

Trees as a source of fodder for goats

in arid and semi-arid regions of India

Mohd Arif*, Arvind Kumar and R Pourouchottamane

ICAR-Central Institute for Research on Goats, Makhdoom, Mathura 281 122

Fodder trees have good potential for supplying the quality fodder with good amount of crude protein for goats throughout the year. Tree leaves serve as a concentrate to sheep and goats reared by poor farmers at very low cost or on zero input. In case of no browsing, lopping provided by the farmer forms a good fodder source for goats. Production of cultivated green fodder is a time bound operation due to seasonality of fodder crops, availability of irrigation water, timely availability of good quality seed and other inputs, etc. Further, in the month of December to June when grasses are either grazed away or become dry with poor palatability and digestibility, tree fodder serves as a potential source of feed. Therefore, in the situation when no cultivated green fodder is available fodder trees provide a good quality fodder for the growth and maintenance of goats.

Keywords: Fodder trees, Goat, Hyper arid western India, Sandy loam soil

TREES producing shoots or sprouts of tender twigs and stem from woody parts with their leaves browsed by domestic and wild animals to varying extent are known as fodder trees. Fodder trees can be grown either in combination with agricultural crops under agroforestry system or on separate land usually not fit for other crops. One of the main advantage of trees over crop is to tap underground water with their deep root system particularly in the period of rainfall scarcity.

In case of livestock, tree fodder is generally known as emergency fodder or scarcity fodder (Table 1). However, in case of small ruminants (Sheep and goat) it is an integral component. It is assumed that out of total feed available for sheep and goat, 60% of total feed comes from trees fodders only. It is more in case of goats since they spend more than 90% time in browsing on top feed and hardly 10% to graze on surface vegetation that too when sufficient top feed are not available. Further, it is also observed that tree, shrubs and

bushes are highly preferred by goats as a feed source compared to other animals (Fig. 1). In case of tree fodder tannin is one of the limiting factors in leaves. However, lopping of the fodder trees can be used as a source of fodder if it is used up to level i.e. up to 30% of total dry matter intake.

Important fodder trees

The most common fodder tree

species are:

Khejri (*Prosopis cineraria*): It is most commonly found in the dry and arid region of Rajasthan so called Hyper Arid Western Rajasthan (Fig. 2). The soil of this region is coarse sandy with low organic matter. It is the only indigenous tree which can withstand the harshest condition of Rajasthan desert. In the month of March to June when all the vegetation in desert are defoliated,

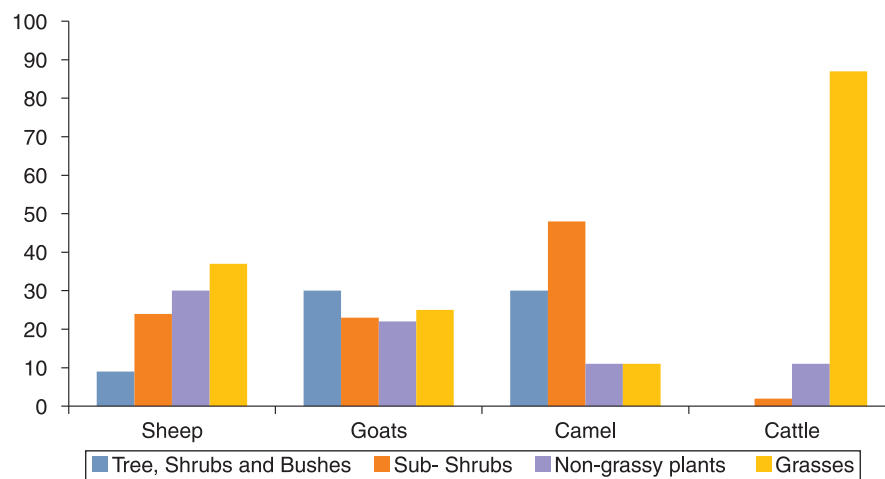


Fig. 1. Preference of forage by different class of livestock
Source: Adapted from Das, 2015.



