

Silage - An Option as Nutritive Fodder for Cattle

The use of **Silage** started in the 1970s but it was not popular due to the wide availability of agriculture crops, and wide adoption of fresh fodder cultivation in Punjab. With the progress in dairy in the State, feeding in general, and nutritious feeding in particular, became challenging and farmers adopted fresh fodder cultivation in small areas of their field (0.5 acre). Fodder cultivation in different seasons is sufficient to feed 2-3 animals in a backyard.



Pic: Good quality silage

What is Silage?

“**SILAGE**” is an age-old practice to preserve grasses for fodder. It was practiced in ancient Greece around 1000BC. The technique was limited to Europe and spread to the rest of the world in the 19th century.

The technique is to store grass in an airtight environment until fermentation and acidification happens. The acid decreases the pH and kills most of the bacteria and microorganisms, which prevent any decomposition, and fodder remains preserved for 1-1.5 years.

“In 1877, **Goffart**, a French farmer, published the first book on ensiling, detailing his experiences in making whole plant corn silage.”

Different kinds of green fodder can be preserved through this technique and fed to animals. The crops used for silage making are maize, sorghum, oats, pearl millets, hybrid-napier, beet etc. The best silage crops are corn/maize and sorghum, due to their high sugar content.

“**Maize or Corn silage**” is widely used in Indian conditions.

The advantage of silage feeding are:

- Regular supply of green fodder
- Uniformity of feeding round the year
- Can be balanced with other feed ingredients
- Can be prepared in any weather
- High utilisation of greens and less wastage, control of parasites, etc.

In the last 3 decades, the State has gained 2.7 times in milk production (4.97 Million Ton in 1990 to 13.37 Million Ton in 2020). The per capita availability of milk has increased 1.8 times during the period. The increased production has made mechanisation viable with the introduction of milking machines, fodder processors and other tools. Dairy has progressed from an agriculture- allied activity to a commercial business. The number of animals per shed has increased and nearly 8,500 commercial dairies have come up.

There has been multi-fold increase in the productivity of indigenous cows (7.59 LPD), crossbreds (13.86 LPD), and buffaloes (8.65 LPD). The high productivity of animals is the result of better breeding to produce high- yielding cows, better management and optimum feeding.

The increased number of animals and high producing heavy animals have resulted in high fodder requirement. The situation has also worsened due to labour issues, fluctuating and increasing prices of grain-based feed and wheat straw. The farmers have found that **Silage** is a solution for many issues and there has been wide acceptance of silage by farmers in Punjab in the last 10 years. Although, women are less involved in commercial dairy in Punjab, it has reduced the drudgery of fodder management at home for women.

Reasons for the increase in demand for silage in recent years?

In recent years, a lot of emphasis has been laid by government organisations (AHD) and research institutions (like PAU, GADVASU) on popularising silage feeding. The PDDDB, Corteva/Pioneer, Cargill, Nestle, has also played an important role in the demonstration of silage feeding and have provided handholding support in all stages - from cultivation and processing, to feeding. The other important reasons behind the adaptation of silage feeding are:

Desired Quality of Good Maize Silage

- Dry Matter (DM%): 30-38
- Crude Protein (% of DM): 6-9
- ADF (% of DM): 25-35
- NDF (% of DM): 35-55
- Starch (% of DM): 25-35
- pH : 3.7- 4.2
- Free from Molds and other impurities.

- Increase in price of grain-based feed (nearly double).
- There is less consistency in labour availability due to alternative options. The COVID pandemic has also affected labour availability recently.
- Silage has been recognised as having an overall high impact on sustaining animal health along with stable milk production.
- Silage is also a convenient way to store for longer durations of time and the bales can be stored in open air in all weather conditions.
- Silage also fits well into advanced feed management techniques like precise rationing and TMR.
- Dairies are coming up in small spaces and they have less space for feed and fodder.
- This year (2022), there was a sudden increase in wheat straw prices due to less production.
- Entrepreneurs are also popularising the product and there is good demand for the product from nearby states like J&K and Rajasthan.

Silage in Punjab

Dairy farmers have a wide awareness about Silage in the state ecosystem. It is popularly known as “*Makke Da Achar*”. Most of them are also aware about the process of ensiling. The entire process of silage-making is strategically well-fitted to one season of the year, which starts from the 1st week of May and ends by 30th August. Maize cultivated during the Spring or post-potato, is the main crop for silage-making. Approximately, 30% of farmers go for post-wheat and maize cultivation (Summer maize) and ensiling is done in July. Summer maize always runs a risk of rain and machine scarcity.

