Small-Scale Dairy Farming Manual

Volume 3

Husbandry Unit 5.1

PASTURE AND FODDER

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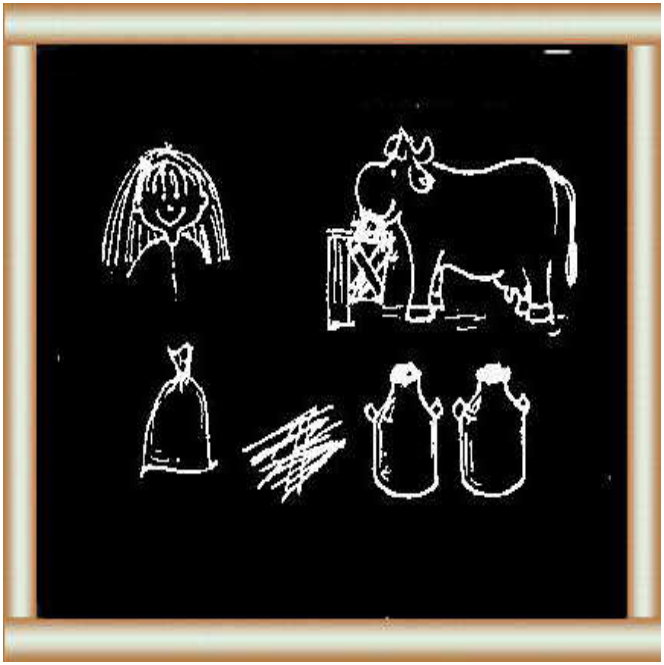
Extension Materials

What do you know about pasture and fodder?

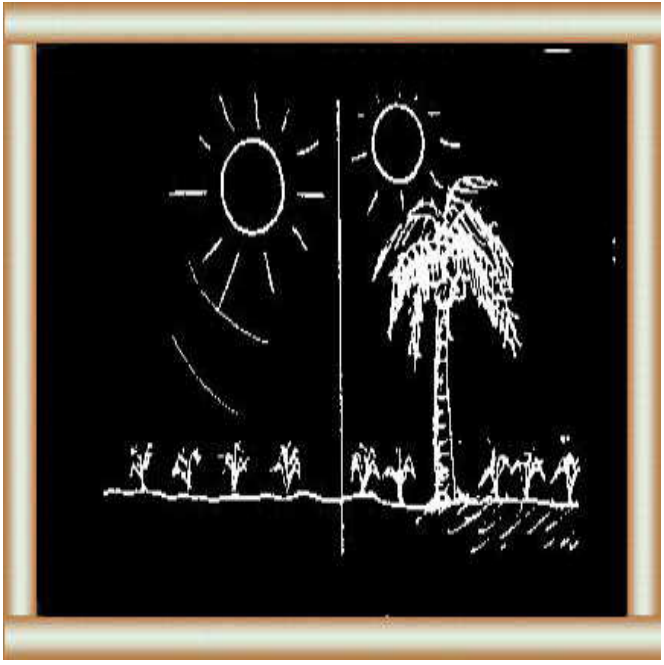
1 Why do your animals need high quality roughages or concentrates? (5-8)

Because they cannot eat enough low value roughages to give good production.



2 How can you select suitable roughages? (9-26)

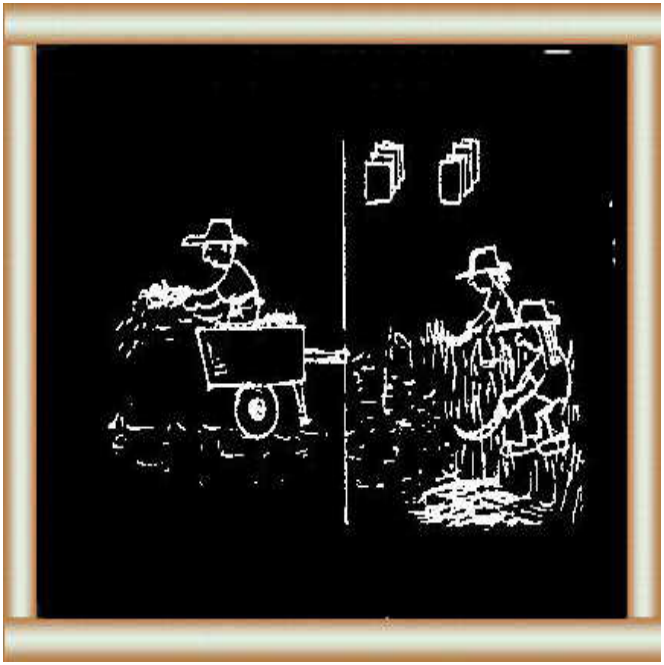
You must think about important things e.g.:
- growth
- cost
- management etc.



3 What improved varieties are there? (27-31)

There are many improved varieties of pastures, legumes, fodders to suit different conditions.

4 How can you manage improved varieties?



(32-57)

You must plan management for:
- the type of pasture/fodder
- your local conditions.

PASTURE AND FODDER

Husbandry Unit 5.1:

Technical Notes

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

Ruminants including cattle and buffalo have the ability to convert low value roughages such as grass and leaves of trees etc. to high value

products such as milk, meat and hides etc. (5)

The ability of the animals to produce milk, meat etc. has increased over the years with the implementation of various selection and breeding programmes. But their ability to consume and utilize larger quantities of roughages has not increased in keeping with the increase in productivity. (6)

Therefore, animals capable of producing higher quantities of milk and meat have to be supplied with high quality roughages or concentrates, or both. (7)

In Asian countries, the roughages available to cattle and buffalo mostly come from crop residues and grasses and weeds etc. growing naturally in forests, roadsides and wasteland not utilized for growing various crops. Where animals with a capacity to produce larger

quantities of milk are kept, the shortfall of nutrients available from roughages is met by offering concentrates. The concentrates are mostly crop residues and by-products.

In some areas, where income from dairying (or dairying in combination with meat production/draft) is sufficiently high, good quality roughages are cultivated for cattle/buffalo feeding, sometimes as pure stands but mostly as components of an integrated farming system (see Unit H.1.1). (8)

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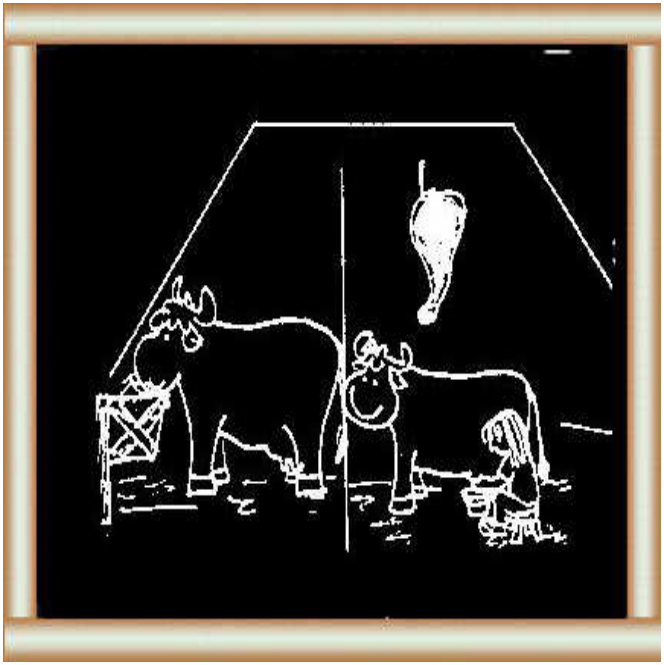
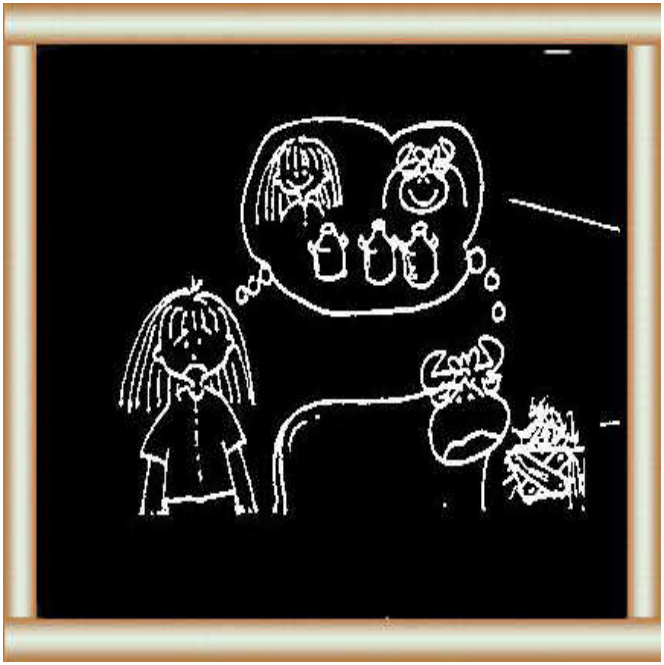
Why do your animals need high quality roughages or concentrates?



5 Dairy cattle and buffalo can change:

- low value roughages e.g. grass, leaves

- to high value products e.g. milk, meat.

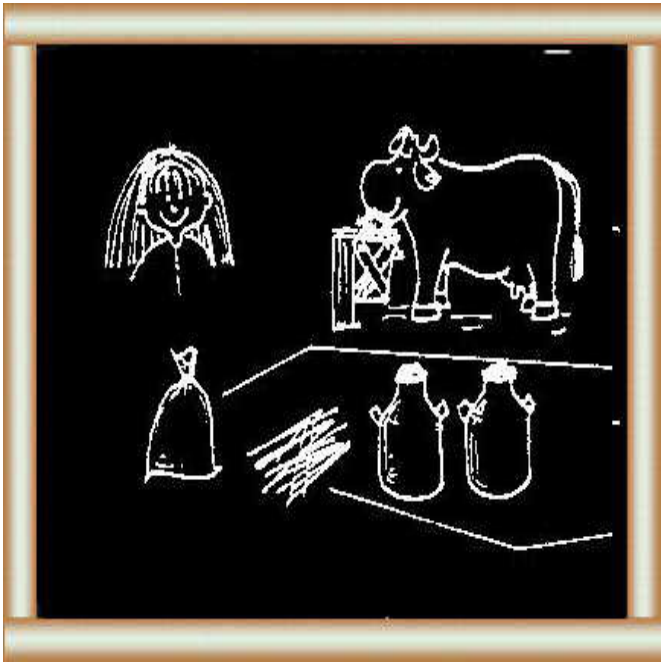


6 With better breeding and selection:

- your animals can produce more but

- they cannot eat enough low value roughages for production.

7 Therefore, you must



give your animals high quality:
- roughages
- concentrates
- or both.

8 You should consult your extension worker about growing good quality roughages:
- alone
- or as part of an integrated farming system (see H 1.1)

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Improved types of roughage

There are many improved pasture and fodder varieties that can be grown in Asian countries. However, only a few of them are particularly suitable to the conditions prevailing in any given area, e.g. the climatic conditions such as rainfall, length of dry season, elevation above sea level, soil conditions etc.

(Much research has been carried out on the suitability of various species for various conditions. The extension officer should acquire adequate knowledge on the recommended varieties for particular areas, especially with regard to the best establishment and management practices as well as the productivity that can be achieved).

In selecting a suitable variety, some important factors to be taken into consideration are nutritive value, growth, persistence, ease of establishment and cost of maintenance. A variety with high nutritive values and good yields may be difficult to establish and costly to maintain. Therefore, the suitability of a particular variety will depend on the particular farmer's circumstances. (9)

Nutritive value: The nutritive value of pastures

and fodders depends on the amount of energy, proteins, minerals and vitamins that the animals can obtain from them. This in turn depends on how much of the nutrients are contained in the pasture/fodder, how much of the pasture/fodder can be eaten by the animals voluntarily (palatability), how much of what is eaten by the animals can be digested and absorbed, and how much of what is absorbed is wasted e.g. if there are toxic substances, the animals will waste nutrients in overcoming their ill effects. (10-11)

Growth: The yield of dry matter (that part which contains the nutrients) of the pasture or fodder varies with the variety, under similar soil and climatic conditions. It is common to find varieties giving yields of 30,000 kg DM per hectare per year and some hybrid varieties of fodder such as hybrid Napier give much higher yields under good management, e.g. regular

application of fertilizer and harvesting at appropriate intervals at appropriate height above ground level. (12)

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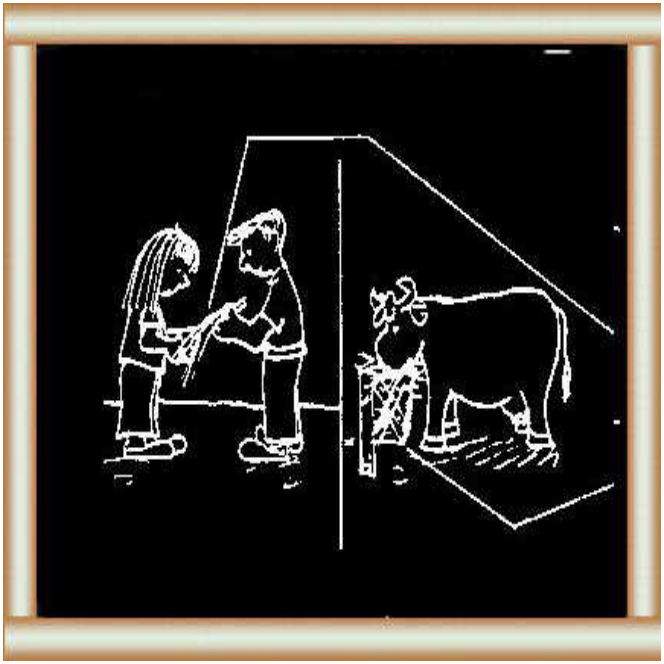
How can you select suitable roughages?

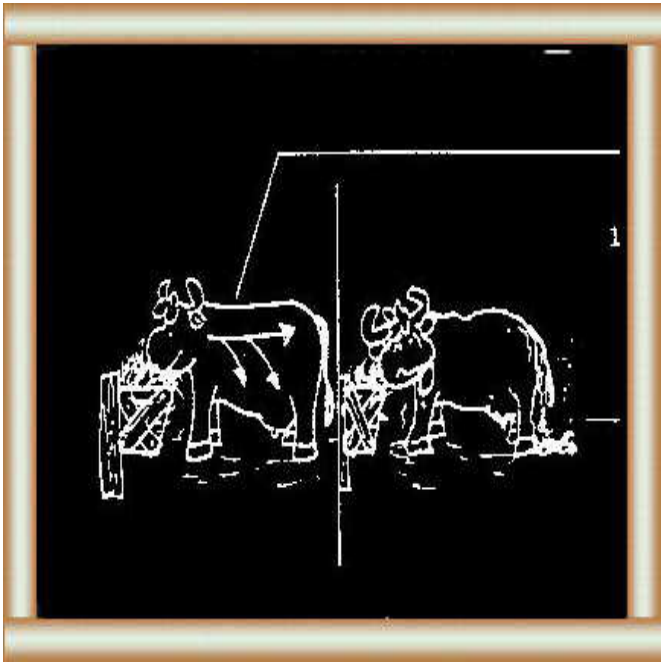
9 Your extension worker can advise you about suitable pasture and fodder crops for your area.
Many things are important in choosing the right crop for you.



Nutritive value

10 This is how much energy, proteins, minerals and vitamins are:
- in the pasture/fodder
- in the amount of pasture/fodder your animals can eat (palatability)

11
- in the amount of pasture/fodder your animals can eat and absorb



- not wasted because of bad feed causing ill effects.

Growth

12 You need:

- high yield of dry matter (which contains nutrients) by e.g. using fertilizer and harvesting at the right time

Even though high annual yields are quite

important, it would be advantageous to have this yield distributed over a long period of the year. If the yield is concentrated within a few months, additional expenditure has to be incurred on fodder conservation and there are also corresponding losses of nutrients. (13)

Persistence: In Asia, it is common to use a pasture or fodder for several years continuously, once established. This practice reduces the costs of re-establishment. Varieties that continue to produce well, year after year, sometimes even under severe grazing, are said to have a high degree of persistence. These varieties are usually resistant to insects and other diseases and to extreme drought or cold, as the case may be. (14-15)

In varieties that spread by runners or rhizomes the growing points are inaccessible to the

grazing animals. Therefore, they recover quickly even after continuous grazing. (16)

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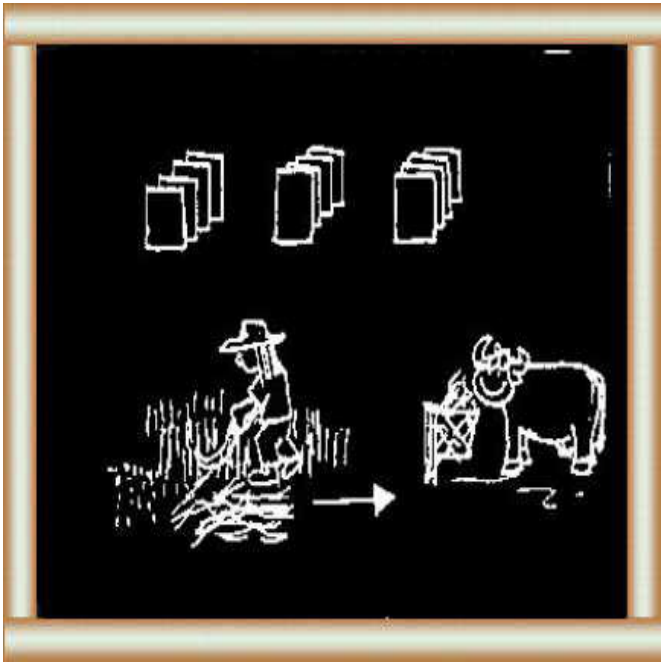

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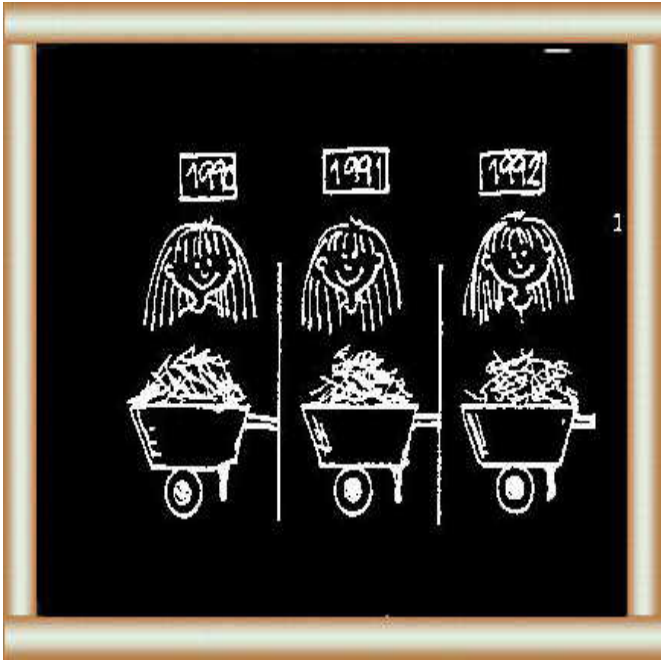
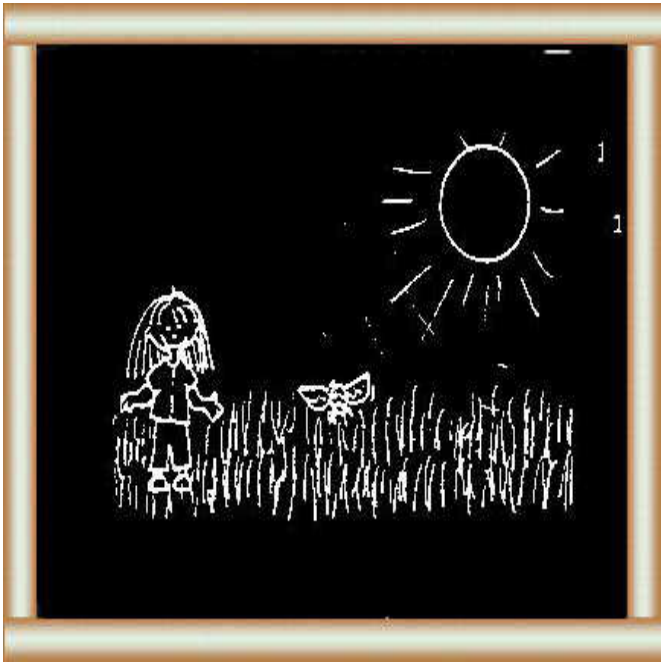
- the yield over a long period of the year.

This reduces the costs of keeping fodder and the loss of nutrients.

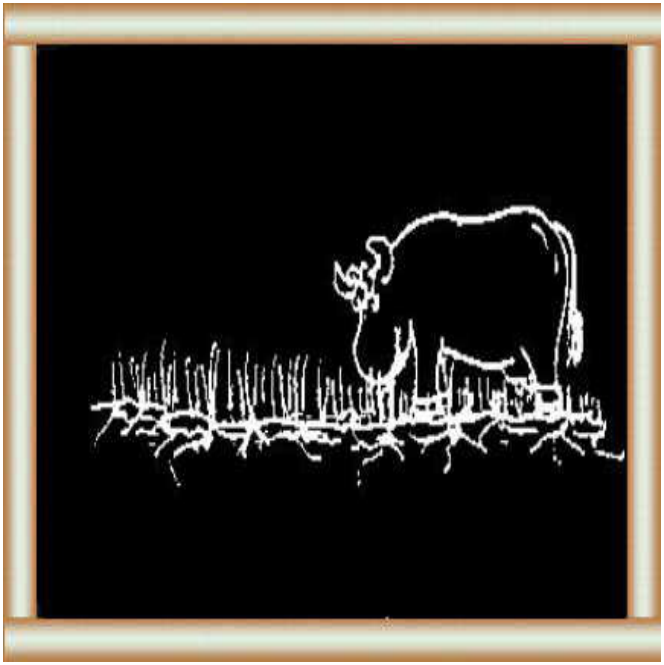


Persistence

14 You need a pasture/fodder that produces well for many years, even with heavy grazing.



This reduces the costs of planting a new crop (re-establishment)
15 The pasture/fodder you choose should resist:
- insects
- disease
- drought etc.



16 Your animals cannot eat crops from runners or rhizomes because the growing points are under the ground. They recover quickly even after continuous grazing.

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Ease of establishment: **Establishment of different varieties is effected through seeds or stem cuttings or root stocks. Different methods of establishment require different types of land preparation. (17)**

Therefore, in selecting a particular variety of pasture or fodder (or a combination of varieties) the methods of establishment and types of land preparation required and their costs have to be taken into account. (18)

Ability to associate (mix) with other crops:
There is no single variety of pasture or fodder that can supply the nutrient requirements of dairy cattle and buffalo in a balanced manner. The overall quality can be improved by having a mixture of varieties and also introducing a legume. (19)

When pasture/fodder is a component of an integrated farming system, the ability of the species to survive in the mixture without causing losses to the other crops in the mixture is an important aspect. (20)

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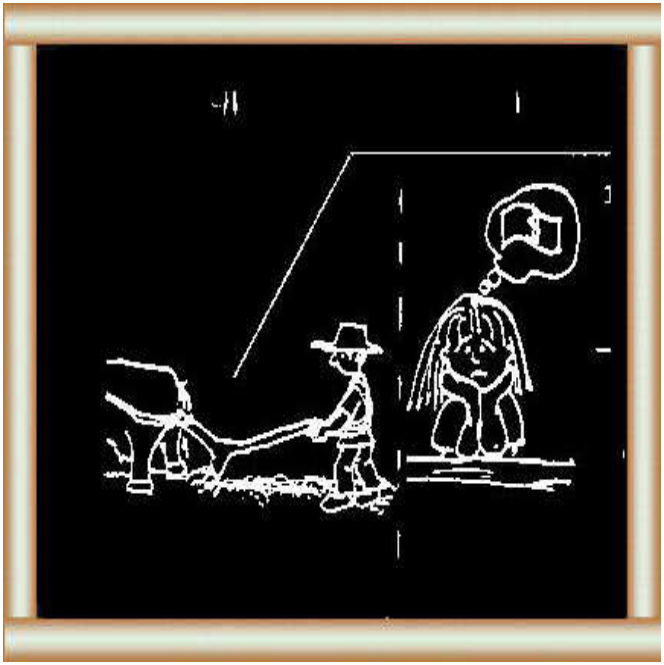
Ease of establishment

17 Land preparation depends upon the pasture/fodder and whether it has seeds, stem cuttings or root stocks.

18 Before choosing a pasture/fodder, think about:
- land preparation
- costs.



Ability to mix with others crops

19 You need different pasture/fodder crops (including a legume) to meet your animals' nutrient requirements.

20 You must choose crops which grow together well.
(See H1.1 Integrated Farming Systems)

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Examples of competition between pasture/fodder and other crops are:

- competition for sunlight; reduced sunlight is available for pasture/fodder growing under permanent crops like coconut, rubber etc.; (21)

- competition for moisture and fertilizer; pasture/fodder growing together with other crops may compete for moisture and fertilizer unless there is sufficient rainfall and addition of fertilizer to meet the requirements of the crops and the pasture/fodder. (22)

Cost of establishment and maintenance: Cost of establishment and maintenance is a very important aspect to be taken into account in making a decision on pasture/fodder establishment. Generally the more nutritious and higher yielding varieties are more costly to establish and maintain, and require higher management skills. (23)

However, when land is scarce and expensive,

returns from dairying are sufficiently high, and suitable varieties are available to meet the local agro-ecological (environmental) conditions, it may be more profitable to use more nutritious and higher yielding varieties. (24)

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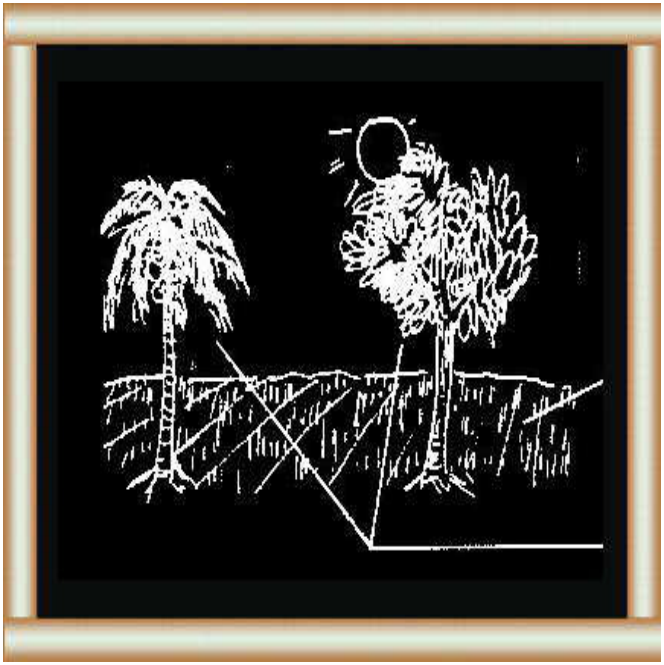
Be careful, some crops compete:



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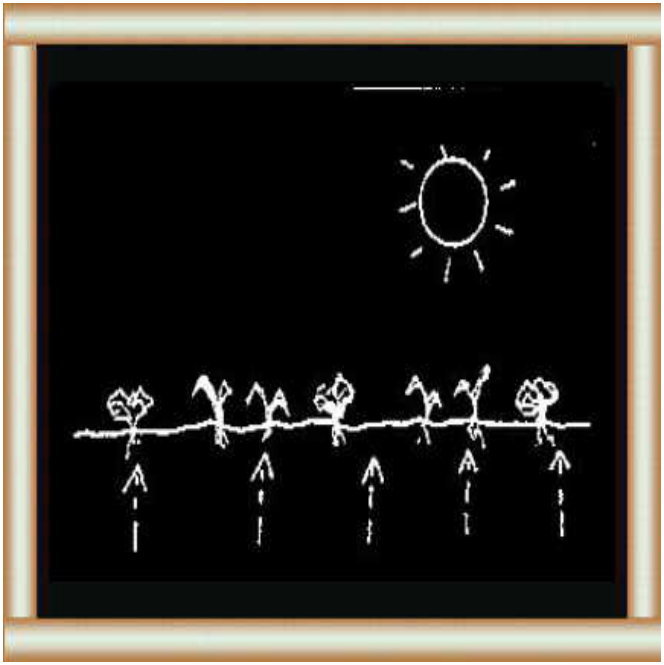
- for sunlight e.g. pasture/fodder growing under coconut, rubber etc.



22
- for moisture and fertilizer, unless there is enough rainfall and you add fertilizer.

Cost of establishment and maintenance

23 You must balance:

- the cost of establishing, maintaining and managing fodder/pasture with high nutrients and yields

against

24
- the extra nutrients and yields you gain.

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Other benefits: **Apart from serving as a feed resource, especially for cattle and buffalo, there**

are other benefits from pasture/fodder.

These include:

- building up soil fertility in lands that have been used continuously for crop production over a number of years ("ley" farming technique); (25)

- addition of fertility to the soil by incorporation of legumes together with pasture/fodder;

- prevention of soil erosion. (26)

Among the improved pasture varieties are:

Brachiaria brizantha (Signal grass); Brachiaria decumbens; Brachiaria milliformis; Brachiaria mutica (Para grass, Water grass), Brachiaria ruziziensis (Ruzi grass); Cenchrus ciliaris (Buffel grass); Cynodon species; Dactylis glomerata (cocksfoot); Digitaria decumbens (Pangola

grass); Panicum maximum (Guinea grass); Panicum maximum (Hamil grass); Paspalum plicatulum; Paspalum urvillei; Pennisetum clandestinum; (Kikuya grass); Setaria sphacelata; Tripsacum laxum (Gautamala grass) etc.

The different varieties are more suitable for certain particular conditions.

Some examples are:

- Brachiaria brizantha for low rainfall conditions;

- Brachiaria milliformis for shade conditions such as found under coconut; (27)

- Brachiaria mutica for water logged conditions;

- Brachiaria ruziziensis, suitable also as a fodder in high rainfall areas with well drained soil; (28)

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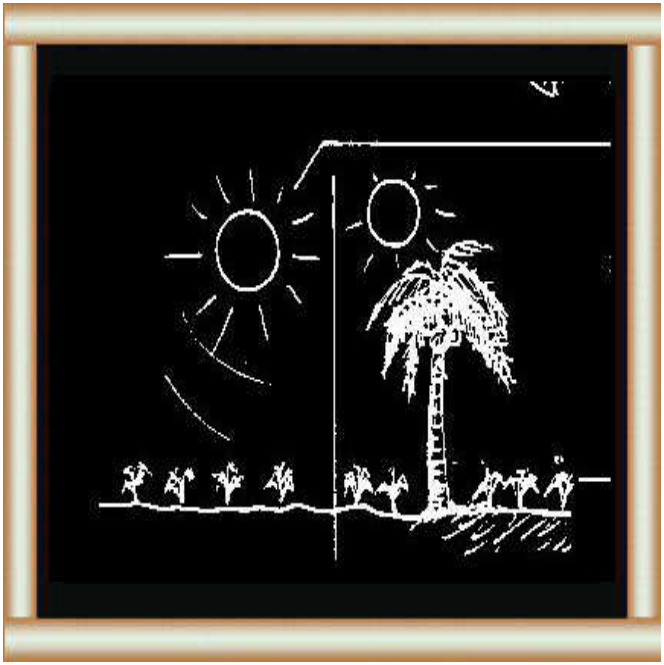
Other benefits 25 These include: - building up soil fertility where you used fields for crop production for many years ("ley" farming technique)

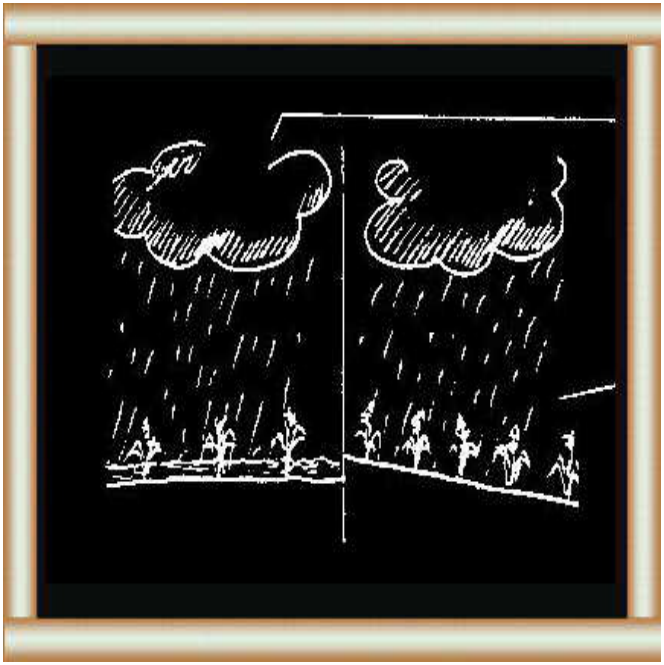
26
- increasing fertility by using legumes with pasture/fodder

- preventing soil erosion.

What improved varieties are there? See Annex I for a list. Pasture



27 Different varieties are suitable for certain conditions e.g.:
- Brachiara brizantha for low rainfall conditions
- Brachiara milliformis for shade e.g. under coconut



28

- Brachiara mutica for water logged conditions

- Brachiaria ruziziensis for high rainfall with well-drained soil

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- Pennisetum clandestinum and Paspalum varieties for cool climates in areas with high

altitude and high rainfall. (29)

Improved legume varieties

Among the improved legume varieties are:

Centrosema pubescens; Desmodium intortum (Green leaf desmodium); Desmodium uncinatum (Silver leaf desmodium); Dolichos axillaris; Dolichos lab lab (lab lab bean); Gliricidia maculata; Glicine javanica; Glicine wightii; Leucaena leucocephala (ipil-ipil); Phaseolus atropurpureous (Siratro); Pueraria phaseoloides (Tropical Kudzu); Stylosanthes guyanensis (Cook stylo); Stylosanthes hamata; Stylosanthes humilis (Townsville lucerne); Styzolobium atterimum (Velvet bean); Trifolium pratense (Red clover); Trifolium repens (White clover); Trifolium rupellianum (African clover); Trifolium semipilosum (Kenya white clover).

The legumes may be established as pure stands, as components in mixture with other crops as grasses, or as fences or hedges. (30)

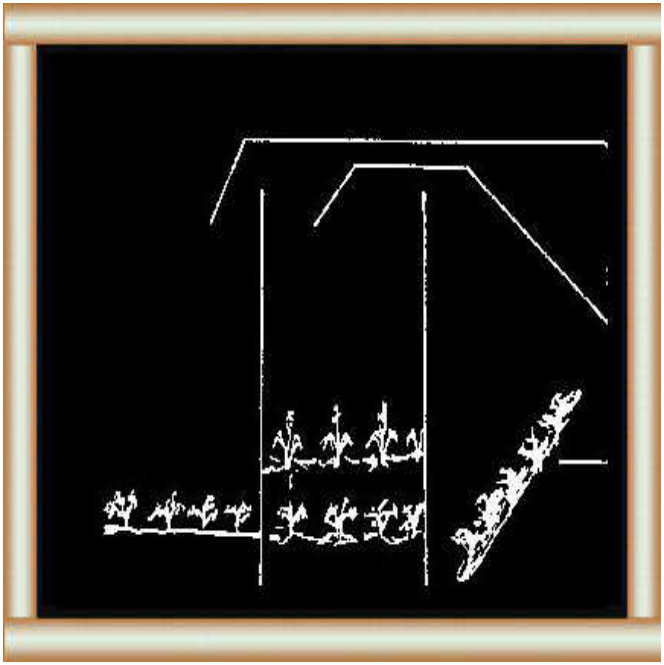
Improved fodder varieties

Some of the varieties listed under pastures and legumes can also be used as fodders, e.g. Brachiaria ruziziensis; Panicum varieties; Paspulum varieties; Glyricidia; Leucaena etc.

Some varieties that are used mainly as fodders are, Pennisetum purpureum (Napier grass or Elephant grass) and its newly developed hybrids such as "NB 21" or Poosa Giant Napier"; fodder maize varieties and newly developed hybrids; fodder sorghum varieties and newly developed hybrids etc. (31)

29

- Pennisetum clandestinum and Paspalum varieties for cool climates, high altitudes and high rainfalls.



Legumes
30 You can grow legumes:
- alone
- with other crops
- as fences or hedges.

Fodder

31 You can also use some varieties of pastures and legumes as fodders e.g.:
- Brachiara ruziensis
- Panicum varieties
- Leucaena etc.

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Land preparation

The conventional land preparation methods consist of ploughing the land to break up and loosen the soil, followed by harrowing to further loosen the soil clods into smaller soil particles and for thorough incorporation of the plant materials into the soil. The number of ploughings and harrowings will depend on the soil condition and the type and density of the weeds present at the time of ploughing. (32-33)

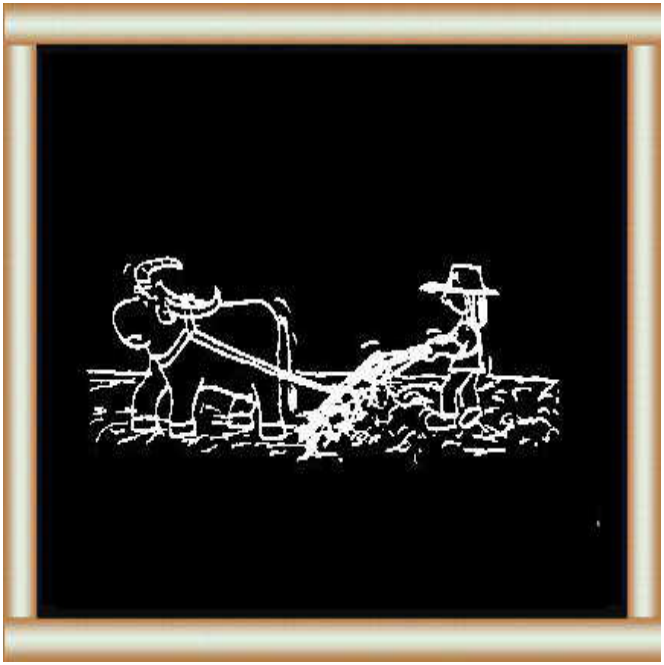
Generally, species with small seeds require a finer soil than those with large seeds. The species propagated by rootstocks, stem cuttings or stolons may be planted immediately after ploughing on rougher soil surfaces. (34)

In high rainfall areas, sloping land especially is not suitable for fine seedbed preparation because of the possibilities of severe soil erosion. (35)

How can you manage improved varieties?

Land preparation

32 You need to:
- plough to break up and loosen the soil



33
- harrow to further break up and loosen the soil and mix plant materials with the soil.

34 You can plant rootstocks, stem cuttings or stolons after ploughing.
Varieties with smaller seeds need finer soil (more harrowing).

35 In areas with high rainfall and especially sloping land do not make a fine seedbed:
- this causes soil erosion.

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Method of planting

Methods of planting depend on the planting materials used.

When propagation is by seed, one of following methods may be used:

- broadcast by hand
- sown with fertilizer distributor
- drilled with a seed drill. (36)

Grass seeds need to be embedded at depths varying from 0.75 to 1.25 cm and seeds of big-seeded legumes can be embedded down to 7.5 cm depending on soil moisture. (37)

When propagation is by vegetative methods, the follow-ing procedures may be adopted:

- stem cuttings (e.g. Napier grass) with 2 or 3 nodes may be planted by hand using a hoe or plant-ing pick, by sticking the stem in an inclined

position; (38)

- an alternative method is to lay the stem cuttings in shallow furrows at a suitable depth depending on soil type and moisture conditions and cover with soil by a plough or mammoty. (39)

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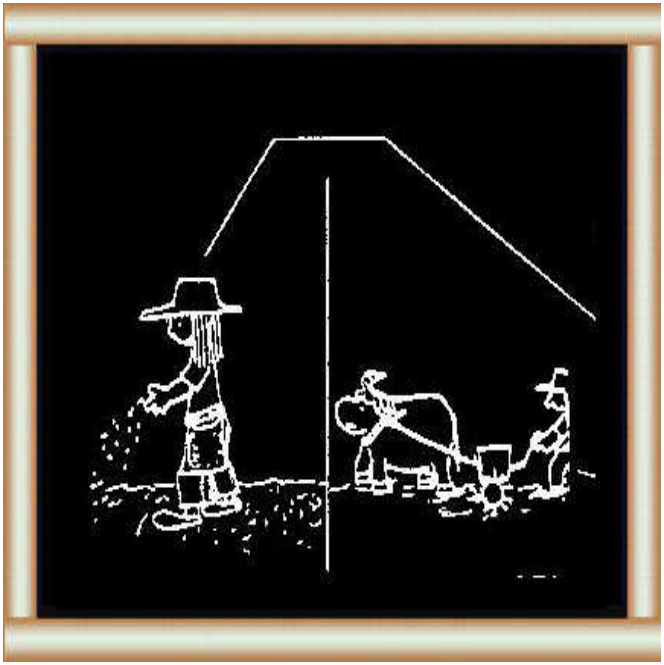
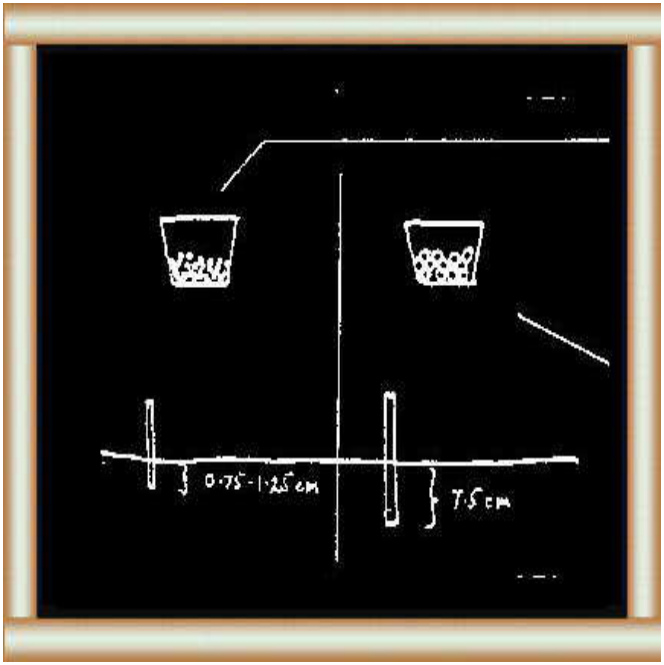
Methods of planting

36 This depends on



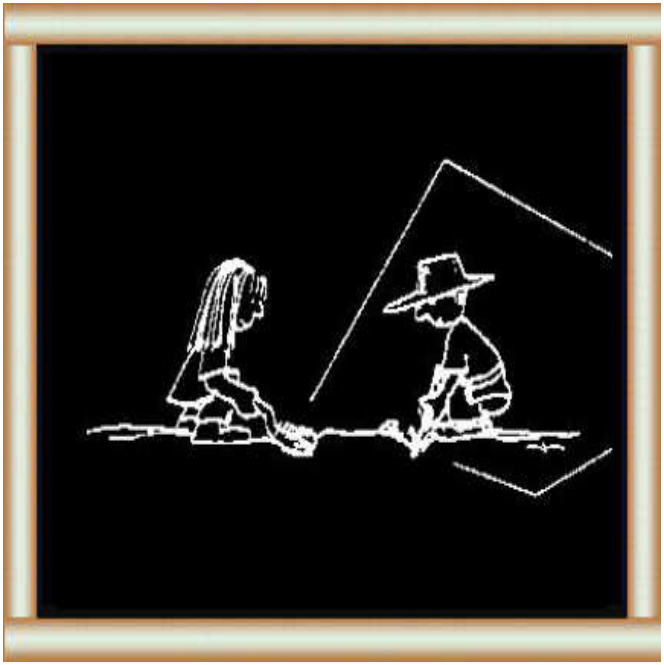
planting materials:
Seed propagation:
- broadcast by hand
- sow with fertilizer distributor
- drill with seed drill.



37 Place grass:

- seeds at a depth of 0.75 to 1.25 cm - legumes with large seeds at depth up to 7.5 cm depending on soil moisture.

38 Vegetative



propagation:

Stem cuttings e.g. Napier grass with 2 or 3 nodes:
- use a hoe or planting pick to make a hole
- put the stem in at an angle
or

39
- lay the stem cutting in shallow furrows
- cover with soil by plough or mammoty.

- tufts or rootstocks with 3 to 5 tillers (e.g. Guinea grass) may be planted by hand using a

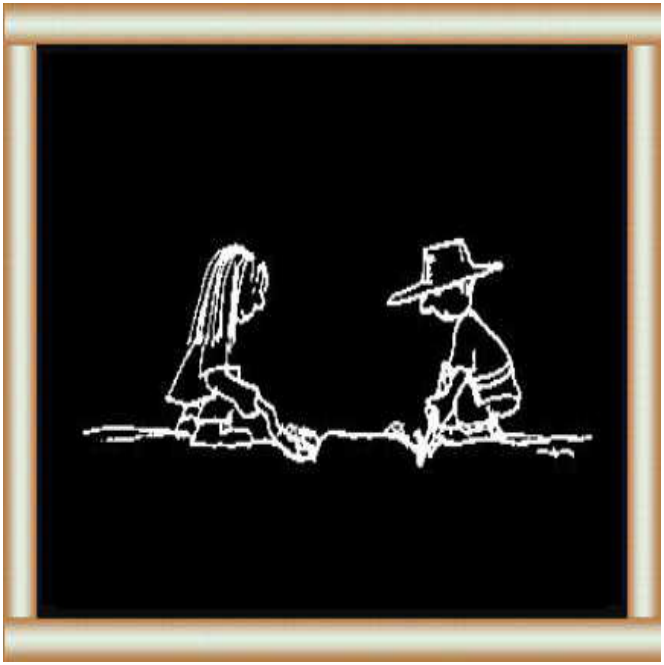
hoe at 25 x 25 cm intervals; (40)

- an alternative method is to plant in furrows and cover by pushing the soil with the help of the foot. (41)

- Pieces of rhizomes or stolons (e.g. Brachiaria species) may be planted by spreading them on loose seedbed and pushing into the soil with the foot or by driving a cart or tractor over them; (42)

alternative methods are:

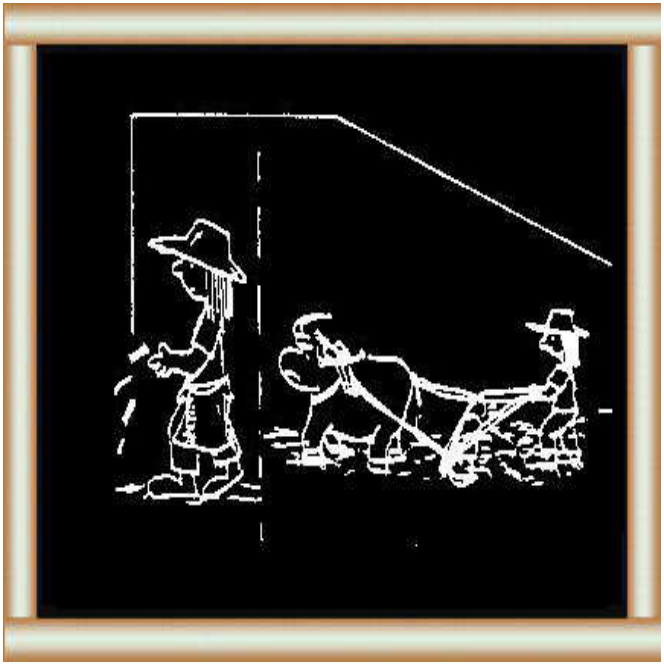
- to scatter mature cuttings on the surface of seedbed and run a disc harrow over them (under wet conditions); (43)



40 Tufts or rootstocks e.g. Guinea Grass with 3-5 tillers:
- plant with a hoe at 25 x 25 cm spacing
or

41
- plant in furrows and cover by pushing the soil by foot.

42 Rhizome or stolon pieces e.g. Brachiaria species:
- spread on a loose seedbed
- push into the soil by foot or by driving a cart over them
or



43 in wet conditions:
- spread mature cuttings on a seedbed
- run a disc harrow over them

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- to plant with a hoe or to drop into shallow furrows (44)

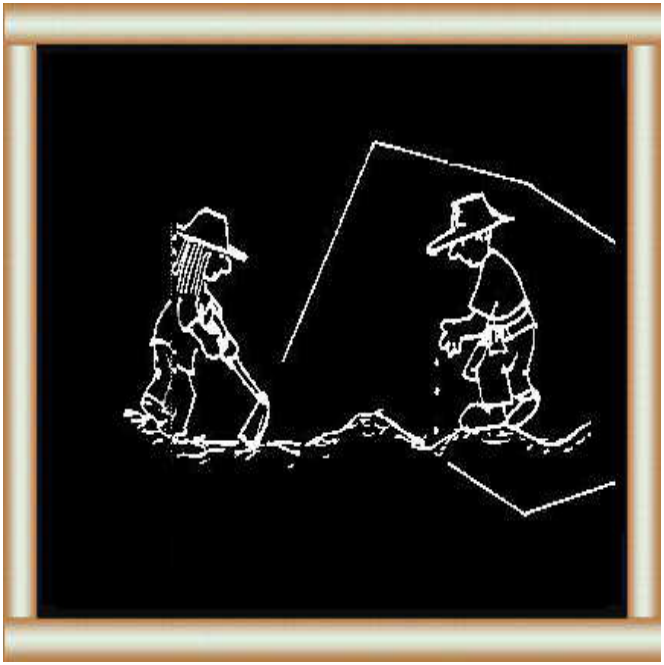
- and cover by turning soil with the plough or by pushing soil with the foot (under drier conditions - anticipating rain). (45)

Time of planting

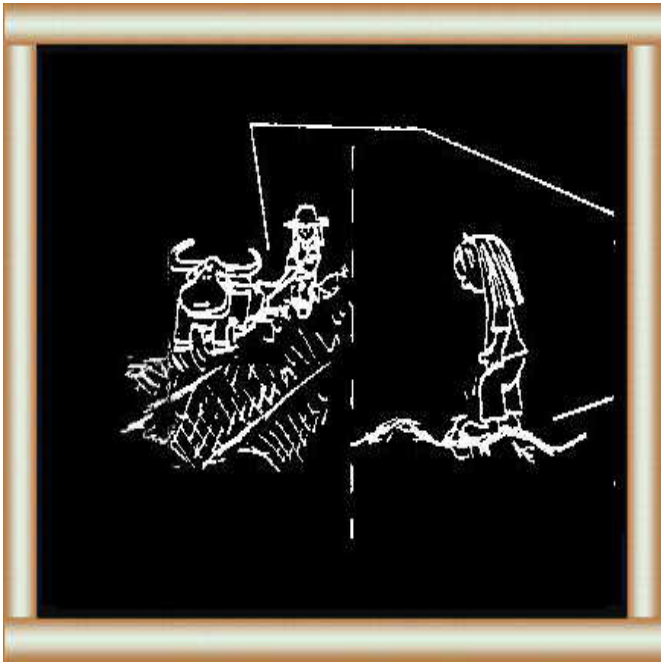
After land preparation, planting should be undertaken without delay to minimize the growth of weeds. Therefore, land preparation should take place with the first rains.