Fig. 2. Khejri tree

this tree produces leaves, flower and pod and all these parts are nutritionally very important. The leaves of khejri are small in size but highly nutritive and palatable. These leaves are locally known as “Loong” and it is very much liked by goats. It is much valued as fodder tree that way lopped heavily. On an average a full grown tree is expected to yield about 60 kg of green forage.

Siris (*Albizia lebbek*): It is mainly grown in tropical and sub-tropical climate. It grows profusely on black soil however, it can be grown on all types of soil. It can be raised either by seed or by planting the seedlings. The leaves of siris tree are reported to be good for goat rearing purposes. Supplementation of 40-45% siris leaves seems to be optimum for adult goat fed on mature dry grasses (Fig. 3).

Ardu (*Ailanthus excelsa*): It is widely grown in semi-arid and semi-moist condition. It can be grown on

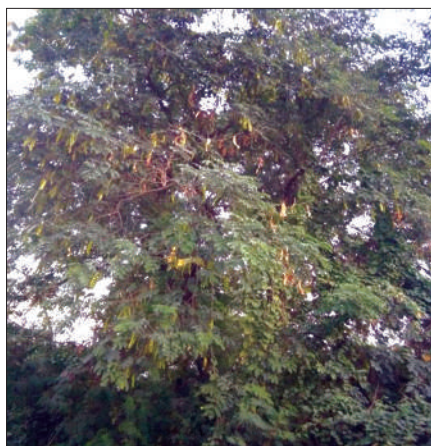


Fig. 3. Siris tree

wide range of soil conditions; however, sandy loam soil is best suited for it. Nursery seeding planting is better over seed and stump sowing. A full grown tree produces on an average 5-7 quintals of green leaves twice in a year i.e. in the month of November – December and May – June. Ardu leaves are excellent tree fodder with high palatability and are nutritious for sheep and goat (Fig. 4).

Bakain (*Melia azedarach*): It is a tree of sub-tropical climate. It can be easily grown on wide range of soil types however, deep fertile sandy loam soil is best suited for it. It can be propagated either through seed, or by nursery raising or by stumps. The leaf fodder is highly nutritious (Table 1) and can be used for supplementing the sheep and goat ration.



Fig. 4. Ardu tree

Khair (*Acacia catechu*): It can be grown on wide climatic conditions except temperate and very humid climates. It is considered to be a good fodder tree and extensively lopped to feed goats.

Bargad (*Ficus benghalensis*): It is most commonly found in tropical and sub-tropical climate of India. It can be grown on wide range of soil types; however, sandy loam soil is best suited for it. It can be grown either by nursery raising or by planting the long stem (about 2 m) cutting. The crude protein content is higher in monsoon season and lopping during winter season has better fodder value (Fig. 5). Bargad leaves are very much liked by goats as compared to other



Fig. 5. Bargad tree

Table 1. Composition and nutritive value of common fodder trees

Fodder tree	CP (%)	CF (%)	NFE (%)	EE (%)	Ash (%)
<i>Prosopis cineraria</i>	14.20	22.06	53.24	4.35	6.14
<i>Albizia lebbek</i>	16.81	26.47-37.52	35.99-42.76	2.85-4.68	7.11-11.54
<i>Ailanthus excelsa</i>	19.87	12.82	51.81	3.53	11.97
<i>Ficus benghalensis</i>	7.74	13.91	37.61	2.46	9.30
<i>Ficus religiosa</i>	13.30	-	-	4.20	11.07
<i>Ficus glomerata</i>	16.73	-	-	4.92	14.89
<i>Azadirachta indica</i>	12.40-18.27	11.40-23.08	43.32-66.60	2.27-6.24	7.73-18.87
<i>Leucaena leucocephala</i>	21.45	14.25	49.48	6.54	4.28
<i>Ziziphus mauritiana</i>	15.4	15.8	58.0	2.7	10.2
<i>Acacia nilotica</i>	14.0	9.2	69.8	3.2	7.1
<i>Morus alba</i>	21.50	12.00	48.50	5.15	18.0
<i>Salvadora persica</i>	7.87	-	-	0.73	18.48
<i>Tamarindus indica</i>	13.87	21.99	52.90	4.27	9.67
<i>Mangifera indica</i>	9.41	-	-	4.78	4.64
<i>Acacia catechu</i>	16.0	22.0	48.50	3.75	9.70
<i>Ficus lacor</i>	13.2	-	-	2.20	10.17
<i>Melia azedarach</i>	14.09	18.96	57.61	4.04	5.3
<i>Sesbania sesban</i>	6.41	22.5	-	-	10.0

