4.7. FORAGE CONSERVATION, STORAGE AND FEEDING

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INTRODUCTION

Fodders and grasses can be preserved either as hay (dried fodder) or as silage (wet fodder), depending on the weather conditions and the available resources. Silage and hay are fed in some high input farms in India to bridge seasonal scarcity periods. However, silage and hay making have been extended only sporadically to low input farmers. Previous efforts have not given the desired result due to very high losses and reluctance in its acceptance by animals during the initial stages of feeding. Though the technology has been fully standardised and can be easily applied under favourable conditions, even little carelessness in its application results in quality loss or even complete spoilage.

On mixed crop-livestock farms in India, much of the roughage for animal feeding consists of crop residues. Most of the cultivated fodder is grown in the Northern and Western parts of the country, where still only about 8% of the area is under fodder crops. In the Central, Southern and Eastern regions, only 1-3% of the area is used for forage production. Another source of

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fodder is from grasses and shrubs that grow abundantly on the rangeland and roadsides during the monsoon season. Most of these reach their flowering stage during August-September. In irrigated areas of North India, fodder crops such as oats and berseem grow very fast during March and April. During this period, green fodder is available in plenty and many times it exceeds the daily animal requirements. From November onwards, there is a shortage of green fodder which causes animals to loose weight, particularly during the summer months. This situation is more prevalent in the Eastern and Central parts of India, where irrigation facilities are scarce.

Hay making is a suitable method to preserve these fodders and grasses. Leguminous plants, which are a major source of protein, can also be conserved in this way for feeding at a later stage. The low moisture content of hay considerably reduces costs and efforts involved in transportation and handling. Its flavours can be preserved well, especially if the drying process takes little time. Any method of feed conservation involves losses of dry matter in the process of fermentation and handling. Besides that, there is extra expenditure in terms of labour and materials on the processing of green fodder over direct feeding as green fodder.

This chapter deals with methods of conservation, storage and feeding commonly followed for hay, stovers, straws and various other forages. General guidelines for these methods are summarized, with particular attention to prevention of losses and improvement of the nutritional value.

HAY MAKING

The basic principle of hay making is to reduce the moisture concentration in the green forages sufficiently as to permit their storage without spoilage or further nutrient losses. The moisture concentration in hay must be less than 15% at storage time. Hence, crops with thin stems and many leaves are better suited for hay making as they dry faster than those having thick and pithy stems and small leaves.

Harvesting, curing and baling of hay

Leguminous fodder crops should be harvested at their flower initiation stage or when crown buds start to grow, while grasses should be harvested at their pre-flowering or flower initiation stage. Harvesting should be done preferably when air humidity is low. The harvested forage should be spread in the field and raked a few times for quick drying. The dried forage should be collected and baled when the moisture concentration becomes lower than 15 per cent. Baling the hay helps in storage and requires less space.

Artificial drying

Field curing is mostly done during bright sunny days, which causes bleaching of the forage and loss of leaves due to shattering. Nutrients may also be leached out if the forage is exposed to rain. To avoid these losses, forages can be dried in barn by flowing hot air though the forage. Its main benefits are that nutrient losses due to leaf shattering and bleaching can be avoided, and that the forage can be harvested irrespective of the prevailing weather conditions. Although artificial drying results in hay quality

approaching that of the fresh forage, it is expensive and beyond the reach of small and marginal farmers.

Losses in hay making

Monsoon grasses and fodder crops come in flowering during August and September. Fast lignification and translocation of sugars in these crops occurs after this due to high temperatures, resulting in a rapid decrease of the digestibility. Considerable losses occur with the monsoon grasses, because they are not harvested and preserved at the stage when their digestibility is fairly high. This may be due to the prevailing weather conditions and the lack of interest and skills for proper preservation and storage. Preservation of any surplus fodder can be beneficial during a scarcity period.

Respiration by living plant cells after harvesting occurs at the cost of carbohydrates. However, this loss is nominal as compared to losses due to shattering, leaching and bleaching.

During the process of drying and curing, there are losses due to **shattering and dropping of leaves**, which are the most nutritious part of the plant. Legumes are particularly sensitive to leaf shattering.

Leaching is caused by rain during the drying period of hay, through which the soluble nutrients are lost. Continuous and excessive rainfall may result in large losses due to decomposition and mould growth.

