Small-Scale

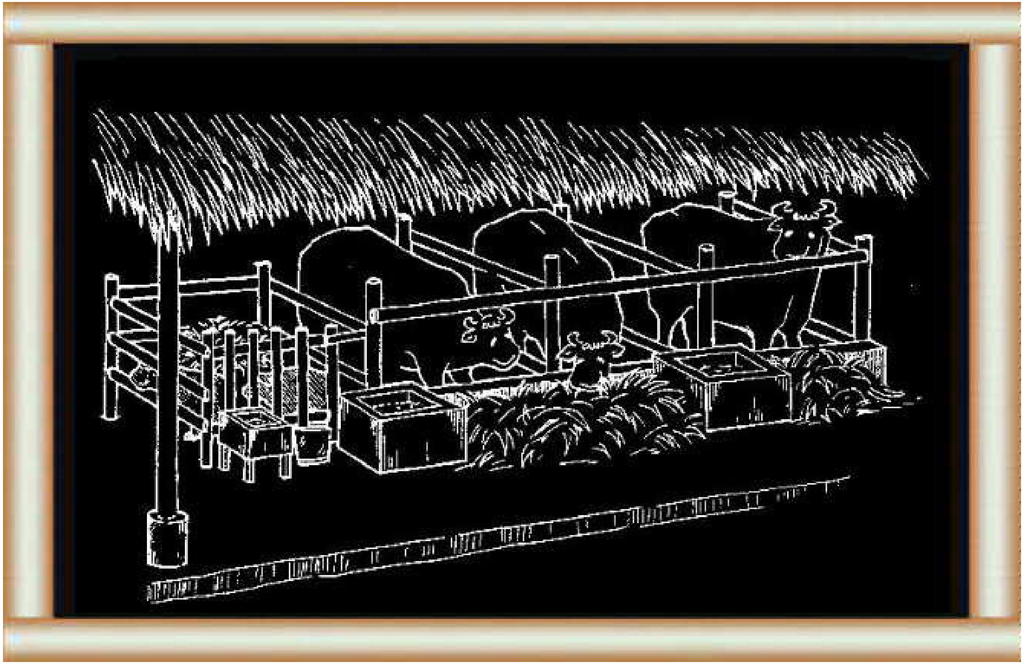
Dairy Farming Manual

Volume 2

Husbandry Unit 3.1

PRINCIPLES AND DESIGN OF DAIRY CATTLE AND BUFFALO HOUSING

page 77



PRINCIPLES AND DESIGN OF DAIRY CATTLE AND BUFFALO HOUSING

Husbandry Unit 3.1:

Technical Notes

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

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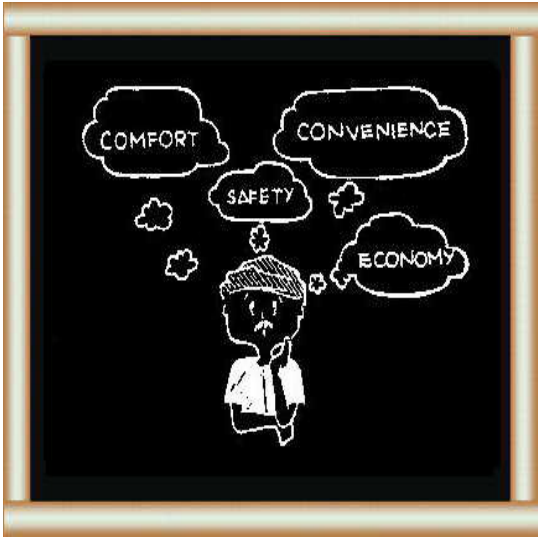
Extension Materials

What should you know about housing for dairy cattle and buffalo?

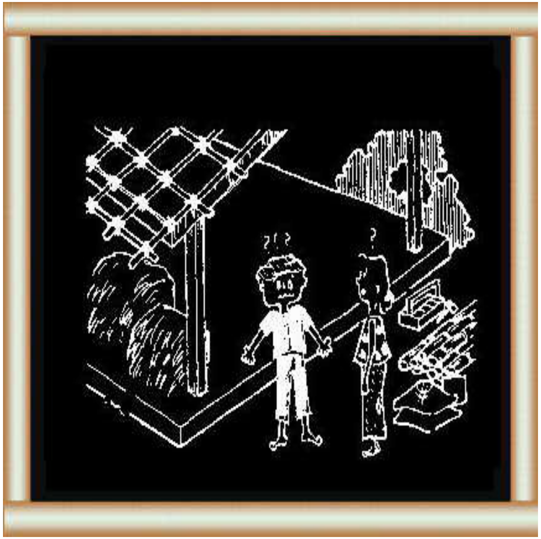


What is important in designing housing for your dairy animals? (4-19)

1 You should think about:
- comfort
- safety
- economy
- convenience.

How can you construct simple housing to meet the basic needs of your dairy animals? (20-36)

2 By careful planning of the location and basic design of your cattle shed.



How can you construct improved housing to better meet the needs of your dairy animals? (37-147)

3 By making sure you understand what each improvement is for and how much it will cost you.

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Important points in housing design

Some important aspects that must be taken into account in designing housing for dairy animals are:

- Optimum comfort for the animal so that it will produce most. This involves protection from rain and extremes of heat and cold and strong winds; adequate ventilation. (4-8)

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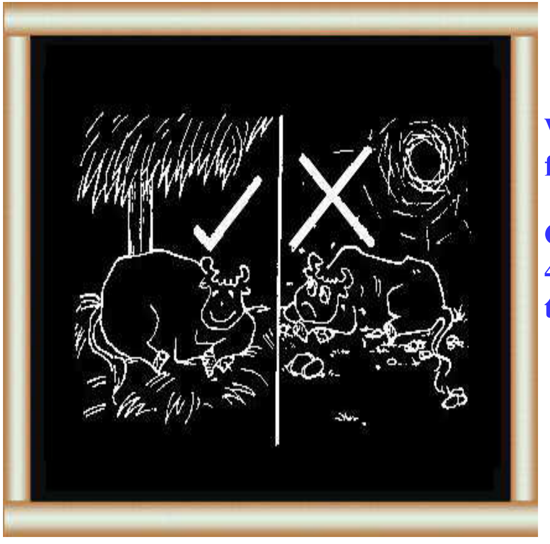

What is important in designing housing for your dairy animals?

Comfort

4 Make your animals comfortable so that they produce more milk.

5 Protect your animals from rain and strong winds.

6 Protect your animals from heat

7 and from extreme cold.

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- Costs of construction and subsequent maintenance. (9-10

- Prevention of feed wastage. (11)

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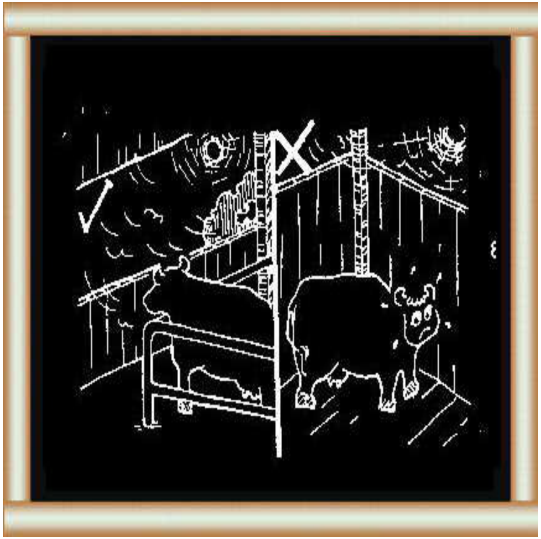
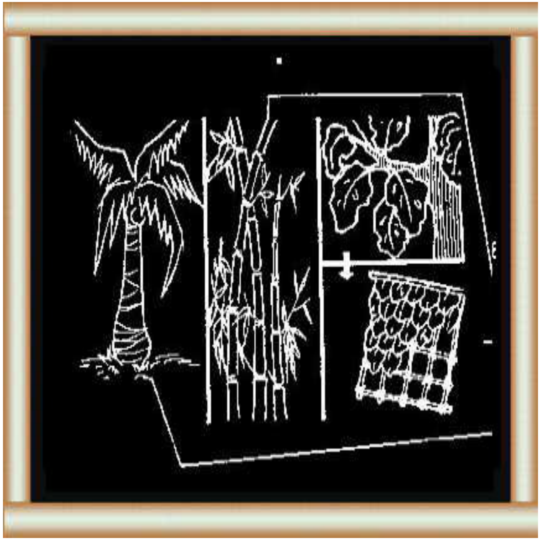


8 Make sure there is good ventilation.

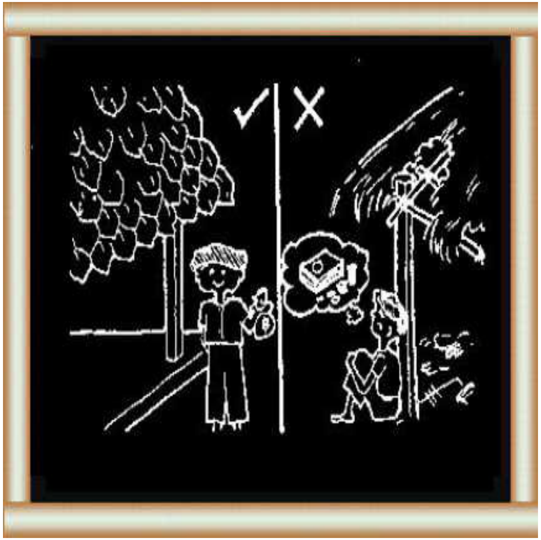
Low construction and maintenance costs

9 Use cheap materials available locally



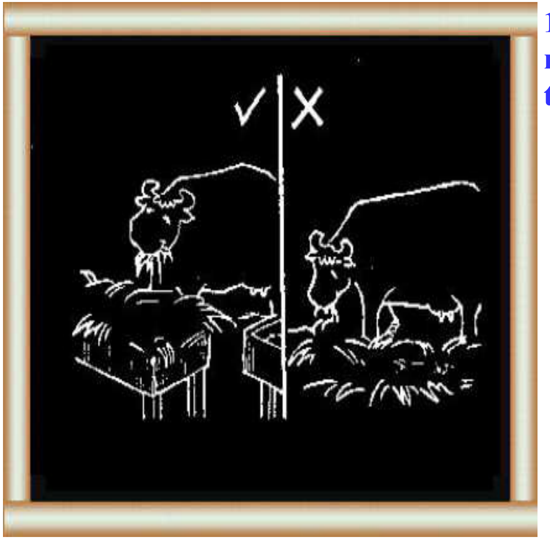
e.g.

- bamboo and coconut
- seasoned leaves
- coconut frond mats (cadjan)



10 but choose strong materials so that your repair and maintenance costs are low too.

Preventing feed wastage



11 Your animals should feed easily from racks and troughs and not trample on the feed.

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- Prevention of injury to animals. (12-15)

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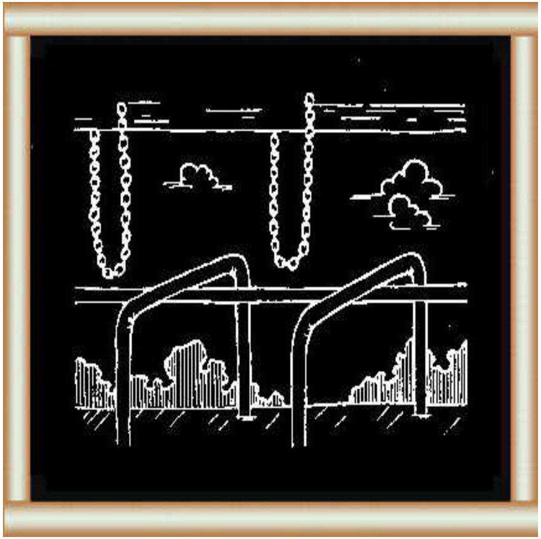
Preventing injury
12 Make sure the standing is not slippery



13 and there is the right amount of space for your animal to get up and lie down easily.

14 Too little space makes it difficult for your animal to lie down and get up and may cause injury.

15 Too much space allows your animal to move across and drop dung and urine on the standing.

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- Easy and profitable disposal of dung, urine and other wastes. (16-18)
- Convenience for operational activities e.g. feeding, milking and maintenance of hygienic environment. (19)

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Making use of wastes
16 In well-designed housing you can easily remove dung, urine and other wastes

17 and use them to make compost manure (See H. 1.2 Compost Manure)

18 or pass them through a bio-gas digester.
This also reduces the breeding of flies.

Ease of feeding, milking, cleaning
19 Well designed housing makes these operations easier (See below).

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Construction of simple housing to meet basic needs

The more productive dairy cattle have a high metabolic rate which results in the production of a considerable amount of heat. Thus they would be more comfortable in a cold, dry climate than in a hot, humid climate because the former would be helpful in getting rid of the extra body heat. However, there are vast areas with hot and humid tropical climates in the region. The basic model presented, therefore, would be one suitable for these unfavourable conditions. Providing adequate ventilation and protection from excessive sunlight and heavy rains is extremely important under these conditions. This model can be easily modified to meet the needs of the climatic conditions, by providing half walls, curtains etc. where necessary.

The materials used for construction and the construction itself should not be too expensive. Many small farmers cannot afford such luxury even for their own dwellings. However, the material used should be durable, otherwise the costs of repairs and maintenance will be too high. Fortunately in most rural areas less expensive material such as bamboo, coconut and other wood and cadjan (mats made

of coconut frond), straw or other seasoned leaves are used traditionally and indigenous technology is available.

It is quite common for small scale producers with one to a few dairy cattle to house them in open sheds with an earth floor. Sometimes cattle may be kept in a basement under the human dwelling or under a stack of straw. Even though the animals may have shelter from sun and rain, and the construction costs are minimal, the other requirements are generally not met. (20-23)

Convenience for operational activities, e.g. feeding, watering, milking and maintenance of a hygienic environment, has to be provided for in designing the arrangements within the shed and in the actual construction. These are discussed under the layout, floor construction etc. as appropriate.

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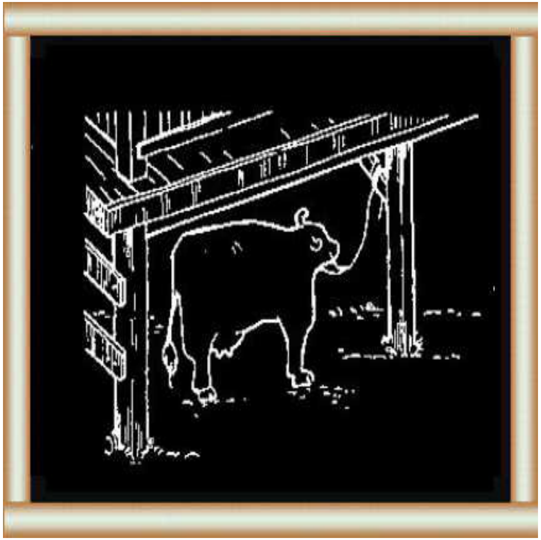
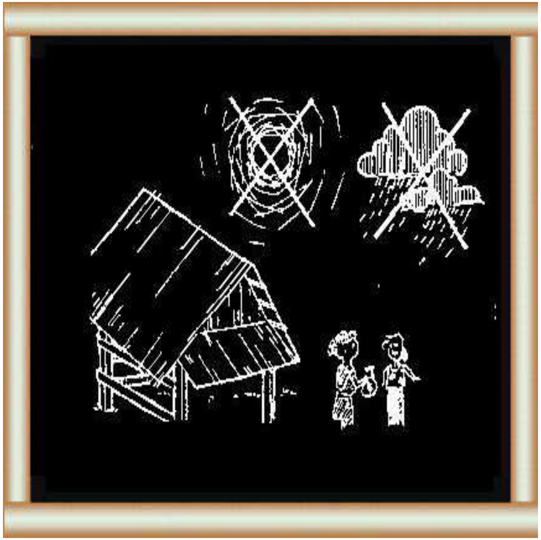
How can you construct simple housing to meet the basic needs of your dairy animals?

20 Many small scale farmers house their dairy animals in open sheds with earth floors.



21 Other farmers keep their animals in a basement under their house

22 or under a stack of straw.



23 Although this housing protects your animals from sun and rain and is cheap to build

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Wastage of feed by trampling, inability to make full use of the urine as a source of fertilizer and inability to maintain a hygienic environment resulting from the formation of pools of mud and urine etc. are some of the problems. (24-25)

Most of these problems can be overcome to a very great extent by:
- Constructing the shed in a well drained area and having a shallow drain around the shed. (26)

- Having a systematic arrangement within the shed for tying the animals, preferably in a row, with appropriate space between animals and a separate area for the calves. (27)

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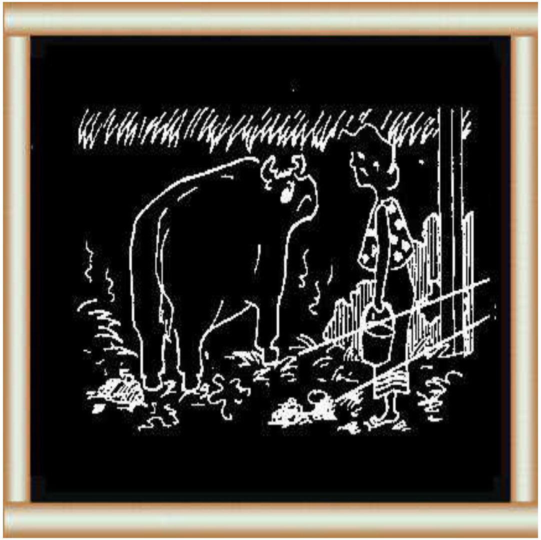

24 there are problems of:
- feed wastage by trampling
- difficulty of cleaning dung, urine and mud (unhygienic environment)

25

- not making good use of dung and urine.

Good design of housing can overcome these problems.

26 Construct your shed in a well drained area and make a shallow drain around your shed.

27 Make a good structure for tying your animals, best in a row with the right space and a separate area for calves.

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- Having a partition between the animals and the feed area to prevent the trampling of roughage feed, and offering concentrates/minerals and water in suitable containers. (28)

- Waste of feed, specially by trampling, is prevented by designing a suitable feed trough from which the animal can conveniently pick up its feed, whether it be cut and preferably chopped roughage or concentrate. (29)
- Making the roof leak-proof i.e. maintaining the roof in a good state of repair, especially during rainy weather. (30)
- Ramming the floor adequately with gravel to have an even floor and attending to the floor regularly to prevent uneven areas developing. (31)

Injury to the animal is prevented by constructing a non-slippery standing, allowing adequate space for the animal to lie down and get up without obstruction. Space between animals has to be restricted, however, to prevent them moving across the standing, dropping dung and urine on the standing.

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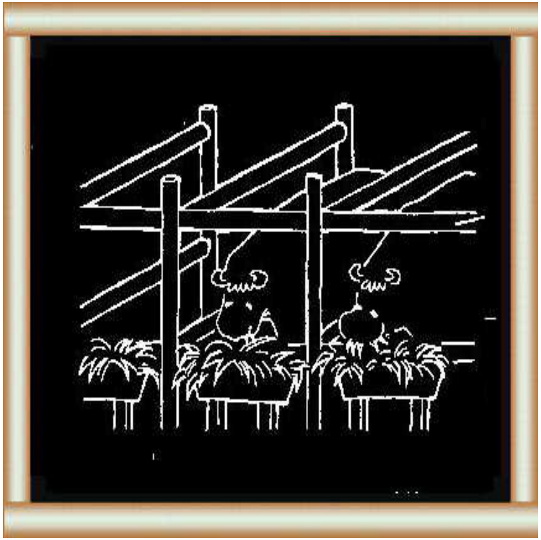
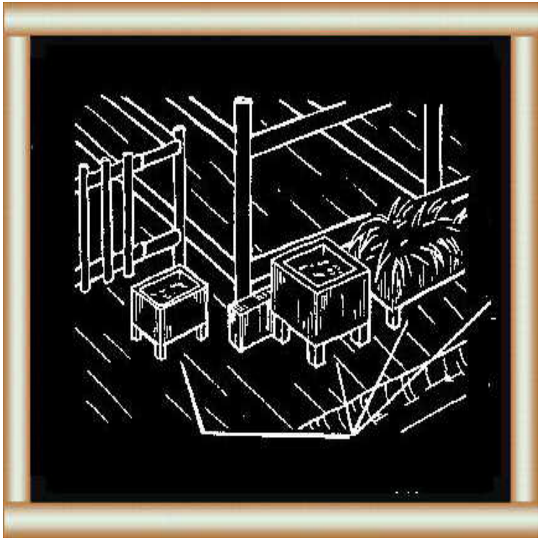
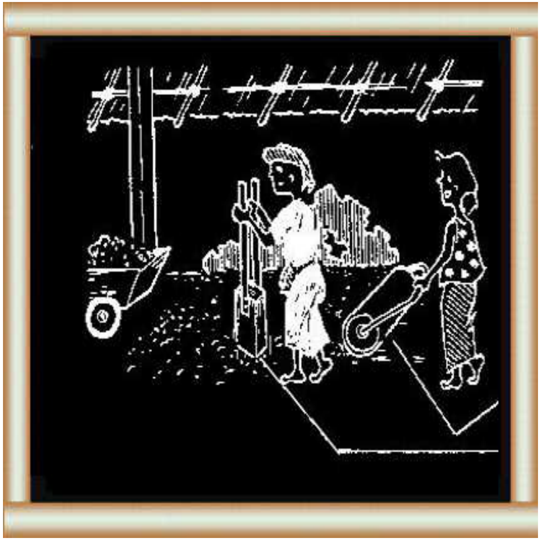


28 Make a partition between your animals and the feed area.
This prevents the trampling of roughage feed.



29 Make suitable containers for concentrates/minerals and for water.

30 Make sure your roof does not leak. Check it and repair if necessary before the rainy season.



31 Make sure the shed floor is even. Ram it with gravel and use a roller, if possible.

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- Providing a sufficient slope to prevent urine and water flowing towards the animal or stagnating in pools. (32)

- Providing suitable bedding such as saw dust, left over roughage, straw etc. into which some of the urine may be absorbed and which can subsequently be used for compost making. (33)

It would be advantageous if dung, urine and other wastes could be disposed of in a manner that would facilitate the production of compost. By arranging for the dung and urine to pass through a bio-gas digester, an additional benefit of a supply of bio-gas can be obtained, at the same time reducing the breeding of flies.

- Taking the animal outside the shed for bathing, washing, spraying etc. (34)

- Providing curtains made of material available in the area e.g. bamboo strips, cadjan etc. to prevent rain beating in and cold draughts disturbing the animals (where applicable). (35)

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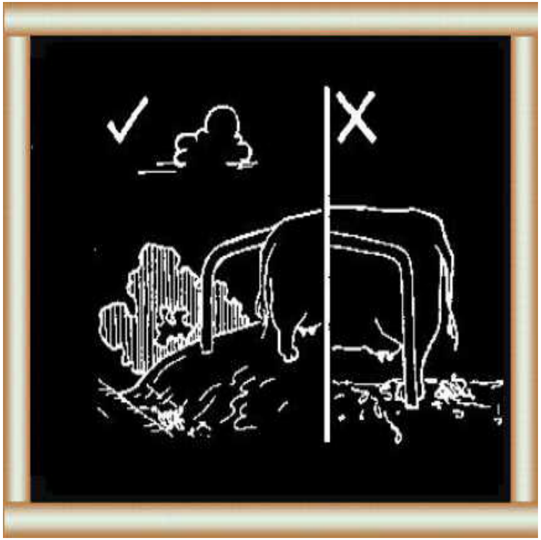
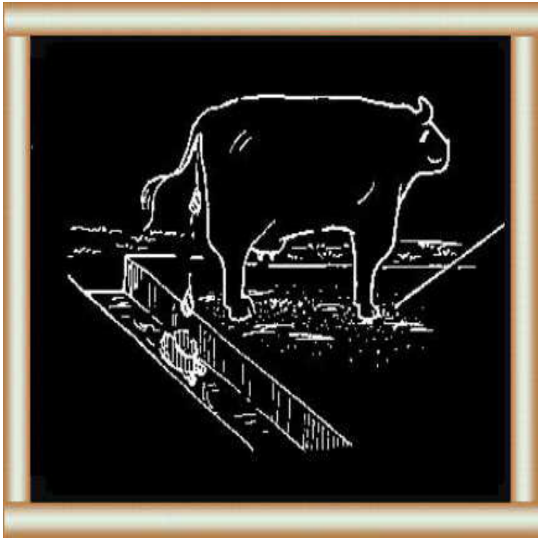


32 Make sure your floor has enough slope so that water and urine
- do not pool
- flow away from your animal.



33 Lay down suitable bedding e.g. saw-dust, straw, left-over roughage to soak up urine and to make compost manure.

34 Take your animals outside the shed for washing, bathing, spraying etc.

35 Use curtains made of local materials (bamboo strips, coconut fronds etc) where rain or cold draughts may disturb your animals.

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- Growing a few trees at a suitable distance away from the shed to provide shade and also to serve as a wind barrier

where appropriate. Fruit trees, tree legumes etc. are suitable. (36)

Construction of improved housing

The basic simple model can be improved upon in various ways. Some examples are discussed below. Before making recommendations to farmers, the extension officers should:

- Understand the benefits of these improvements. (37)

- Work out their costs, as applicable to the particular situation. (38)

- Discuss with the respective farmers the relevance of these improvements to their particular situations. (39)

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36 Grow trees (fruit, legume etc) at a suitable distance from your shed to provide shade and stop strong winds.

How can you construct improved housing to better meet the needs of your dairy animals?

37 In many ways but make sure:

- you understand how the improvements will help you

38
- you know how much the improvements cost

39
- you discuss with other farmers who have already made improvements.

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Siting the cow shed

If the cattle/buffalo are to be kept in the basement under the human dwelling or if a shed is to be constructed making use of an existing wall of a house, there will be very little choice in siting the cattle shed. (40)

If a choice is available, the following should be taken into account in siting.

- Well drained and at a higher elevation. (41)

- Trees for shade and to serve as wind breaks or possibility of growing them if no trees exist.

- Avoiding direct draught into shed and preventing severe winds blowing off the roof. (42)

- Convenient access, for supply of feed and water etc. and removal of milk. (43)

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Siting your cow shed

40 If you keep your animals:
- under your own house
- or in a shed attached to your house
the site is already selected.

41 If you can choose, your site should be:

- well drained

- on high ground

42

- near trees for shade and wind breaks or where you can grow trees

- where there are not strong draughts to make cattle ill or strong winds to blow the roof off

43

- easy to get to:
- to bring feed and water
- to take away milk.

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The layout

The layout is usually constrained by the availability of space and funds in the small farmer situation. Several alternatives can be considered. Flexibility, cost saving and optimum utilization of space (e.g. ceiling to store hay or straw) are important criteria. (44)

- If making use of an existing wall, an elongated shed can be constructed and an area can be separated for calves etc. (45)

- If making use of the basement of a human dwelling, an appropriate arrangement has to be devised, keeping in line with floor area. It may be that only Module 1 (see below) can be accommodated initially. (46-47)

Layout

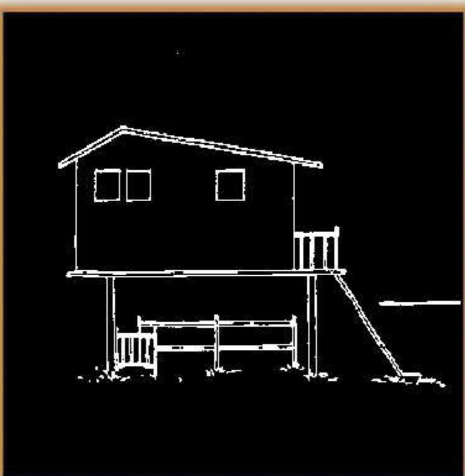
44 Small scale farmers should think carefully about

- good use of space

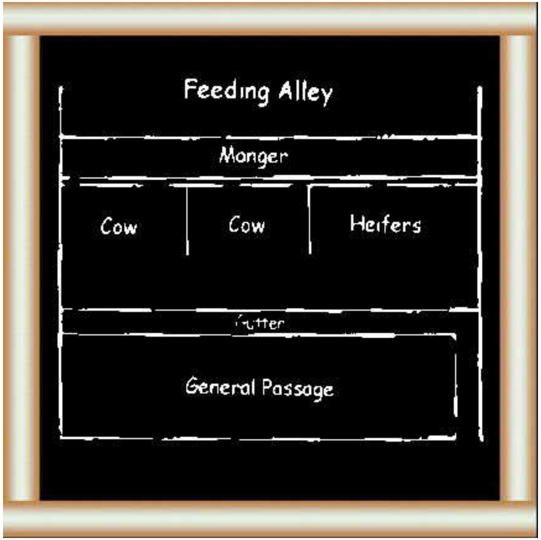
- low costs.

45 You can construct a shed against an

existing wall and make a separate area for calves.



46 If you use only the area under your house



47 you may use only Stage 1 of the cow shed plan (see below).

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- If adequate space is available, several alternatives can be considered. Two of them are presented here.

Open cattle shed for 2 cows/1 heifer/2 calves. The design was developed by MLDC/Sri Lanka. (48-51)

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48 If you have enough space, you could construct an open cattle shed for 2 cows, 1 heifer and 2 calves.

