

Unconventional fodder resources

for augmenting milk production in dry areas

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In arid and semi-arid regions, agricultural crop production is constrained by climatic and edaphic related limitations. Therefore, animal centric farming system is more sustainable and profitable in these regions. However, profitability of animal husbandry is more dependent on availability of quality and quantity of feed and fodder. At present, India experiences a deficit of 35.6 and 10.95% in green and dry fodder respectively. The scope of increasing green fodder production through increase in cultivated area is very limited as the area under fodder crop has remained static (around 8.6 mha) for the last decade. Thus, unconventional feed and fodder resources such as Indian mesquite, halophytic forages etc. that are available, need to be utilized for augmenting fodder availability to the animal farming.

Key words: Anjan, Dryland fodder, Gangeti, Gundi, Indian mesquite, Moringa, Thornless cactus

MANY native and fodder producing trees such as, Khejri (*Prosopis cineraria*), Adusa (*Ailanthus excelsa*), Anjan (*Hardwickia binata*), Pilu (*Salvadora oleoides*), Moringa (*Moringa oleifera*) (Fig. 1) and shrubs like Indian Ber (*Ziziphus nummularia*), Gangeti (*Grewia tenax*) and Gundi (*Cordia gharaf*) can be included as agro-forestry trees on wide range of soils (Fig. 2). Recently, thornless cactus (*Opuntia ficus-indica*) has shown high potential as a fodder crop, especially on degraded and marginal lands of arid and semi-arid regions. Similarly on high saline-sodic soils where normal crop production is not economical, a few halophytic vegetation have been identified at ICAR-CAZRI, RRS, Bhuj as promising and palatable fodder crop and can successfully be grown through seed on cultivated fields.

UNCONVENTIONAL FODDER RESOURCES IN ARID AND SEMI-ARID REGIONS

Tree

Indian mesquite (*Prosopis cineraria*)

Indian mesquite, also popularly

known as Khejri is an important component of farming system of arid and semi-arid regions of Rajasthan, Gujarat, Haryana, Punjab, Delhi and some parts of southern India. The tree provides nutritious forage for animal, edible pods for human consumption and fuel wood for household energy and it is rightly called *Kalpvrksha* of arid lands. The tree is heavily lopped during winter for forage use to the animal. Field studies carried out at ICAR-CAZRI, Jodhpur indicated that on an average, the tree can provide leaf fodder yield of 0.42 t/ha. The leaf fodder is highly palatable to cattle, sheep and goat. The fodder contains about 12% of crude protein (CP), 20.1% crude fiber (CF), 3.2% ether extracts (EE) and 12% of total ash. It is generally not advisable to use leaves as whole feed for animals as it contains about 8-10% tannins.

Adusa (*Ailanthus excelsa*)

Adusa is a important agroforestry tree for semi-arid and arid regions which is planted for multipurpose uses like leaf fodder, soft wood for industrial use and has a high demand in the industry. A full grown tree is

capable of producing about 500-700 kg green leaf and can be lopped twice a year. The fodder is highly palatable to cattle, goat and sheep. The fodder contains about 19.87% CP, 12.72% CF, 3.53% EE and 11.97% total ash.

Anjan (*Hardwickia binata*)

Anjan is an important top-feed tree of arid and semi-arid regions India. This tree is planted either on bunds or agroforestry plantation as silvi-pasture. Fresh leaves of this tree are palatable to goat and sole feeding supports the body weight growth. It contains about 9.86% CP, 28.16% CF, 6.17% EE and 8.92% total ash. On an average, this tree can produce about 2.31 t/ha dry leaf fodder when planted as silvi-pasture system.

Pilu (*Salvadora oleoides*)

This is an important multi-purpose tree of arid and semi-arid regions, especially of saline ecosystem. The tree produces edible fruits and palatable leaf fodder for goat, sheep and camel. The fruit is highly relished by the local people either as raw fruit or in the form of juice during summer. A full grown

tree can produce about 16.60 kg leaf fodder per year. The leaf fodder contains about 9.0% CP, 15.1% CF, 4.0% EE and 2.3% Ca. Pilu can be planted either on field bunds or as agroforestry plantation.