Silage-making is voluminous work, and roughly 100 Quintals (10 Ton) of silage is required for a 20 LPD producing cow for the entire year. There is an estimate that a farmer has to spare 0.4 acre of land (Spring maize) per cow for silage cultivation for the entire year. Silage feeding and production are dependent on the type of dairy farmers:



Type of Farmers	No of Cows/Buffalo	Preference for Silage
Small Farmers	1-4 animals	Purchase silage in case of green unavailability only. They do not prepare silage. Baled silage is the only option for them.
Medium Farmers	5-10 animals	Prepare own Pit silage for partial feeding only, mixed with other feed. Sometimes purchase silage in case of scarcity.
Commercial Farmers	11-40 Animals	Prepare own silage, and also arrange for greens for the entire year.
Big Farmers	50+ Animals	Own setup and machinery for silage preparation.

The production of silage in the State is limited to a small window of 45 days in the year (Peak during 15th May -30th June), when there is high requirement of skilled and unskilled labour, along with machines. The pit silage prepared at the farmer's shed requires machinery to harvest, transport, and press. In case of rain, 50% of the process is done manually which increases the production cost by almost two to three times.

The entire process of ensiling is highly voluminous work and is to be done in small intervals of time. Maize needs to be harvested precisely at a particular stage of ripening to have better quality silage. Any early harvest or delay in harvest, has an effect on production as well as quality. After harvest, the harvested maize has to be pressed and packed immediately to start the fermentation process.

Hence, the entire process at all levels is highly machine and energy dependent.



Farmer-Level Pit/Bunker Silage Production

Silage is well accepted among the farmers, and it is well known that it has a good effect on milk production and health of animals. Farmers rearing 6 animals and more, prefer pit silage production. The main reasons behind silage acceptance are:

- Farmers are finding it difficult to manage the farms due to labour scarcity. The process of harvesting of greens, chaffing and feeding to animals is a rigorous task.
- There is unavailability of greens round the year, so the farmers have to manage the cultivation of crops in their fields through the year. It is possible only if the number of animals is large. Silage is the second choice after fresh greens, the farmers have to spend 135 days only to feed the animals for the entire year. Also most of the silage work is mechanised.
- The farmers find silage better in economics as the production is highly cost effective and saves fuel and labour that is spent daily on greens.
- The animals reared on silage have better production and the cost of production decreases by 20-30%.

According to rough estimates, nearly 35-40% of the cattle heads of the State are under silage feeding. The production is to the tune of 35 Lakh Ton, covering 1.75 Lakh acre of maize. This silage is produced for the consumption on the farm and rarely sold to others. Silage requires 6 months advanced planning. Planning starts from the number of cattle to be reared during the year

and similarly, bunkers or pits to be prepared. There is a requirement of 1m³ space for 230-260 kg of silage from maize. The big dairy farms have permanent silage bunkers, but new farmers make the silage pit on the ground covered with poly sheet.

The silage is ready to feed after 45 days, the farmers open the silage pit once the greens are exhausted or when required.



Current Production

35

Lakh Ton

Market Value @ INR 3000/ton

1050

INR Crore

Industry Perspective

The Pit/Bunker silage of high quality, with better yield and low wastage, can be ensured with farm management from seed to harvest. There is high mechanisation in the entire process but there is also scarcity of equipment in that small window.



Table: Industry perspective of Pit/Bunker Silage

Inputs	Present Companies	Market Size	Expectation of Farmers
Seed Requirement	Corteva (Pioneer), Bayer, Nuziveedu Seeds, Syngenta, PAU Seeds	1200-1500 Ton (For silage)	Good Quality seed with high germination % leaf and starch Content. High Biomass- yielding seeds, with cob maturity and 36-40% cob ratio.
Seed Drills	Shaktiman, and Agro-industries manufacture	High availability due to use in multiple crops	Regular spacing for easy harvest
Single Harvester	Shaktiman, CLAAS, Fimaks (Turkey), Holand, Tussan	700-800 Machines Per annum	40 HP tractor requirement
Multi row	Fimak (Turkey), Celikel, Tosun, Kartar Agro	High adoption nowadays, 80-100 Machines per annum	80 HP Tractor is required
Self-Propelled	CLAAS (Jaguar 850), Holland Tractors	Limited due to high import cost, 15-20 per annum	Self-Propelled with weighing & Moisture meter

Commercial Silage Production

Pit Silage was limited to the farms where it was produced and consumed. There were issues to handle at all levels from harvesting to packing and then transporting to other places due to its bulkiness. Silage also deteriorates rapidly once opened, hence it cannot be transported for long distances. The introduction of plastic bags and then, plastic wrap packing popularly known as “Bale Packing”, has given impetus to the industry. Bale packing has made handling of silage very easy, and there is almost no loss of nutrients. The silage bales are kept in the open without much loss. The cost of silage has been increased by 25-33% (INR1.5-2/kg), depending upon the size of Bales, but it has opened the avenues of “Silage Baling” as an industry.

Bale packing was introduced in 1970 in Europe. In India this has been introduced only 15-16 years back (2005). Bale packing is totally mechanised work from harvesting to ensiling, which makes the entire process very fast, and less labour-dependent. Since the process is mechanised, there is a requirement of huge investment from crop production to harvesting and ensiling.

