

# Silage : The Conserved Fodder

**Ms. Bindu Kumari**

Assistant professor, Department of Botany, Govt. Degree college, R.S. Pura.  
Corresponding author email id: bindu.angurana@gmail.com

**Abstract** – Livestock rearing is one of the foremost occupation in India. Besides as a source of food, it also provides manure, draught power for agriculture and local transportation. Despite of having huge livestock population its contribution to the GDP is too low. There as on of low productivity is attributable to growing human population, it is necessary that the production of milk, meat and other animal products is increased at rapid rate. One of the important factors through which this can be achieved is by increasing animal feeds for further conversion into production. Conservation of fodder, when they are in plenty as silage is a promising strategy to bridge up the gap.

**Keywords** – Conservation, Silage, Silo.

## I. INTRODUCTION

The green fodders at right stage when stored in packed and compressed condition so as to expel the air and then sealing up with a covering to prevent the contact with fresh air, with minimum loss of nutrients in order to preserve it by fermentation for use as a succulent fodder during scarcity is called Silage. Whereas Silo is a receptacle (pit, trench or tower) in which silage is made. Pit silos are more common in India. The pits are dug 2.4-3.0m deep; with variable sizes. The size of the silo should be calculated on the basis of number of animals to be fed and the length of feeding period and should be located on elevated ground.

## II. HISTORY

Using the same technique as the process for making sauerkraut, green fodder was preserved for animals in parts of Germany since the start of the 19<sup>th</sup> century. This gained the attention of a French agriculturist, Auguste Goffart of Sologne, near Orleans, who published a book in 1877 which described the experiences of at preserving green crops in silos. Goffart's experience attracted considerable attention. The conditions of dairy farming in the USA suited the ensiling of green corn fodder, and was soon adopted by New England farmers. Francis Morris of Maryland prepared the first silage produced in America in 1876. The favorable results obtained in the US led to the introduction of the system in the United Kingdom, where Thomas Kirby first introduced the process for British dairy herds.

Early silos were made of stone or concrete either above or below ground, but it is recognized that air may be sufficiently excluded in a tightly pressed stack, though in this case a few inches of the fodder round the sides is generally useless owing to mildew. In the U.S. structures were typically constructed of wooden cylinders to 35 or 40 ft. in depth.

In the early days of mechanized agriculture, stalks were cut and collected manually using a knife and horse drawn wagon, and fed into a stationary machine called "silo filter"

that chopped the stalks and blew them up a narrow tube to the top of a tower silo.

## III. PRINCIPLES OF SILAGE MAKING

At harvest, plant cells do not immediately "die," they continue to respire as long as they remain adequately hydrated and oxygen is available. The oxygen is necessary for the physiological process of reparation, which provides energy for functioning cells. In this process, carbohydrates (plant sugars) are consumed (oxidised) by plant cells in the presence of oxygen to yield carbon dioxide, water and heat: sugar + oxygen.

Once in the silo, certain yeasts, molds and bacteria that occur naturally on forage plants can also reach populations large enough to be significant source of respiration. In the silage mass, the heat generated during respiration is not likely readily dissipated, and therefore the temperature of silage rises.

Although a slight rise in temperature from 80-90 F is acceptable, the goal is to limit respiration by eliminating air (oxygen) trapped in the forage mass.

Some air will be incorporated into any silodurint the filing process, and a slight increase in silage temperature is likely. These temperature increases can clearly be limited by harvest in at the proper moisture content and by increasing the bulk density of the silage. Generally, it is desirable to limit respiration during the fermentation process by using commonsense techniques that include close inspection of the silo walls prior to filling, harvesting the forage at the proper moisture content, adjusting the chopper properly (fineness of chop), rapid filling, thorough packing sealing and close inspection of plastics for holes.

## IV. FACTORS AFFECTING SILAGE MAKING

### 1. Type of Fodder:

Types of fodder affect the final quality of Silage. Factors such as type of forage to be ensiled, maturity, dry matter content and water soluble carbohydrates content (WSC) of that forage, all influence the ensiling process and ultimately the quality of Silage that is produced. In general good quality silage can be produced from cereal fodders than legumes or grasses, because of their low buffering capacity and their high content of WSC.

The WSC in cereals provide a readily available source of energy that is rapidly fermented to lactic acid by anaerobic microorganisms. Consequently Ph decline is usually more rapid, and the final Ph is usually lower in cereal silage than in grass or legume silage.

### 2. Forage Maturity:

As forage matures, the moisture and WSC concentration which impedes fermentation, and as a result, the pH of ensiled fodder is higher than that of the silage harvested at

early – dough.

### 3. Forage Dry Matter:

Dry matter content of forages also influences the silage quality. High moisture silages promote very active fermentation and they are often associated with increase in seepage losses from the silo. Furthermore, intake of high moisture silages is also less, relative to intake of forage ensiled at optimal dry matter content. Wilting can be used as an effective tool to elevate forage dry matter into an acceptable range for ensiling. However, over wilting the forage also reduces silage quality.