(Data expressed on dry matter basis); CP, Crude protein; CF, Crude fibre; NFE, Nitrogen free extract; EE, Ether extract.

animals. Further, the tannic acid present in its leaves does not show any effect on total fatty acid production when goats fed on it.

Pipal (*Ficus religiosa*): It is widely grown in sub-tropical humid climate. It prefers sandy loam soil with good drainage facility. Natural propagation takes places through seeds. Whereas



Fig. 6. Pipal tree

artificial propagation takes place either by planting seedling or rooted branch cutting. Pipal leaves are rated as a good fodder (Fig. 6). Goat relishes the leaves and palatability of the leaves for other animals is also fairly good. It can form a maintenance ration for goats.

Sesbania sesban: It grows well in sub-tropical climate and is tolerant to water logging. It can also tolerate moisture stress, salinity and alkalinity. It is commonly propagated through seed. The leaves are rich source of

nitrogen, hence excellent source of protein rich diet in ruminants. It is reported that sesbania hay is a good source of protein and calcium and its feeding with poor quality cellulosic material in the ratio of 1:3 can meet the maintenance requirement of adult sheep. It can also be successfully fed to goats as a sole diet.

Sesbania grandiflora: It is a tree of hot and humid climate and can tolerate water logging. It is easily propagated by direct seeding. Leaves and pods of this tree can be used as a valuable fodder for ruminants. Due to high protein content, it can be combined with poor quality roughages and intake can be increased by supplementing it. The best feeding method is to supplement it in 15-30% of total diet.

Pakar (*Ficus lacor*): It is a tree of sub-tropical climate and can be grown on wide range of soil types, however, deep alluvial soil best suited for it. It can be grown either by nursery raising or through planting of branch cutting. The leaves of pakar are highly nutritious and palatable. The total digestible nutrients are more in young leaves (Fig. 7).

Gular (*Ficus glomerata*): It is a tree of moist sub-tropical and tropical climate and can be grown on wide range of soil types but grow best on alluvial soil. It can be grown either by nursery raising or through planting of branch cutting. It is extensively lopped for fodder (Fig. 8).



Fig. 7. Pakar tree



Fig. 8. Gular tree

Table 2. Fodder availability periods in important fodder trees

Tree species	Fodder availability period		Preference to livestock
	Leaf fodder	Pod fodder	
<i>Acacia nilotica</i>	May-February	April-June	Cattle, Goat, Sheep, Camel
<i>Ailanthus excelsa</i>	May-March	-	Goat, Sheep
<i>Albizia lebbek</i>	April-November	August-November	Goat, Sheep, Cattle
<i>Azadirachta indica</i>	Throughout the year	July-August	Goat, Sheep, Cattle
<i>Bauhinia variegata</i>	April-November	-	Goat, Sheep, Cattle
<i>Dalbergia sissoo</i>	February-December	April-September	Goat, Sheep, Cattle
<i>Ficus religiosa</i>	July-November		Sheep, Cattle
<i>Hardwickia binata</i>	April-June	Feb.-March	Cattle, Sheep, Goat
<i>Leucaena leucocephala</i>	Throughout the year	Dec.-May	Cattle, Goat, Sheep
<i>Melia azedarach</i>	July-November	-	Goat, Sheep, Cattle
<i>Prosopis cineraria</i>	Throughout the year	May-June	Goat, Sheep, Camel, Cattle
<i>Sesbania grandiflora</i>	July-November	-	Cattle, Sheep, Goat
<i>Sesbania sesban</i>	Throughout the year	Dec-March	Cattle, Goat, Sheep
<i>Ziziphus mumularia</i>	Throughout the year	-	Cattle, Goat, Sheep

Source: Rai et al. 2007.