Commercial maize bale production has the following components:

Fodder Maize Growers

Maize is the normal cultivation in Punjab and covers almost 1.39% of the Gross Cropped Area. Cultivation is done mainly for grains and as animal feed. Maize is popularly grown in Spring (post-potato), Summer (post- wheat) and Kharif season. Silage can be produced in all the seasons, but there is high preference for Spring due to favourable weather and ease of processing. Biomass yield of maize is also high at 20 Ton per acre against 16 Ton in Kharif.



Maize is popular as a 3rd crop with potato growers, the silage biomass harvest gives a profitability of INR 25,000 per acre and the field gets empty for paddy one month ahead. The farmers also have an option of harvesting the grain and selling. The crop has the only disadvantage of high evaporative water loss in Summer.

The Kharif crop has the advantage of water, but the biomass yield is less and there is high pest attack also. In Kharif, cultivated maize grains are being procured much below the MSP, due to the high moisture content (up to 35% against the desired 13.5%). The selling of crop for silage has the advantage of cash income and preparing the field for the most important paddy crop.



Bailers

Bale silage was initiated by entrepreneurs who had been exposed to silage technology from Pakistan (Pioneer facilitated the visits), Turkey, Holland and USA, in 2015. The first silage bales were prepared by using the straw baling machine (MASCHIO)⁹ at “Farm2Energy” at Khanna.



Pic: Properly chaffed maize for silage production

History of Bale Silage in Punjab

2015: The first silage bale was prepared using the paddy straw baler, with imported wrap film at “Farm2Energy” at Khanna, Bija. Approx 5,000 tons of silage was prepared for a third party.

2016: The first silage was started by “Nutrimeal” at Rajpura with technological help from DuPont, now known as Corteva Agriscience. The owner was already in the cattle feed business. The company imported the first Baling Machine of OrkelTM .

2017: 11,000 Ton of silage produced at Nutrimeal Plant, Rajpura, Patiala.

2018: Two 100 kg Turkish machines were imported at Khanna and 6 Chinese static baler machines imported for Patanjali Silage-making in Gujarat. The Indian companies like Bkashish and S Well also started assembling baling machines.

2019: Silage becomes popular, and many Entrepreneurs have started the business. The production was 1.8 Lakh Ton.

2020: The production touched 3 Lakh Ton of Bale silage.

2021: 2.5 Lakh Ton of bale silage produced.

2022: 3.5 Lakh Ton of silage produced by 71 Balers across Punjab.

In the year 2016, Nutrimeal Silage came up in the market from Silageagro at Rajpura, Patiala.

After 2018, the Bale silage business became very popular and attracted many entrepreneurs to invest.



Pic: Poorly chaffed maize cause wastage in silage

The unavailability of good quality, reliable, baling machines was an issue. Indian manufactures were not able to compete with the imported machines. The imported machines had the disadvantages of being costly, unavailability of spares, and maintenance.

Most of the Balers are engaged in alternative agriculture businesses like rice shelling, brick kiln, iron business, feed mills etc. Balers find the shortage of green fodder and dry fodder in nearby states to be business opportunities.

Current Production of Bales

3.5

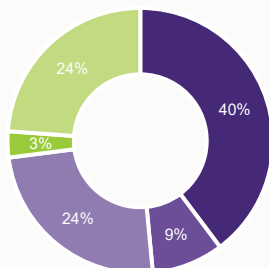
Lakh Ton

Market Value @ INR 6000/ton

210

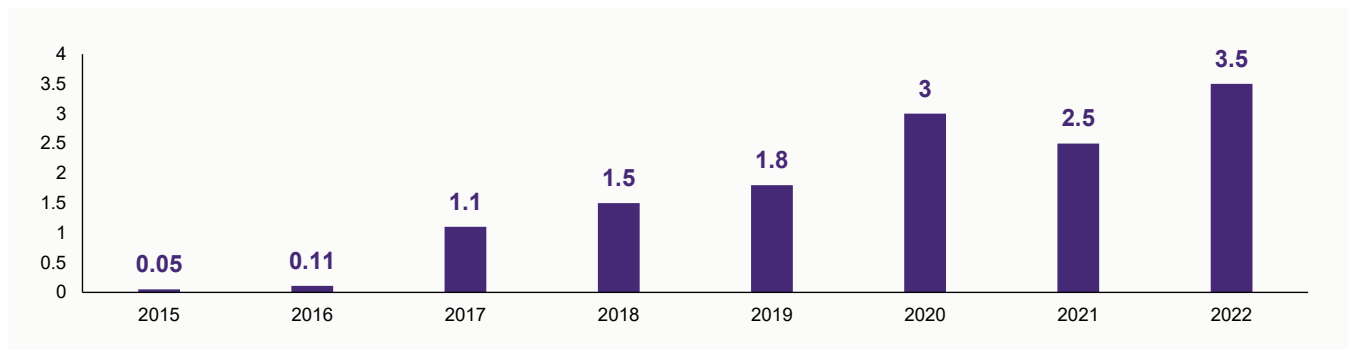
INR Crore

Economics of Balers



- Cost of Green Chafed Maize with transport
- Chaffing and Handling
- Baling cost
- Logistics and Handling
- Gross Profit

