GREEN FODDER PRODUCTION AND UTILIZATION IN DAIRY CATTLE - AN AGRONOMIC AND REGIONAL PERSPECTIVE

Prince Chauhan[1]& Simranjeet Uttam[2]
[1]Assistant professor - Animal Nutrition, Khalsa College of Veterinary and Animal Sciences, [2]Assistant professor – Veterinary and animal husbandry extension, Khalsa College of Veterinary and Animal Sciences
*Corresponding author's mail: *prince35chauhan@gmail.com*
DOI: https://doi.org/10.5281/zenodo.21670869

Abstract

Fodder is the single largest recurring input in dairy production, yet it remains the most inconsistently managed resource on most farms, particularly across the smallholder-dominated systems common in South Asia. This article reviews the scientific and agronomic basis of fodder management and examines how cropping decisions must be integrated with regional agro-climatic conditions to sustain year-round green fodder supply. It classifies fodder crops into cereal, legume, and perennial-grass groups and outlines how agronomic levers, sowing time, seed rate, nutrient and water management, intercropping, and harvest stage, determine both yield and nutritive value. Zone-specific cropping sequences developed for northern, southern, eastern, and western production systems are compared, illustrating how staggered sowing across Kharif, Rabi, and summer seasons closes the seasonal gap that otherwise depresses milk output during the lean May–June period. The article also reviews fodder conservation through silage and hay, noting which crops ferment or dry reliably and which require blending, and considers emerging approaches such as hydroponic fodder for land-constrained systems. Evidence is drawn from Indian Council of Agricultural Research and Indian Grassland and Fodder Research Institute cropping recommendations alongside peer-reviewed agronomy literature. The review concludes that scientifically planned, regionally adapted fodder calendars can reduce feed costs substantially while improving milk yield consistency, and offers a practical reference for dairy farmers, extension workers, and animal nutrition students.

Keywords: Fodder management, dairy farming, agronomy, cropping calendar, silage, hay, agro-climatic zones, green fodder.

Introduction

Feed costs typically account for the majority of the recurring expense in dairy production, and within that, fodder, rather than purchased concentrate, is usually the largest single component. Despite this, fodder is frequently treated as a residual land use: cultivated on marginal plots, sown without a clear calendar, and harvested opportunistically rather than at the growth stage that maximises nutritive value. The consequence, well documented across Indian dairy systems, is a chronic shortfall in green fodder availability, particularly during the pre-monsoon lean period that depresses milk yield and pushes farmers toward more expensive purchased concentrate to fill the gap.

This article reviews the scientific and agronomic principles that govern fodder crop productivity and quality, and examines how these principles must be adapted to regional agro-climatic conditions to sustain a genuinely year-round supply. It draws together crop classification, agronomic management, zone-specific cropping calendars, and conservation practice into a single framework intended to help farmers and extension personnel move from opportunistic fodder cultivation to planned, integrated fodder management.

Why Fodder Is the Foundation of Dairy Profitability

Milk yield, fertility, and body condition all trace back to whether a cow receives adequate, good-quality forage on a consistent basis. Where quantitative and qualitative feed is limiting, the effects are well characterised: reduced milk yields, delayed conception, later age at first calving, and longer calving intervals. In smallholder systems especially, natural pasture and crop residues often remain the default feed base, with commercial protein concentrate used only sparingly because of cost, which makes the productivity and quality of home-grown fodder the primary lever available to most farmers.

Well-managed fodder production changes this picture substantially. Studies of integrated fodder-feed systems report that properly planned fodder cultivation can lower overall feed costs by roughly 35–45% while sustaining comparable milk output, largely because it displaces a portion of purchased concentrate with home-grown, nutritionally comparable green fodder. Legume fodders add a second economic benefit: through biological nitrogen fixation, they improve the fertility of the soil for the cereal crop that follows in rotation, lowering the fertiliser bill for the farm as a whole.

Classifying Fodder Crops by Nutritional Role

Cultivated fodder crops fall broadly into three groups, each contributing a different part of the dairy ration's nutritional profile. Table 1 summarises these groups; in practice, a well-designed fodder programme draws on all three rather than relying on a single category.

Table 1. Classification of major cultivated fodder crops. Source: compiled from [2, 6, 7].