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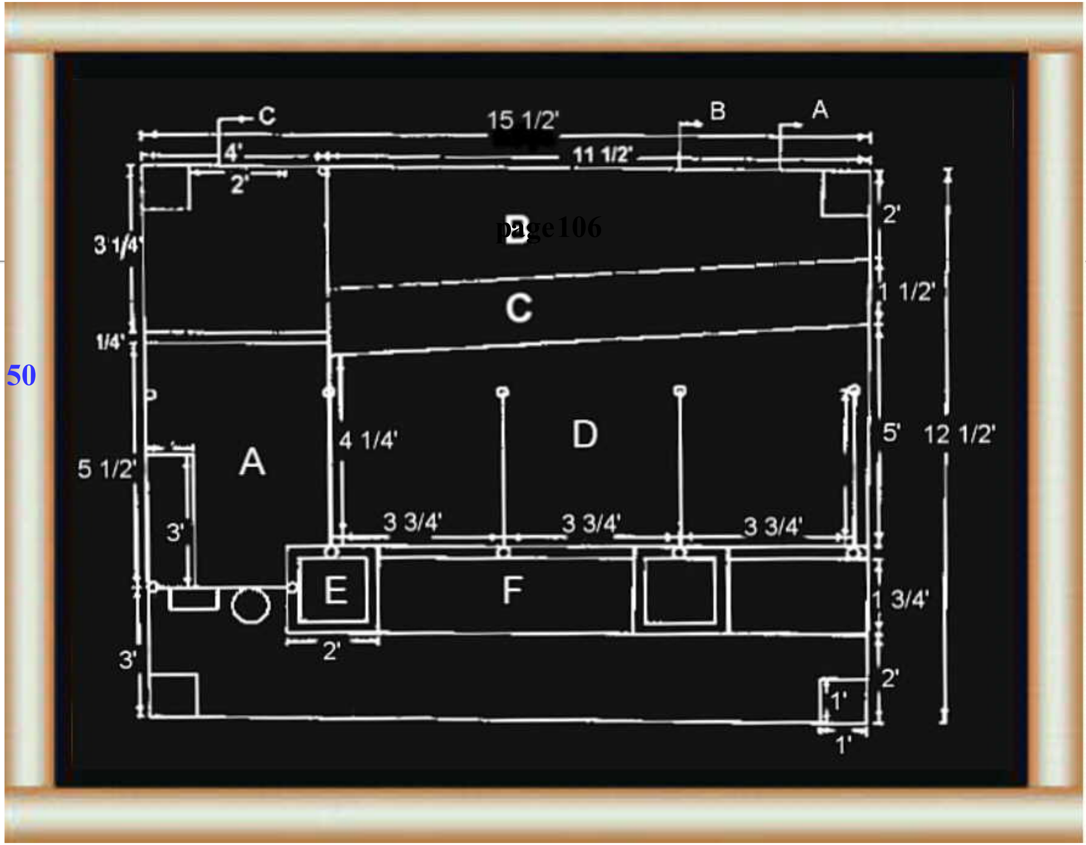
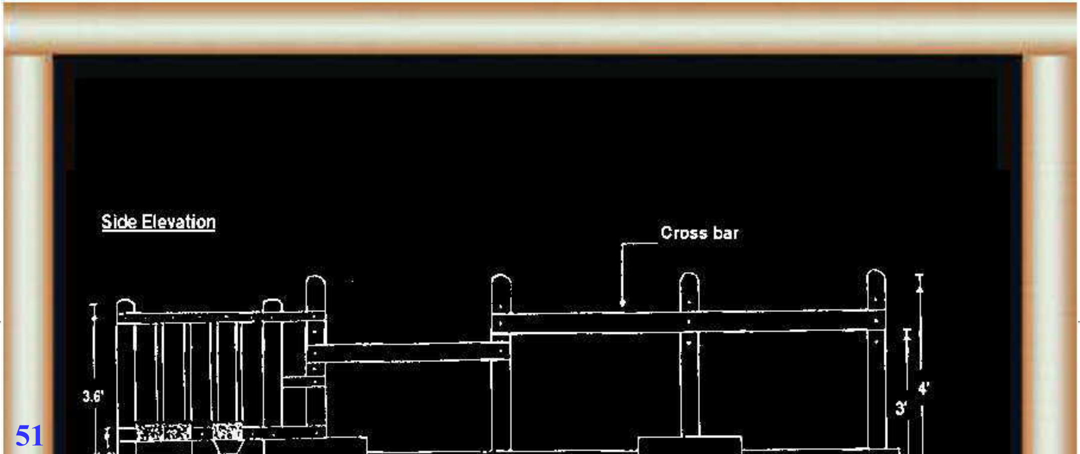
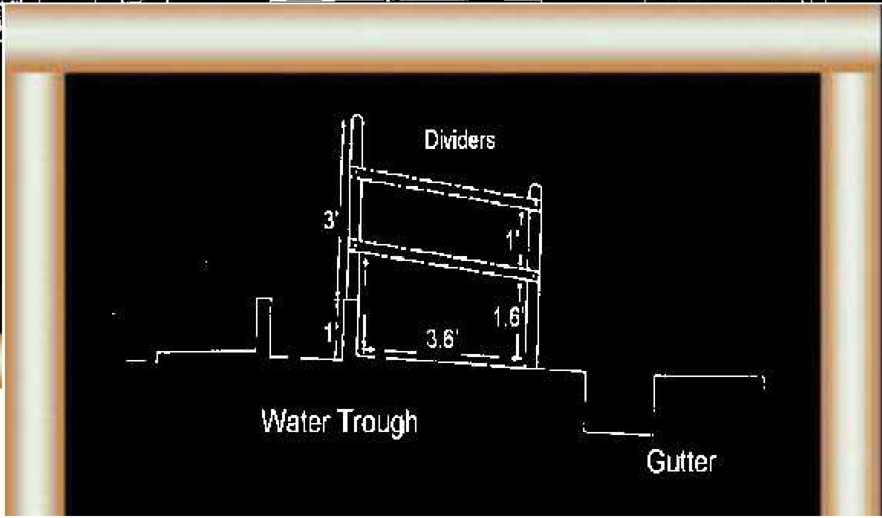
49

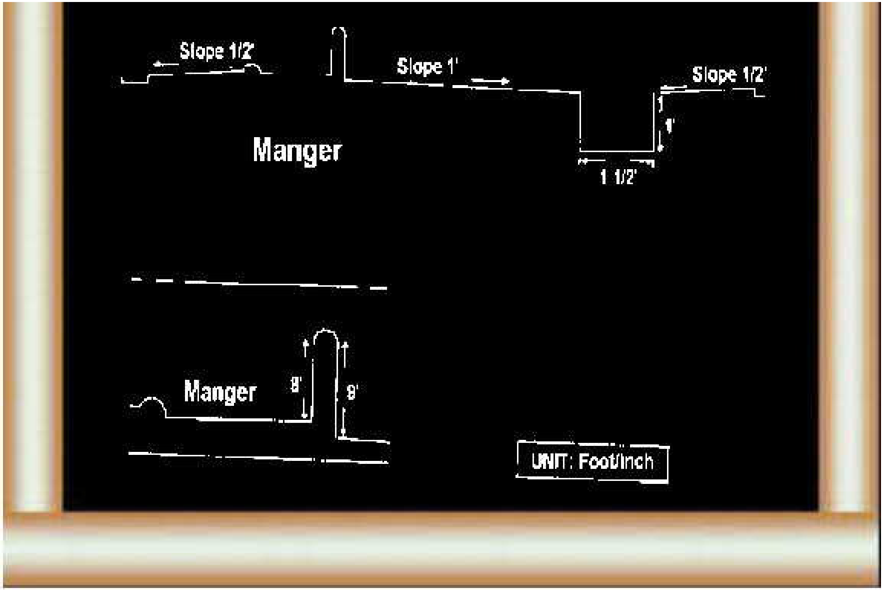
50


C
15 1/2'
B
A
4'
11 1/2'
2'
page106
B
2'
3 1/4'
C
1 1/2'
1/4'
4 1/4'
D
A
5'
12 1/2'
5 1/2'
3 3/4'
3 3/4'
3 3/4'
3'
E
F
1 3/4'
3'
2'
2'
1'
1'

51


Side Elevation
Cross bar
3.6'
3'
4'


Dividers
3'
1'
1'
1.6'
3.6'
Water Trough
Gutter



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Modular approach proposed by FAO-RDDTTAP. (52-53)

- Module 1 comprises the living area for the cows, heifers and calves. This is constructed initially on a simple layout,

according to the means of the smallholder.

- Module 2 comprises a movable calf box, storage for fresh fodder and exercise area with an attached manger added on subsequently as and when income from milk production permits. This addition would bring addi-tional benefits from healthier calves, higher breeding efficiency and ease of work.

- Module 3 comprises separate areas for concentrate feeds, farm equipment, water storage, and milk and milk utensils. This is added on to Modules 1 and 2 as and when income from milk production permits. The additional benefits would be from improved cleanliness of milk, ease of work and improved work efficiency.

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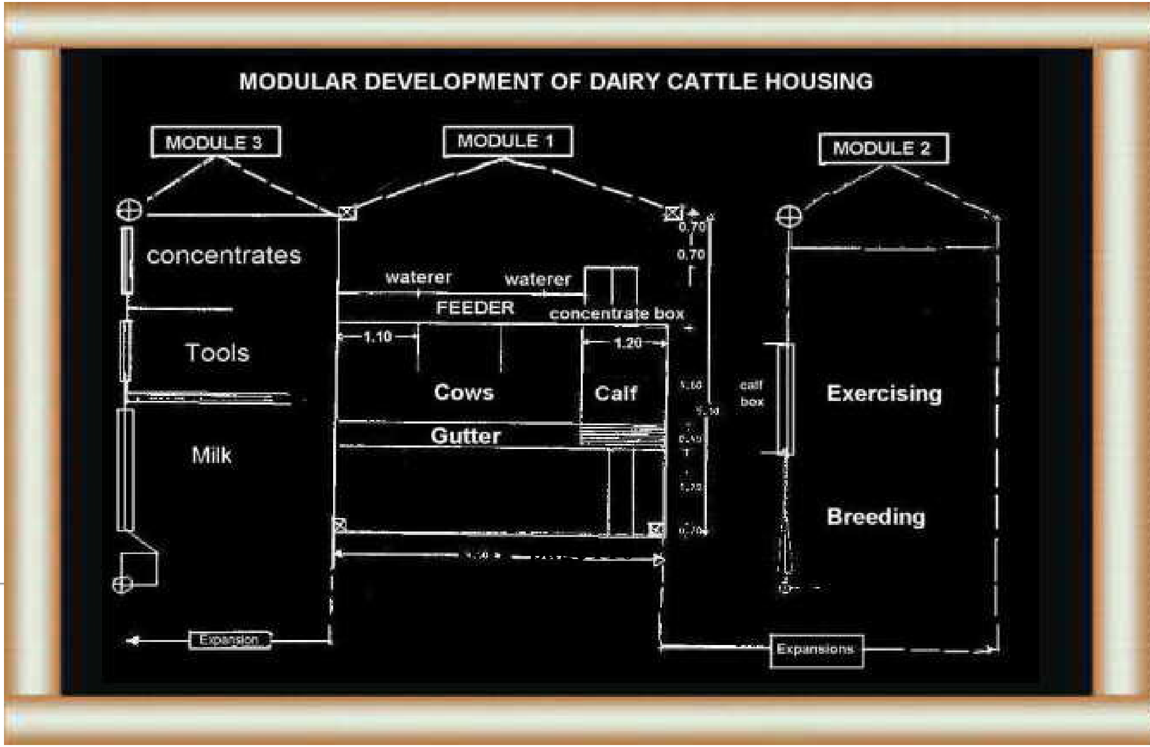
52 You could build your cattle shed in 3 stages (modular approach):


MODULAR DEVELOPMENT OF DAIRY CATTLE HOUSING
MODULE 3
MODULE 1
MODULE 2
concentrates
Tools
Milk
waterer
waterer
FEEDER
concentrate box
1.10
1.20
Cows
Calf
Gutter
0.70
0.70
calf
box
Exercising
Breeding
Expansion
Expansions

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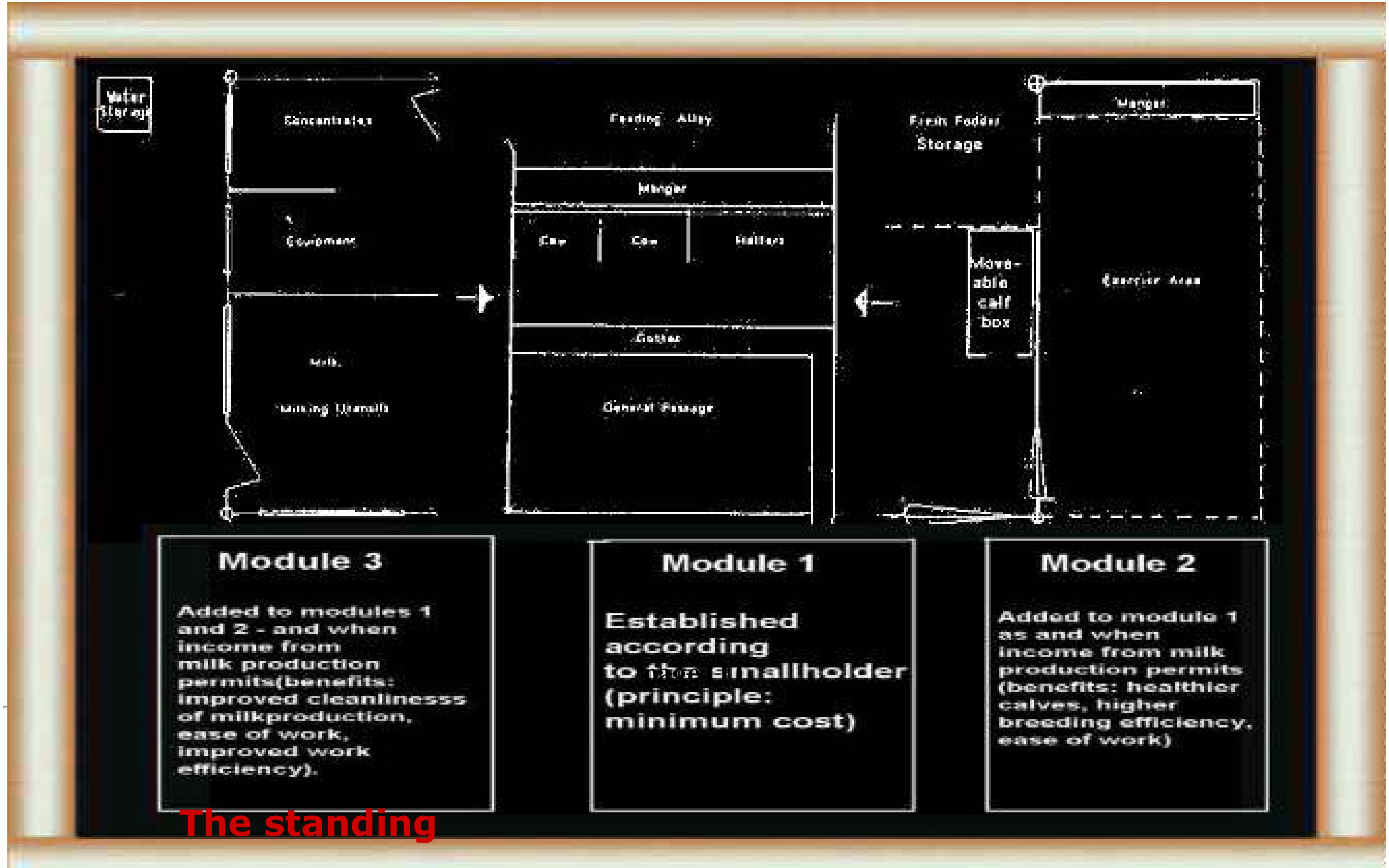

The standing

The standing is the area allowed for cows and heifers. (54)

The main aspects to be considered are the floor area, type of floor and slope, partitioning and tethering arrangements.

Floor area

The floor area on the standing allowed for each cow/heifer depends on the size of the animal. The principle is to provide adequate space for the animal to lie down in comfort and to get up without obstruction. At the same time the urine and dung should drop away from the animal, preferably into the gutter (dung channel). (55)

The standing area usually allowed for a crossbred dairy cow is about 1.60 m x 1.10 m (See Module 1). (56)

The area for the heifers can be reduced by changing the position of the gutter (See MLDC layout). (57)

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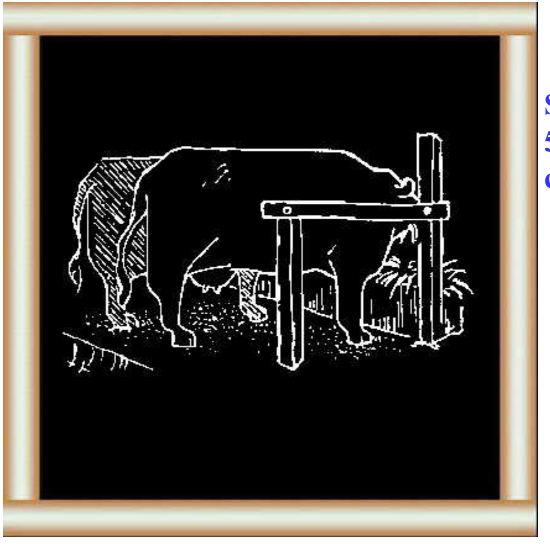
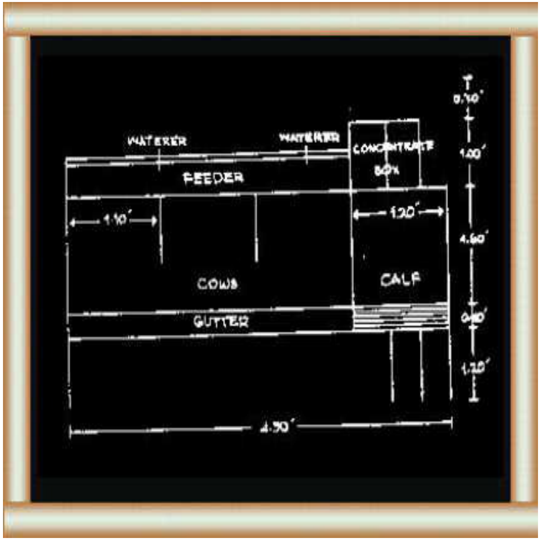


Standing

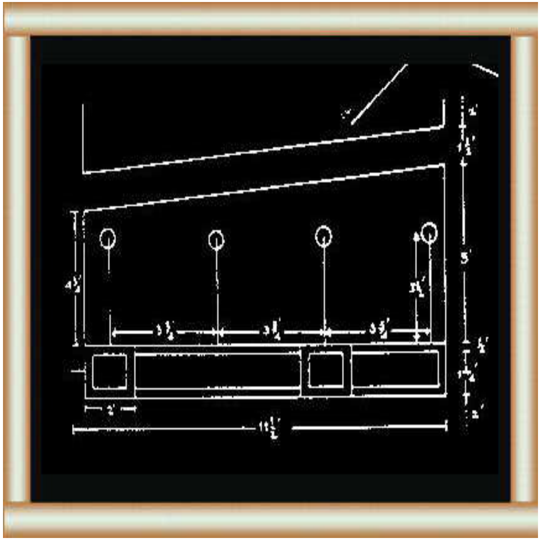
54 The standing is the area for your cows and heifers.

Floor area

55 Your animal should be able to lie down and get up easily.



56 A crossbred dairy cow needs about 1.60 m x 1.10 m. (See Module 1 in 52-53 above)



57 Heifers need a smaller area and you can angle the gutter. (See 49 above)

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Slightly larger areas are being recommended for buffaloes (2.25 m x 1.35 m). (58)

Type of floor and slope

The floor can be made of:

Rammed earth and gravel (59)

For a rammed earth and gravel floor, a slope of about 3 % or 1 in 30 (towards the gutter) will be required. (60)

The main advantage of a rammed earth and gravel floor is its low initial cost. However, it needs constant maintenance to prevent the appearance of uneven areas where pools of mud and urine will form. (61)

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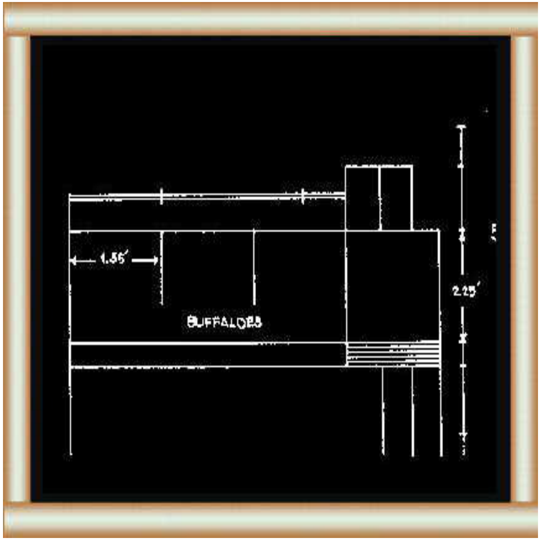

58 Buffaloes need a larger area - about 2.25 m x 1.35 m.

Type of floor and slope

Rammed earth and gravel

59 You can make the floor of rammed earth and gravel.

60 Make the slope 1 in 30 (3 %) towards the gutter.

61 This floor is low cost but:
- you must keep it flat (and sloping) to prevent pools of mud and urine

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There are also difficulties in collecting all the urine for fertilizer or compost making because part of it will be absorbed into the floor. (62)

This can be partially overcome by having sufficient bedding e.g. saw dust, straw or left over roughage around the hind quarters of the animals. (63)

Large pieces of rubble with the flat surface facing up

The rubble is laid on and bound together with a mixture of cement and sand, e.g. 1:3. (64-67)

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62

- it is difficult to collect urine for compost manure because it soaks into the floor.

63 You can help soak up urine by putting bedding (e.g. saw-dust, straw, left-over roughage) around the back of the animal.

Rubble and cement

64 You can make the floor of rubble and cement.

65 Make sure the site is sloping at least 1 in 60 (1.5 %) towards the gutter.

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7.5 cm layer of concrete

Cement, sand and gravel are mixed in a suitable ratio, e.g. 1:3:3. (68-71)

The slope can be reduced to about 1.5 % or 1 in 60 when large rubble on cement or concrete is used.

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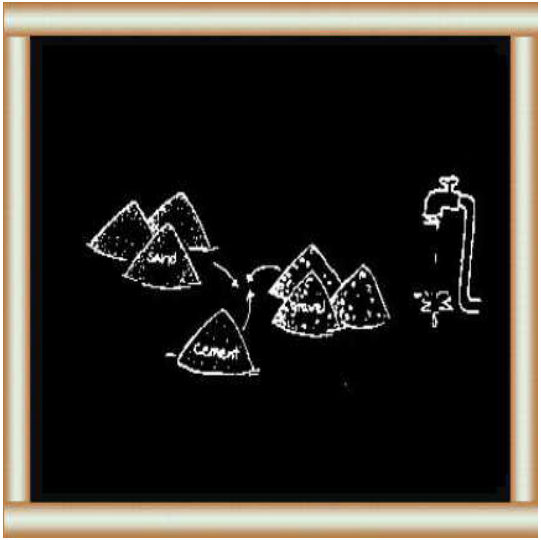
66 Lay down the rubble with the flat side up. Follow the slope.
Mix 1 part of cement with 3 parts of sand and a little water.

67 Pour the sand/cement mixture between the rubble and make a flat surface.
Check the slope is still at least 1 in 60.

Concrete

68 You can make your floor of

concrete.
Make a wooden frame 7.5 cm deep with strong supports.
Remember: 1 in 60 slope



69 Mix 1 part of cement with 3 parts of sand, 3 parts of gravel and a little water.

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Wooden floors

Wooden floors should be used only where the wood is of good quality and freely available. The costs of maintenance and repair increase as good quality wood becomes scarce. (72-73)

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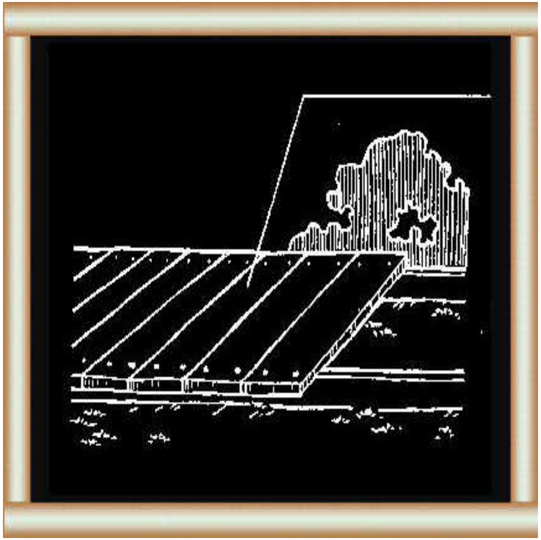
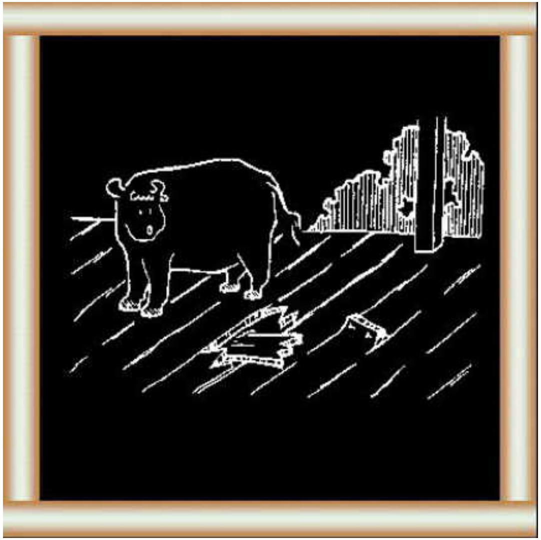
70 Pour the concrete into the frame with a bucket.
Use a spade to push down the concrete and to make the surface flat.

71 Make a fence round the floor to protect it and sprinkle water for 2-3 days until the concrete sets.



Wooden floor

72 You can make a wooden floor.



Use good quality wood.
73 Maintenance and repair costs are high for poor quality wood.

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Partitioning

Partitioning within the shed keeps the calves separated from the adult cattle and also restricts the movement of the adult cattle across the standing. If the animals are allowed free movement across the standing, dung and urine will be dropped all over (may affect hygiene and make cleaning more difficult) and injuries may be caused e.g. by one

animal trampling another's udder. (74-76)
The partitions can be made of wood available in the area or galvanized piping or a combination of the two. Initial costs and costs of maintenance should be taken into account in deciding what to use. (77)

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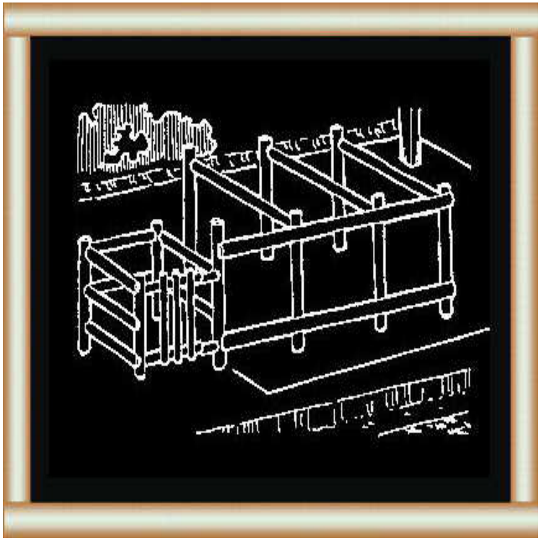
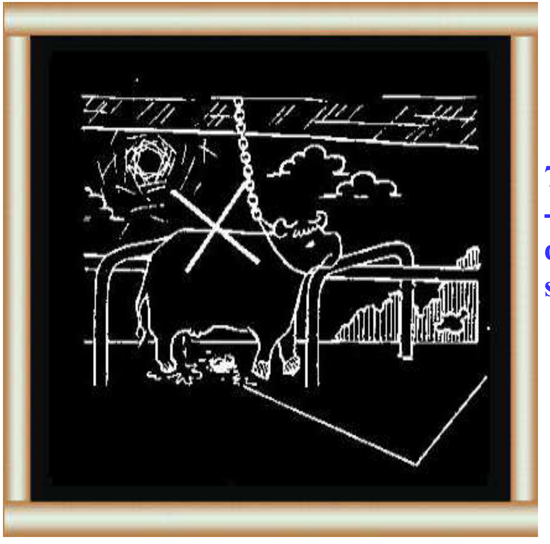


Partitioning
74 You need partitioning to:
- separate your calves from your adult cattle

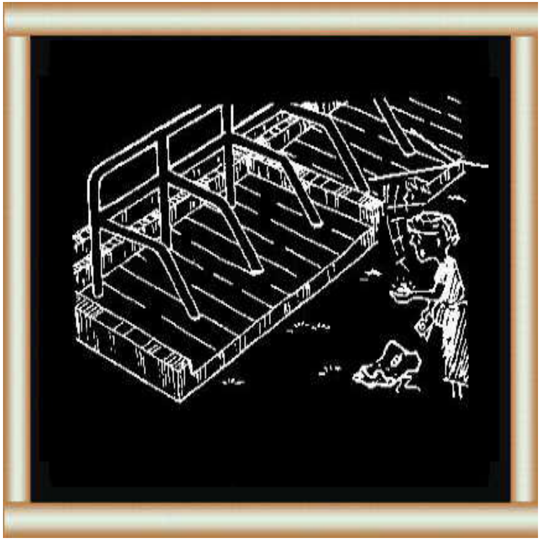


75

- stop your animals moving around and dropping dung and urine on the standing; cleaning is difficult.

76

- stop one animal trampling on another animal's udder; this may cause injury (and mastitis).



77 You can use wood or galvanized piping or both.
Plan carefully for construction and maintenance costs.

page123

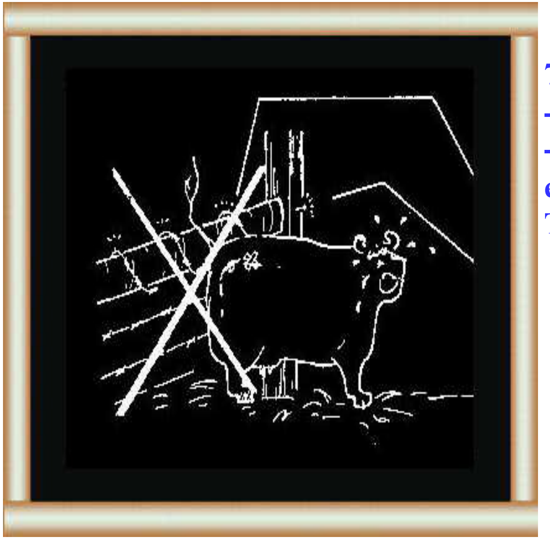
Barbed wire should never be used on partitions. Nails, or pointed or sharp edges of the material used should not be allowed to protrude because these can injure the animals. (78)

Partitions (dividers) between two adult animals are usually placed about 1.10 m apart and may extend only a distance of about 100.0 cm from the head of the standing to allow free

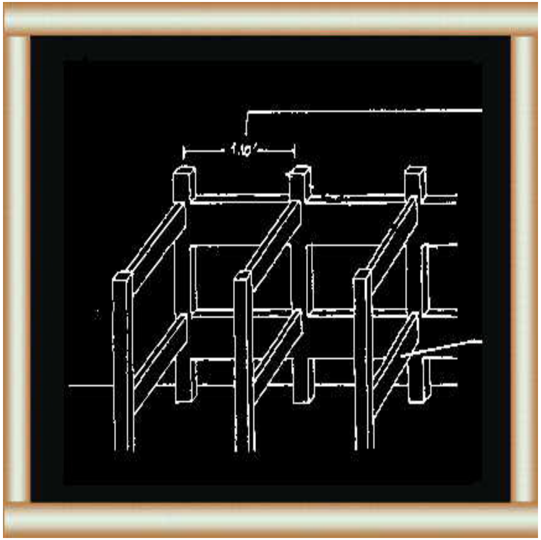
access to the animal for milking etc. They may consist of two rafters (e.g. coconut), placed about 30.0 cm apart with the top one at a height of about 75.0 cm., fitted to two wooden posts, one at the head of standing and the other about 100.0 cm from it; or a 40.0 mm. diameter galvanized pipe fitted to a wooden or galvanized post at the head end, and bent about 100.0 cm away so that the other end can be buried in the standing. (79-80)

Tethering arrangements

The simplest tethering arrangement is to tie the animal by its neck to a wooden post erected on the floor, using a coir (coconut fibre) rope. However, to prevent injuries to the animals and also to restrict its movements various improvements have been made. (81)

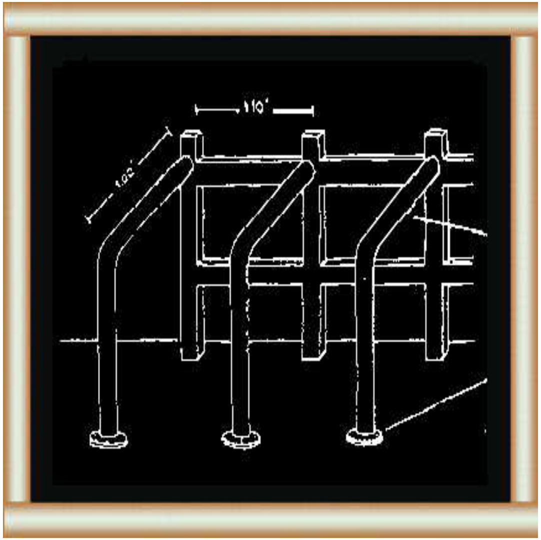


78 Never
- use barb wire
- leave nails sticking out or pointed edges.
These can injure your animal.



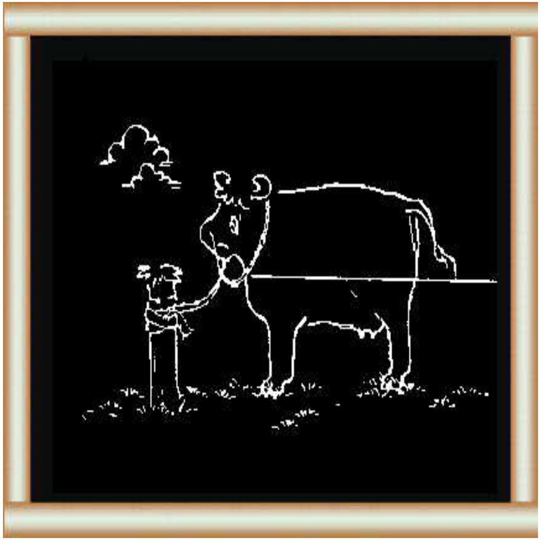
79 For adult animals, place wooden partitions about 1.10 m apart with a length of 1.00 m - so you can easily get to your cow for milking

80 You can also use 40 mm diameter



galvanized piping.
Bend at 1.00 m and bury the bottom in the standing.