At the time of planting, the soil should be moist and additional rainfall should be available for a number of weeks after plant-ing. If irrigation facilities are available, timing of planting would not be constrained by rainfall. (46)

An adequate supply of appropriate planting material of good quality should be ensured at the time of land preparation. (47)



44 in drier conditions when you expect rain:
- plant with a hoe or drop into shallows furrows



45
- turn soil with a plough
or push with foot.

Time of planting

46 Time land preparation with the first rains so that soil is moist and there is rain after planting (unless you have irrigation).

47 Make sure you have enough good quality planting material at the time of planting.

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Fertilizer application

When the soils are too acidic, it is customary to add Lime or Dolomite to bring the soil pH to the desired levels, before planting the pastures/fodders/legumes. (48)

Three primary nutrient elements required by plants are Nitrogen, Phosphorus and Potassium.

- Small amounts of Nitrogen, usually applied in the form of Ammonium Sulphate or Urea will help the initial establishment and growth of newly sown or planted grasses. (49)

- Application of Phosphorus (usually in the form of Superphosphate) will benefit specially the legumes planted as pure stands or as mixtures with grasses. (50)

- Potassium is also needed especially by legumes for proper establishment. This is usually supplied in the form of Potassium Chloride. (51)

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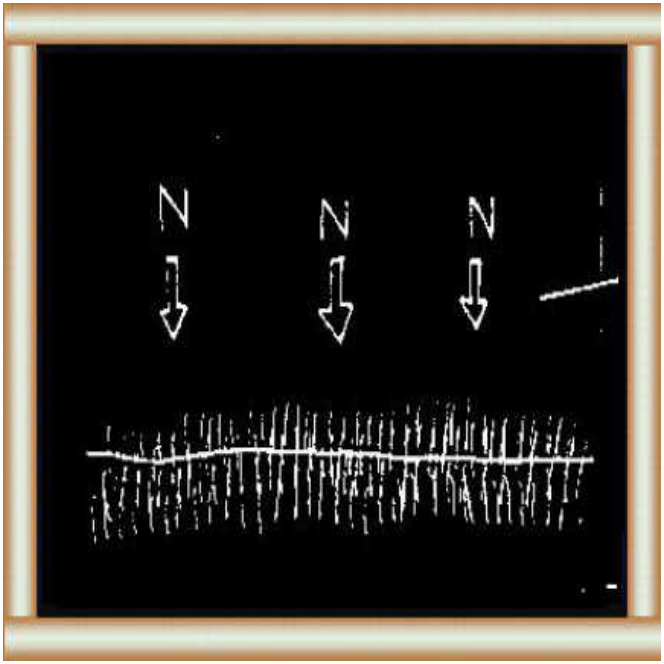
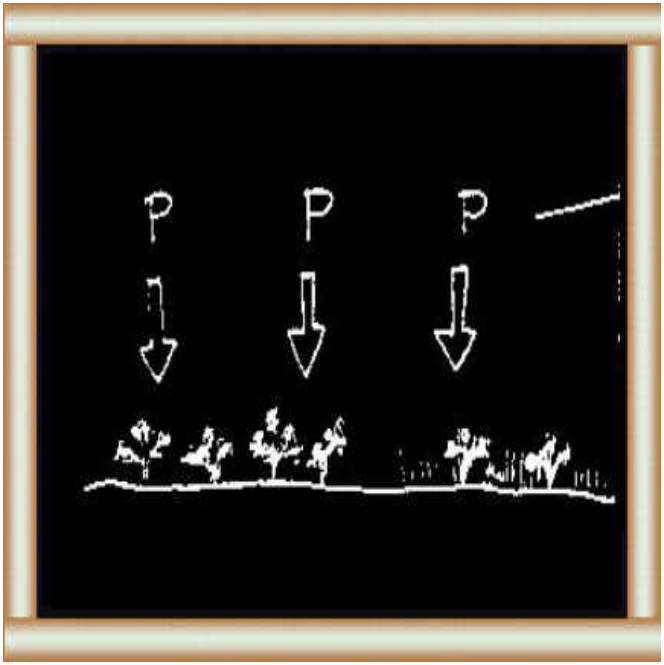
Fertilizer application

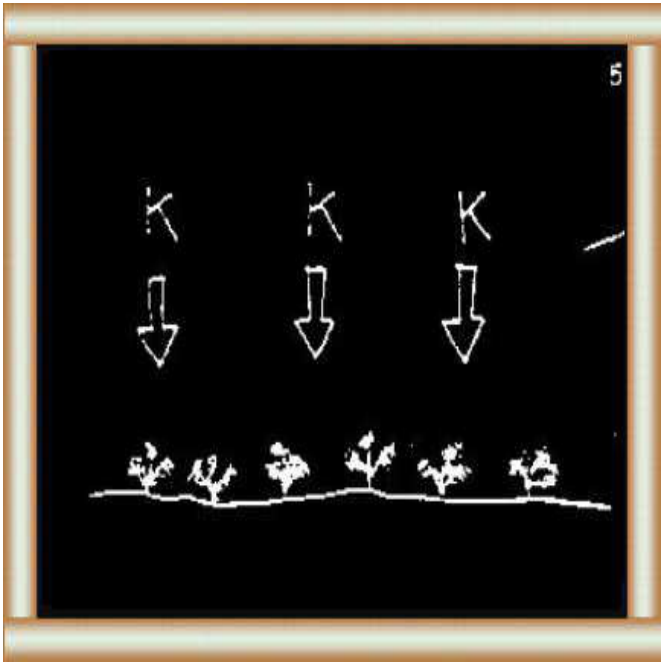
48 If your soil is too acid apply Lime or Dolomite before planting pastures/fodders/legumes to bring soil to the correct pH.



49 Plants need 3 major nutrients.
Give Nitrogen by applying e.g. Ammonium Sulphate or Urea.
This helps establishment and growth of grasses.



50 Give Phosphorus by applying e.g. Superphosphate. This helps especially legumes planted alone or with grasses.



51 Give Potassium by applying e.g. Potassium Chloride.
This helps especially establishment of legumes.

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These nutrients can also be supplied by adding compost manure which will in addition improve

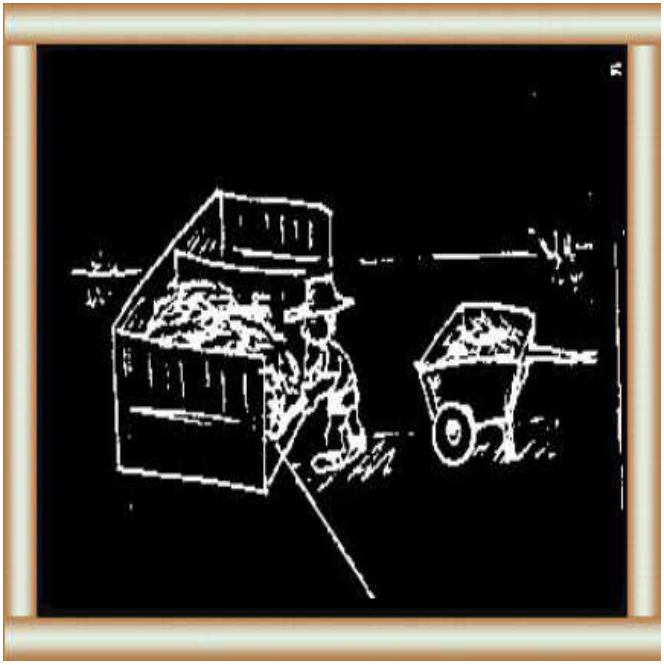
the soil texture (see Unit H.1.2). (52)

The quantities of fertilizers to be added and the timing of application will depend on the rainfall, soil fertility and the varieties of pastures, fodders and legumes. The recommendations made by research institutions and extension officers should be followed in this regard. (53)

Grazing/cutting of newly planted pastures/fodders

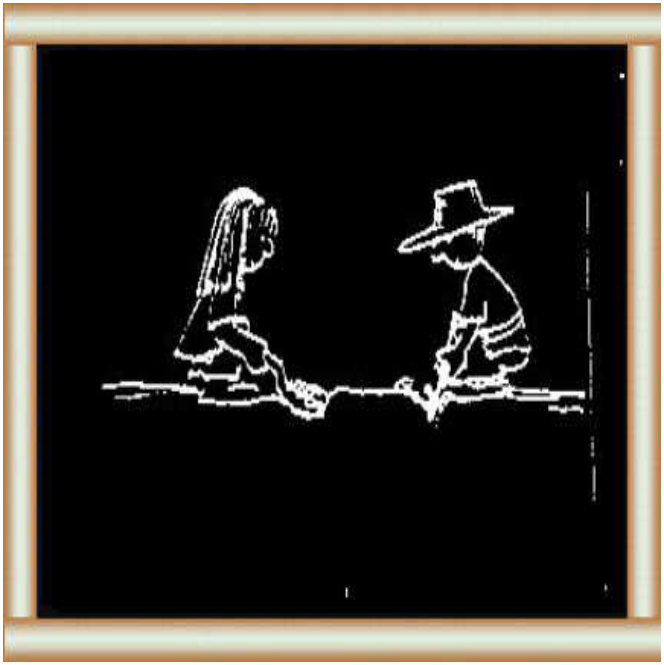
The varieties propagated by vegetative methods can be first utilized within 2-3 months, if adequate moisture (rainfall or irrigation) is available. (54)

Seeded varieties require a longer time to become established and may be first used in about 5-6 months time. (55)



52 You can add these nutrients by applying compost manure (See H 1.2).

53 How much fertilizer and when you apply depend on:
- rainfall
- soil fertility
- type of pasture/fodder.
Consult your extension worker.



Grazing/cutting newly planted pasture/fodder Vegetative propagation (See 38 above)
54 You can use within 2-3 months if you have enough water (rainfall or irrigation).

Seed propagation (See 36 above)
55 Establishment takes longer and you can use within 3-6 months.

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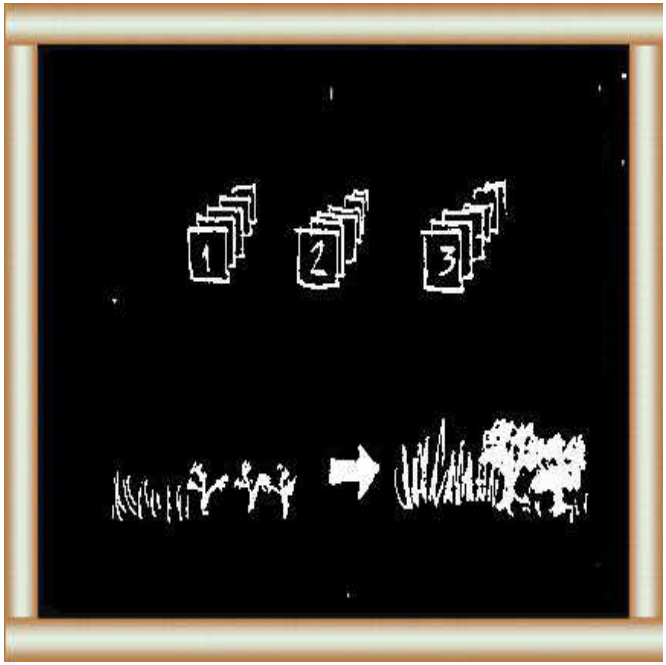
Subsequent management

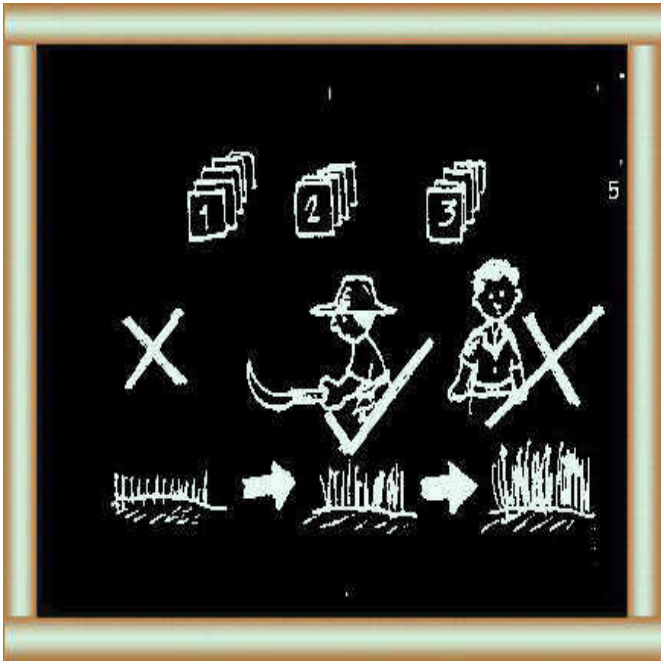
The rate of growth of the pastures/fodders/legumes depend on the varieties used, rainfall (or irrigation), fertility of soil, cutting or grazing intervals etc. (56)

As the grasses mature, the dry matter yield increases but the overall digestibility and crude protein content decrease. Therefore, for animals to obtain the maximum amount of nutrients, the grasses have to be grazed or cut before they are too mature. Different varieties have different optimum grazing/cutting intervals. Advice should be obtained from research institutions and extension officers in this regard. (57)

Subsequent management



56 Growth of pastures/fodders/legumes depends on:
- variety
- rainfall or irrigation
- soil fertility
- cutting/grazing interval
etc.



57 Older grass has:
- more dry matter
- less digestibility and crude protein content.
Consult your extension worker about the best times to graze/cut.

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Annex I: Improved varieties

Pasture (27)

Brachiaria brizantha (Signal grass)
Brachiaria decumbens
Brachiaria milliformis
Brachiaria mutica (Para grass, Water grass)
Brachiaria ruziziensis (Ruzi grass)
Cenchrus ciliaris (Buffel grass)
Cynodon species
Dactylis glomerata (cocksfoot)
Digitaria decubens (Pangola grass)
Panicum maximum (Guinea grass)
Panicum maximum (Hamil grass)
Paspalum plicatulum
Urvillei
Pennisetum clandestinum (Kikuya grass)

Setaria sphacelata
Tripsacum laxum (Gautamala grass) etc.

Legumes (30)

Centrosema pubescens
Desmodium intortum (Green leaf desmodium)
Desmodium uncinatum (Silver leaf desmodium)
Dolichos axillaris
Dolichos lab lab (lab lab bean)
Gliricidia maculata
Glicine javanica
Glicine wightii
Leucaena leucocephala (ipil-ipil)
Phaseolus atropurpureous(Siratro)
Pueraria phaseo-loides (Tropical Kudzu)
Stylosanthes guyanensis (Cook stylo)
Stylosanthes hamata

Stylosanthes humilis (Townsville lucerne)
Styzolobium atterimum (Velvet bean)
Trifolium pratense (Red clover)
Trifolium repens (White clover)
Trifolium rupellianum (African clover)
Trifolium semipilosum (Kenya white clover).

Fodders (31)

Some of the varieties listed under pastures and legumes can also be used as fodders, e.g.

Brachiaria ruziziensis
Panicum varieties
Paspulum varieties
Glyricidia
Leucaena etc.

Some varieties that are used mainly as fodders are:

Pennisetum purpureum (Napier grass or Elephant grass)

and its newly developed hybrids such as:

"NB 21" or "Poosa Giant Napier"
Fodder maize varieties
Newly developed hybrids
Fodder sorghum varieties
Newly developed hybrids etc.

What do you know about pastures and fodders?

Reasons for using high quality roughages or concentrates

Selection of suitable roughages

Small-Scale

Dairy Farming Manual

Volume 3

Husbandry Unit 5.2

FODDER FROM SHRUBS AND TREES

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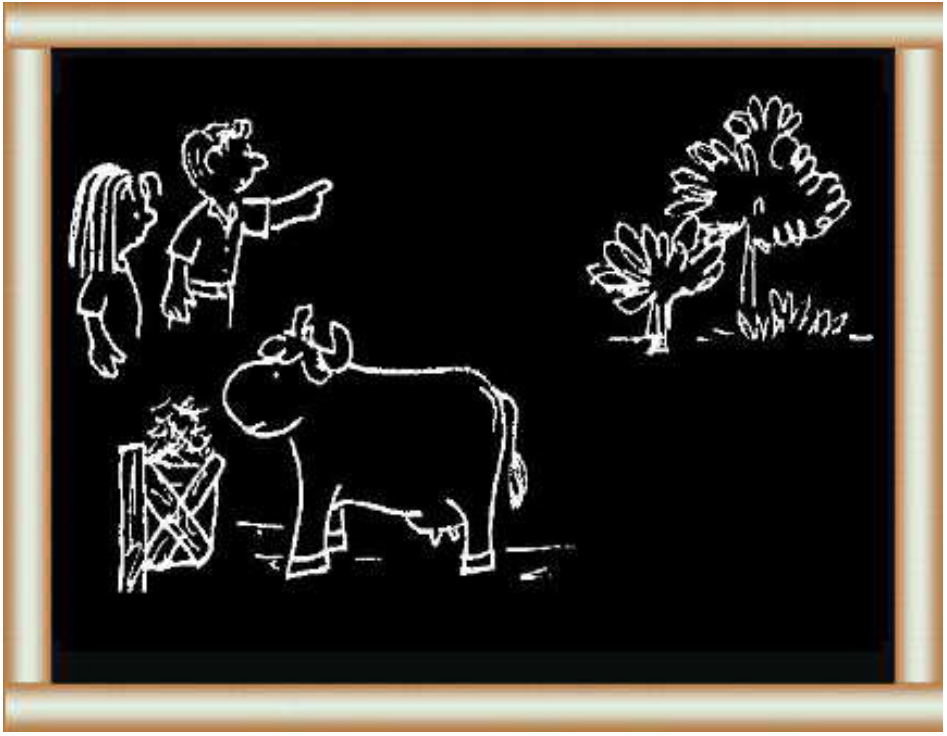

Extension Materials

What should you know about fodder from shrubs and trees?

What are the advantages of feeding shrub and tree fodders

to your animals? (5-13)

1 They:
- provide feed for your animals
- save you work
- save you money.

Are there any disadvantages? (14-16) 2 You should not use more than 30 % of shrub and tree fodders in your feed.

What suitable varieties of shrubs and trees are there? (17)

3 See Annex I.

How can you establish and manage tree fodders? (18-40)

4 See the examples:
- Leucaena leucocephala (18-33)
- Glyricidia maculata. (34-40)

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FODDER FROM SHRUBS AND TREES

Husbandry Unit 5.2:

Technical Notes

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

In Asian countries, fodders from trees and shrubs have been used for feeding livestock from ancient times. However, not much work has been done on their management and utilization for feeding dairy cattle and buffalo. With increasing interest in dairy development and competition for the limited land resources available, the potential of shrub and tree fodders in the feeding of dairy cattle and buffalo is being recognized.

The advantages of feeding shrub and tree fodders are many. Some of the important ones

are:

- there are some naturally growing shrubs and trees, fodders from which are already available for many farmers; an understanding of their nutritive value will enable them to be included in the diets of cattle and buffalo; (5)

- trees and shrubs can be grown on lands unsuitable for other crops and pastures; (6)

- they can be grown in crop areas, spacing them suitably to prevent excessive shade to the crops; (7)

- using them as fences and hedges reduces the costs of fencing which is an additional benefit; (8)

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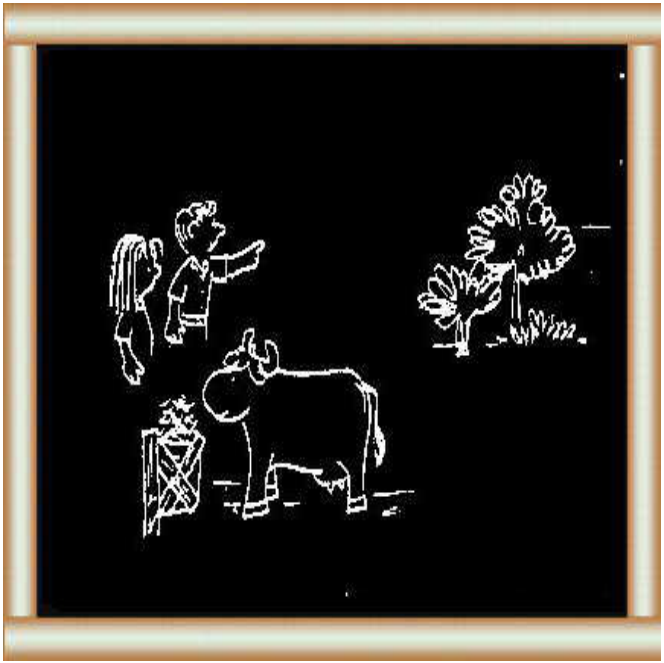
What are the advantages of feeding shrub and tree fodders

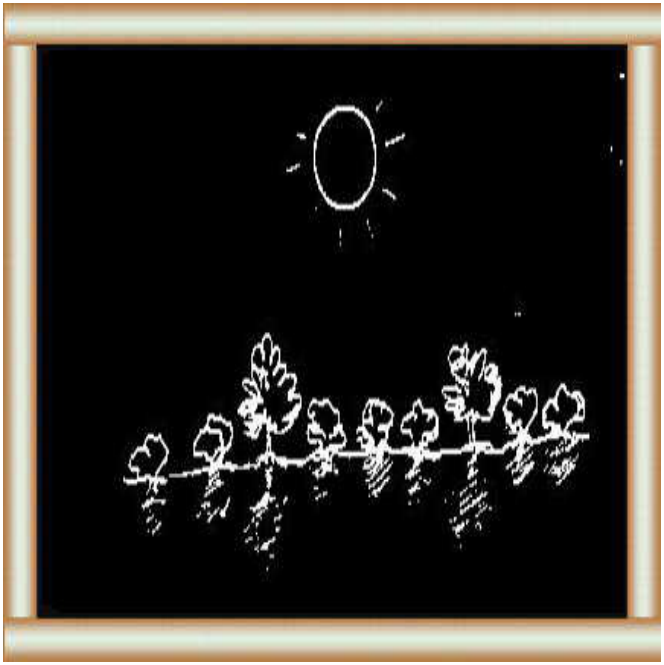
to your animals?



5 Some shrubs and trees grow naturally.

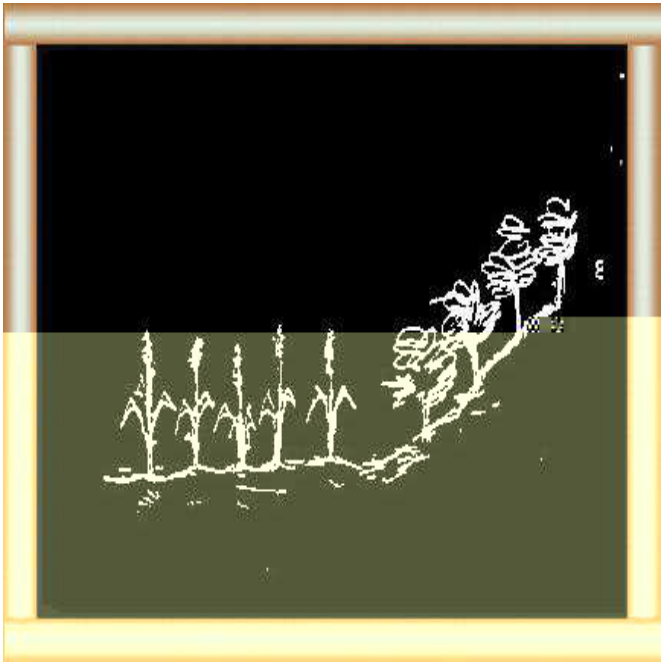
If you know their nutritive value, you can add them to your animals' feed.

6 You can grow shrubs and trees:
- on land which is not suitable for other crops and pastures



7
- with other crops.

Space them correctly so they do not shade other crops too much



8
- as hedges and fences.

This saves you money.

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- as the root systems penetrate deep into the soil, trees and shrubs can continue to produce

foliage over a longer period into the dry season; (9)

thus cattle and buffalo can be given a green roughage along with crop residues such as straw, supplemented with concentrates where necessary, during the dry season; (10)

- establishment and maintenance are easier and less expensive than the pasture and fodder grasses and they have a long life span reducing the costs of re-establishment; (11)

- mature branches can be used as a source of firewood; (12)

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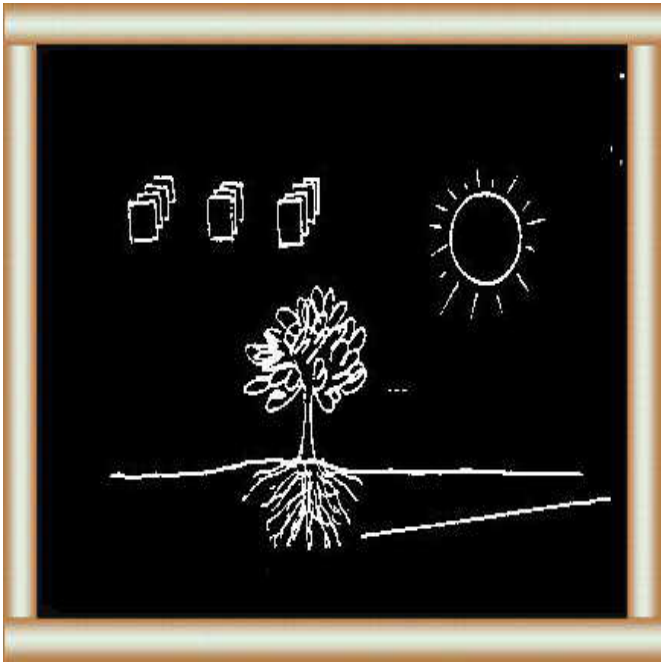
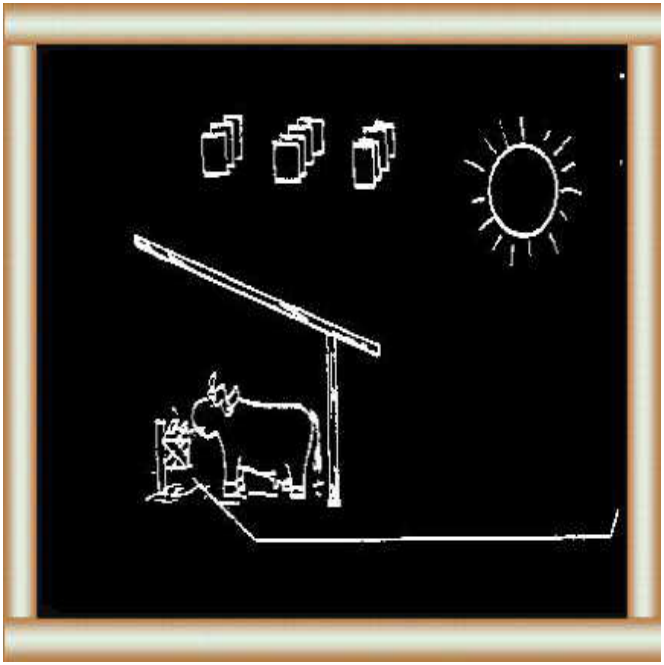
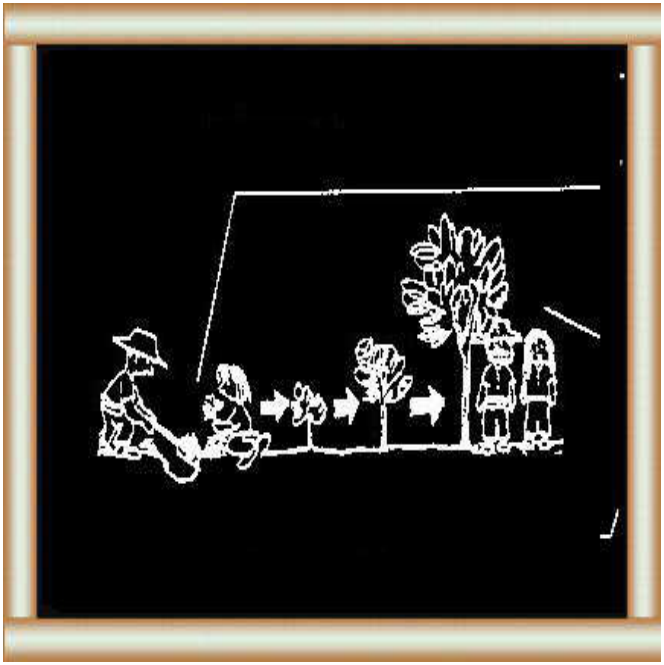


9 They produce foliage longer into the dry season because the roots go deep in the soil

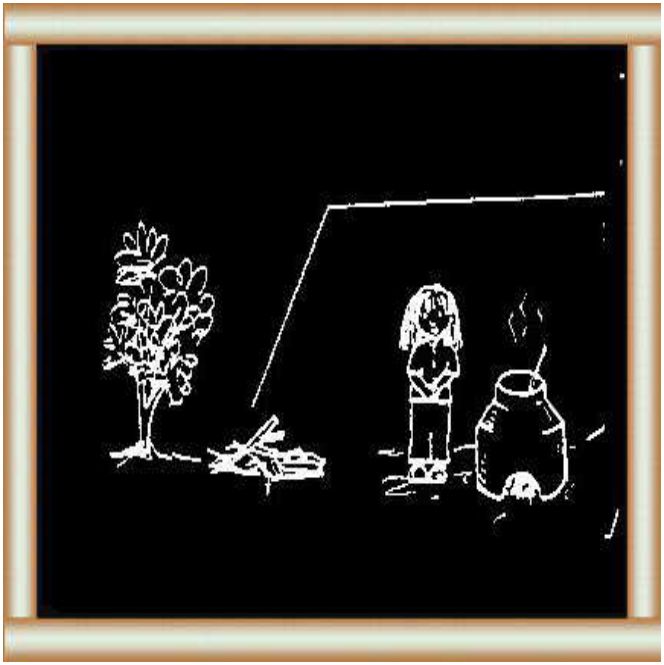


10 so you can give your animals a green roughage with crop residues e.g. straw and concentrates (where necessary) in the dry season.



11 You can establish and maintain shrubs and trees more easily than pasture and fodder grasses.

They live a long time so you spend less money on re-establishment.



12 You can use mature branches

as firewood.

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- when cutting is done manually, which is the practice with smallholders, it is more convenient

and less time consuming with shrub and tree fodders than with many varieties of pasture and fodder grasses. (13)

The main disadvantage with tree fodders is that some of them have certain toxic compounds. However, these compounds usually occur only in small quantities and their ill-effects would disturb the animals only if they are given as the main (or only) feed over a long period of time. (14)

These ill-effects can be overcome by limiting the quantity of tree fodders to about 30% of the total daily feed intake (measured in terms of dry matter). (15)

Another disadvantage is that adequate information on the nutritive value of most of the tree and shrub fodders is not freely available. This is a problem that must receive the attention

of research institutions and extension officers. Presently available information shows that fodders from such plants as Leucaena leucocephala (ipil ipil) and Glyricidia maculata are as nutritious or even more nutritious than some of the pasture and fodder grasses. (16)

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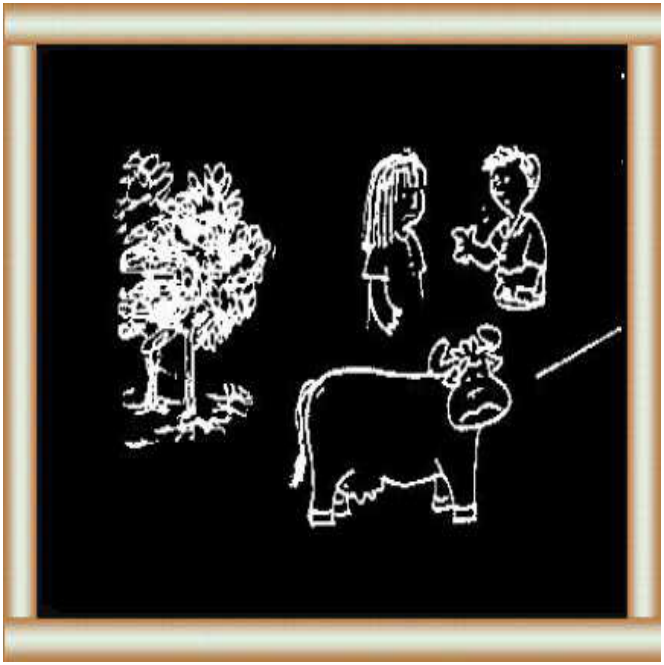
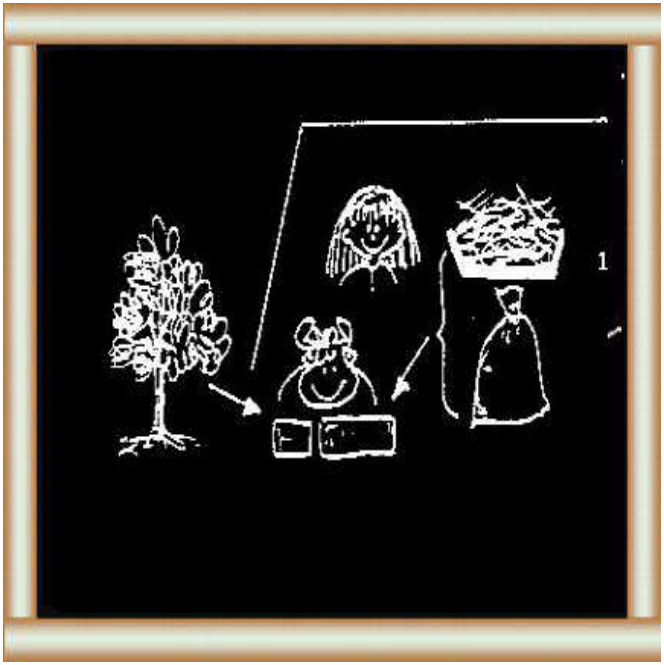
13 It is easier and quicker to cut shrubs and trees/fodders by hand than to cut pasture and fodder grasses.



Are there any disadvantages?
14 Tree fodders contain small amounts of poisons which are bad for your animals if tree fodders are the only feed for a long time.



15 Up to 30 % of tree fodder in feed (measured by dry matter) should cause no ill effects.

16 Ask your extension worker for information (though sometimes there is none for shrub and tree fodders).

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Suitable varieties

There are several varieties of fodder trees and shrubs which can be grown under different agro-climatic conditions. They are classified in the Annex. (17)

Establishment and management of tree fodders

Tree and shrub fodders can be propagated vegetatively or by seeds depending on the species. Two examples are given below, one for propagation by seeds and the other by stems as well as seeds.

Example 1

Leucaena leucocephala: There are many varieties of this species. Different varieties are being recommended in different countries. Even though many Leucaena plantations were destroyed by an insect during the mid 1980's,

resistant varieties have now emerged. Leucaena does not grow well in water-logged areas and acidic soils. In acidic soils, acidity has to be reduced by the addition of Lime or Dolomite. Addition of Superphosphate will facilitate the initial establishment. (18)

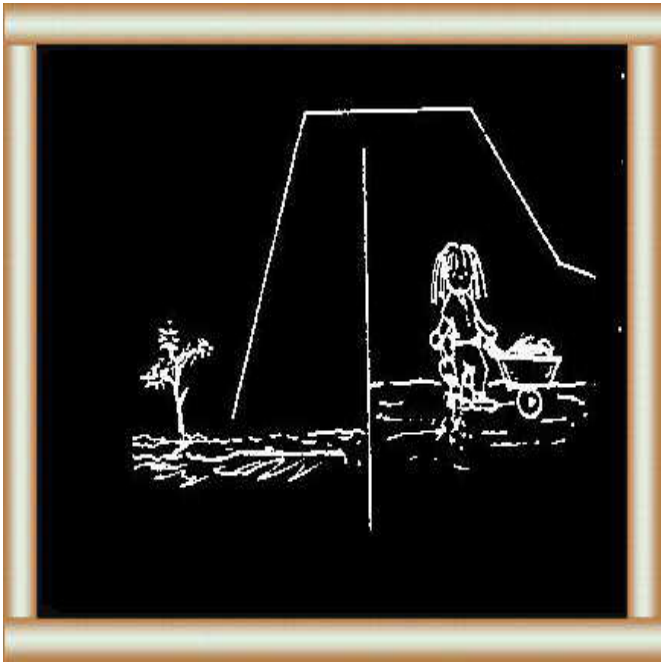
Propagation is by seeds.

- Seeds have to be soaked in boiling water for about a minute before planting to damage the hard seed coat. (19)

- Seeds are allowed to cool and then mixed with inoculum. Inoculum can also be added to the seed bed in the form of a solution, after the seeds have started to germinate. (20,22)

What suitable varieties of shrubs and trees are there?
17 See the list in the Annex for different local conditions.

How can you establish and maintain tree

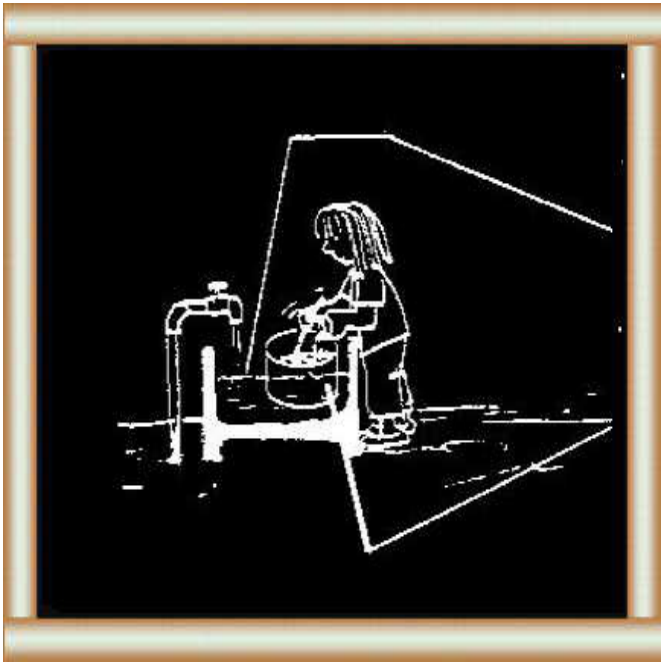


fodders?
Leucaena leucocephala
by seed propagation

18 Do not grow in water-logged soils.

Apply Lime or Dolomite to acid soils and Superphosphate to help establishment.

19 Soak the seeds in boiling water for 1 minute to damage the hard seed coat.



20 Cool the seeds and mix with inoculum.

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- Seeds can be planted directly in the soil; to avoid being attacked by rabbits, monkeys etc. repellents such as diluted fresh animal urine may

be poured on the plants. (21)

- Another method is to plant the seeds in a nursery: e.g. small polythene bags containing a mixture of soil and compost (with an extra amount of Superphosphate, where necessary). Plant two seeds in each bag. (23-24)

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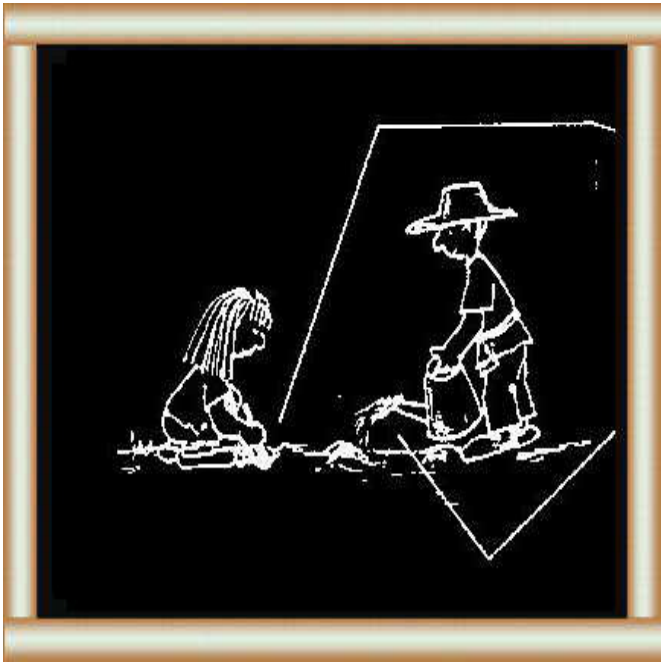
21 Plant the seeds



directly in the soil.

Apply e.g. animal urine mixed with water to keep rabbits, monkeys etc. away.

22 When the seeds begin to grow, you can apply a solution of inoculum.

23 You can plant the

seeds in a nursery:
- mix soil with compost (and Superphosphate if necessary)

- fill small polythene bags with soil mixture

- plant 2 seeds in each bag.

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- Transfer to the soil at planting time is easy but it is difficult to transport over long distances.

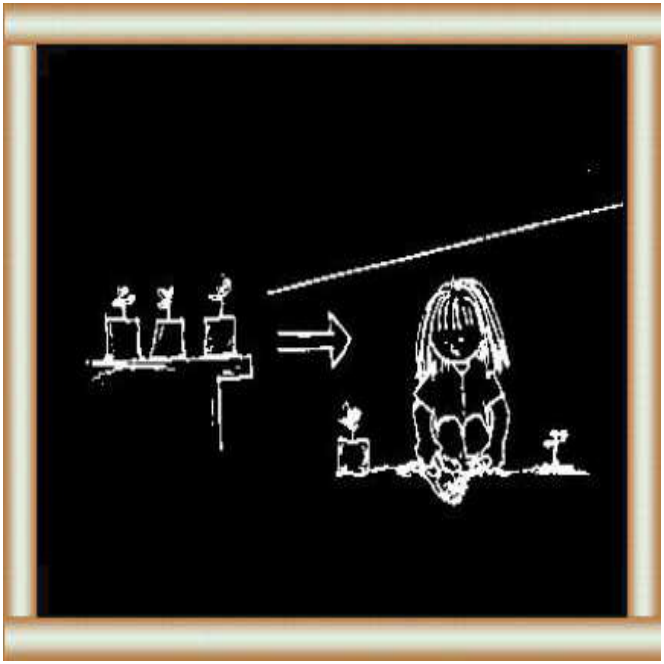
(25)

- Another method is to add a layer of soil (and compost) about 15 cm thick over polythene spread on firm ground and to plant the seeds on this seed bed. (26)

- The seedlings are uprooted at planting time and all the leaves are pulled off by hand before transplanting in holes made with an iron bar. (27)

Space allowed between plants depends on where they are planted.

- If planted to serve as a fence, the spacing can be about 6 cm. Two or three rows planted at a distance of about 6 cm from each and maintaining the same space between plants makes a beautiful hedge. (28)



25 When the seedlings are 20-40 cm. tall, move them to the field.

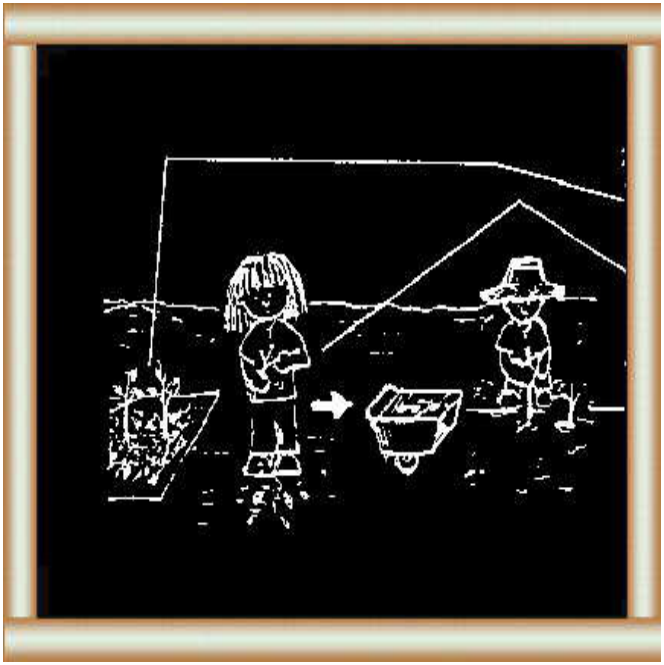
This method can be difficult if the field is far away.

26 You can also:
- spread a polythene sheet on firm ground

- add a 15 cm layer of soil/compost

- plant the seeds on this seedbed

27



- uproot the seedlings at planting time

- pull all the leaves off by hand

- plant in the field in holes made with an iron bar.

28 For fences:
- plant 2 or 3 rows 6 cm apart

- each plant 6 cm apart in the row to make a beautiful hedge.

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- Such hedges can be grown at a distance of 2-3 m on open pastures or as a component in an

integrated farm-ing system. (29)

- They may also be grown as individual plants in an open pasture at spacings of 2 x 2 m; animals may be allowed to graze these plants with the pasture when they are about a metre high. (30)

- Alternatively, the plants may be allowed to grow to maturity beyond the reach of animals and the animals allowed to graze the new seedlings that sprout from the seeds falling onto the ground. (31)

- Leucaena plants can be grazed when they are about a metre tall. When they are cut to be used as a fodder, the plants may grow up to a height of about 1.5 to 2 m.

- Grazing or lopping is usually done at 2-3 month intervals. When lopping, it is good practice to leave a few small branches to

facilitate regrowth. (32)

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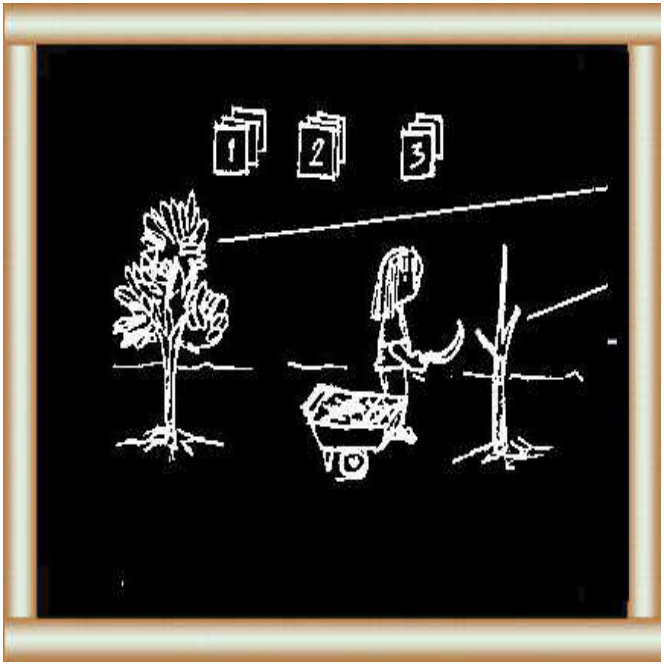
29 You can grow hedges at 2-3 m spacing on open pastures or as part of an integrated farming system. (See H 1.1)

30 You can grow plants at 2 m spacing in open pasture.

Your animals can graze on the pasture and these plants when they are about 1 m high

31 or you can let the trees grow to full height and your animals can eat the seedlings from seeds on the ground.



32 Lop trees for fodder when they are about 1.5-2 m tall.

Leave a few branches for good regrowth.

Graze or lop every 2-3 months.

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- If adequate space is allowed between plants, e.g. when grown as separate plants or in a single

row fence, each tree may give a yield of about 3-5 kg per lopping. The yield is lower during periods of drought. 90-100 trees will provide about 5 kg of leaves per day on average, throughout the year, if managed well. (33)

Example 2

Glyricidia maculata: This species grows in a wide variety of agroclimatic regions and can thrive on many different types of soil. It has adapted well under adverse climatic conditions and shows a high degree of resistance to pests and diseases. Glyricidia is used as a shade tree in tea and coffee plantations and as a support and shade in pepper plantations. (34)

Propagation can be by seeds or stems. To prevent the planted stems being disturbed by cattle and buffalo, 1.5 m long stems can be planted along fences. The stems are planted in

holes made by an iron bar. No other land preparation is usually necessary for planting stems. Spacing between plants varies depending on where they are planted: (35)
- in a single row fence, the spacing is usually 15-30 cm;
- in a double row fence, it is usually 60 cm between rows and 60 cm between plants;(36)

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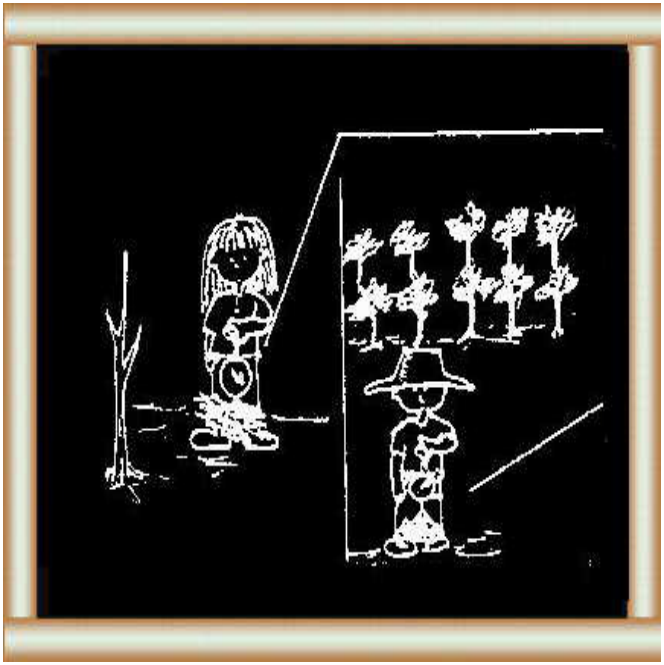
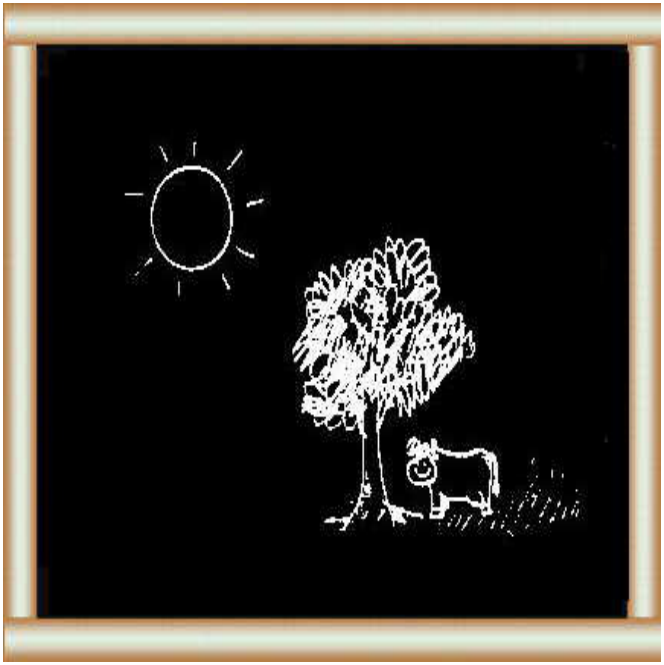
33 With enough space, each tree gives about 3-



5 kg per lopping (less in dry periods).