Category	Representative Crops	Nutritional Contribution
Cereal fodders	Maize, sorghum, pearl millet, oats	High energy (starch/soluble carbohydrate); herbage quality declines sharply after flowering
Legume fodders	Berseem, lucerne, cowpea, cluster bean	High crude protein; fix atmospheric nitrogen, improving soil fertility for the following crop
Perennial grasses	Hybrid Napier, guinea grass, para grass	Very high biomass yield per hectare; multiple cuts per year; moderate protein

Agronomic Practices That Determine Fodder Quality

A fodder crop's genetic potential sets an upper ceiling on its nutritional value, but agronomic management determines how much of that ceiling is actually realised in the field. Several levers matter most:

- Sowing time: Delayed sowing consistently reduces both fodder yield and digestibility; matching sowing date to the crop's optimal window is one of the simplest, lowest-cost quality interventions available.
- Seed rate and nutrient management: Adequate seed rate ensures a uniform, leafy stand, while balanced nitrogen, phosphorus, and potassium application, ideally supported by soil testing, avoids both the yield penalty of under-fertilisation and the nitrate-accumulation risk of over-fertilisation.
- Water management: Soil-moisture requirements vary by crop; berseem, oats, maize, teosinte, sorghum, hybrid Napier, and cowpea perform best around 75% available soil moisture, lucerne and cluster

bean tolerate roughly 50%, and triticale can produce an acceptable yield at only 25%, information that should guide irrigation scheduling on water-limited farms.

- Intercropping: Cereal-legume combinations, such as maize with cowpea, improve digestible dry-matter content relative to either crop grown alone, while also spreading harvest risk and improving land-use efficiency.
- Harvesting stage: Cereal fodders lose feed value quickly once they pass flowering; maize fodder, for example, is best cut between the milk and early dough stage for fresh feeding, while a later dough-stage cut is preferred if the crop is destined for silage. Sorghum requires particular care at cutting, since prussic acid (HCN) can accumulate in young regrowth, making early harvest of stressed or drought-affected sorghum a genuine poisoning risk.

Matching Cropping Calendars to Agro-Climatic Zones

India's fodder base spans an unusually wide range of soils and climates, and no single cropping sequence performs well everywhere. Research institutions, notably the Indian Grassland and Fodder Research Institute, have developed zone-specific rotations that keep green fodder flowing across the Kharif, Rabi, and summer seasons rather than concentrating supply into one or two months. Table 2 summarises representative sequences for four broad zones.

Table 2. Representative regional fodder-cropping sequences. Source: compiled from [3, 4].

Zone	Representative Cropping Sequence
North Zone	Maize + cowpea → sorghum + cowpea → berseem + mustard; or hybrid Napier interplanted with cowpea (summer) and berseem (winter), giving 9–10 cuts/year
Western & Central Zone	Pearl millet + cluster bean → annual lucerne (6 cuts); or hybrid Napier/guinea grass interplanted with cowpea, 8–9 cuts/year
Southern Zone	Sorghum + cowpea (3 cuts) → maize + cowpea → maize + cowpea; or hybrid Napier/guinea grass interplanted with lucerne, 8–9 cuts/year
Eastern Zone	Maize + cowpea → teosinte + rice bean → berseem + mustard; or hybrid Napier/setaria interplanted with subabul

Even with a well-chosen rotation, most rain-fed cropping calendars share a structural weak point: a lean period in the pre-monsoon months when the previous Rabi crop has been exhausted and the new Kharif sowing has not yet matured. Figure 1 illustrates this pattern schematically for a typical North Indian rotation.

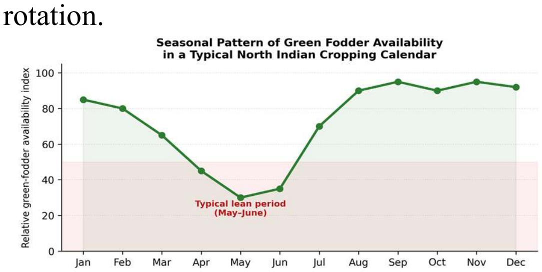

Fig. 1: Seasonal pattern of green fodder availability, illustrating the typical May–June lean period.Source: author's schematic based on cropping-calendar patterns reported in [3, 4, 5].

Overlapping cropping systems, such as berseem interplanted with hybrid Napier, are specifically designed to blunt this seasonal dip by ensuring a perennial grass component continues yielding while annual crops are between cuts. Perennial grasses also carry a substantial yield advantage over annual fodders on a per-hectare basis, which is one reason they anchor many of the zone-specific rotations in Table 2. Figure 2 compares typical green fodder yields across commonly grown crops.

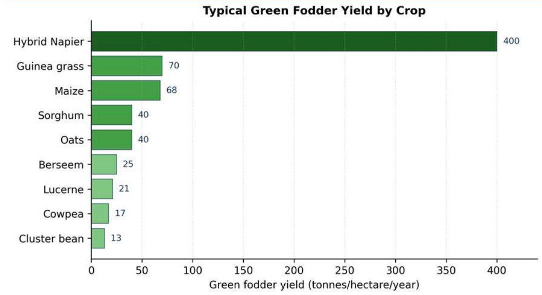

Figure 2. Typical green fodder yield by crop (tonnes/hectare/year). Source: author's compilation from [4, 6].