Growth of Baled Silage in Punjab (Lakh tons)



Equipment and Machinery

The State enjoys a high degree of mechanisation in Agriculture, which paved the way for silage preparation, with slight modification of machinery. The one row tractor-based harvester and self-propelled harvesters originated from static chaff cutters. The technology was further modified for shredding rather than cutting, fitted with booms and conveyers for silage preparation.

Silage preparation, packaging and transport cannot be thought of without machines. The growing silage industry will purpose demand for appropriate advanced machines as per the need. Earlier machinery was imported from Turkey, Germany, Norway and China which were very costly, and the maintenance of such equipment was tough. Indian entrepreneurs have started assembling and manufacturing such equipment in India. Indian machines need to compete with the imported ones in precision, use of sensors, data managers and low maintenance cost.

Type of Work	Type of Machines	Indian/ Imported	Capacity	Cost	Companies
Harvester	Single Row	Indian & Imported	3-4 Acre/Day	2.5-3.5 Lakh	CLAAS, Shaktiman, Holand,
	Self-Propelled	Indian & Imported	20-25 Acre/Day	25-30 Lakh	
	Multi-row Self- Propelled	NH 850, Jaguar, Channy		80-300 Lakh	CLAAS, NH,
Balers	400 kg	Imported/Indian	50 Bales/hr		Shaktiman. T Kornel, Orkel
	100kg	Imported/Indian	300 Bales/Day		Orkel
Accessories	Grabbers, Loaders, Trolleys and Tippers	Indian		INR 1.5-2 Lakh/Unit	Local agricultural industries



The harvesting of Spring maize is easy as the machines easily move into the fields as compared to Kharif maize. Except for the single row harvester, all harvesters are front loaded on tractors, and do not require any initial cleaning.

The harvesting of maize in the rainy season is very challenging, and the unavailability of machines to harvest, chaff and bring the moisture content to desired levels are the challenges. In the rainy season, the crops also fall onto the ground, which makes machine harvesting tough. The unavailability of machines makes the farmers dependent on labour which increases the cost of silage 2-3 times. There is also less productivity of crops in the Kharif season.

The silage bale-making machines are static type unlike the hay machine which harvests, makes and bales in the field. The bale-making machine needs electricity for its operations. There are baling machines from 60kg to 500kg. The 100 kg bale machine is popular as it is easy to handle, while the 500kg machine offers good margins. There are requirements of other machinery like grabbers, loaders and trolleys which are accessories fitted to tractors. Machinery and equipment are important supporters for the silage industry and R&D efforts are necessary for more automation.

The Equipment and Machinery requirement will keep growing as they are the tools for decreasing the cost of silage. Dairy farmers may opt for silage bale-making for themselves through baling service providers in the near future. There will be increased demand for machinery renting once the silage industry progresses as the machines are costly and are required only for a short interval of time.



Fodder Maize Seed

Fodder maize varieties play an important role in making silage profitable, adding to a slight increase in biomass yield. There are a variety of seeds from Pioneer (P1844), and Nuziveedu Seeds (Dragon 1247), and PAU varieties. There is a necessity for research to improve the yield of biomass and also to enhance the resistance to pests in Kharif. The high yielding hybrid seeds produce good biomass for silage making. Their price falls in the range of INR 350-400/kg for most of the suppliers. The selection of seeds is very important for silage production as it contributes to 18-20% of the input cost and poor seeds have a drastic effect on the silage yield.



Current Market Size for Silage Maize Seed	Market Value @ INR 4 Lakh /ton	% of Total Silage Cost (Pit & Bale)
1250-1500 Ton	60 INR Crore	4.7%

Additives (Inoculants)

Silage additives are added to improve the quality of silage by improving fermentation, reducing losses, discouraging growth of harmful bacteria and moulds, and the early stabilisation of silage. In Punjab, microbial inoculants are used mainly, which are safe to handle and non-corrosive to machinery. They help in rapid fermentation and bring down the pH rapidly. There are enzyme additives also for silage.

The inoculant business is supportive to the silage industry and it helps in promoting the silage business. Most of the companies provide technical help to farmers through knowledge transfer and expert guidance. The reach of inoculants is however, limited to less than 50% of the bale silage industry and only 2-3% in pit silage. There is a potential of growth in additives as the sensitivity towards quality is increasing.

