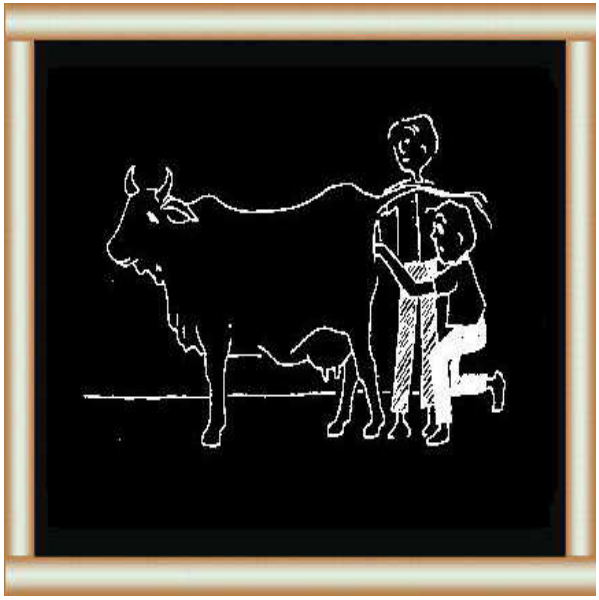
- rotational crossbreeding using several temperate breeds;
- production of synthetic breeds e.g. Jamaica Hope (approximately 80 % Jersey, 5 % Friesian and 15 % Sahiwal), Australian Milking Zebu - AMZ - (approximately 60 % Jersey and the balance 40 % mainly Sahiwal and a minor contribution from the Red Sindhi which was used at the initial stages of the programme) and Australian Friesian Sahiwal - AFS - (produced under a similar programme as the AMZ but with Friesian and Sahiwal breeds only).

Recently some countries have embarked on programmes to import pure bred temperate cattle, particularly Friesians, while others continue with the crossbreeding programmes. On the other hand, Sahiwal herds are also maintained pure and considerable improvements in yield characteristics are being achieved through selection within the breed. Sahiwal bulls are used to upgrade tropical cattle in some areas where it is not feasible to use cross-

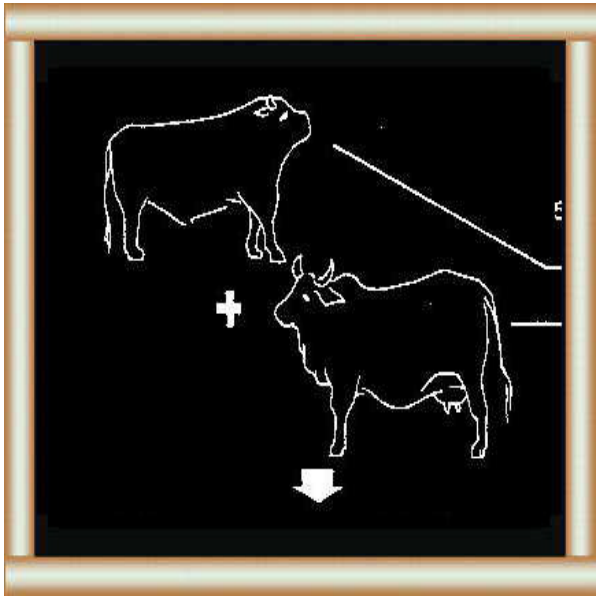
breeding with temperate breeds.

Considering the wide variety of strategies being adopted in the region, it is important that extension officers get a clear understanding of the strategies that are recommended for the particular area. Then only will they be in a position to assist the farmers to make correct decisions on breeding without making mistakes that may prove to be costly later on. (53-65)

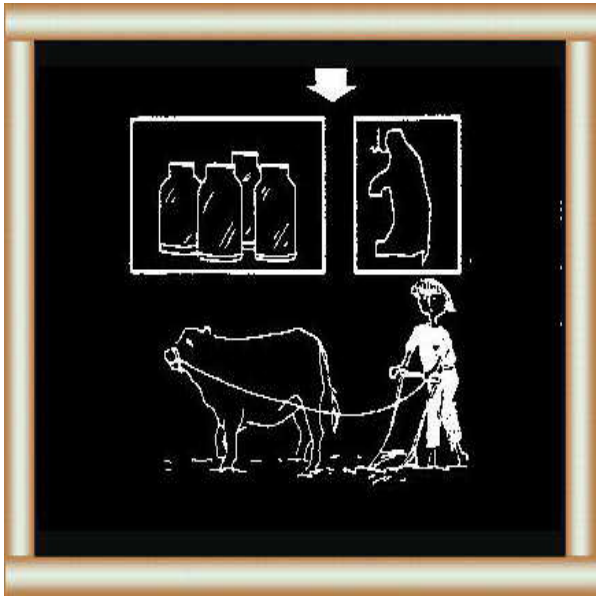
51 They set up some nucleus herds to produce pure bred stock, especially bulls and semen



52 for cross-breeding with local stock.