90-100 well managed trees give about 5 kg leaves per day for the whole year.

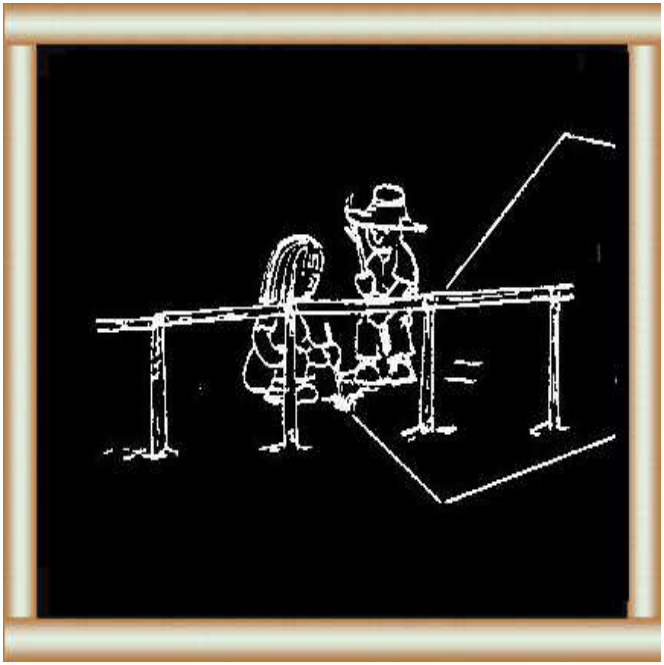
Glyricidia maculata by



seed or stem propagation
34 This tree grows under many conditions and resists pests and diseases.

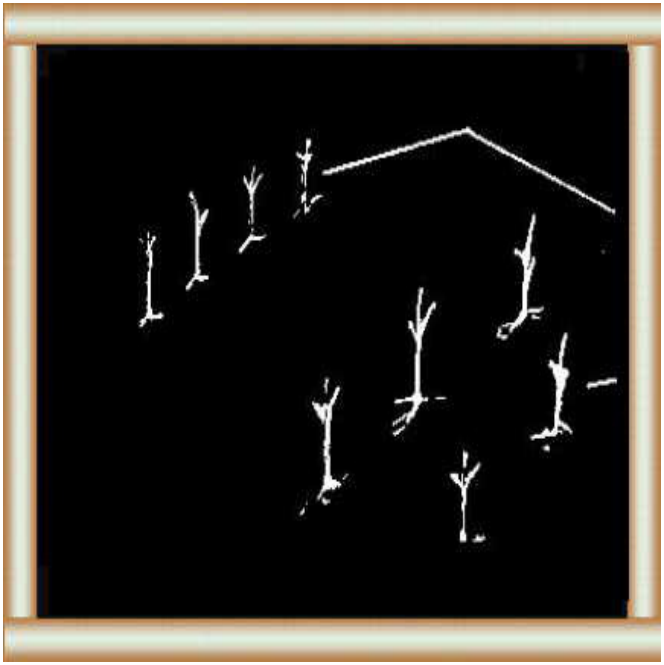
Farmers often use it for shade.

35 Plant 1.5 m stems along fences to protect



from your animals.

Use an iron bar to make holes.



36 Spacing is usually:
- 15-30 cm in a single row fence

- 60 cm between plants and rows in a double row fence

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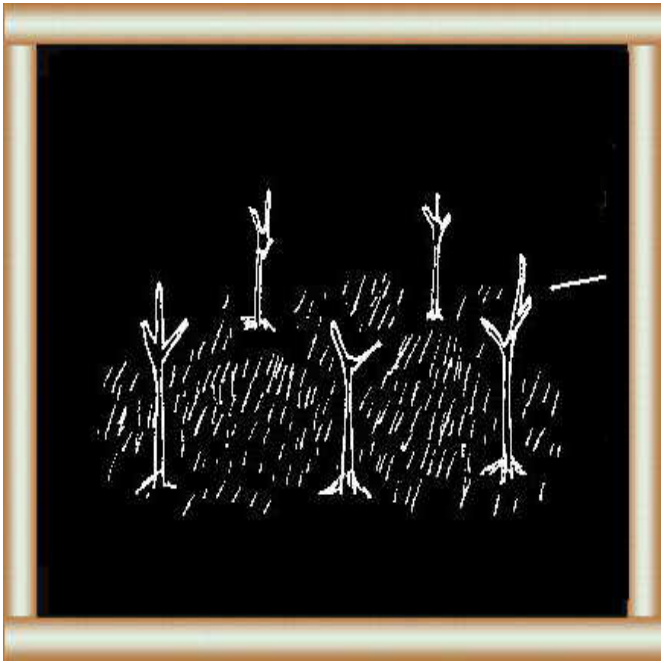
- if planted individually among other crops, spacing is 5 x 5 metres. (37)

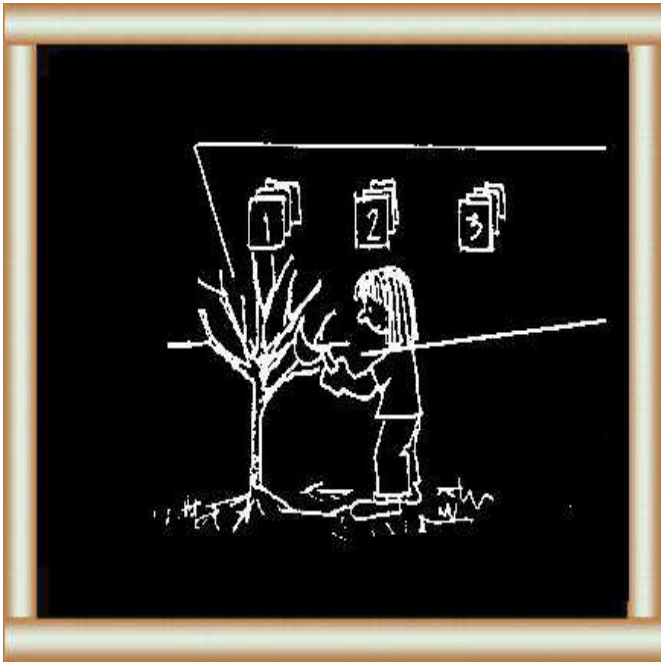
Lopping of branches is done once in about 2-3 months. The plants should not be allowed to grow to a height of more than 2.0 m. A single tree may bear about 10-15 branches at a time. (38)

When lopping, about 25 % of the branches are allowed to remain intact, to facilitate further growth. The harvest at one lopping is about 7-9 kg per tree. (39)

Addition of cow dung and compost increases the yield. It has been estimated that the yield from about 175-200 well managed trees would be sufficient to supply the roughage requirement of a cow throughout the year, when mixed with chopped rice straw. A fence of about 60 m length will have this number of trees. (40)



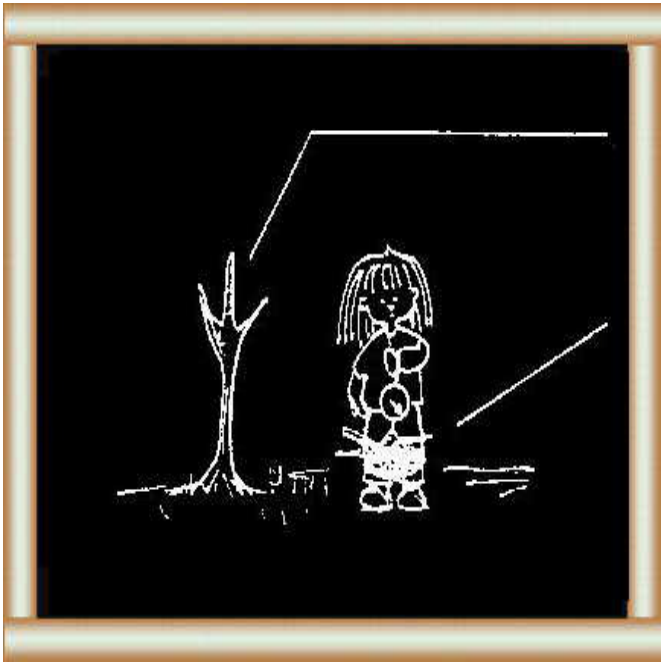
37
- 5 x 5 m for individual plants among other crops.



38 A tree can bear 10-15 branches at one time.

Lop every 2-3 months and do not allow to grow taller than 2.0 m.

39 Leave 25% of



branches for good regrowth.

You should get 7-9 kg branches from each tree.

40 Apply cow dung and compost for higher

yields.

175-200 well-managed trees (a fence of 60 m) gives enough roughage for 1 cow for 1 year when mixed with chopped rice straw.

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Annex I

Species suitable for various climatic conditions

(a) Humid tropics

Albizia chinensis
A. lebbek
A. procera
Artocarpus heterophylla
Azadirachta indica
Bauhinia purpurea
Gliricidia maculata
Moringa oleifera
Morus alba
Leucaena leucocephala
Sesbania grandiflora
S. sesban.

(b) Semi-arid tropics

Acacia nilotica
A. tortilis
Ailanthus excelsa
Albizia amara
A. lebbek
Azardirachta indica
Capparis decidda
Dichrostachys cinerea
Hardwickia binata
Leucaena luecocephala
Parkinsonia aculeata
Pithecellobium dulce
Prosopis juliflora
Sesbania sesban
Tamarix spp.

(c) Arid tropics

Acacia nilotica
A. tortilis

Ailanthus excelsa
Albizia amara
A. lebbek
Bauhinia variegata
Casuarina equisetifolia
Dichrostachys cinerea
Hawdwickia binata
Zizyphus mauritiana.

(d) Temperate and sub-temperate areas

Betula alboides
Celtis australis
Morus serrata
Robinia pseudoacacia
Salix spp.

(e) Hot arid desert

Acacia arabica

A. tortilis
Albizia amara
Azadirachta indica
Dichrostachys cinerea
Eucalyptus terminalis
E. camaldulensis
Prosopis cinerea
P. juliflora.

(f) Semi-arid, rocky and gravelly

Acacia catechu
Ailanthus excelsa
Albizia lebbek
Cassia siamea
Dalbergia sisso
Dendrocalamus strictus
Dichrostachys cinerea
Hardwickia binata
Prosopis juliflora.

(g) Cold desert

Juniperus communis
J. wallichiana
Populus spp.
Salix spp.

(h) Ravines

Acacia arabica
A. catechu
A. tortilis
Albizia lebbek
A. amara
Dalbergia sisso
Dendrocalamus strictus
Dichrostachys cinerea
Eucalyptus spp.
Prosopis juliflora.

(i) Swampy and wet lands

Arundo danax
Baringtonia spp.
Bischoejia javonica
Eucalyptus robusta
E. rudis
Casuarina equisetifolia
Diosphyros ambryopteris
Pterospermum acerifolium
Sapium sebifecum.

(j) Shore and riverbeds

Acacia spp.
Albizia spp.
Dichrostachys cinerea
Hardwickia binata
Leucaena leucocephala
Sesbania spp.

(k) Cultivable wastelands

Acacia spp.
Albizia spp.
Dichrostachys cinerea
Hardwickia binata
Leucaena leucocephala
Sesbania spp.

(l) Saline-sodic soils

Acacia arabica
A. tortilis
Albizia amara
Butea monosperma
Dalbergia sisso
Prosopis juliflora
Salvadora spp.
Tamarindus indica.

Source: Singh, 1988

page111&112

What do you know about fodder from shrubs and trees?

Advantages of feeding shrub and tree fodders

1 Growth and nutritive value (5-10)

2 Ease of establishment, maintenance and cutting (11-13)

Disadvantages

Toxic content (14-16)

Suitable varieties

Small-Scale

Dairy Farming Manual

Volume 3

Husbandry Unit 5.3

SMALL SCALE HAY

MAKING

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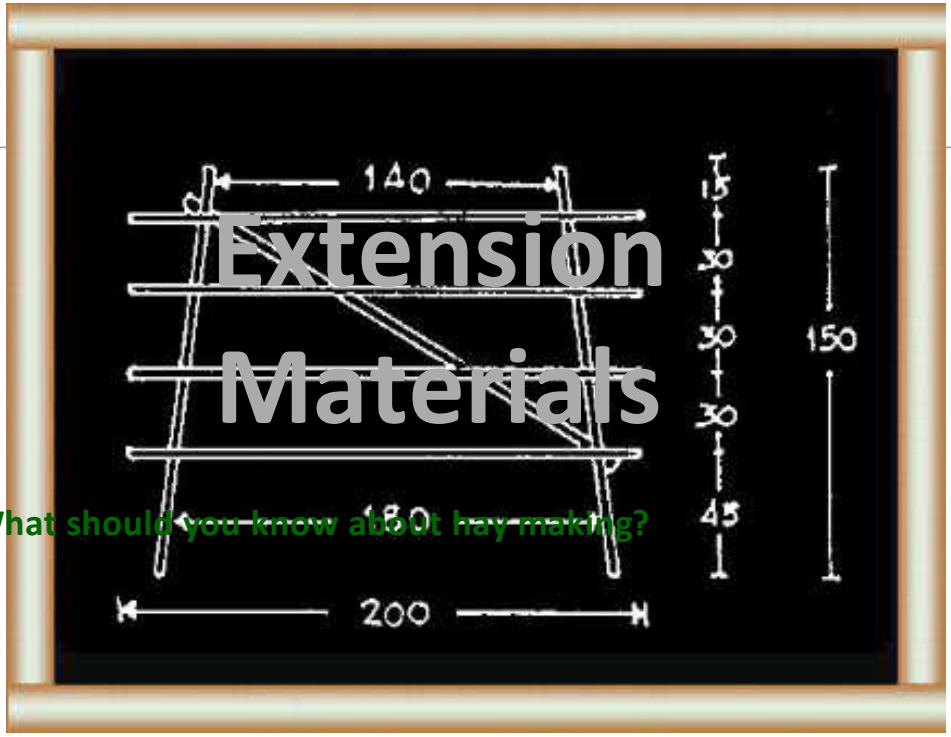
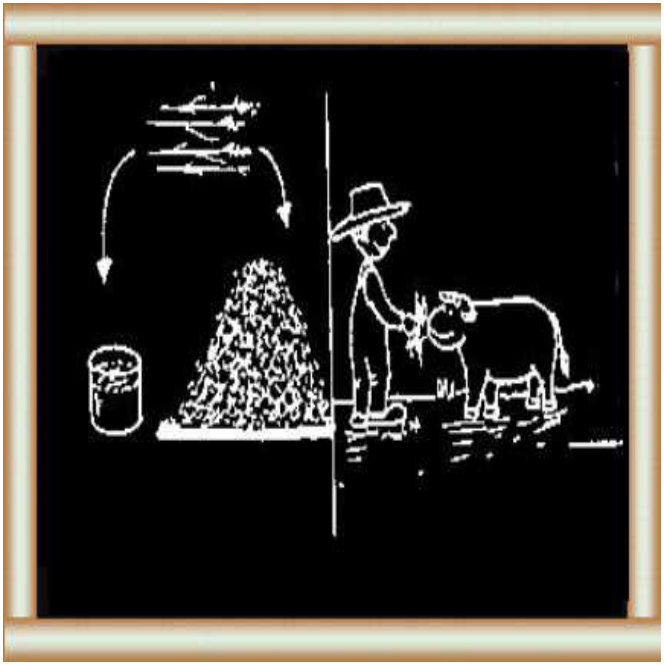


Extension Materials

What should you know about hay making?

What is hay and why is

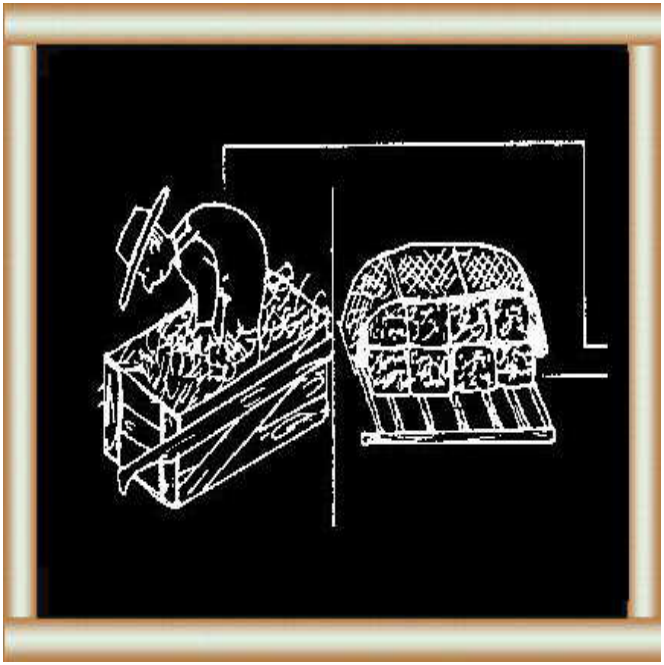


feeding hay important? (5-20)

1 You should know:
- the feed value of hay
- the importance of feeding hay when there is no grass.

When do you cut and how do you dry your hay crop? (21-47)

2 You should know about:
- equipment
- time of cutting
- ways of drying.



How do you bale and store hay?(48-74)

3 You should know how to:
- make and use a baling box
- make a hay store and keep your hay dry.

How can you feed hay? (75-80)

4 You should know how to make feeders for your:
- calves
- cows.

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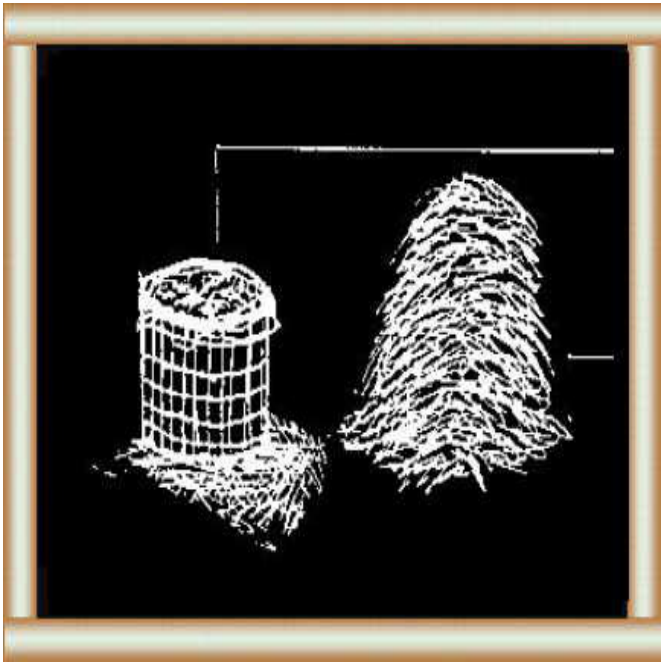
What do you make hay from?

5 During the rains there is more grass than at any other time of the year.

6 There is enough grass for fresh feeding. There is also a surplus of grass.



7 You can turn this surplus forage into silage or hay.

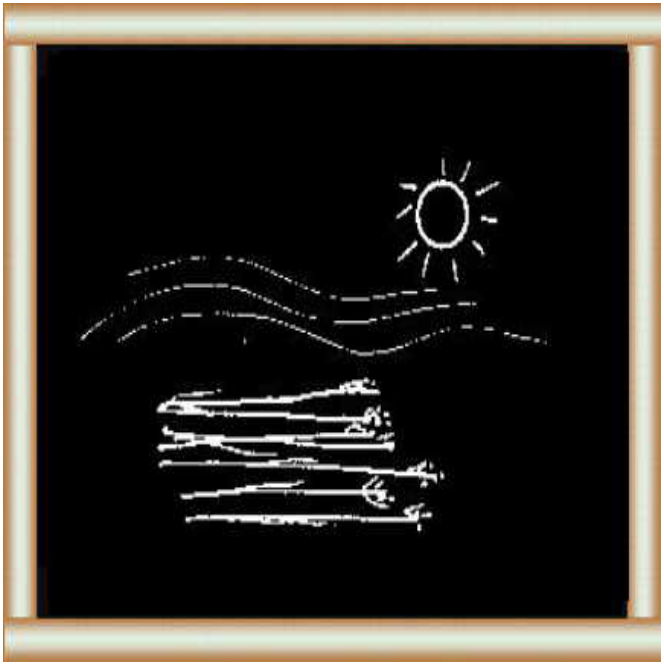
What are the steps in making and handling hay?
8 Cutting Drying Baling Storing Feeding

page118

What is hay?

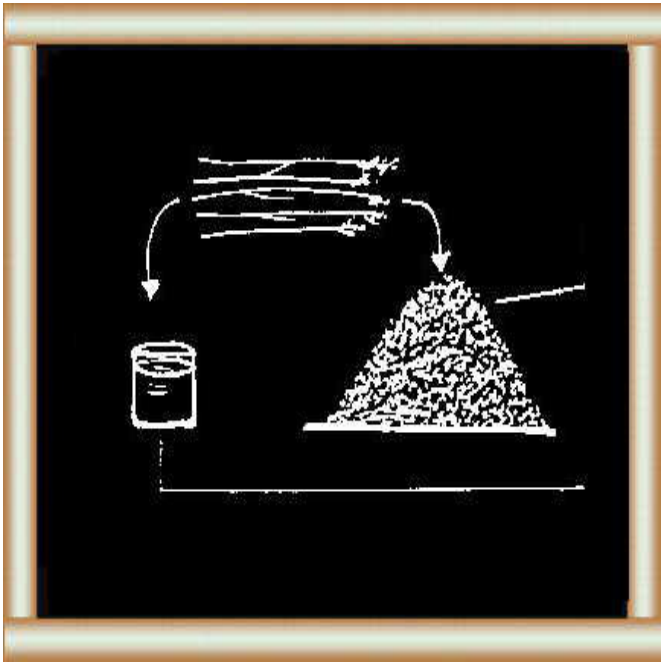
9 Grass or legumes which you cut at the beginning of flowering.

At this time your hay crops:
- are rich in protein
- are low in fibre
- give high yields of green matter.



10 Grass or legumes which you dry quickly in the sun and wind to:
- reduce the water content of fresh plant matter
- preserve the nutrients.

11 Hay contains about 80% dry matter and



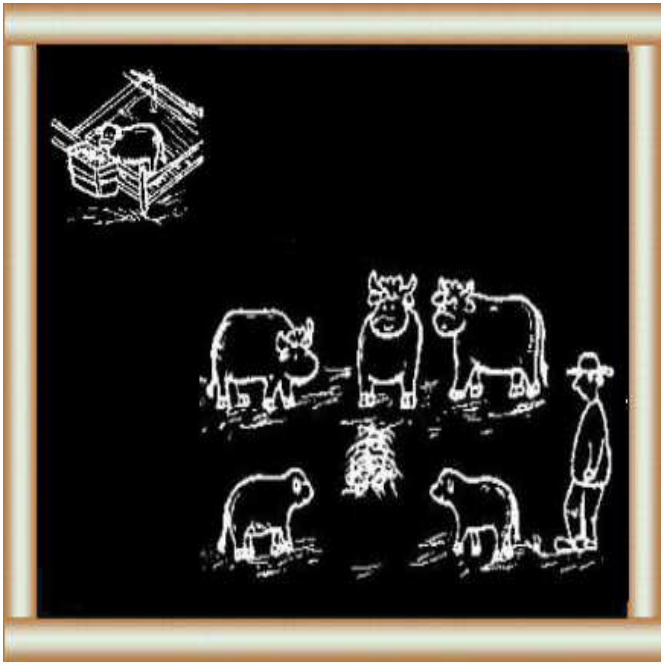
20% water.

Quality hay is green in colour and smells good.

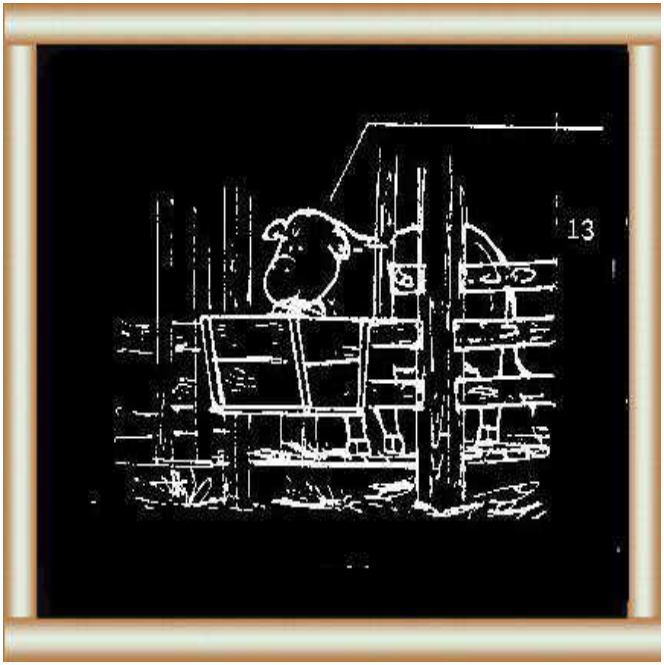
Green hay contains:
- carotene
- B complex vitamins
- vitamin D.

page119

Why is feeding hay important?



12 There may not be enough grass to make hay for all your cows and calves



13 but you can produce enough hay for your calves.
They need it most.

14 At two weeks old, feed one handful of hay every day.
Gradually increase the amount.

15 Feeding hay to young calves:
- maintains growth when there is no grass

- helps the development of the rumen
- reduces milk consumption in liquid feeding so you can deliver more milk to the collecting centre.

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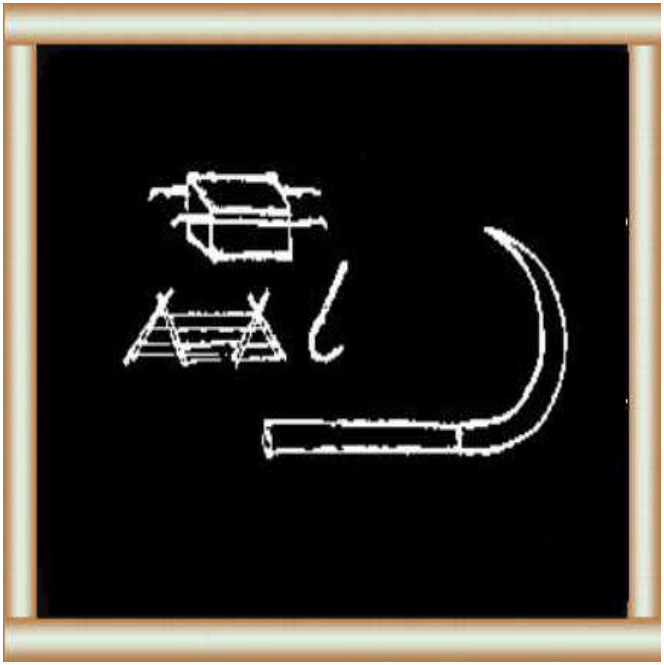
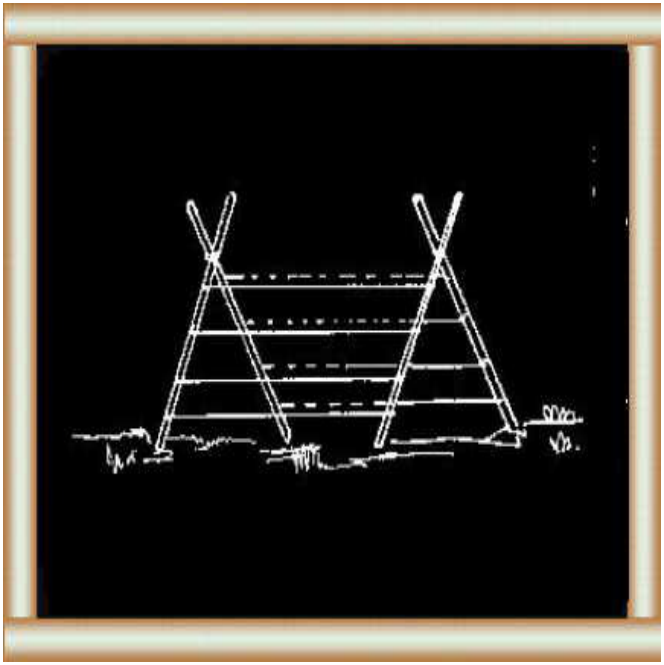
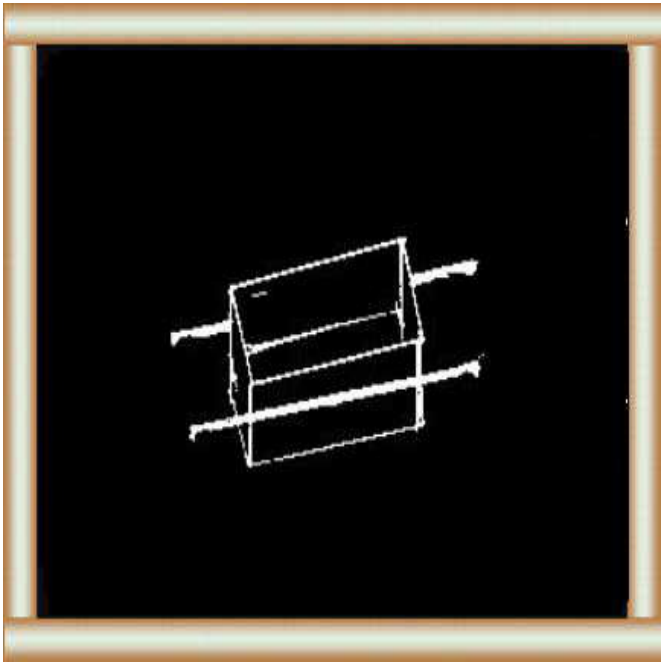
What equipment do you need to make and handle hay?



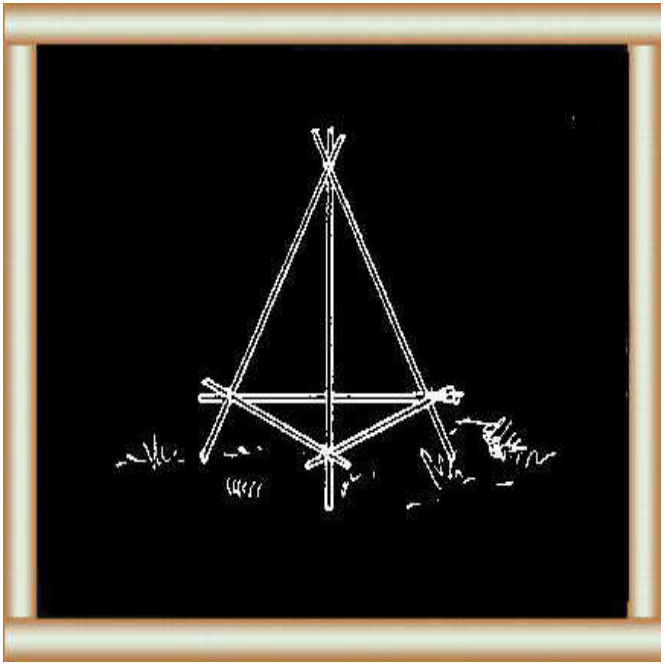
16 A sickle for cutting the hay crop.



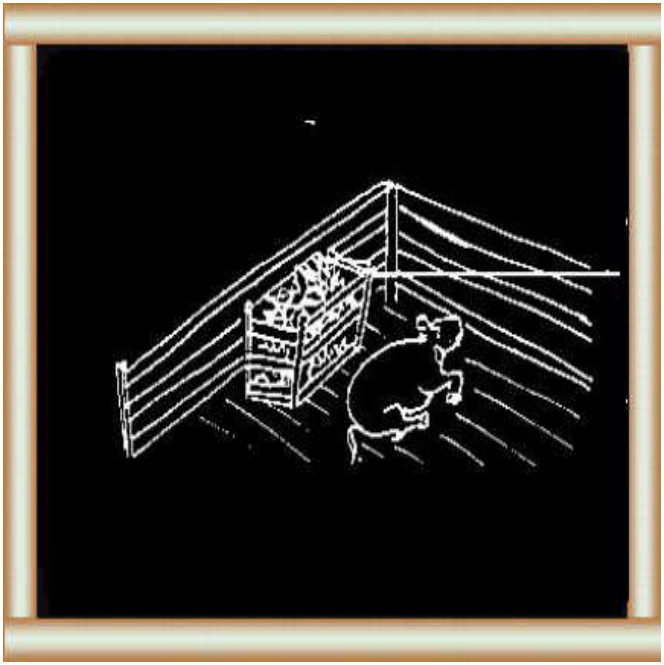
17 A rack for keeping the crop off the ground while drying it.



18 A wooden box for making the hay into bales.



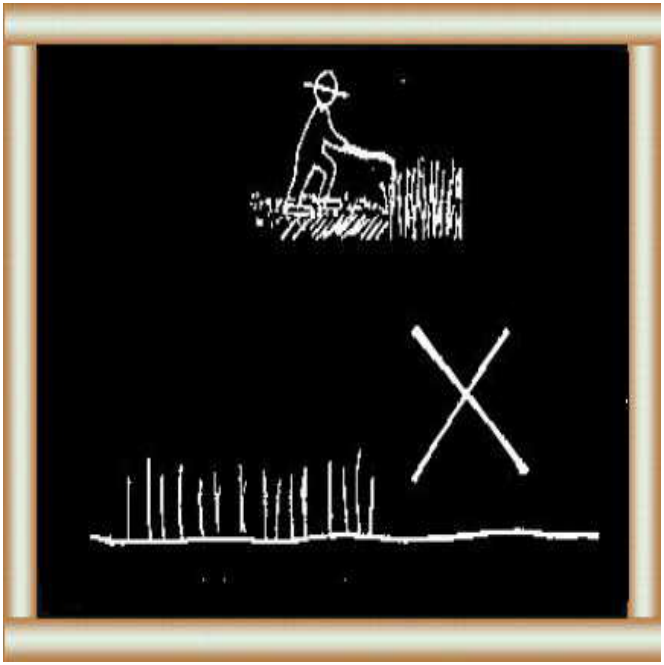
19 A structure with a roof for storing the hay and keeping it dry.



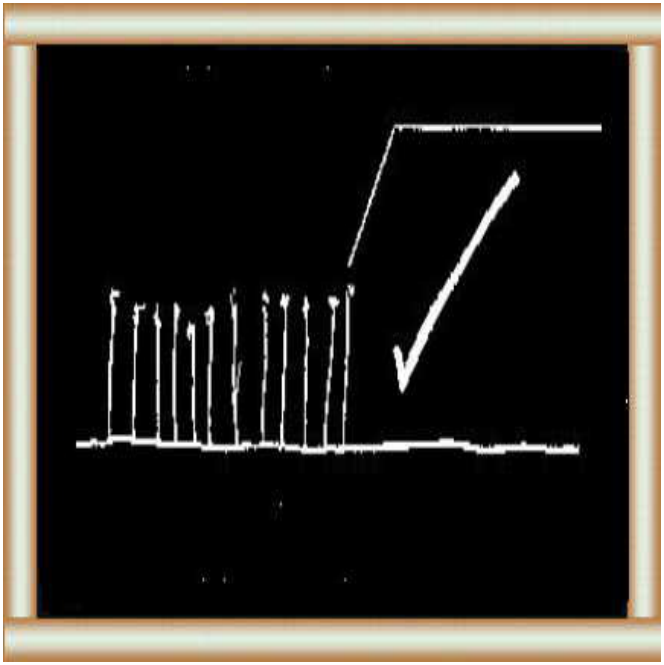
20 A rack for feeding the calves.

page121

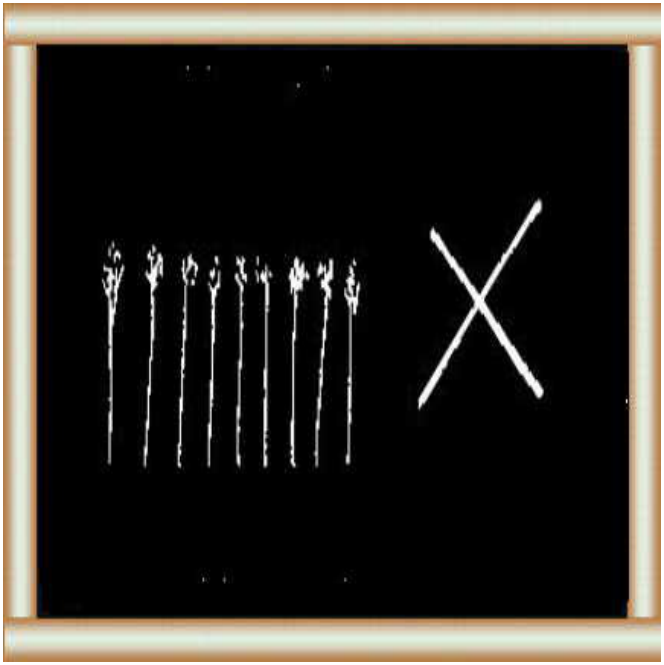
When do you cut your hay crop?



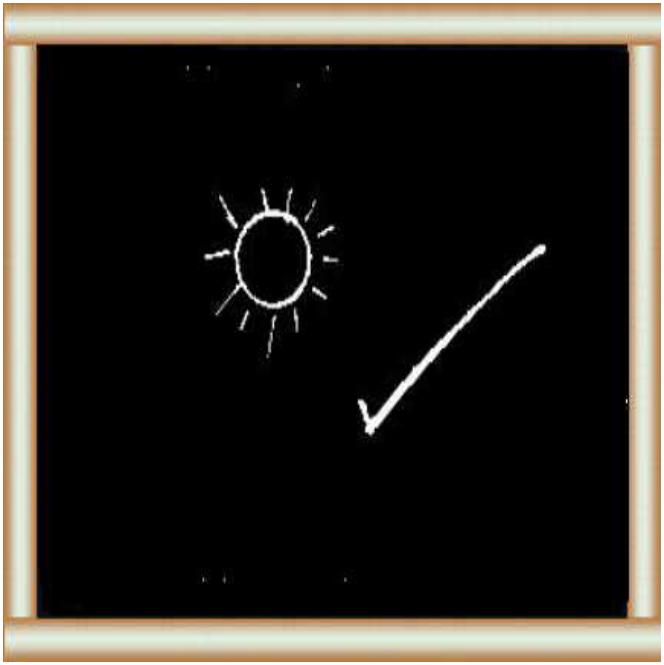
21 At the right time.
Too early:
- not enough green matter.



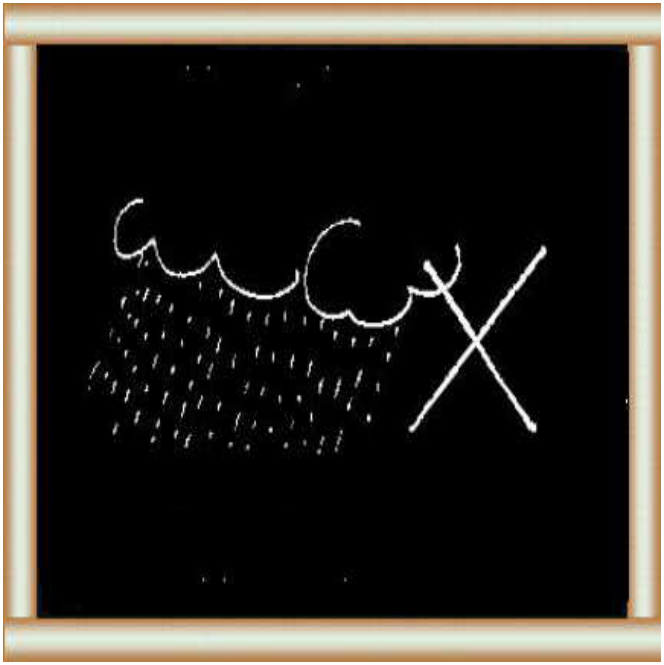
22 When the hay crop starts flowering:
- at this time, the crop has maximum nutrients and green matter.



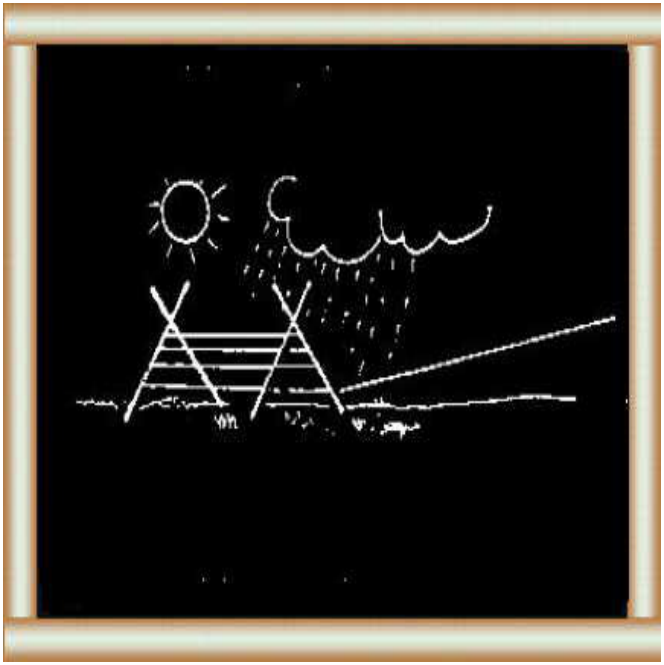
23 Too late:
- too low in protein
- too high in fibre.



24 When the weather is dry.



25 Too wet:
- at this time, the crop will dry more quickly but do not wait for sunshine.



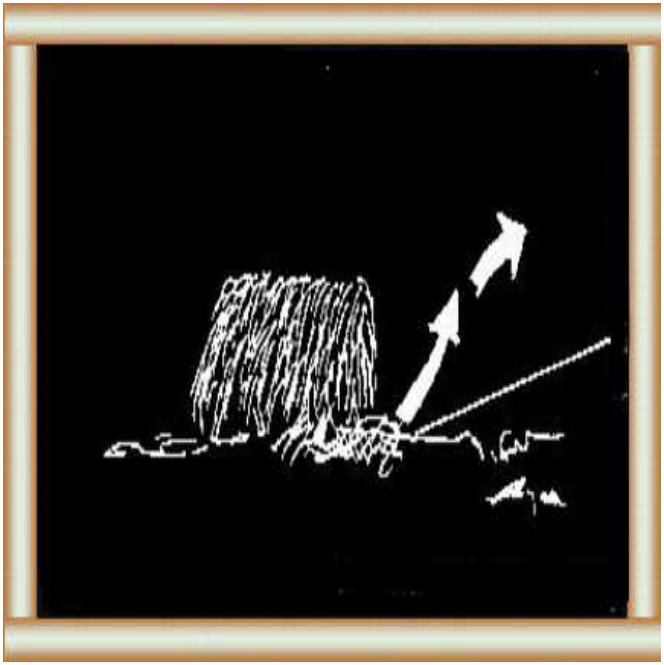
26 A drying rack can help you to overcome your problems with the weather.

page122

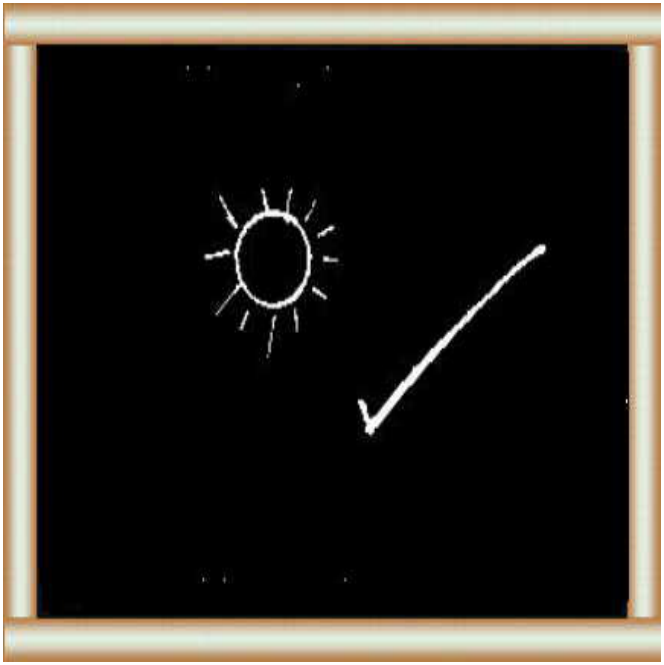
How can you dry the hay crop quickly?

27 After cutting the hay crop, turn over often to help wilt all parts of the crop.

28 Load hay onto a drying rack.



29 Take away plant matter which touches the ground.

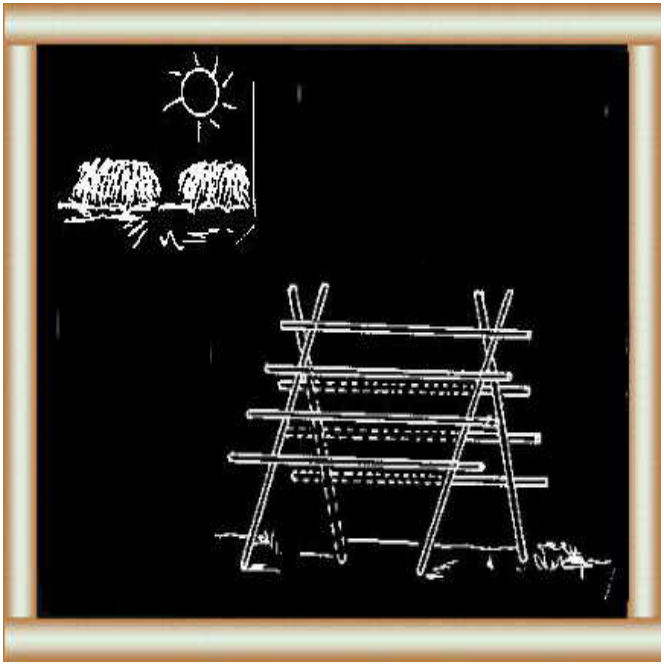


30 Cover the rack with mats before it becomes wet by rain.

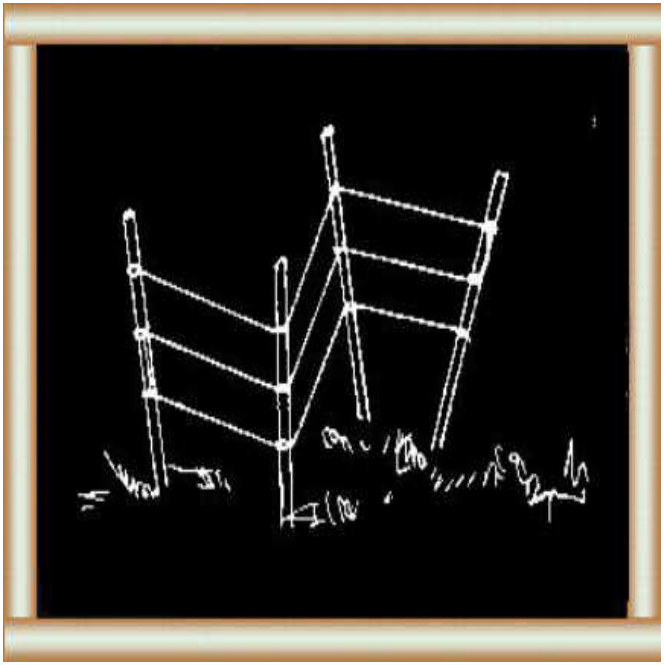
31 If you do not have enough mats to cover the sides, brush the hay downwards so that it sheds rain.

page123

What kind of drying racks can you use?



Hurdle
32 The hurdle:
- is suitable for smallholders
- has a capacity of 30-40 kg
- is easy to assemble.



Heinz

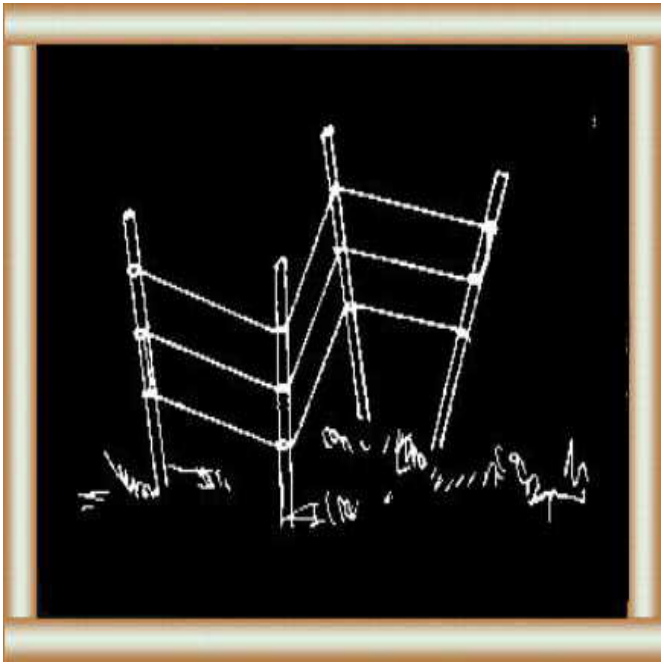
33 The heinz:

- is suitable for all weather conditions

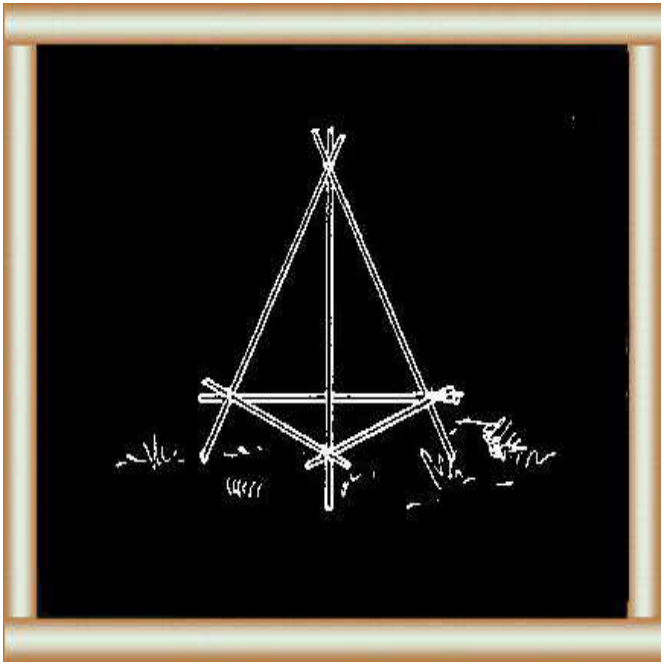
- is easy to make and assemble

- requires a plastic tent.