Current Market Size for Silage Inoculants	Market Value @ INR 0.6 Lakh /ton	% of Total Silage Cost (Pit & Bale)
2-2.5 Ton	1.5 INR Crore	6.5%

Film Wrap

Bales are packed with highly stretchable films to prevent the entry of oxygen (set up of anaerobic environment for fermentation), handling, storage and transport. The films cover the silage bale entirely and prevent any leakage of water or gas. The wrap also protects the silage from UV radiation.

The required wrap film is in the thickness of 23 to 29 micron (27 micron is most preferred), with varied width of 250mm, 500mm and 750 mm etc. A good quality of wrapping protects the nutrients and dry matter content. The raw materials are petroleum-based and 60-70% are imported from other countries; the price fluctuation in the petroleum industry affects the raw material price and wrap film price.

Current Market Size for Film Wrap	Market Value @ Rs 1.7 Lakh /ton	% of Total Bale Silage Cost (Only Bale)	Major Players in Market
1000 Ton	17 INR Crore	8-9 %	Bostan Polymers, Indosmith Pvt Ltd, Polybird.



Logistics and Transport

Fodder maize is cultivated in farms and it needs to be transported to the Silage Pit or Silage Bale-making point. The local farm equipment manufacturers have developed tractor trolleys with hydraulics to transport the fodder maize from fields.

Marketing of Bales

The silage industry has developed due to the surrounding fodder deficit states like J&K (-53%), Rajasthan (-32%), Uttarkhand (-55%) and Himachal Pradesh. There is a shortage of greens in these states due to unavailability of irrigation facilities but the milk production is improving. The bales from Punjab are marketed to Rajasthan (25-30%) and J&K (30%). There is sporadic supply to nearby states like Uttar Pradesh, Bihar, NE states also. The market is limited due to high freight charges and long distance transport makes the silage costly for farmers.

In the State, most of the big dairy farmers prepare their own silage and there is no inclination towards bale silage as it is costly. The farmers purchase the bales in case of scarcity only, where the handling and logistics becomes a challenge. There is an increase of 12-15% in the cost of bales till it reaches the farmer's doorstep. The nearest availability is important for silage marketing and hence, local industry, local production and local consumption should be emphasised.

Bale entrepreneurs have adopted their own internet network for the marketing of the product. There is always some uncertainty associated with sales.

Challenges to Silage Industry Growth

Finance

Pit Silage or Bales are prepared once in a year and it is fed for the entire year. The investment in Pit silage is roughly INR 3,000 per ton or INR 30,000 per cow for a year. If a farmer has 10 cows or buffaloes, the investment required is INR 3 Lakh for a year. The recovery of invested money is through milk sale and it is gradual throughout the year. In the case of Bale silage, the investment is more than Pit Silage and is around INR 4.5-4.8 Lakh/10 Ton. The operating expense requirement for 10,000 Ton of baled silage is near INR 4.5 Crore. There is a requirement for investment in machinery, labour and space also.

There is a financing requirement of INR 4,500 per ton, and currently, the investment is being done by the entrepreneurs themselves. There is no direct type of financing for silage-making working capital. However, there is support for Bale Machines and harvesters from the Animal Husbandry Department, Punjab.

Technology

The silage industry requires the use of technology for estimation of maize crops on the field (area cultivated), yield estimation, in situ moisture and sugar estimation, microbial contamination assay, and more automation in the entire process. Essentially, the Bale silage-making process is 90% mechanised and 10% of the work is manual.



Pic: Half milk line stage for cob-Proper stage for harvesting for silage



Testing facility

There is a requirement for silage quality testing facilities to improve silage, in every district. The sample reports give confidence to customers as well as silage producers.

Certification

There is a requirement for standardisation of process and quality of silage.

Price stabilisation and Market demand

Silage is prepared in one season of the year, the price depends on the demand and price of other fodder. The prices need to be stabilised as per the months, as many balers incur losses due to a sudden fall in price owing to competition.

Government Policies

Silage production is skewed towards Spring maize cultivation rather than Kharif maize cultivation due to better ROI, convenience, and silage quality. Infrastructure and capabilities for smart and sustainable irrigation have to be developed to support the growing silage industry in Punjab as a role model for the entire nation.

The price of wrap film will also double if polythene is banned in the country, as the thickness will have to go above 50 micron (the current thickness is 23-27 micron).



Other Fodder Preservation Technology and Hay-making

Feed and fodder accounts for 65-70% of the cost of cattle rearing, where the shrinking fodder crop area and utilisation of grains for commercial use is pushing the feed cost higher. Ruminants can digest a variety of roughage like wheat and paddy straw, maize and jowar stalk, and tree leaves. The rising feed cost and scarcity of dry fodder and green fodder can be resolved by using available agriculture industry by-products in better ways. Straw is regarded as an important source of roughage and fed to animals in most parts of India. However, they contain high lignin and silica which need to be treated to improve the palatability and digestibility.