53 They found that genes from temperate cattle and genes from local cattle



54 can produce animals with high production which live happily in local conditions.

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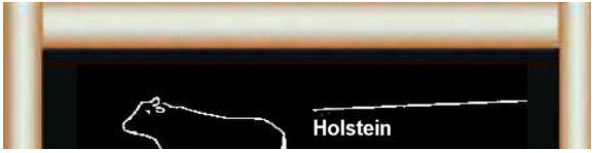
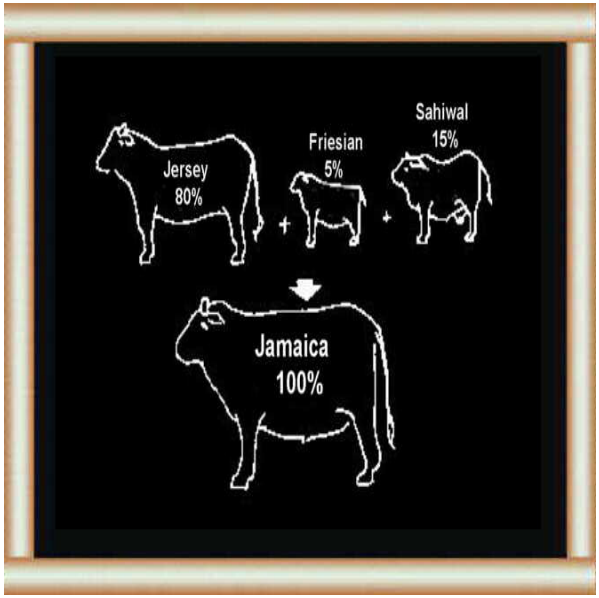
Rotational cross-breeding

