THE SCIENCE WORLD
A Monthly e Magazine
ISSN:2583-2212
Popular Article
August, 2026 Vol.6(8), 2498-2506

Smart Fodder Management: Improve Animal Nutrition with Quality Silage

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doi.org/10.5281/ScienceWorld.22636758

Abstract

By supplying a steady and balanced supply of feed throughout the year, fodder management is essential to guaranteeing sustainable livestock production. Animal health and productivity are negatively impacted by seasonal shortages of green fodder in many farming systems, particularly in mountainous and rain-fed areas. Planned cultivation, the use of a variety of fodder resources, and the implementation of suitable conservation measures are all necessary for effective fodder management. Silage production is regarded as one of the best ways to preserve excess green fodder with the least amount of nutrient loss among other fodder conservation techniques. Controlled anaerobic fermentation is used to make silage, which improves cattle palatability, digestibility, and calorie availability. Producing high-quality silage requires careful crop selection, timely harvesting, moisture control, compaction, and airtight sealing. Using silage technology in conjunction with better fodder management techniques lowers feed costs while increasing milk production, reproductive efficiency and overall farm profitability. Therefore, effective silage-making methods along with fodder management are essential for bolstering livestock-based farming systems and improving farmers' standard of living.

Introduction

Since the availability of sufficient and nourishing feed directly affects animal health, productivity, and farm profitability, fodder management is an essential part of successful livestock production. Feed and fodder alone make up the majority of animal husbandry expenses in the majority of developing and mixed farming systems. Despite this, inadequate planning and management of fodder resources frequently results in seasonal shortages, uneven feeds, and subpar animal performance. By guaranteeing a consistent, affordable, and

sustainable supply of feed throughout the year, effective fodder management seeks to address these issues.

Crop wastes, natural grasses, and scarce green fodder are the main sources of nutrition for livestock in India and other rural economies. These sources are frequently insufficient, particularly during dry and cold seasons. In rain-fed, hilly, and marginal places where arable land is limited and climate conditions limit the production of feed, the issue gets worse. Because of this, animals often experience undernutrition, which results in decreased milk production, stunted growth, delayed maturity, and heightened susceptibility to illness. Therefore, fodder management is a strategic method to maximize the utilization of available land, water, and biological resources rather than just a feeding practice. Planned fodder crop cultivation, effective use of crop leftovers, incorporation of legumes and fodder trees, and implementation of suitable conservation techniques are all components of scientific fodder management. In order to maximize yield and nutritional content, it highlights the significance of cultivating appropriate fodder varieties in accordance with agroclimatic conditions, preserving soil fertility, and harvesting fodder at the appropriate time. Furthermore, in order to improve overall farm efficiency without competing with food crops, fodder management promotes the integration of fodder crops with current cropping systems, such as intercropping and mixed cropping.

Fodder conservation, which tackles the problem of seasonal mismatch between fodder availability and animal demand, is another essential component of fodder management. Conservation methods like hay and silage production help save nutrients for use during lean times when there is an excess of green food. Among these, the production of silage has become increasingly important since it can preserve green fodder with little waste while increasing its palatability and energy content. Combining effective conservation techniques with proper fodder management guarantees a steady supply of feed, lessens reliance on expensive concentrates, and promotes sustainable livestock production systems. All things considered, fodder management is the foundation of dairy and cattle farming since it balances and economically connects feed resources with animal needs. Adoption is crucial for raising farmers' livelihoods, guaranteeing animal welfare, and increasing productivity—especially in regions where fodder scarcity occurs frequently.

The Fodder Management Goals:

• Make sure that dry and green feed is available all year round.

• Lower the cost of feed

• Boost reproductive, milk and meat production

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• Avoid fodder shortages in the summer and winter.

Fodder Types Based on Availability:

The topography of Himachal Pradesh is varied, ranging from high-altitude alpine zones to subtropical valleys. The kinds of fodder that are available vary according on the season, altitude and land use because of this variance. Green fodder crops, grass pasture and natural grasses, agricultural wastes, and tree/shrub fodder are the general categories of fodder supplies.