## V. STEPS FOR PREPARING SILAGE

### 1. Harvest at Proper Stage of Maturity

The crop for silage is generally harvested at the flowering stage when it has the maximum amount of nutrient. For maize this is about the early stage (well matured stage normally harvested for seed) of maturity and for sorghum the late dough stage (stage at which seeds are soft and immature) at the earliest. Silage materials containing less than 25% DM will form very sour silage and will usually lose significant amount of silage juices during storage, involving a considerable loss of nutrients. Thus plants for silage making may be allowed to mature till the DM content attains 35-40%.

### 2. Cut to Proper Length

The length of the cut sections affects the packing and hence the quality of the silage. Silage crops usually vary from a fraction of an inch in length. Grass silages require to be more finely chopped than maize and sorghum. Wilted and dry forages and forage with hollow stems should be chopped more finely than forage of high content, thus permitting more through packing and eliminating most air pockets.

### 3. Control the Moisture Content

The moisture content in the crops to be ensiled should be 60-65%. The high moisture content of the silage crops may be lowered by any one or combination of the following methods:

#### i) Conditioning/Wilting:

This method is suitable for making of grass silage. Conditioning/Wilting for 3-4 hrs. On a good sunny day may reduce 10-15% moisture content.

#### ii) Adding Dry Hay or Straw:

During poor wilting weather, the moisture content of grass forage can be reduced within the desired range by adding 5- 20% straw.

#### iii) Combining High and Low Moisture Crops:

By mixing at a calculated ratio between high and low moisture crops, the forage may be made into desired moisture content.

#### iv) Adding Dry Preservatives:

Dry preservative as ground grains, maize and cob meal, dried molasses, etc. will reduce moisture content.

#### v) Add Silage Conditioners When Needed:

Some common additives and preservatives are discussed below.

- *Molasses:*

Some green forages such as legumes and certain grasses are low in sugar content. Adding molasses @ 3-3.5% of green weight of forage (in either liquid or dehydrated form) lactic and acetic acid production. It also increases the palatability and nutritive value.

- *Urea:*

Adding urea @ 0.5% of fresh forages enriches the silage with nitrogen as cereal forages are mostly deficient in this element.

- *Limestone:*

It may be added at the level of 0.5- 1% of maize silage to increase acid production. It allows the lactic acid bacteria to perform longer and to produce more desirable acids.

- *Sodium Metabisulphite:*

It is an anti- bacterial and improves carotene content.

- *Organic Acids:*

Propionic and formic acid are used for enhancing preservation of forages without the loss of palatability.

- *Bacterial Cultures:*

Silage preservation containing cultures of acid forming bacteria like *Lactobacillus acidophilus*, *Torulopsis* sp. and *Bacillus subtilis* are added to silage crops. The basis for including these are preservatives is to provide inoculums to increase the number of bacteria for helping rapid fermentation.

## VI. JUDGING THE QUALITY OF SILAGE UNDER FIELD CONDITIONS

The quality of silage can be judged by its smell, colour, taste and touch.

*Color:*

In general, pale yellow indicates good quality. If the color is from dark brown to dark green, the silage underwent bad fermentation and is of bad quality.

*Smell:*

Acidic or sweet sour pleasant smell indicates good quality. On the other hand, if there is a mature smell or putrid smell and it is so repungent that one cannot put the silage near one's nose, the quality is poor.

*Taste:*

If the silage tastes sour and there is no problem in putting it in one's mouth, the quality is good. On the other hand, if the silage tastes bitter and one cannot put it in one's mouth, the quality is poor.

*Touch:*

When squeezing the silage tightly in a hand and then opening the hand, if the silage breaks into two, that silage is of good quality. If the silage breaks into small pieces separately, the silage is deficient in moisture content. If water is dripping, the moisture content of the silage is too high.

## VII. ADVANTAGES OF SILAGE

1. Intensification of forage production (i.e., increased yield of forage per hectare.);
2. Minimization of risk factors associated with weather conditions (rainfall losses) when trying to harvest high

- quality forages;
3. Improvement of the producer's control over cutting dates and optimal stage of maturity at harvest;
  4. Minimization of loss of leaves and other small plant parts of high quality in the field;
  5. Storage of non – forage feeds that cannot be preserved as hay, such as agro- industrial by products;
  6. Stable composition of the feed (silage) for a longer period (upto 5 yrs.);
  7. Plants can be harvested at optimal phase of development and are efficiently used by livestock;
  8. Reduction of nutrient losses (below 10%) which in hay may amount to 30% of the dry matter.
  9. More economical use of plants with high yield of green mass;
  10. Better use of the land with 2-3 crops annually; requires times less storage space compared to hay;
  11. Silage is produced in both cold and cloudy weather;
  12. The fermentation in silage reduces harmful nitrates accumulated in plants during droughts and in over – fertilizes crops;
  13. Allows by products (from sugar beet processing, maize straw, etc.) to be optimally used;
  14. Maize silage has 30-50% higher nutritive value compared to maize grain and maize straw; 2 kg of silage (70% moisture) has the equal nutritive value of 1 kg of hay;
  15. In addition to serving as roughage, silage is good appetizer, slightly laxative in nature and maintains feed intake during hot weather;
  16. Compared to pasture there is less infestation of worms and parasite with silage feeding.

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