Tethering



81 It is very easy to use a coconut fibre (coir) rope tied to a post.
But your animal can get injured by the rope.

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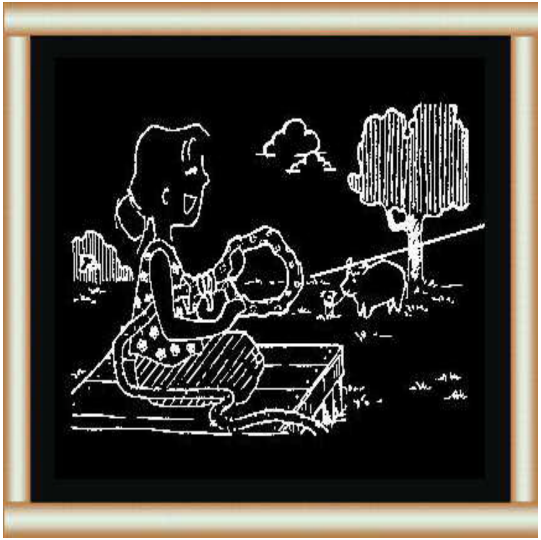
The rope itself can be lined on the outside with a cotton cloth and a girdle placed round the animal's neck. Ordinary coir rope is then used to connect this girdle to a post or other stay. The coir can be replaced by more durable and smooth material e.g. nylon or an iron chain. (82-83)

The stay for tying each animal may be an iron ring fixed to the floor close to the manger halfway between two

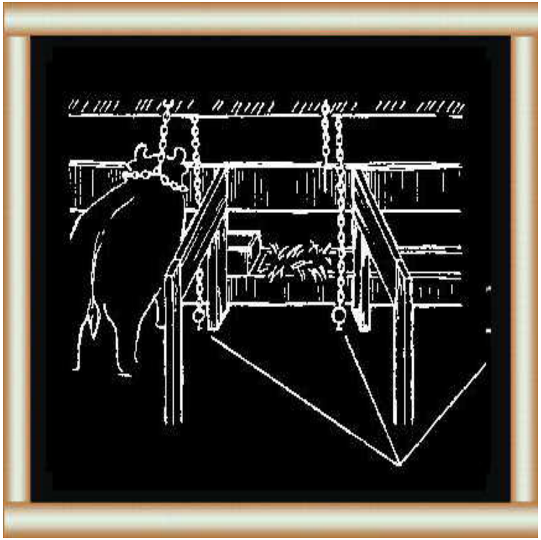
partitions. Alternatively, two rings may be fixed for each animal, one close to each partition, so that the animal is more restricted to the centre of the standing. (84-85)

page126

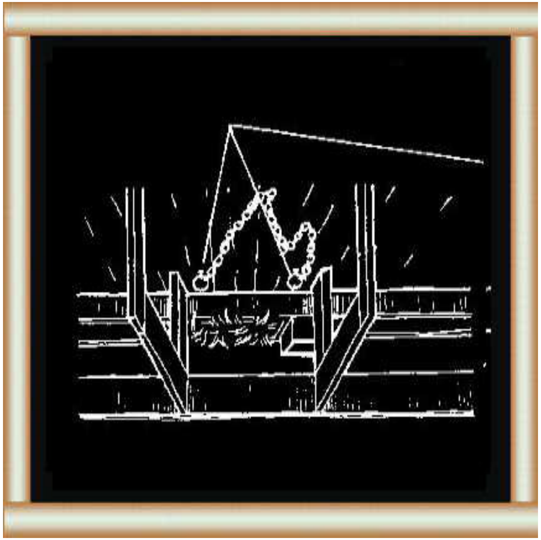


82 Wrap the rope with cloth and make a girdle to go around your animal's neck

83 or use a strong smooth material like nylon or an iron chain.



84 You can fix an iron ring (stay) to the floor near the manger between the partitions.



85 By fixing two rings close to the partitions, you can keep your animal near the centre of the standing.

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There are more elaborate tethering arrangements e.g. fixing an iron girdle round the neck which then gets attached by a chain to two points, one on the floor and the other above the animal. Most of the elaborations have been introduced with convenience of operation and the requirements of various feeding arrangement etc. as the basis. (86-87)

The gutter (also called drain or dung channel)

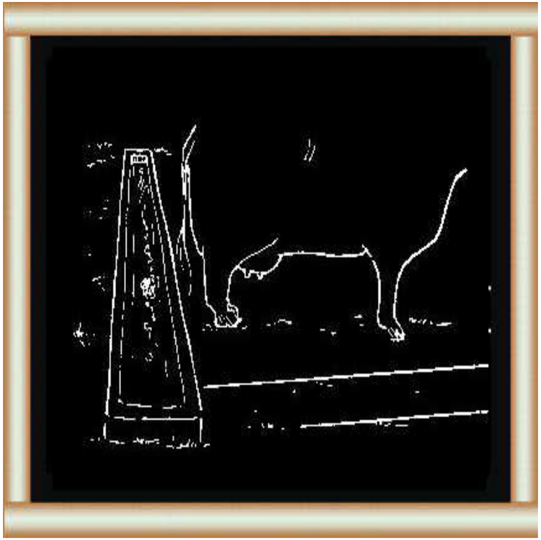
Even when the floor is of rammed earth and gravel, it is best to have the gutter made in rubble and cement or brick and cement. (88)
If the sides of the gutter are not strong, they will continuously erode into the gutter and proper maintenance of the floor of the standing will be impossible. By having the gutter finished smooth with cement and sand, cleaning will be convenient and the dung and urine can easily be led into a urine pit or a bio-gas digester outside the shed. (89-91)

86 This tether has an iron girdle and a chain fixed to the floor and above the animal.

87 Choose a design which is:

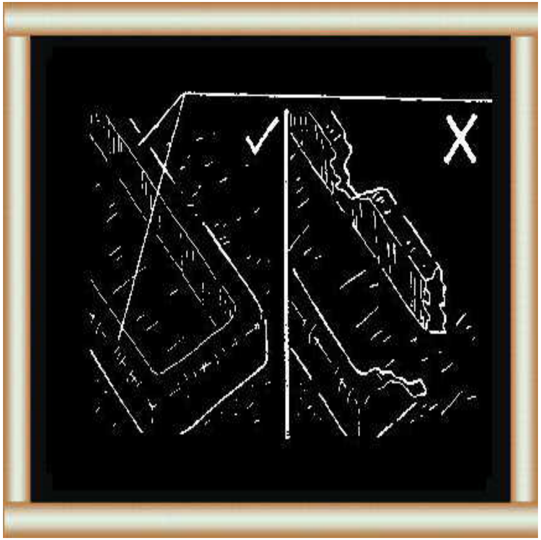
- easy to use

- suitable for your feeding arrangements.



Gutter (Drain or Dung Channel)

88 Always make your gutter of rubble (or brick) and cement, even if your floor is rammed earth and gravel.



89 This makes sure the sides of the gutter are strong for good maintenance of the floor.

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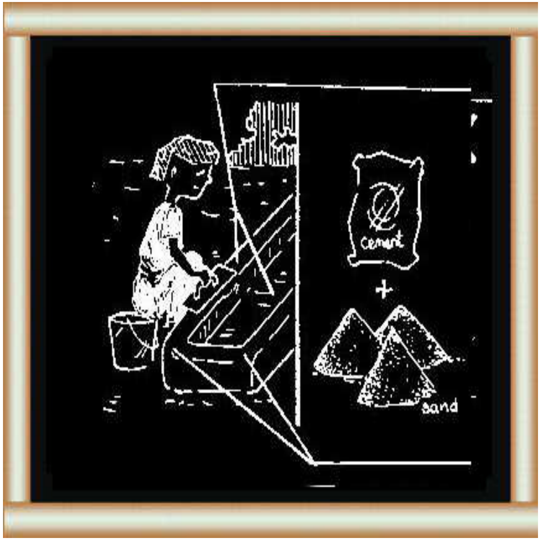
The gutter may be about 15.0 cm deep at the start, 40.0 cm wide with a slope of about of 2.5 % or 1 in 40 lengthwise. Gutters of 30.0 cm depth are also being used to prevent animals standing in the gutter and dropping dung and urine on the passage.

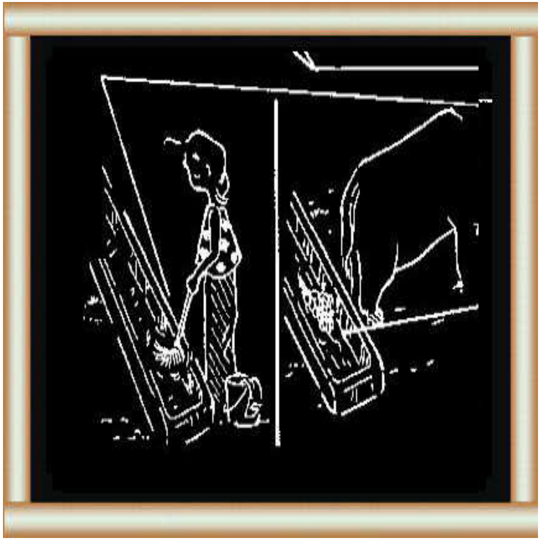
If cement rendering is used, the edges may be rounded to facilitate cleaning. The gutter may lead to a urine pit about

60.0 cm x 60.0 cm and 40.0 cm deep or to a bio-gas digester. (92-93)

page130

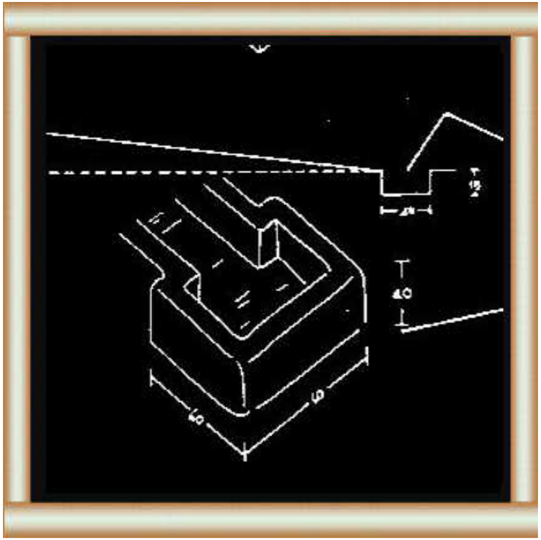


90 Make walls and bottom of the gutter smooth with a sand/ cement mixture and round the edges



91 so the gutter is easy to clean and carries urine and dung easily to a urine pit or bio-gas digester.

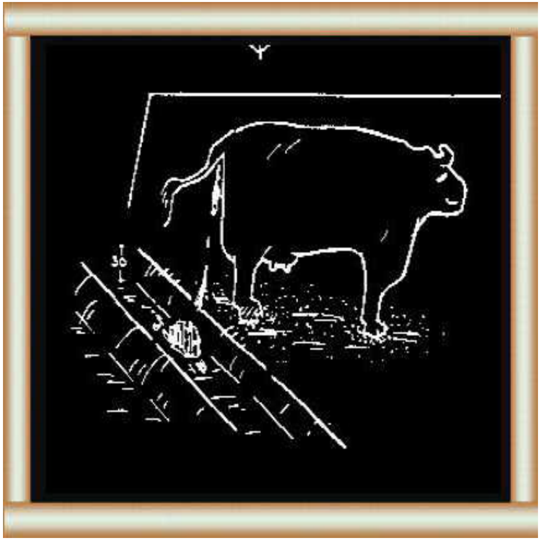
92 The gutter can be about 15 cm deep,



40 cm wide with a slope of 1 in 40 (2.5 %).

It can lead to a urine pit (60 cm x 60 cm x 40 cm deep) or a bio-gas digester.

93 Some farmers use 30 cm deep



gutters to prevent animals:
- standing in the gutter
- dropping dung and urine on the standing.

The feeder (also called the manger)

The floor of the feeder can be made with rammed earth, rubble on cement or cement concrete. (94)

In its simplest form, the feeder is an area separated out from the standing with a wooden plank. There is a slope away from the animal of about 2.5 % or 1 in 40. (95).

The disadvantages of this arrangement are: (96)

- the animal cannot pick up some of the feed which may thus get wasted;

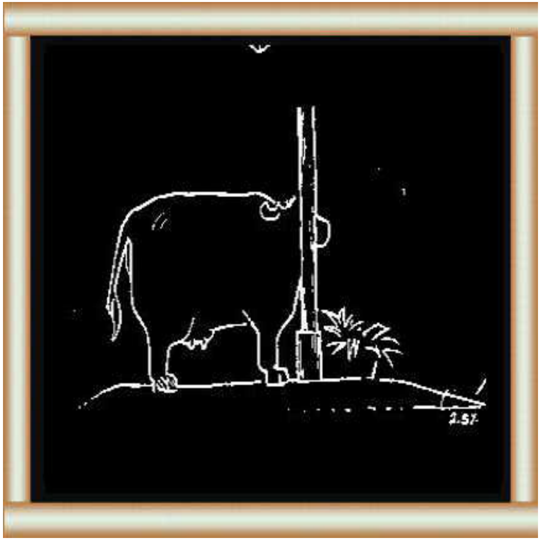
- a container has to be used for feeding concentrates.

The feeder may be made of wooden planks, bamboo poles, bamboo strips or galvanized sheets. A metal barrel cut into two may also be used as a feeder. This will corrode rapidly if used for silage feeding. (97-98)

page132

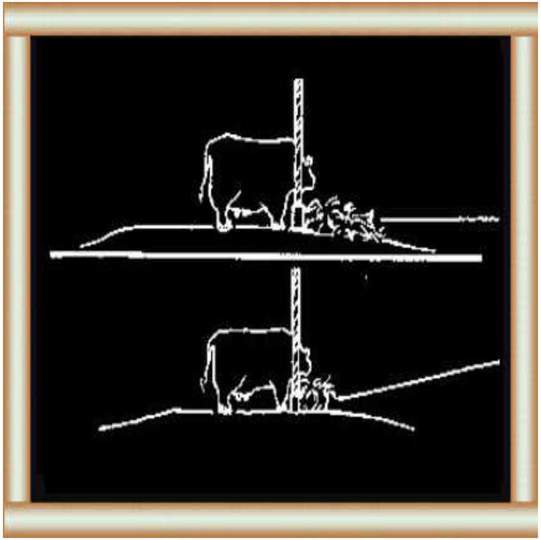
Feeder (or manger)

94 You can make the floor of the feeder of:
- rammed earth
- rubble/cement or
- concrete.



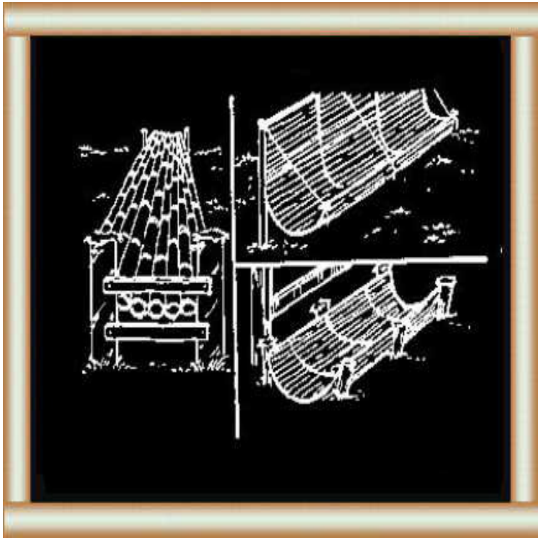
95 The floor of the feeder should slope away from the animal 1 in 40 (2.5 %) but this simple design has problems:

96



- your animal cannot pick up some of the feed and it is wasted
- you need a container for concentrates.

97 You can make the feeder of:



- wooden planks
- bamboo poles
- bamboo strips
- galvanized sheets

page133

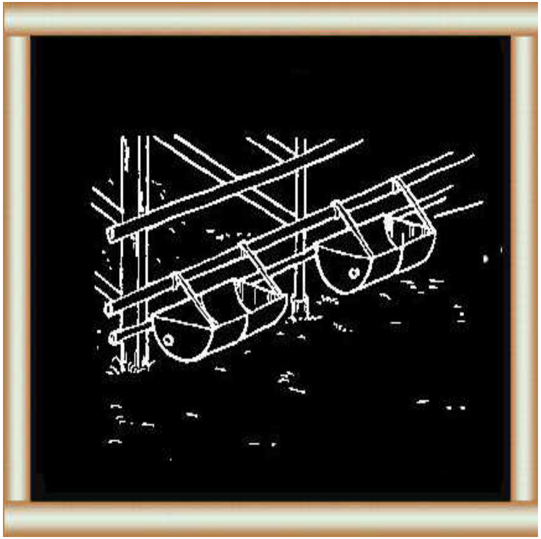
When constructing feeders with brick and cement, a rule to remember is that: "The higher the bottom of the trough, the further the animal is able to reach into it to feed." (99)

A wooden shaft or galvanized piping may be fitted at a height of 90.0 cm from the ground and over the wooden partition (head rail) to prevent the animal attempting to get into the feeder area. (100)

The waterer

The simplest method is to supply water in buckets several times daily (at least three times a day). (101)

page134

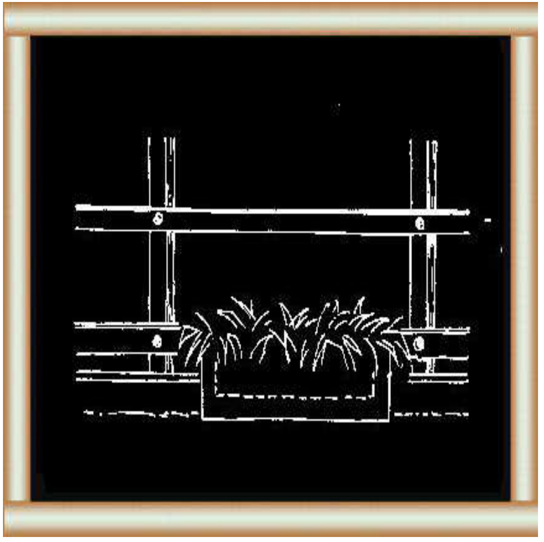


98 or metal barrels cut in 2
but these will corrode rapidly if used for silage feeding.

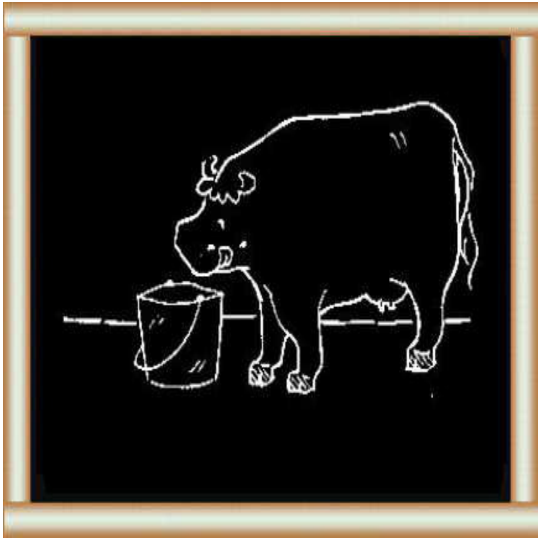
99 If you use brick and cement, remember:

- your animal can reach further to feed with a high bottom.

100 Fit a piece of wood or galvanized



pipe 90 cm above the floor to prevent your animal getting into the feeding area.



Watering

101 It is easy to provide water in buckets several times a day (at least 3 times).

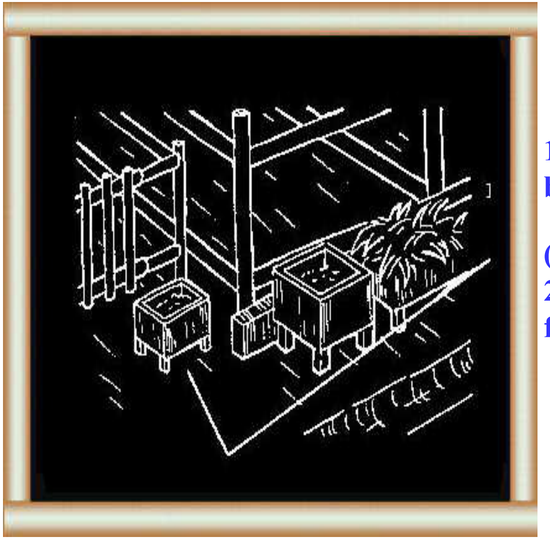
page135

Water requirements are better met by making water available to the animals throughout the day by having a small compartment in a cement/concrete manger or having a small water tank (e.g. 60.0 cm x 50.0 cm and height 20.0 cm) constructed by the side of the manger. (See the MLDC arrangement providing one common tank to two animals 48-51). (102)

The roof

When the animals are to be housed in a basement of a human dwelling or under a stack of straw, the material to be used for the roof, roof arrangement etc. is already decided. But when a separate shed is constructed, the most appropriate and least expensive alternatives should be selected. Materials that can be used for the roof are many. The decision has to be made considering various aspects. (103)

Cadjans, straw, dried grasses and other seasoned leaves are being used in many areas. The supporting structure can also be very simple in these cases, which makes it quite economical initially. However, these materials need replacement at regular intervals of 1-3 years depending on the material used and how skillfully the job is done. Therefore, maintenance is more costly than roofs made of clay tiles or galvanized sheets. (104-107)



102 It is better to provide water all day by having a water tank

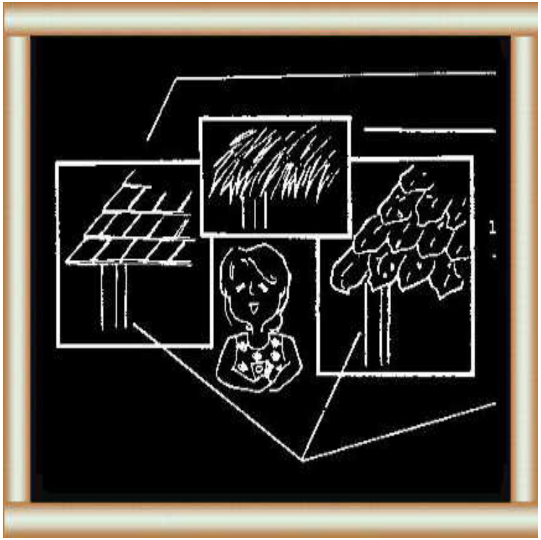
(e.g. cement/concrete 60 cm x 50 cm x 20 cm deep) beside the manger (1 tank for 2 animals).

Roof

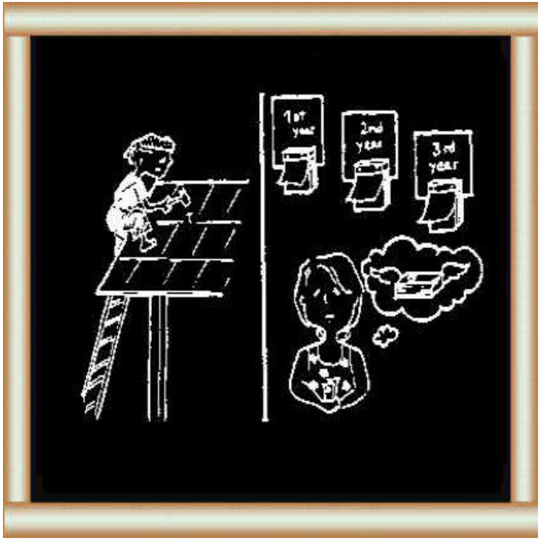
103 When you choose roof materials, you should think about:

- purchase cost

- maintenance and repair costs.



104 Coconut frond mats, straw and dried grasses, seasoned leaves need a simple support and are cheap to buy.



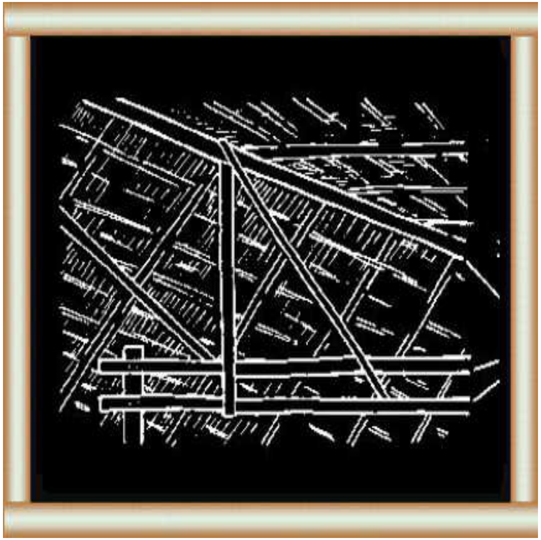
105 If the materials are good and the labour skilful, they may last 3 years so your maintenance and repair costs are high.

page137

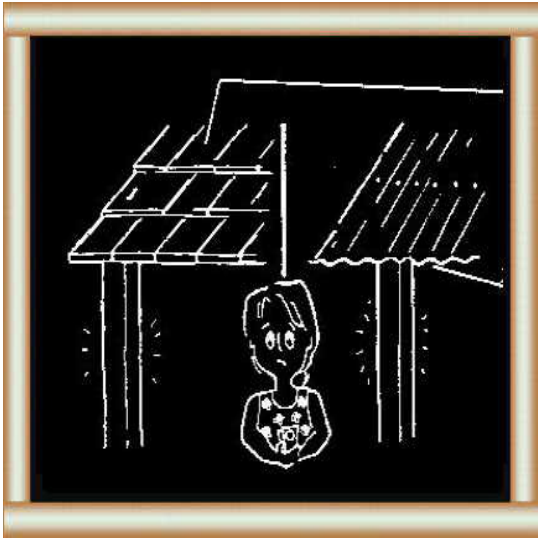
Roofs made of clay tiles or galvanized sheets are more expensive and, together with the strong supporting structure required especially for clay tiles, the initial expenditure can be extremely high. (108-109)

page138

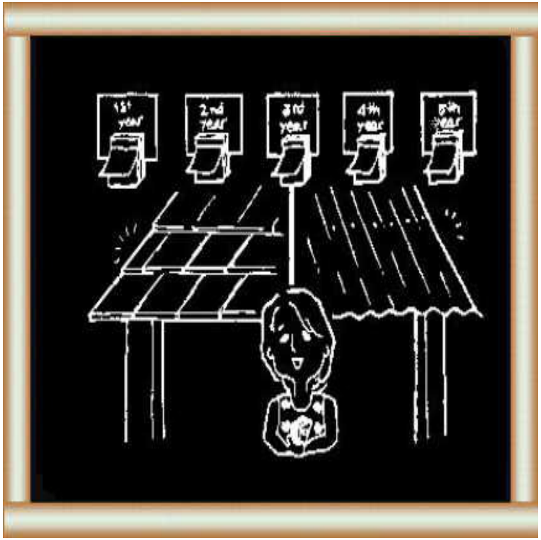
106 This is a large straw (thatched) roof



107 and its supporting structure of wood or bamboo.



108 Clay tiles, galvanized sheets need a stronger support and are more expensive to buy



109 but they last longer so your maintenance and repair costs are lower.

page139

In addition, in warm areas with bright sunlight and when there are no shade trees, the temperatures within the shed can be too high to be comfortable for dairy cattle. This effect can be overcome by having an overlay of cadjan or straw or by having a warm air outlet on the roof. The warm air outlet can be provided by having the roof at two levels. (110-112)

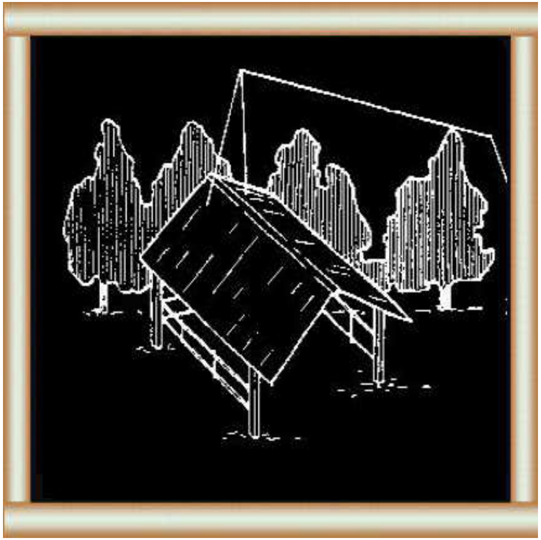
When an existing wall is used as one side of the shed, the lean-to roof (with a single slope) is the most convenient arrangement. When a separate shed is constructed away from other structures, a roof sloping in either direction from the centre would be best. (113, 116)

page140

110 In tropical areas with little shade it can get very hot in the shed with a tile or galvanized roof.

111 You can keep the shed cooler by laying mats, straw or leaves over the tiles or galvanized sheets

112 or by having a warm air outlet e.g. with the roof on 2 levels.



113 If the shed is separate from other buildings, a roof sloping in 2 directions away from the centre is best.

page141

The height of the roof at the eaves should be adequate to allow easy access and ventilation, but should not exceed 2.40 m. Excess height can result in rain beating in and may make it easier for the roof to get blown off by severe blowing. (114)

Having the roof extended about 60.0 cm beyond the floor

area will also help in reducing the rain beating in. At the same time, curtains can be attached to the roof where necessary. (115)

Pillars and posts

Pillars and posts within the shed can be made of wood, galvanized piping (of appropriate gauge and diameter), bricks and cement or cement concrete. When wood and or galvanized piping is used, durability can be improved by having the bottom of the pillar made of concrete up to a height of about 30.0 cm. (117-118)

page142

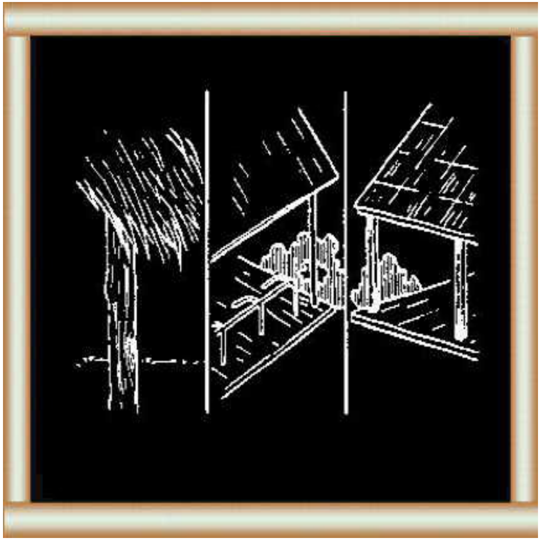
114 Make the height at the eaves enough for good ventilation but not more than 2.40 m - rain may blow in and the roof may blow off.