1. Green Fodder Crops: Fresh, lush herbage used to make hay or silage or fed directly to animals is known as green fodder. In Himachal Pradesh, rainfed farms rely more on natural grasses and agricultural wastes, while green fodder crops are often planted in valleys and mid-hills where irrigation is available. Maize (*Zea mays*) is a common green fodder crop. During the kharif season, it is a significant source of succulent fodder and is frequently utilized for silage. Grown as a rabi fodder crop, oats (*Avena sativa*) offer high-quality green feed in the winter and spring. Because of its rapid regeneration, hybrid Napier and Napier-Bajra hybrids are planted in irrigated locations for several cuts throughout the year. Seasonal feed, such as sorghum and bajra (pearl millet), is best suited to lighter soils with little watering during the warmer months. Although barley has historically been utilized as a food crop, it is increasingly being used as green fodder, particularly in cooler, rainfed regions where other fodder crops are less productive. To increase the supply of green fodder outside of natural pastures, these crops are usually grown throughout the Rabi (winter) and Kharif (monsoon) seasons.

2. Natural Grasslands and Pasture Fodder: In hilly and high-altitude areas where farming is restricted by steep slopes and tiny landholdings, natural grasslands and pastures are important sources of fodder. Sheep, goats and cattle graze directly on a variety of native grass types that make up these.

Common species found in grasslands include

• Common grasses in the lower and mid-hills are *Andropogon* and *Chrysopogon species.*

• Species of *Festuca* and *Eragrostis* are found in colder hill regions.

• Other grass species that contribute to grazing biomass include *Pennisetum, Imperata*, and *Cymbopogon* species.

Farmers are forced to rely on stored fodder or tree fodder during lean times due to the seasonal availability of natural grass, which is most abundant in the spring and monsoon but limited in the dry summer and cold winter.

3. Crop wastes: In winter or when green fodder is scarce, agricultural wastes from food and fodder crops are an important source of dry fodder. Wheat straw, paddy straw, maize stalks and stover, and legume residues (such as gram and pulses) are examples of crop residues. In order

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to increase their palatability and nutritional value, these residues are frequently gathered after harvest and given to animals or processed (e.g., treated with urea or used in haylage).

4. Fodder Trees and Shrubs: Fodder trees and shrubs are crucial for supplying livestock feed in mountainous areas with little grass production, especially during the winter and dry seasons. To feed animals, farmers frequently lope (chop leaves or branches).

In Himachal Pradesh, significant fodder plants and bushes include:

1. *Grewia optiva*: Cattle love this nutritious and highly tasty plant.
2. *Morus* (mulberry): Due to its large leaf output, it is significant in mid-hills.
3. Locally accessible tree fodder sources include *Celtis australis* and *Ficus species.*
4. *Bauhinia variegata* and *Robinia pseudoacacia*: Used as feed in agricultural and forests.
5. *Quercus* and other forest trees: Livestock may browse young branches and leaves in alpine and sub-alpine regions.

These tree species assist boost fodder biomass through silvipastoral systems and offer green fodder at times when grasses are scarce, like winter.

Planning for Fodder Production

1. Using fodder crops in crop rotation
2. Combining non-legume and legume crops
3. Growing fodder alongside major crops
4. Using better types of feed
5. Appropriate stages of fertilization, irrigation, and harvesting

Techniques for Fodder Conservation

1. Making hay
2. Making silage
3. Straw treated with urea
4. Full feed blocks

The best way to preserve green fodder among these is to make silage.

Silage: Its significance and production method

The process of creating silage involves cutting new green fodder, such as maize, sorghum, jowar, and bajra, chaffing it, and packing it in closed containers or buildings called silos to keep oxygen out. Here, fermentation takes place in an anaerobic atmosphere, converting sugar to acids. The majority of germs are killed and the feed is preserved in an acidic environment. Silage is the end result of a sequence of procedures that ferment high-moisture cut forage to create a stable feed that is resistant to further degradation in anaerobic storage. Using this method, grass is kept in an airtight environment until fermentation and acidity take place.