There is also a geographical disparity in fodder availability where in some states fodder is in surplus, but it cannot be transported to other deficit states due to its bulkiness. Also, animals are dying during natural calamities due to a lack of basic dry fodder. Crop residue after harvesting, is difficult to manage and the farmer must spend INR 5,000-6,000 per acre to remove it. Therefore, straw is burnt in the field which in turn, causes environmental pollution and degradation of soil. The efficient management of crop residue and other available resources is required today to manage animal feeding.

The technologies available to utilise crop residue as well as the alternative crop preservation techniques are:

Densified TMR Blocks

DTMR¹⁰, also called Densified Total Mixed Ration, is one of the concentrates of mixed ration with roughage in sufficient quantity. In this technology, roughage like wheat straw, paddy straw, sugarcane bagasse, or any other crops are mixed with concentrates, mineral mixture, salt and binder and then pressed into blocks. The blocks are prepared in different sizes depending upon the requirement and type of cattle. TMR blocks help in balanced feeding of cattle, and helps improve the production status which will ultimately save cost. The DTMR blocks are easy to store, transport, and less labour is involved in feeding. In Punjab, the technology has been introduced recently. The NDDB provides technical assistance in setting up such plants. There are two other plants operating in Kolhapur and Nellore (Fertile Greens Inc). There is further palletisation of TMR to facilitate longer shelf-life and transport. The potential of such feed alternatives needs to be explored further.

Processing and fortification of straw

This is another method for the compression and preservation of straw with slight fortification and enzyme treatment. Wheat straw is an important component of cattle feed, and is necessary to supply roughage content in the feed. The straw is high in lignin content and low in protein (2-5%), which makes it less digestible (<60%) and less palatable. The treatment of straw with enzymes and Nitrogen compounds helps in breaking up the cellulose, as well as improving the protein content.

The treated straw can be further pressed into blocks for transport and proper storage in small spaces. The technology has been recently introduced in Punjab by a young entrepreneur Mr. Gurjot Singh in Khanna-Rattanheri-Bhadla Rd (www.richfodder.com). The marketing potential of such treated straw needs to be further explored.

Hay Processing

Hay is also a green fodder conservation technique where green forage is harvested and dried to 85-90% dry matter. There are a variety of crops which can be processed into hay like oats, Rhodes, Guinea grass, thin Napier, and legumes like Alfa-alfa (lucerne), berseem, methi grass, beans etc. The hay is further packed in bales and transported to other places. USA is the largest exporter of hay¹¹ followed by Australia, Spain, Canada, and Italy. The market is in Asian countries like Japan, China and Korea, followed by Middle Eastern countries like Saudi Arabia and UAE. In India, there is a market for hay with the farmers keeping high yielding cows (above 30 LPD), breeding bull farms, and stud farms. Hay is also consumed by goat farms in the scarcity period. The recent turmoil between China and USA has opened the markets of India for US-based Hay. The Hay market in the USA is about \$1.2 Billion (2017-18)¹². The Indian hay market is yet to evolve. The export value for Indian hay in 2021 was \$104.04 k and volume was 100.13 Kilo Metric Ton. The major importing destinations are Brazil (73.24%), Nepal (23.4%)¹³ followed by Sweden, Malaysia, Croatia, UAE, Maldives, Canada and Hongkong.

10 <https://indiadairy.com/expert-article/densified-complete-feed-blocks/>

11 <https://ucanr.edu/blogs/blogcore/postdetail.cfm?postnum=29204>

12 <https://ucanr.edu/blogs/blogcore/postdetail.cfm?postnum=29204>

13 <https://www.tridge.com/intelligences/hay/IN/export>

Fodder Policies



The Feed and Fodder sector requires investments. The sector needs investment in R&D for development of high biomass-yielding seed varieties, equipment for on-field quality diagnostics, machinery for pre & post-harvest management, and logistics facilities for transporting to distant places. The feed and fodder business is not very attractive due to variable raw material prices and low purchasing power of farmers. Enhancing milk production will become more challenging as the farmers move away from the business. There are chances of low-cost adulterated milk and milk products flourishing in the market. There is therefore, a need for policy interventions and support to farmers for natural milk production and to help maintain growth in the sector to feed the growing population.

Feed and fodder production are influenced by internal as well as external policies. The important prevailing policies influencing the market are:

Foreign Policies

The Dept. of Agriculture and Farmer Welfare has signed an agreement with the USDA in the “2 Vs 2” scheme¹⁴ where India will export mangoes and pomegranates to the USA and in return, import cherries and **hay**. There is an almost **nil** hay market in India and imports will help in establishing the hay market in India, which will benefit farmers in the future.

The UAE and Saudi Arabia, both water poor countries, have taken steps to prevent the use of water for forage production since 2018. This will facilitate the import of hay from India and other countries (USA and Australia).