115 Make the eaves of the roof 60 cm beyond the floor area to prevent rain blowing in.
Fit curtains if necessary.

116 If you use the wall of another building, a single slope roof is best.

Pillars and posts

117 Pillars and posts within the shed



can be made of:
- wood
- galvanized piping (of correct gauge and diameter) or
- bricks/cement or concrete.

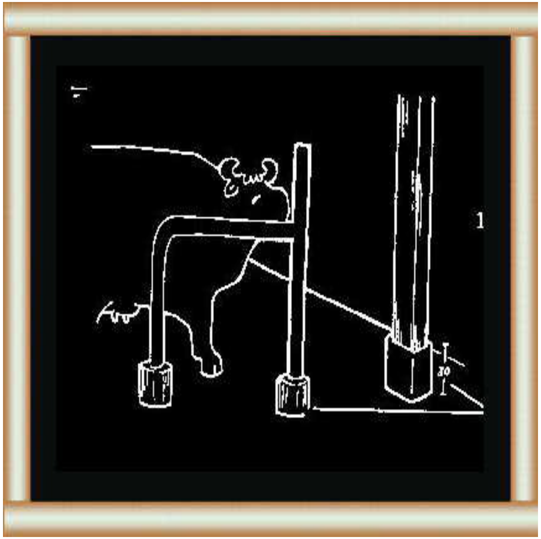
page143

Side walls, curtains etc.

For most places in the region, the best arrangement would be to have the sides open. When the shed is constructed making use of an existing wall, it automatically gets bounded by a complete wall on one side. Consideration should be given to the possibility of selecting a wall which

would also serve as a wind barrier where strong winds are present. It is usual to have the feeder towards the wall end of the standing as more space is required at the hind end of the animal for milking, A.I. etc. (119-121)

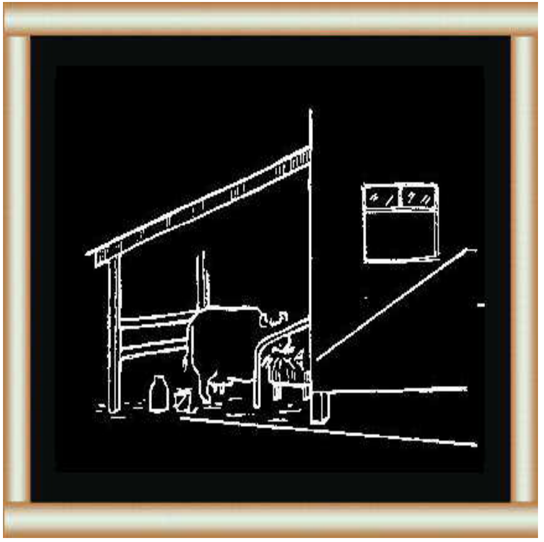
page144



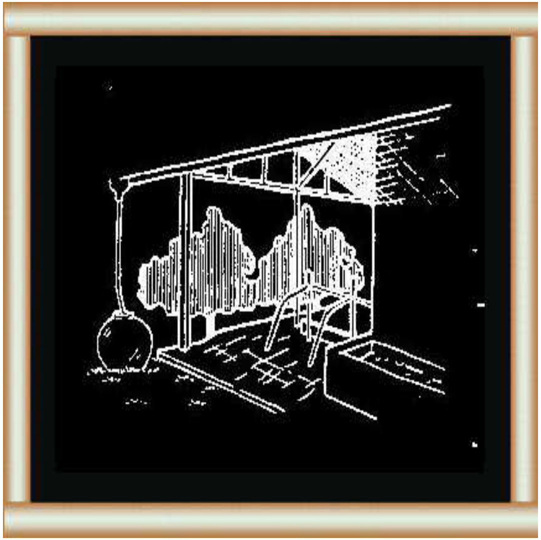
118 You can make wood and galvanized piping last longer by putting concrete around the base of the pillar to a height of 30 cm.

Side walls and curtains

119 Choose the wall of another building which helps protect from wind and rain.



120 Place the feeder near wall so you have more space at the back of your animal for milking, A.I. etc.



121 In most areas, it is better to have the sides open.

page145

In areas with extremely cold winters and/or strong cold winds, it may be necessary to construct half walls or even full walls on one or more sides of the shed. These should be considered only when a temporary curtain is not sufficient. (122, 124))

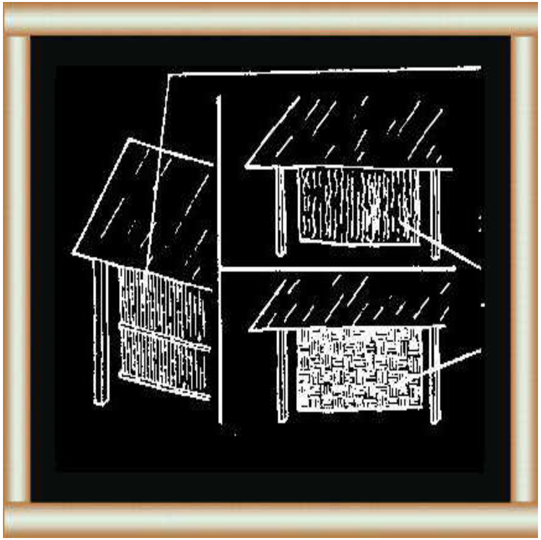
The material to be used for curtains can vary from dried

grass or straw to cadjan or bamboo strips. (123)

The material to be used for the half walls/walls may be bamboo or any other wood, wooden planks, wattle and daub (wood/bamboo structure covered with mud) plastered with lime and sand mixture or brick and cement. (125)

page146

122 In areas with cold winters and/or strong cold winds, try to use temporary curtains.



123 You can make the curtains of:
- bamboo strips
- straw or dried grass
- coconut frond mats.

124 If curtains do not give enough

protection, make:

- half walls or
- full walls

on one or more sides of the shed.

125 You can make walls of:
- bamboo or wood
- wattle and daub
- bricks and cement.

page147

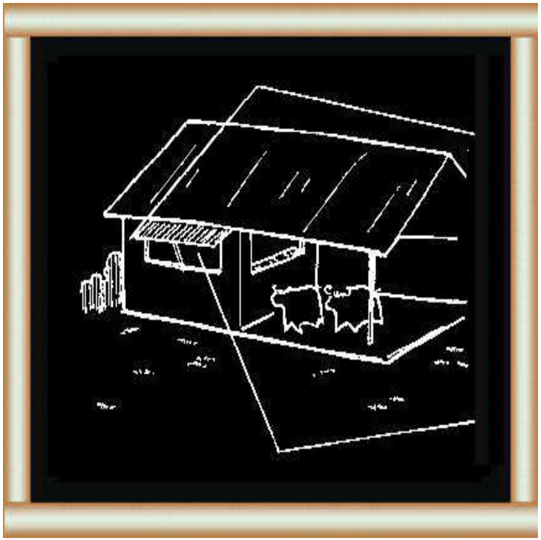
Storage of milk utensils

The ideal arrangement would be to have a separate room with good light and ventilation for storing milk utensils. (126)

However, a sufficient degree of cleanliness and hygiene can be achieved by having a rack attached to an existing wall or

provid-ing an arrangement to hold the milk cans against a post but not close to standings or gutters. It is necessary that the wash waters get drained off making the utensils dry and that the dust is not disturbed or any dung/urine etc. does not get splashed into the utensils while they are being stored. (127-130)

page148



Storing milk utensils

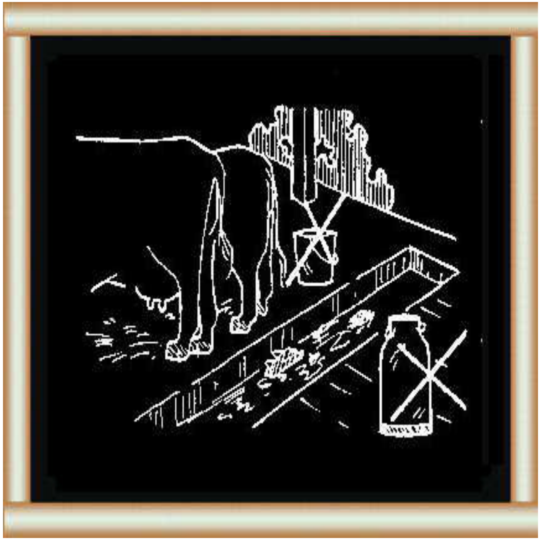
126 if possible, have a separate room for storing milk utensils.

Make sure there is good light and ventilation.

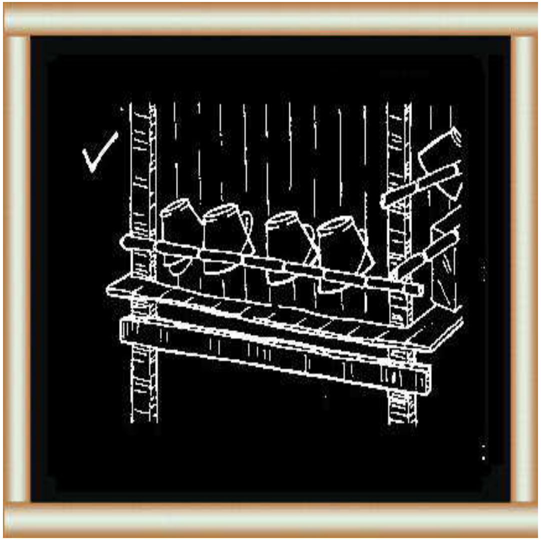
127 But you can keep things clean by:

- making a rack on a wall or

- hanging cans against a post.



128 Do not store milk utensils close to standings or gutters.



129 Make sure the water can drain off the utensils easily.

page149

Collection and storage of rain water

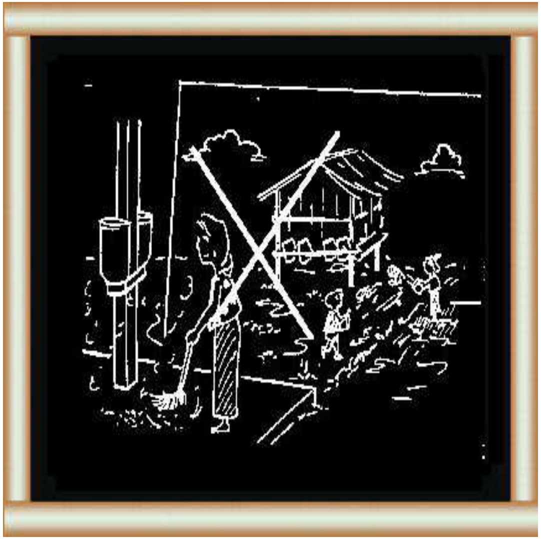
Rain is a very cheap source of clean water suitable for all purposes in the shed. (131)

The usual method of collection is to attach a gutter made of galvanized sheeting or, plastic (or even wood) to the edge of the roof and to lead the water through a down pipe made

of galvanized sheeting, plastic, earth or cement to a storage tank/container of appropriate shape and capacity. (132-133)

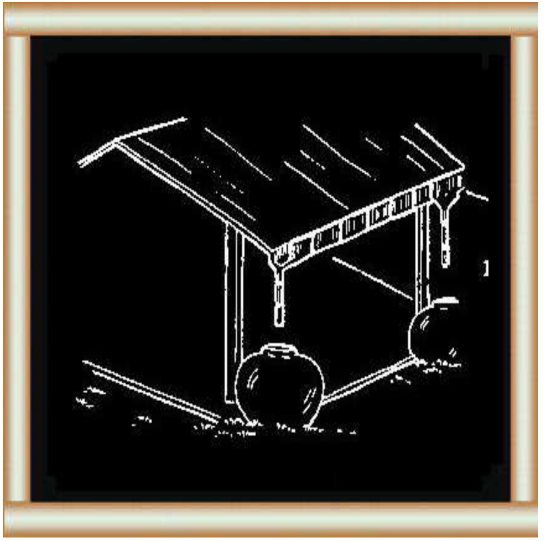
page150

Collecting and storing rain water

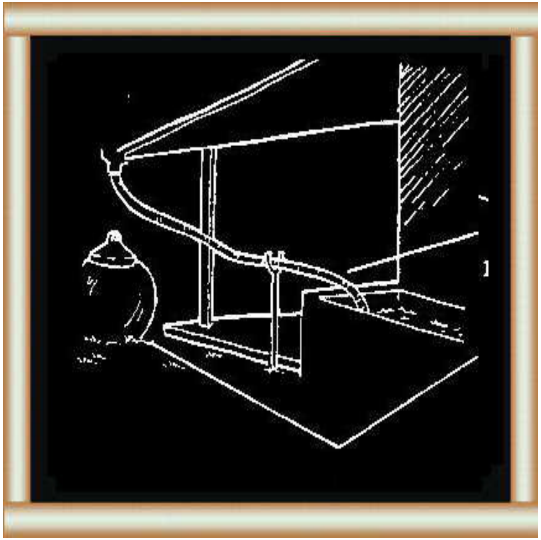


130 Do not
- make dust
- splash dirty water
on to utensils which are drying.

131 Storing rain is a cheap way of getting clean water for your farm.



132 You can collect it from your roof with a gutter made of plastic or galvanized sheet or even wood



133 through a pipe of galvanized, plastic, earth or cement to a storage tank or container.

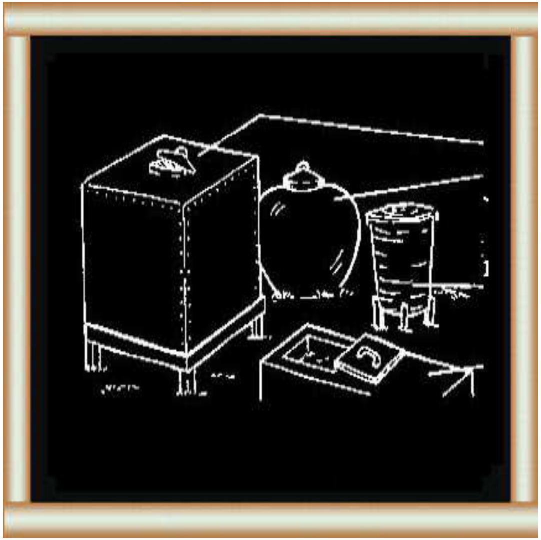
page151

The storage container may be made of earth, fibre glass, metal that does not rust easily or brick and cement. Some savings can be made by erecting a brick and cement tank in a corner between two existing walls, provided they are strong enough and leak proof. (134-135)

The sizes and numbers of the containers to be kept on any

farm will be determined by the availability of other clean water (and costs of bringing same to the site), the rainfall patterns of the area, the costs of construction/purchase and the investment capability of the farmer.
(136-137)

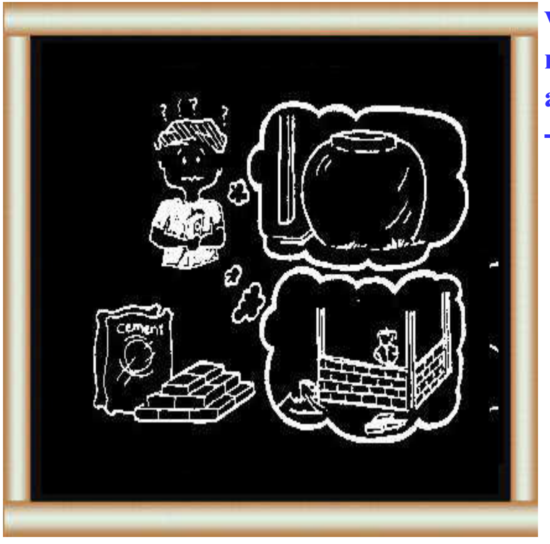
page152



134 The storage tank may be made of earth, fibre glass, metal (if it does not rust easily) or brick and cement.

135 You can save money by building a brick and cement tank between 2 walls if they are strong and do not leak.

136



When planning the type, size and number of water containers, think about:

- the cost of buying or making them.

The rainfall
other clean water supply
the cost of bringing clean water to your farm.

page153

Housing of dairy calves

The housing of dairy calves needs more attention because they are more susceptible than adult animals to adverse environmental conditions including diseases. (138)

In its simplest form, a calf house can be just a separated out area in a cattle shed. This arrangement is suitable in a dry

area, where adequate ventilation can be provided without the risk of the calf getting exposed to severe cold winds etc. Even under these conditions, it is best to provide individual pens for the calves and prevent calves of different ages being kept together. (139-140)

In areas which require closed housing, e.g. extremely cold climates, strong cold winds etc., and in damp conditions, where it is difficult to keep the floor dry, calf pens are usually fitted with a raised platform. The platform (slatted floor) may be made of strips of wood, placed about 15.0 mm apart, to prevent the calf's foot getting entangled in the space between strips. (141)

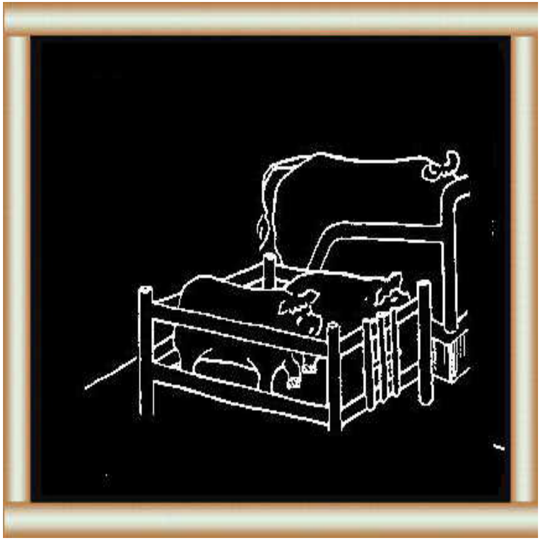
page154

Dairy calves
Housing of dairy calves

138 Plan housing for your dairy calves carefully - it is easy for them to get disease or suffer from the weather.

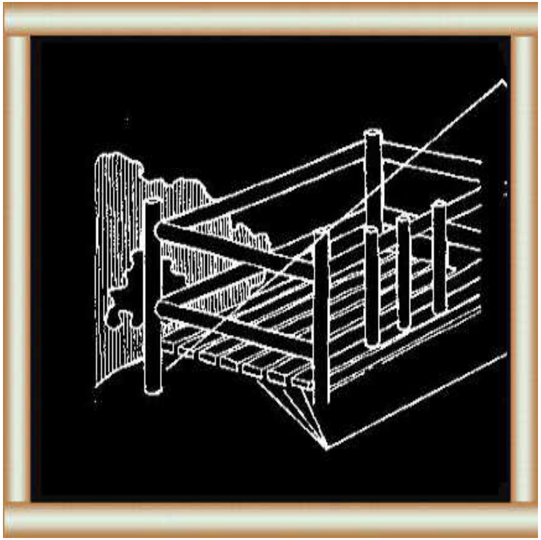
139 In dry areas where you have adequate ventilation without cold winds, you can separate part of your shed for your calves.

140 But make separate pens for each



calf (or keep only 2-4 calves of same age in one pen with adequate space). Do not keep calves of different ages together.

141 In areas which are cold or wet,



raise the floor of the calf pen to keep it dry.
Use strips of wood 15 mm apart so that your calf's foot cannot go through.

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Adequate space should be provided in a calf pen, as the calf is expected to be housed in it till it is about 3 months old. An individual pen may be 1.80 m x 1.0 m in size. (142)

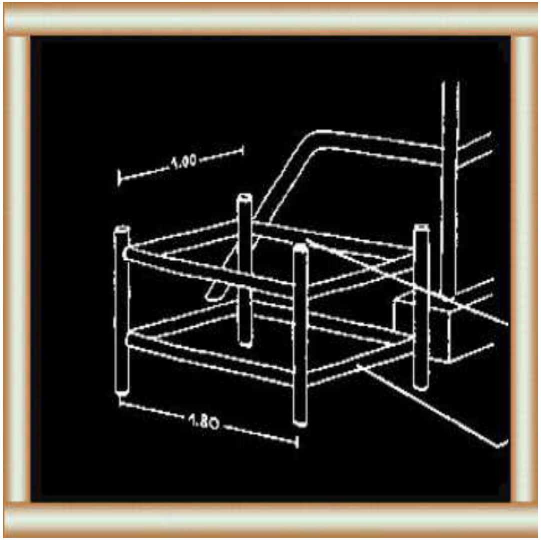
Movable calf pens

The space within the cow shed can be put to optimum use and the calf pens can be maintained in a very high state of hygiene by using movable calf pens. By moving the pens outside the shed to a suitable pasture area, the calf can be offered good quality roughage as well. (143-144)

Feeding and watering

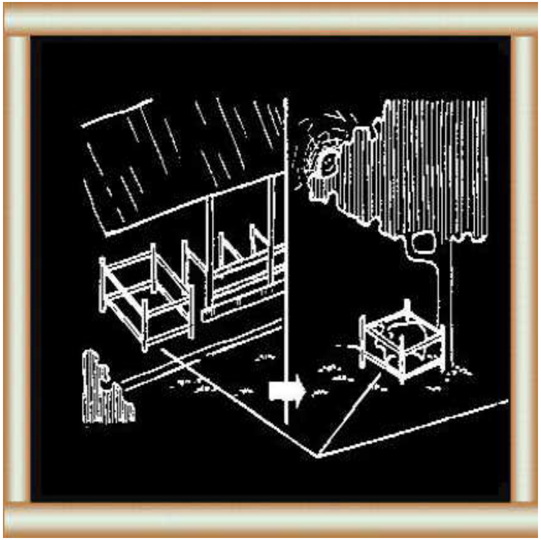
A feeding rack can be fixed within the calf pen while a concentrate trough and a bucket for water/milk placed on a holder outside the pen, but within easy reach of the calf. (145)

page156



142 Your calf stays in the pen until about 3 months old so make sure it is big enough - about 1.80 m x 1.0 m.

Moveable calf pens



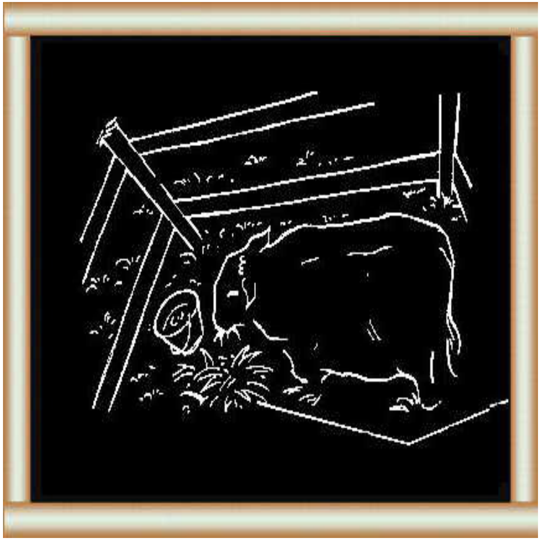
143 You can:

- make good use of space

- keep everything clean

by using moveable calf pens.

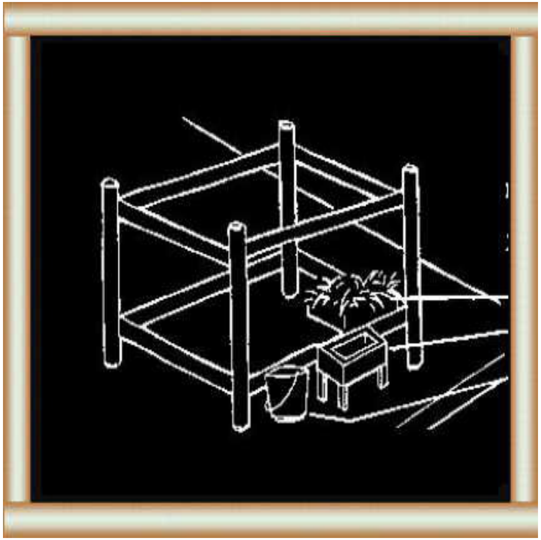
144 By moving the pen to a suitable



pasture area, you can offer good quality roughage as well.

Feeding and watering

145 You can place the:



- feeding rack inside the pen
- concentrate trough and bucket for milk/water outside the pen within easy reach.

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Exercise yard

When the calf's movements are limited within a calf pen, it would be useful for its healthy growth to provide an exercise yard. (146)

Materials such as barbed wire that can injure the animals should not be used in these areas. (147)

A simple arrangement of a perimeter fence for an exercise yard is to fix horizontal shafts (made of wood or coconut) to wooden posts placed about 1.80 m apart and to tie the droppers by rope (made of coir or similar material) through holes drilled in the horizontal shafts. Whole bamboo and/or bamboo strips may also be used for the perimeter fence.

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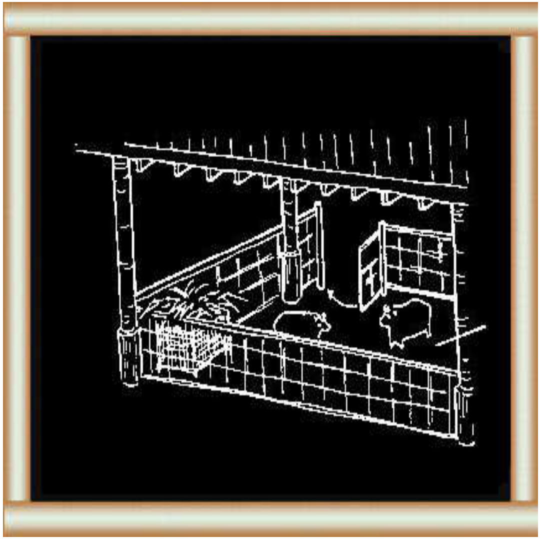
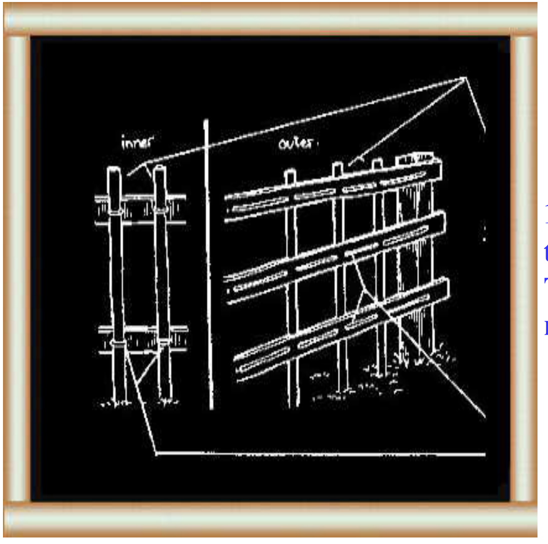
Exercise yard



146 Calves in pens need an exercise yard for healthy growth.



147 Do not use nails or barbed wire in the area.
Tie droppers (wood or bamboo) with ropes made from coconut fibre.

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What do you know about housing for dairy cattle and buffalo?

Important things in designing housing

Construction of simple housing

Construction of improved housing

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Volume 2

Husbandry Unit 3.2

HUSBANDRY IN DAIRY CATTLE AND BUFFALO HOUSING

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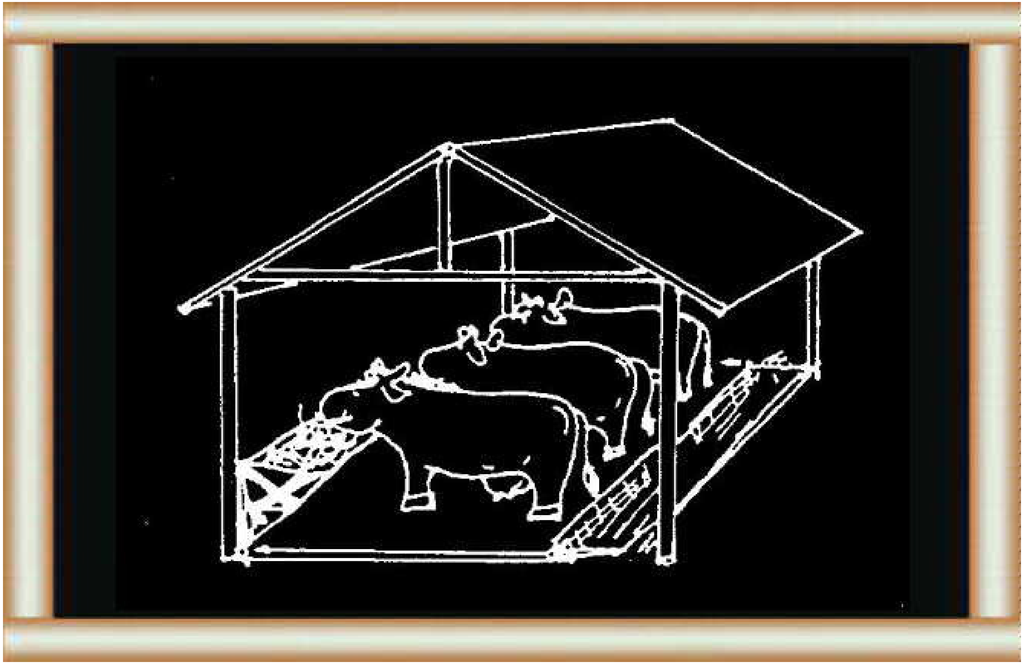
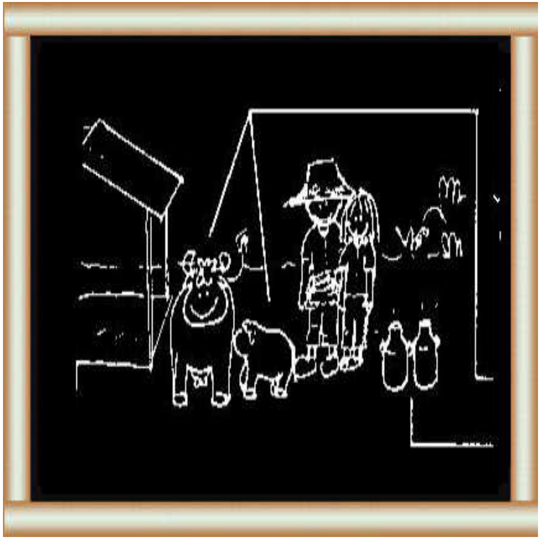


Extension Materials

What should you know about husbandry in dairy cattle and buffalo housing?