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Fodder is maintained for one to one and a half years because the acid lowers the pH and eliminates the majority of germs and microorganisms. Table 1 shows the final products of silage fermentation, which are frequently seen to evaluate silage quality.

Table 1: End Products of silage fermentation

Items	Positive or Negative	Action(s)
Ph	+	Low pH inhibits bacterial activity.
Lactic acid	+	Inhibits bacterial activity by lowering pH.
Acetic acid	- +	Associated with undesirable fermentation. Inhibits the growth of yeast responsible for aerobic fermentation.
Butyric acid	-	Associated with protein degradation, toxin formation, and large losses of DM and energy.
Ethanol	-	Indicator of undesirable yeast fermentation and high DM losses.
Ammonia	-	High levels indicate excessive protein degradation
Acid detergent insoluble nitrogen	-	High levels indicate heat damaged proteins and low energy content.

Source: Kumar et al (2019)

The technique of ensiling involves storing grain or fodder in silos so that it can be transformed into silage, a more succulent meal for animals. When it comes to preserving nutrients, especially from forages, ensilage offers numerous advantages over other techniques. Precautions must be taken for the correct preservation of nutrients when ensiling fodder since poor quality silage is produced due to a lack of knowledge about the factors involved in this process, which has an impact on animal performance. The microorganisms found in fresh herbage or additives that maintain anaerobic conditions and inhibit clostridial growth with the least amount of nutrient loss control the fermentation process.

Process of silage making

The following steps are involved in ensiling, the process of creating silage:

1. The optimal stage of green fodder harvesting.
2. Fodder with a high moisture content should be wilted to 65–70% moisture.

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3. To enable the necessary compaction, chop the feed into shorter lengths, such as 1-3 cm. To provide sufficient effective fiber in the silage, at least 20% of the particles must be longer than 2.5 cm. Additional cut length is determined by the crop's dry matter content (Table 2).
4. Polythene sheets or plaster should be used to line the walls of the silo pits. In order to fill the silo pit and chop the fodder at the same time, the chopping should be done close to the silo.
5. Layers of one foot should be filled as quickly as feasible.
6. To keep air out of the pit, the fodder should be regularly compressed.
7. To minimize temperature rise brought on by respiration, compact the forage as firmly as you can. 700 kg is the typical packing density in a 1 m3 area.
8. The silo should be positioned in a semicircle with a dome-shaped top and filled one meter above the ground.
9. To make the pit airtight and rainproof, cover it with a layer of straw that is one foot thick and plaster it with mud that has been mixed with wheat straw (bhusa). The chopped forage can also be covered with a plastic sheet.
10. Examine the filing pit once a week to prevent plaster cracking, since the fermentation process will be impacted by any cracks in the plastered layer. The silage will be prepared in 45 days.

Table 2: Ideal chopping length for silage making

Dry matter	Ideal Chop length
28-35%	½ -3/4 inches
20-28%	¾ -1 inches
<20%	>1 inches

Crops used to make silage

Maize, sorghum, oats, pearl millets, hybrid napier, beets, and other crops are used to make silage. Because of their high sugar content, sorghum and corn/maize are the finest crops for silage. In India, maize or corn silage is frequently utilized. Because silage retains the nutrients in their natural form, it is just as nutritious as green fodder. Since the crop is harvested at the right time, it is advantageous to harvest fodder crops once in order to make silage. The palatability of the fodder crops increases during the silage-producing process because the stiff stem softens during fermentation, making it easier for dairy cows to digest. Additionally, during silage fermentation, anti-quality elements like nitrate are either eliminated or reduced.