Bleaching of hay, due to its excessive exposure to sunshine during the

drying and curing process causes losses of nutrients, particularly carotene.

High moisture content at the time of storing may lead to **fermentation and moulding** of hay. If the hay is moist at the time of storing, fermentation sets in with a rise in temperature. The overall loss of dry matter and nutrients may range from 15 to 50 per cent, and may lead to development of mould, fungi and undesirable bacteria. A high moisture content at stacking time results in fermentation of forage and a rise in temperature, resulting in overall dry matter and nutrient losses ranging from 15 to 50 per cent. A moisture content above 15% may also lead to the development of mould, fungi and undesirable bacteria, which make the hay unsuitable for animal consumption. General guidelines, and points of attention for hay making are summarized in Box 1.

Box 1. Important points for hay making

- The crop is harvested for hay making at its pre-flowering or flowering stage, when its growth is levelling off and its feeding value is still high;
- hay is best made during rain free days;
- crops with thick and juicy stems should be dried after chaffing and conditioning, which will speed up the drying process and slow down the loss of nutrients;
- hay should be raked only a few times during the drying process in order to avoid the shattering of leaves and the bleaching of the hay;
- legumes should be raked in the morning hours to avoid leaf shattering;
- after drying and curing, baling and/or stacking should be done as early as possible. Storage under a roof is preferred;
- for hay baling, the maximum permissible water concentration is 15%. Storage of hay before sufficient drying may cause fire due to spontaneous combustion;
- storage of hay with higher moisture concentration may result in mould growth, making the hay unfit for feeding;

SILAGE MAKING

The basic principle of silage making is to convert the sugars in the ensiled fodder into lactic acid, this reduces the pH of the silage to about 4.0 or lower, depending on the type of process. In this way, the biological activities responsible for spoilage are inhibited. To attain this, the early establishment and maintenance of an oxygen free, i.e. **anaerobic**, micro-environment is essential.

The term 'silage' refers to any wet and/or green fodder, preserved by organic acids, chiefly lactic acid, that is produced naturally by bacterial fermentation of sugars in the plants under anaerobic conditions. Stored material is highly acidic and has a lower feeding value compared to the original green fodder in the field. Silage making is commonly recommended in most parts of India, but it has not been established for a number of reasons:

- a lack of surplus forage during the rainy season;
- an unreliable rainfall pattern, making farmers reluctant to ensile a forage surplus during the rainy season, since the actual feed shortage during the dry season will then also vary considerably. Often it is possible to bridge the scarcity period in other ways and without great complication.
- the requirement for labour (cutting, raking, collecting, chopping, pit construction and cleaning, ensiling) and materials (polythene, molasses) may be a problem in some areas;
- the organizational aspects (punctual and sometimes fast action is required) may be felt as a complication.

Some of these problems may be overcome if larger quantities of silage are prepared by the cooperative milk unions from the surplus green fodder during the flush season and supplied to its members during scarcity periods. There is also scope to prepare silage near the reserve forest areas by harvesting the forest grasses at a proper stage and ensiling them rather than allowing them to dry and burn. Box 2 lists some important points for silage making.

Box 2. Important points for silage making

- crops and plant material rich in soluble sugars such as maize, sorghum, oats, sugarcane tops, hybrid napier grass and other grasses are highly suitable for ensiling;
- the dry matter concentration of the forage at the time of ensiling should be around 15-30 %, but higher is possible;
- chaffing of the material for ensiling increases its compactness, thus eliminating the air space to the maximum extent;
- green to semi-green forage, which may use the oxygen present for respiration, results in high quality silage;
- the silo should be air-tight after filling;
- fermentation starts within hours after closing the silo, and accelerates over the next 2 to 3 days. It terminates after about three weeks. Organic acids, primarily lactic and acetic acid, ethanol and gases such as CO_2, CH_4, NO_2 and NH_3, are produced during the fermentation process;
- due to the production of acid, the pH of the biomass is reduced to a level below 4, resulting in the termination of all biological activities, after which the material remains conserved under anaerobic conditions.

Advantages of silage making are:

- when harvested at or before the flowering stage, more nutrients (per area unit, time unit and kg feed) can be available for animal feeding;
- losses due to shattering, leaching and bleaching during hay making are avoided;

- the silage making is less affected by adverse weather conditions (or fire), as compared to hay making.