Central Government Policies

The Central Government provides technology support to enterprises in seed production, equipment and machinery development to entrepreneurs in the fodder-based technologies. There are institutes engaged in fodder research including Agriculture universities, IGFRI Makhdoom, fodder stations across the country and various private organisations. The National Livestock Mission (NLM)¹⁵ has special sub-missions on feed and fodder. There are two types of assistance available for feed and fodder development:

- Assistance for Fodder Seed Production- The assistance is to all types of Government agencies in seed production along with private entrepreneurs. The assistance is on all types of seeds like Breeder Seed (250/kg), Foundation Seed (150/kg) and Certified Seed (100/Kg). If the farmer is engaged in any type of seed production, he/she can get 75% of the subsidy and 25% will be with the seed producing agencies.
- Capital Subsidy for establishment of Hay/Silage/Fodder Block/TMR plants- There is capital subsidy of 50% or up to 50 Lakh on machinery and equipment for fodder processing and storage.

State Policies

Most of the states follow the Central Government policies, but in addition some states develop their own feed and fodder schemes.

- Fodder Security Policies in Uttar Pradesh- The State is going to roll out fodder security policies for the period of 2022-27 to ensure fodder availability to animals. The State is to spend INR 525 Crore for providing high yielding seeds, awards and subsidies on agriculture to produce silage and hay, and to facilitate straw treatment.
- The Andhra Pradesh Government has launched Fodder Schemes providing INR 10,000/acre to farmers who cultivate fodder crops. The fodder will be sold to other farmers on subsidised rates. The farmers will also get a commission payment for cutting at the rate of INR 10,000/acre for three cuttings.

14 <https://www.newindianexpress.com/business/2022/jan/11/governmentsecures-usda-approval-for-export-of-indian-mangoes-to-america-2405610.html>

15 National Livestock Mission, Operational Guideline, July 2021, Gov of India.

The Way Forward for the Fodder & Silage Industry in Punjab

Green or dry fodder is an important component of cattle feeding for economic milk production. They are the cheapest source of dry matter as well as macro-micro nutrients. The growth in the dairy industry is being challenged by quality animal availability, as well as quality feed and fodder availability. High-yielding animals are being fed with good quality protein and energy to maintain the production. Hence, the fodder industry must grow along with dairy animal numbers to sustain the growth. There is a requirement for improvement in Fodder Cropped Area (Current FCA is 8.95 Lakh Ha), high biomass-yielding varieties of seeds, easy processing and transport, and sharing of crops between the districts, along with quality assurance.

The following suggestions may be considered on priority to move ahead.

Fodder Grid & Fodder Bank

The availability of fodder is a real challenge due to its seasonality of production, climate and irrigation dependence. In India, there are regions where irrigation facilities are poorly developed, and hence, the dairy industry is not growing due to quality fodder unavailability. It is also difficult to feed the animals to keep them alive in some periods of the year (summers). There is also scarcity of fodder during natural calamities like flood, drought and pest attack.

The creation of **Fodder Banks** at various levels will create buffer storage and build confidence among farmers to expand or scale down the number of animals. The movement of quality fodder along the different borders and geographies will create employment opportunities both directly and indirectly. The **Fodder Grid** will facilitate the distribution of fodder from surplus areas to deficient areas. The grid will help in adding value to the straw and minimise wastage due to rotting and burning.

Maize Cultivation and Biomass Circulation

The increasing cultivation of maize during the Spring season (Mid Feb-March) is popular for silage-making, as the farmers make good money 15,000-20,000 per acre in a short interval (80-90days). The fields get ready for paddy cultivation in Kharif and the farmer takes a 3rd crop with additional income. There is a concern of high water consumption by the maize crop, and most of the water is evaporated due to high temperature in this season¹⁶, almost every 4th day there is a requirement of irrigation. The present situation needs to be managed through the use of smart irrigation practices like rain guns and drip irrigation to save water. The farmers, government and other stakeholders should work together to make maize cultivation sustainable during the Spring season and boost the Silage/Dairy Industry in Punjab.

Shri Gurbeer Singh (PDFA-11) of Kakra Village in Bhawanigarh, Sangrur has a cattleshed with 100+ cows and he is managing the farm with surplus silage production in 4 mega silo pits of dimension 16 X 12 X 50 Cubic ft. He has used the same silage for three years. He is using the most advanced system of feeding through TMR and also has a milking parlour. The dairy is managed by 4 helpers and 3 family members. The dairy is not limited to milk business, but also intelligently manages the liquid and solid waste. He has a slurry pump along with a movable tank to utilise the slurry spray in the field. He does not use any other type of fertilisers in his Basmati fields and maize fields.

Maize is boosting the dairy industry and improving the profit of farmers. Hence, there must be **biomass circulation**. Farmers can return the biomass (cow dung manure) to the maize field. There is requirement of sensitisation and awareness to deal with the situation. There are examples in the field where farmers have intelligently managed the utilisation of manure for agriculture production.