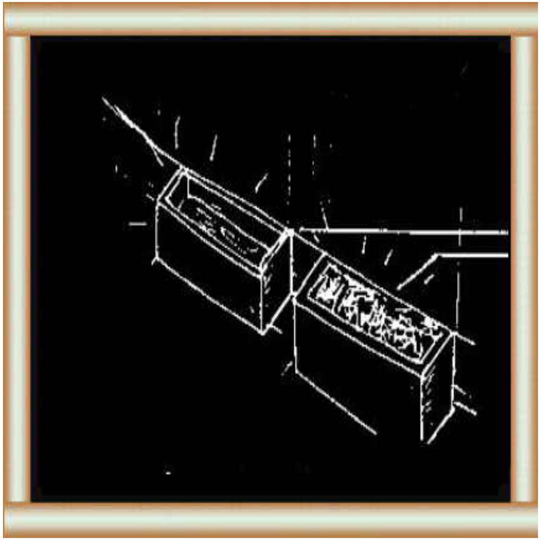


Why is clean housing important? (10-17)

1 Because clean housing improves the health of your cows and calves and the quality of your milk.

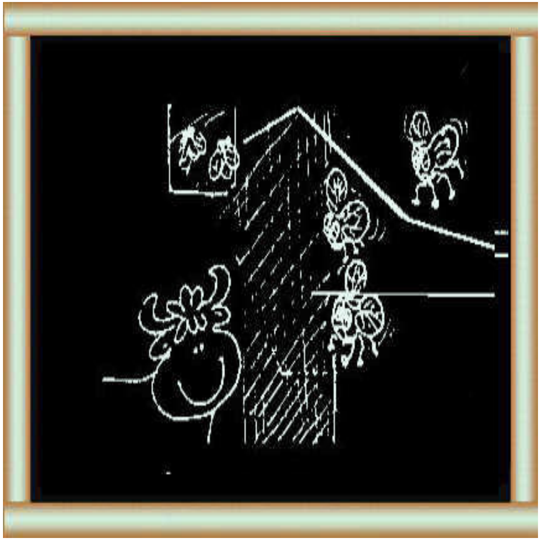
How can you handle manure? (18-23)

2 Keep manure away from your animals and use it for compost manure or biogas.



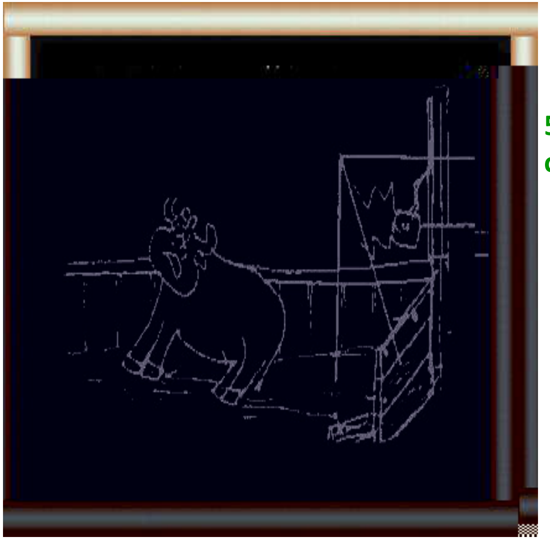
How can you handle feed and water? (24-36)

3 Keep feeders and drinkers clean and change feed and water often.



How can you handle insects? (37-42)

4 Keep flies and other insects away by using netting and/or flypaper.



How can you improve safety? (43-48)

5 Make sure floors, walls and fittings cannot harm your animals.

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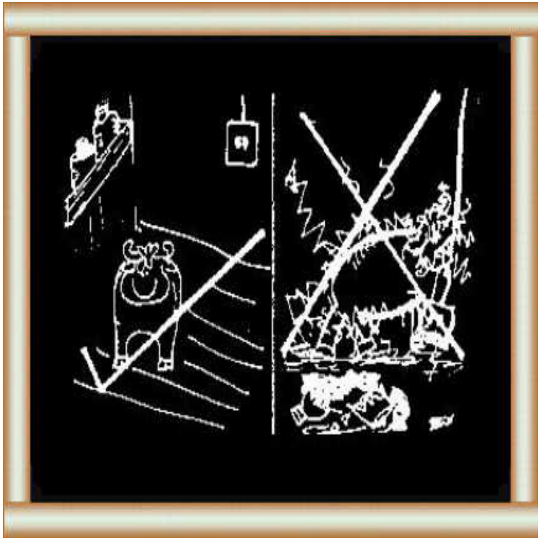
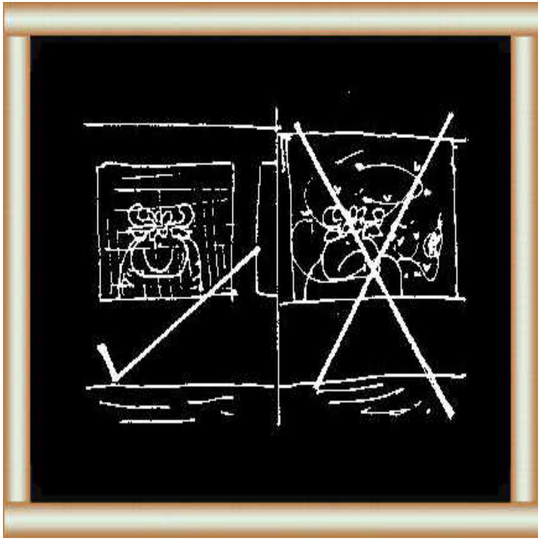
How should you control your animals' environment?

6 Make sure:
- it is clean



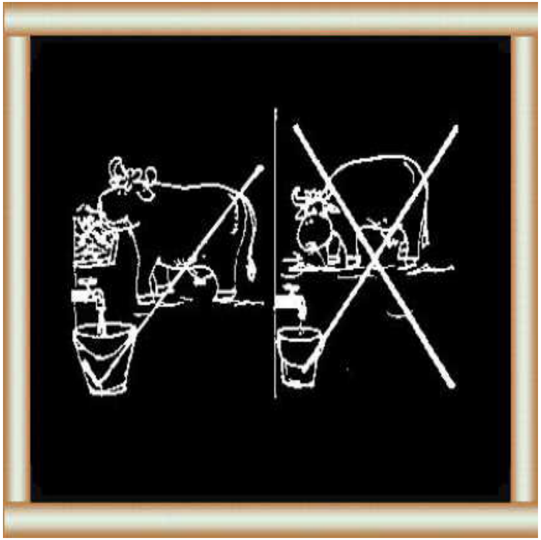
7

- and safe



8

- with few insects



9

- and good feed and water supplies.

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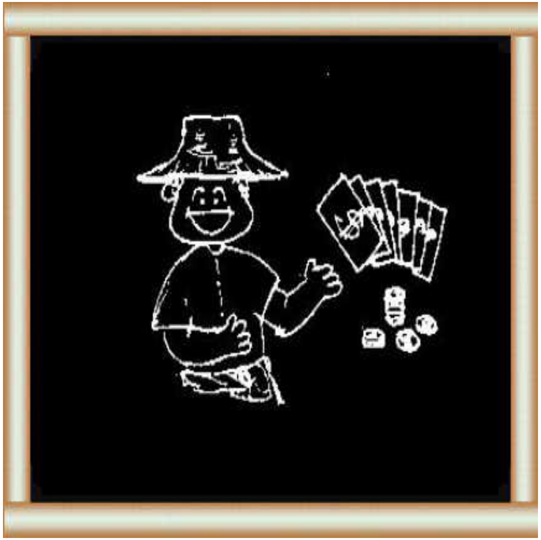
Why is clean housing important?

10 Give your animals clean housing

11 and you have healthy cows and calves

12 good quality milk



13 and you earn more money.

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14 If you give your animals dirty housing

15 you have dirty, unhealthy cows and calves

16 a lower yield of poor quality milk

with

- flies

- high bacteria levels

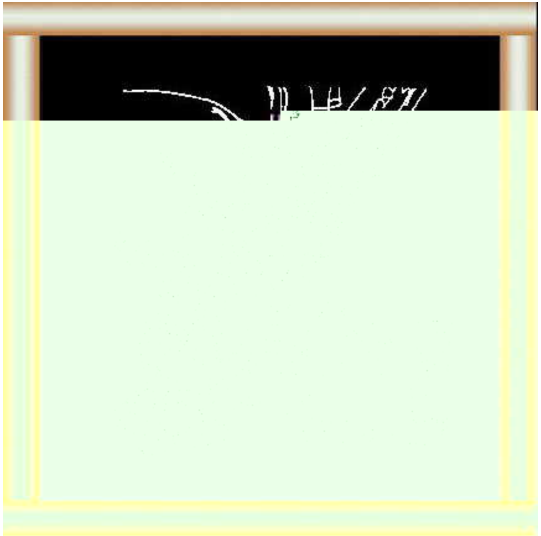
- a bad smell

17 and you earn less money.

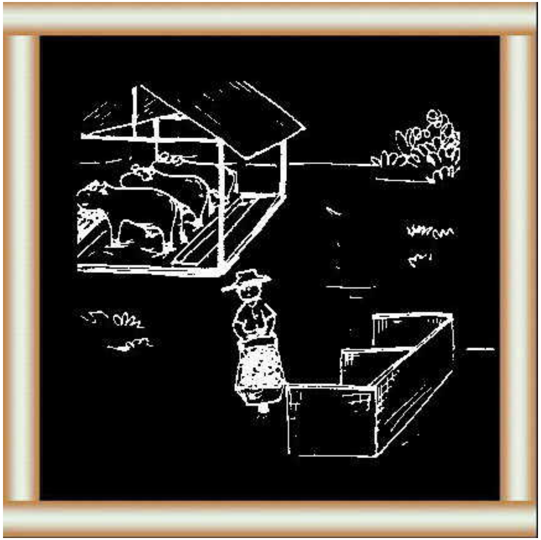
page168

How can you handle manure?

18 Keep manure away from your animals' area.



19 Remove manure from your cattle shed at least twice a day, before milking.



20 Take the manure to a storage site, for example a compost heap.

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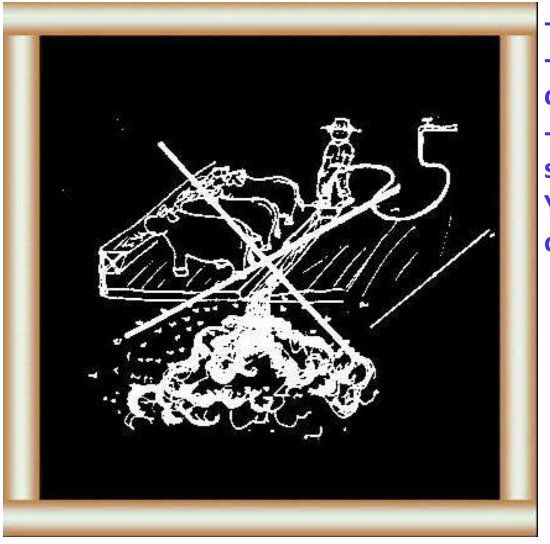
21 You can also store manure in a biogas tank or a storage tank underground.

22 Never wash or sweep manure out of the shed. Wet, muddy manure-swamps outside the shed create problems:

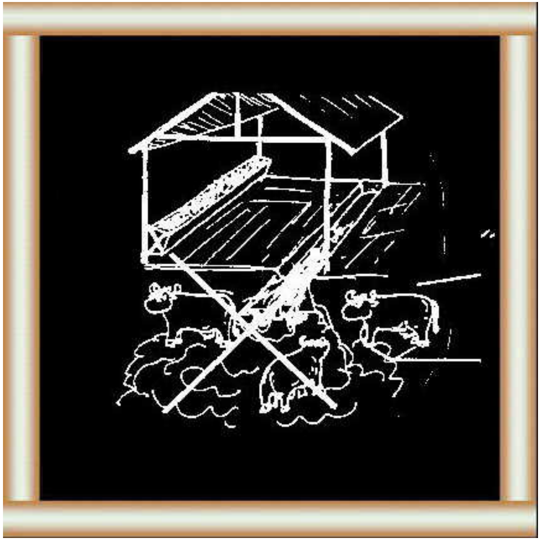
- insects come and breed



- bacteria increase quickly
- flies spread bacteria and diseases and contaminate your milk
- your milk gets a strong unpleasant smell.

You cannot use the field or area outside because it gets spoiled.

23 If manure runs into your exercise



area, worms and other parasites can spread from animal to animal.
Your cows also get problems with their hooves.

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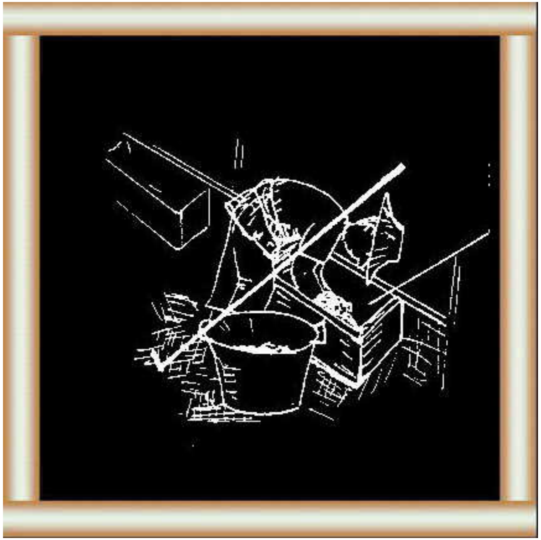
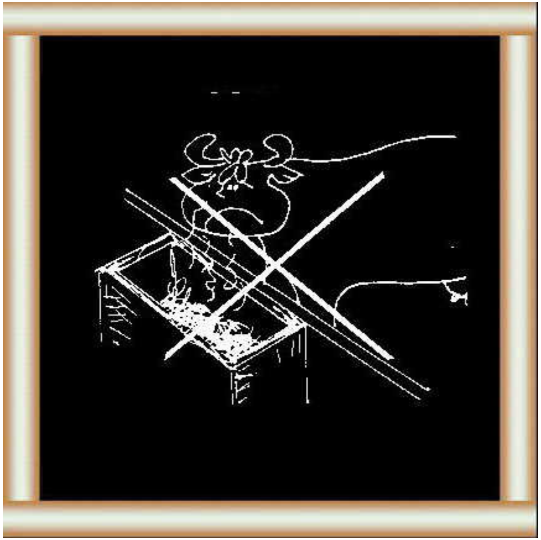
How can you handle feed?

24 Remove old feed from feeders every day.



25 Clean troughs every day.



26 Concentrates quickly spoil or turn sour if you leave them too long in the feeder.

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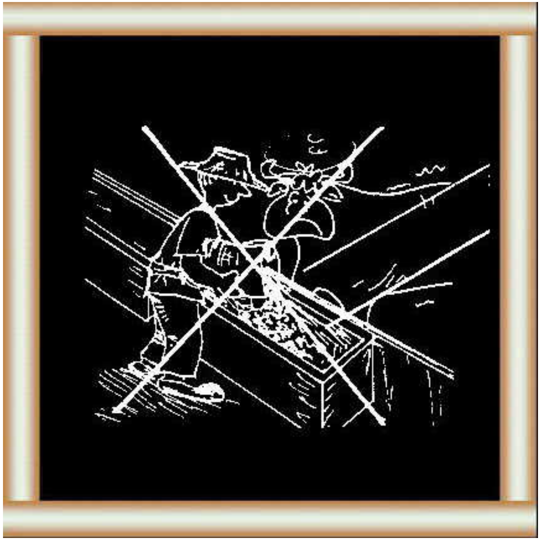
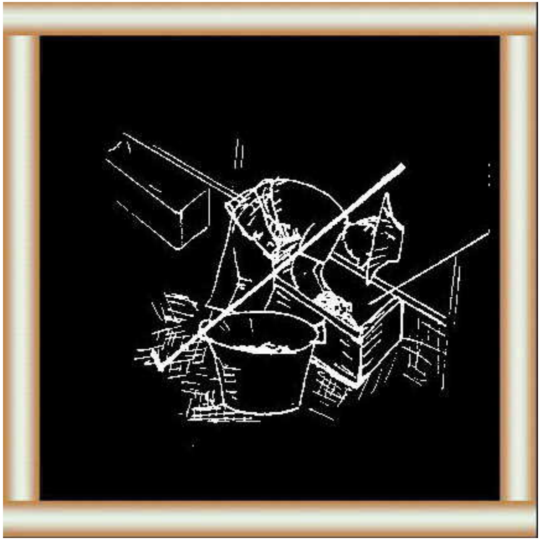


27 Never fill fresh concentrate on top of old. The old concentrate ferments and your cows become sick.



28 Always remove the old concentrate first.

29 Then fill with the fresh concentrate.

page172

How can you handle water?

30 Cows need a lot of water.
Give them as much water as they want to drink.

31 If your cow does not get enough water, she produces less milk or no milk at all.

32 Make sure drinking water for your cows is clean.

33 Empty out dirty water from drinkers

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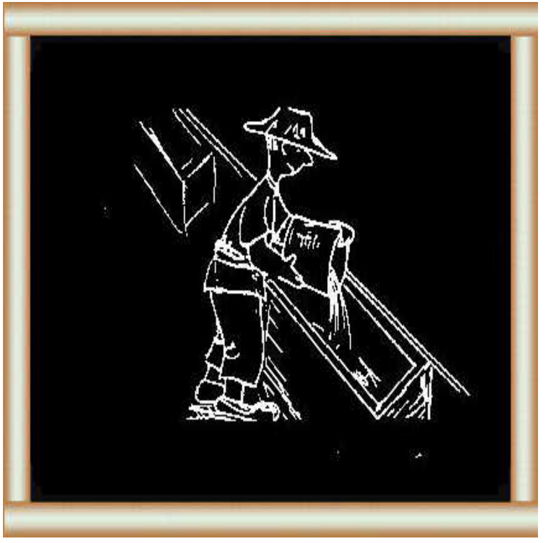
34



35 and fill up with fresh water every day.

36 If drinking water is left dirty, your cows do not drink it, and produce less milk.

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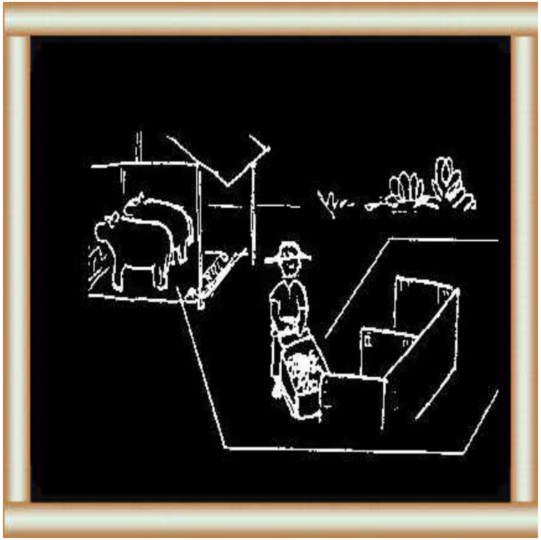
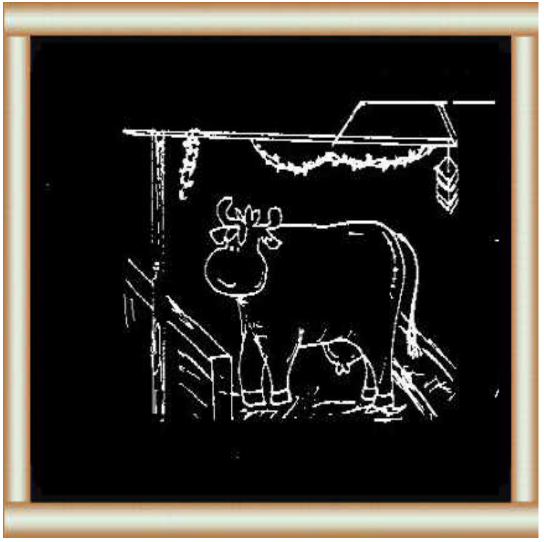
How can you handle insects?

37 Flies make your cows uncomfortable.
Stress can reduce milk production.

38 Your cows are difficultto milk when flies disturb them.



39 Reduce fly breeding by:
- proper disposal of wastes
- keeping sheds clean.



40 Flycatching strips or flypaper improve the conditions for your cows.

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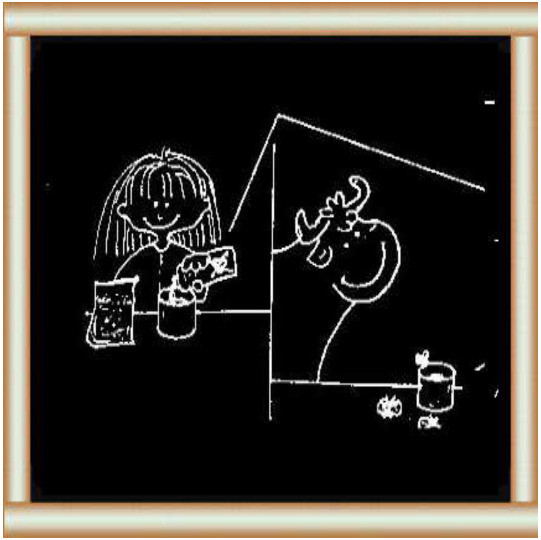
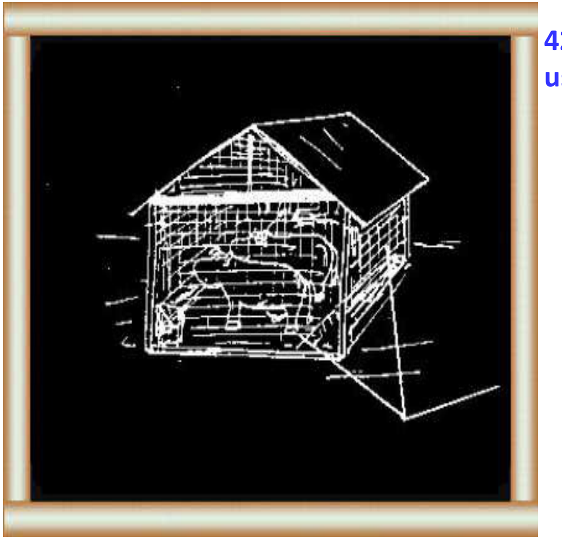


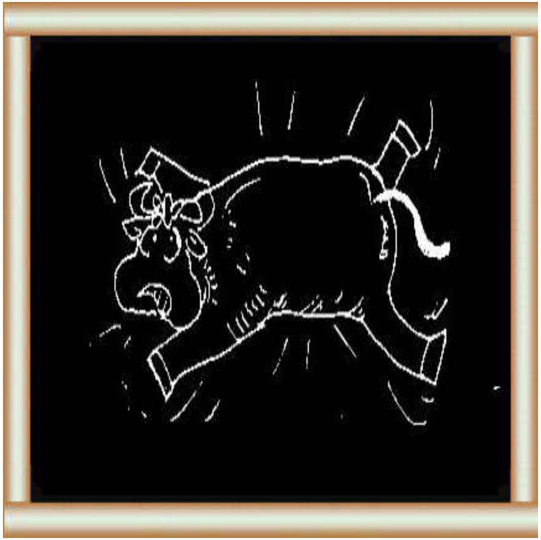
41 Mix sugar with an appropriate insecticide and place in a small tin. This will attract the flies and kill them.



42 Protect your cows from flies by using flyproof netting round the shed.

How can you improve safety?

43 Your cows cannot move easily on slippery floors.
They become scared of walking.



44 They hurt themselves when they fall.

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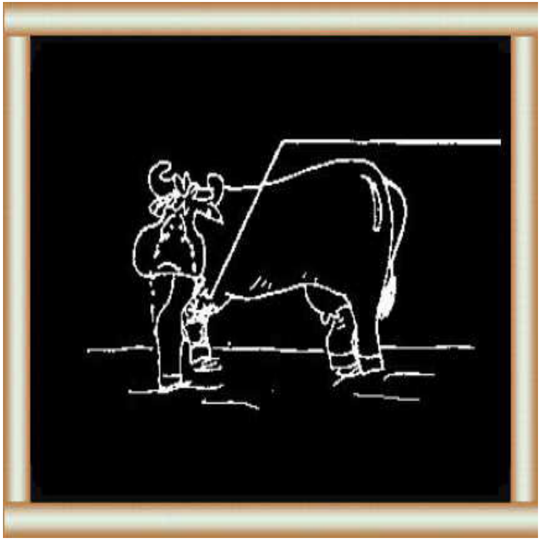

45 They can break their legs and then you have to slaughter them.

46 Make floors safe so that it is easy for cows to walk on them.

Make sure:

47 Your exercise area is free from anything which can injure your animals.

48 The electrical connections are safe.

A good living environment for your cows gives a good income for you in return.

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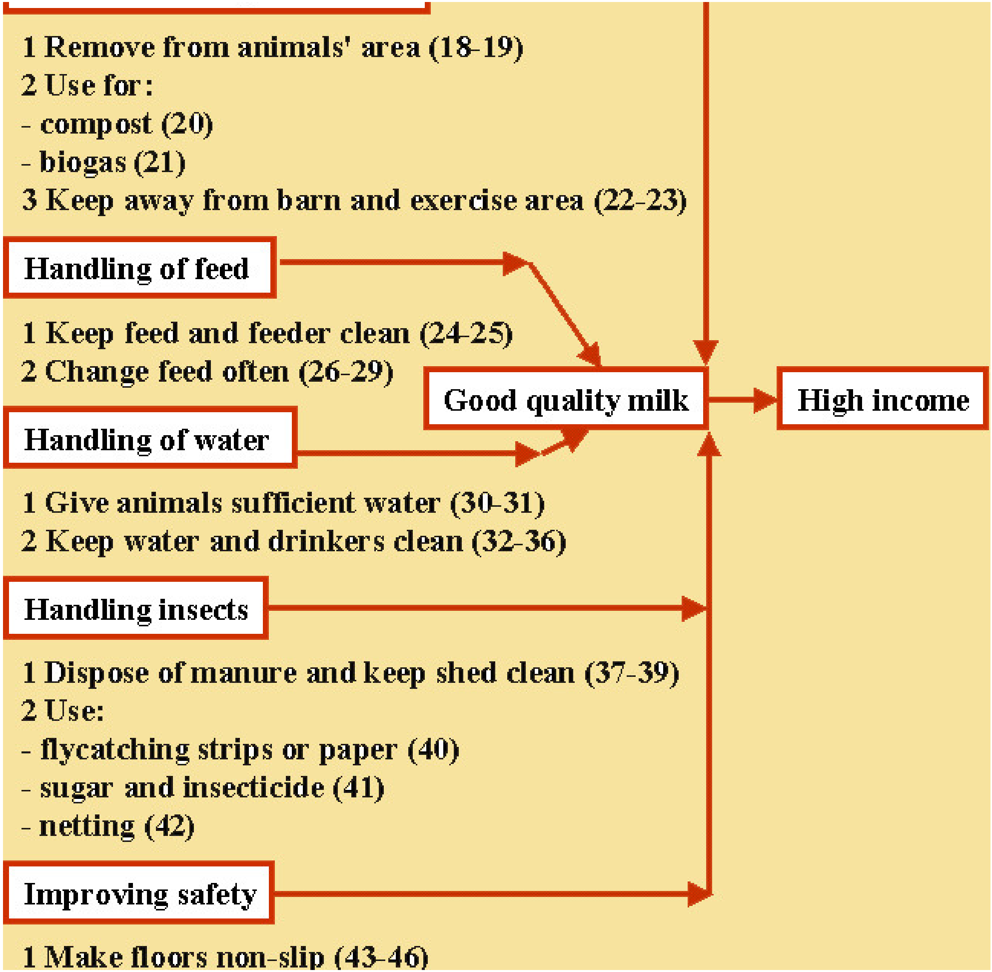
What do you know about husbandry in dairy cattle housing?

Clean housing

1 Healthy cows and calves (11)
2 Reduce insects and bacteria (14-17)

Careful handling of manure

(**11**)
(**14-17**)



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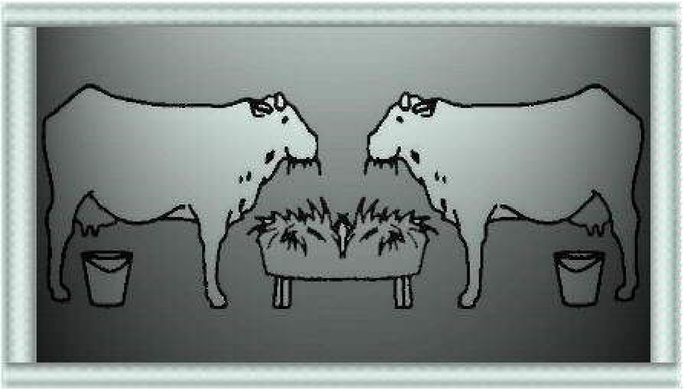

Small-scale

dairy farming manual

Volume 3

Husbandry
Units 4 and 5

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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AND BUFFALO

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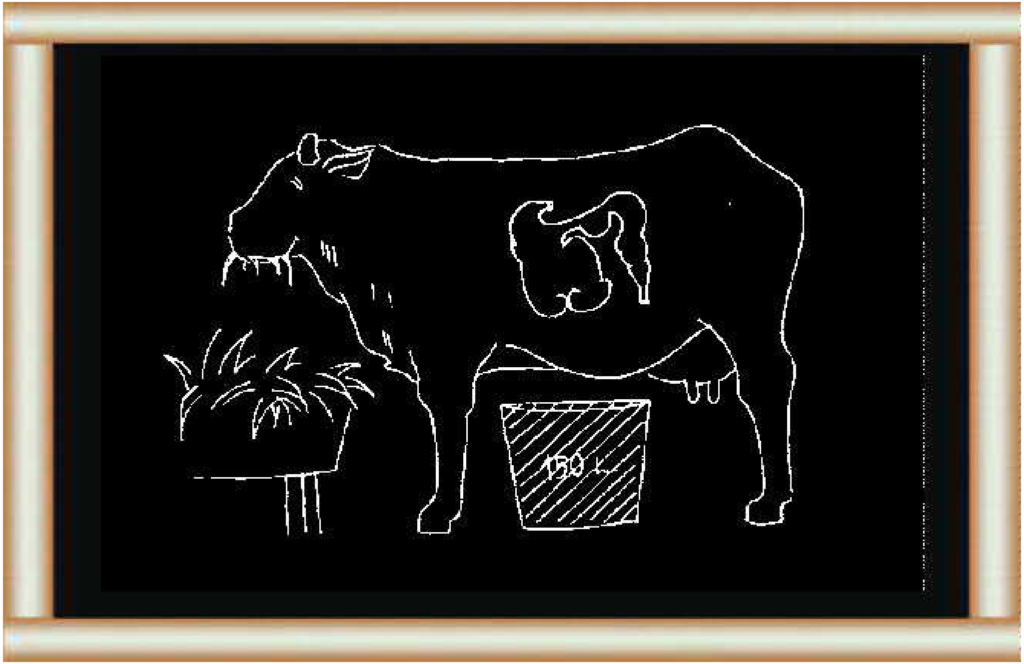
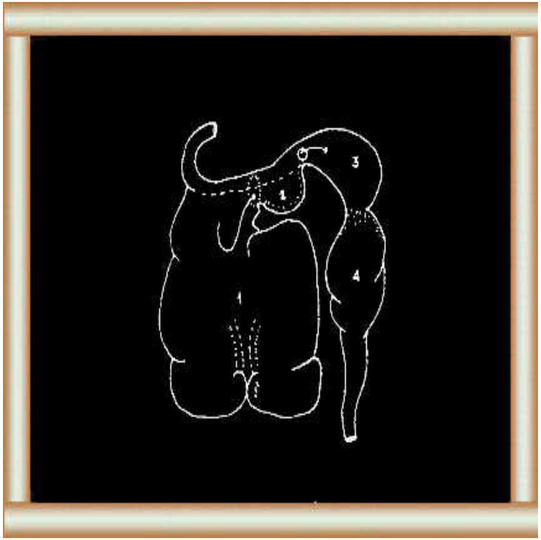


Extension Materials

What should you know about feeding dairy cattle and buffalo?