Some disadvantages of silage making are:

- it requires labour for filling of the silo;
- the construction of a silo requires an investment;
- handling and transportation requires more effort as compared to hay, due to the lower dry matter concentration;
- nutrient losses are generally 10% over losses with green fodder, which may be more with smaller quantities;
- slight carelessness at the time of ensiling may result in heavy losses due to aeration;
- the marketability of silage is very low.

Box 3 summarizes general guidelines for preparation and usage of a silage pit.

Losses in silage making

The losses resulting from silage making are the sum of respiration losses, fermentation losses, effluent losses, and losses due to prolonged fermentation and moulding.

The **respiration losses** occur because the plant is normally still active at the time of ensiling. Respiration continues as long as air is available. During this stage, oxygen and sugars are converted into water, carbon dioxide and heat. Therefore, sound compaction and air-tight closure of the silage pit are major factors that inhibit and stop this process as soon as possible.

Box 3. Guidelines for preparing and using a silage pit

Harvesting
High (or medium) quality silage is obtained from high (or medium) quality grasses and fodders containing between 15-35 % dry matter. This is found at the dough stage in maize, at flowering in sorghum, ear emergence in pearl millet, milk stage in oats and at flowering stage in most of the grasses. Partial wilting of legumes is necessary to reduce the water concentration to about 70%. For proper filling and compaction, grasses, particularly those having thick and pithy stems, should be chaffed to 2-3 cm size.

Silo preparation
The structure must be thoroughly cleaned and if the bottom and sides of the silo are kachcha, a 10 cm layer of straw or waste fodder is spread on them. In all cases, such layer is advisable in cemented pits. Chopped fodder should be filled layer by layer of about 50 cm each within a day or two and compacted properly to remove trapped air. If fodder contains little soluble sugars which is the case in legumes, liquid or dried molasses should be sprinkled on top of each layer to increase the fermentation. The entire pit should be filled in the same manner up to a height of about 1.5 to 2 metres above the ground, to ensure that after complete setting the silage mass is well above the ground level, in order to avoid water collection in the pit. Trampling must be more thorough near the sides and edges of a trench silo.

Closing the silo
After properly shaping-up the mass on the top layer (dome shape), the silage pit should be covered as soon as possible with a layer of straw or waste fodder, and subsequently with a plastic sheet of 250 to 275 micron thickness to prevent oxygen from coming in. In trench silos, plastic sheets should overlap each other to avoid the entry of air. Sufficient weight should be put on plastic sheets to keep them intact. A layer of mud can also be put over plastic sheets. During the setting period cracks etc. must be properly closed to avoid the entry of water and air into the pit. The fermentation process will be complete in 4 to 5 weeks and after that the mass becomes stable.

Opening the silo
During the shortage of green fodder, silage may be fed to animals. While opening the silo, the cover should be removed properly and a plastic sheet is taken out in a section of the pit, taking care that the minimum possible surface is exposed to the atmosphere. Some mouldy material may be found on top and also on the side, which should be removed before taking the silage for feeding. A well-preserved silage will be of yellowish green colour, having a pleasant acidic smell, is not sticky, and is free from mould growth. Milch animals should be fed with silage after milking as feeding of silage just before milking may give some silage smell in the milk.

Fermentation losses occur during the fermentation process, because bacteria convert sugars into - mainly - lactic acid. Gradually, this end products create a micro-environment which is increasingly hostile to those bacteria, eventually stopping their activity. Throughout an average fermentation in a silage pit, bacteria use 4-5% of the energy present in the ensiled mass. If the water concentration at the time of ensiling exceeds 75%, juices will accumulate on the pit floor, and may flow out of the pit, causing **effluent losses**. If air is able to penetrate the silage, a **prolonged fermentation** may lead to an additional loss of organic material in the silage pit. This results in the production of butyric acid and moulding, and spoilage may take place.

SILAGES FROM DIFFERENT FORAGES

Silage from cereals like maize, oats and sorghum

Maize, oats and sorghum are important fodder crops, that are rich in carbohydrates. During periods of abundant green fodder availability, they can be chopped and ensiled to produce silage for feeding during scarcity periods. Sorghum and oats should be harvested at flowering stage when 50% ears have emerged, while maize should be harvested at its milk stage.

