TRENDS IN AGRICULTURE SCIENCE
Popular Article
Vol.3 Issue 08 August 2024, Page: 2092-2095

"From Roots to Ruminants: The Vital Role of Trees in Goat Nutrition"

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https://doi.org/10.5281/zenodo.13378086

Abstract

Fodder trees are a vital resource for goats, offering high-quality feed rich in crude protein year-round. Their leaves are an excellent concentrate for sheep and goats, especially for resource-poor farmers relying on low-cost feeding methods. When goats cannot browse freely, lopping provides an essential fodder source. Seasonal constraints on cultivated green fodder, such as limited irrigation and seed availability, make fodder trees particularly important from December to June, when grasses are depleted. These trees ensure consistent, high-quality nutrition, supporting goat health and productivity during periods when other feed options are scarce.

Introduction

Fodder trees are a crucial resource for livestock, offering a reliable source of nutritious feed, particularly during periods of scarcity. These trees, known for their tender branches and leaves, thrive in diverse environments and are highly valued by both wild and domestic animals for their foliage. One of the main benefits of fodder trees is their extensive root systems, which enable them to tap into underground water sources, especially during dry spells. Tree fodder serves as an essential emergency or supplemental feed, providing vital nutrition when other feed options are scarce.

For small ruminants such as sheep and goats, tree leaves play a significant role in their diet, often making up about 60% of their total feed intake. Goats are particularly inclined to browse on tree fodder, dedicating over 90% of their feeding time to consuming leaves, twigs, and branches from trees, shrubs, and bushes. They only graze on surface plants when there is a lack of available browse.

Goats exhibit a distinct preference for tree-based feed over other types. However, some tree leaves contain tannins, which can reduce their suitability as fodder. To address this issue, farmers can

Published: 26 August 2024
ISSN: 2583-7850

adopt management practices like lopping, which involves periodic pruning of trees to ensure sustainable leaf harvesting. This practice helps to manage feed intake, keeping it within a recommended limit of 30% of the animal's total diet.

Integrating fodder trees into agroforestry systems—where they are grown alongside crops or on less productive land—offers several advantages. These trees contribute to improved soil fertility, help control erosion, and enhance ecosystem diversity and resilience.

Important Fodder Trees

Khejri (*Prosopis cineraria*) is a standout in the harsh, arid regions of Rajasthan, specifically in the Hyper Arid Western Rajasthan. During the dry season from March to June, when most plants shed their leaves, Khejri remains productive, growing fresh leaves, flowers, and pods. The leaves, known locally as "Loong," are small but nutritionally rich, making them a favorite for goats. Due to its high value as fodder, Khejri often undergoes significant lopping. A mature tree can yield approximately 60 kg of green forage, providing essential nutrition in a challenging environment.

Siris (Albizzia lebbeck) flourishes in tropical and subtropical climates. It prefers black soil but is versatile enough to grow in various soil types. Siris can be propagated from seeds or seedlings, offering flexibility in planting. The leaves of the Siris tree are especially beneficial for goats. Incorporating 40-45% Siris leaves into their diet, combined with mature dry grasses, supports optimal nutrition for adult goats. **Ardu (*Ailanthus excelsa*)** thrives in semi-arid and semi-moist environments, preferring sandy loam soil for optimal growth. Although it can be propagated from seeds or stumps, nursery seeding is typically favored. A mature Ardu tree produces 5-7 quintals of green leaves twice annually, in November-December and May-June. These leaves are both nutritious and palatable, making them an excellent fodder source for sheep and goats.

Bakain (*Melia azedarach*) is well-suited to sub-tropical climates and can grow in various soil types, though deep, fertile sandy loam is ideal. Propagation methods include seeds, nursery raising, or stump planting. The highly nutritious leaves of the Bakain tree provide valuable supplementation in the diets of sheep and goats.

Table 1: Availability Periods of Fodder from Tree Species

Tree species	Fodder availability period Leaf fodder	Pod fodder	Preference to livestock
Acacia nilotica	May-February	April-June	Cattle, Goat, Sheep, Camel
Ailanthus excelsa	May-March	-	Goat, Sheep
Albizia lebbek	April-November	August-November	Goat, Sheep, Cattle
Azadirachta indica	Throughout the year	July-August	Goat, Sheep, Cattle
Bauhinia variegata	April-November	-	Goat, Sheep, Cattle
Dalbergia sissoo	February-December	April-September	Goat, Sheep, Cattle
Ficus religiosa	July-November		Sheep, Cattle
Hardwickia binata	April-June	Feb.-March	Cattle, Sheep, Goat
Leucaena	Throughout the year	Dec.-May	Cattle, Goat, Sheep

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leucocephala			
Melia azedarach	July-November	-	Goat, Sheep, Cattle
Prosopis cineraria	Throughout the year	May-June	Goat, Sheep, Camel, Cattle
Sesbania grandiflora	July-November	-	Cattle, Sheep, Goat
Sesbania sesban	Throughout the year	Dec-March	Cattle, Goat, Sheep
Ziziphus mumularia	Throughout the year	-	Cattle, Goat, Sheep

Source: Rai *et al*. 2007.