Fence



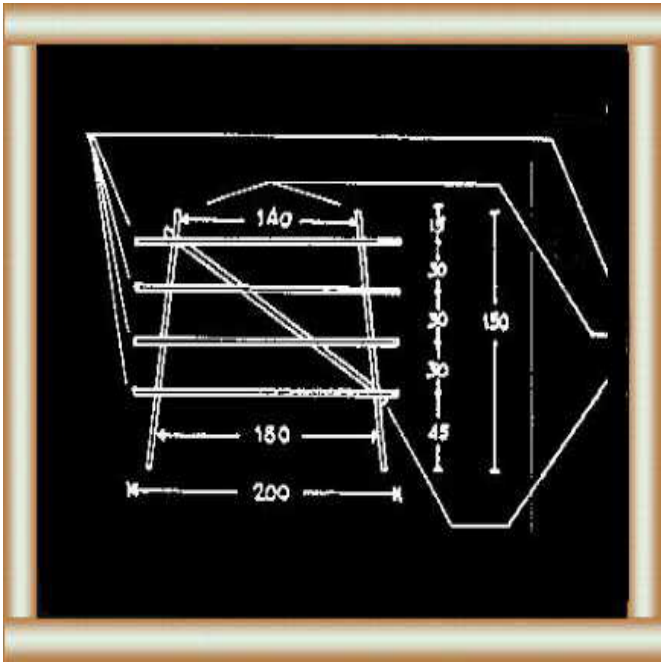
34 The fence:
- requires little material
- has a capacity of 80 kg (4 poles)
- can be loaded with wet hay
- requires careful assembly.



Tripod
35 The tripod:
- is better in dry climates
- leads to moulding in high humidities.

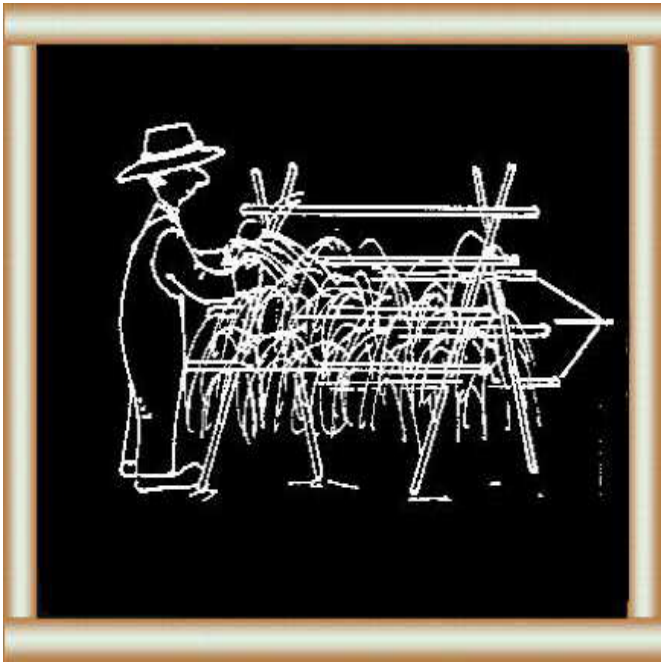
page124

How can you make a hurdle?



36 You need:

8 poles : 200 x 8 x 5 cm
4 poles : 150 x 8 x 5 cm
2 poles : 165 x 8 x 5 cm
Tie, nail or screw the poles together to make two frames like this.

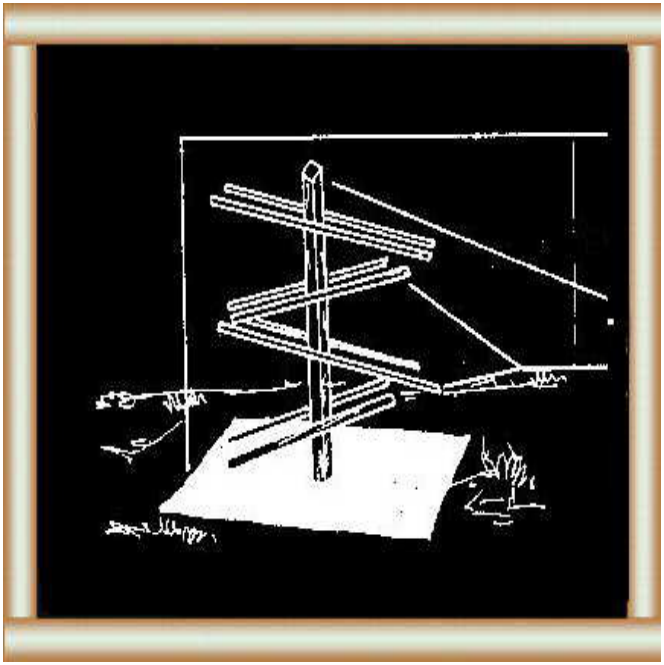


37 Lean one frame against the other to make the hurdle.

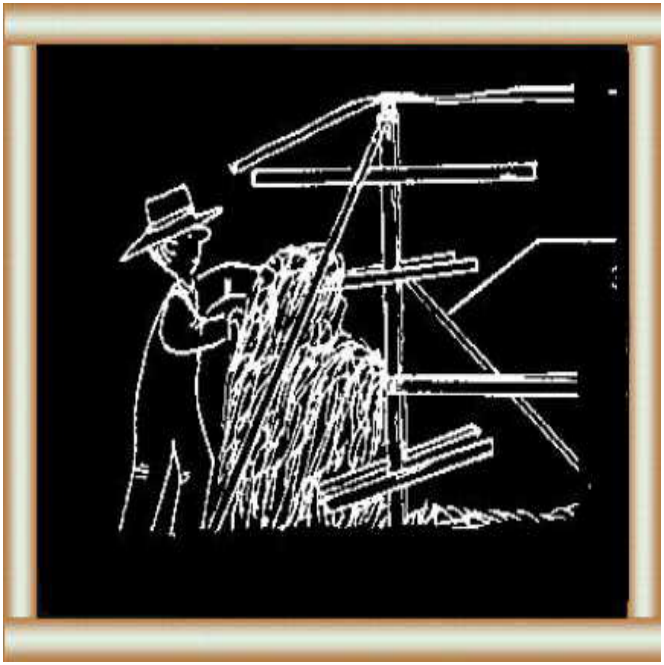
Load the hay crop onto the horizontal bars.

page125

How can you make a heinz?



38 Lay a dark plastic sheet on the ground to collect the sun's rays.
Put a thick pole into the ground.
Fix thinner poles in horizontal positions at right angles.



39 Fix support poles and a roof pole. Load the hay crop onto the horizontal arms.

40 Cover with a clear plastic sheet to protect from rain.

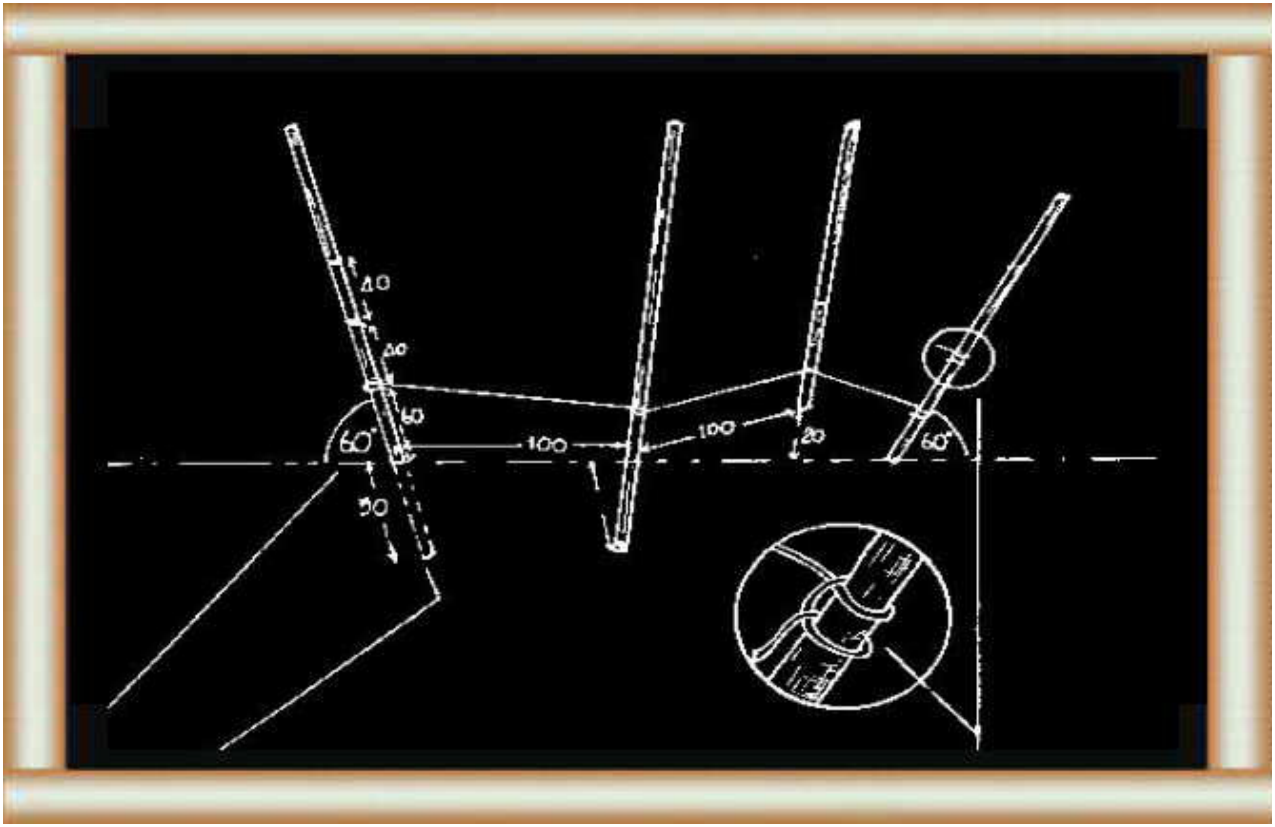
41 After about two days the hay is dry and you can remove it.

page126

How can you make a fence?

42 You need:

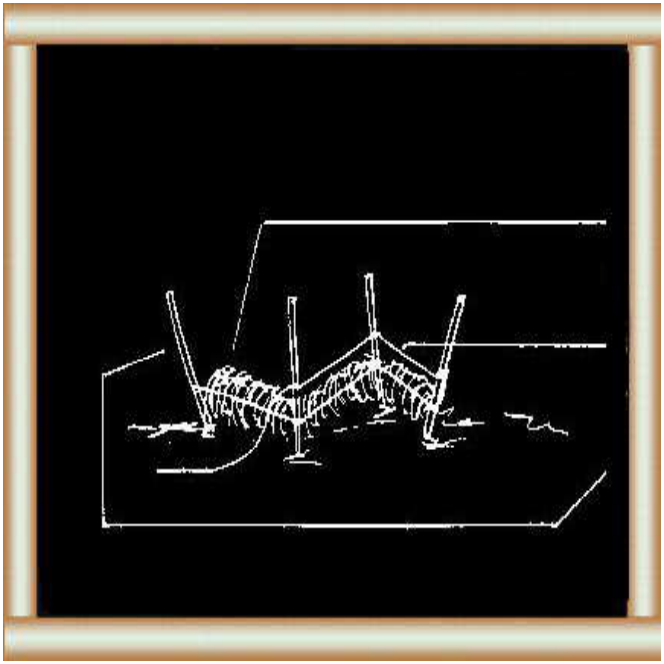
- 4, 5 or more round poles, 240 x 8 x 5 cm
- a bar to make holes
- sisal or ropes.



Make holes in the ground with a bar. **Note** the **angle** of the poles!

Make holes in the ground with a bar. Note the angle of the poles!

Tie the rope to the poles for the first layer of hay.



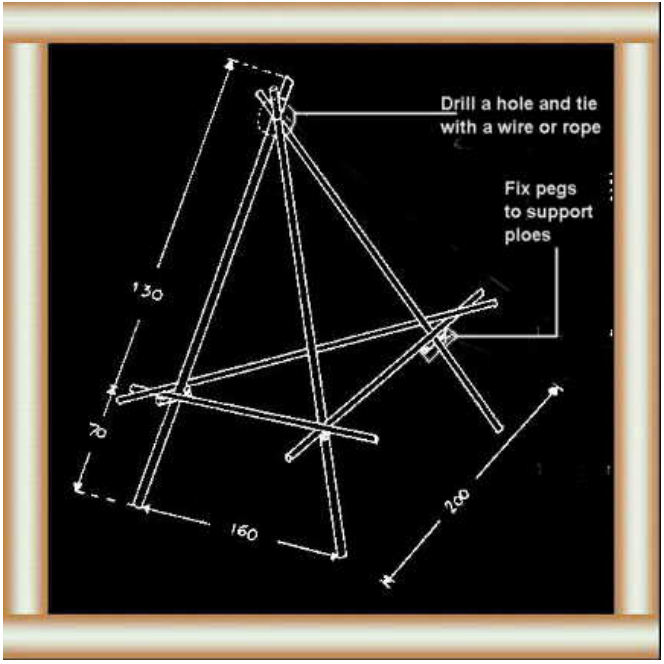
43 Load the first layer of hay crop on the rope.

Then tie the second rope on top and add the second layer of hay.

Continue to tie ropes and add layers of hay.

page127

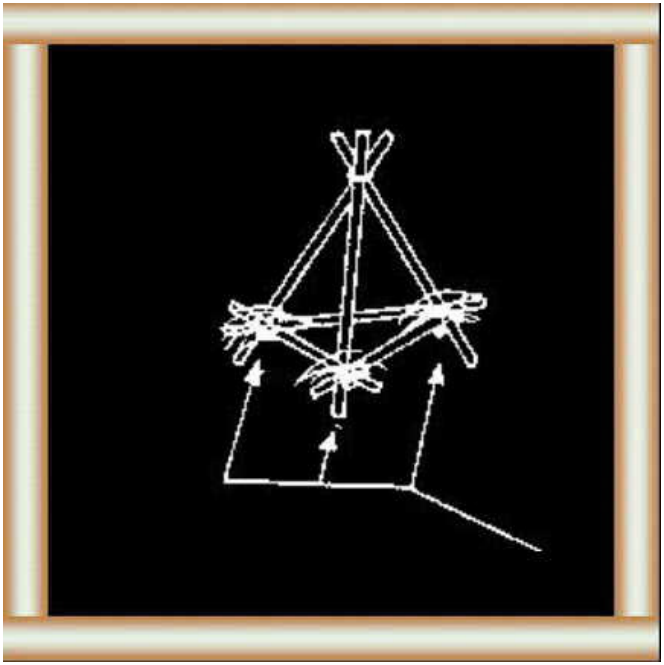
How can you make a tripod?



44 You need:

3 poles : 200 x 8 cm
3 poles : 200 x 8 cm
3 pegs : 30 x 8 cm
Drill a hole and tie with wire or rope.

Fix pegs to support poles.



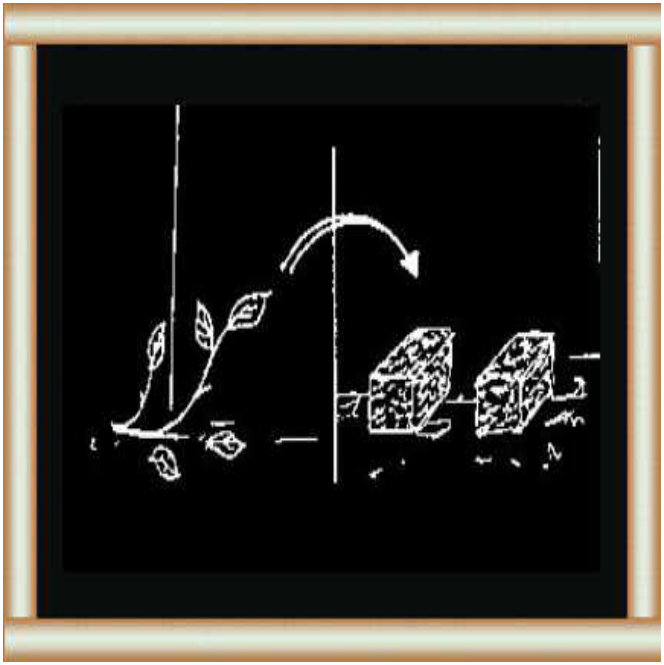
46 Begin loading from all three corners. Then move towards the middle.

47 Load the hay to form a cone. Keep the surface area small.

A tripod can carry about 500 kg of grass.

page128

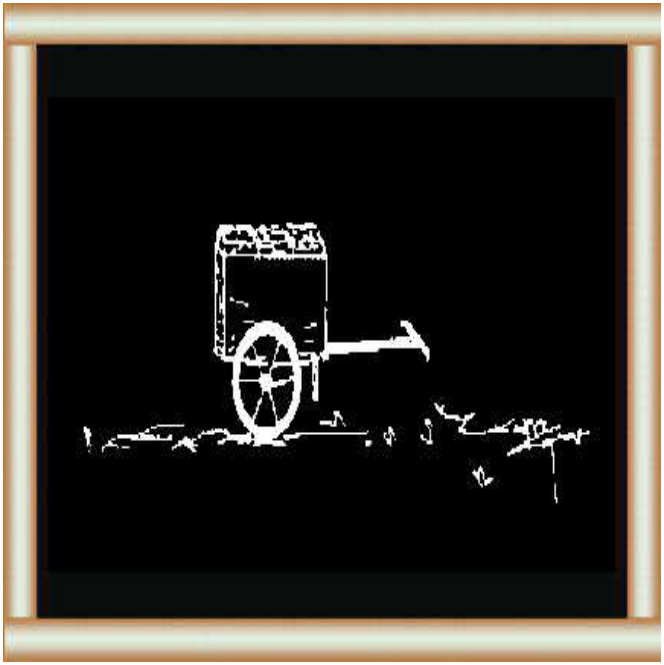
Why should you bale hay?



48 Legumes cut for hay lose their leaves easily.

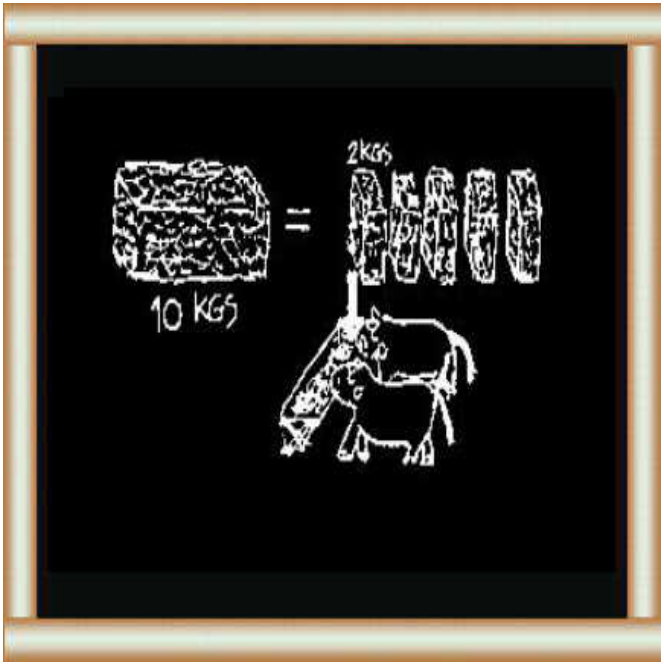
Baling keeps the leaves in the bale - from the field to the feeder.

49 Baled hay is easy to handle.



50 It is easy to transport

51 easy to store



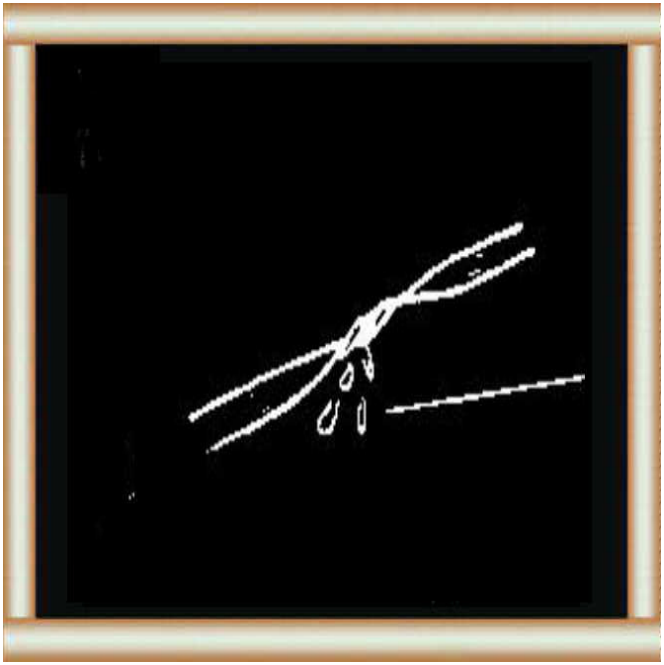
52 and easy to ration at feeding time.

page129

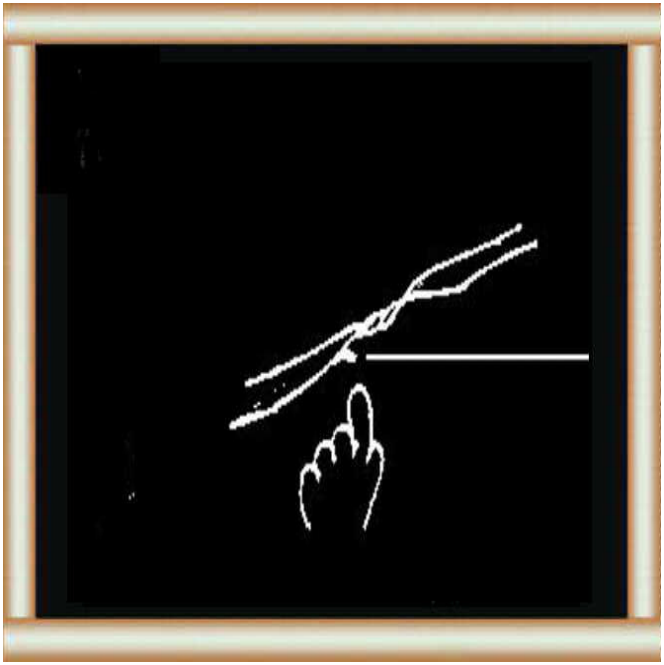
How do you know when hay is dry enough to bale or store?

53 Take a handful of hay from the inner layers of the drying rack.

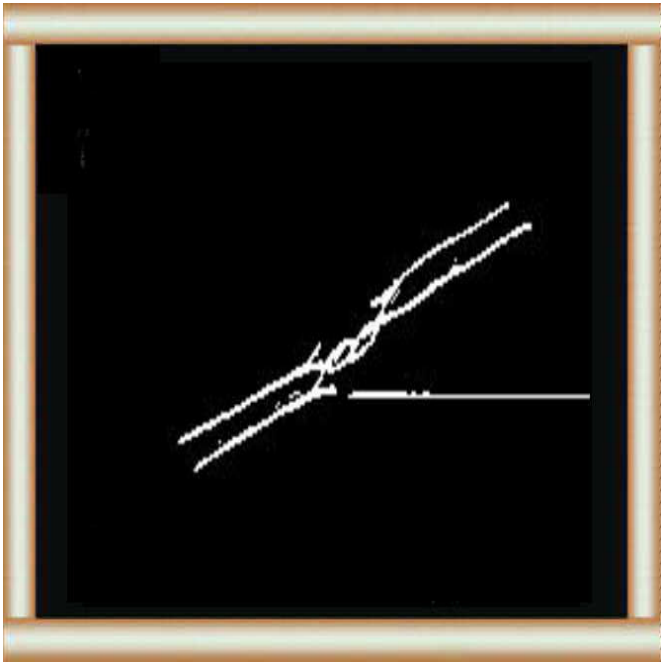
54 Twist the hay by hand and look at it carefully:



55 Does not break.
Shows moisture.
Do not store the hay.
Dry longer.



56 Skin comes off.
Do not store the hay.
Dry longer.



57 Breaks a little.
Shows no moisture.
Store the hay.

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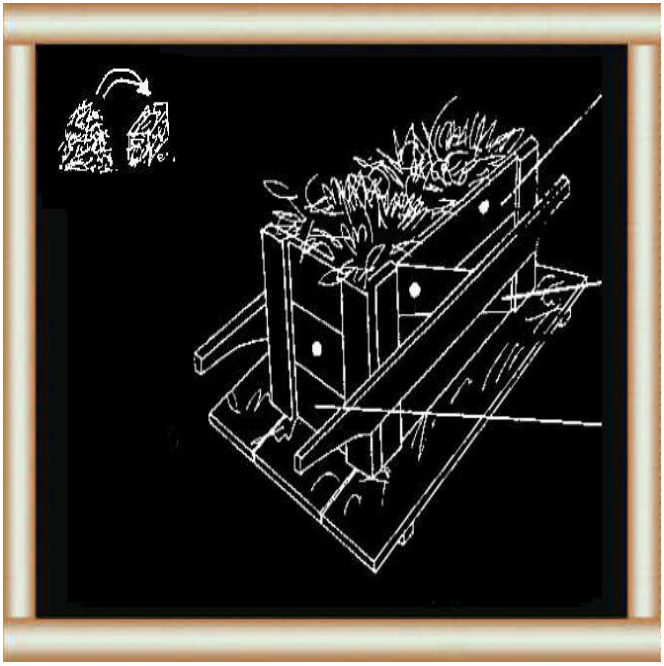
How can you make a baling box?

You need:



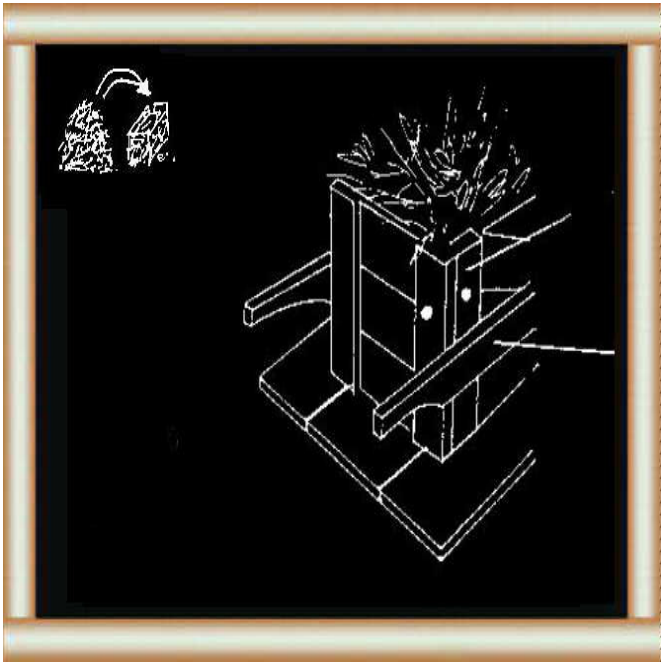
58

Side boards: 6 pieces 65 x 12 x 2 cm

Cross bars: 2 pieces 50 x 15 x 2 cm

End boards: 6 pieces 36 x 12 x 2 cm

59



Corners: 8 pieces 36 x 15 x 2 cm

Handles: 2 pieces 105 x 8 x 2 cm

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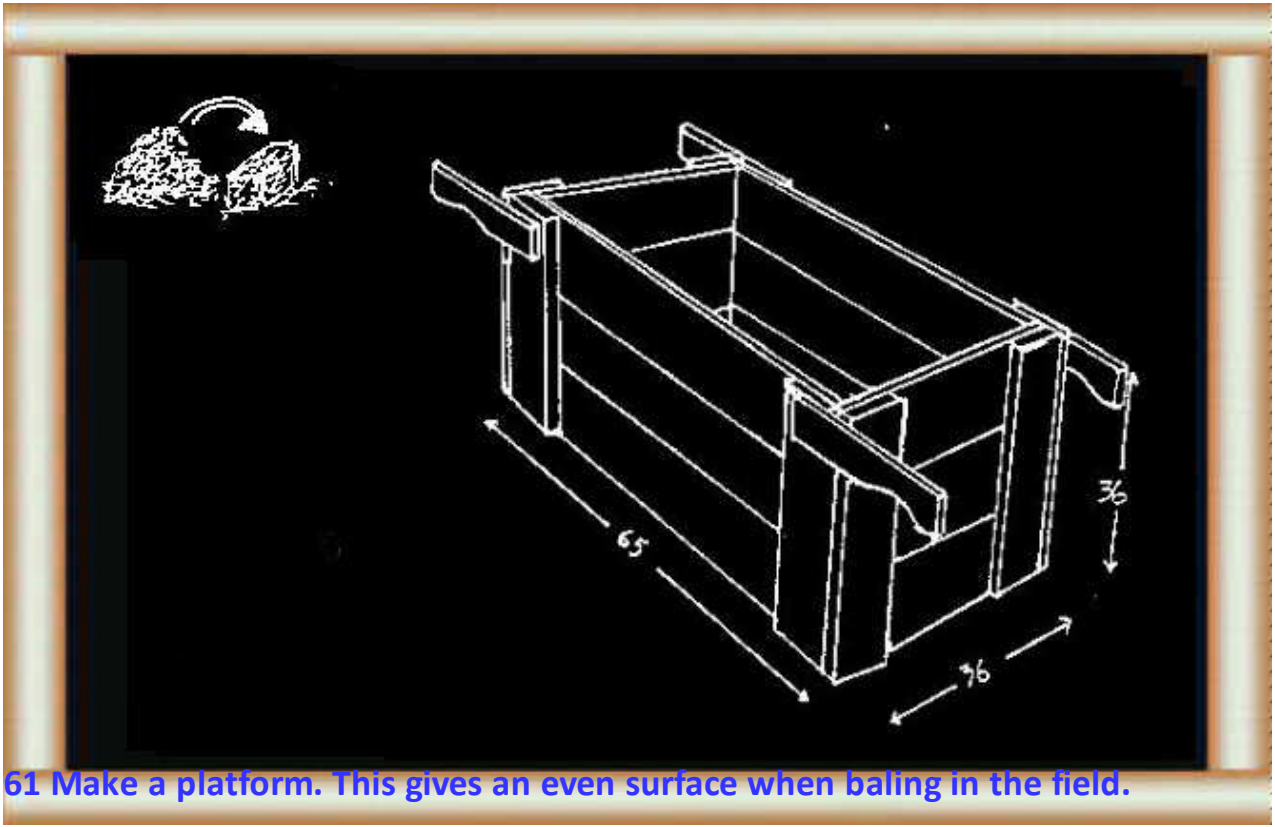
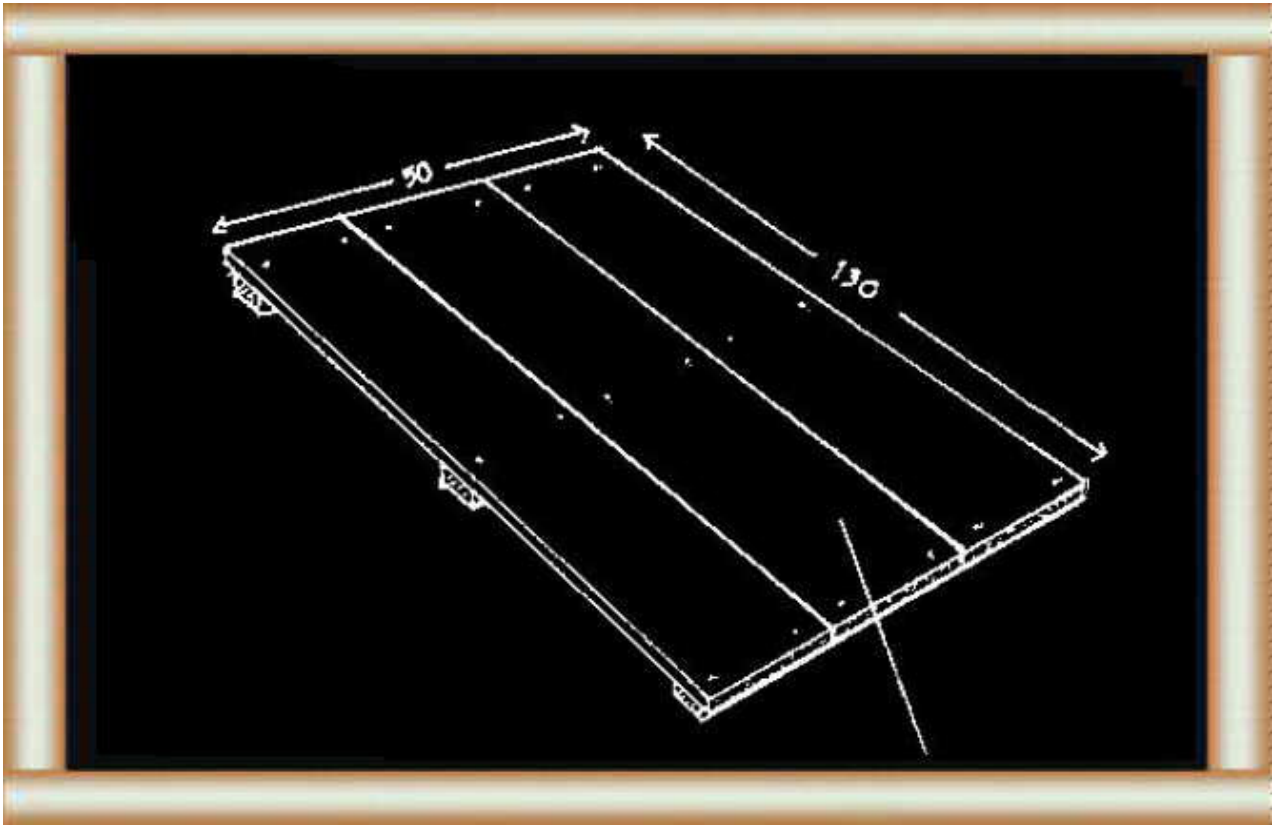
60



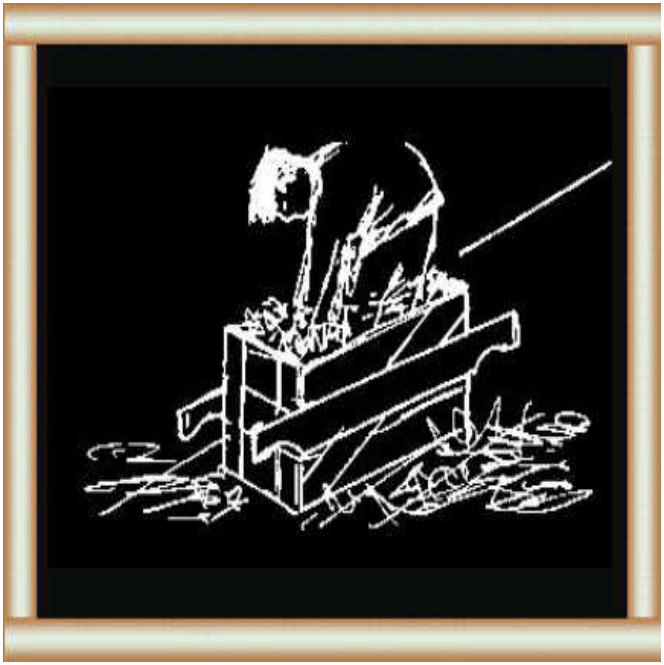
61 Make a platform. This gives an even surface when baling in the field.


50
130

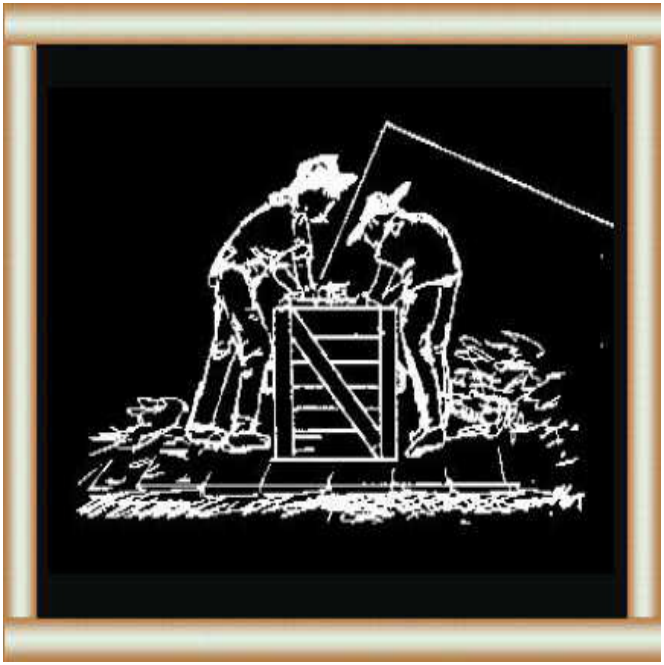
page132

How do you use the baling box?

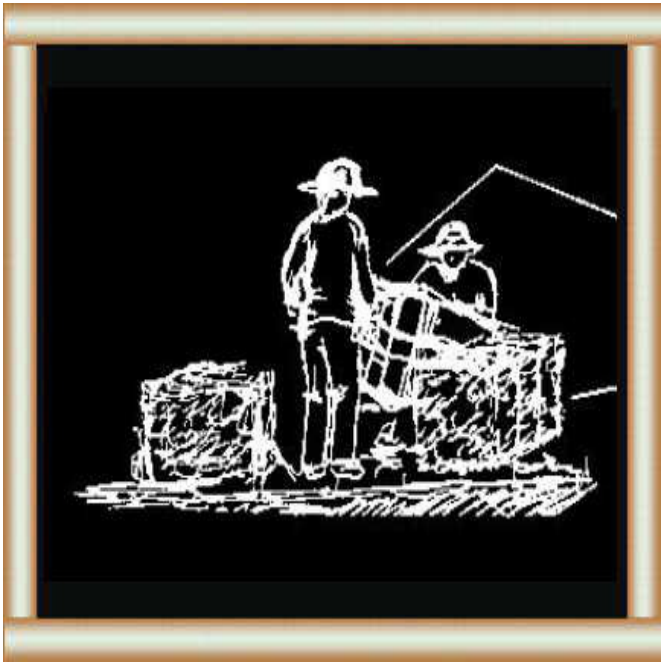
62 Put two long ropes into the baling box.



63 Tread the hay into the box.



64 Tie the ropes very tightly.



65 Lift the baling box, and tip the bale out.

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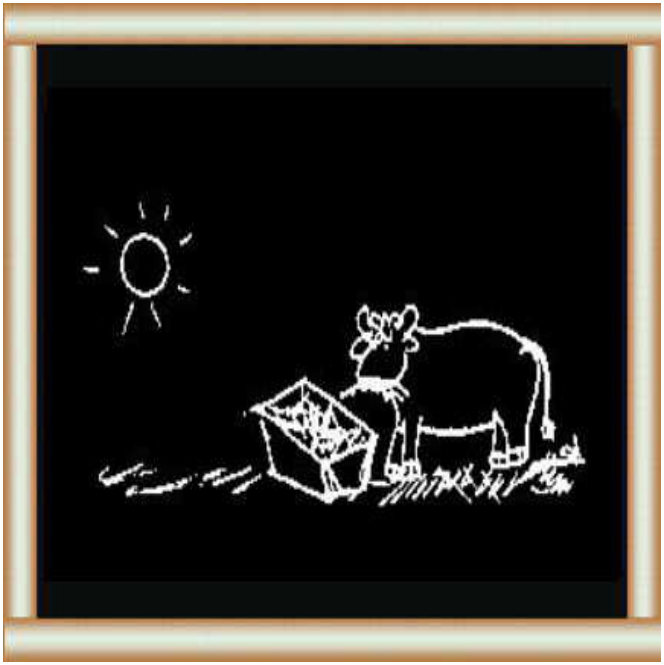
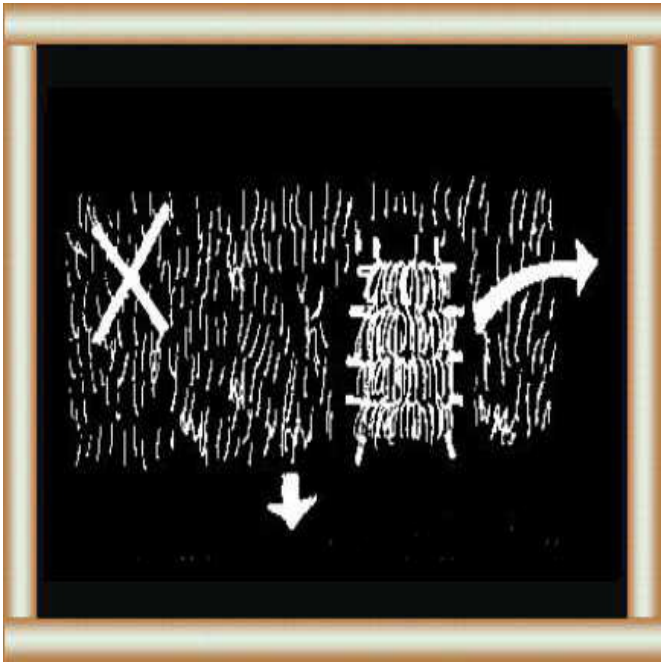
Why should you store hay?

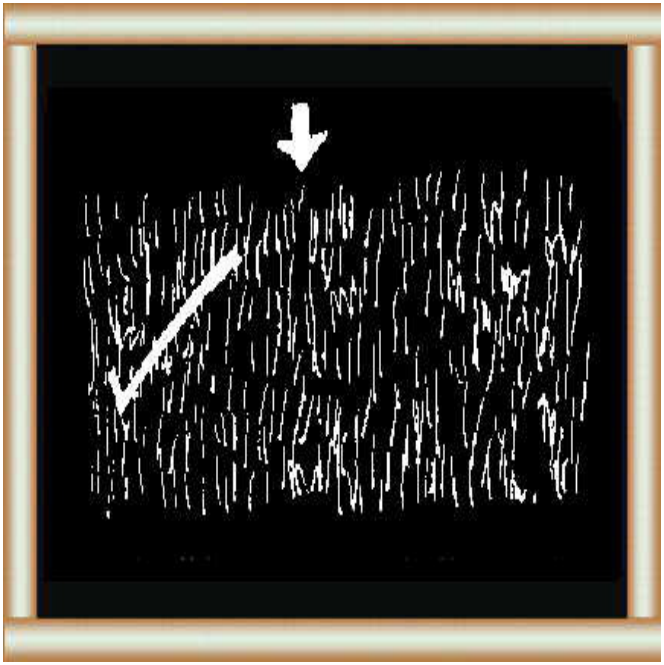


66 Hay is made from crops grown in the wet season but your calves and cattle need high quality feed for many months in the dry season.

You must store hay for the dry season. Then your animals can feed when grass cannot grow.

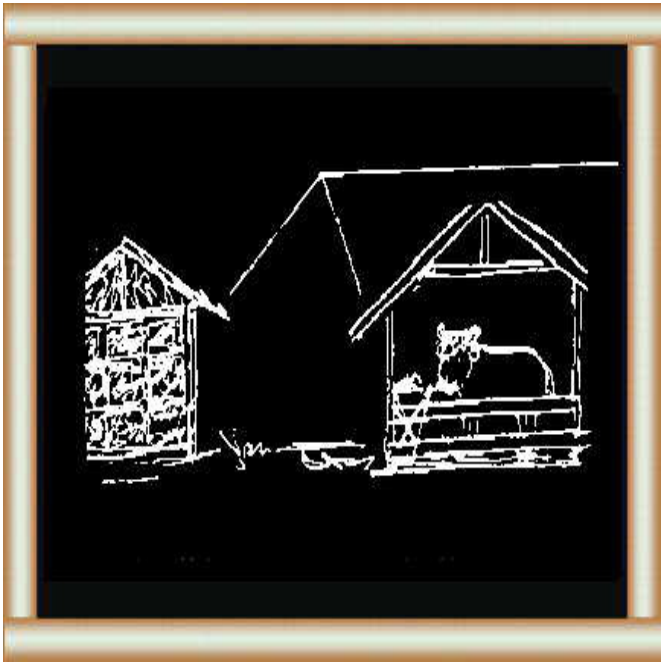


67 How can you store hay?



68 When the hay is ready for storing, remove it from the field.

More grass can grow where you put your hay racks in the field.



69 Store hay close to the shed.

Then it is easy to feed your cattle.

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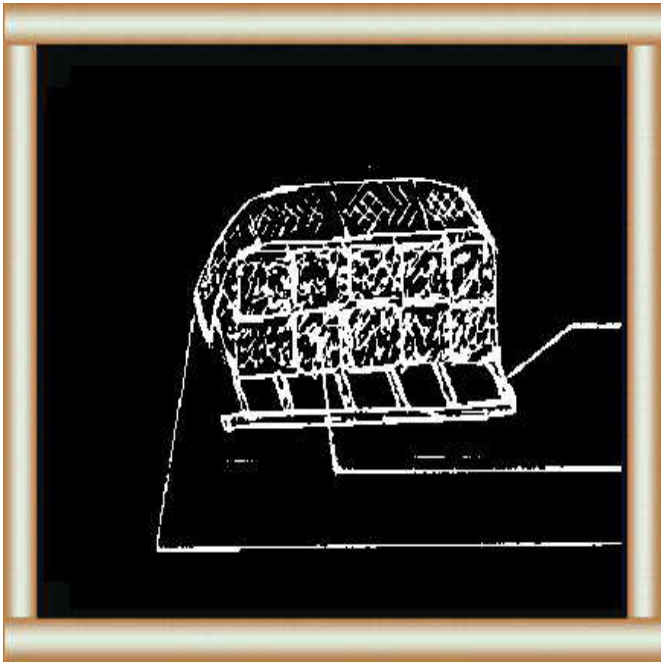
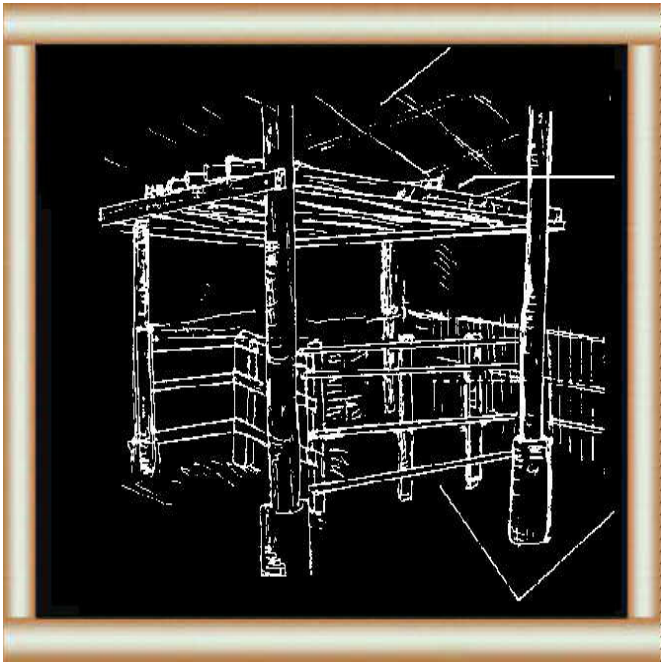


70 If you have no suitable storage site, store hay on slats:
- slats to keep the hay off the ground
- mats or plastic cover to keep the hay dry
- bales of hay.

71 If you store hay for a long time, it has lower feed value.

Hay may also become mouldy.
Watch out for mould.
Do not feed mouldy hay to calves.



72 You can store hay under the roof of the cow shed and above the housing area for calves.

Storage platform

Calf pen

page135

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73 You can also store hay with silage.

The roof shelters hay and silage.

The platform supports the hay and helps further drying.

74 The pit gives room for forage to make silage.

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How can you feed hay?