Silage from cultivated and forest grass

During the monsoon season, cultivated as well as forest grass grow luxuriantly, and there is abundant availability of green fodder. These grasses can be harvested at their pre-flowering or flowering stage when growth has levelled off while their feeding value is still high. If the weather is too humid for hay making, these grasses might be conserved in the form of silage for feeding during scarcity periods.

The main **stovers** used for silage are from sorghum, though also crops like pearl millet and green maize can provide stover for silage. The prussic acid which is present especially in younger sorghum plants or quick regrowth, and which is dangerous if fed to ruminants in larger quantities, is destroyed completely by ensiling. Particularly sorghum plants are green and juicy at the time of harvesting for grain. Normally the ears are removed and the plants are left in the field as standing hay. (See also #5.4.).

Large quantities of **sugarcane tops** are available in sugarcane growing areas during the crushing season. They are rich in soluble carbohydrates but poor in protein. Out of about 80 million tonnes of sugarcane tops, only 30% is used for animal feeding as fresh feed. The rest is partly used as fuel by the sugar industry. The silage is usually offered to the animals as wet fodder during the scarcity period in the summer months.

Tall varieties of **paddy straw** are grown in some traditional rice growing areas in India. They are susceptible to lodging under conditions of high fertilization, in which there is an excessive initial growth of the crop. To avoid lodging, about one third of the top portion of the crop is removed during the vegetative stage. Fresh straw of many dwarf varieties of paddy is quite succulent at maturity, when the crop is harvested and the grain is separated out. A moisture concentration of 50-65% in paddy straw at the time of harvesting is still suitable for ensiling.

In all these situations, the available biomass, including the succulent weeds, can be ensiled and utilized as wet fodder during the lean periods. Paddy straw treatment with urea/ammonia improves the feeding value of straw.

However, ensiling and urea treatment of straw have some basic differences, as presented in Box 4.

Box 4. Differences between ensiling of grass and urea- ammonia treatment of straw (adapted from Schiere and Ibrahim, 1989)

	(grass) ensiling	urea-treatment (of straw)
Basic process	microbiological fermentation	chemical reaction
pH during process	acid	alkaline
Addition of urea	not essential, may even be harmful	essential
Purpose of process	conservation of feed	increase in feeding value
Effect on nutritive quality	negative	positive
Use of pit or other structure	one large batch per season	several small batches per season
Need for airtightness	essential	desirable
Purpose of sealing	to keep oxygen out	to keep ammonia and moisture in
Name of process	ensiling	treatment

Water hyacinth is an aquatic weed, abundantly growing in Eastern India. In its fresh form it is not liked by ruminants. Its leaves are rich in protein but the plant contains 90-94% water. In order to prepare silage from water hyacinth, it is necessary to reduce the water concentration to about 70%. As the leaves dry faster than the petiole and the stems, they drop down during the drying process, and the nutritive value is reduced (#).

Berseem is an important green fodder legume in Northern India. It grows luxuriantly during March and April. However, it is not suitable for ensiling, due to its high moisture and protein concentrations: 85-90% and 14-18% (on DM basis), respectively.

A **mixture of berseem/paddy or berseem/wheat straw** in a ratio of 4:1 can be suitable for ensiling. Addition of molasses (4% of total biomass) further improves the fermentation and quality of the silage. For that purpose, any other material such as crushed maize grain, spent barley from breveries, apple pomace or citrus pulp, can also be used instead of molasses.

USE OF ADDITIVES IN SILAGE MAKING

For grasses, fodders or crop residues that are rich in sugars, sufficiently dried (i.e. above 25% DM) and with a CP-level under 20%, there is no need to use additives. In all other cases, additives do not only upgrade the silage quality, but they also reduce the risk of failure to preserve the forage. The benefits of using additives should be seen in comparison to the costs of applying them. The most common ones are organic acids, molasses and preservatives. Most of the undesirable bacterial activity can be prevented by adding an **organic acid** to the crop. By adding **molasses** to the silage, the pH of the silage can be quickly reduced to a level below 4.0. A standard rule is to dissolve 15 litres of molasses in 15 litres of water, before adding it to one tonne of silage. **Preservatives**, such as salt and sodium metabisulphite are sometimes used for ensiling forages. Salt adds flavour, and it mainly reduces water activity.