Khair (*Acacia catechu)* is versatile and can adapt to a range of climatic conditions, excluding temperate and extremely humid regions. It is valued as a fodder tree and is commonly lopped to feed goats, playing an important role in livestock nutrition.

Pipal (*Ficus religiosa*) thrives in humid, sub-tropical climates and prefers sandy loam soil with good drainage. It can spread naturally through seeds, but can also be propagated from seedlings or rooted cuttings. The leaves of the Pipal tree are highly palatable, making them a favored fodder for goats and other animals.

Sesbania sesban is well-suited to sub-tropical climates and demonstrates resilience to waterlogging, moisture stress, salt, and alkaline soils. The leaves of Sesbania sesban are rich in nitrogen, providing a valuable protein source for ruminants. When used as hay alongside poor-quality cellulose at a 1:3 ratio, it effectively meets the dietary needs of adult sheep and can also be a significant food source for goats.

Sesbania grandiflora thrives in hot, humid conditions and is tolerant of water. It can be easily cultivated from seeds. Both the leaves and pods of this tree serve as excellent fodder for cows and sheep. Its high protein content makes it a beneficial addition to their diet, ideally comprising about 15-30% of their total feed.

Kathal (*Artocarpus heterophyllus*) thrives in moist tropical climates but is also adaptable to drier or cooler regions. It prefers deep, fertile soil for optimal growth but can tolerate various soil types. Its leaves are particularly enjoyed by sheep and goats. Fig. (c)

Imli (*Tamarindus indica*) flourishes in warm tropical climates and is versatile regarding soil types, with loamy soil being ideal. This tree can be grown from seeds or stumps. Its leaves are a nutritious and appetizing fodder option for livestock.

Neem (*Azadirachta indica*) is notable for its adaptability to various climates and soil types, including sandy and clay soils that drain well. Neem leaves are rich in nutrients, low in phytin-P, and free of anhydrous oxalic acid, which enhances calcium absorption, making them a valuable fodder choice.

Subabul (*Leucaena leucocephala*) is excellent for tropical and sub-tropical regions. It grows rapidly and thrives in diverse soil conditions, including saline and alkaline soils. Subabul leaves are rich in carotene, vitamins, and amino acids, making them comparable to lucerne. Goats can

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ISSN: 2583-7850

safely consume up to 30% of their diet as Subabul leaves, thanks to the ability of rumen microbes to convert mimosin into a non-toxic form. Fig. 1 (a)

Fig.1 (a) Subabul (b) Ber (c) Kathal

Ber (*Ziziphus mauritiana)* is well-suited for dry sub-tropical climates and thrives in a range of soil types, though it performs best in deep sandy loam. It reproduces naturally via seeds, root suckers, and coppicing, and can also be cultivated by sowing seeds directly or planting whole plants and stumps. The leaves of Ber are highly valued as fodder for goats due to their significant nutritional content. Fig 1 (b)

Babul (*Acacia nilotica*) flourishes in tropical and sub-tropical climates and can grow in various soil types, with alluvial sandy loam being ideal. The seeds of Babul are non-dormant and are typically propagated by sowing. The tree's leaves are highly nutritious and are commonly lopped for livestock feed, making Babul a crucial resource for supporting animal nutrition.

Morus alba or white mulberry, is an outstanding fodder tree renowned for its highly nutritious leaves, which are rich in protein, digestible fiber, and low in anti-nutritional factors. This fast-growing and resilient tree can yield up to 400 kg of fresh leaves annually, depending on factors like age, species, and management practices (Saddul et al., 2014). The leaves are versatile and can be fed either fresh or dried for winter use. Farmers value Morus alba for its beneficial impact on milk production, enhancing both the quantity and fat content.

Conclusion

Fodder trees are vital for providing high-quality, protein-rich feed for goats, especially during dry seasons when cultivated fodder is scarce. Their leaves serve as an affordable and nutritious alternative, supporting the growth and maintenance of goats, thereby enhancing the livelihoods of resource-poor farmers in arid and semi-arid regions.

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Published: 26 August 2024
ISSN: 2583-7850