What is important in feeding dairy cattle and buffalo? (5-16)

1 Feeding the right amounts of:
- proteins
- carbohydrates and fats
- minerals and vitamins.



How do dairy cattle and buffalo digest feeds? (17-28)

2 By having a special stomach with 4 parts.

What type of feeds are there and what

is their value? (29-51)

3 There are:
- roughages
- concentrates
- mineral and vitamin supplements.

How much feed do dairy cattle and

buffalo need? (52-91)

4 This depends on:
- their body weight
- what they produce.

page3

FEEDING DAIRY CATTLE & BUFFALO

Husbandry Unit 4:

Technical Notes

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

Introduction (5-8)

There are large cattle and buffalo populations in the Asian region. In most countries the indigenous stock is mainly used for draught and meat. However, in India and Pakistan some indigenous breeds have been selectively bred for improved milk production.

In most of the countries in the region, programmes have been undertaken for the crossbreeding and upgrading of the indigenous cattle with temperate breeds to obtain higher milk production. Some countries have resorted to large scale importation of pure-bred temperate cattle for the same purpose.

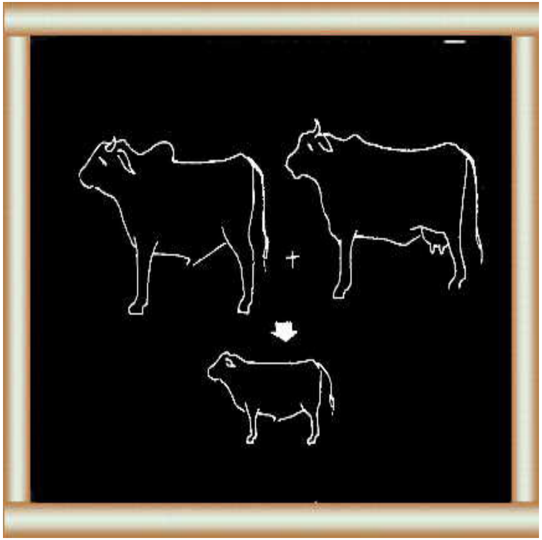
It is observed, however, that adequate attention is not being given to proper feeding of dairy animals. Thus they are not producing what they could (i.e. the full genetic potential for milk production is not expressed). This is shown by the higher levels of production in well managed herds than in poorly managed herds with the same type of animals.

Adequate attention, therefore, should be given to the proper feeding of

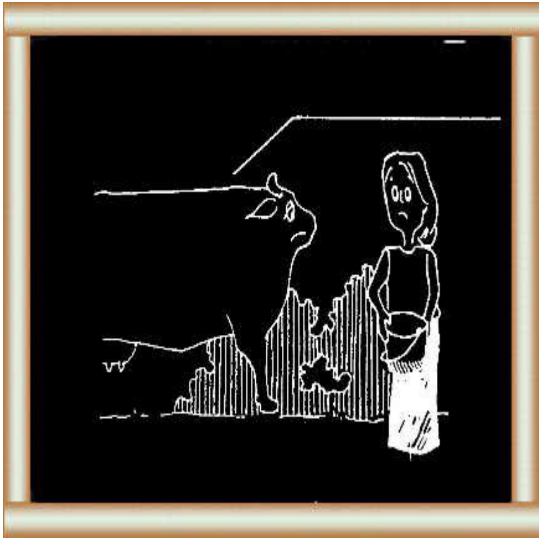
dairy animals to obtain best results.

page4

What is important in feeding dairy cattle and buffalo?



5 For high milk production good feeding must go together with good breeding.



6 Even a good temperate breed e.g. Friesian gives low milk production with poor feeding

7 whereas crossbreeds or selected local breeds can give good milk production with good feeding.

8 Good feeding gives you more milk which you can sell for more money.

page5

Nutrients from feeds (9-16)

Dairy cattle and buffalo, like humans and all other animals, need food to obtain the various nutrient requirements for their proper functioning. (The roles played by the combined action of the various nutrients are too complex to be

discussed in detail. Only important practical aspects are considered here to make the farmers aware of their importance.) The nutrient requirements can be thought of in a simplified manner as follows.

- Bones, which give the body its structure, provide attachment points for the muscles and make it possible for easy move-ment from place to place, are made of minerals. (Minerals are also required in certain varying amounts for proper functioning of the body.)

- Muscles, which make it possible for one organ to move rela-tive to others and for the animal to move from one place to another, are made mainly of proteins. (Proteins can also be used as a source of energy, but the main requirement is for body building and repair functions.)

- Energy, which is necessary for the various body functions (energy for running an engine is obtained from the fuel that it burns) comes mainly from:

- Carbohydrates

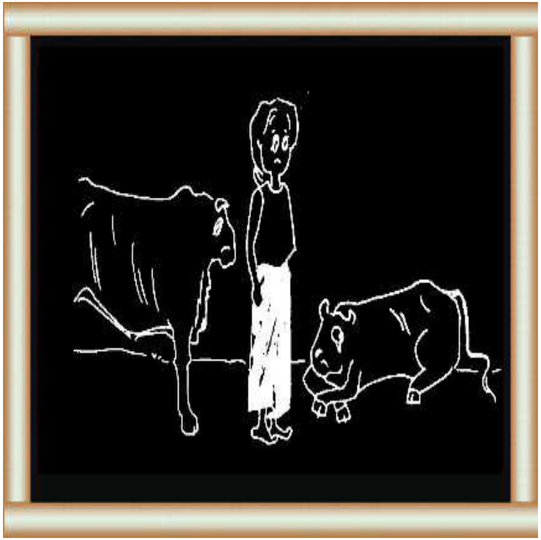
- Fats. (These are stores of energy and also form part of the connective tissue which bind organs together.)

- Activation of various metabolic activities in the body require the presence of vitamins. These are required in minute quantities and may be compared to the lubricating oils in an engine.

Whereas animals require these nutrients in a ready made form which can be digested and utilized by them, plants can manufacture these nutrients from air, water and soil nutrients with energy from the sun.

9 Your animals need nutrients from feeds to be strong and healthy.

10 If some nutrients are missing your

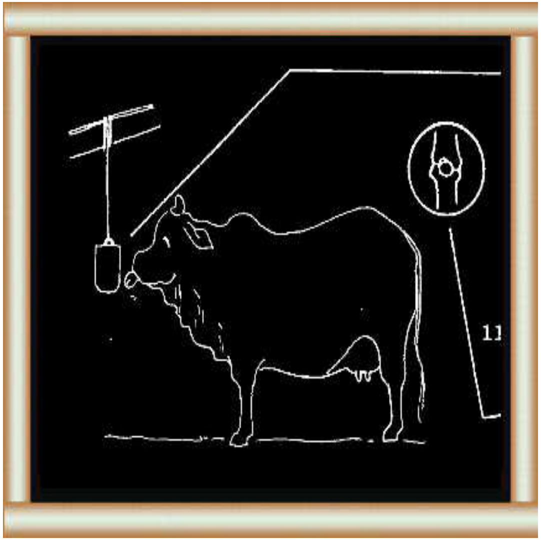


animals:

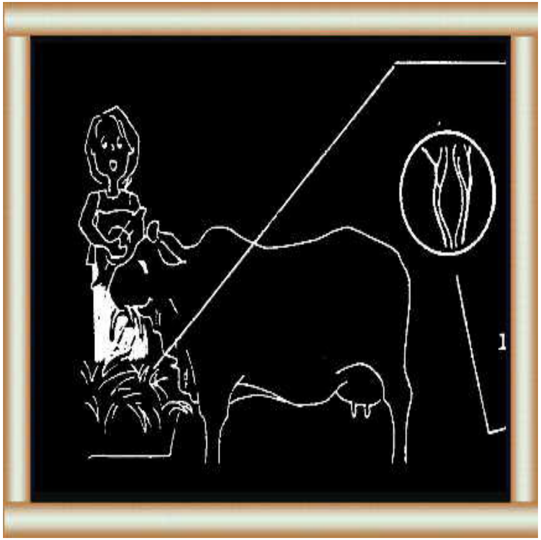
- become weak and get disease

- produce less

- may not become pregnant.

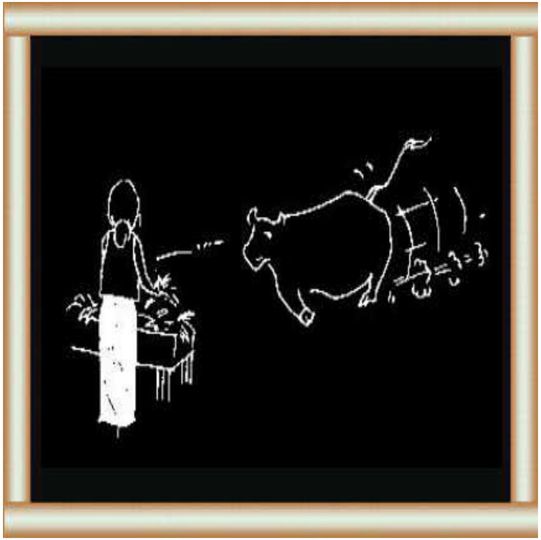


11 Your animals need minerals for strong bones and joints



12 and proteins to build strong muscles.

page7



13 They need carbohydrates and fat for energy

14 and vitamins so their bodies can work properly.

15 Plants can make these nutrients from the air, soil, water and with energy from the sun.

16 Animals cannot make nutrients, unless you feed the right amounts of the correct feeds.

page8

The Ruminants (17-28)

Cattle and buffalo belong to the group of animals referred to as ruminants. These animals have a "complex" stomach comprising four different compartments, which enable them to utilize various roughages efficiently and to obtain nutrients from them.

The four compartments are rumen, reticulum, omasum and abomasum. The abomasum is the true stomach and is comparable to the "simple" stomach of the non-ruminants. The other three are the "fore" stomachs.

At birth the calf resembles a non-ruminant because the "fore" stomachs are not developed. Thus the calf requires milk or milk replacers and calf starters in its early days of life. During this early period, milk gets directed into the abomasum, without passing through the "fore" stomachs, by a special mechanism.

As the calf grows it starts to nibble grass (or hay offered to it) and the "fore" stomachs become functional rapidly. Thereafter, the food taken by the animal first enters the rumen. Here the digestive process starts (before reaching the abomasum).

The capacity of the "fore" stomachs is about 13-14 times that of the abomasum. In adult cattle/buffalo, the rumen alone may have a capacity of up to 150 litres. Thus they can consume very large quantities of roughages.

Within the rumen are billions of micro-organisms, both bacteria and protozoa. These micro-organisms initiate the process of digestion by:

- converting the carbohydrates (e.g. sugars, starches, cellulose etc) to volatile fatty acids (VFA);

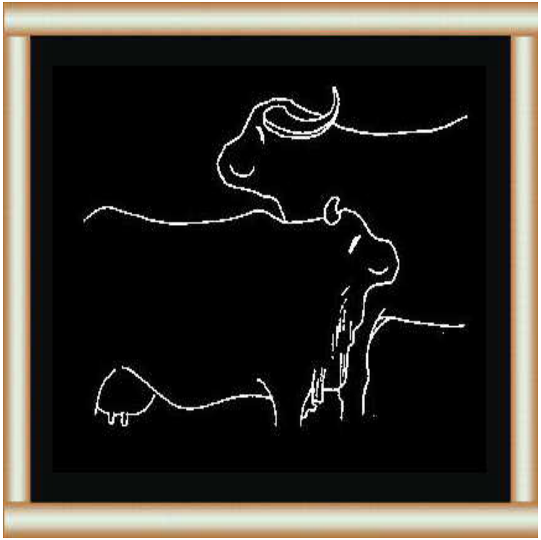
- breaking down the proteins into amino acids and even further into ammonia, carbon dioxide and VFA; and

- forming new amino acids (including the "essential" amino acids) and more proteins by multiplying themselves. (The bodies of the micro-organisms contain proteins; more proteins are formed when they multiply; the proteins are made of amino acids - both essential and non-essential.)

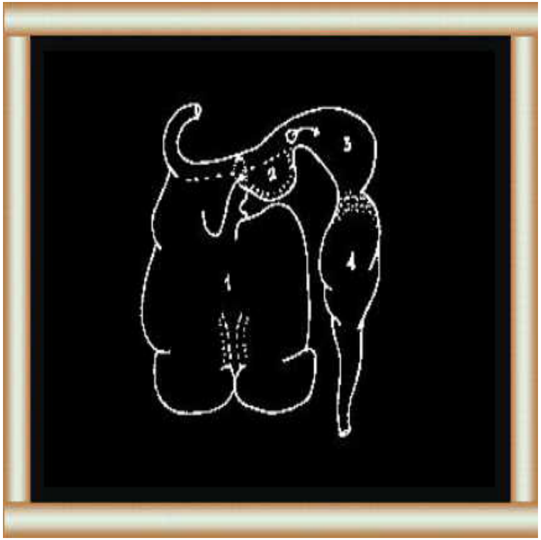
The micro-organisms also produce (synthesize) vitamins of the "B" group, which are absorbed and utilized by ruminants.)

page9

How do dairy cattle and buffalo digest feeds?

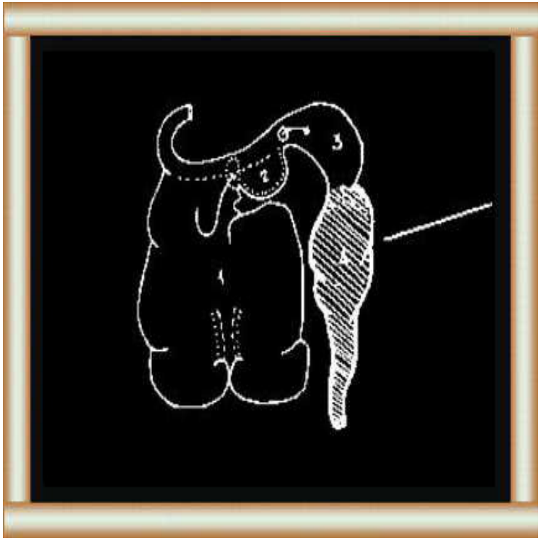


17 Cattle and buffalo are called "ruminants"



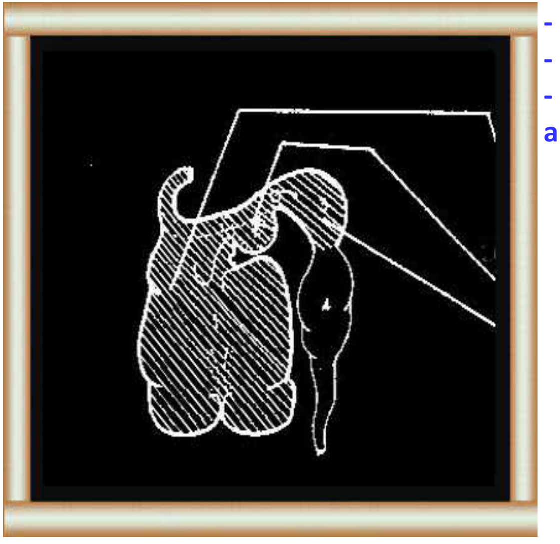
18 because their stomach has 4 parts.

With this complex stomach, they can get nutrients from roughages.



19 The abomasum is the "real" stomach and is similar to your stomach.

20 The other 3 stomachs



- rumen
- reticulum
- omasum

are the "fore" stomachs.

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The most important features of the ruminant digestive process are:

- the ease with which roughages are converted into VFA, which are then absorbed and utilized by the animals as a source of energy (and production of fat); and

- the formation of essential amino acids (or proteins contain-ing them, which are broken down into the respective amino acids in the abomasum) from non-protein nitrogen sources e.g. urea and proteins which do not contain any essential amino acids. The amino acids are subsequently absorbed and utilized to form proteins or as a source of energy.

Therefore, to make dairying economical, feed buffalo and cattle appropriate quantities of:

- **roughages**
- **protein supplements (with poor quality proteins) and**
- **non-protein nitrogen sources.**

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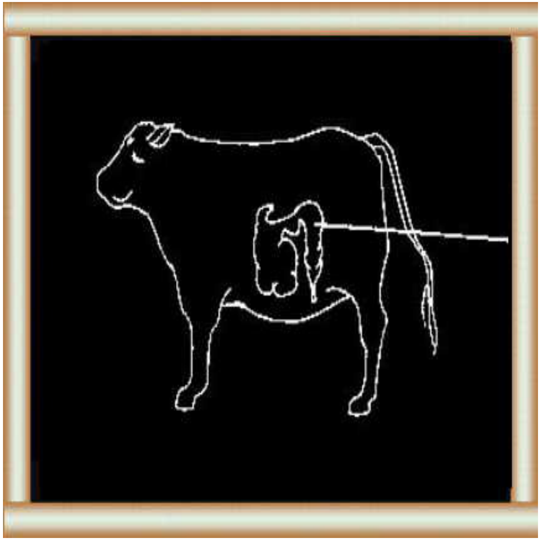
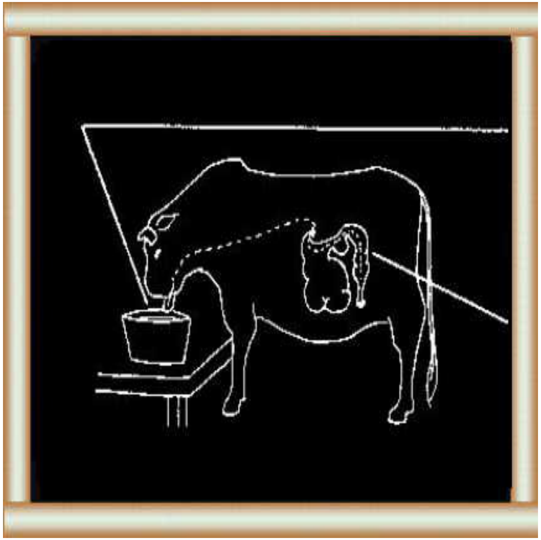
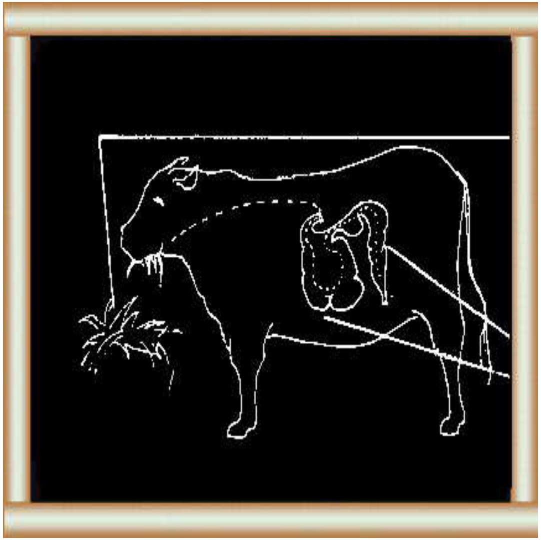


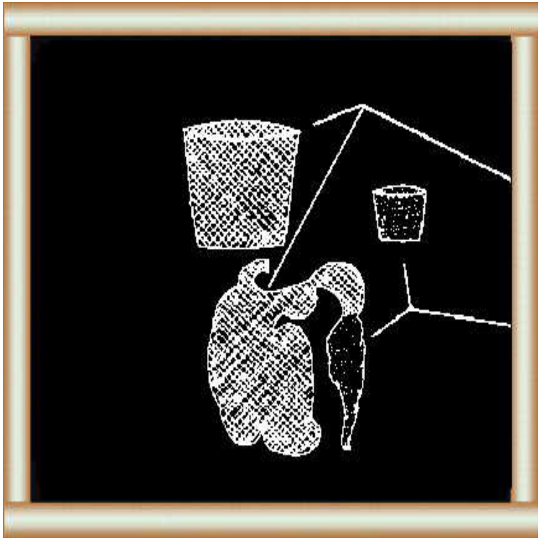
21 At birth, your calf has a stomach like yours.
The "fore" stomachs are not developed.



22 So your calf needs milk and milk replacers.
They go straight to the abomasum without entering the "fore" stomachs.



23 As your calf grows, it feeds on grass and hay.
The food enters the "fore" stomachs before passing to the abomasum.



24 The "fore" stomachs can hold 13-14 times as much as the abomasum.

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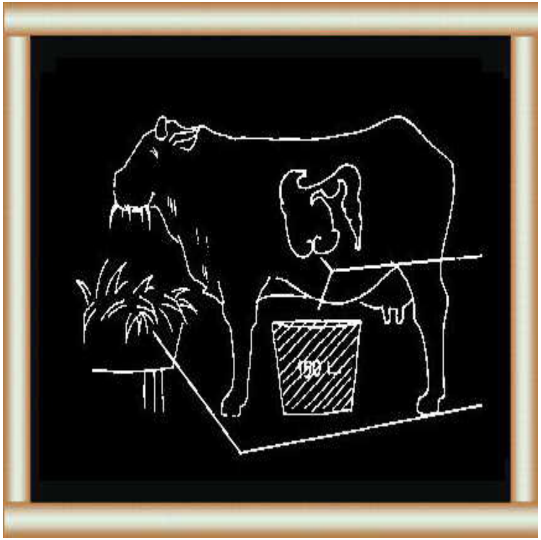
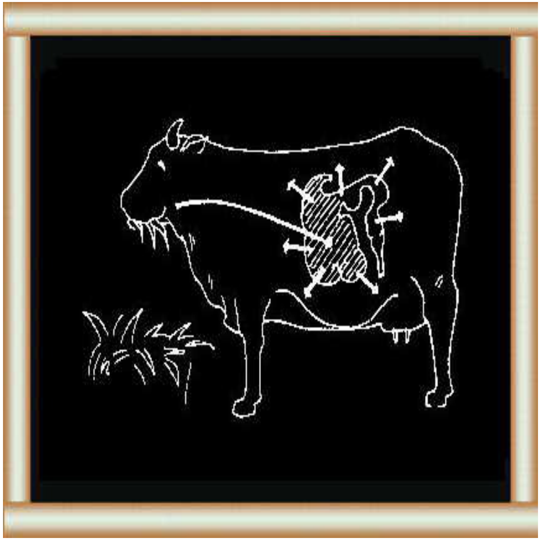


25 The "fore" stomachs of your adult animals can hold up to 150 l.
They can consume large amounts of roughages.



26 The rumen contains a great number of micro-organisms which help to change roughages into useful nutrients.

27 To save money but still have good milk production, feed the right amounts of

- roughages

28

- protein supplements (with poor quality proteins)
- feeds with non-protein nitrogen.

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Types of feed (for ruminant feeding) (29-40)

A simple way of classifying feeds is to group them as roughages, concentrates and mineral supplements.

- Roughages are feeds with a high fibre content. These include grasses, fodders and legumes - either in the fresh state or in preserved forms such as hay or silage; leaves of

trees (tree fodders) and crop residues (see H.1), which can be fed as they are or after treatment to improve the nutritive value e.g. urea treated straw (see H. 5.4).

- Concentrates are characterized by a higher dry matter content and a higher digestibility. They can be of plant origin or animal origin. Some of them contain significant amounts of one or more minerals.

Mineral supplements are usually available in the form of powders to be offered with the concentrates and in the form of blocks to be offered as licks. They contain varying combinations of minerals. An ideal mineral supplement should supply the shortfall between the animals needs and what is available in the feed it receives.

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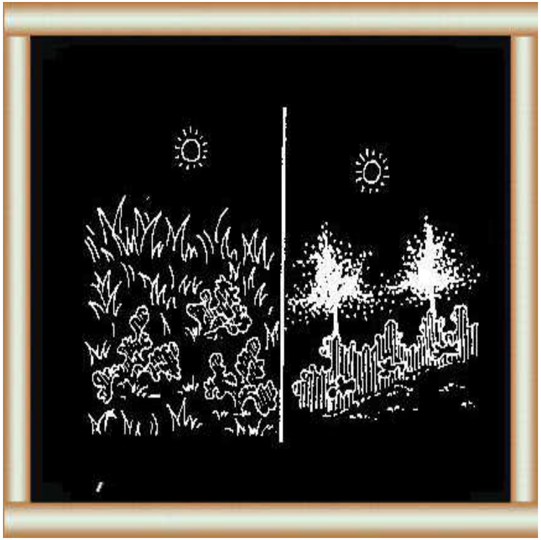
What types of ruminant feed are there?

29 There are three main types of feed.

Roughages

Roughages are feeds with a high fibrecontent.

30 They include:



- grasses
- fodders
- legumes

either fresh

31 or preserved as
- hay (See H. 5.3)
- silage (See H. 5.4)

32

- leaves of trees (tree fodders) (See H. 5.2)
- crop residues (See H.1)

either fresh

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33 or treated to improve the nutrient value e.g. urea treated straw (See H. 5.5).

Concentrates

34 Concentrates are feeds with a

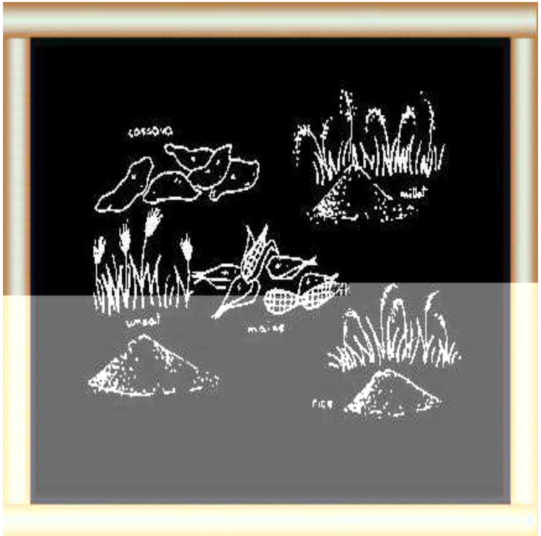
higher dry matter content and a higher digestibility.

Plant concentrates

There are two types of concentrates which come from plants.

35 Energy-rich concentrates

These include:



- dried cassava tubers
- cereals e.g. rice, wheat, maize, millet, sorghum
- agricultural by-products e.g. rice bran, wheat bran, molasses.

36 Protein-rich concentrates

These include residues after you remove oil from vegetable products e.g. cakes or meals.

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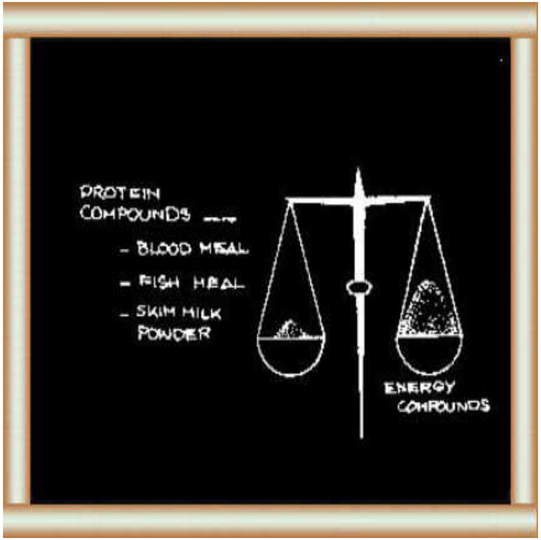
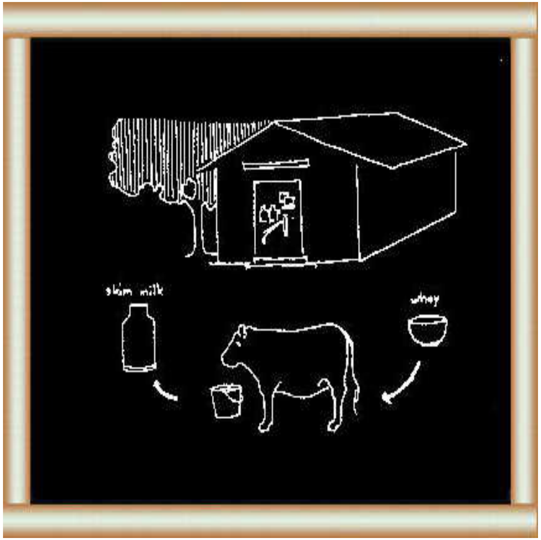


Animal concentrates

37 Concentrates which come from animals have more high-quality proteins.

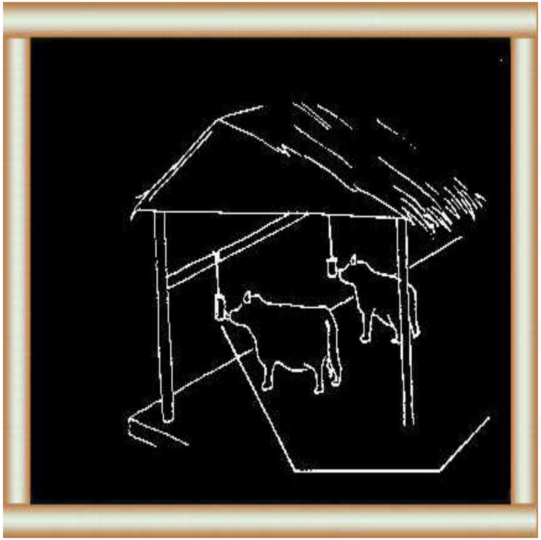
38 They include by-products from milk processing e.g.



- skim milk
- whey
for calf feeds.
These are too expensive for adult animals.

Mineral supplements

39 The roughages and concentrates



contain most of the minerals required by cattle and buffalo.

Supplements are necessary where the quantities in the feed fall short of requirements.

40 A good mineral supplement should

make up for the shortfall of minerals in feeds.
Consult your extension worker about this.

page17

Feed quality

The value of a feed depends on:

- How much of the intended product (e.g. milk, work, meat)

is produced with a unit quantity of the feed.

- How much of it will be consumed by an animal (feed intake).

It is not easy, however, to establish such a relationship because the final outcome depends on a combination of feeds and many other factors (e.g. the animal's potential for production, the environment, management practices etc.).

A simpler way to evaluate the quality of a feed is to determine the quantity of nutrients that can be digested and absorbed from a given quantity of the feed. Even this is not easy to carry out, because it involves:

- analysis of a sample of the feed in a laboratory to determine its composition, and

- tests to determine the digestibility of each component.

However, in most countries, data is already available on the nutritive value of at least the more important feedstuffs. It is very important to remember that the nutritive value of any particular feedstuff can vary, depending on a large number of factors. Some examples are:

- the same grass grown in different locations may have differ-ent nutritive values depending on:

- climatic conditions and season e.g. rainfall, environmental temperatures, elevation above sea-level etc;

- soil fertility and fertilizer application;

- stage of growth etc.

- hay or silage made from the same plot of grass may have different nutritive values depending on the process of hay making, ensiling etc;

- rice bran from different mills or from the same mill at different times may have different nutritive values.

Therefore, the extension officer should be aware of the different feedstuffs available to the farmers in his area, and consult the appropriate research institute or authority to obtain information on the nutritive values of these feedstuffs.

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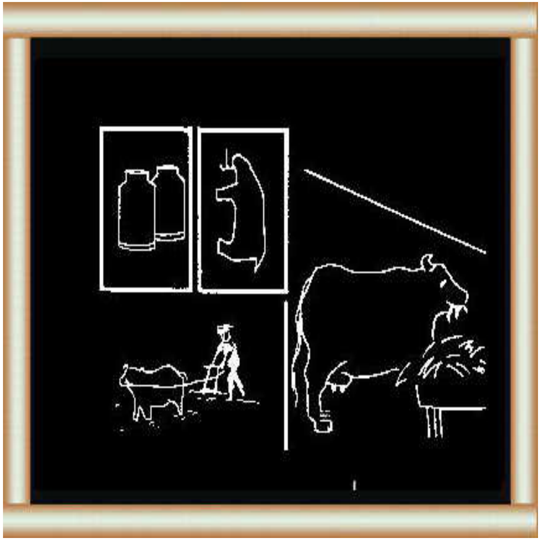
How can you find the value of feeds?