Conserving Surplus Fodder: Silage and Hay

Even a well-planned calendar produces seasonal surplus, and converting that surplus into silage or hay is what actually closes the year-round supply gap rather than merely shifting it. The two methods suit different crops, summarised in Table 3.

Table 3. Suitability of common fodder crops for silage and hay production. Source: compiled from [6, 8].

Conservation Method	Well-Suited Crops	Practical Notes
Silage	Sorghum (jowar), maize, pearl millet, oats, barley, hybrid Napier, guinea grass	High-sugar, non-legume crops ferment reliably; berseem, lucerne and cowpea ferment poorly alone but work when blended with a cereal or straw
Hay	Oats, berseem, lucerne, cowpea	Best from leafy, lower-moisture cuts; requires rapid field drying to avoid mould and nutrient loss

A further option gaining interest, particularly on land-constrained farms, is hydroponic fodder: cereal grain sprouted over roughly six to eight days under controlled conditions to produce a dense mat of green shoots and root material. It offers a compact, weather-independent supplement, though the evidence on its economics is mixed. Controlled trials on organic dairy farms found that sprouted barley fodder did not improve milk yield, milk fat, or body condition score relative to a standard total mixed ration, and that income over feed cost generally favoured not feeding it, except when the price of cracked corn rose sharply. Hydroponic fodder is, therefore, best regarded as a niche tool for specific constraints, extreme drought, very limited arable land, or surplus labour, rather than a general substitute for field-grown fodder.

Conclusion

Fodder management sits at the intersection of agronomy and animal nutrition, and treating it as a planned, scientific input rather than a residual land use is one of the highest-leverage changes a dairy operation can make. Crop selection has to answer to two masters at once: the nutritional role a crop plays in the ration, energy-dense cereal, protein-rich legume, or high-biomass perennial grass, and the agro-climatic realities of the specific zone in which it is grown. Agronomic discipline around sowing time, nutrient and water management, intercropping, and harvest stage determines how much of a crop's genetic potential is actually captured as usable feed. Regionally adapted, overlapping cropping calendars are the most reliable way to close the seasonal gaps that otherwise depress milk production, and conserving surplus as silage or hay converts a seasonal advantage into a year-round one. None of these interventions require exotic technology; they require planning, and the evidence suggests that planning pays for itself directly in feed cost and milk yield consistency.

References

1. Sharma A. Dairy Operation and Management: A Comprehensive Review of Practices, Challenges, and Innovations. International Journal of Applied and Behavioral Science. Available from: https://ijabs.niilmuniversity.ac.in/dairy-operation-and-management-a-comprehensive-review-of-practices-challenges-and-innovations-abhinav-sharma/
2. Impact of Agronomic Management Practices on Quality and Productivity of Fodder Crops: A Review. Agricultural Reviews. 2024. Available from: https://arccjournals.com/journal/agricultural-reviews/R-2672
3. Enhancing Fodder Production: Measures to Increase Productivity of Fodder Crops by Agro-Climatic Zone. Available from: https://www.slideshare.net/slideshow/enhancing-fodder-production/191799320
4. Comprehensive Guide to Fodder Crop Cultivation Practices. Agriculture Notes by Agriculture.Institute; 2026. Available from: https://agriculture.institute/livestock-pasture-management/comprehensive-guide-fodder-crop-cultivation/
5. Forage Production in India: Bottlenecks and Opportunities. Asian Journal of Dairy and Food Research. Available from: https://arccjournals.com/journal/asian-journal-of-dairy-and-food-research/DR-2050
6. Animal Food Crop or Fodders (Pashu Khadya). IndiaAgroNet. Available from: https://indiaagronet.com/indiaagronet/Animal_husbandry/cultivation_of_fodders.htm
7. Fodder Crops Grown in India & Their Types. TractorKarvan. Available from: https://tractorkarvan.com/blog/best-fodder-crops-for-indian-farmers
8. Conserving Fodder in the Form of Silage and Hay. Krishisewa. Available from: https://www.krishisewa.com/crop-cultivation/236-fodder-conservation.html
9. Sustainable Fodder Crop-Feed Integration Practices: Impact on Dairy Farm Economics and Agricultural Diversity. ResearchGate; 2025. Available from: https://www.researchgate.net/publication/387843386
10. Atwill ER, et al. Evaluation of Fodder Production Systems for Organic Dairy Farms. Journal of Dairy Science/ScienceDirect;2018.Availablefrom:https://www.sciencedirect.com/science/article/pii/S1080744618300093
11. Analyzing Trends and Future Projections in Fodder Oats (Avena sativa L.) for Quality Seed Production in India. PMC; 2024. Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC12009856/

Cite this article:
Prince Chauhan & Simranjeet Uttam. (2026). Green fodder production and utilization in dairy cattle - an agronomic and regional perspective. Vet Farm Frontier, 03(07), 22–26. https://doi.org/10.5281/zenodo.21670869