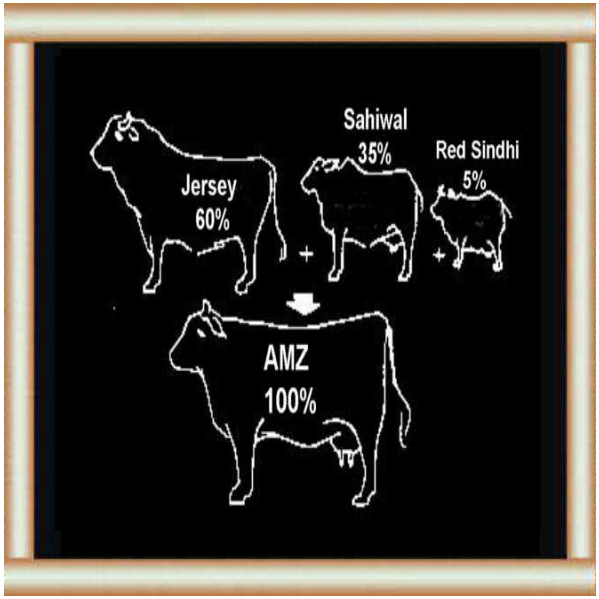


55 One temperate breed of Bull (e.g. Holstein) is cross-bred with a native cow (e.g.

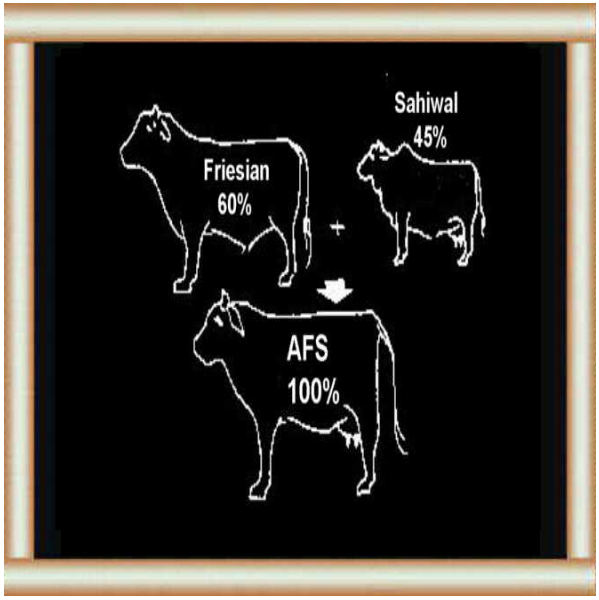
Synthetic breeds



58 Jamaica Hope
- 80 % Jersey (approximately)
- 5 % Friesian (approximately)
- 15 % Sahiwal (approximately).

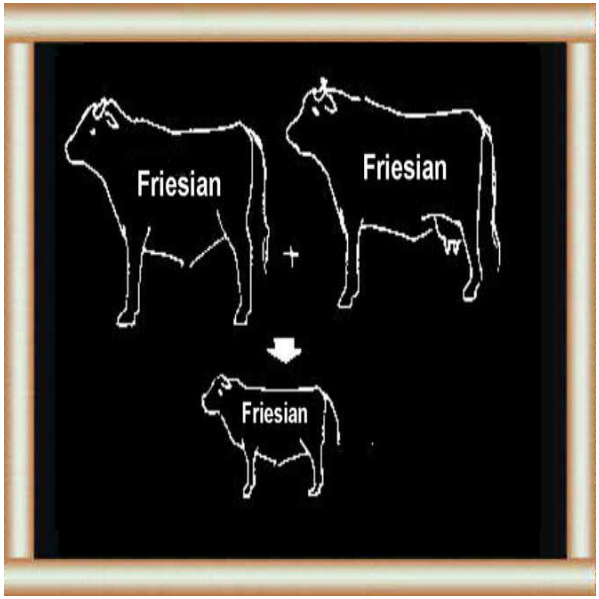


59 Australian Milking Zebu (AMZ)
- 60 % Jersey (approximately)
- 35 % Sahiwal (or more)
- 5 % Red Sindhi (or less).



60 Australian Friesian Sahiwal (AFS)
- 60 % Friesian (or more)
- 45 % Sahiwal (or less).

Recent country programmes



61 Some countries bring in pure-bred temperate cattle, especially Friesians.

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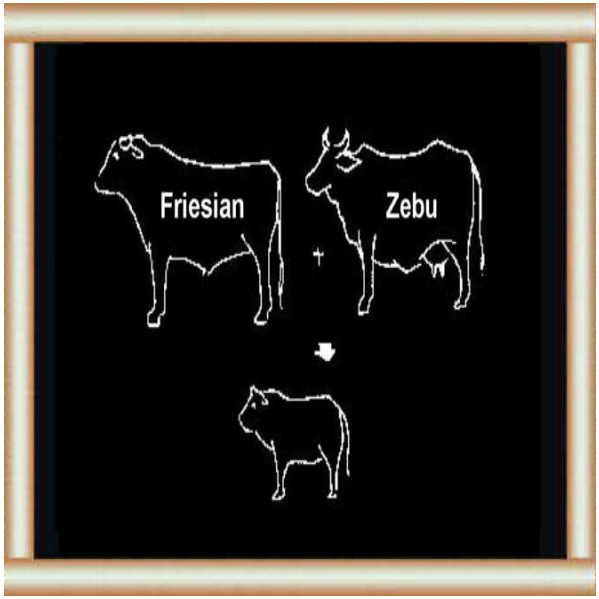
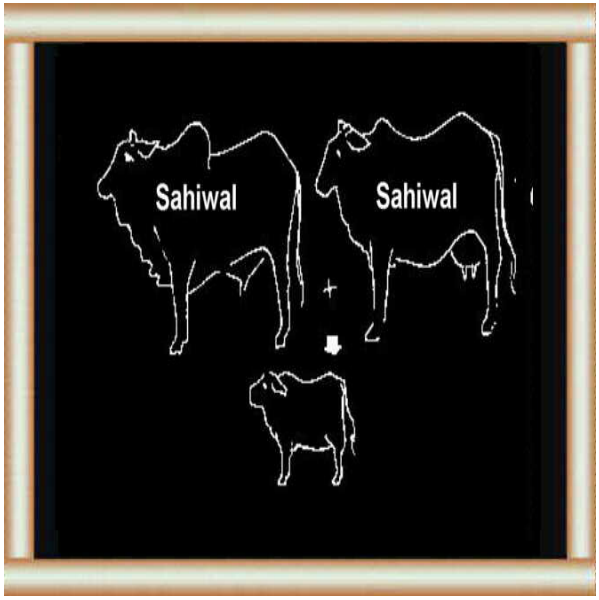
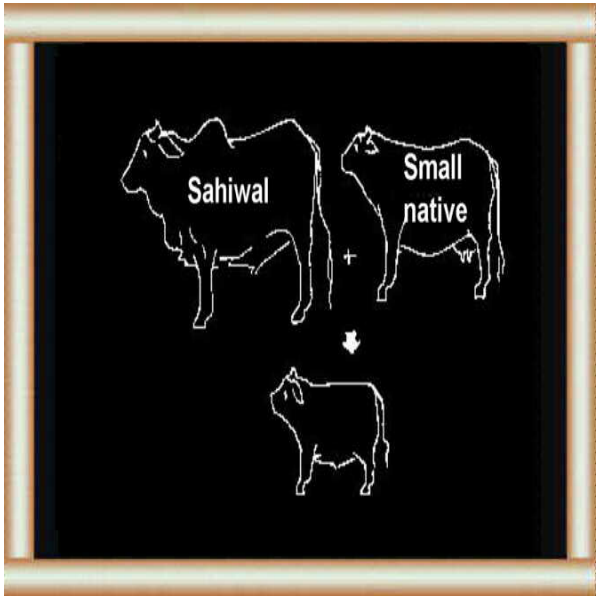


62 Other countries cross-breed temperate and native cattle.



63 Pure-bred Sahiwal herds and careful selection within the breed are increasing production.



64 Some countries use good Sahiwal bulls to upgrade native cattle where it is difficult to use temperate breeds for cross-breeding (e.g. when A.I. is difficult).