STORAGE STRUCTURES FOR SILAGE

A silo is a structure designed to store and preserve high moisture fodder such as silage. The selection of a silo is made on the basis of required capacity, climatic conditions and economic considerations. Different silo types are used to conserve and store fodder:

- horizontal silos, such as trench silos and bunker silos;
- vertical silos, such as pit silos and tower silos.

Trench silos are horizontal silos, commonly used for easy handling of the silage. Trenches of different sizes, with depths up to 4 m are used, but the size can usually be made as per requirement. On an average, 700 kg fresh silage per cubic meter can be preserved. The ground water table should be below the maximum depth of the silo.

Bunker silos are another type of horizontal silos that are used instead of trench silos, when the ground water table is high. The basic difference between trench and bunker silos is only that the former is below ground level, whereas the latter is above ground level.

Pit silos are circular or rectangular vertical pits with a depth of 3-8 m. Usually the required dimensions are prepared, keeping in view that the ground water table is lower than the depth of the pit. Circular pits are preferred as the silage can be compacted much better than with a rectangular pit. Both earthen and masonry structures can be used, but losses are lower and silage quality is higher in the masonry structure as compared to the

earthen structure. Pit silos are most suitable and economical for storage of smaller quantities, such as frequently available in Indian conditions. Their cost is lower, and the losses are also lower than with the trench silos.

Tower silos are vertical silos, used instead of pit silos in areas with high ground water tables. They are generally of the so-called 'pacca-structure'. The cost of these tower silos is a major limitation for their adoption.

STORAGE METHODS FOR STRAWS AND STOVERS
(other than for silage and hay making)

Straws and kadbis are a major source of dry matter in mixed farming systems. Proper storage of such material is important. Different structures, including permanent and temporary types, are used for their storage. Different methods are followed to store paddy straw, wheat bhusa and stovers.

Storage of paddy straw is generally done on uplands in the form of stacks. The upper part of the stack is given a conical shape, which prevents the water from entering into the stack. The straw can be kept well for many years. However, improper shaping of the above portion of the stack may allow water to leak into the stack and spoil it. In Southern India, finger millet straw, which has a higher feeding value as compared to paddy straw, is also stored just like paddy straw. Straws of these crops are also used for thatching of structures erected to store crop residues. The intake of stored paddy or ragi straw is usually better than the intake of the fresh straw.

Storage of chopped wheat straw (wheat bhusa) is done after chaffing wheat straw to a particle size of 1-2 cm. Wheat straw is a main crop residue for animal feeding in Northern India. It is stored in permanent or temporary structures, depending on its quantity and the economical condition of the farmer. In Punjab and Haryana, wheat straw is generally stored in open structures, either vertical (called "Bunga") or horizontal (called "Dhar" or "Dhad"). Use of the vertical construction is more common where the heap is properly packed on a platform in a round structure of the required diameter, while the upper portion is given the shape of the cone. Long paddy straw, coarse grasses of *Saccharum* or dry sugarcane leaves, are used to thatch the structure in such a way that rain water cannot penetrate into the heap. The daily requirement is taken out from one side without dismantling the structure. In general, the feeding from such a structure is started only after the monsoon. The horizontal heap is covered with paddy straw or coarse grasses, and plastered with a mixture of mud and cow dung to avoid the entry of raining water. Since the surface area open to the sky is much larger in the horizontal structure, losses are also greater as compared to the vertical structure.

Long, dried **stovers** of maize, sorghum and pearl millet (Bajra) are tied in bundles, weighing about 10-15 kg each. These are called poolies. They are stacked on a platform or elevation in such a way that its slopes are directed on the outside. These structures are covered with paddy straw, sugarcane leaves or coarse and long dried grasses in such a way that rain water cannot enter into the stack. Large quantities of such stovers are stored in drought prone areas for feeding during feed scarcity.

SUITABILITY AND PRACTICES OF CONSERVATION

Feeding strategies based on conserved fodder include feeding of dry fodder (hay, dried crop residues or grazing of dried grasses), silage (preserved green fodder or grasses) and standing hay/stover (standing mature fodder crop or crop residue). Such fodders may been screened for their feeding value for ruminants, as presented in Table 1. Depending on the local availability of labour and other inputs, a particular conservation technique may or may not be suitable on a farm.

Dry feeding

Straws are a major source of roughage for ruminants, particularly after the monsoon, but also during planting and in the early wet season.

