Fodder Preservation Techniques – Hay and Silage Making

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The seasonal nature of green fodder availability and a number of farm by products necessitate their preservation to feed the animals throughout the year. For example, green fodder is available in surplus during rainy season and in winter, while paddy and wheat straw and other crop residues are available during harvest seasons. Contrary to this, it is too difficult to meet the requirements of the animals in summer. Hence, it is essential to conserve the seasonal surplus for feeding the animals throughout the year. Hay (dried fodder) making and silage (wet fodder) making are the two preservation methods, of which ensiling is preferred on the basis of fodder quality.

Hay Making

Hay making is the most common and easy method of preserving the seasonal excess of the green fodder and the only method of preserving farm by products. Legume hay, non-legume hay and mixed hay are the major three types of hays used to feed the livestock. Hay is different from straw, because the straw is obtained from the crop after the seed formation, while for hay making the crop is harvested at flowering stage.

The basic principle of hay making is to reduce the moisture content in the green forage sufficiently so as to permit their storage without undergoing fermentation or becoming moldy or further nutrient losses. The moisture content in hay must be less than 15 per cent 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

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 harvest has to be taken up after the dew has dried.

Curing

Field methods

Windrow

- ✓ The harvested material occupies one third to half of the field
- ✓ Drying is faster than in swath, because of the opening of the stomata in the lower layers

Swath

The entire field is the spread area. The harvested fodder has to be allowed for curing in the field itself, and has to be turned after every 4-5 hours. By the evening the moisture content could have reduced from 75 per cent to 40 per cent and it has to be loose heaped in windrows. Next day it requires 1 or 2 turnings. The moisture content by the second day afternoon could have reduced to 25 per cent provided the sunshine is not interrupted. Normally 70-75 sunshine hours are required for drying the grass in the-field method. For rainy season hay curing sheds are recommended.

Mechanical Methods

Fence method

Drying frames made of wire fencing with angle iron posts are used. It is more suited for berseem and lucerne, The hay possessed green colour and pleasant aroma. In mechanical drying, the protein loss is only 2-3 percent and it is directly proportional to drying time.

Artificial drying

Forage can be dried in barn by flowing hot air through the forage. This method avoids nutrient losses and enables harvesting of forage irrespective of the prevailing weather conditions. However, it is expensive and beyond the reach of small and marginal farmers.

Baling of hay

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.

General guidelines for hay making

- ✓ 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 drying to avoid shattering of leaves and bleaching of 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;
- ✓ Storage of hay before sufficient drying may cause fire due to spontaneous combustion
- ✓ Storage of hay with higher moisture results in mould growth, make it unfit for feeding
- ✓ High moisture content at stacking time results in dry matter and nutrient losses of 15 to 50 per cent.

High quality hay is light grey color, leafy, pliable & free from mustiness.

Chemical changes in the fodder on hay making

After harvest, respiration continues leading to the conversion of soluble sugars to CO_2 and H_2O. This not only results in the loss of nutritive value and digestibility but also increase cellulose and lignin percentages. The plant enzyme act on protein and occurrence of proteolysis lead to production of amino acids. This again reduces nutritive value and keeping quality. Hence quick drying under sun light is preferred.

Losses in hay making

- ✓ Nutrient losses due to late cutting.
- ✓ Shattering of leaves and finer parts especially in legumes.
- ✓ Loss of soluble nutrients due to leaching caused by rain during drying
- ✓ Continuous and excessive rainfall results in fermentation and mould growth.
- ✓ Excessive exposure to sunshine leads to loss of chlorophyll and carotene (bleaching).

Merits of hay

- ✓ Hay can be prepared quicker and easier than silage
- ✓ It is best among dry fodders as it has high nutrient content
- ✓ Conveniently fed to the animals during lean period
- ✓ Cost of making hay is low

Demerits of hay

- ✓ Hay is less digestible and nutritious than silage
- ✓ Less tasty
- ✓ More nutrient loss
- ✓ High risk of catching fire
- ✓ Difficult to make hay during bad weather condition

Silage Making

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. 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 anaerobic environment is essential. Stored material is highly acidic and has a lower feeding value compared to the original green fodder in the field.

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.

Types of silos

Horizontal silos

Trench silos are commonly used for easy handling of the silage. Trenches of different sizes, with depths up to 4 m are used. 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

These 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.

Vertical silos

- ✓ Pit silos are circular or rectangular vertical pits with a depth of 3-8 m. 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. Pit silos are most suitable and economical for storage of smaller quantities. Their cost and the losses are lower than with the trench silos.
- ✓ Tower silos are 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.

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 crude protein level under 20 per cent, there is no need to use additives. Additives not only upgrade the silage quality, but they also reduce the risk of failure to preserve the forage. The most common ones are organic acids, molasses and preservatives such as salt and sodium metabisulphite. Most of the undesirable bacterial activity can be prevented by adding an organic acid to the crop. By adding molasses (15 litre in 15 lit water) to one ton of silage, the pH can be quickly reduced to below 4.0. Salt adds flavor and reduces water activity.

Guidelines for preparing and using silage pit

Harvesting

Crops and plant material rich in soluble sugars such as maize, sorghum, oats, sugarcane tops, hybrid napier grass and other grasses are highly suitable. High or medium quality grasses and fodders containing between 15-35 per cent dry matter results in high or medium quality silage. 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. Green to semi-green forage use the oxygen present for respiration, results in high quality silage. Partial wilting of legumes is necessary to reduce the water concentration to about 70 per cent. 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, 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. Fermentation starts within hours after closing the silo, and accelerates over 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 fermentation process. The fermentation process will be complete in 4 to 5 weeks and after that the mass becomes stable.

Opening the silo

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 atmosphere. Some moldy material may be found on top and also on the side, which should be removed before taking the silage for feeding.

Characteristics of good silage

- ✓ No mould growth
- ✓ Golden / greenish yellow
- ✓ Pleasant fruity odour or acceptable aroma
- ✓ Free flowing and non-sticky texture
- ✓ 3-4% increased palatability
- ✓ Increased nutritive value
- ✓ pH around 4.0 – 4.5

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.

Advantages of silage making:

- ✓ When harvested at or before the flowering stage, more nutrients can be available for animal feeding
- ✓ Losses due to shattering, leaching and bleaching during hay making are avoided
- ✓ Silage making is less affected by adverse weather conditions as compared to hay making.

Disadvantages of silage making:

- ✓ It requires labour for filling of the silo
- ✓ Construction of a silo requires an investment
- ✓ Handling and transportation require more effort as compared to hay
- ✓ Nutrient losses are generally 10 per cent over losses with green fodder
- ✓ Slight carelessness at the time of ensiling may result in heavy losses due to aeration
- ✓ Marketability of silage is very low.
- ✓ Feeding of silage just before milking may give some silage smell in the milk, so milch animals should be fed with silage after milking.

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