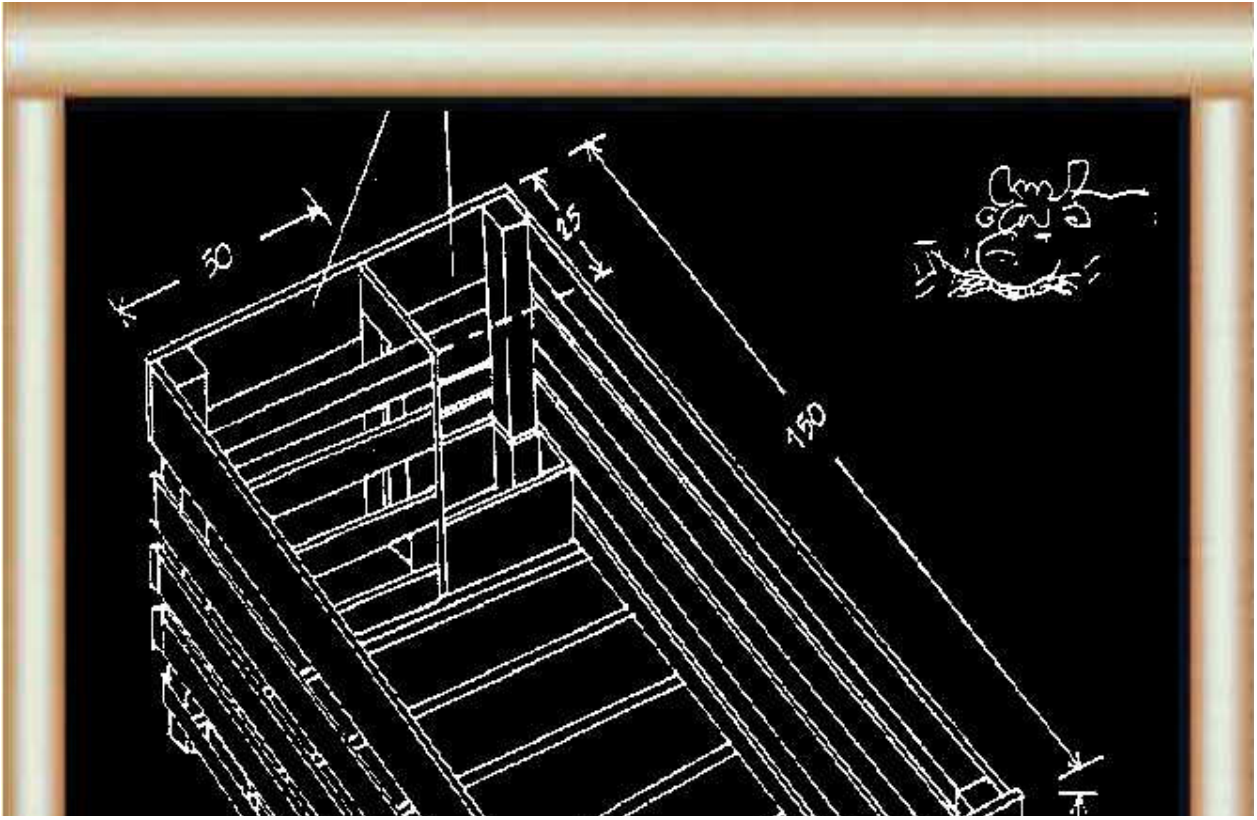
75 You can feed hay from hay racks in individual calf boxes

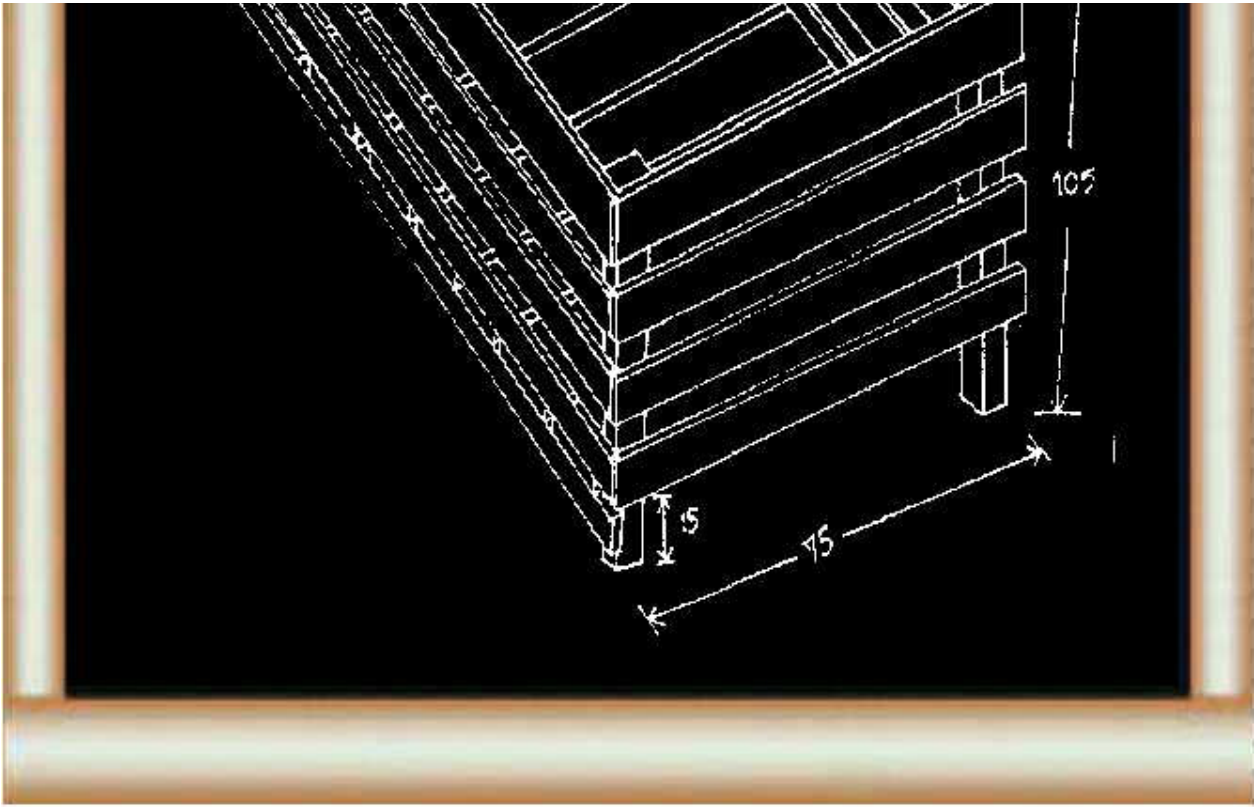
76 or from self feeders for calves in your exercise yard.

How can you make a hay rack?

77 Make your calf box like this (measurements in cm):

- with a rack for hay
- and a place for concentrates and water buckets.





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How can you build a basket hay store and self feeder for the exercise yard?

78 You need:
- grass for the roof
- sticks and branches for the sides.

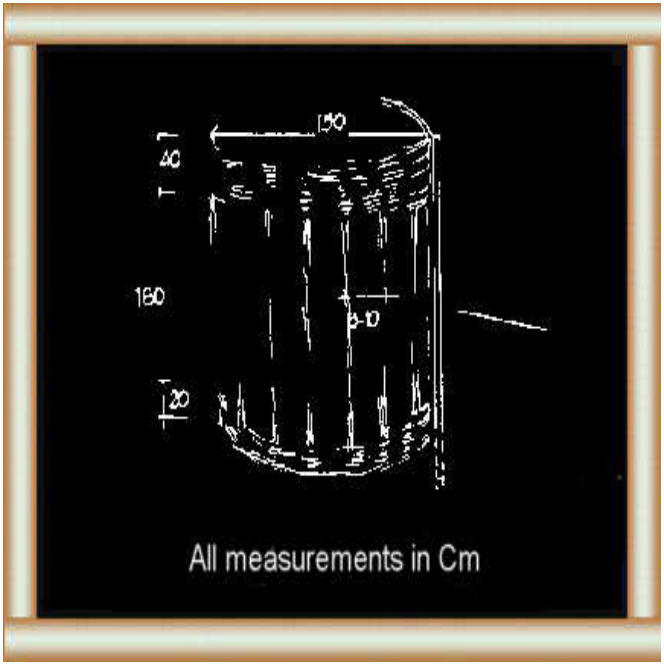
Do not use nails or wire.

These may hurt cattle.

Use ropes to tie branches and sticks.

79 Make the roof from thatching grass.
You can lift the roof to add more hay.

Add poles to make the feeder stronger. A feeder of this size can



hold up about 250 kg of hay.

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What do you know about hay making?

Feeding good hay increases your milk production

1 Good hay is: (9-11)

- low in fibre

- rich in protein and nutrients.

2 Feed when you have no grass in the dry season. (12-15)

Making hay for feed requires planning and equipment

	Planning	Equipment	
Cutting	**Sickle -1 When crop flowers**	**Sickle**	(21-26)
	2 When weather dry		
Drying equipment	**1 Prepare**		(27-31) (32-

	2 Load and	Drying Racks	35) (36-
turn hay			
	3 Keep hay	Hurdle	37)
off ground/dry		Heinz	(38-
	4 Choose a	Fence	41)
suitable rack		Tripod	(42-
	(size, ease of		43)
making,			(44-
	weather)		47)
Baling			
	1 For		
keeping leaves			
	2 For easy		(48-
handling,			52)
			(53-
transportation and			57)
	rationing		(58-
	3 Checking		61)
dryness		Baling box	(62-
	4 Making a		

baling box			**65)**
	5 Using a baling box (treading, tying, tipping)		
Storing - for the dry	**Keep hay dry season**	**Slats and cover Platform**	**(66-74)**
Feeding rack	**1 Making a hay**		
	2 Making a haystore and self feeder	**Hay racks**	**(75-80)**
	3 Locating for easy feeding		

Small-Scale

Dairy Farming Manual

Volume 3

Husbandry Unit 5.4 - Part 1

SMALL SCALE SILAGE MAKING

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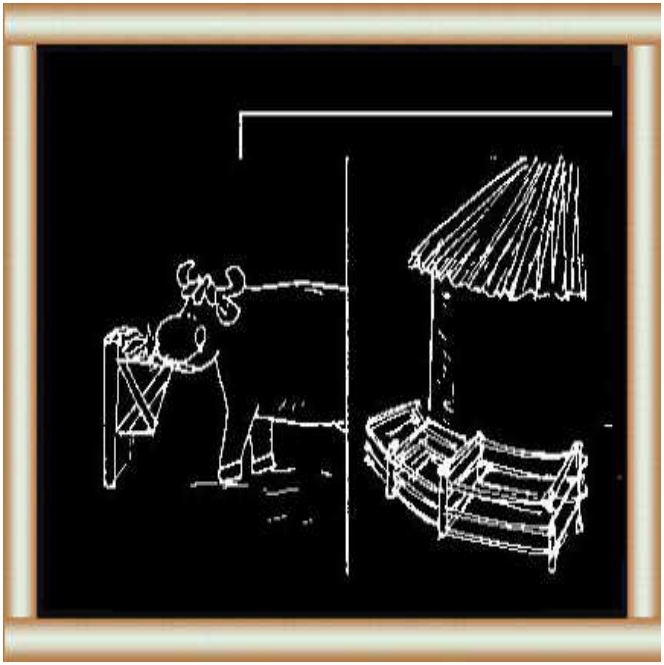
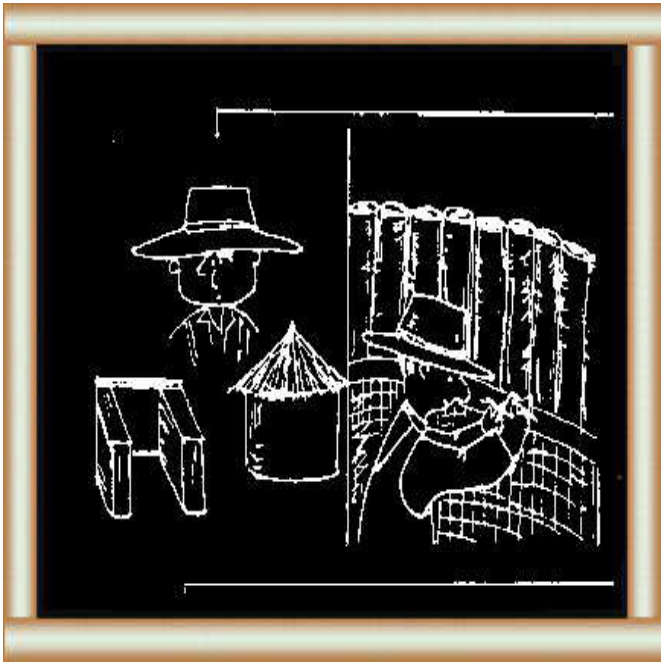
Extension
Materials
What should you know about silage making?



What is silage and why is silage important?(5-12)

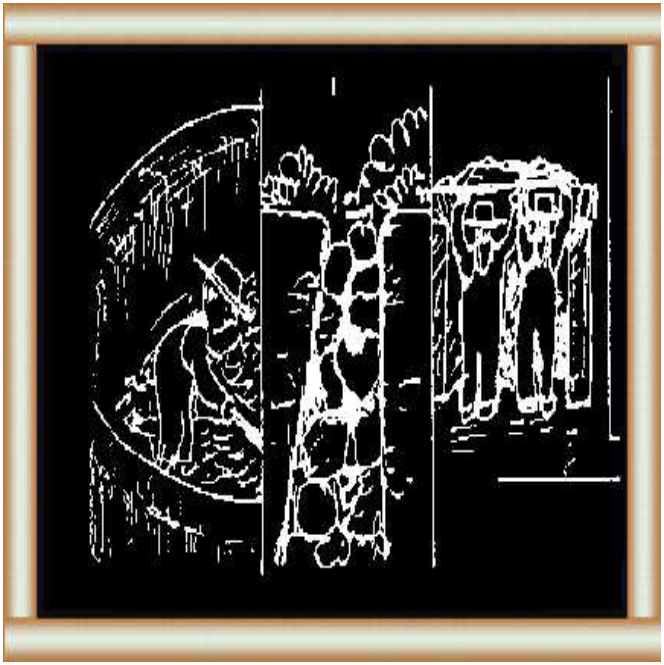
1 You should know:
- the feed value of silage
- the importance of storing and feeding silage.



How can you make a "silo"?(13-56)

2 You should know:
- the types of silos
- how to make a suitable silo for your farm.

How do you prepare



the crop and handle silage?(57-82)

3 You should know how to:
- prepare your crop and fill your silo
- seal and drain your silo
- remove silage.

How do you feed silage?(83-87)

4 You should know how to:
- make a feeder for your silage
- find the feeding value.

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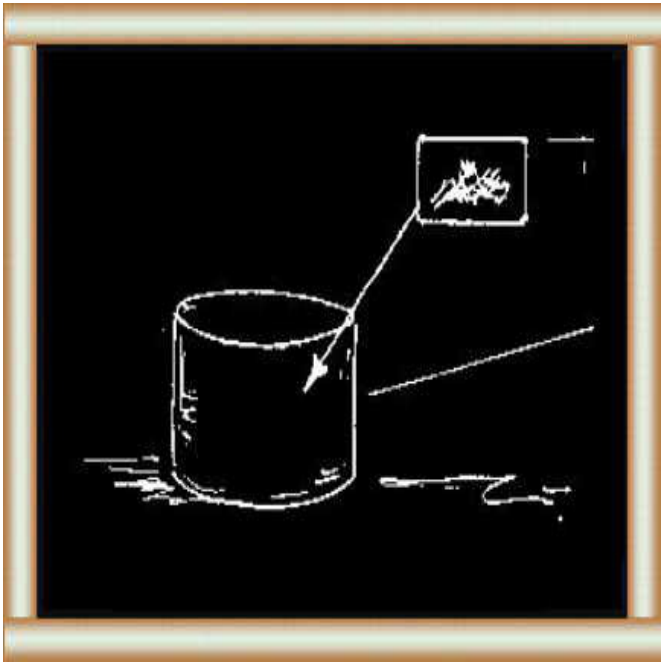
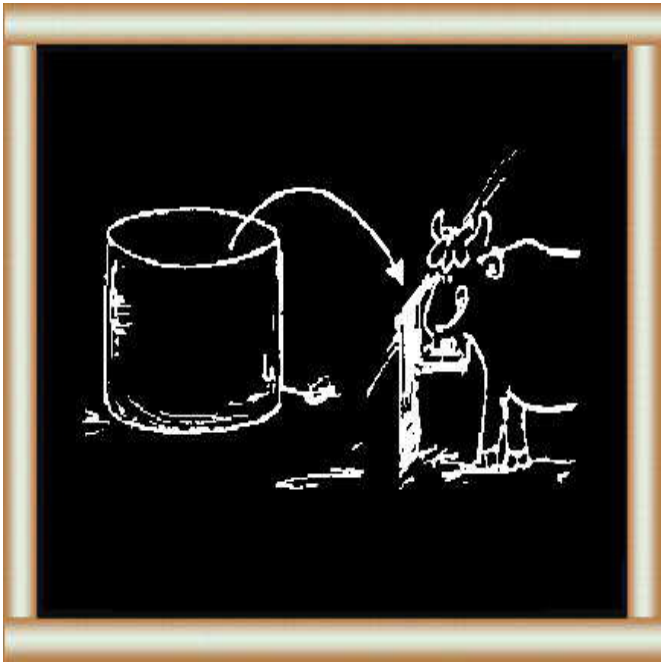
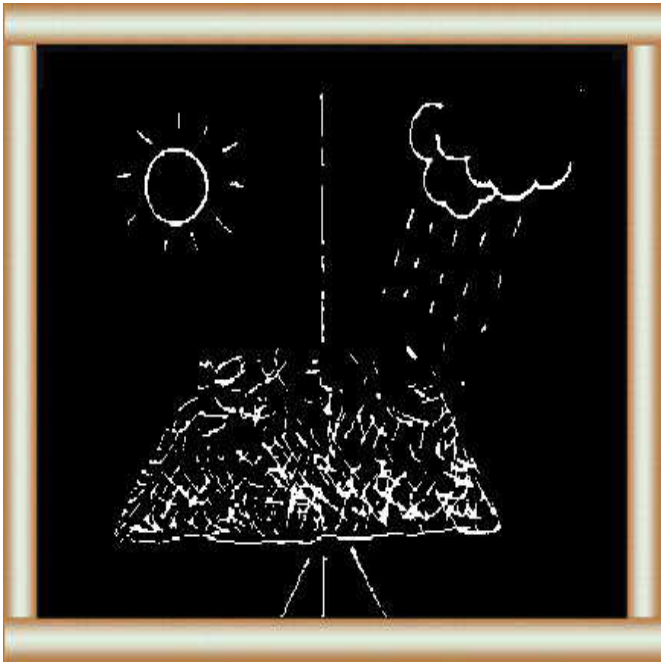
What is silage?



5 Silage is cut plant material sealed in a silo without air and water.
Rainy Season
Dry season



6 You can store the silage for many months and still have good animal feed
- up to 85% of the energy and protein value of the original crop.



7 If you store the cut plant material with air and water

8 it becomes rotten material/ compost. You can use it for fertilizer but not for animal feed.

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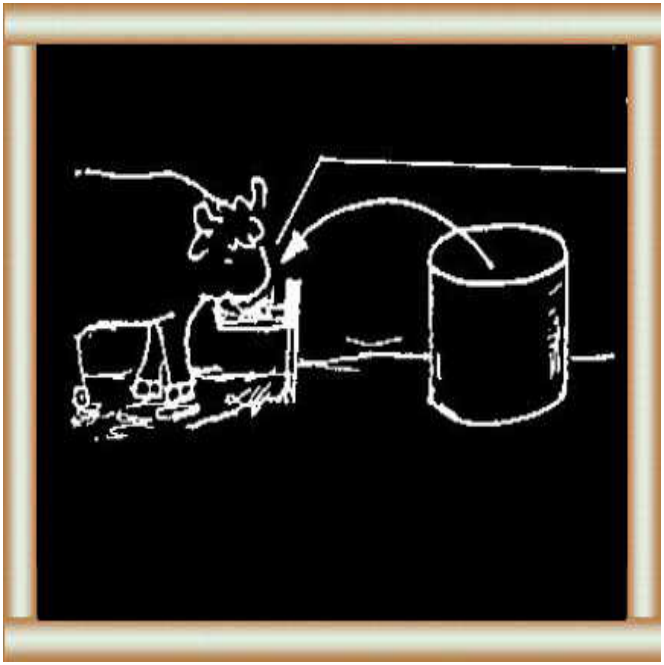
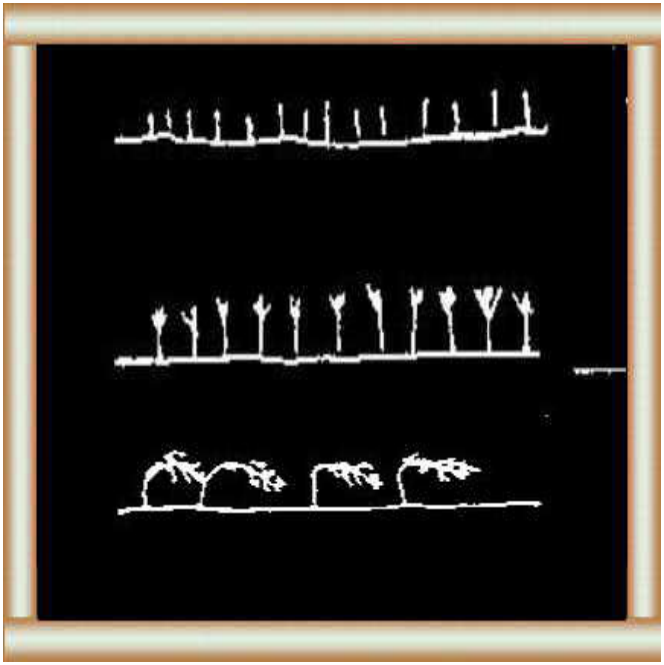
Why make silage?

9 You can store extra feed as silage

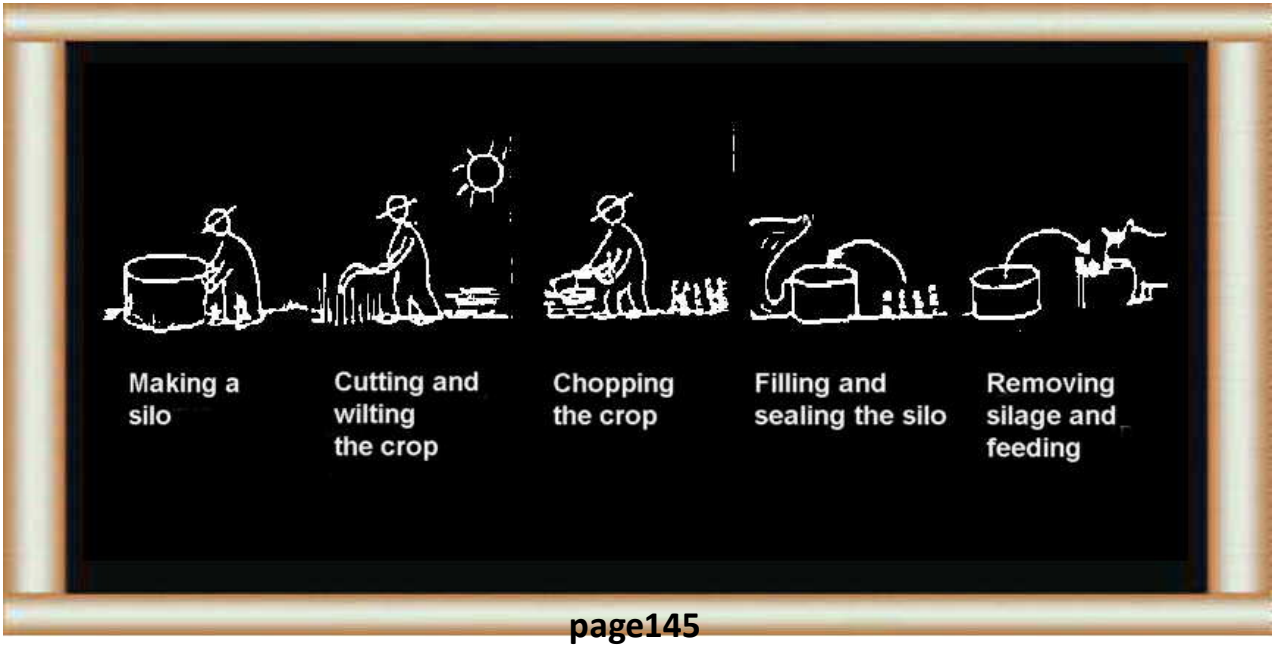


10 and use it as animal feed when plants are not growing.



11 You can harvest your crops when they have highest feed value and store them for use throughout the year.

12 What are the steps in making silage?



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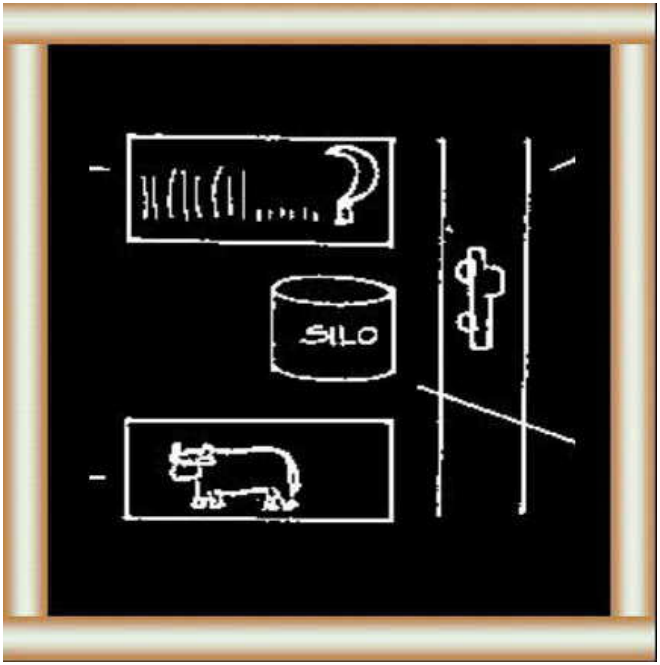
Making a silo.
Where is a good place for the silo?

13
Near to where the

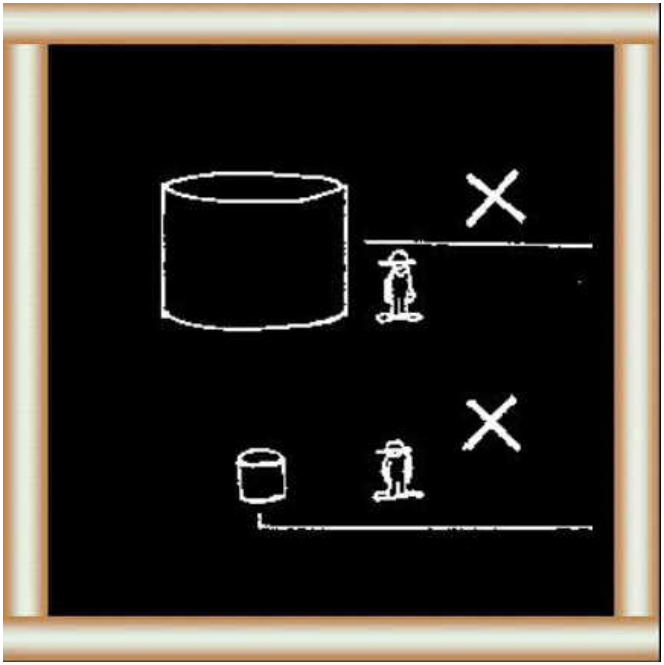


crops are cut - short distance from the field to the silo.

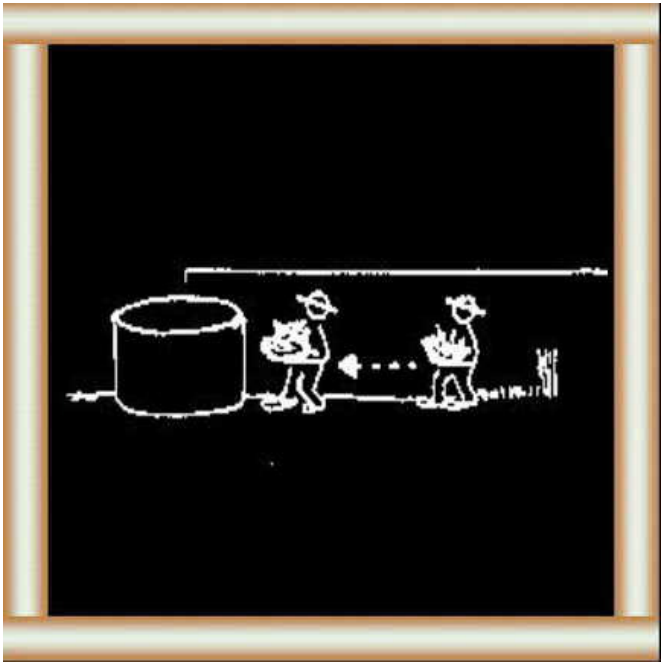
Near to the road - you may want to transport or sell your silage.

Near to where the animals feed - short distance from silo to feeding animals.

No water - in a dry area which is easy to drain.



What is important in making a silo?
Right size
14 Big silos cost more.
Very small silos have a lot of waste.



15 The smallest silos should have 4-5 m^3 of silage. You need to cut the plant, carry it and fill the silo in one day.

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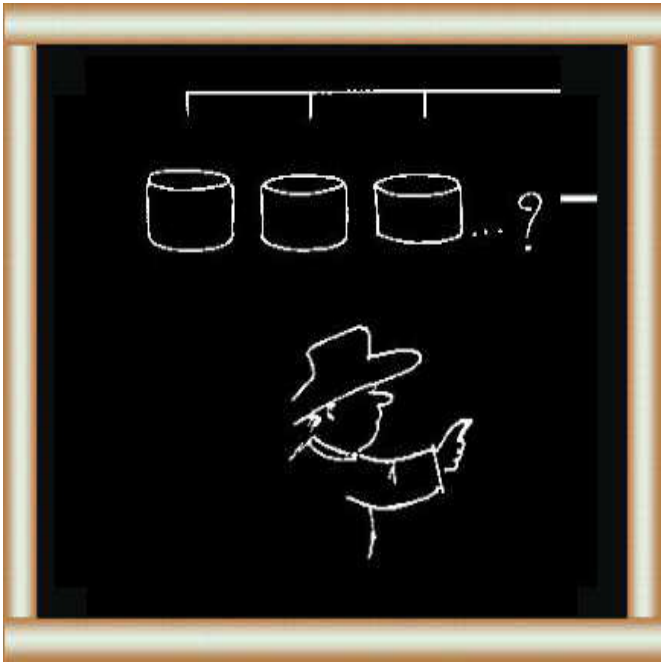
16 You need enough silage to feed your animals throughout the

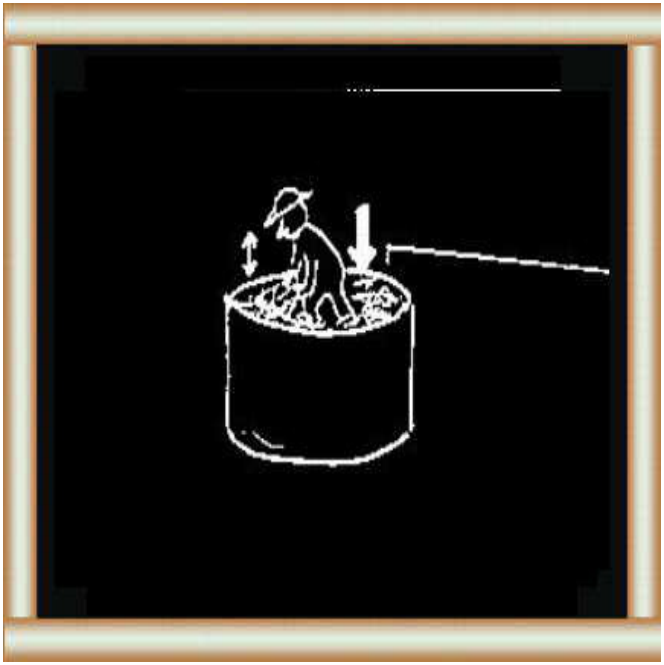


dry season. Make more small silos not one big silo.

IMPORTANT: How many animals do you have?

How much feed does each animal need?

How much spare crop do you have for silage?

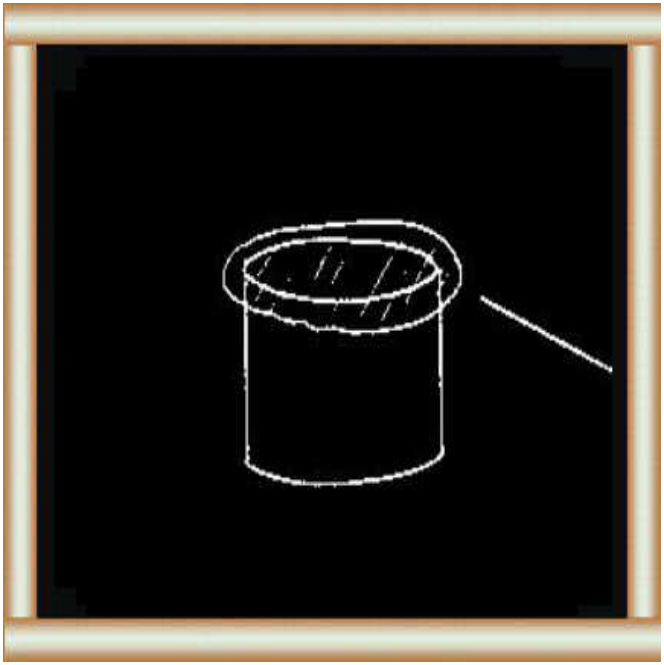


Strength
17 You must compact the silage to remove air.

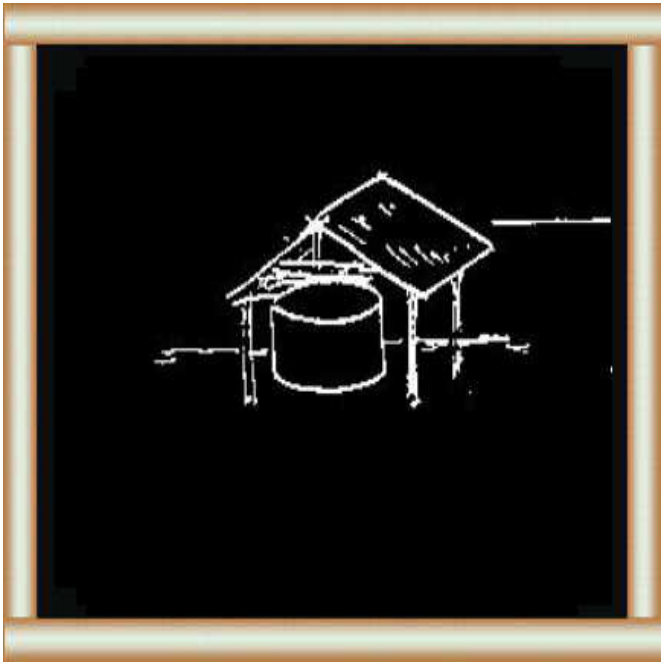
The silo must be strong enough for this.

No air

18 Air in silage causes



problems:
- loss of energy
- increase in temperature
- growth of fungi.
Seal the top of the silo to keep air out, replace the seal quickly after removing silage.



No water/sun

19 Make a roof to protect silage from rain and sun.

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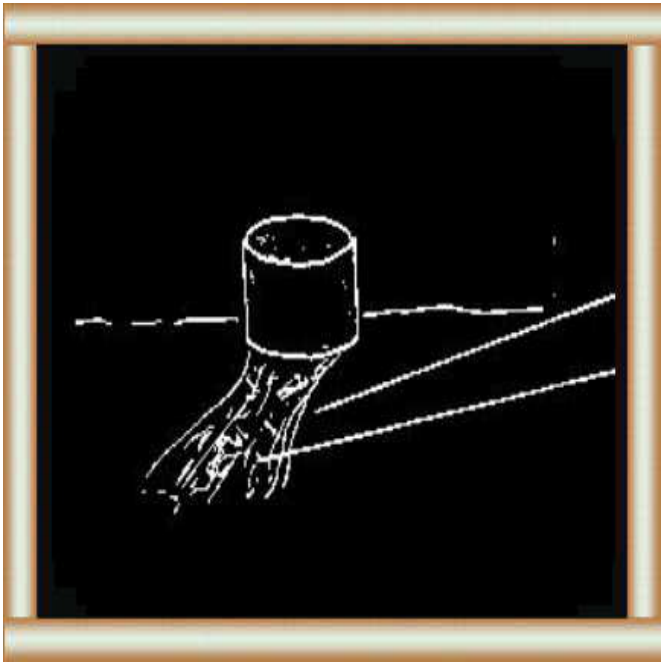
Drainage

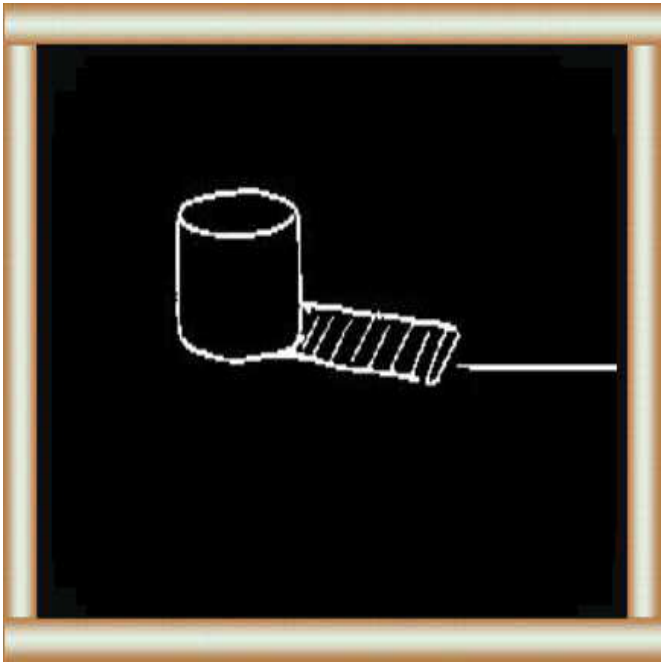


20 Silage produces a lot of effluent.

Make drains on each side of the silo floor to remove waste.

Fill the drains with stones and rocks.

Make sure the drains do not go near drinking water.



Base

21 If your silo is large, make a base for unloading equipment.

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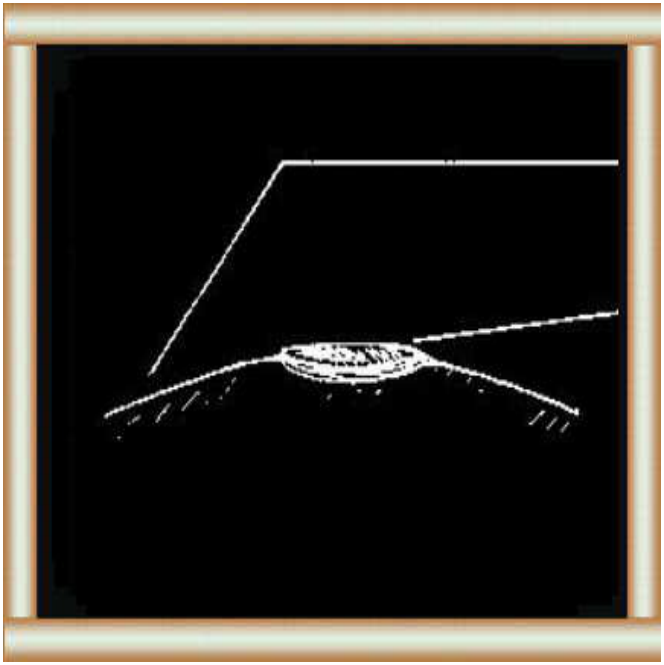
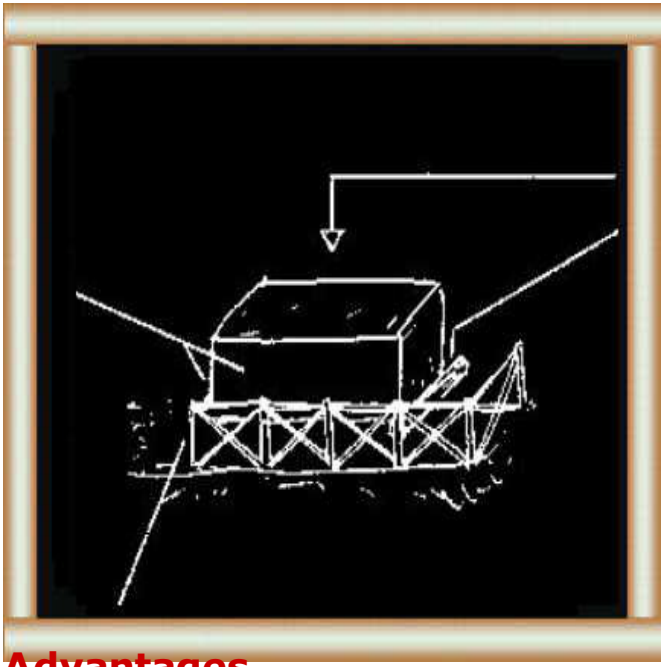
Types of silo
How can you make a stack silo?



22 Choose a site with good drainage and firm soil base.
If possible, lay a concrete floor.

23 Stack the cut crop carefully.



Make it high at the sides and the ends.

Compact the stack.
Cover the stack with plastic sheets.
Fence the stack so that cattle cannot step on the silage.

Advantages
Disadvantages

1 Low cost. 1 Lot of waste at sides and ends.
2 Easy to move. 2 Difficult to roll the stack to check

for

high temperatures.

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Material Labour	Manhours
1 Earth bricks laying	1 Brick 90
2 Cement (12 bags) walls & concrete	2 Make 32
3 Sand (3 m^3) drains & fill	3 Dig 8

trenches with stones
4 Wire-mesh (34 m)
& staples (.8 kg)

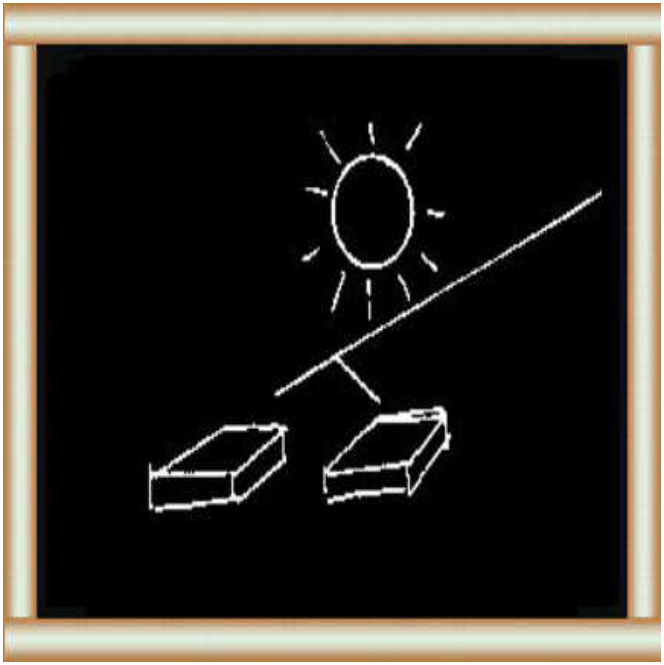
5 Broken stones for drainage (1.6 m^3)

Total

man/hrs: 130

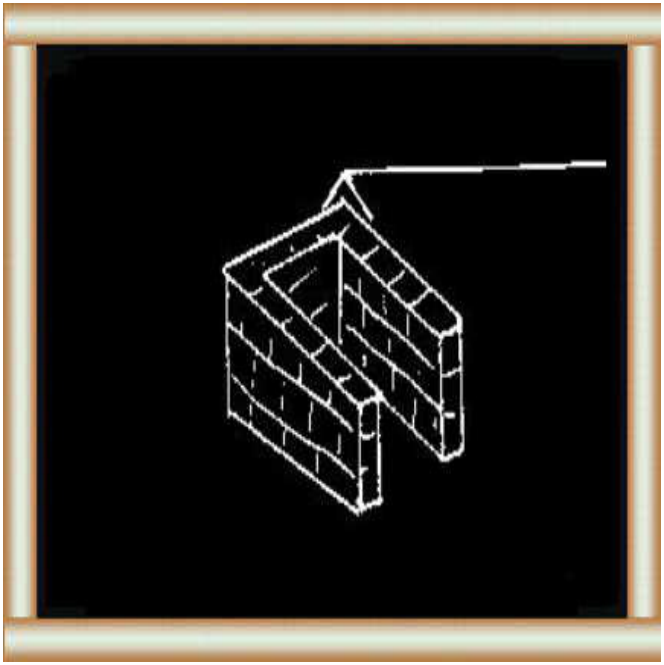
How can you make a walled clamp silo?

24 Make earth into

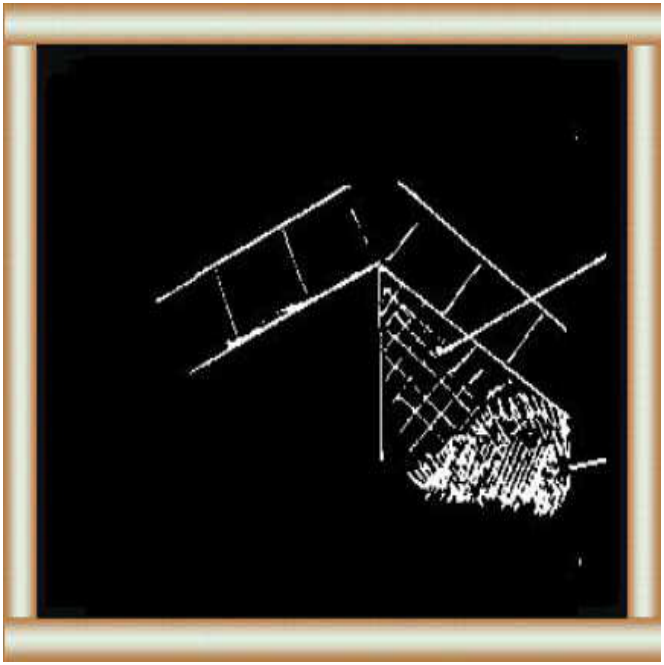


bricks and bake them hard in the sun.

Cover the wire-mesh with a layer of concrete.



25 Build the walls of the silo from the bricks.



26 Put wire-mesh on the inside of the walls.

27 Make a roof out of wire-mesh and cover with a thin layer of straw.

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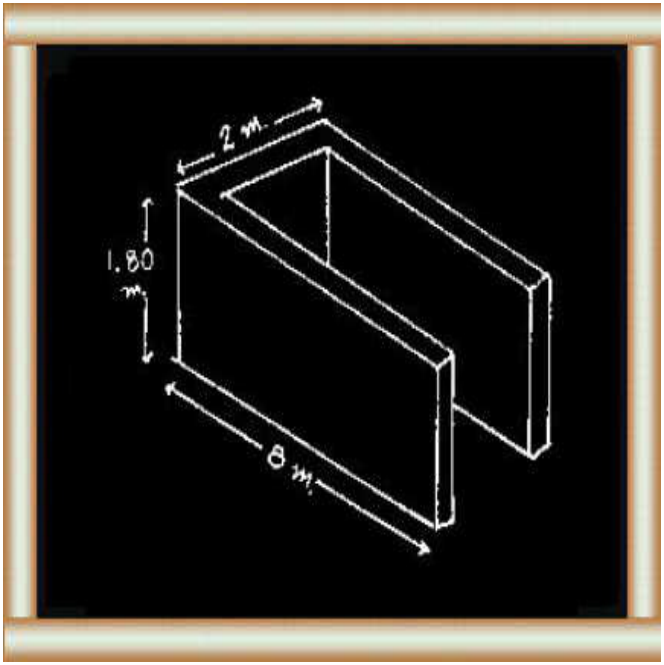
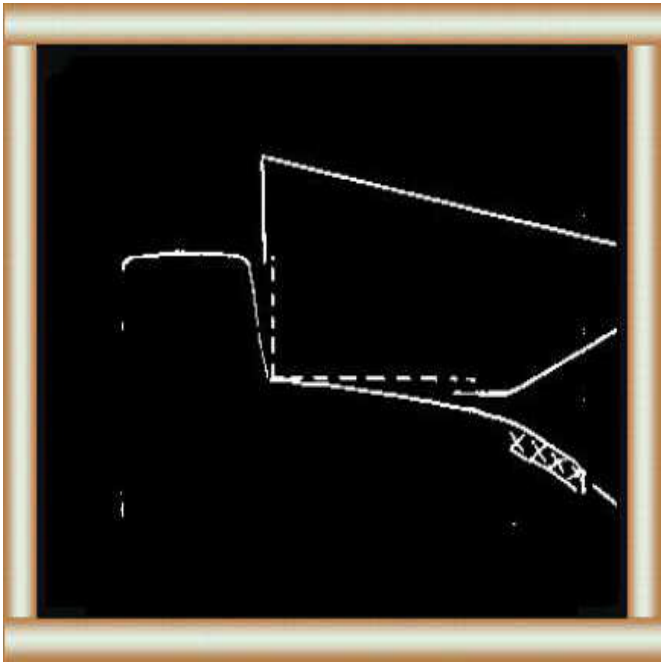


28 The silo has a capacity of about 35 m^3 (11,000 kg).
This is enough to feed 5 milking cows for 90 days.

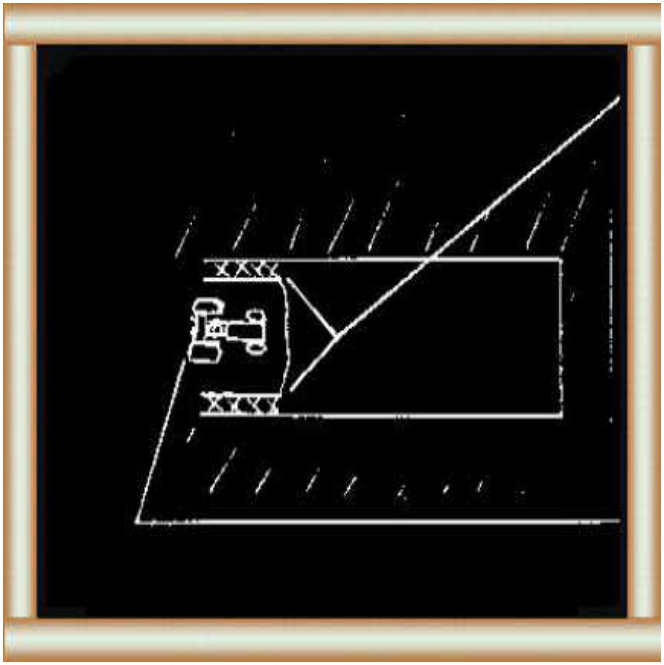
Note:
1 Other materials for walls: metal or wood e.g. railway sleepers.
2 Silage produces acids. Treat materials with asphalt to protect them.

How can you make a trench silo?

29 Choose a site with sloping land and firm soil.
Side view



30 Dig a trench:
- with a 10% slope on the back wall and bottom.
This will carry the waste towards the drains.



31
- wide enough for a tractor or cart to enter.