Drum stick/Moringa (*Moringa oleifera*)

Drum stick or Moringa, also known as Sahjan in Hindi is known for its nutritious pod and leaf, and it is highly palatable to cattle, goat, sheep and camel. This tree is mainly planted commercially for its pod and leaf production. However, it has also been cultivated as top-feed tree for leaf fodder production. Due to its high nutrient content in leaf, this tree is now recommended for intensive fodder cultivation by planting in close-row spacing of 1 × 1m or even denser. In 1 × 1 m planting, about 10-50 t/ha of green leaf fodder can be obtained. In a year, 6-7 cutting of fodder can be obtained. A full grown tree can produce 1.5-3 kg dry leaf fodder. The leaf contains about 21.8% CP, 4.5% CF, 6.5% EE and 12.0% total ash.

Shrubs

Indian Jujube (*Ziziphus nummularia*)

The Indian jujube, commonly

known as Ber is one of the most ancient cultivated fruit/fodder trees in arid and semi-arid regions in India. There are three main species found in the country; *Ziziphus mauritiana*, a main species for commercial crop, *Z. rotundifolia* (boradi) with small fruit and *Z. nummularia* (Jharber), leaves rich in protein. This tree is commonly grown in the rural areas as top-feed species. Even in drought years when normal field crops fail, this top-feed tree can provide fodder for animal. The tree is heavily lopped during winter for its leaf fodder known as Pala. Field experiment conducted at CAZRI, Jodhpur revealed that ber tree with a density of 400 trees/ha gave on an average leaf fodder yield of 1.87 t/ha Pala, besides an additional fuel wood of 2.64 t/ha. A full grown tree can produce about 2.5-3 kg dry fodder leaves over a year. The leaves, also known as Pala, are highly palatable, even more than Khejri leaves, to cattle, goat and sheep. The Pala contains about 12.9-16.9% CP, 13.5-17.5% CF, 1.5-2.7% EE and 10.2-11.71% total ash.

Gangeti (*Grewia tenex*)

Gangeti bears small fruits, well

relished by the local people. Its leaf fodder is highly palatable and contains about 11.93% CP, 14.65% CF, 1.6% EE and 13.2% total ash. The fodder is palatable to goat, sheep and camel. Gangeti is planted on filed bunds, with pasture or as agroforestry plantation. Field studies carried out at ICAR-CAZRI, Bhuj indicated high survival rate and growth even during very less rain fall (less than 300 mm).

Gundi (*Cordia gharaf*)

Gundi is an important top-feed tree of arid and semi-arid regions. Due to its narrow leaf and strong tap root system, it can survive well under moisture stress period. It bears orange or red colour edible fruits which are well relished by the local people. Its leaf fodder is palatable to goat, sheep and camel. The fodder contains about 16.60% crude protein, 16.4% crude fibre, 1.99% Ca and 0.16% P. It can be planted on field bunds or as agroforestry/silvipasture system.

Thornless cactus (*Opuntia ficus-indica*)

Thornless Cactus (*Opuntia ficus-indica*) belongs to family Cactaceae and is native to Mexico. The root system is extensive, densely branched and with many fine shallow absorbing roots highly suited to arid zones. Due to its ability to produce increased dry matter under limited water condition through specialized photosynthetic mechanism called Crassulacean Acid Metabolism (CAM), it is regarded as the future forage crop in the drylands of India. Green cladodes of cactus pear are source of low cost livestock feed during driest of the season (March-June) when no green fodder is available. Cactus pear can be grown in degraded and marginal soil as well in soil which is not suitable for most of the other crops. Its well-developed roots system prevent soil erosion caused through wind and water and allow to grow in marginal soils. Compared to various important food and fodder crops, cactus is easy to establish, maintain and utilize as fodder crops. Once established in field, it can produce a very high green