41 The value of a feed is

- what your animal produces (e.g. milk, meat, work)
in relation to

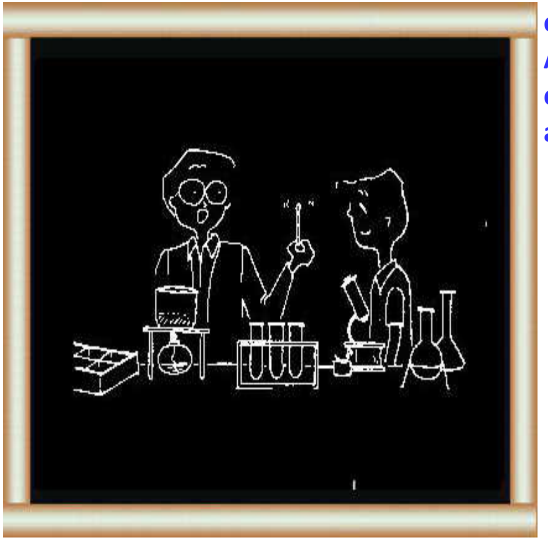
- what your animal eats (feed intake).

42 The value of feeds depends on

many factors:

- type of feedstuff and variety of plant
- climate
- stage of growth
- type of processing.

43 Laboratory analysis gives the value



of feed.
After a lot of laboratory analysis, estimates of feed value are usually available.

44 Consult your extension worker for advice on the value of different feeds.

Total digestible nutrients (TDN)

page19

In the Asian region, the nutritive values of cattle/buffalo feeds are usually expressed in terms of the TDN, DCP and the content of important mineral elements in 100 g of the feedstuff (i.e. as a percentage).

- TDN (Total Digestible Nutrients) is a measure of the amount of energy that can be obtained from a unit quantity of the feed. A particular feed with 60 % TDN contains 60 g

of TDN in 100 g of the feed or 600 g of TDN in 1 kg of the feed.

- DCP (Digestible Crude Protein) is a measure of the amount of protein in the feed that can be digested and absorbed by the animal. A feed with 20 % DCP contains 20 g of digestible crude protein in 100 g of the feed or 200 g of digestible crude protein in 1 kg of the feed.

- The amounts of important minerals contained in the feeds are also usually indicated in terms of a percentage. Thus a feed with 1 % Phosphorus contains 1 g of Phosphorus in 100 g of the feed or 10 g of Phosphorus in 1 kg of the feed.

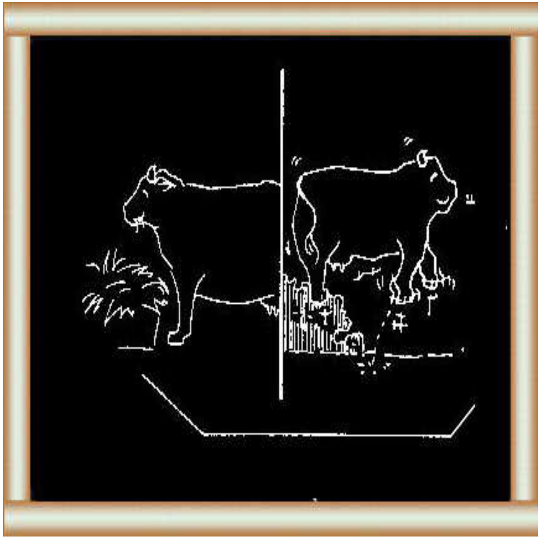
The DM (Dry Matter Content) of a feed, e.g. grass, can vary widely. Thus the nutritive values expressed in terms of 100 g of grass, for example, may not be meaningful. Therefore, the nutritive value is usually expressed in terms of a percentage of the DM in the feed. However, it is sometimes expressed as a percentage of the whole feed. The DM percentage is also indicated to make the necessary computations.

The extension officer should:

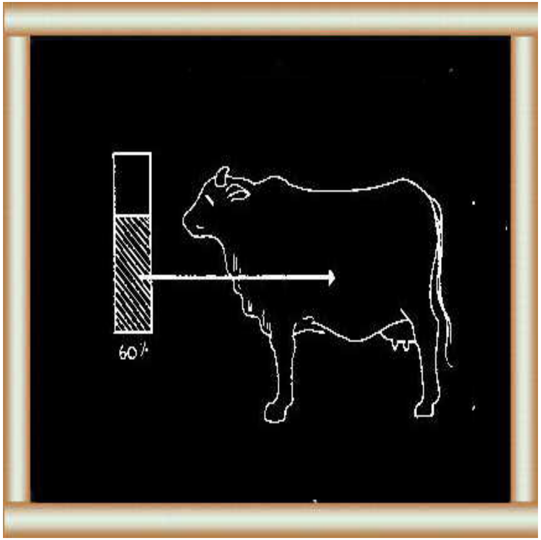
- have a clear understanding of these differences; and

- make the appropriate adjustments in computing the nutritive value of the feeds available to farmers.

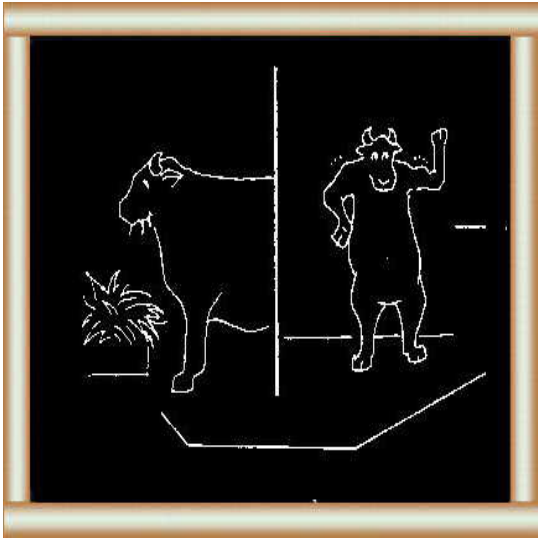
page20



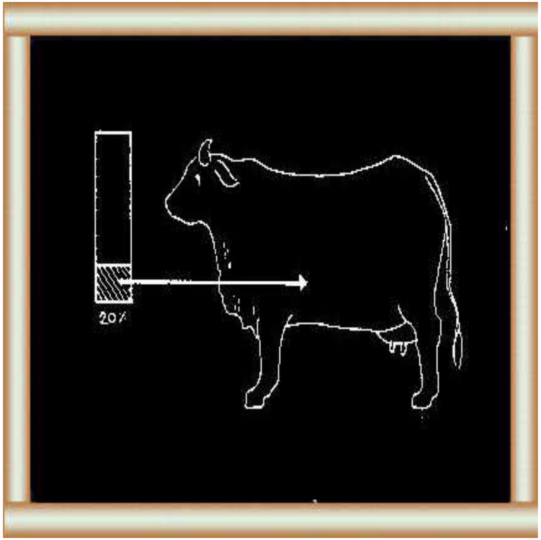
45 TDN tells you how much energy your animals can get from a feed.



46 If your feed has 60 % TDN your animals can get 600 g TDN (of energy) from 1 kg of feed.



Digestible crude protein (DCP)
47 DCP tells you how much protein your animals can get from feed.



48 If your feed has 20 % DCP your animals can get 200 g of protein from 1 kg of feed.

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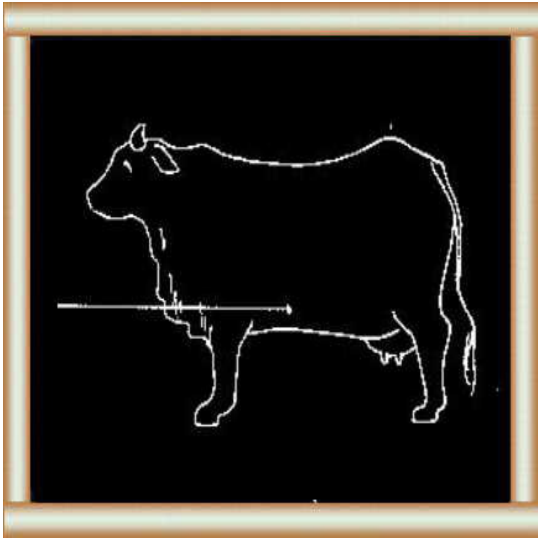


Minerals

49 Important minerals are necessary.

If your feed has 1 % phosphorous your animals can digest 10 g of phosphorous in 1 kg of feed.

Dry matter content (DM)

50 The DM of feeds is very different in:

- different types of feed

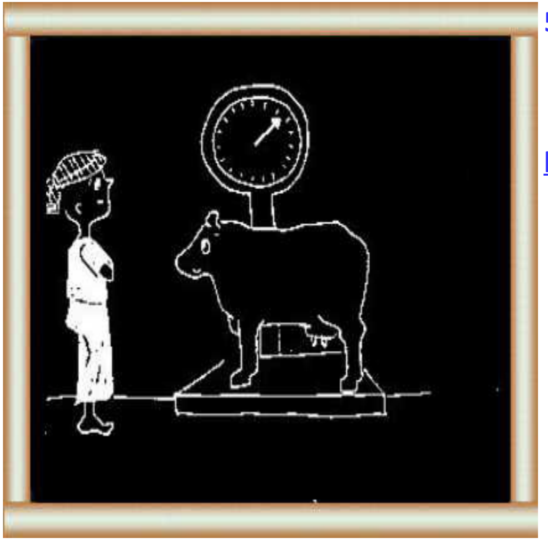
- stage of harvesting or growth

- type of processing

- climate.

51 Check carefully if the TDN, DCP and mineral values are percentages of the DM or the total feed.
Consult your extension worker .

How can you find the feed intake of your animals?



52 Feed intake (DM of feed)

A simple way is to take:

$$\frac{\text{body weight} \times 3}{100}$$

page22

Feed intake (52-61)

A feed has two main components: water and dry matter. It is the DM component that supplies the nutrients. Therefore, feed intake refers to dry matter intake (DMI).

The approximate DMI of cattle can be computed in different ways:

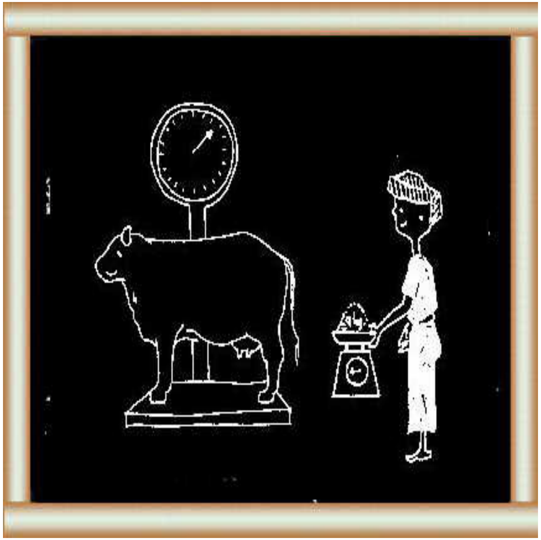
- 3 % of the body weight
- 21/2 % of body weight + 10% of milk yield
- 6 kg + 1 % of body weight + 20 % of milk yield

The estimated DMI based on the last method of computation is given in Table 1 in Annex 2.

The DMI depends on many factors. Among them are availability of water, type and quality of roughage, feeding frequency, amount of concentrates given, digestibility of the feeds, condition of the animal, weather conditions etc.

Roughages are very important in the diet of ruminants because they supply the crude fibre which is necessary for proper functioning of the rumen. Optimally 18-20 % of the DMI has to be crude fibre.

If the crude fibre content is too low, milk fat content in the milk can fall. On the other hand, if the crude fibre content is too high, the animal will not be able to consume sufficient DM. Thus it will not receive all its requirements of energy and proteins, and the milk yield will drop.



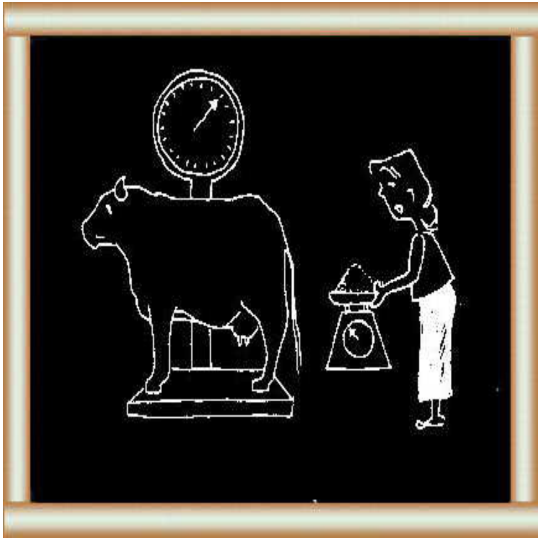
53 So for a 300 kg cow, the feed intake is:

$$\frac{300\ \text{kg}}{100} \times 3 = 9\ \text{kg}$$

54 To allow for milk yield, you can estimate the feed intake as:

$$6\text{ kg} + \frac{\text{body weight}}{100} + \frac{\text{milk yield}}{5}$$

55 So, for

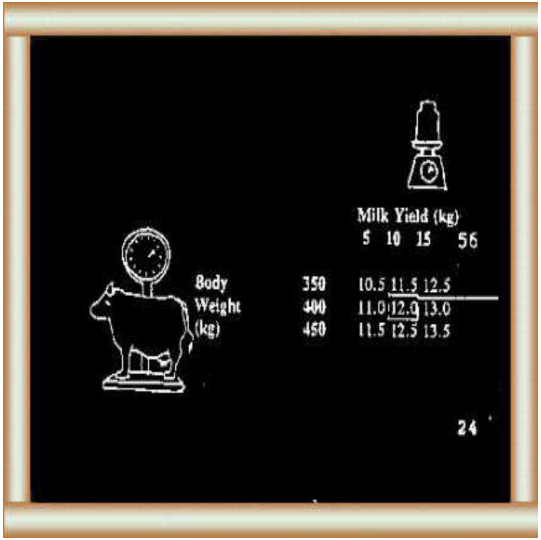


300 kg cow 10 kg milk yield,

feed intake is:

$$6\text{ kg} + \frac{300\text{ kg}}{100} + \frac{10\text{ kg}}{5} = 11.0\text{ kg}$$

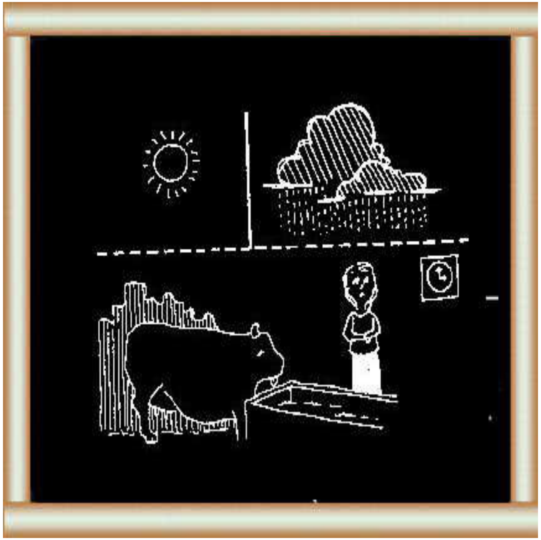
56 Ask your extension worker to show



you a table.

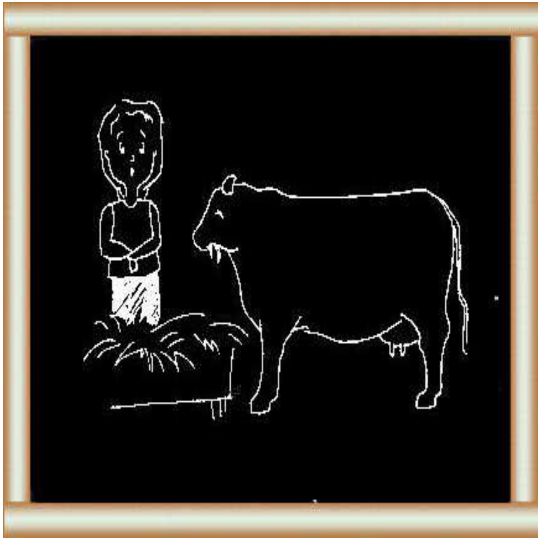
Feed intake for a 400 kg cow with a milk yield of 10 kg.

page24



57 The feed intake depends on:

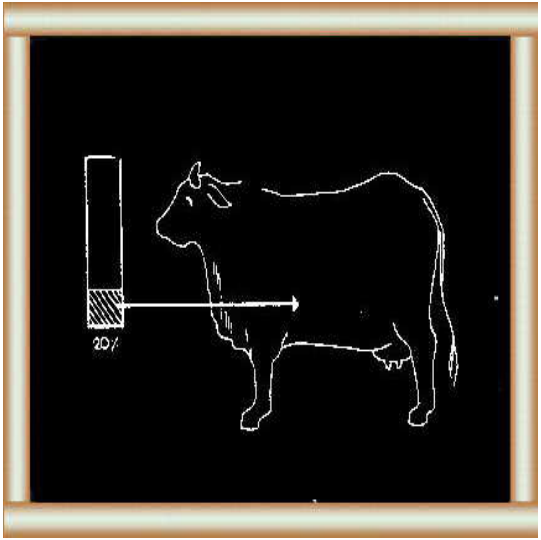
- climate
- availability of water
- how often you feed your animals



58

- the type and quality of roughages
- the amount of concentrates
- how digestible the feeds are etc.

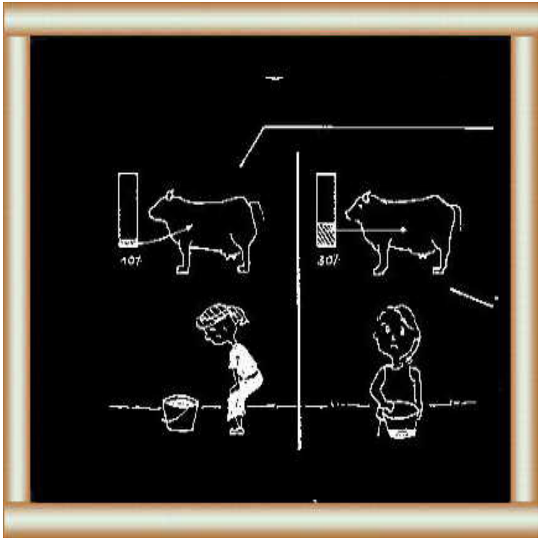
59 At least 20 % of the feed intake



should be crude fibre for good digestion.

Roughages are important because they provide crude fibre.

60 Too little crude fibre content leads



to low milk fat content.

Too high crude fibre content leads to poor feed intake and low milk yields.

page25

Water intake (62-64)

Water is an essential requirement for the proper functioning of animals. Some of its main actions relate to: digestion and absorption of food; transport of nutrients throughout the body and metabolic wastes to the excretory organs (being a component of all body fluids); control of body temperature (conductive and evaporative cooling) and milk secretion

(being a component of the milk).

Animals obtain their water requirements from three main sources:

- water in the food;

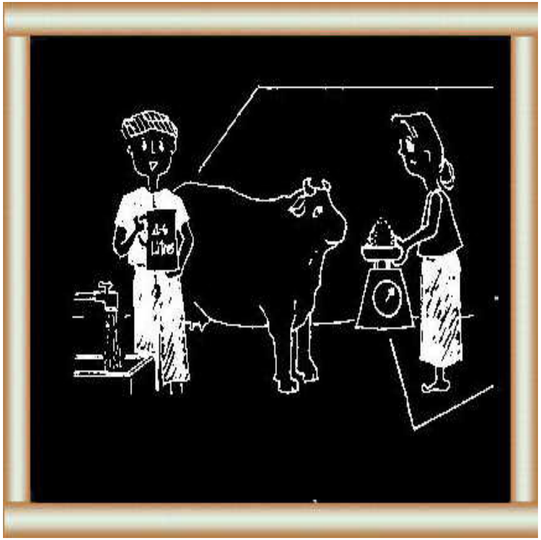
- water consumed voluntarily;

- water formed in metabolic activities of the body.

As a rule of thumb, lactating cows require 4 to 6 litres of water per kg DM consumed. Higher amounts may be required in hot tropical conditions.

The ideal is to allow dairy cattle and buffalo continuous access to drinking water. Where this is not possible, they should be offered as much as they can drink, at least twice a day.

61 Buffaloes can make use of coarse feeds better than cattle.



Water intake

62 You can estimate that lactating cows need 4-6 l of water for each 1 kg of feed intake (DM).

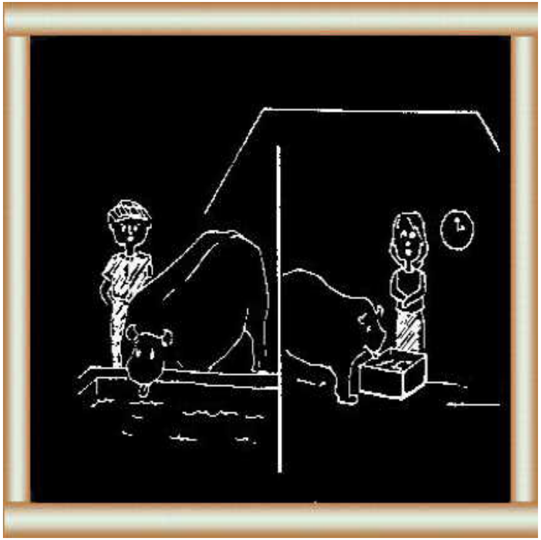
63 So the 300 kg cow with a 10 kg milk

yield and 10 kg feed intake needs:

11 kg x 6 l = 66 l

(feed intake) (water)

64 If possible, give your animals free



access to water.

If not, make sure they have enough to drink at least twice a day.

page27

Nutrient requirements (65-73)

The requirements of the different nutrients vary depending on several factors. Basically they can be considered as maintenance requirements and production requirements.

Compare the nutrient requirements of dairy cattle/buffalo to the fuel requirements of a motorcycle.

Maintenance requirement is the requirement of nutrients to just maintain the animal without losing body weight. It depends on the size of the animal, which is usually measured in terms of its weight.

(If a motorcycle is started without being put to any use, some fuel and lubricating oils will be used up. In a similar manner, the living animal also uses up mainly energy and proteins and also small quantities of other nutrients, just to maintain the body mechanisms functioning.)

Production requirement is the requirement of nutrients for the various production functions. The different production functions require varying amounts of nutrients.

- A young animal that is still growing requires more nutrients in addition to its requirement for maintenance.

(A motorcycle requires more fuel and oil to be driven from one place to another.)

- A pregnant animal requires more nutrients for the growth of its calf (foetus) in addition to its own maintenance re-

quirement. A young growing heifer which is also pregnant requires nutrients for maintenance, its own growth and the growth of its calf.

(Compare to a motorcycle - using its engine power to move from one place to another, with an additional passenger.)

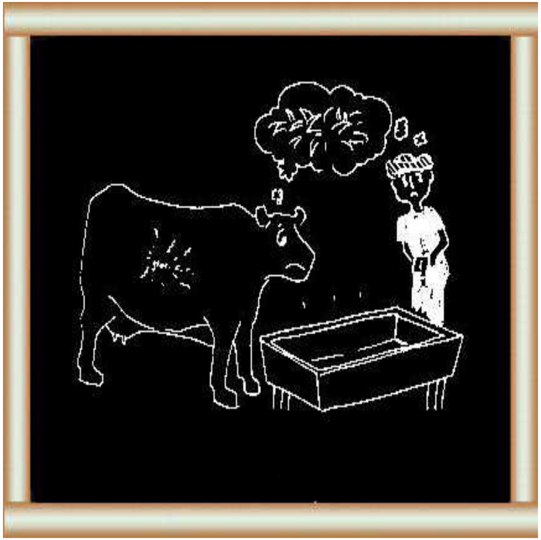
page28

How can you find the nutrient requirements of your animals?

Maintenance requirement

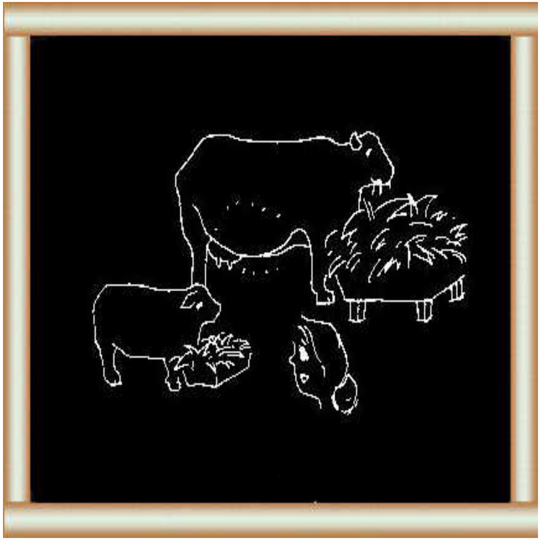
65 This is the amount of nutrients an animal needs when it is not growing or producing.

It depends on the weight.



Production requirement

66 Your animal needs more than the maintenance requirement to produce = production requirement



67 Your animal needs extra nutrients for:

- growth

- pregnancy

68

- milk production
- work.

page29

- A lactating animal requires more nutrients for milk production in addition to its maintenance requirement. Thus a cow that starts lactating before completing its own growth requires nutrients for its maintenance, own growth and milk production.

(Compare to a motorcycle - using its engine power moving from one place to another, up a hill.)

- An animal that is used for work requires more nutrients for work in addition to its maintenance requirement.

(Compare to a motorcycle used to pull a carriage.)

The nutrient requirements of dairy cattle have been worked out under experimental conditions. (See Tables 2 and 3 in Annex 2)

page30

Ask your extension worker to show you tables:

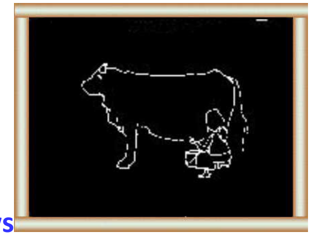
69 Growing heifers (small breeds)

Body weight (kg)	Daily weight gain (kg)	Protein Total (g)	DCP (g)	Energy TDN (kg)	Minerals Calcium	Phosphorus
50	500	215	160	0.9	4.9	3.8

75	550	275	190	1.2	7.0	5.4
100	550	320	210	1.6	9.0	7.0

70 Growing heifers (large breeds)

100	750	370	260	2.0	10.9	8.4
150	750	435	295	2.7	15.0	12.0
200	750	500	330	3.4	18.0	14.0



71 Maintenance of mature lactating cows

350	468	220	2.8	14.0	11.0
400	521	<u>245</u>	<u>3.1</u>	17.0	13.0
450	585	275	3.4	18.0	14.0

72 Maintenance and pregnancy

(last 2 months of gestation)

500	780	430	4.8	29.0	22.0
550	850	465	5.2	31.0	24.0
600	910	500	5.6	34.0	26.0

73 Milk production (nutrients/kg milk)

% Fat

4.0	78	51	0.330	2.7	2.0
4.5	82	54	0.355	2.8	2.1
5.0	86	56	0.380	2.9	2.2

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Balanced rations (74)

Remember that all nutrients have to be supplied in required amounts. If there is a deficiency in the supply of any one nutrient, the animal will be unable to utilize adequately the other nutrients supplied.

The principal of the minimum bucket applies. The deficient nutrient limits the utilization of the others.

Therefore, balanced rations should be supplied in adequate amounts.

The extension officer should:

- develop the skills to formulate suitable rations incorporating available feeds for the dairy cattle/buffalo in the local area, using the standard nutrient requirements and nutritive values of various feeds as guidelines; and

- advise farmers on feeding these rations to their cattle and buffalo.

Ration calculation (75-83)

An example is worked out below to show how to do a ration calculation. The example is simplified for easy understanding of the principles. The field situation can be more difficult and variable.

To get a clearer picture of the field situation, a ration calculation worksheet can be used. (See extension materials).

Step 1 - Obtain general data

- age and body weight of cow
- milk yield and fat percentage
- stage of lactation and pregnancy and lactation number
- feeds available and their nutritive values

- tables of nutrient requirements

Assume step 1 results in the following information:

Crossbred cow; age 4 years and body weight 400 kg; daily milk yield 10 kg with 5 % butter fat; 2nd month of lactation; not pregnant and lactation number 2:

Feed available	Nutritive value		
	DM (%)	TDN (% DM)	DCP (% DM)
Fresh grass	20	60	4
Concentrate mix	90	70	18

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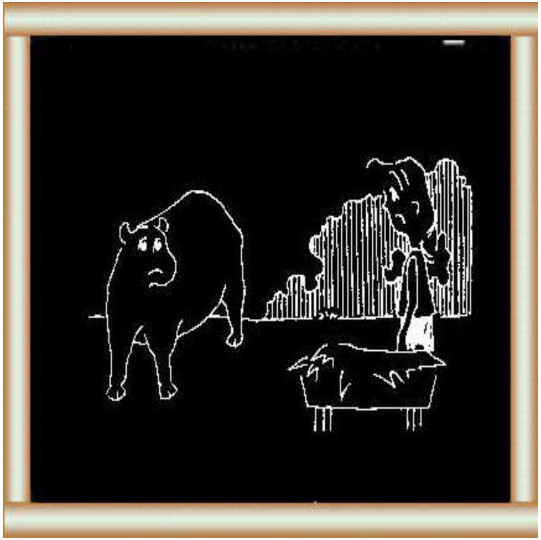


Balanced rations

74 Your animals need balanced rations.

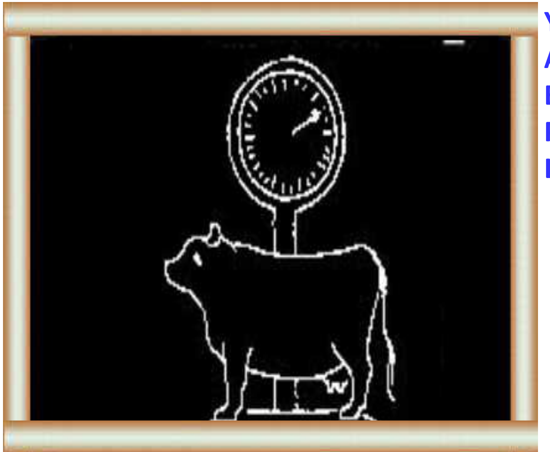
If one nutrient is lacking, they cannot make good use of the other nutrients, even if the other nutrients are sufficient.

How can you calculate rations?

75

A: INFORMATION REQUIRED

You must collect information for your worksheet (See A on next page) e.g.:



Your crossbred cow

Age: 4 years

Body weight: 400 kg

Pregnant: No

Lactation: 2nd month of 2nd lactation.