32 Dig drains and fill with rocks or stones.

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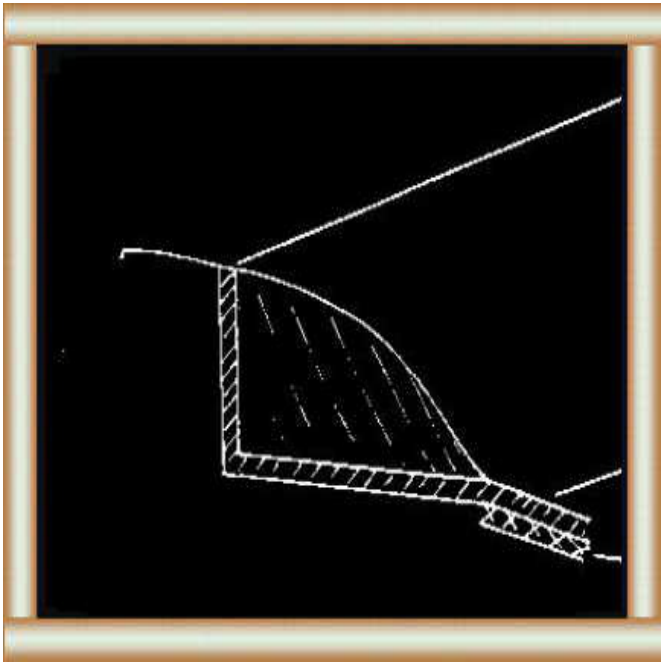


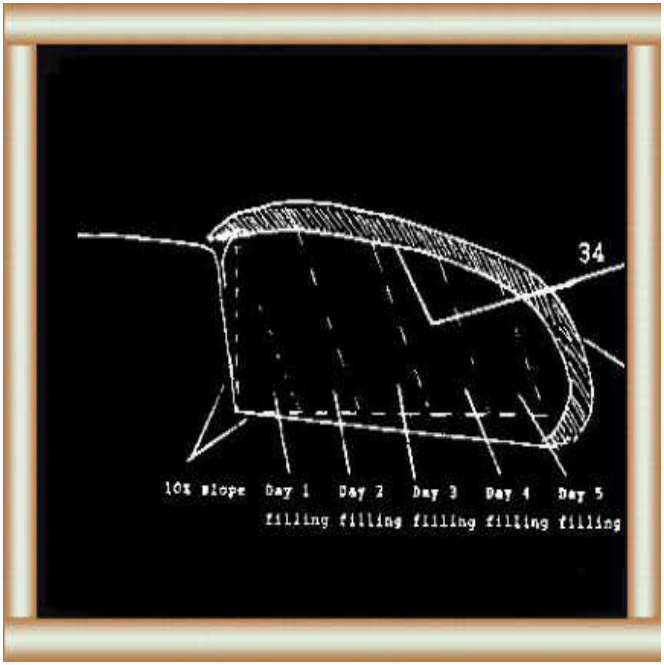
33 Your trench silo will be better if you line the sides, bottom and walls with a 10 cm layer of concrete.

Extend the concrete for 3-4 m on the slope.

Drains

34 Cover the silage with a polythene sheet.

This will keep the air



and water out.
Add a 15 cm layer of soil. This will compact the silage.

Make the slope of the back wall and bottom 10 %.
This trench was filled in 5 days.

35 Make a roof.

This is bamboo with a "cadjan" covering.

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Materials	Labour
1 Broken stones (drainage)	1 Dig

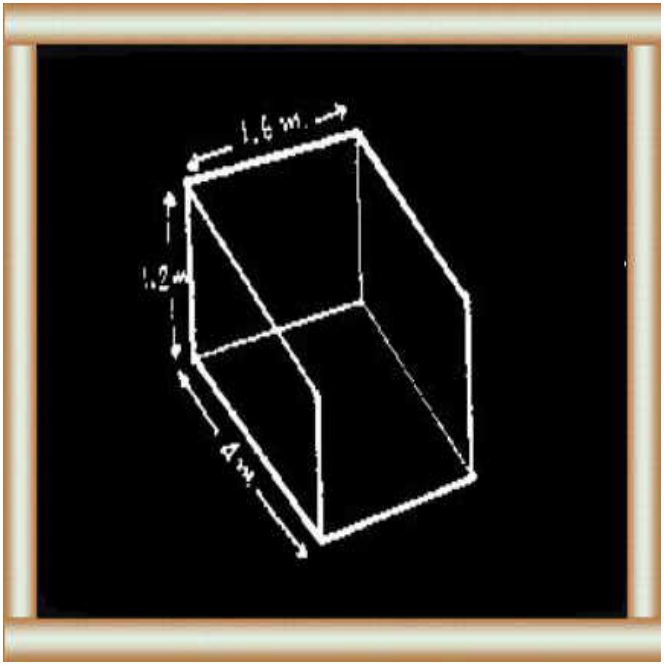
trench
2 Poles
Make roof
3 Roofing material & ropes
4 Wood preservative

2

Size
Capacity

36 This silo has a capacity of about 10 m^3 (3,500 kg).

This is enough to feed 2



cows and 2 calves for 60 days.

It is suitable for small - medium scale silage operations.

Note:

1 Replace roof mats every year.

2 Replace roof structure every 3 years.

3 Replace trench after 5 years.

Advantages

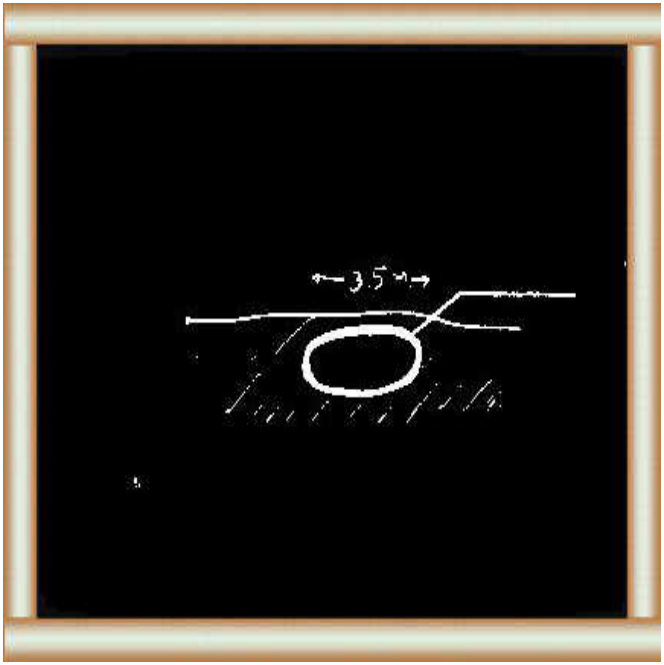
Disadvantages

1 Low cost, about US$ 5-10 per m^3
2 Low waste because of walls of water running into
3 Easy to load and unload trench, especially in because at ground level. tropical regions

1 Needs a good, sloping site
2 Danger the

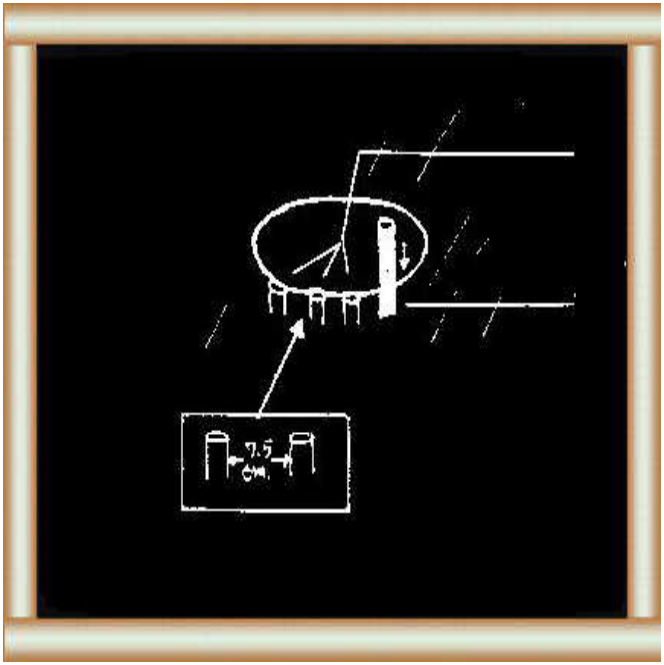
page154

How can you make a circular wattle silo?



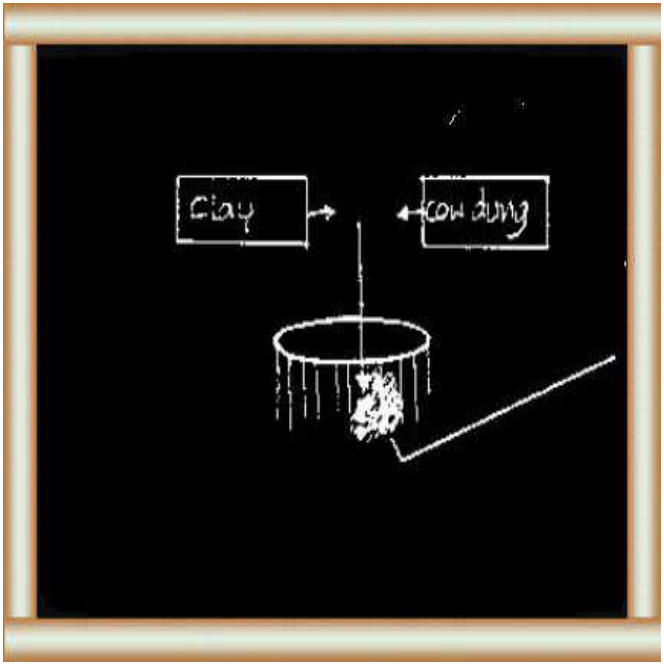
37 Choose a well-drained site with firm soil.

Draw a circle on the earth, 3.5 m in diameter.



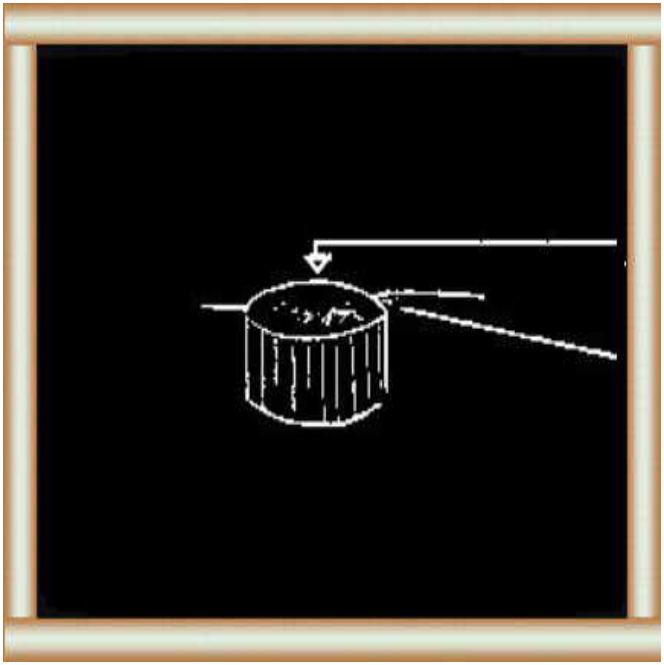
38 Make holes around the circle, 7.5 cm apart.

Errect the poles.



39 Mix clay and cow dung.

Plaster over the poles.



40 Add and compact the crop.
Seal the top with a mixture of soil and straw or with a plaster jacket.

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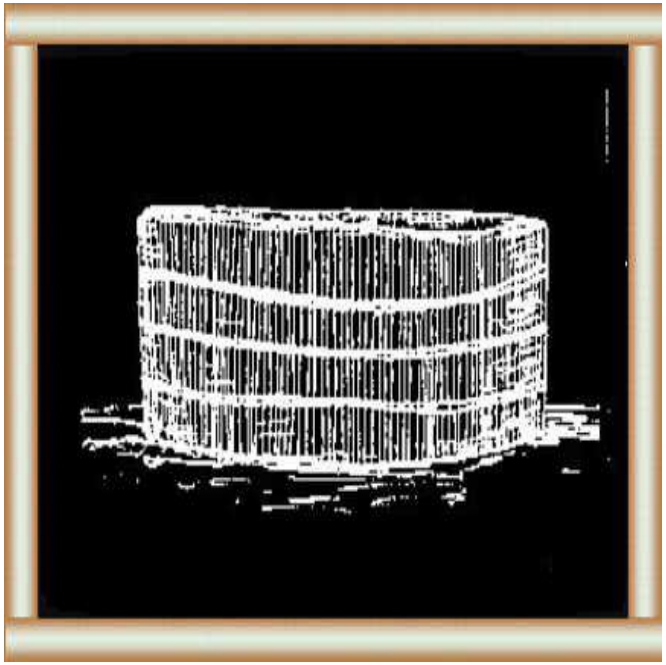
41 Build a roof for the silo.



42 A "wattle and daub" silo.

Materials
Labour

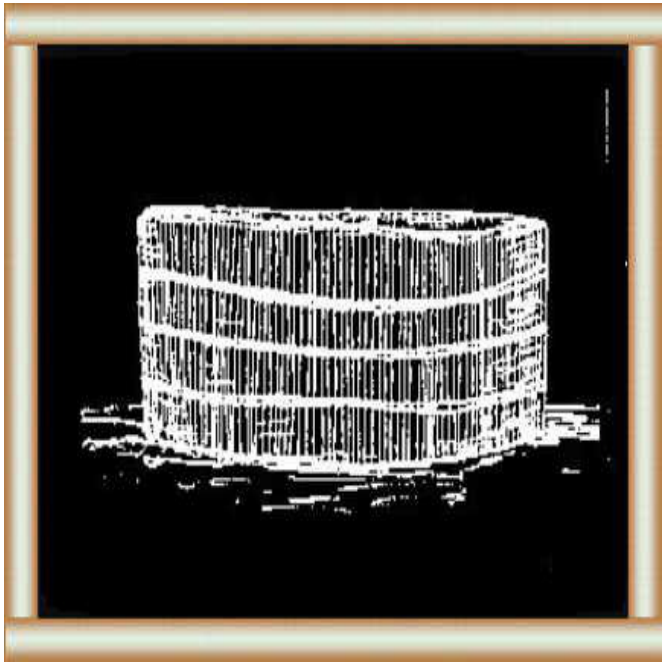
1 140 wooden poles (2.20 m long,
1 Dig holes for poles

0/ 0.06 m diameter)

2
Poles
2 Erect & connect poles

3 Soil, cattle
manure, **3 Prepare**
mud
straw chaff (to produce mortar
for wall coating)

4 Plastic
jacket **4**
Plaster walls



43 This silo has a capacity of about 18 m^3 (6,000 kg). This is enough to feed 3 cows and 3 calves for 60 days (daily ration: 25 kg/cow, 6 kg/calf).

Note:

1 Replace plastic jacket after 1 year.

2 Replace basic structure after 2 years.

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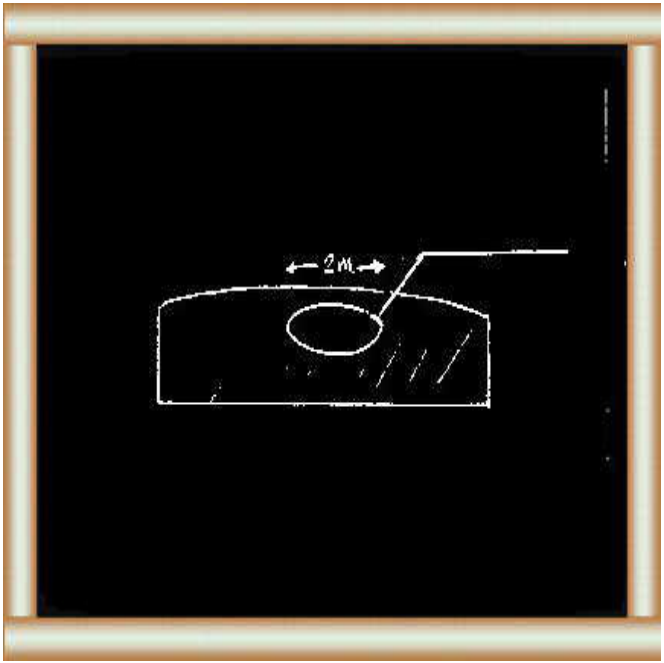
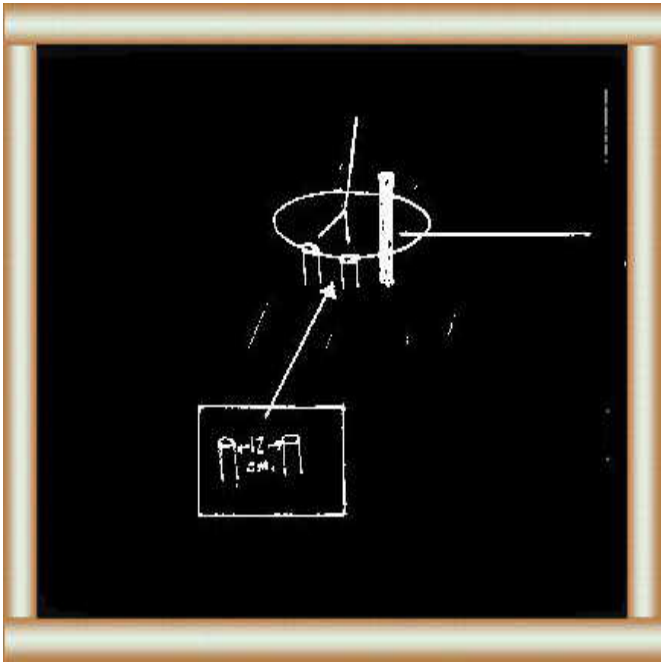
How can you make a bamboo silo?



44 Choose a well-drained site with firm soil.
Draw a circle on the earth 2 m in diameter.



45 Make holes around the circle
12 cm apart.
Erect the poles.

46 Attach wire-mesh to the walls.
This supports the cement lining.

47 Mix 1 part cement with 2 parts sand and water.

Plaster over the wire-mesh.

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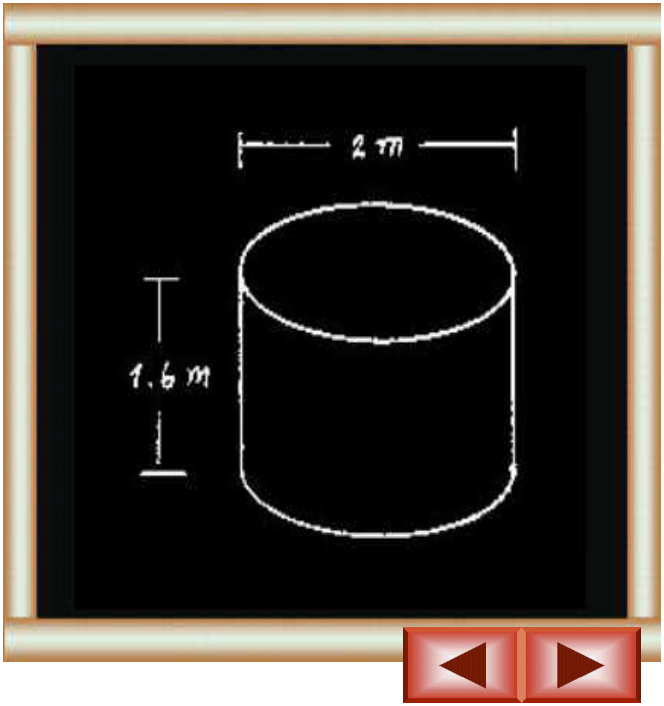
Materials	Labour
1 20 bamboo poles	1 Dig
holes for poles	
2 Wire mesh (12.5 m)	2 Errect
& connect poles	
3 Nails 1 kg	3
Prepare cement	
4 Seven sacks cement	4
Plaster walls	
5 Sand	
6 Wood preservative	

7 Binding wire
8 Roof (sugar cane leaf)

SIZE

48 Capacity
This silo has a capacity



of about 5 m^3 (2,000 kg).
This is enough to feed 2 cows for 45 days.

Note:
1 Replace roof after 2 years.
2 Replace structure after 5 years.

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Small-Scale

Dairy Farming Manual

Volume 3

Husbandry Unit 5.4 -Part 2

SMALL SCALE SILAGE MAKING

The Chamber Silo

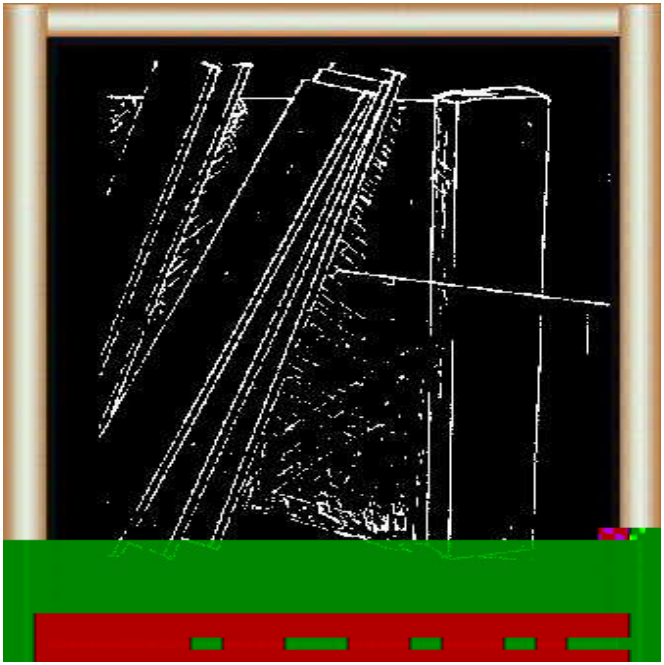
49 The Chamber Silo

Materials

Walls -Bricks (12 cm) 900 pcs
- Sand 1.0 m^3 (for brick laying & coating)
- Cement 370 kg
- Iron wire 90 m (< 0/ 5 mm) (between every 2nd layer of bricks)

Floor -Layer of gravel 0.30 cm
-Gravel 1 m^3

50 Chamber silo with 4 chambers and roof. This type of silo is quite expensive, but the silo can last for many years. You can fill and close each chamber



separately so you can fill quickly and reduce losses. You can add or remove slats at the front of each room. This makes it easy to fill the plant matter into the silo as well as remove the silage from the silo.

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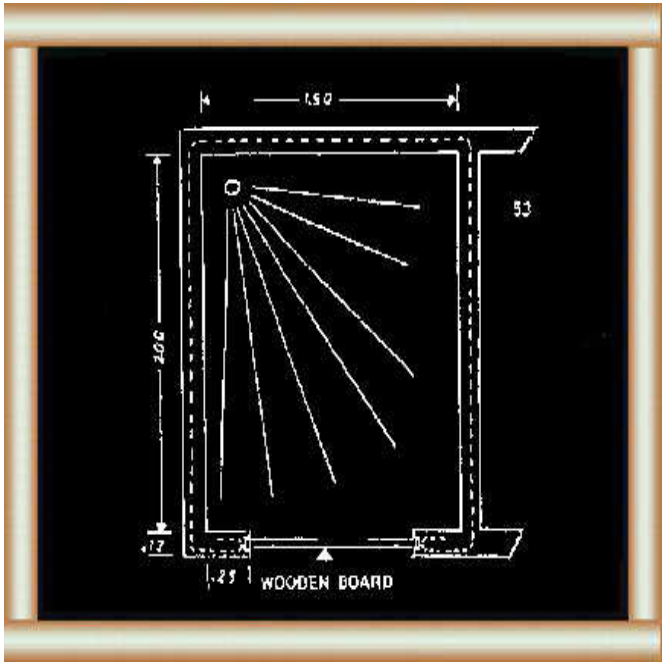
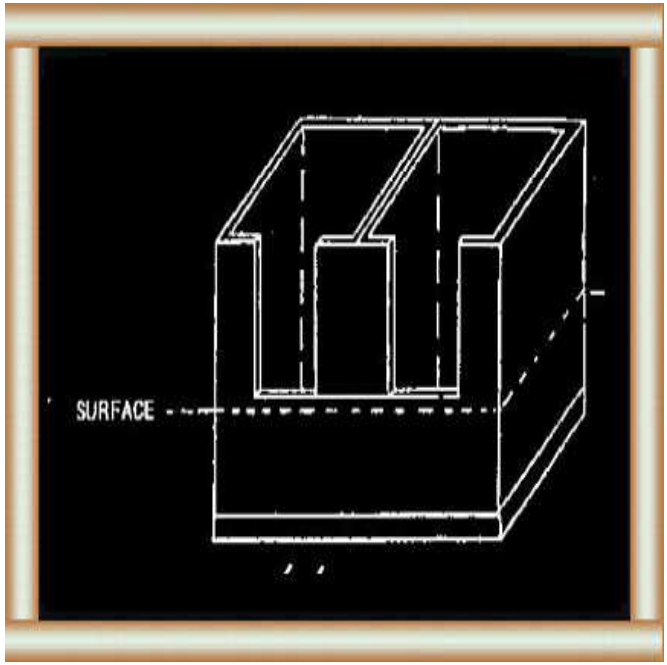




52 Specifications:

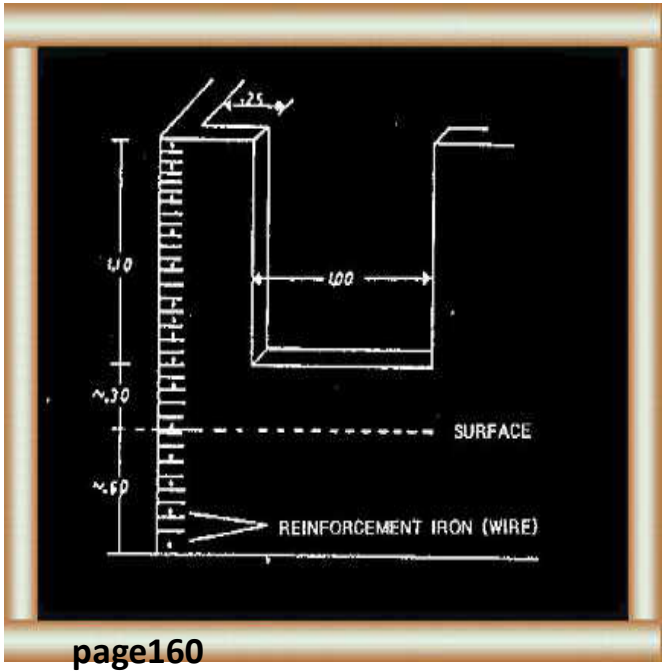
Silage requirements:

To feed 3 milking cows for 30 days.

Silo measurements :

2.00 m x 1.50 m x 2.00 m= 6.00 m^3

(per chamber)



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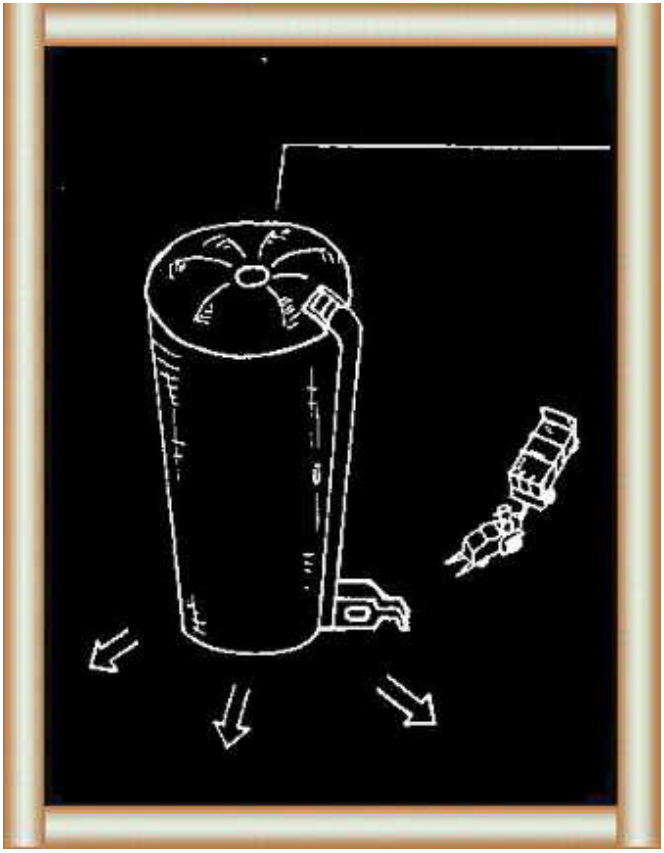
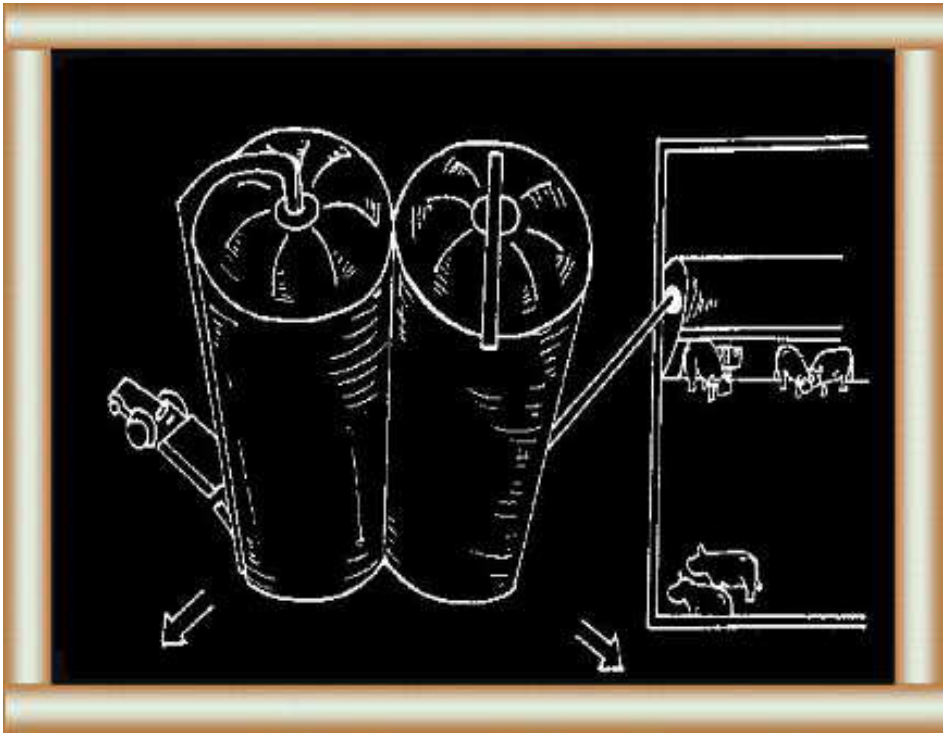
54 Large upright silos are convenient and not expensive if labour costs are high. They keep air out to reduce



losses. Unloading structures and mechanical feed handling systems make it easy to fill and feed.
Important
1 Locate silos carefully, plan the location of other structures.
2 Fill and feed out quickly to avoid top spoilage.
3 Arrows show drainage away from silo.
Investment (1986): First cost US$ 12-16 per ton capacity



55 **Investment (1986):** First cost US$ 20-35 per ton capacity

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How can you prepare your crop for the silo?

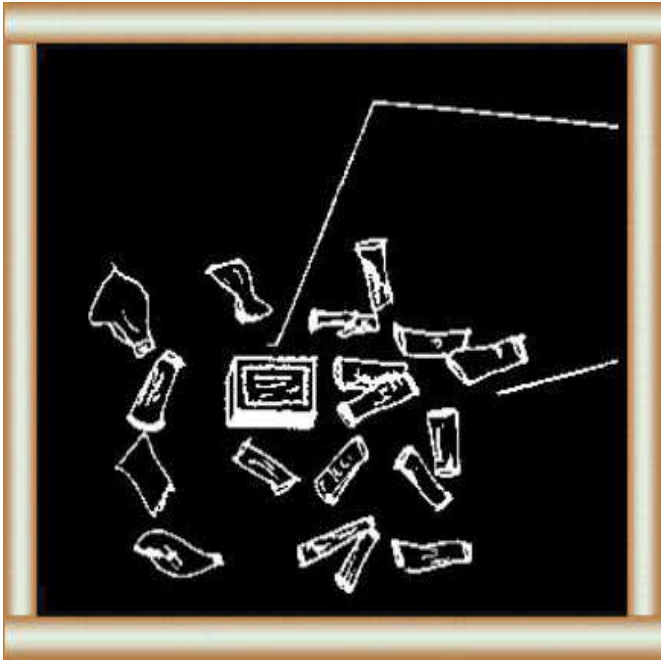
Cutting

Cut the crop at the right time to get the best feed value. Here are some examples:

Crop	Cutting Time
Lucerne	full bud
Elephant grass	before 1.5 m high
Other grasses	just before flowering
Grass/shrub	end of the rainy season
Oats	beginning of the "dough" stage
Maize	50-55 days after silking

Wilting

Check the dry matter content of the crop. If necessary, wilt the crop to 30-35% dry matter content. This improves the feed value.



Chopping

Chop the crop to a length of 30-35 cm.

56 This crop is chopped to the length of a match box. It is easy to compact and remove the air.

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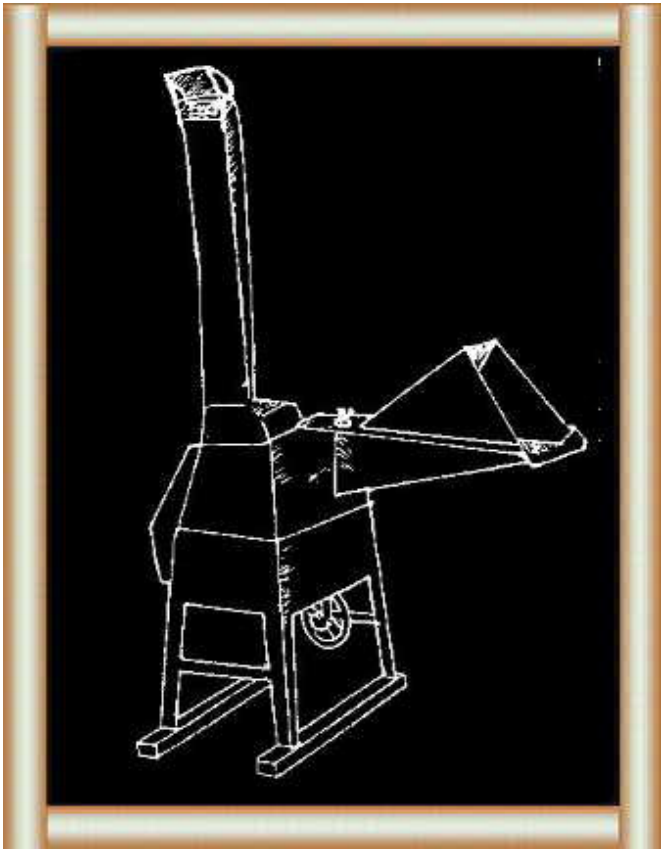
57 You can chop by hand but it is slow. This is a problem because you must fill the silo quickly.



58 Machines are expensive but you can share them with your neighbours.

This one can chop 1,500 - 1,800 kg of crop per hour and fill a 10,000 kg silo in one day.

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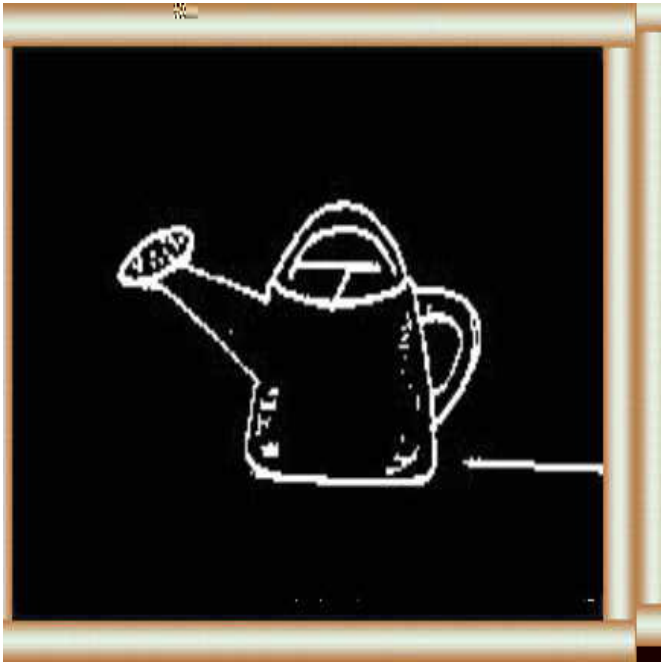
How can you fill and seal your silo?

Silage Additives

You can add substances to the crop to make your silage better and more quickly.

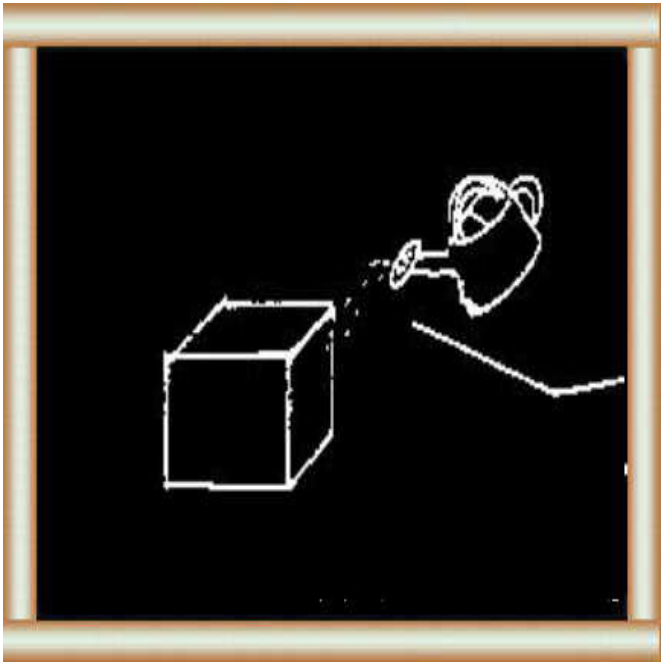
Molasses

Some green plant material, e.g. young grasses and legumes, does not have enough carbohydrate to make a good silage. Add molasses to the crop to provide carbohydrate.



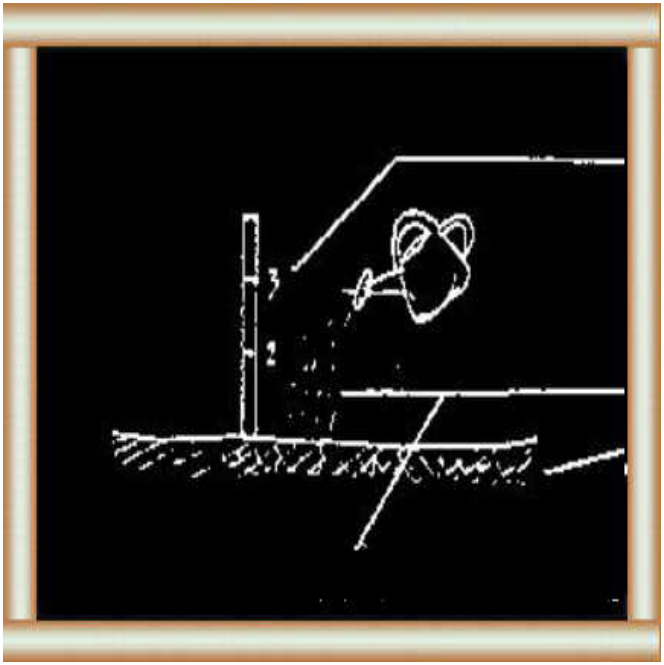
59 Mix 1 part of molasses with 2 parts of water.

Put the mixture in a large sprinkling can.

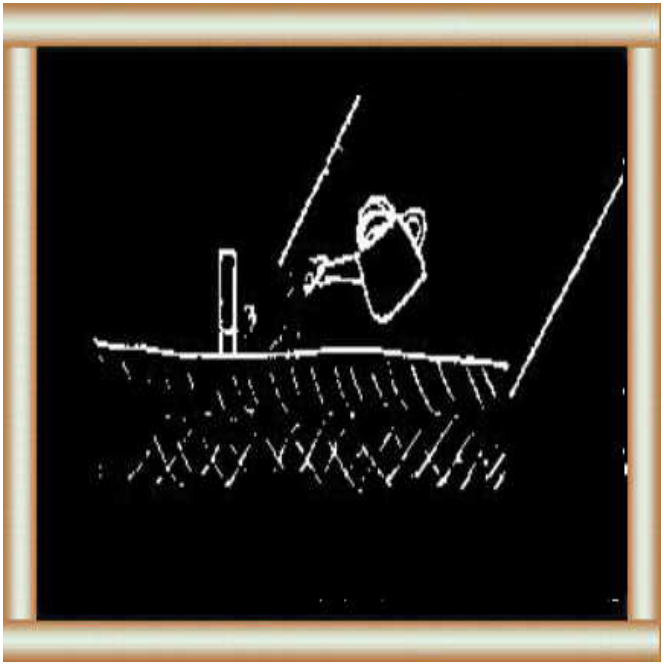


60 Add 35 l of the mixture for every 1 m^3 of crop (less for short, leafy grass, more for legume crops).

61 Measure the



amounts of crop by marking a pole along the silo wall.
After adding each layer of crop, sprinkle on the molasses mixture.



62 Note

Molasses is not so necessary:
- after wilting the crop
- for maize silage.

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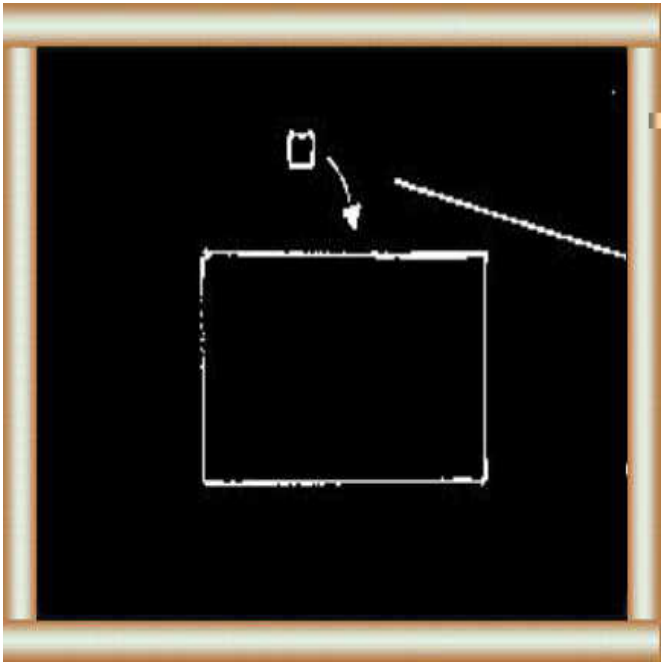
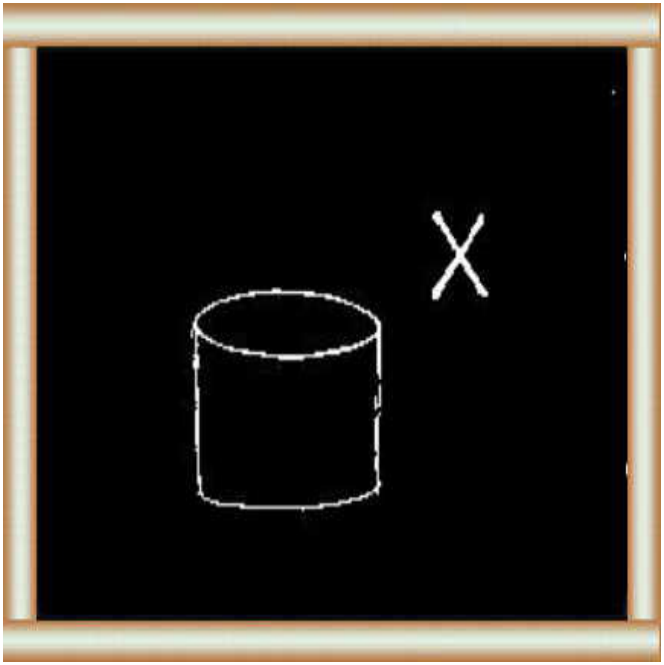
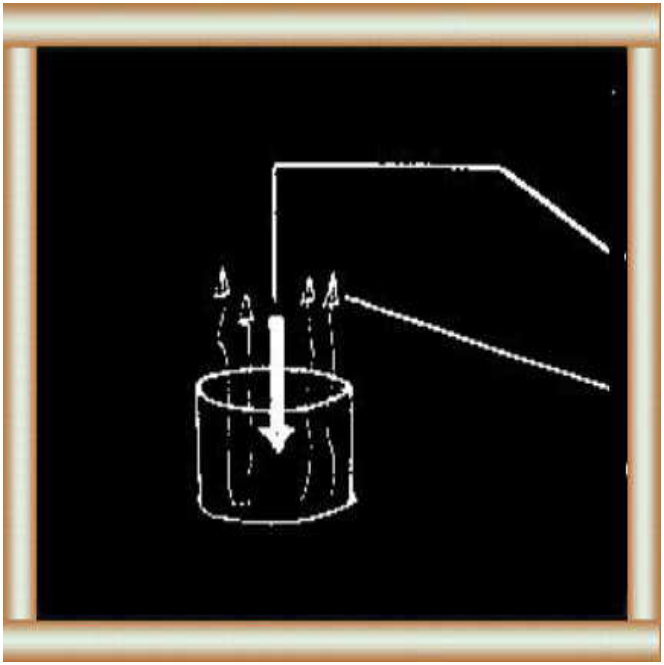


63 Salt
Salt helps the silage process in the same way as wilting.
Add 1-2% of salt to the crop (less if the crop is dry, more if it is not so dry).



64 Keeping out soil
Do not put any crops with soil or other dirty material into the silo.

This will slow down or spoil the silage process.
.



65 Compacting

Compact the crop all the time as you fill the silo.
This will remove the air

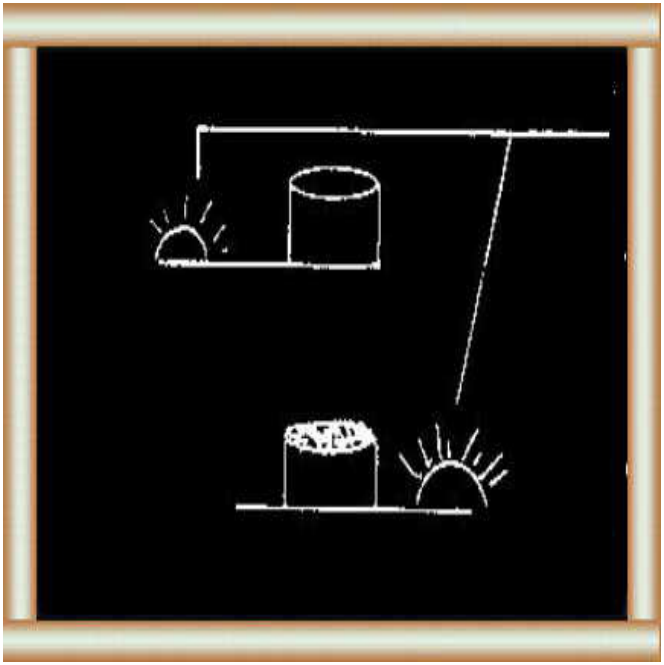
66&67 Compact the crop by **continuous treading**.

page165

68 This farmer compacted his crop well.

The silage is good. He can slice it with a spade and there is little waste.

69 This farmer did not compact his crop well. The silage is poor. It is difficult to harvest with a spade and there is a lot of waste. You can also compact the crop by machine.



How long does it take to fill a silo?
70 Fill your silo in one day and seal quickly.

This will improve and speed up the silage process.

Important when planning:

1 How long to chop the crop?

2 How long to put the chopped crop into the silo?

If necessary, ask your neighbours to help fill the silo in one day.

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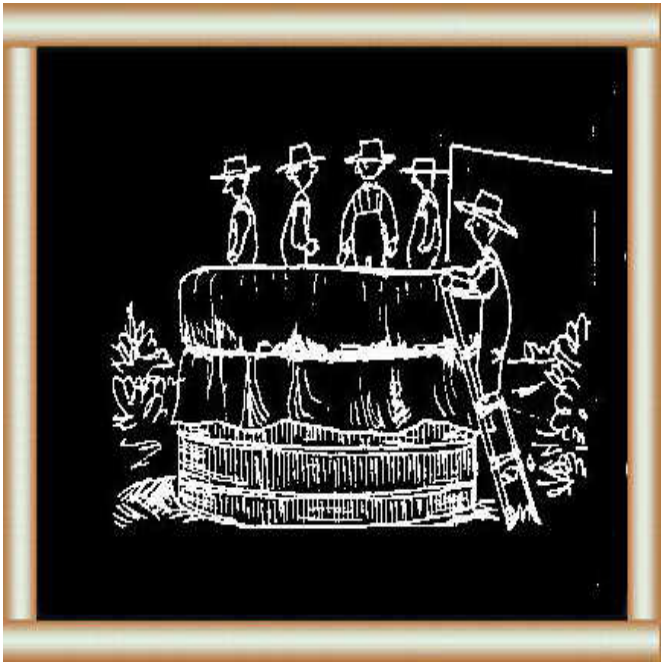
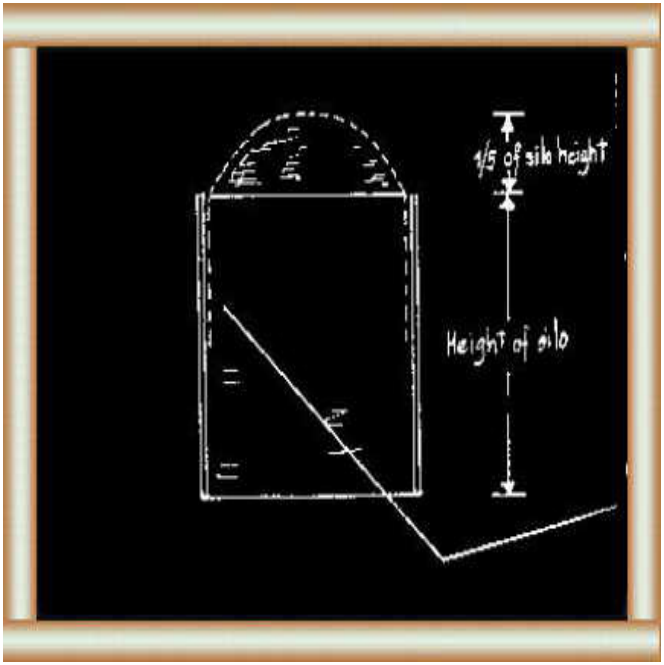
How can you seal a silo?