Silage feeding

When feeding silage, the following points should be considered:

- Silage should be fed after milking, as silage feeding during or before milking may add undesired flavours to the milk.
- mouldy and decomposed silage, if found on the top and sides of the silo, should be discarded;
- once a silo pit has been opened, it is better to feed it uninterruptedly until is empty. Otherwise, considerable spoilage may take place due to exposed surfaces that are easily subject to decomposition.

Table 1. Tentative screening of different fodder conservation techniques for animal feeding

Parameters	Silage from cereal fodders	Silage from grasses	Silage from fresh stover	Hay from cereal fodder	Hay from legume	Straw/ stover animal	Storage in body
Feed Value Characteristics:							
DM supply	+++	+++	+++	+++	+++	+++	N.A.
CP supply	+	+	+/-	+	++	--	+/-
Energy supply	++	++	+/-	+	+	+/-	+/-
Maint. ration	++	++	+/-	+	++	+/-	+/-
Growth ration	+	+	+/-	+	+	-	--
Medium prod.	++	+	+/-	+/-	+	--	N.A.
High prod.	+	+/-	-	+/-	+	---	N.A.
Farm Management Aspect:							
Peak labour saving	---	---	---	-	--	+/-	N.A.
Total labour saving	--	--	--	-	-	+/-	N.A.
Capital cost	---	---	--	-	--	-	N.A.
Transportability	---	---	--	-	-	-	N.A.
Feed security	++	++	+	+	++	+	N.A.
Farming System and their Suitability:							
Specialized Dairy Farming:							
In arid regions	+/-	+/-	+/-	+	++	+/-	N.A.
In humid regions	++	++	+/-	-	--	+	N.A.
Draft Animals:	++	+	+/-	+	+	+/-	N.A.
Sheep and Goats:							
Arid regions	+/-	+/-	-	+	++	--	+/-
Humid regions	+	+	+/-	+/-	+	--	+/-

+ positive effect. - negative effect. N.A. not applicable

Feeding of standing hay

In many rainfed farming areas, only one crop is grown in a year, generally during the monsoon. In such areas, fodder crops, crop residues or stovers of maize, sorghum and pearly millet are left in the field as standing hay. The plants at this stage dry gradually during the winter season, while their feeding value decreases with time. The daily required amount of stovers is directly harvested from the field and fed mostly after chaffing. This results in utilization of family labour during the lean period when there is not much work in the field. This practice is common in the Bundel Khand region near Jhansi and also in Central and Southern India, where sorghum is an important grain crop.

SOCIAL ASPECTS OF FODDER CONSERVATION

Silage and hay making are labour intensive and heavy tasks, often done by women. Therefore, the gender division of labour should be considered. When the basic fodder for hay or silage making is composed of grass which has to be collected in a short period, family labour will not be sufficient for this task. Possibilities to reduce the work load especially for women during the silage making process, should be explored.

Persons use communal or state land to collect weeds daily, enough for a few animals. How does the community or local leadership react when a farmer decides to employ a number of labourers to collect all the weeds in a short time, leaving the other people without any for the coming weeks ? Communal land is neither considered to be 'nobody's land', nor privately owned land, but there is a limit to freely remove the amount of vegetation

one desires. The local rules for using the communal land are therefore to be considered and respected. Regular communication between users, is important, especially when the number of people using the land for their animals increases.

CONCLUSION

To avoid the loss of nutrients from green fodder at the time of abundant availability, and/or to maintain the nutrient supply during scarcity periods, fodder conservation can be useful. In humid areas, roadside/forest grasses and cereal fodders may be preserved as silage. In arid and semi-arid areas, surplus fodder - if any -may be preserved as hay or silage, depending on the weather conditions. Leguminous and other slender fodders such as cowpea, berseem or lucerne are more suitable for hay making but leaf loss is to be prevented. Fresh succulent stovers of sorghum and pearl millet and sugarcane tops may also be preserved as silage for better feeding value during the lean season. Since there are some unavoidable losses in quality as well as in quantity of fodder during storage, and since additional labour and capital is required for fodder preservation, such practices can only be recommended after thorough cost-benefit analysis. Conservation techniques are a standard practice at organised farms, but whether this technology should be extended to farming families for feeding of high yielding animals during the period of green fodder scarcity depends on local conditions.

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