65 Farmers and extension workers should try to use the best breeding programmes for their local conditions.

Buffalo breeding for milk production (66-68)

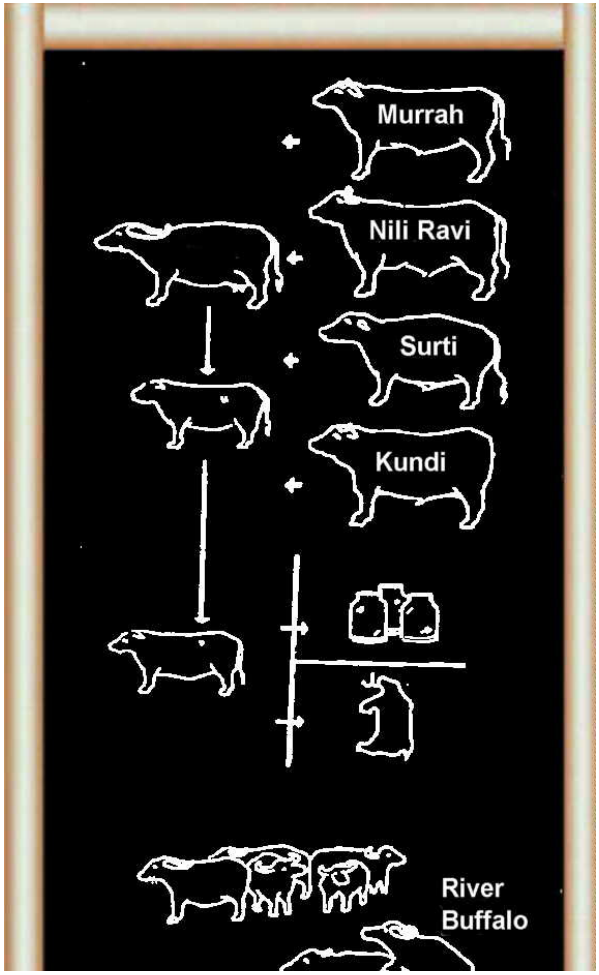
The five main breeds of dairy buffaloes found in India and Pakistan are being selectively bred for increased milk production.

Programmes are being undertaken in many countries to improve the milk production potential of Swamp buffalo by crossbreeding with different dairy breeds (of the River type). Murrah, Nili Ravi, Surti and Kundi are the prominent breeds used.

Some reports indicate that the crossbred offspring perform better than either parent breed under similar conditions. More common are findings of an intermediate performance between the two parent breeds.

Nucleus herds of dairy buffalo breeds can be conveniently established in tropical countries (unlike the case of dairy cattle breeds like Friesian and Jersey). The bulls from the nucleus herds can then be used to breed the Swamp buffaloes even where A.I. is not feasible (again an advantage over the Friesian and Jersey bulls).

Dairy buffalo breeding



66 Many countries use River Buffalo to upgrade Swamp Buffalo, especially:
- Murrah
- Nili Ravi
- Surti
- Kundi.

67 The cross-bred cows produce as well as the River type parent or better.

68 It is easy to set up nucleus herds of River Buffalo bulls (unlike temperate cattle) and

to use them for breeding.

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What do you know about breeds of dairy cattle and buffalo?

Things to look for in different breeds

1 Heat tolerance (6)
2 Low nutritional requirements (7)
3 Disease resistance (8)
4 High milk production (9)
5 High fat and solids-not-fat (10)

content

6 High meat production (11)

7 Draught ability, where relevant

Major breeds of dairy cattle

1 Zebu (Bos indicus) (15)

- Characteristics (16)
- heat tolerance
- low nutritional requirement
- disease resistance
- low milk production (17)
- short lactation period
- high fat and solids-not-fat content

- low weight gain (18)
- late maturity and first calving

- Characteristics
- high milk production (35)
- high meat production
- good draught ability (36)
- Breeds
- Murrah (37-38)
- Nili Ravi (39-40)
- Kundi (41-42)
- Surti (43-44)

2 Swamp Buffalo

- Philippines (Carabao)
- Thailand (Kwai Tui, Kwai Saam, Kwai Kam) (45-46)

Dairy cattle breeding

Dairy buffalo breeding