Kathal (*Artocarpus heterophyllus*): It requires moist tropical climate, however, it can be cultivated in drier and cooler climates. It can be grown on variety of soil types but requires deep fertile soil for optimum growth. It can be grown either through seed or by nursery raising. The leaves are very well consumed by sheep and goat.

Imli (*Tamarindus indica*): It is mainly found in tropical climate and can be grown in wide range of soil types but it thrives well in loamy soil. It can be grown either by seeds or by stumps. Its leaves are used as a good source of fodder.

Neem (*Azadirachta indica*): It has wide climatic adaptability and can be grown on varying soil types from sandy to well drained clay soil. It can be raised through direct sowing, planting out of entire plant or by



Fig. 9. Neem tree

stump. In general neem leaves are not browsed by cattle but goats browse it well. The leaves have negligible amount of phytin-P and no anhydrous oxalic acid consequently calcium utilization is very good. The neem leaves provide enough nutrients and can very well be used as a green fodder supplement (Fig. 9).

Subabul (*Leucaena leucocephala*): It is a promising forage tree for tropics and sub-tropics. It is a very fast growing tree and can be grown in all type of soil including problematic soils like - saline, alkaline soil. It can also be grown with poor quality irrigation water. Its leaf fodder is highly palatable; however, high mimosin content limits its use as sole feed but now-a-days low mimosine varieties are also available. The leaves are a good source of carotene and vitamins. Subabul leaf meal is specially valuable due to its amino acid content which is superior



Fig. 10. Subabul tree

to other plant proteins and it is almost as good as lucerne. It is reported that anaerobic microbes of goat rumen can degrade mimosin to non toxic form; hence goat can be reared with ration containing 30% subabul leaves (Fig. 10).

Ber (*Ziziphus mauritiana*): It is a tree of dry sub-tropical climate and can be grown on wide range of soil types. However, deep sandy loam soil is good for its growth. Under natural propagation it reproduces through seed, root sucker and coppice; it can



Fig. 11. Ber tree

also be cultivated either by direct sowing or planting out entire plants or stumps. The leaves are considered to be good fodder for goats and have fairly high nutritive value (Fig. 11).

Babul (*Acacia nilotica*): It is a tree of tropical and sub-tropical climate. It can be grown on wide range of soil types however, alluvial sandy loam soil is best suited for it. Seed have no dormancy and it is mainly propagated



Fig. 12. Babul tree

through seed. The leaves are excellent fodder and extensively lopped for fodder. Its leaves are also used as a fodder (Fig. 12).

Aam (*Mangifera indica*): It can be grown in wide climatic conditions

but prefer moist warm climate. It can be easily propagated from seeds. Mango tree leaves are lopped for fodder during the scarcity period and it is reported to be lopped in different states.

Shahtut (*Morus alba*): It is a tree of sub-tropical to mild temperate climate and can be grown on wide range of soil types. However, it prefers alluvial deep loamy soil with good water holding capacity. It can



Fig. 13. Shahtut tree

be propagated either by nursery raising or by rooted branch cutting. The leaves are good fodder and can profitably be utilized as a supplement to poor quality roughages. Leaves are highly palatable to sheep (Fig. 13).

Kharjal/Pilu (*Salvadora persica*): It is mainly found in dry and arid climatic conditions; however, it can be grown in varied climatic conditions where ground water is readily



Fig. 14. Kharjal tree

available. It can be directly grown from seeds and by raising the nursery. Leaves and young shoots are browsed by the goats and sheep (Fig. 14).

¹Scientist, ICAR-CIRG, Makhdoom, Mathura, Uttar Pradesh. *Corresponding author e-mail: arifkhan.ag782@gmail.com