76 Your milk

Milk yield: 10 kg/day

Butter fat: 5 %

77 Your Feeds

Availability

Nutritive value

	DM (%)	TDN (% DM)	DCP (% DM)
Fresh grass	20	60	4
Concentrate mix	90	70	18

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RATION CALCULATION WORKSHEET

Farmers name: Date: **Advisors name: Cow No:**

INFORMATION REQUIRED **Weight of cow: (kg) Milk yield: kg/day** **Stage of lactation: (months)** **Butterfat %** **Age of cow: (years)** **Dry matter intake: kg** **Gestation: months** **Feeds available: Lactation No:** **a) on the farm:** **b) purchasable:**	**A**
ANIMAL REQUIREMENTS **TDN kg Protein kg** **Maintenance:** **Desired weight gain:** **Milk production:** **Gestation:** **TOTAL:**	**B**
NUTRIENT CONTENT OF FEEDS AVAILABLE	

Feed DM % TDN % Protein % Cost per kg **1** **2** **3** **4** **5** **6** **7** **8** **9** **10**	**C**
FINAL RATION RECOMMENDED **Forage:** **Concentrate:**	D

***Notes:* 1 Desired weight gain: add 20 % to the maintenance allowance during the first lactation and 10 % during the second lactation.**

2 At least 25% of DMI must come from forage to protect milk quality.

Step 2 - Fill in part A of ration calculation sheet

Step 3 - Calculate the requirements of the cow (part B of sheet) as follows:

Animal's requirements	DM (kg)	TDN (kg)	DCP (kg)
Maintenance	-	3,1001	2451
Desired weight gain	-	3102	252
Milk production	-	3,8003	5603
Gestation	-	-	-
Total	12.04	7,210	830

(1) The relevant values for cow of 400 kg body weight from Table 3.

(2) 10 % of maintenance requirement as the cow is in second lactation.

(3) The relevant values against 5 % fat in Table 3 multiplied by 10.

(4) Given value for 400 kg cow with 10 kg milk yield per day. See # 56

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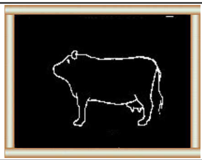
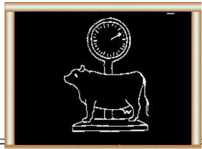
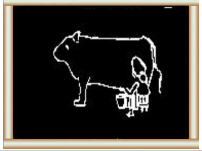
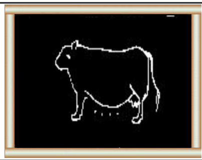
B: ANIMAL REQUIREMENTS

78 You must calculate the requirements of your cow:

	Animal Requirements	DM (kg)	TDN (g)	DCP (g)
	Maintenance[1]		3,100	245

	Desired weight gain[2]		310	25
	Milk production[3]		3,800	560
	Gestation		-	-
	Total	12.0[4]	7,210	830

Note:

1 See the table in 71 above for a 400 kg cow.

2 As the cow is in 2nd lactation, take 10 % of the maintenance ration:

$$\textbf{TDN} = \frac{3{,}100\text{ g}}{10} = 310$$

$$\textbf{DCP} = \frac{245\text{ g}}{10} = 25\text{ g}$$

3 See the table in 73 above for 5 % fat. For 10 kg milk/day:

TDN = 0.380 kg x 1,000 g x 10 = 3,800 g

DCP = 56 g x 10 = 560 g

4 See the table in 56 above - DM for a 400 kg cow with a milk yield of 10 kg/day.

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Step 4 - Calculate the amount of nutrients that can be supplied by roughages

In this example, only one roughage is considered. In the field various combinations of roughages may have to be considered. In any event, the availabilities of roughages will vary during different seasons. Therefore, fresh computations have to be done when the availability changes.

If the total DM requirement of 12 kg is supplied with the available fresh grass, the nutrients supplied are:

TDN (600 x 12)	**= 7,200 g**
DCP (40 x 12)	**= 480 g**

Therefore, there is a shortfall of (7,210 - 7,200 =) 10 TDN and (830 - 480 =) 350 g DCP.

It is also unlikely that the cow will consume (100/20 x 12

=) 60 kg of the fresh grass to obtain 12 kg of DM from grass alone, because of the bulk and the low palatability.

Therefore, it would be necessary to offer a concentrate to meet the shortfall.

Step 5 - Calculate the amount of nutrients that have to be supplied from concentrates

In this particular example, it is assumed that the cow will consume only about 9 kg DM of grass i.e. (100/20 x 9 =) 45 kg of fresh grass.

	DM (kg)	TDN (kg)	DCP (kg)
Total requirement	12	7,210	830
Supplied from grass	9	5,400	360
Shortfall	3	1,810	470

By supplying 3 kg DM of the concentrate containing 70 % TDN and 18 % DCP, 2,100 g TDN and 540 g DCP will be available to the cow, thereby meeting the shortfall in the nutrients. If the concentrate mixture contained 90 % DM, the amount of concentrate mixture to be supplied is (100/90 x 3 =) 3.3 kg.

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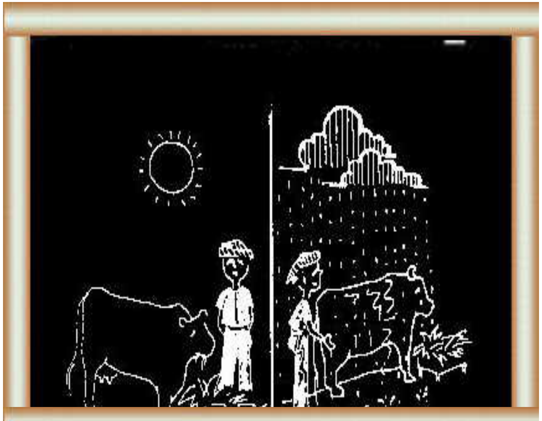
C: NUTRIENT CONTENT OF FEEDS AVAILABLE

You must calculate the amount of nutrient available from:

Roughages
79 Different roughages are available in different areas



and different seasons.

Calculate again where the roughage changes. Here is an example for one roughage: fresh grass.

80 Your cow needs (See 70-72):

DM TDN DCP

Requirements

12.0 kg 7,210 g 830g

If your fresh grass provides (See 77):

DM	TDM	DCP
20 %	60 %	4 %
20 kg DM come from 100 kg fresh grass **so** **12 kg DM come from $^{100}/_{20}$ x 12 kg**	**1 kg DM provides 600 g TDN** **so** **12 kg DM provide 600 x 12**	**1 kg DM provides 40 g DCP** **so** **12 kg DM provide 40 x 12**

= 60 kg fresh grass	= 7,200 g TDN	= 480 g DCP
	7,200 g TDN & 480 g DCP are available in 60 kg fresh grass	

NUTRIENT REQUIREMENTS - NUTRIENTS AVAILABLE = SHORTFALL

TDN: 7,210 g - 7,200 g = 10 g TDN

DCP: 830 g - 480 g = 350 g DCP

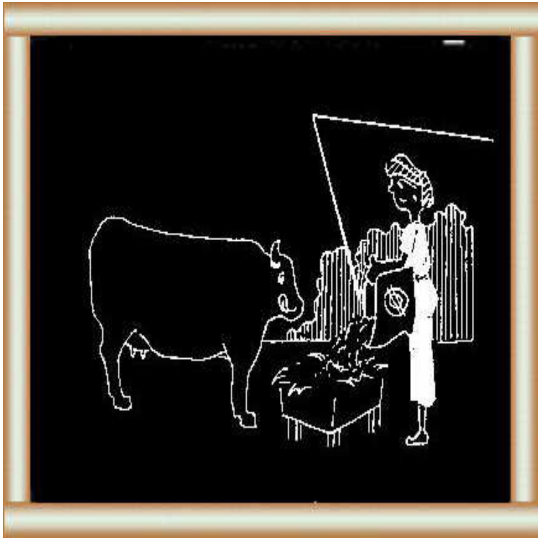
You must offer your animals concentrates to make up for this shortfall.

Concentrates

81 If your cow only consumes 45 kg fresh grass (9 kg DM)

	DM (kg)	TDN (g)	DCP (g)
Your cow's requirement	12	7,210	830
Available in	9 kg	5,400	360

Fresh grass 3
1,810 470
short fall --



82 If you use this concentrate:

DM (kg)	TDN (70%)	DCP (18%)
1 kg	700 g	180 g
3 kg	2,100 g	540 g

3 kg DM is enough to meet the shortfall.

83 If the concentrate is 90 % DM, you

page39

need

$3 \text{ kg} \times \frac{100}{90} = 3.3 \text{ kg}$ concentrate

to meet the shortfall.

If your cow eats less than 45 kg fresh grass, then you need more concentrates.

Concentrate mixtures (84-87)

Sometimes it is necessary to make concentrate mixture to meet particular needs.

If:

(i) - in the above example (Step 5), the shortfall from the fresh grass was 1,800 g TDN and 400 g DCP i.e. the grass contained more DCP;

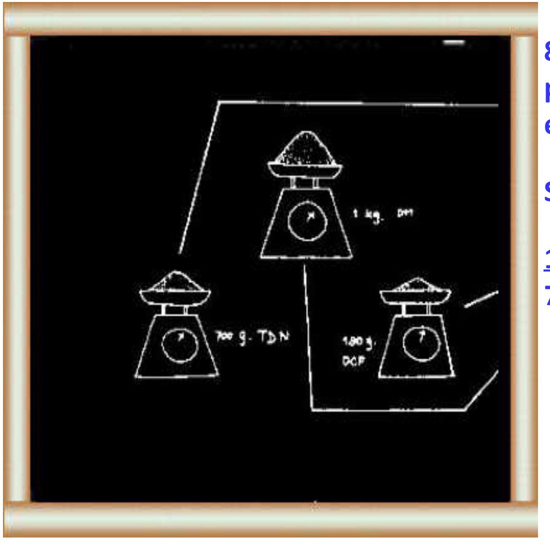
(ii) - in the concentrate mixture that was available (i.e. concentrate mixture 1) each kg DM contained 700 g TDN and 180 g DCP i.e. 180 g DCP per 700 g TDN or (180/170 x 1,000 =) 257 g DCP per kg TDN;

(iii) - the requirement would be 1,800 g TDN and 400 g DCP i.e. (400/1,800 x 1,000 =) 222 g DCP per kg TDN.

The requirement, therefore, is for a mixture with less DCP than the one available. If the available mixture is fed, there will be a wastage of DCP, when adequate TDN is supplied.

This mixture has to be balanced with another feedstuff with less DCP. Suppose rice bran with DM 90 %, TDN 50 % and DCP 9.0 % is available. It has 90 g DCP per 500 g TDN or (90/500 x 1,000 =) 180 g DCP per kg TDN.

Concentrate mixes



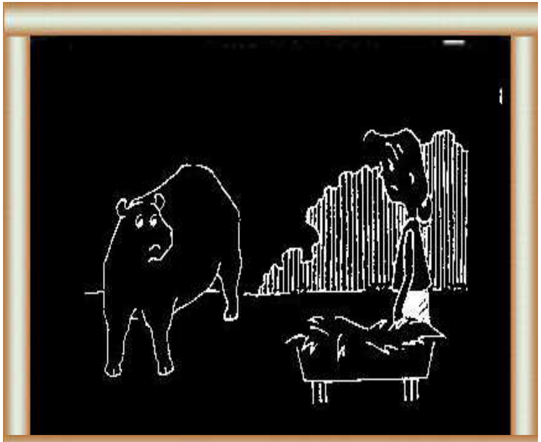
84 The concentrate in 82 above provides 700 g TDN and 180 g DCP for each 1 kg DM.

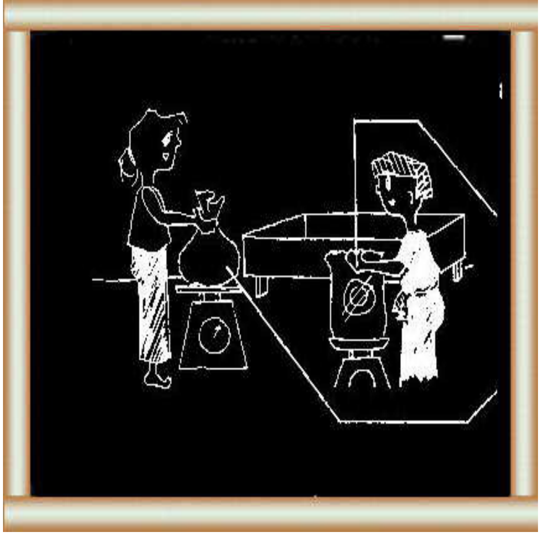
So 1 kg TDN provides

$\frac{180}{700} \times 1{,}000 = 257$ g DCP/kg TDN

85 This farmer has a shortfall of:

TDN	DCP
1,800 g	400 g





from the roughage available to him.

So the requirement is:

$$\frac{400}{1{,}800} \times 1{,}000 = 222 \text{ g DCP/kg TDN}$$

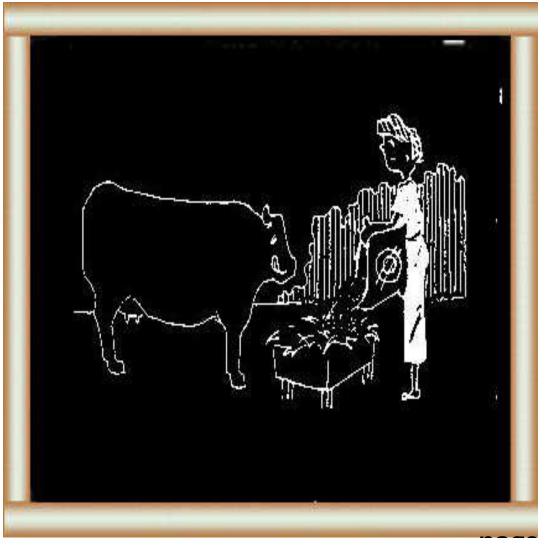
86 If he feeds the concentrate in 82, when the animal has enough TDN, there is a wastage of DCP.

He can mix the concentrate with a feed which has less DCP e.g. rice bran with the following composition:

87

DM	TDN	DCP
90 %	50 %	9 %

So the rice bran has:



90 g DCP/500 g TDN or

$$\frac{90}{500} \times 1{,}000 = 180 \text{ g DCP/kg TDN}$$

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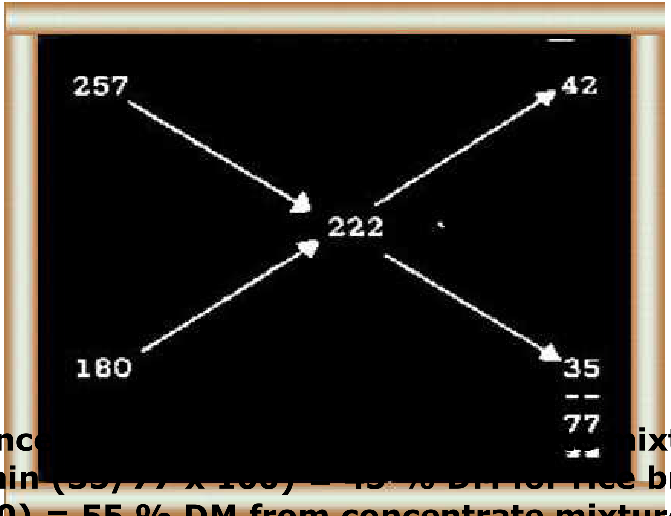
By using Pearson's Square, the composition of the new ration (i.e. concentrate mixture II) can be calculated.

Concentrate MixtureI

Concentrate Mixture II



Rice bran

The new conc [illegible] ixture II) should contain (35/77 x 100) = 45 % DM for rice bran and (42/77 x 100) = 55 % DM from concentrate mixture I. As the DM contents of the concentrate mixture I and rice bran are given as 90 % the quantities to be used by weight are also in the same proportions. If the DM contents are different, the proportions of concentrates mixture I and rice bran have to be adjusted accordingly.

3 kg DM of concentrate mixture II would contain 1,650 g DM from concentrate mixture I and 1,350 g of DM from rice bran. The nutrients supplied by 3 kg DM of the concentrate mixture II are as follows:

Feed Quantity
TDN DCP
of DM (g)
(g) (g)

Concentrate 1,650 700 x 1,650 =
1,155 180 x 1,650 = 297
Mixture I
1,000 1,000

Rice bran 1,350 500 x 1,350 = 675
90 x 1,350 =121
1,000
1,000
--

Concentrate 3,000
1,830 418
Mixture II --

This shows that 3 kg DM which is equal to (100/90 x 3 kg =) 3.3 kg by weight of concentrate mixture II are adequate to meet the shortfall of TDN and DCP supply from fresh grass.

He can use Pearson's Square to calculate the composition of the new concentrate mix.

			Concentrate Mix
Concentrates (from 82)	**257 g DCP/kg TDN available**		**42 (222-180) parts concentrate (from 81)**
		222 g DCP/kg TDN requirement	
Rice bran	**180 g DCP/kg TDN available**		**35 (257-222) parts rice bran**
			77 (42+35) parts concentrate mix

So for a concentrate mix

with 222 g DCP/kg TDN, mix:

35 x 100 = 45% DM rice bran with
77

42 x 100 = 55% DM concentrate
77 (from 82)

(The DM for rice bran and concentrates are both given as 90%. Adjust if the DM's are different).
3 kg of concentrate mix provide:

Feed DM (g) TDN (g)
DCP (g)

Concentrate 55 x 3,000 = 1,650 700 x 1,650=
1,155 180 x 1,650 = 297
(from 82) 100
1,000 1,000

Rice bran 45 x 3,000 = 1,350 500 x 1,350 =
675 90 x 1,350 = 121
100
1,000 1,000

Concentrate mix 3,000
1,830 418

So 3 kg DM or 100 x 3 kg = 3.3 kg of concentrate mix is enough to meet the
90
shortfall of TDN and DCP from fresh grass in 85 (page24).

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Notes (88-91)

- Ration calculations should be used only as a guideline. The nutritive value and the palatability of the same feedstuff can vary widely depending on a large number of factors. There are differences among individual animals, too, with regard to feed utilization.

However, feeding the animals based on a scientific method is definitely better than blindly offering whatever is available.

- Even in this particular example, if the cow does not eat 45

kg of fresh grass per day or if this quantity is not available, more concentrates will have to be offered to meet the shortfall in the nutrient supply.

- It is generally accepted that 1 kg of a good concentrate mixture supports the production of 2 kg of milk. However, when the amount of concentrates offered is increased, the amount of milk produced from each kg of concentrates de-creases (law of diminishing returns).

- This is particularly important when the difference between the prices of concentrates and milk is very small (or if the concentrates cost more than milk). On the other hand, if the animals do not receive sufficient nutrients, apart from low yields of milk other problems such as long calving intervals can arise due to the cows not conceiving regular-ly.

- Apart from the energy and protein supplies, mineral requirements also have to be supplied. A suitable mineral mixture should be provided either with the concentrates or as a separate lick.

Annex 1 Feeding dairy buffaloes

The countries where buffaloes are raised for both milk production and as draught animals have large animal populations. The feeding of stock is not always given proper attention. In India and Pakistan, buffaloes are raised mostly on crop residues. Part of the requirements are met through grazing stubble, canal banks etc. Green fodder is also produced and fed under the cut and carry system. The fodder is grown to such a stage of maturity that it provides lots of bulk but lacks nutrients. Rice and wheat straw are fed in plenty since year round supply of green fodder is not ensured.

Although buffaloes have shown excellent abilities for using crop residues, for satisfactory milk yield, an adequate fodder supply is essential during all stages of raising. For lactating animals adequate nutrients must be provided both for body maintenance and production. In good producers even ample green fodder may not fulfil all the requirements. Hence feed supplements/concentrates are required.

After parturition even poorly fed buffaloes tend to maintain milk production for a few days at the expense of their body. This leads to poor production and shorter lactations.

In India and Pakistan and several other countries many

village buffaloes are low producers because their requirements are not met. Much higher milk production potential has been demonstrated in well managed herds which produce over 3,000 litres of milk per lactation.

Good buffaloes produce 12-15 litres of milk per day and on average between 5-10 litres of milk per day. Higher producing animals must be provided with ample nutrients to maintain production as well as general health.

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Buffalo can consume a variety of coarse fodders. For milk production 1 kg of concentrate is fed for 2 to 2.5 litres of milk produced. A ration could consist of green fodder + wheat straw + concentrate. Depending on the dry matter and TDN the green fodder, straw and concentrates must be adjusted.

60 to 70 kg of succulent fodders (Egyptian clover etc) would be fed to a buffalo weighing 500 kg. A single source of fodder may be deficient in nutrients such as legumes and require phosphorus supplementation. When a large quantity of wheat or rice straw is fed, Ca and P deficiency occurs.

For fodders with less maize, millet etc and high dry matter the quantity should be adjusted to between 20 to 30 kg per day along with some straw and concentrate. Avoid feeding coarse fodders to lactating animals. Silage or hay can also be efficiently used if available.

Feeding pregnant buffaloes

The ideal calving interval is 13-14 months. Owing to feeding and management practices, however, the animals tend to have a long calving interval with a long dry period. Since many pregnant buffaloes will not be producing any milk during the last part of pregnancy, these are not properly fed. During this period the buffalo should build up body reserves lost in early lactation. Nutrients are required for the fast growing foetus during the later stages of pregnancy. The body condition of the buffalo must be given proper attention. In addition to good fodder, 1 to 1.5 kg concentrate during the last part of pregnancy will help in attaining good foetal growth, health of buffaloes and a good start in subsequent production.

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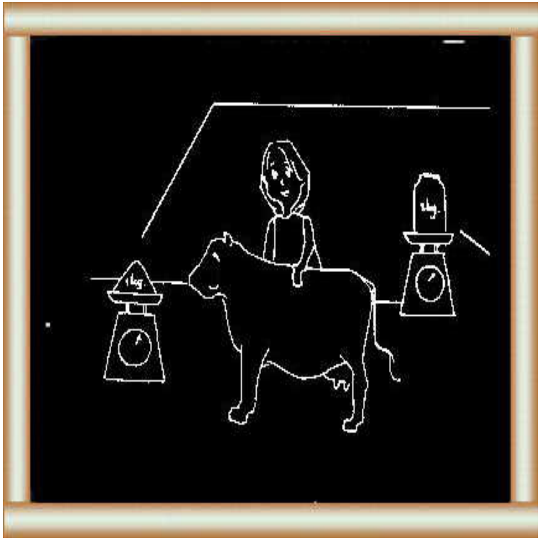
Important

88 Use these examples and calculations as guidelines.

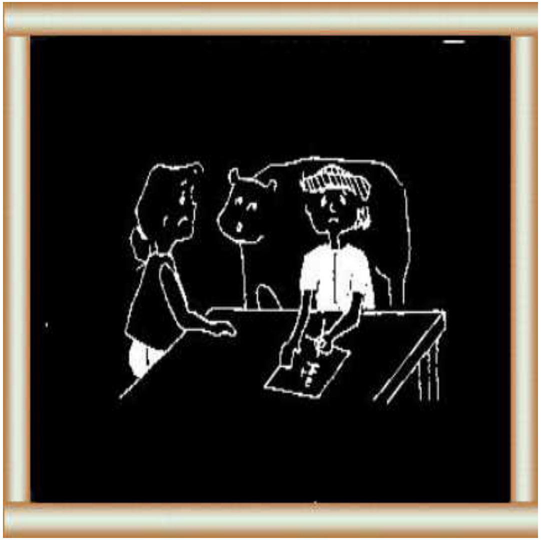
Consult your extension worker when planning feeds.

89 You can estimate that 1 kg of good



concentrate mix supports the production of 2 kg of milk, but increasing concentrates does not increase milk production at the same rate.

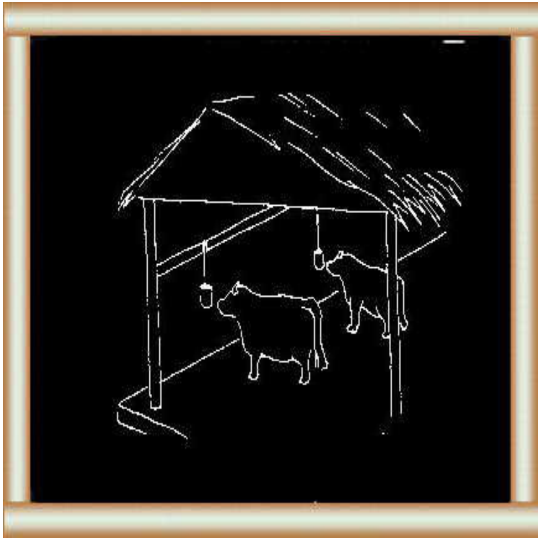
90 Calculate carefully:



- giving too much concentrates wastesmoney.

- giving too little concentrates may lead to low milk yields or calving intervals.

91 You should meet your animal's



mineral requirements by:
- mixing with concentrates
- a separate mineral lick.

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What do you know about feeding dairy cattle and buffalo?

Important points in feeding

1 Good feeding and breeding must go (5-

together for high milk production	8)
2 Animals need:	
- nutrients for strength, health	(9-10)
- minerals for strong bones and joints	(11)
- proteins for strong muscles	(12)
- carbohydrates and fats for energy	(13)
- vitamins for proper body functioning	(14)
- to be fed the right amounts of the correct feeds	(15-16)
Digestion of feeds	
1 The complex stomach	(17-18)
- abomasum	(19)
- rumen, reticulum, omasum	(20)
2 Stomach development in calves	(21-23)
3 Stomach capacity	(24-25)
4 Stomach micro-organisms	(26)

Types of ruminant feed

Finding the value of feeds

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RATION CALCULATION WORKSHEET

Farmers name: Date: **Advisors name: Cow No:**	
INFORMATION REQUIRED **Weight of cow: kg Milk yield: kg/day** **Stage of lactation: months** **Butterfat %** **Age of cow: years Milk yield 4%FCM kg/day** **Dry matter intake: kg**	**A**

Gestation: months **Feeds available:** **Lactation No:** **a) on the farm:** **b) purchasable:**	
ANIMAL REQUIREMENTS **TDN kg Protein kg** **Maintenance:** **Desired weight gain:** **Milk production:** **Gestation:** **TOTAL:**	**B**
NUTRIENT CONTENT OF FEEDS AVAILABLE **Feed DM % TDN % Protein % Cost per kg** **1** **2** **3**	**C**

4 **5** **6** **7** **8** **9** **10**	
FINAL RATION RECOMMENDED **Forage:** **Concentrate:**	**D**

Notes:

1 Desired weight gain: add 20 % to the maintenance allowance during the first lactation and 10 % during the second lactation.

2 At least 25% of DMI must come from forage to protect milk quality.

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Table 1 :

The Estimated Dry Matter Intake of a Cow[1]

MILK YIELD kg/day

kg Live Weight	NIL	5	10	15	20	25	30	35	kg Live Weight
350	9.5	10.5	11.5	12.5	13.5	14.5	15.5	16.5	350
400	10.0	11.0	12.0	13.0	14.0	15.0	16.0	17.0	400
450	10.5	11.5	12.5	13.5	14.5	15.5	16.5	17.5	450
475	10.8	11.8	12.8	13.8	14.8	15.8	16.8	17.8	475

500	**11.0**	**12.0**	**13.0**	**14.0**	**15.0**	**16.0**	**17.0**	**18.0**	**500**
525	**11.2**	**12.2**	**13.2**	**14.2**	**15.2**	**16.2**	**17.2**	**18.2**	**525**
550	**11.5**	**12.5**	**13.5**	**14.5**	**15.5**	**16.5**	**17.5**	**18.5**	**550**
575	**11.8**	**12.8**	**13.8**	**14.8**	**15.8**	**16.8**	**17.8**	**18.8**	**575**

600	**12.0**	**13.0**	**14.0**	**15.0**	**16.0**	**17.0**	**18.0**	**19.0**	**600**
625	**12.2**	**13.2**	**14.2**	**15.2**	**16.2**	**17.2**	**18.2**	**19.2**	**625**
650	**12.5**	**13.5**	**14.5**	**15.5**	**16.5**	**17.5**	**18.5**	**19.5**	**650**
675	**12.8**	**13.8**	**14.8**	**15.8**	**16.8**	**17.8**	**18.8**	**19.8**	**675**

----

1) Formula used: DMI - 6 kg + 1% of body weight and 20% of milk yield.

Table 2 :

Daily Nutrient Requirements of Dairy Cattle - Heifers

Body Daily
PROTEIN ENERGY
Weight Gain
Total
Digestible NZ TDN Ca P
(kg) (g) (g)
(g) (Mcal) (kg) (g) (g)
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Growing Heifers (*mall broods)

20	100		65	
60	1.1	0.3	1.1	0.8
25	150		90	
80	1.5	0.4	1.5	1.1
35	300		135	
110	2.1	0.6	3.2	2.5
50	500		215	
160	3.3	0.9	4.9	3.8
75	550		275	
190	4.3	1.2	7	5.4
100	550		320	
210	5.8	1.6	9	7
150	550		390	
245	8.3	2.3	12	9
200	550		460	
280	10.5	2.9	15	11
250	550		550	
320	12.6	3.5	17	13
300	500		590	
330	13.7	3.8	19	14

Growing Netters (large breads)

40	200		110	
100	1.8	0.5	2.2	1.7

45	300	135		
120	2.1	0.6	3.2	2.5
55	400	180		
145	3.3	0.9	4.5	3.5
75	750	330		
245	5.4	1.5	9.1	7.0
100	750	370		
260	7.2	2.0	10.9	8.4
150	750	435		
295	9.8	2.7	15	12
200	750	500		
330	12.3	3.4	15	14
250	750	570		
365	14.4	4.0	21	16
300	750	640		
395	16.2	4.5	24	15
350	750	715		
430	17.7	4.9	25	19

Source: Nutrient Requirements of Dairy Cattle. 4th edition. 1971. National Academy of science. Washington.

Table 3:

Daily Nutrient Requirements of Lactating Dairy Cattle

Body	ENERGY		PROTEIN			
Weight	HE	TDN	Total	Digestible	Ca	P
(kg)	(Mcal)	(kg)	(g)	(g)	(g)	(g)
Maintenance of Mature Lactating Cows						
350	10.1	2.8	468	220	14	11

400		11.2	3.1		
521	245			17	13
450		12.3	3.4		
585	275			18	14
500		13.4	3.7		
638	300			20	15
550		14.4	4.0		
691	325			21	16
600		15.5	4.2		
734	345			22	17
650		16.2	4.5		
776	365			23	15
700		17.3	4.8		
830	390			25	19
750		18.0	5.0		
872	410			26	20
800		19.1	5.3		
915	430			27	21

Maintenance and Pregnancy (last 2 months of gestation)

350		13.0	3.6		
570	315			21	16
400		14.1	4.3		

650	**355**	**23**	**15**
450	**15.9**	**4.4**	
730	**400**	**26**	**20**
500	**17.3**	**4.8**	
780	**430**	**29**	**22**
550	**18.8**	**5.2**	
850	**465**	**31**	**24**
600	**20.2**	**5.6**	
910	**500**	**34**	**26**
650	**21.6**	**6.0**	
960	**530**	**36**	**28**
700	**22.7**	**6.3**	
1000	**555**	**39**	**30**
750	**24.2**	**6.7**	
1080	**595**	**42**	**32**
800	**25.6**	**7.1**	
1150	**630**	**44**	**34**

Milk Production (nutrient required per kg of milk)

PAT

2.5	**0.91**	**0.255**	
66	**42**	**2.4**	**1.7**
3.0	**0.99**	**0.280**	

70	**45**		**2.5**	**1.8**
3.5		**1.06**	**0.305**	
74	**48**		**2.6**	**1.9**
4.0		**1.13**	**0.330**	
78	**51**		**2.7**	**2.0**
4.5		**1.21**	**0.355**	
82	**54**		**2.8**	**2.1**
5.0		**1.28**	**0.380**	
86	**56**		**2.9**	**2.2**
5.5		**1.36**	**0.405**	
90	**15**		**3.0**	**2.3**
6.0		**1.43**	**0.430**	
94	**60**		**3.1**	**2.4**

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Source: Nutrient requirements of Dairy Cattle. 4 th edition, 1971, National Academy of Science. Washington

Note: for desired weight gain. Add 20% to the maintenance allowance during the first lactation and 10% during the second lactation.

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