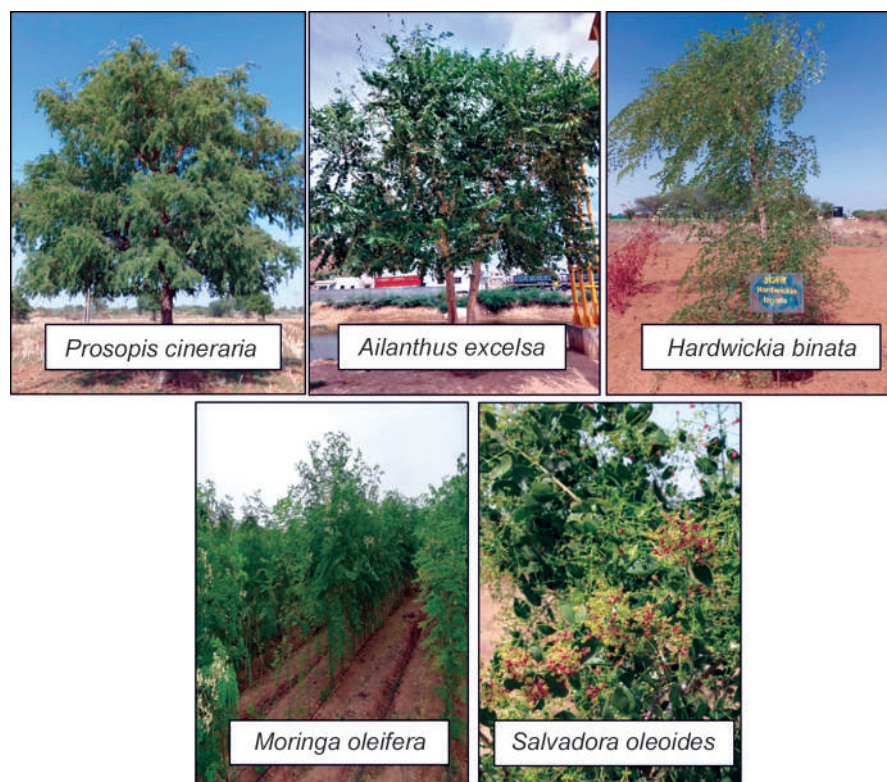


Fig. 1. Tree species used as fodder resources.

Source: Pictures are taken from Research Farm, ICAR-CAZRI, RRS-Bhuj

fodder yield up to 20-30 years .

Field studies with 64 accessions of Thornless cactus during 2012-2017 revealed high potential of cactus in arid and semi-arid regions. Based on survival and growth and fodder yield, 5 accessions have been identified as high yielder. These accessions were field demonstrated on a large numbers of farmer's fields. In one year of growth in field, these cactus accessions produced above ground green biomass of 7.8 to 19.3 t/ha. In a well managed field, cactus produced green fodder yield of 30 t/ha. Nutritional quality analysis showed that the crude protein content ranged from 4.22 to 11.88%, crude fibre 12-19% and total ash from 15.65 to 26.15%. Cactus should be planted during September-October or February-March. Planting should be avoided during rainy and winter seasons. Cactus is traditionally propagated through cutting of cladodes. For higher fodder yield, a dense planting of either at 3 × 3 m or 2 × 2 m should be adopted. Erect planting keeping one third portion of cladode below the soil was found to give higher survival.

Cactus should not be allowed to be grazed directly by animals, as it decreases cactus plant longevity. Cut and carry method is preferred technique over grazing. For this cactus cladodes should be harvested and cut into small pieces. These pieces should be mixed with some dry fodder like wheat, paddy straw in 1:3 ratios (up to 33% of feed). Generally, cacti are highly palatable and digestible. The *in vitro* digestibility values were 72% for protein, 62% for dry matter, 43% for crude fibre and 67% for organic matter.

Halophytic forage

Salt affected soils accounts for 6.727 mha equivalent to 2.1% of the geographical area of India. The maximum area of these soils occurs in Gujarat, Uttar Pradesh and Maharashtra accounting for 62.4% of the total saline/alkaline area of the country. These soils produce un-economical yields of crops due to excessive accumulation of salts. However, some of halophytes which are palatable can be economically grown as animal fodder. Field studies