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Properties of good quality silage

Sr. No.	Parameter	Indication
1.	Smell	Mild, pleasantly acidic, sour milk or natural yoghurt smell.
2.	Colour	Light green-green. Color of good quality silage for maize, cereals and other grass silage.
3.	pH	3.8-4.2
4.	Dry Matter	30-35%
5.	Crude Protein	7-9%
6.	Ether extract	2.8-3.8%
7.	Neutral detergent fiber	35-55%
8.	Ammonia nitrogen	Less than 10%
9.	Lactic acid	Above 4%
10.	Acetic acid	1-3%
11.	Butyric acid	<0.13%

Benefits of silage

1. It can be utilized during the lean time, when green forages are scarce.
2. Ensures consistent feeding throughout the year by supplying a year-round supply of nutrient-rich fodder.
3. Silage is just as nutritious as green fodder because it keeps the nutrients in their natural state, making it as suitable for animal feed.
4. Using solely silage as fodder drastically lowers labor costs in dairy operations.
5. When hard stems are fermented into silage, they become softer and more palatable to dairy cows.
6. Make sure there is a consistent supply of green feed.

7. Efficient use of greens with minimal waste, parasite control, etc.

Silage feeding for milch animals

For milch cattle, silage provides crucial fermented feed, especially when there is a shortage of green fodder. Sustaining milk production, preserving body condition, and enhancing general animal health are all facilitated by feeding high-quality silage. When fed with concentrates and dry hay, properly fermented silage is tasty, high in digestible energy, and promotes effective rumen function. As a general rule, adult cows should be fed silage at a rate

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of 6% of their body weight, or 30 kilogram for a cow weighing 500 kg. A sufficient concentrate combination, minerals, and clean drinking water must always be added to silage, which should typically replace one-third to half of the green fodder need. Particularly during lean seasons, milk animals given high-quality silage exhibit steady milk output and improved feed consumption.

Precautions to be taken while feeding silage

1. Only feed high-quality silage that is greenish to golden-brown in color and has a nice acidic scent; stay away from silage that smells bad, has mold development, or has a slimy texture.
2. Avoid feeding milch animals rotten or fungus-infected silage since it might lead to digestive issues, decreased milk production, abortion, or other health issues.
3. To allow rumen microorganisms to properly acclimate, gradually introduce silage over a period of seven to ten days, beginning with modest amounts.
4. Steer clear of giving too much silage all at once, especially to high-yielding animals, since this could cause acidosis and decreased feed intake.
5. To ensure the right nutrient balance, give silage in addition to dry fodder and a balanced concentrate mixture.
6. To avoid air penetration and secondary spoiling, make sure the silage is removed from the pit or silo layer by layer.
7. Before feeding, keep silage out of the air for as little time as possible to prevent spoiling and nutritional loss.
8. To prevent contamination and animal rejection, keep feeding mangers clean and remove any leftover silage every day.
9. When silage is part of the ration, supply enough clean drinking water and a mineral mixture.
10. To prevent health issues, pregnant and young animals should be fed silage with special caution, making sure it is of the right quality and amount.

Conclusion

The foundation of profitable and sustainable livestock production is effective fodder management, especially in areas where there are seasonal shortages of green fodder. Dairy cows have a consistent and balanced supply of nutrients all year long thanks to scientific planning of fodder resources, which includes growing appropriate fodder crops and using them wisely. Making silage is one of the most dependable and useful ways to preserve excess green fodder without significantly reducing its nutritional value. High-quality fermented fodder that

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is tasty, nourishing, and safe for animals is produced by proper silage manufacturing, which involves timely harvesting, accurate chopping, efficient compaction, and airtight storage. Silage stabilizes milk output, enhances animal health, and lessens reliance on expensive commercial feeds when incorporated into a well-managed fodder system. It also helps close the gap during lean times. Therefore, improving fodder security, guaranteeing year-round feeding, and bolstering the general resilience of dairy farming systems require the implementation of enhanced fodder management practices in addition to scientific silage-making processes.

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