Marketing & Storage of Silage Bales

There is production of Silage Bales in May-June, and the Silage Balers have to wait till January to sell. The entrepreneurs have adopted their own strategies to undertake marketing. Local consumption is nearly 40-45% by the small dairy farmers and non-farmers rearing cows for milk during the fodder lean season of Oct to April. Every baler has his own marketing strategy to sell

16 <https://www.hindustantimes.com/cities/chandigarh-news/punjab-sees-over-20-jump-in-area-under-water-guzzling-summer-maize-101651175849428.html>.

the bales. It is observed that the availability of bales nearby or low transport cost per bale are important factors for purchase. There is a need for the availability of bales at multiple location or options of selling through the conventional dealer network to boost the local consumption of bales.

Silage Testing Facility

The quality of silage is a real concern for the farmers as there is a lack of trust of Balers among the farmers. It has been found that poor quality maize, maize stalks without pods (sweet corn maize stalks), early cutting, or late-cut maize are also ensiled and sold to farmers.

In the State there is only one Silage testing lab at Punjab Agriculture University, and more recently, Milkfed (Verka) has set up a silage testing lab in Ludhiana.

There is requirement of more Testing Facilities for:

- Pre-Ensiling Stage- Estimation of starch, moisture content of maize to understand the harvesting stage for proper ensiling.
- Post-Ensiling Stage- Estimation of DM, Crude Protein, ADF, NDF, and AFM1 and AFB1.

Silage testing is a necessity to protect the animals and to prevent the emergence of any new issues. Tested silage improves confidence among consumers. The balers will then strive to improve quality based on measurable parameters instead of waiting for feedback from farmers.

The testing facilities at various levels will ensure the production of quality silage, which will benefit the stakeholders in the value chain. Better feeding will improve the quality of milk with high TS, and lower toxins and antibiotic residues. The improved feeding practices have a major impact on the export of milk. The country exports milk to 15 countries in Asia. The milk export can only be sustained by proper international quality standards.

Accreditation of Quality of Silage

Silage is directly related to the health of the cow and the people. It is very important to preserve its quality from harvesting to final consumption. There is no agency which is reputed and well accepted by farm consumers for silage certification. The industry is at a very nascent stage and is expected to grow at 7-8% annually. The accreditation of silage will offer better price to farmers and also build trust among farmers. The accreditation of quality silage bales will encourage its wide acceptability.

The stakeholders like FSSAI, Export inspection council (EIC), Export health certification agency (EHC), in the feed and silage industry may adopt initiatives for the accreditation of silage quality as per the standards to compete in the international market.

Traceability of Products

Silage is mainly produced from maize and ensiled in Plastic Wrap Bales. There is need to know the source of feed from its farm to production process and to consumers. The availability of information and traceability of movement will help in quality establishment of the product. Adulteration and malpractices can be checked with proper stringent action. Traceability information will open the windows for export to other countries too.

Financing Window for Silage

There are 70 and more private balers, and above 8,500 commercial dairies who are engaged in silage-making. Silage balers are mostly from other industries like feed mill owners, rice shellers, seed dealers, brick kiln owners etc. They have invested their own capital or capital from other businesses in the silage business. There is no support from banks in any form to start the business. Banks often do not recognise silage and fodder as a business, although the government is providing subsidies on it. There is a possibility of INR 1500 Crore Operational expenditure financing every year, and the estimation is to be done for Capital financing.

Involvement of Farmer Producer Companies (FPC) in Fodder Management

FPCs and FPOs need to be promoted in fodder production and management along with the other commodities. The FPOs can involve themselves in aggregating the surplus fodder, storing and treatment, and further selling to the farmers in need. This will help in creating local management of fodder and decrease the logistics cost.

Extension and Involvement of Village-level Societies in Silage

Village milk societies need to be strengthened for silage production and generation of awareness regarding quality silage feeding. The societies can adopt silage as an important feed ingredient like the concentrate feed and mineral mixture. The dairy societies need to invest in machinery for silage-making like harvesters, balers etc., which can be made available to farmers at the time of requirement.

The participation of stakeholders like seed companies, inoculant industries, PDDB, GADVASU, Milkfed etc. could be concentrated in one place to increase silage adoption by the farmers. The farmers need to be informed and supported for initial adoption of the process of silage. They must know about the quality parameters of silage and its benefit. The PPP mode needs to be explored to increase the silage production and adaptation to it.

Silage Schools need to be promoted by all the stakeholders to disseminate information on the right process to follow for Quality Silage-making at each stage, like harvesting to be done at the right moisture, proper plant stage for cutting, half milk grain stage etc. The chopping also should be done at the recommended size and breaking the seed kernels for better utilisation. The farmers need to be made aware about the ensiling process and the role of micro-organisms, since there is spoilage and wastage of silage with faulty ensiling.



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