71 Fill the silo to 1 - 1.5



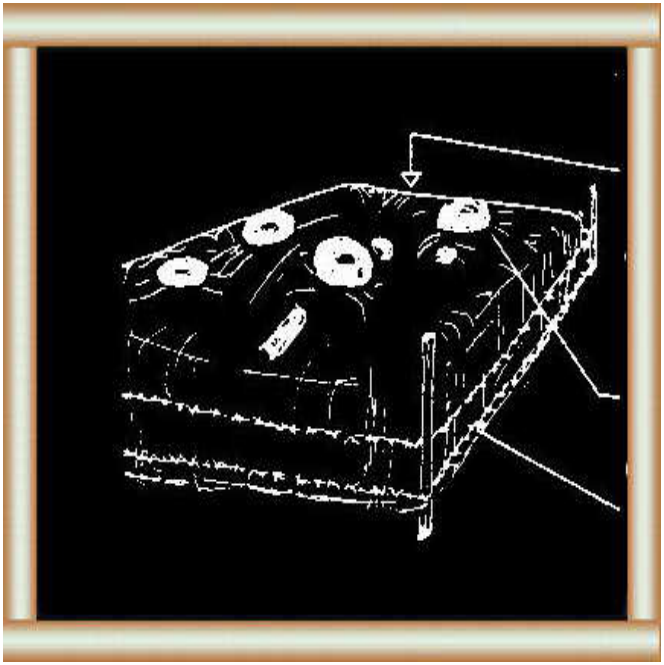
m from the top.
Fix the plastic cover
inside the silo walls.



72 Upright silo with plastic cover.
The plastic sheeting follows the inner side of the silo wall 1-1.5 m.

73 Fill the silo above the level of the edge. Cover the silo with the plastic and seal quickly.

74 Place a layer of soil or daub on top. This protects the plastic



against animals and sunlight.
The weight also compacts the silage.
You can use old tyres for weight and a barbed wire fence to protect the cover against animals.

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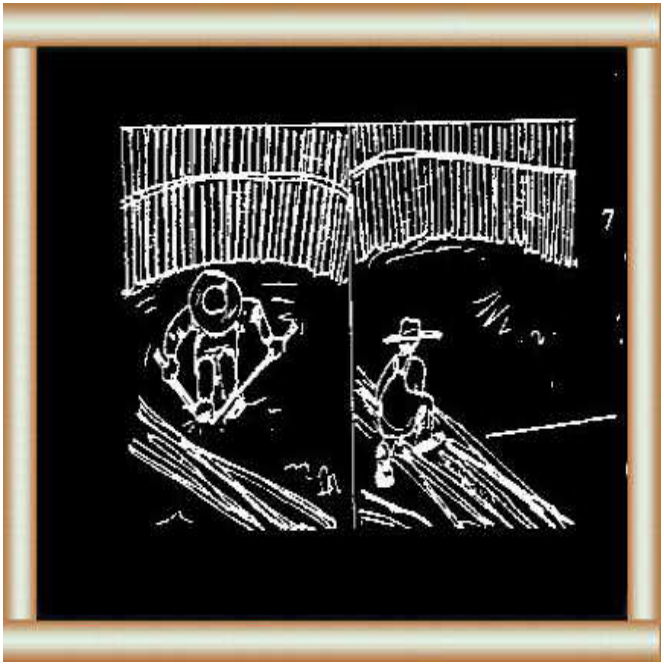
How can you drain waste from your silo?

75 Dig drains to carry the waste away from the silo.

Make sure the waste does not go near your drinking water.

76 Fill the drains with stones or crushed rocks.

77



78 If there are no stones or rocks, fill the drains with branches or twigs.

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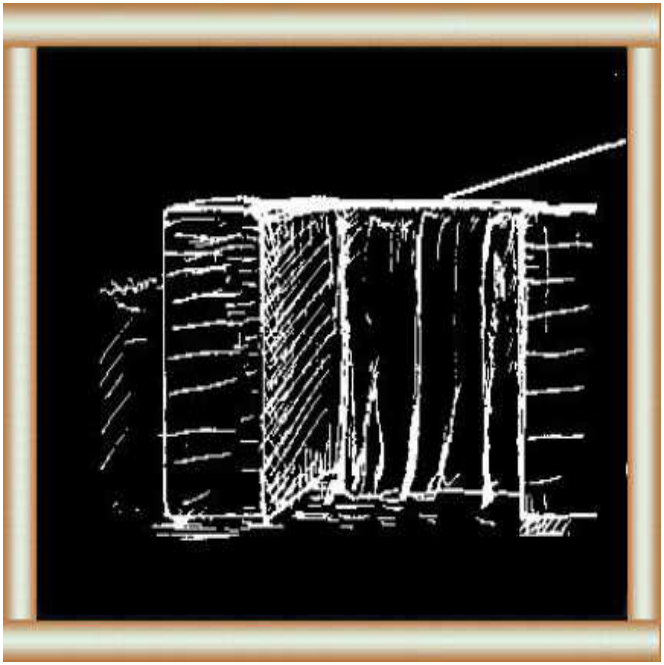
How can you remove and shelter your silage?

\

79 Make a wooden platform to protect the top part of the silo against sunlight.You can move the platform as you remove silage from the silo.



80 Nail gunny bags onto the wooden platform.
This shades the front part of the silo.
The plastic sheet (from sealing) also covers the silo.

81 Make a curtain of gunny bags.
This is easy to lift.
Record feeding instructions in the black area.

82 You can remove the roof on this "wattle" silo.
This shades the silage surface during feeding time.

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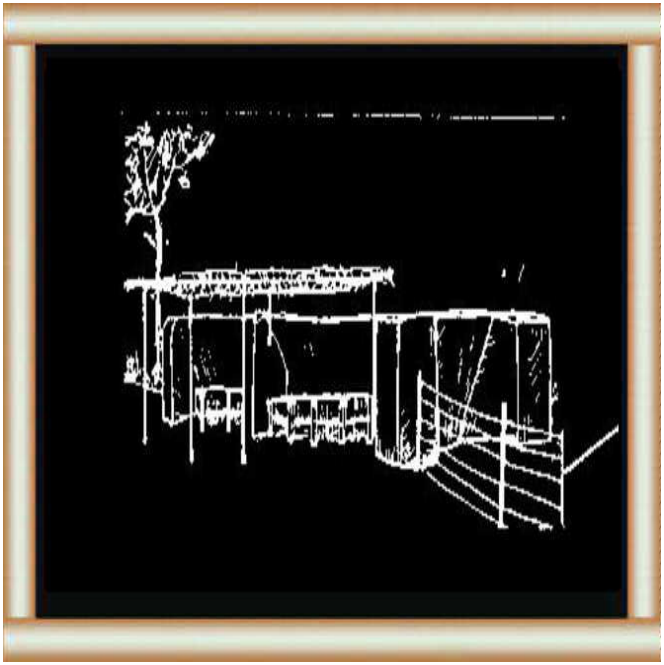
How do you feed silage?

83 You can use a filled wattle-and-daub silo.

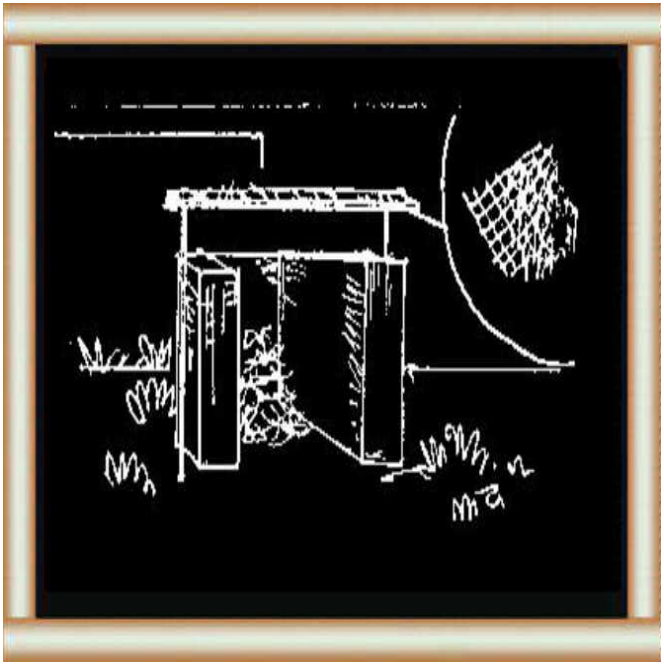
84 Make the feeder from twigs.

Brickwall trench silo

85 Build a barb wire fence to protect your silo.



86 Cut oil drums in half to make feed troughs.



87 Make a simple shade for silo. Use wire-mesh and cover with straw.

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How do you find the feeding value of silage?

The feeding value of silage depends on the type

of crop and the success of the silage process.

Appearance

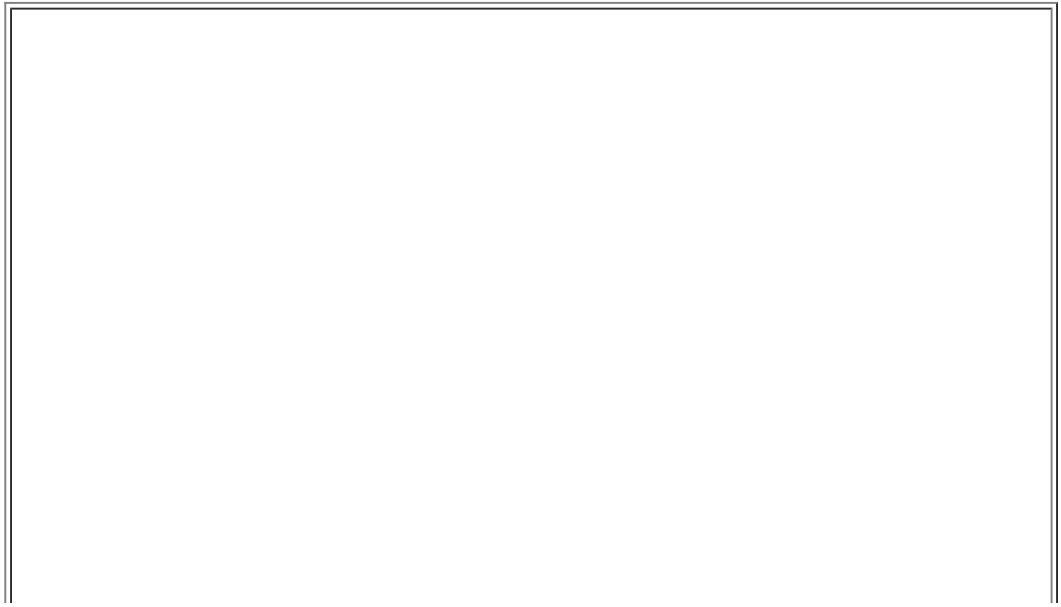
Value	Colour	Smell	Texture
High	Yellow green/brown	Pleasant acid	
Medium	Dark brown	Sweet	Tobacco-like
Low	Olive brown	Foul	Slimy

Dry Matter Content

Take a wad of silage.
Twist in the hand.

Hand pressure	Amount of moisture	Dry matter content
High	None	More than 25 %

Medium	Some	About 25 %
Low	A lot	15% or less



What do you know about silage making?

Feeding good silage increases your milk production

Good silage:

1 has up to 85% feed value of the original crop (5-8)

2 is fed when you have no other crops (9-12)

Making silage for feed requires planning and equipment

Making a silo

Think about:

1 Location
- cutting crop (13)
- feeding
- transport
- drainage
2 Size
- costs (14-16)
- one-day filling
3 Strength
- for compaction (17)
4 Sealing
- no air, water, sun (18-19)
5 Drainage
- capacity (20)
- away from drinking water
6 Base

2 Dry matter content

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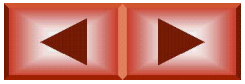

Small-Scale Dairy Farming Manual

Volume 3

Husbandry Unit 5.5

STRAW TREATMENT

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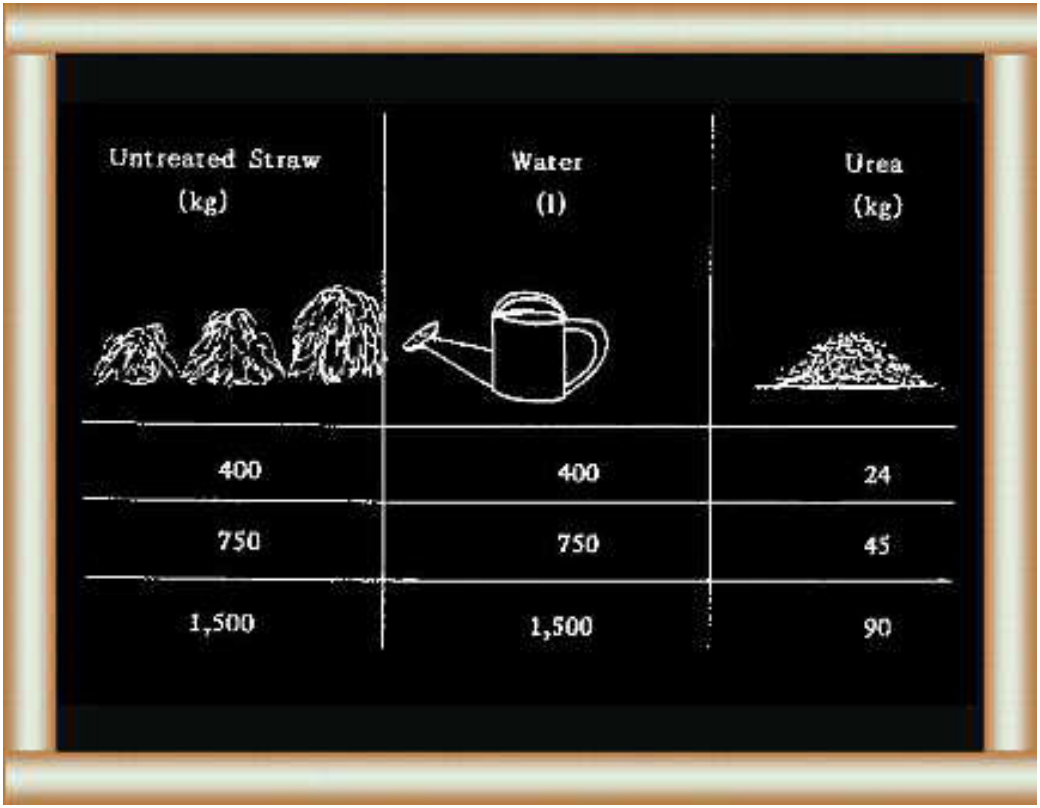
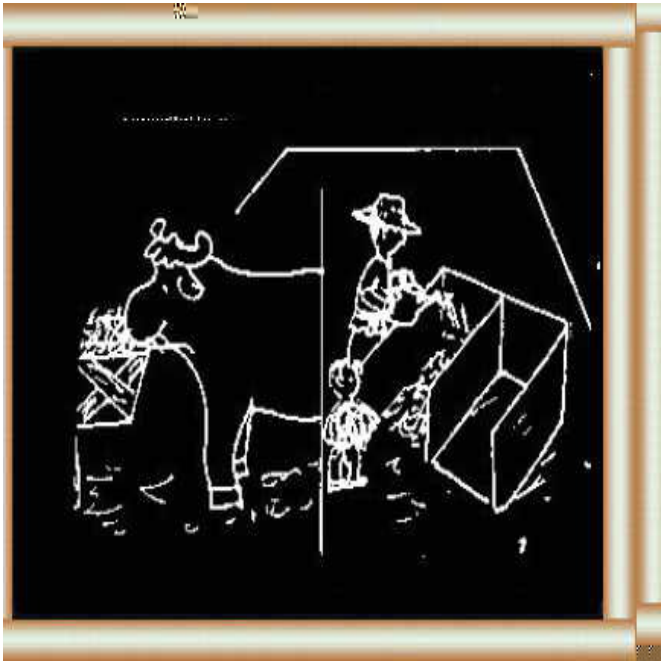

Untreated Straw
(kg)
Water
(l)
Urea
(kg)
400
400
24
750
750
45
1,500
1,500
90

Extension

Materials

What should you know about treated straw ?



Why should you treat straw? (5-13)

1 Treated straw has a higher feed value than untreated straw.
It is easy to make.

Is it expensive to treat straw? (14-17)

2 Making treated straw is not expensive and you save money on concentrates.

How can you treat straw? (18-49)

3 You should know how to:
- make a stack or
- fill a chamber with straw, water and urea and
- seal it with a plastic sheet.

How can you feed treated straw? (50-66)

4 You should know:
- how and when to take treated straw from the stack
- how to supplement treated straw with concentrates and minerals.

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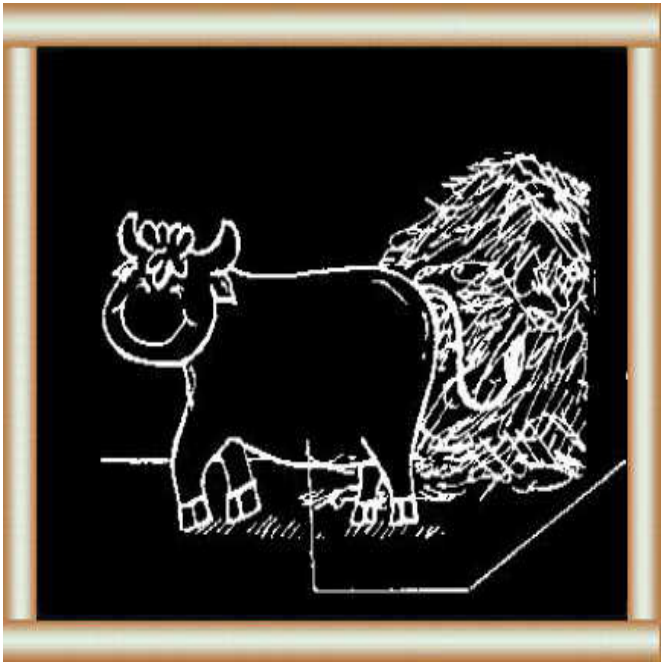
Why should you treat straw?
5 After paddy harvest and threshing, you have a lot of straw.

Should you burn it in the field?
6 No! You can use as a maintenance feed for cattle

but the:
- content
- dry matter digestibility
- balance
of untreated straw are poor.



7 Treat straw with urea.
Treated straw has a higher feed value.
You make better use of your straw.

Is it difficult to produce treated straw?
8 You can treat straw under all farming conditions and on all sizes of farms

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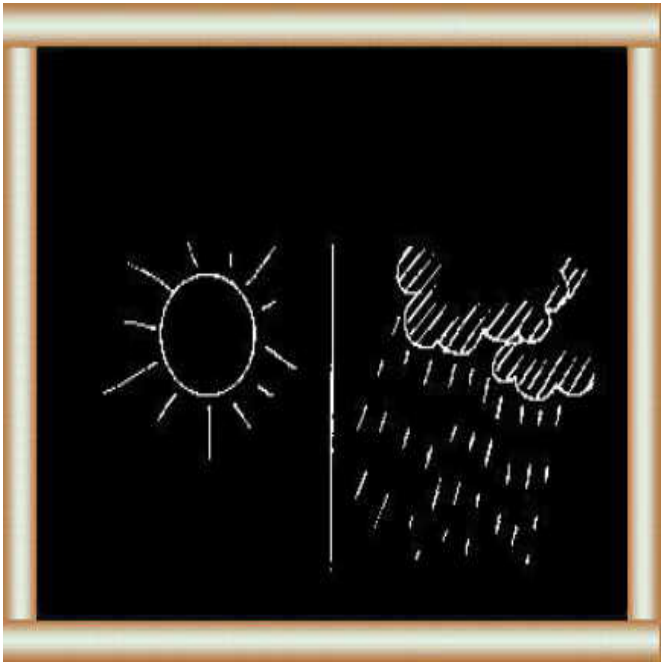
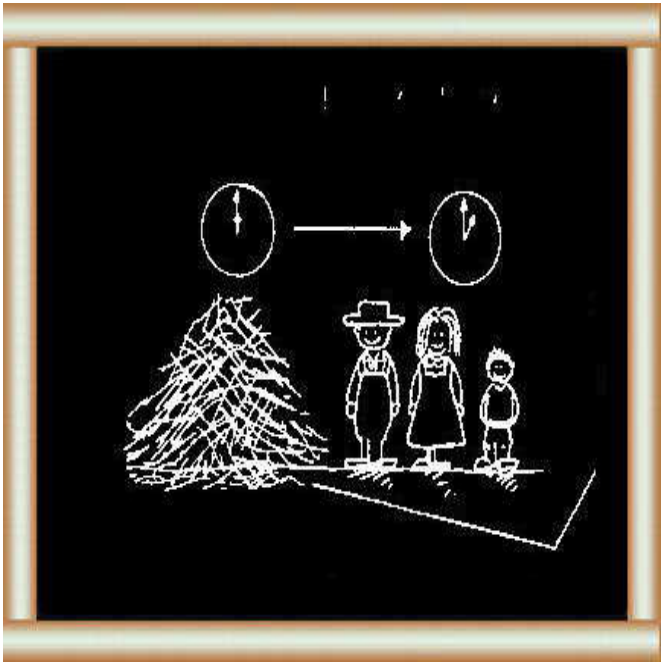
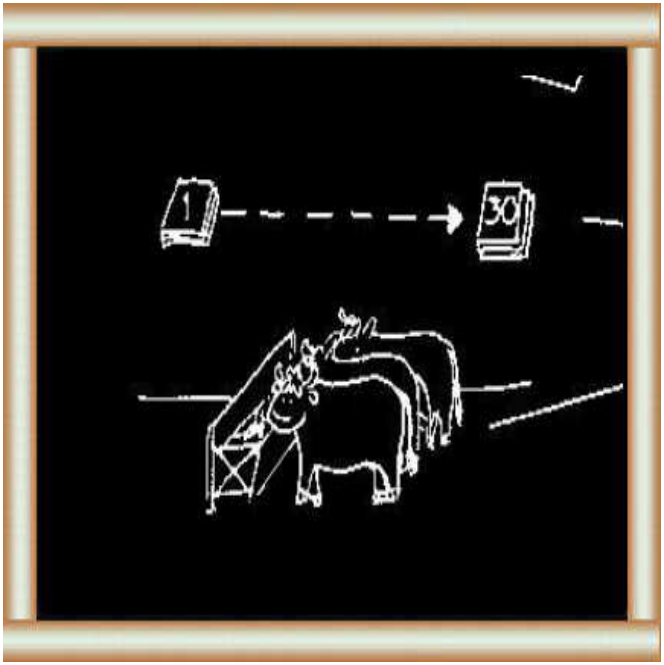


9 and under all weather conditions.

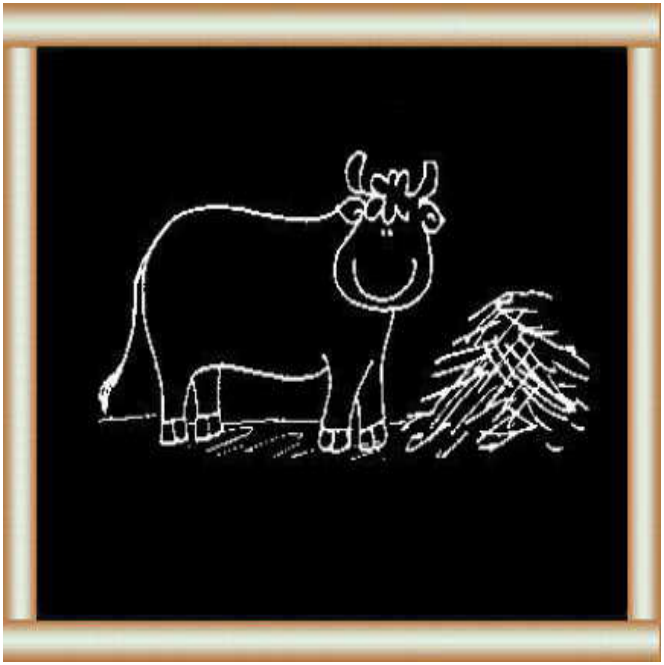


10 On a small farm you can make a large amount of feed at one time.
A few hours work for you and your family



11 makes enough feed for 3 animals for 1 month.

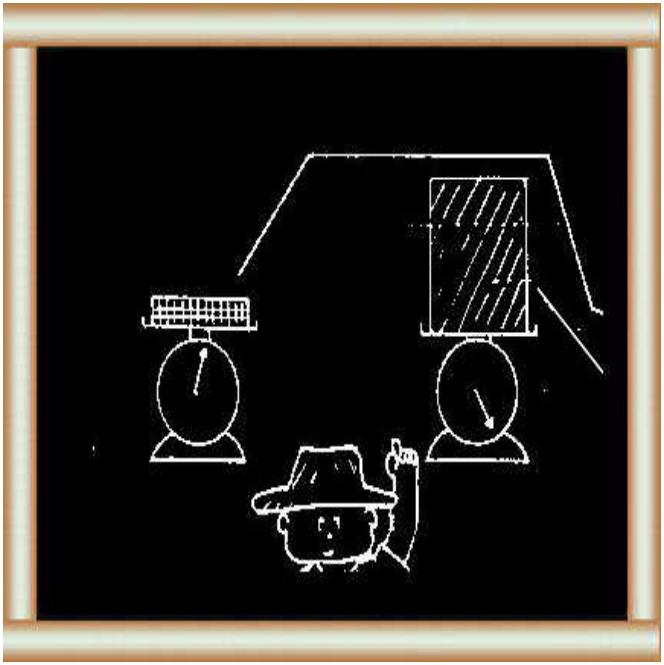
Why not feed urea to your animals?
12 Urea can be toxic if you use it directly as a supplement for roughages.



13 When you treat straw with urea and feed it to your animal, it is fairly safe.

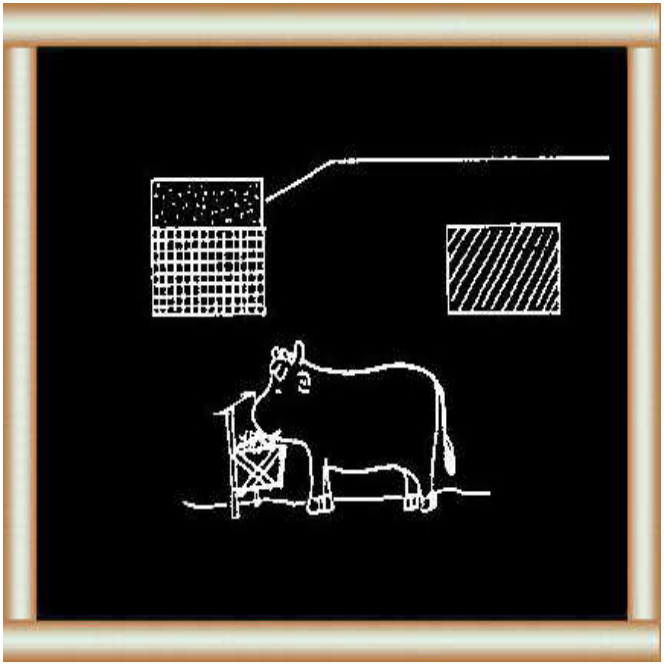
After a few days, animals like to eat treated straw.

page179

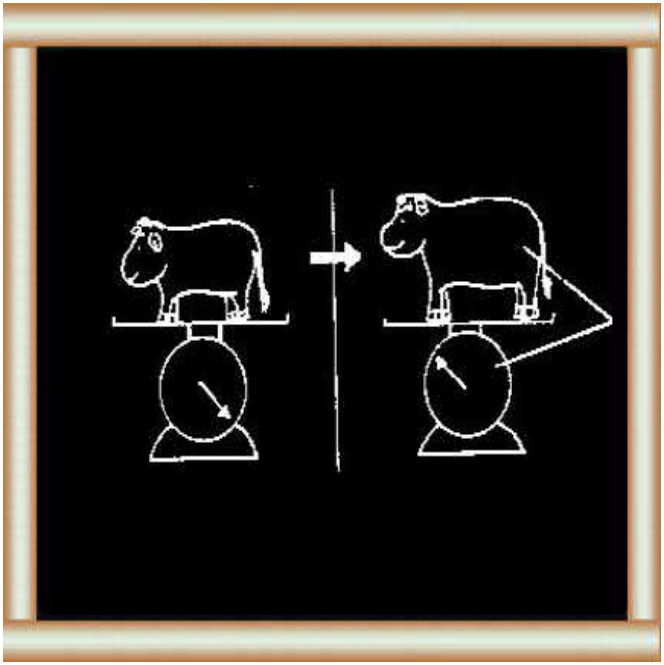


Is it expensive to treat straw?

14 10 kg of urea-treated straw costs the same as 80 kg of untreated straw.

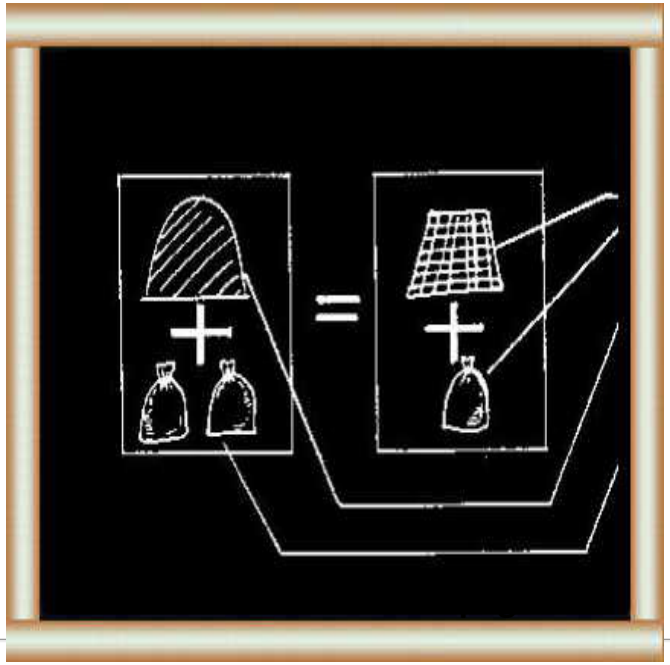


15 Treated straw:
- has a higher feed value
- makes a cheaper maintenance ration.
Your animal eats more straw.



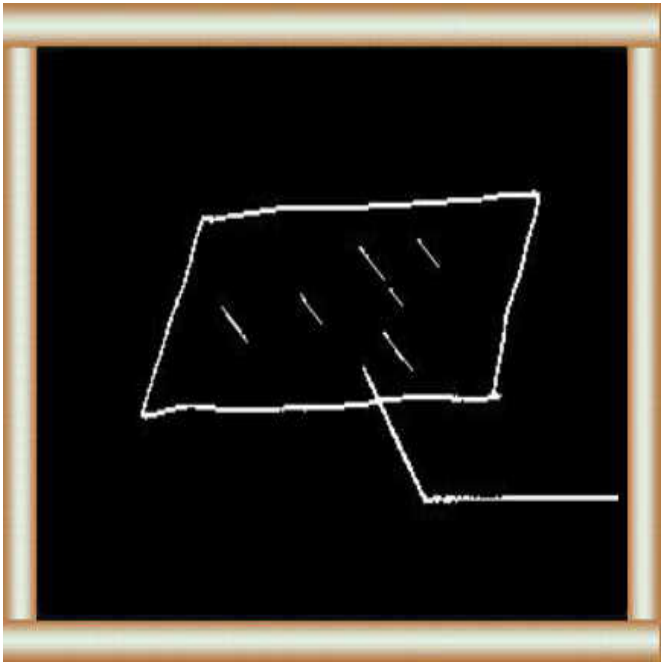
16 For young stock, treated straw supports weight gain and growth better than untreated straw.

17 For the same ration, if you use treated straw you can use less

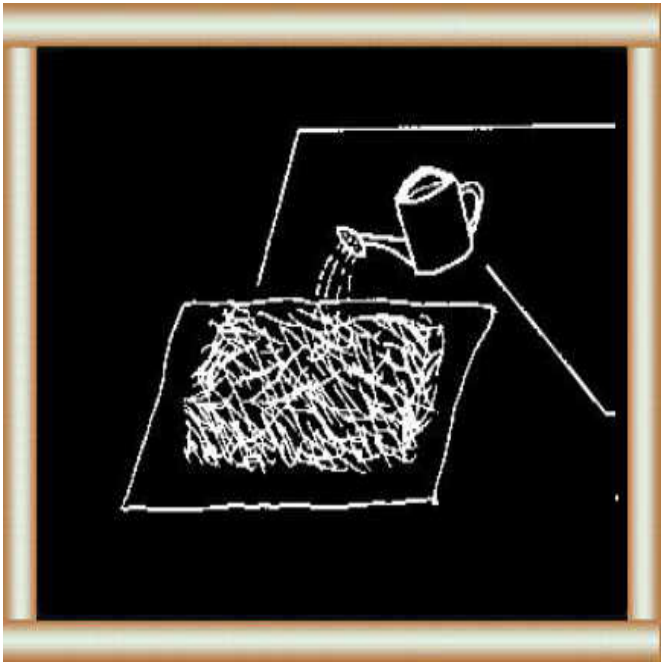


concentrates for maintenance and the lower levels of milk production.
If you use untreated straw you must use more concentrates.
Using treated straw saves you money.

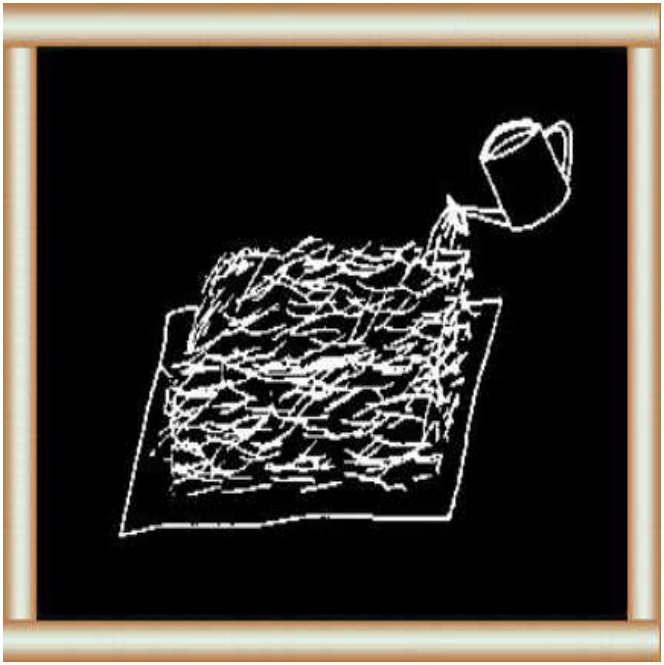
How can you treat straw?



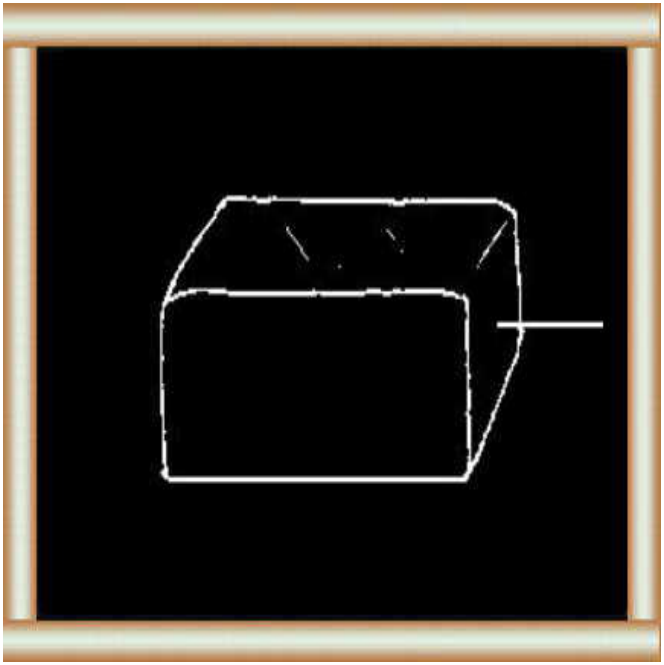
18 You can use a temporary site or a permanent structure for straw treatment.
If you use a temporary site follow these steps:
- lay down a plastic sheet



19
- spread straw on the sheet and sprinkle with urea mixture



20
- repeat the step in 19 a number of times



21
- seal the stack with a plastic sheet.

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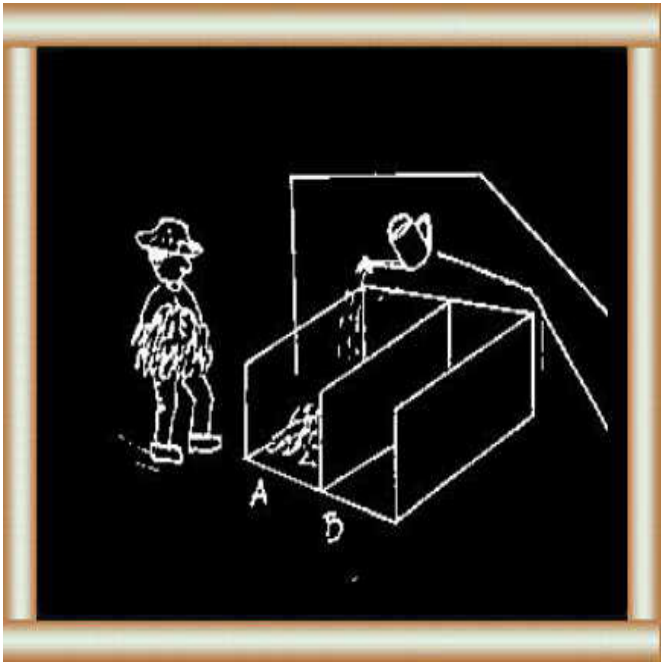
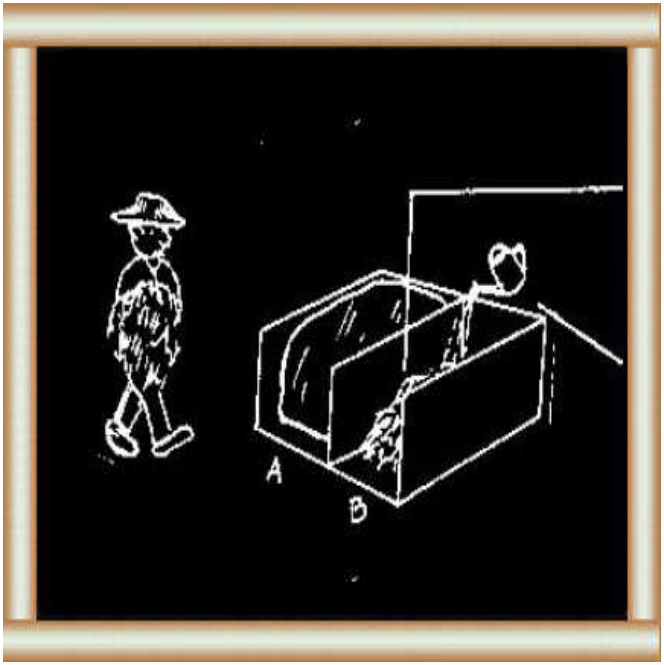
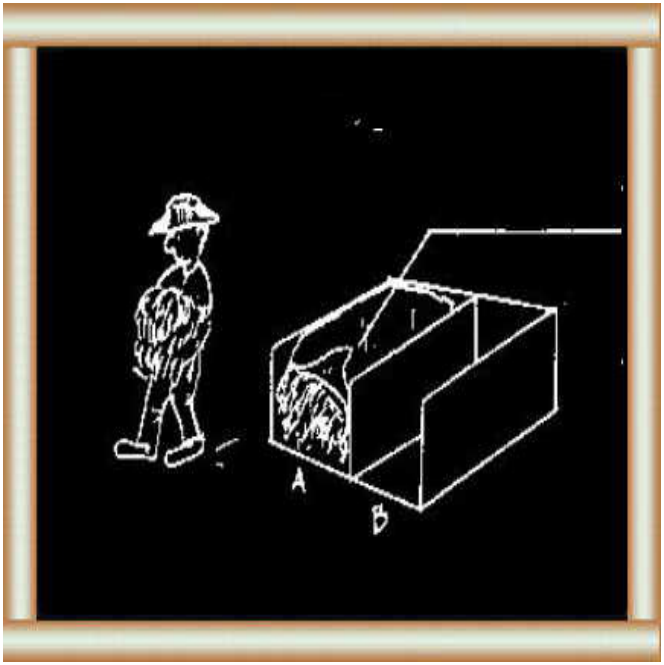


22 If you regularly use treated straw, make 2 chambers and:
Week 1:
Fill chamber A by adding a layer of straw and sprinkling with urea (see 19).



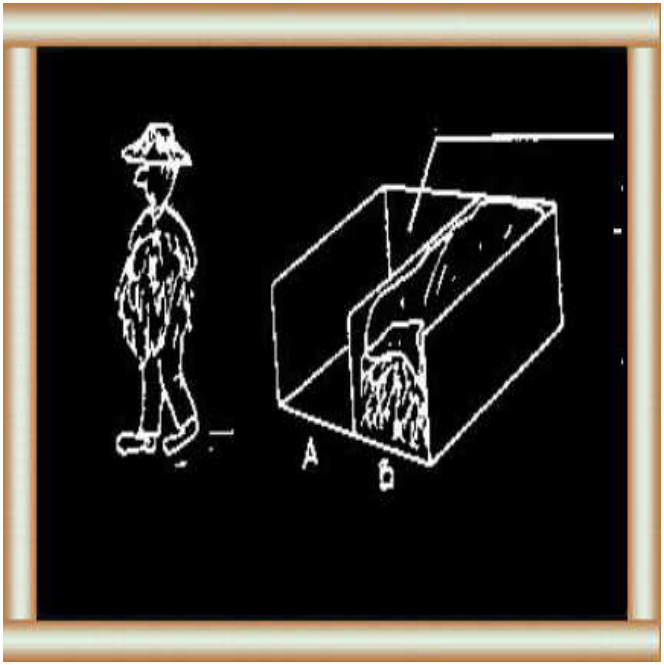
23 Week 2:

Start filling chamber B with straw and treating in the same way as for chamber A.



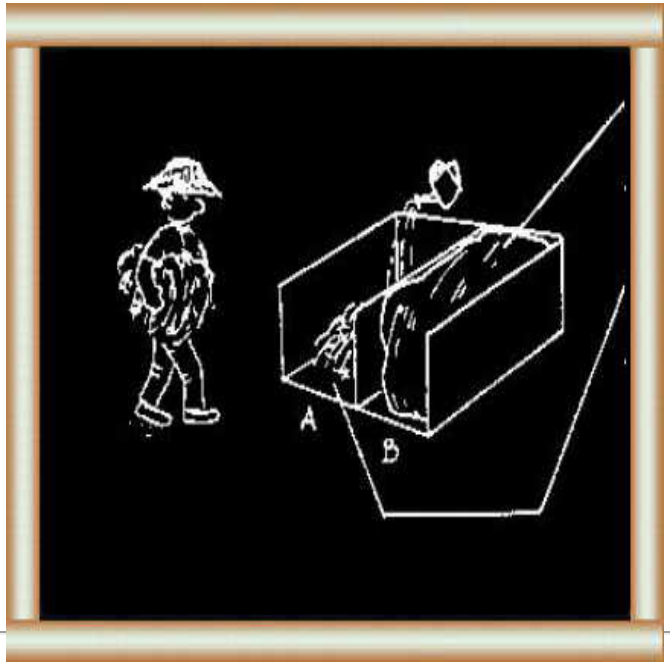
24 Week 4:

Start feeding from chamber A at the beginning of Week 4.



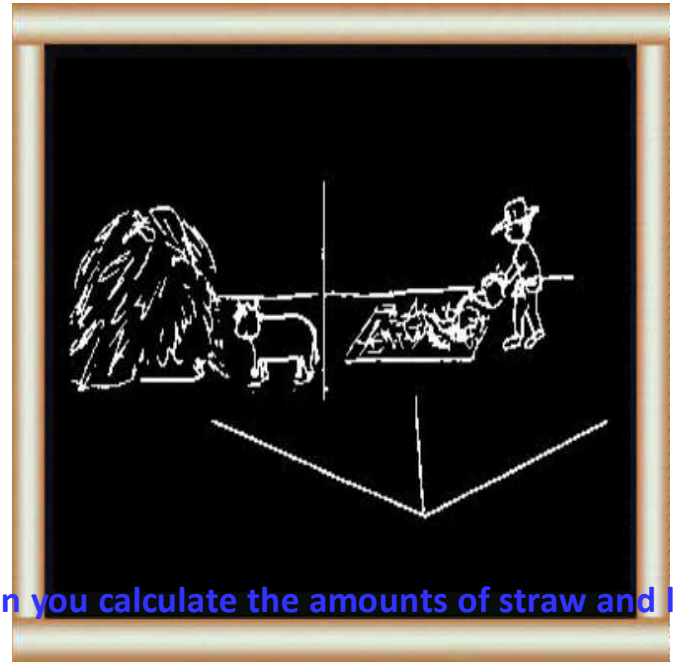
25 Week 7:
When chamber A is empty, start feeding from chamber B.

26 While feeding from chamber B, start filling and treating chamber A



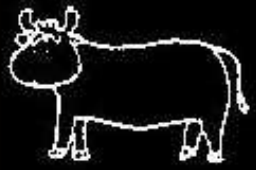
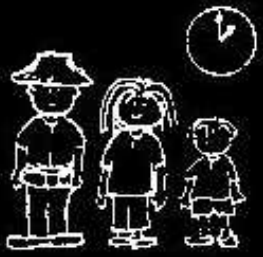
again and repeat the process.
Important
Try to leave your straw for 3 weeks in either chamber before feeding. Therefore, each chamber should hold 3 weeks feed.

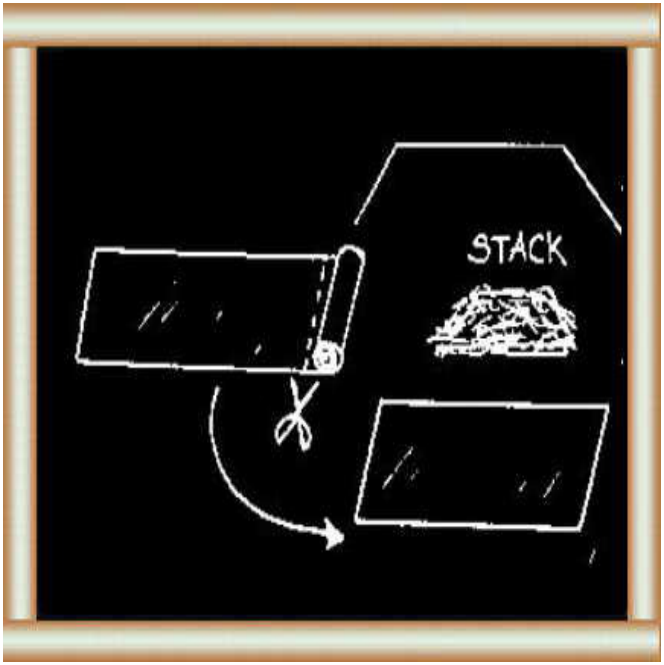
How big should your stack be?
27 Make enough treated straw for 3-4 weeks of feeding.



You need more treated straw if you have more animals.
If your feeding period is longer than 3-4 weeks, make two or more medium-sized stacks rather than one large stack.

28 How can you calculate the amounts of straw and labour?

Number of Cows Feeding 	Amount of Untreated Straw (each cow eating 6 kg of treated straw per day) 	Stack Area (m^2) 	Hours the Farmers have to Work 
2	400	5.00 x 1.80	2
4	750	6.00 x 2.80	4
8	1,500	2 x (6.00 x 2.80)	8



29 Cover with airtight plastic cover.

Buy rolls of plastic and cut in lengths longer and wider than the stack.
Then you can "envelope" the stack after treatment.

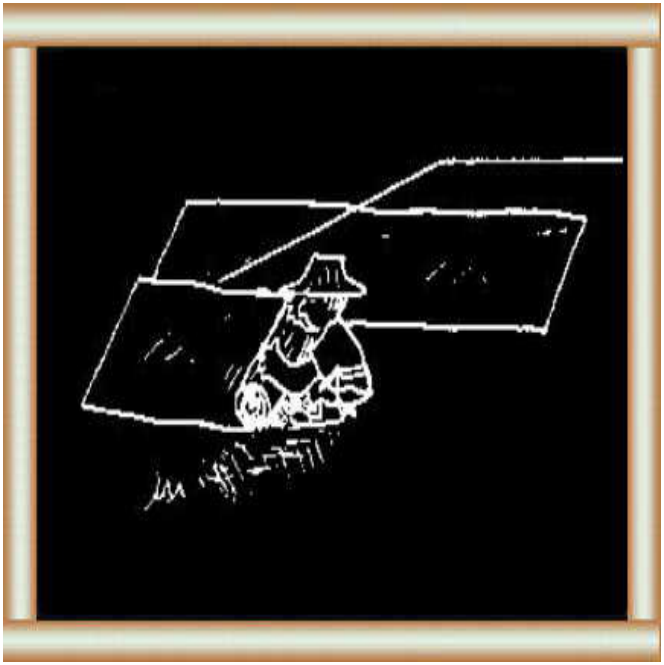
30 How many metres of plastic sheet do you need?

Stack Size (m)	Ground Sheet (m)	Cover Sheet (m)	Total Length of Plastic Sheet (m)
5.00 x 1.80 x 0.80	3 x 6.20 x 1.20	6 x 4.00 x 1.20	43
6.00 x 2.80 x 0.80	4 x 7.20 x 1.20	8 x 5.00 x 1.20	69
2 x 6.00 x 2.80 x 0.80	8 x 7.20 x 1.20	16 x 5.00 x 1.20	138

Straw treatment in detail

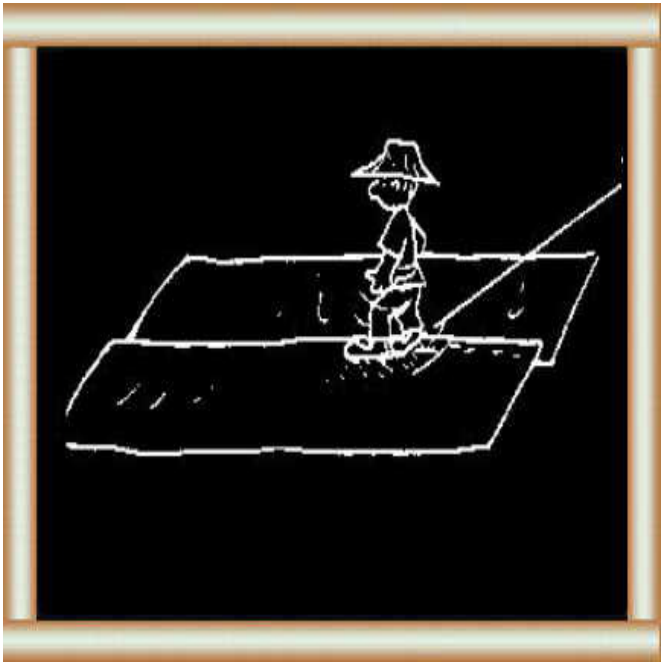
Step 1
31 Choose a site with even ground.