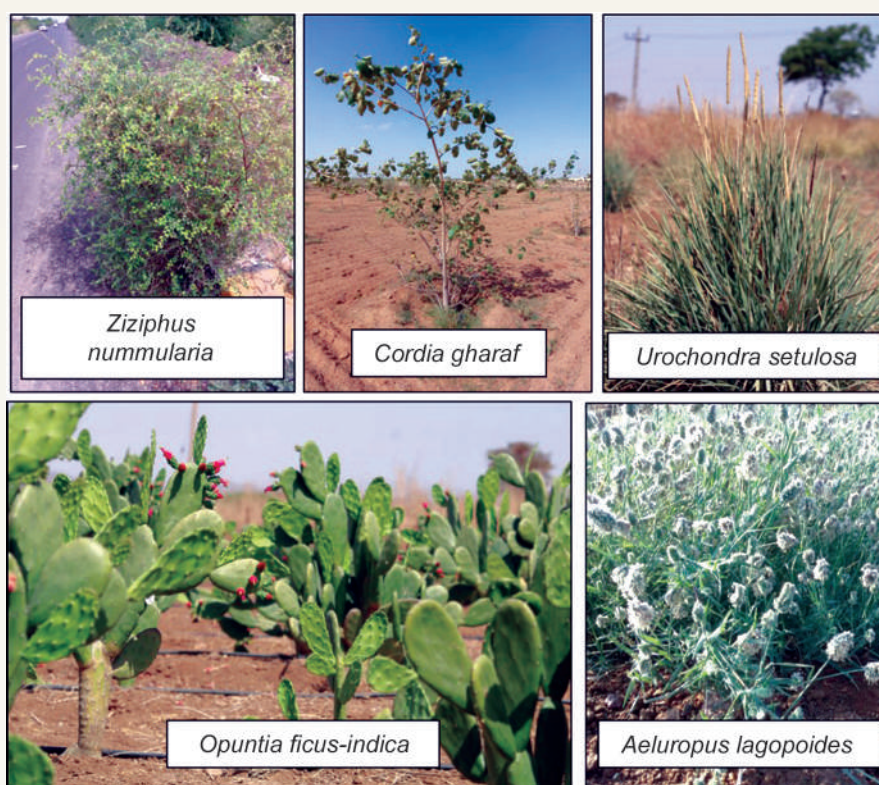


Fig. 2. Shrubs and halophytic forage crops as unconventional fodder resources. Source: Pictures are taken from Research Farm, ICAR-CAZRI, RRS-Bhuj

carried out at CAZRI, Bhuj established that if managed scientifically, these halophytes can produce about 4-5 t/ha dry fodder. The studies on nutritional quality of halophytes revealed wide variation in proximate composition in different halophyte species, the forage quality was the highest at vegetative stage and decreases as plants mature. The organic matter (OM) content of halophytes ranged from 58.4% (*Suaeda nudiflora*) to 90.4% (*Sporobolus marginatus*). The crude protein content of halophytes ranged from 4.7% (*S. marginatus*) to 19.2% (*S. nudiflora*). Occurrence of moderate to high amounts of crude protein, seems fair enough to meet the protein requirements of grazing livestock. The halophyte forages contain high levels of ash and silica also, which could limit intake and digestibility of halophytes as forages. The Na and P contents in most of the halophyte forages are more than the recommended dietary level for cattle. Among the halophytes, *Cressa cretica*, *Suaeda nudiflora*, *Aeluropus lagopoides* and *Sporobolus marginatus* could be the potential source of crude protein and minerals for livestock fed on low quality roughages. However, energy supplements are necessary to

compensate the nutrient requirements of livestock.

SUMMARY

The unavailability of sufficient quantities of feed fodder has become a bottleneck in animal nutrition and thereby affecting the quality and quantity of milk production in dryland areas. The increasing challenges of fodder productivity due to climate changes and land degradation are other unavoidable issues that add to the concerns. Therefore, the unconventional fodder resources such as Indian mesquite, thornless cactus, Anjan, Gundi etc. are often advocated to meet the fodder needs and for augmenting milk production in dryland areas. It may be used as alternatives source during the driest seasons of the year in arid regions when the other conventional fodder crops are not grown. Studies on these unconventional fodder resources will generate useful information on the benefits of these plant species as one of the animal nutrition strategies for optimizing production cost, milk quality and quantity in small-holder dairy farming systems of arid regions.

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