This could be the threshing place or a place close to the cow shed.



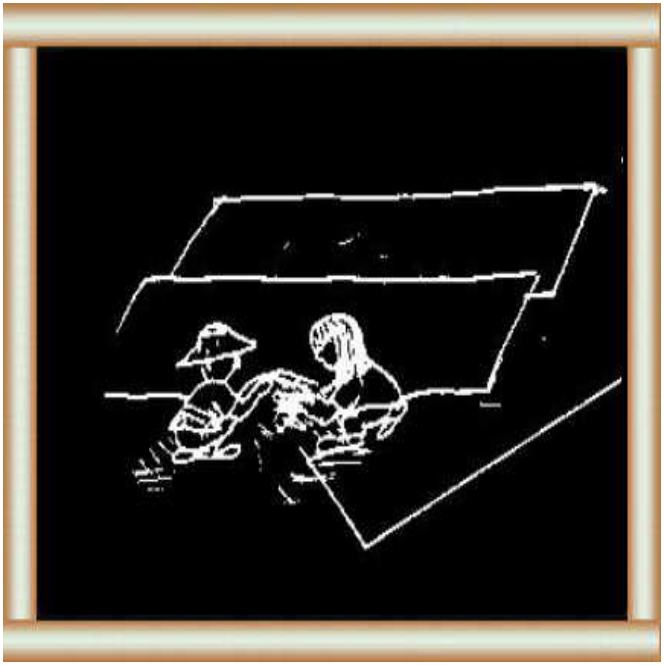
32 Overlap the sheets on the ground.

This makes a seal against the floor surface.



33 Seal the overlapping sheets together.

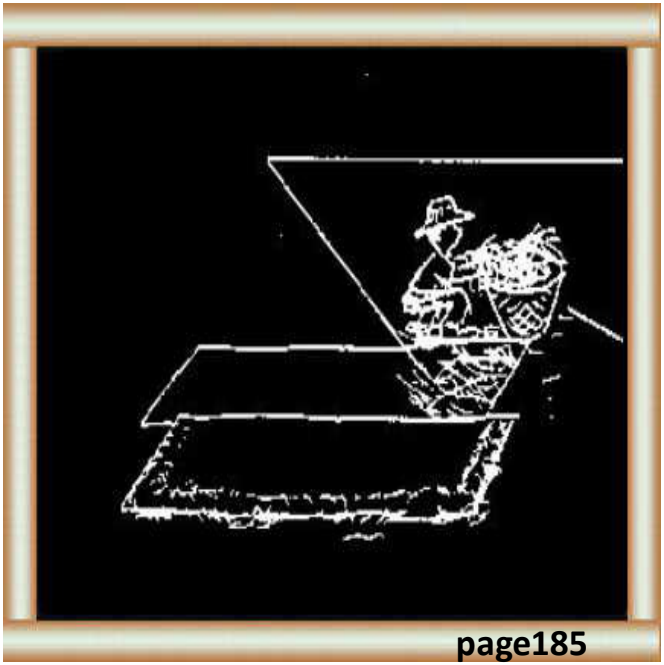
Simply walk along the places where the sheets overlap.



Step 2
34 Lift the edges of the plastic sheet and place loose straw underneath.

This keeps the water/urea mixture in the stack.

Step 3
35 Spread a layer of



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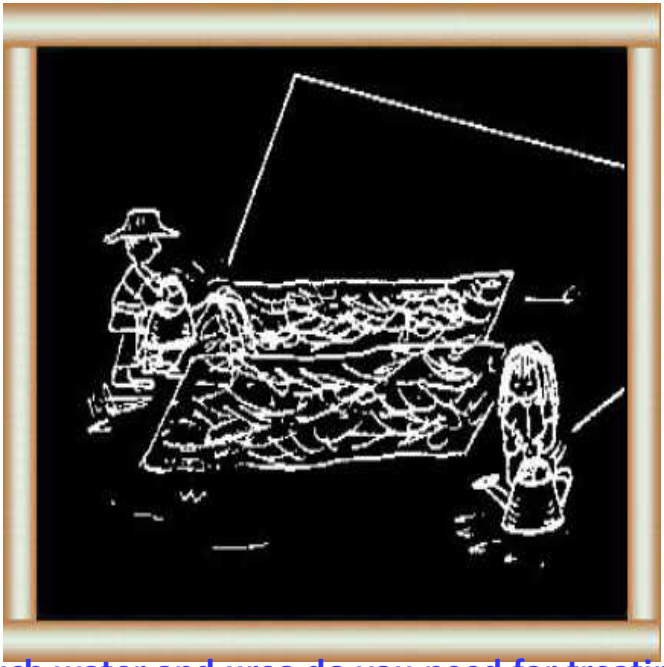
straw over the plastic bottom 10-20 cm high.

50 kg of straw is easy to handle at one time.

Use large baskets to measure and transport the straw.

Step 4
36 Sprinkle 40 kg of



water over the layer of straw.

Mix the other 10 kg of water with 3 kg of urea and stir well.

Sprinkle this mixture over the same layer of straw.

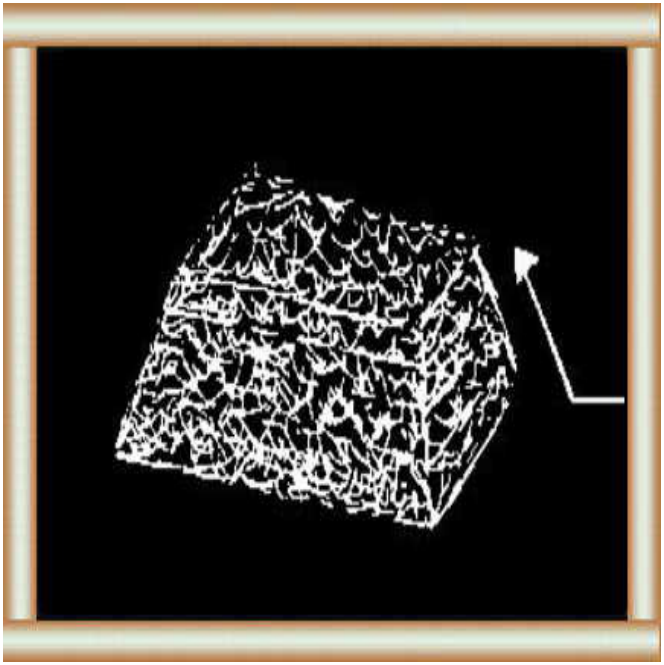
37 How much water and urea do you need for treating different amounts of straw?

Untreated Straw (kg)	Water (l)	Urea (kg)
400	400	24
750	750	45
1,500	1,500	90

Step 3 and Step 4 repeated
38 Add a new layer of 50 kg of straw (Step 3).

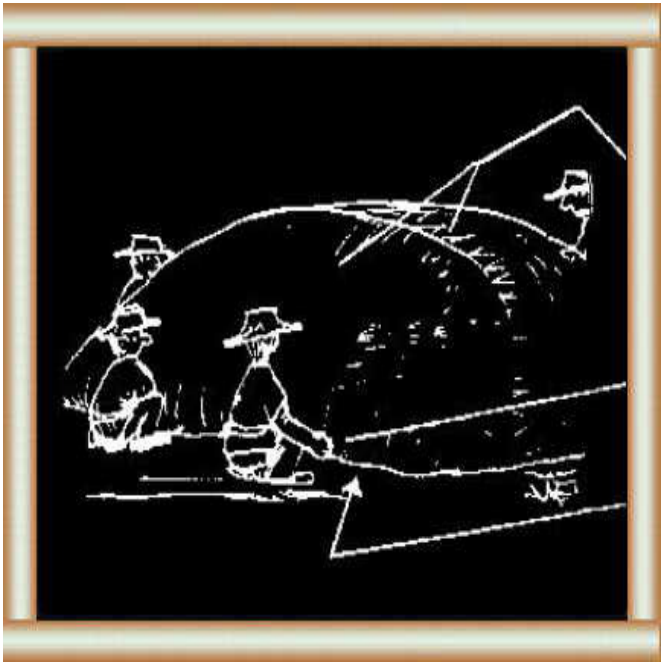
Treat in the same way with water and urea (Step 4).

39 Repeat these steps until you have enough straw to feed your milking animals for 3-4 weeks.



40 As you add more layers, gradually narrow the stack.

Step 5
41 Carefully seal the stack with a plastic top sheet and a plastic ground sheet.



42 Cover the top and the sides with plastic sheets.

Fold these sheets at the bottom and push them under the ground sheet.

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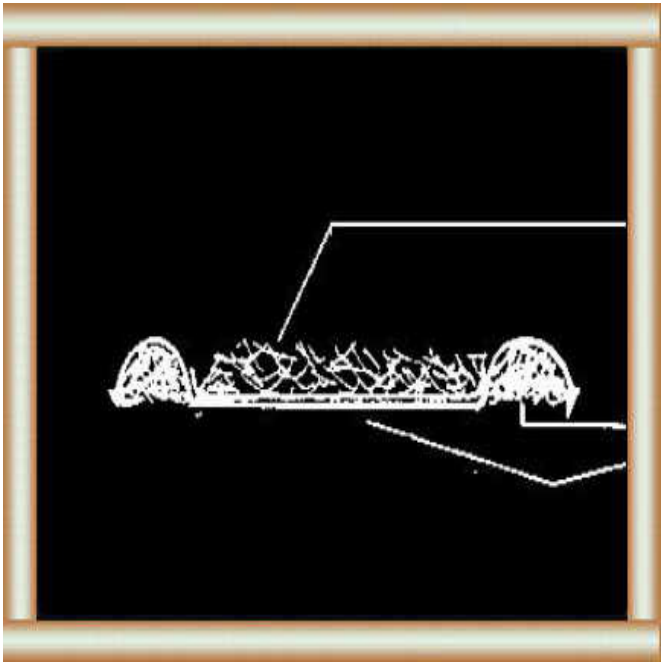
Here are the main steps again:



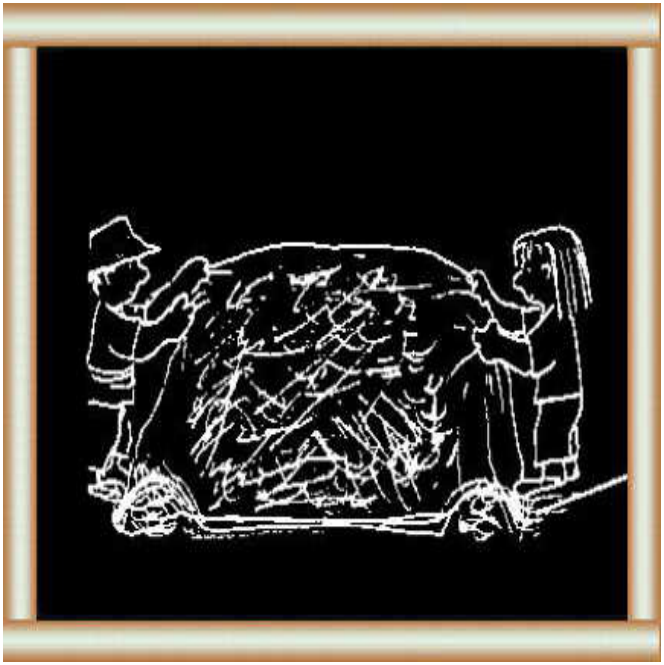
43 Stack begun

First layer of straw

Plastic ground sheet (rolled)

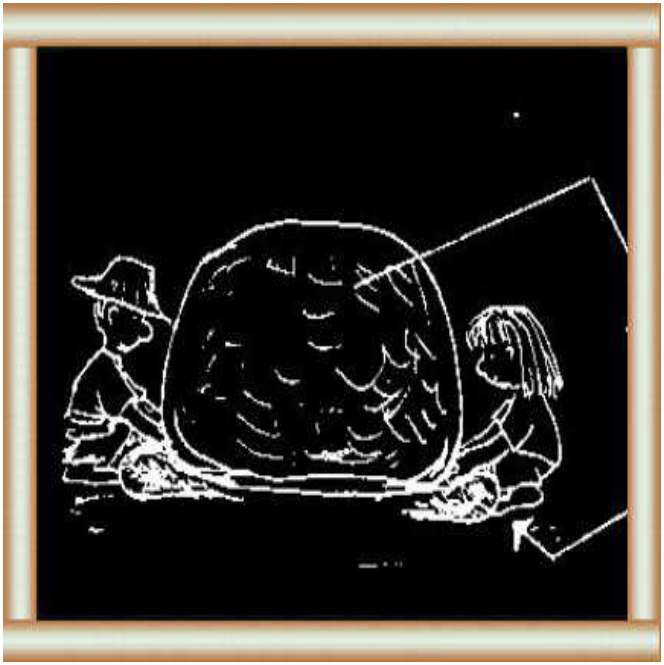
Straw packed to form wall

Plastic ground sheet (flat)



44 Stack completed

Edge of ground sheet showing.



45 Stack sealed

Top sheet folded and pushed under ground sheet.

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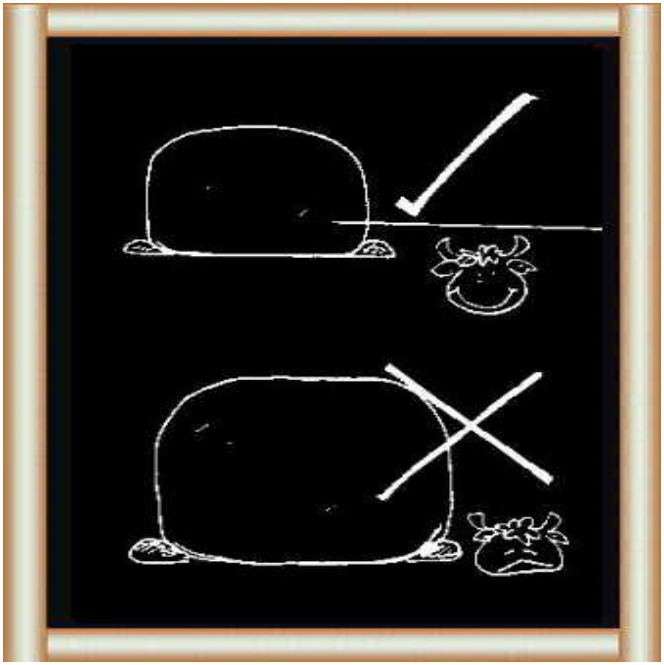
And some more important points:

46 Seals must be airtight.

Keep the ammonia in the stack.

If the plastic jacket is damaged, for example by your chickens, ammonia will escape.

47 How much straw should you treat at one



time?

If you keep treated straw for a long time in a big stack, it loses feed value, a medium-sized stack is better.

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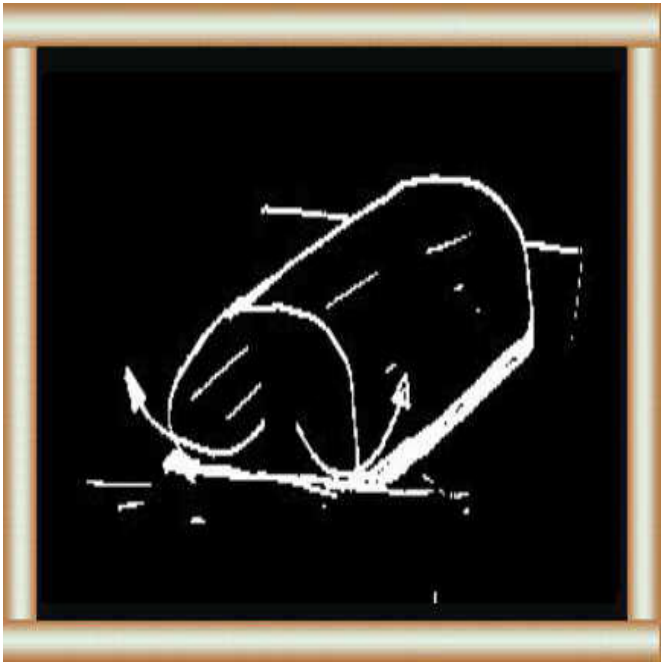
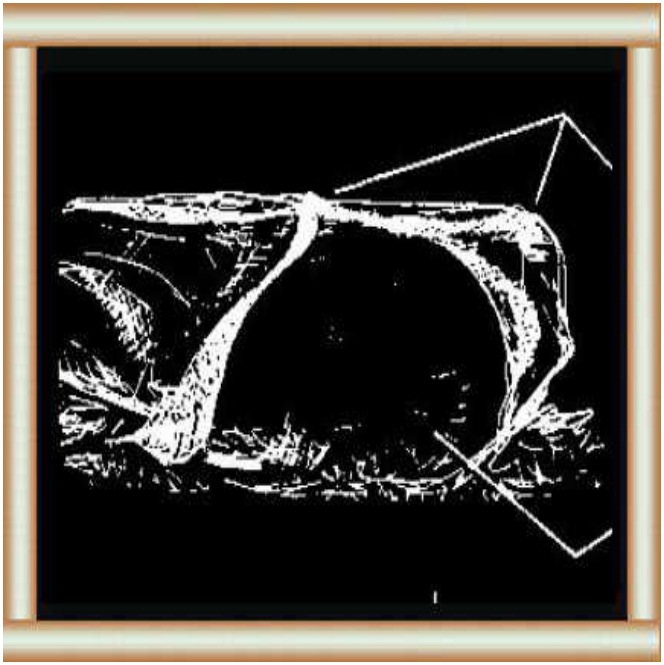
How can you use treated straw for feeding?

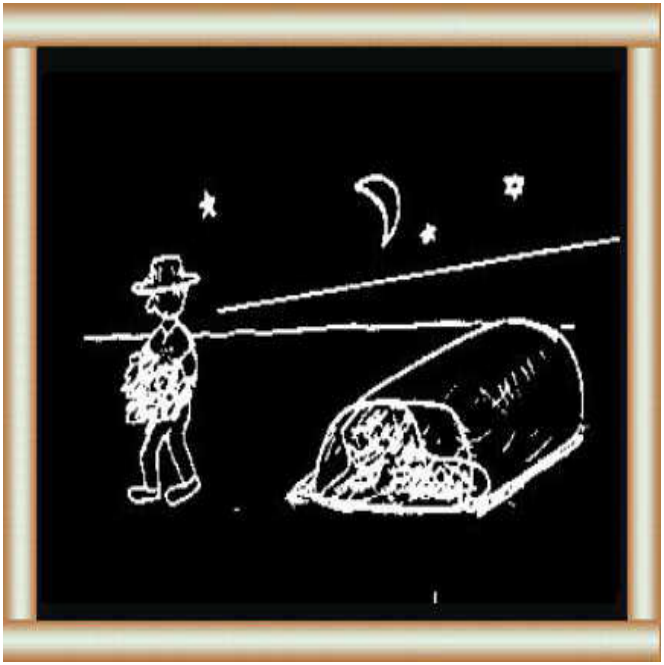


48 Three weeks after treatment remove straw from the small end of the stack.



49 Lift the protective layers of gunny bags and straw and the plastic jacket.
Remove the daily ration of straw.

50 Remove the straw



for the morning and evening feeding the night before and leave it overnight in the open air until feeding time.

This takes away the strong smell of ammonia.

51 Carefully close the stack.

52 Treated straw for feeding should have a mild smell of ammonia.

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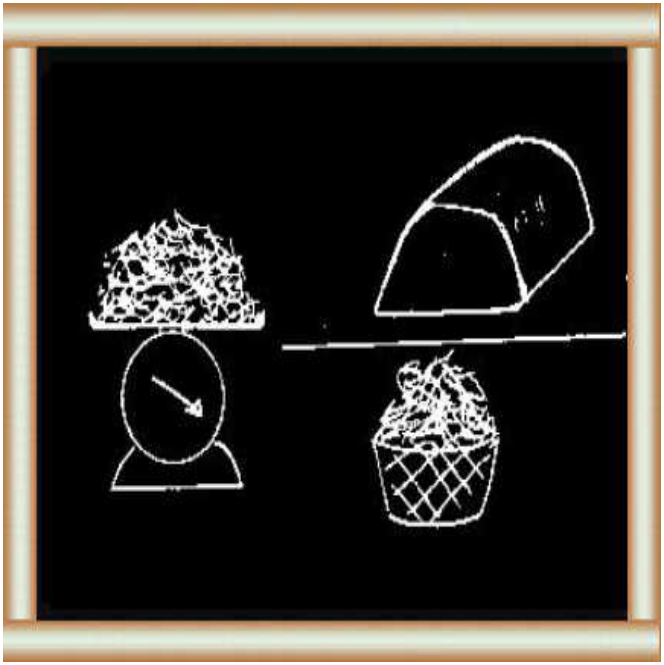
53 If you still have some grass to feed.



54 ... you can give 3 kg of treated straw for each morning and evening feeding (= 6 kg/cow/day).

55 In the dry season, the amount of grass in the ration decreases

56 …. you must give more treated straw:

8, 10 or even 12 kg per cow per day.

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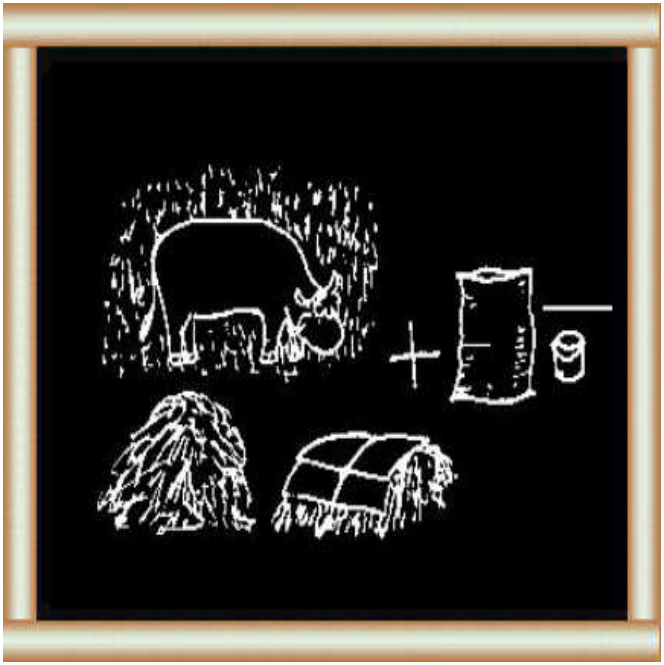

57 Supplement your rations of grass and treated straw with concentrates.

Your extension worker can advise you on quantities.

58 Do not feed more concentrates than necessary.

Your cow cannot digest the straw properly.

59 Keep concentrates to 25% or less of the total ration.

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60 For example, the

ration of maintenance + 8 kg milk yield should include about:
- 22% concentrates (about 4 kg/day)
- 48% treated straw (about 9 kg/day)
- 30% grass (about 6 kg/day)

61 If your rations contain a lot of rice

straw, you must supplement with minerals:
- calcium
- phosphorus
- micro-elements.

Ask your extension worker for mineral blocks.

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What do you know about treated straw?

Reasons for treating straw

Cost of feeding treated straw

You save money because:

Materials as for Stack method with two chambers

Method of treating straw

Stack method (3, 18-21)

1 Materials:

- plastic sheet

- straw

- urea

- watering can and water

2 Calculating:

- straw (28)

- labour (28)

- plastic sheet (30)

- water/urea (37)

3 Operations:

(18,29,31-

- laying sheet (34)
- alternate straw and urea mixture (19-20,35-40)
- sealing (21,33,41-42,46)
- leaving for 3 weeks

Feeding treated straw

1 Preparation:

- removal from stack (48-50)
- resealing (52)
- timing (51)

2 Feeding:

- with grass (54-58)
- with concentrates (59-60)

- with minerals (61)

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Small-Scale

Dairy Farming Manual

Volume 3

Husbandry Unit 5.6

CONCENTRATES

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CONCENTRATES

Husbandry Unit 5.6:

Technical Notes

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

Concentrates are a group of livestock feeds which are characterised by a higher dry matter content and a higher digestibility than roughages such as the stems and leaves of the grasses, fodders, legumes and trees. (1)

Concentrates of plant origin can be either energy-rich concentrates or protein-rich concentrates.

Energy-rich concentrates: dried cassava tubers; cereals such as rice, wheat, maize, millet and sorghum; agricultural by-products such as rice bran, wheat bran, molasses (2)

Protein-rich concentrates: coconut cake; soybean meal; palm kernel cake; sunflower cake; groundnut (peanut) cake; cotton seed cake; rubber seed meal etc. (3)

Concentrates of animal origin are characterized by the larger amounts of high-quality proteins contained in them. Some examples are the by-products of the milk processing industry e.g. skim milk and whey which can be used in calf feeds. These are too expensive to be given to adult ruminants. (4)

Extension

Materials

What are concentrates?

1 Animal feeds with higher:
- dry matter content
- digestibility
than roughages such as the stems and leaves of grasses, fodders, legumes and trees.

What types of

concentrates are there?

2 Two types of concentrates come from plants:
Energy-rich concentrates e.g.
- dried cassava, tubers cereals such as rice, wheat
- by-products e.g. rice bran, molasses

3 Protein-rich concentrates e.g.
- coconut and sunflower cake
- soybean and rubbers seed meal

4 Concentrates from animals are rich in high-

quality proteins e.g. by-products from skim milk and whey processing for calf feeds.

They are too expensive for adult animals.

Small-Scale Dairy Farming Manual

Volume 3

Husbandry Unit 5.7

MINERALS AND MINERAL BLOCK MAKING

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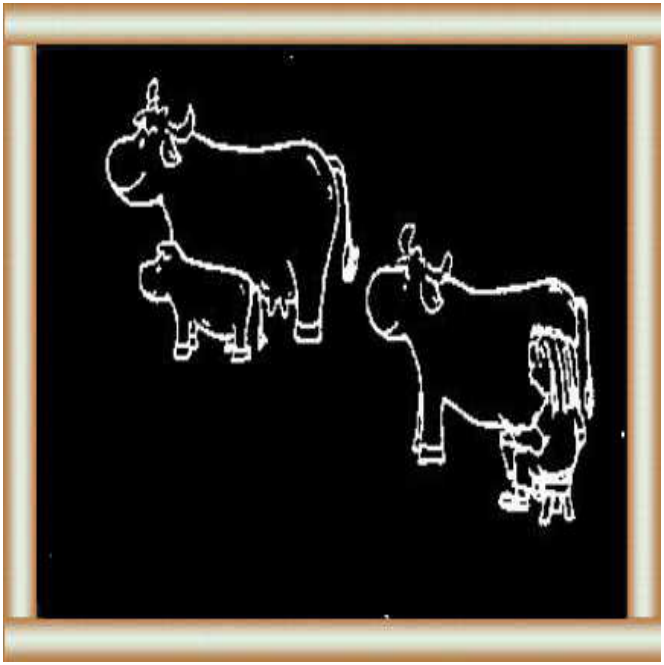
Extension Materials
What should you know about minerals and mineral block making?



Why do your animals need minerals?(5-9)

1 For good
- health
- growth
- production.

How can you feed minerals to your animals? (10-16)

2 By consulting your extension worker and using mineral blocks.

How can you make mineral blocks?(17-27)

3 By:
- using the correct amounts of materials
- carefully preparing the blocks.

How can you store mineral blocks? (28-29)

4 By:
- wrapping in polythene
- keeping away from air and water.

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MINERALS AND MINERAL BLOCK MAKING

Husbandry Unit 5.7:

Technical Notes

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

Minerals are an essential component in the diet of all animals. In dairy cattle and buffalo, minerals are required for the maintenance of general health and for proper growth and reproductive functions as well as to meet the quantities of minerals that are secreted in the milk. (5-6)

The quantities of minerals required vary with the type of mineral, type of animal and stage in the life cycle. Some animals may be able to obtain all the requirements of the minerals that they need from their normal diet. On the other hand, most animals may not show any obvious

signs of a deficiency even if they do not receive adequate quantities of minerals. However, they will yet be susceptible to diseases, will not become pregnant in time and will have a slower growth and lower production than can be obtained, had they received an adequate supply of the required minerals. (7-9)

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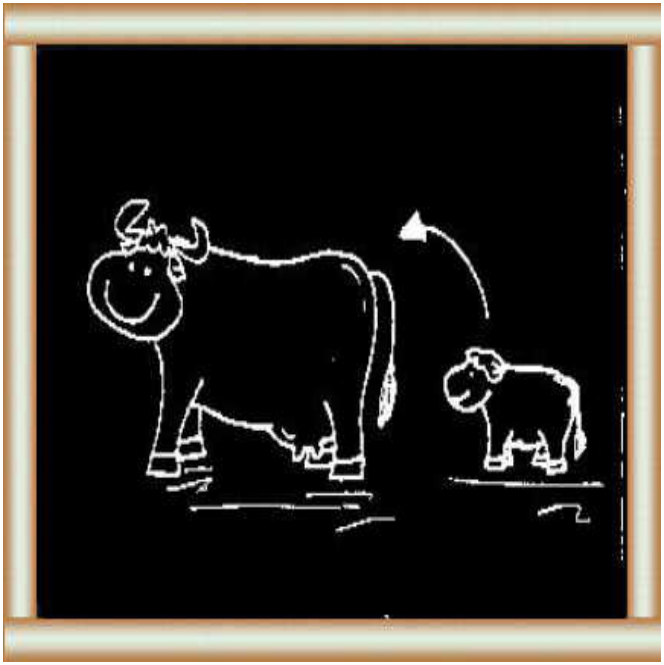
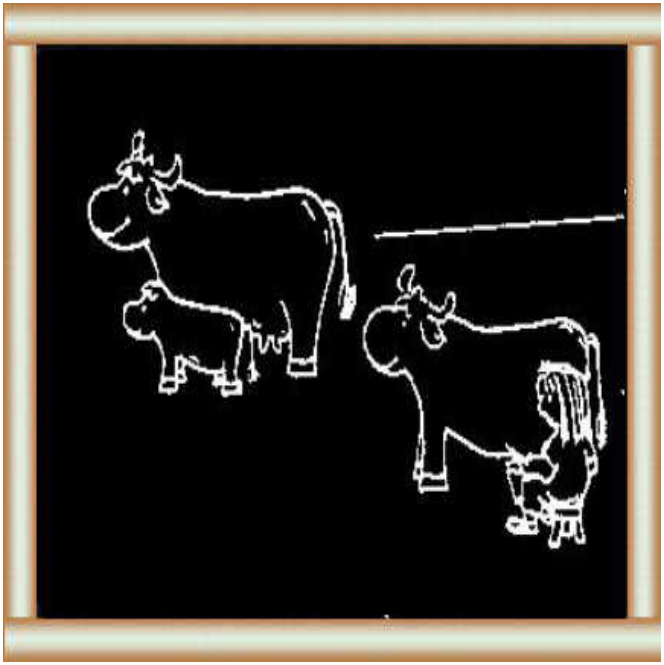
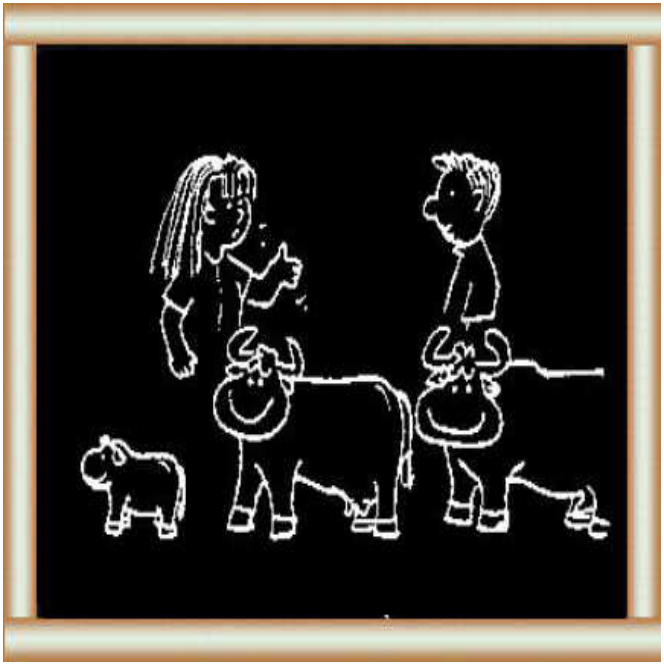


Why do your animals need minerals?

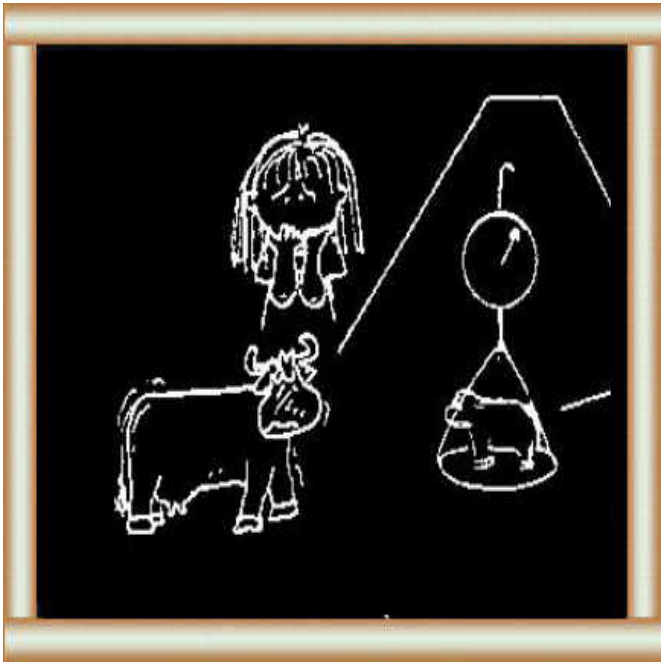
5 Dairy cattle and buffalo need minerals for:
- health
- growth



6
- reproduction
- milk production.



7 The amounts of minerals required depend upon:
- type of mineral
- type of animal
- age and use of animal.



8 If your animals do not have enough minerals, they may look normal but they will:
- get disease more easily
- grow more slowly

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As the normal feeds offered to dairy cattle and buffalo may not contain the required amounts

of minerals, additional quantities are usually supplied in the form of mineral supplements. The mineral supplements available in the market are produced to a standard formula and it may not be economical to feed such supplements under some conditions of feeding. In addition, there are considerable losses due to wastage when minerals are given to animals in the form of powders. (10-11)

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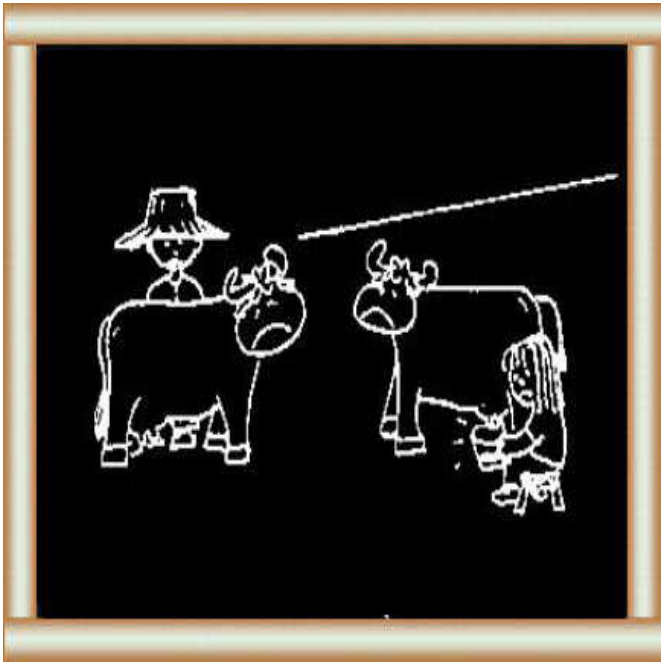
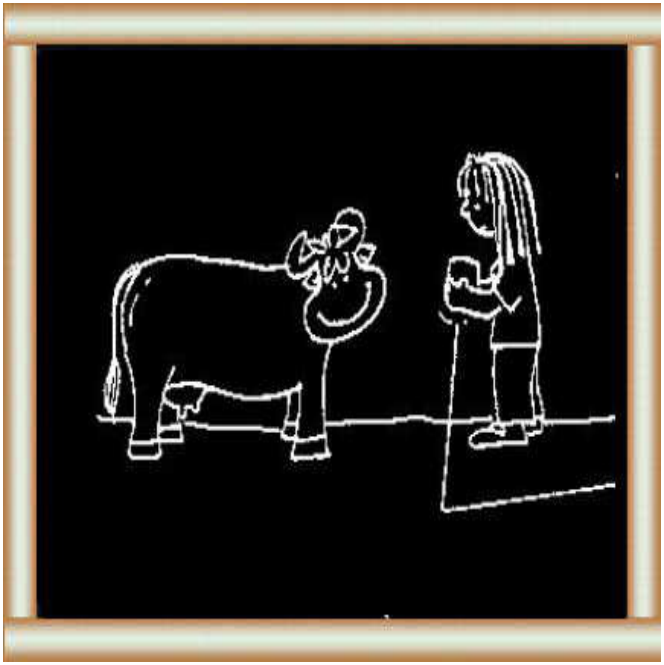


9

- get pregnant late

- have low production.



How can you feed minerals to your animals?

10 Normal feeds may not contain enough minerals:
- you need to give a mineral supplement.

11 But:
- commercial supplements are expensive
- powder supplements have a lot of waste.

12 It is better to use mineral blocks.

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To avoid these difficulties, minerals can be offered in the form of blocks. The advantages

of offering minerals in the form of blocks (over powders) are:
- farmers can themselves make blocks economically using components purchased from the market; (13)

- the composition of the blocks can be changed according to needs e.g. type of feeds available and quantities of minerals that animals can obtain from them; (14)

- the blocks can be left in the barn for the animals to obtain their requirements by licking;

- there is less wastage, even when the blocks are left in the barn. (15)

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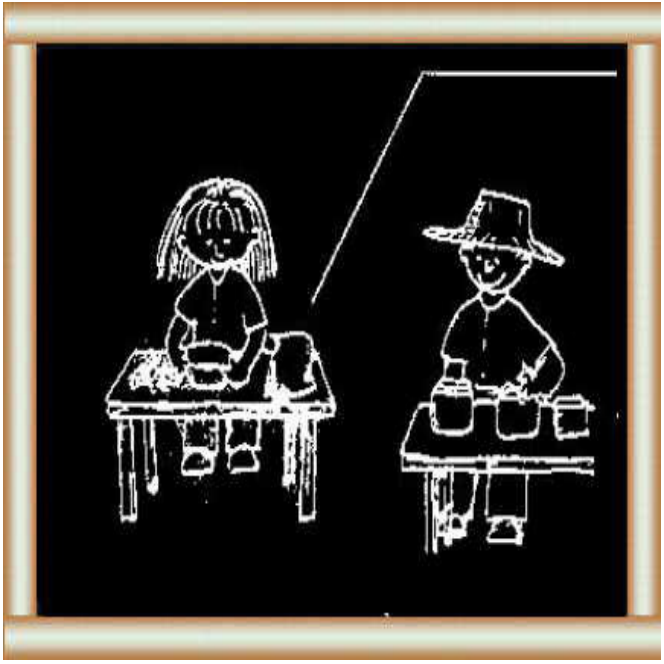
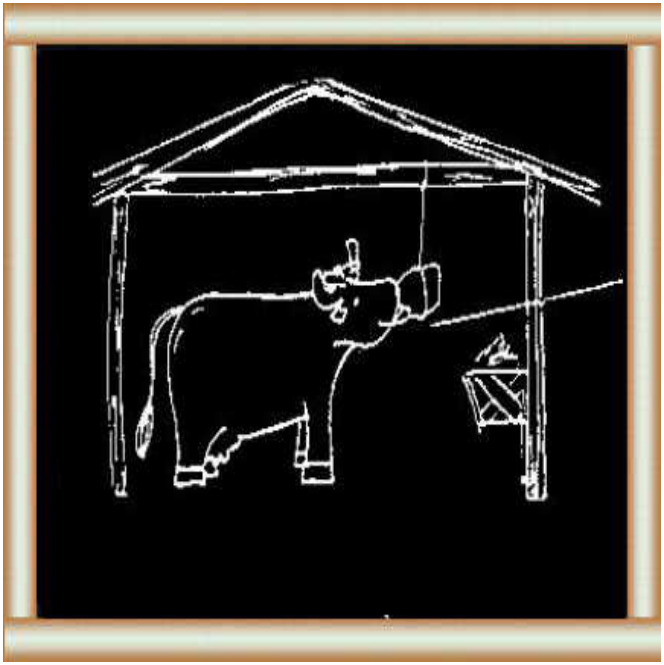


13 Advantages of mineral blocks (over powders) are:
- you can make the blocks yourself with materials from the market

14
- you can choose the composition of the block for your feeds and your animals



15
- you can leave the blocks in the barn for your animals to lick
- even in the barn, there is less wastage.

16 Using mineral blocks:
- is good for your animals
- saves you money.

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The procedure for making mineral blocks may

be explained in several stages as follows:

Stage I: Composition of the mixture to be used for making the block

Some components in the mixture can be increased or decreased depending on the availability of minerals from the feeds consumed by the animals. Extension officers should give necessary advice on this aspect. (17)

An example of a mixture that would be suitable to make five blocks, each weighing 1 kg is given opposite. However, if the animals receive a feed containing adequate quantities of good quality rice bran, which is rich in phosphorous, the amount of dicalcium phosphate in the mixture can be reduced. (18)

How can you make mineral blocks?

Choosing a mixture

17 Consult your extension worker about the correct mixture for your feeds and your animals.

18 This example mixture can make 5 blocks of l kg each.

If your feed has enough rice bran, rich in phosphorus, you can reduce the dicalcium phosphate in the mixture.

Component	Quantity in grams
Cement	1000.0
Quicklime	125.0
Common Salt	1750.0
Dicalcium Phosphate	2000.0
Cobalt Chloride	1.0

Copper Sulphate	**25.0**
Potassium Iodide	**3.0**
Zinc Oxide	**95.0**
Sodium Selenate	**1.0**

Stage 2: The block

A wooden block can be made as shown to make blocks weighing about 1 kg each. (19)

Stage 3: Mixing the components

Cement, quicklime, dicalcium phosphate, common salt and zinc oxide.

Crush any crystals and large particles of these components and sieve to obtain a fine powder.

Mix them well in a bucket or other suitable container. (20)

Cobalt chloride, copper sulphate, potassium iodide and sodium selenate. (21)

Dissolve each component separately in about 100 ml (1/2 a cupful) of clean water.

Add the cobalt chloride solution to the mixture made above and mix thoroughly. (22)

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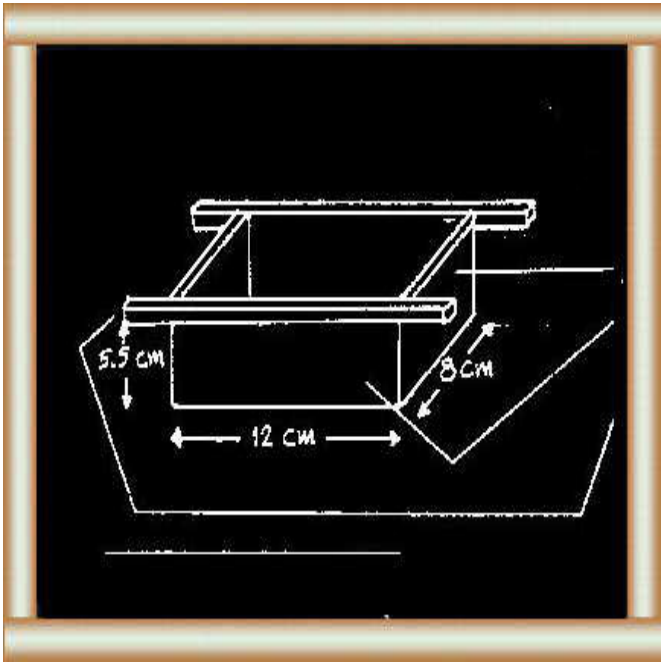

Making the frame

19 Make a frame for 1 kg blocks using the following materials:

2 planks 1.5 x 5.5 x 8 cm

2 planks 1.5 x 5.5 x 12 cm

2 pieces of wood 2 x 2 x 25 cm

Preparing the mixture

20 Take the cement, quicklime, dicalcium phosphate, common salt and zinc oxide:
- crush crystals and large pieces
- put through a fine sieve
- mix together in a bucket.

21 Take the cobalt chloride, copper sulphate, potassium chloride and sodium selenate:
- dissolve each one in 100 ml ($^1/_2$ cup) of clean water.

22 Add each solution from 21 (begin with cobalt chloride) one-by-one to the mixture in 20.
Mix thoroughly before adding the next solution.

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Stage 4: Adding water

Add clean water to the mixture while mixing it

thoroughly until it attains the consistency of a dough. (23)

Stage 5: Making the blocks

Spread a piece of polythene on level ground to cover the area of the block and place the wooden block on the polythene sheet. (24)

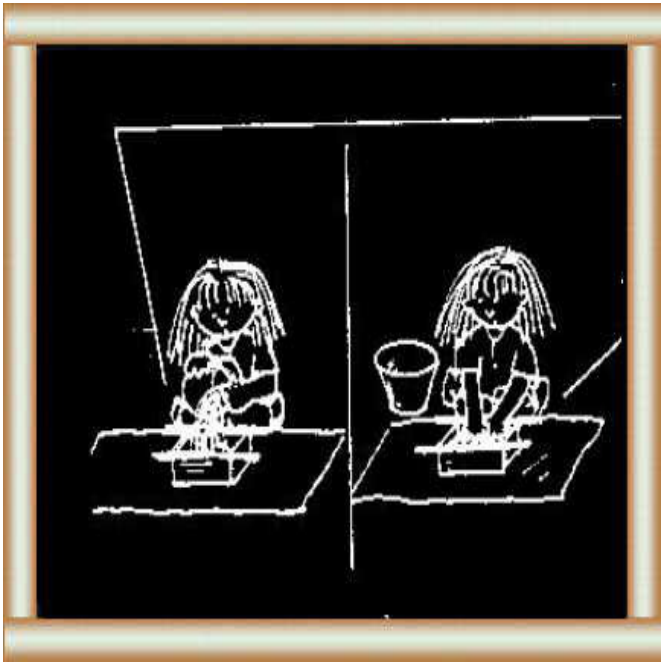
Add a sufficient quantity of the mixture to fill the block and compact it well. (25)

While adding the mixture, place two or three sticks (with a diameter of the size of a pencil) in position as shown to form two or three holes in the blocks. These holes will facilitate drying and can also be used to hang the block). (26-27)

Adding water

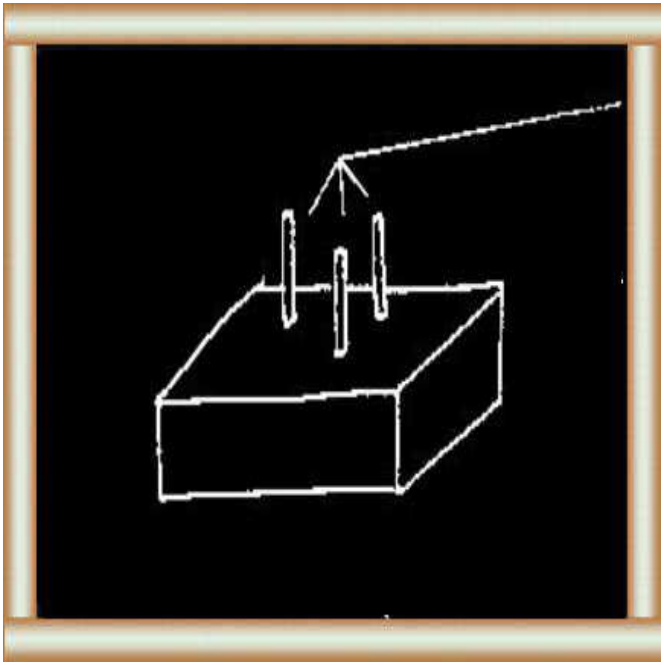
23 Add clean water to the mixture until it is like dough.

Making the blocks
24 Place a piece of polythene on level ground and put the wooden frame on top.



25 Add enough mixture to fill the frame.

Compact the mixture well.



26 Add 2 or 3 sticks (the size of a pencil) to make holes in the block.

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Stage 6: Storage

The blocks can be left in the barn (in a suitable

place to prevent them getting wet) for animals to lick.

The blocks that are not required immediately and are to be kept for future use should be wrapped up in polythene and stored without exposure to air and water.

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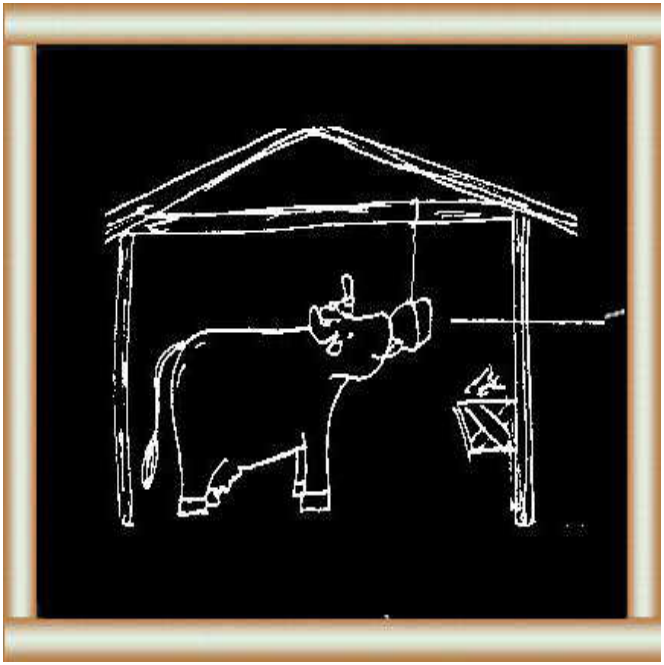
27 You need holes in the blocks to:
- help the blocks dry
- make it easy to hang the blocks.



How can you store mineral blocks?
28 When dry, hang a block
- where it does not get wet
- where your animals can lick it.

29. Wrap the other bricks up in polythene and store in a dry place for later use.

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What do you know about minerals and mineral block making?

Mineral requirements and deficiencies

Feeding minerals

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