LEUCAENA LEUCOCEPHALA AS A FEED FOR RUMINANTS IN SUBMOUNTAINOUS TRACT OF NORTH-WESTERN INDIA - A REVIEW

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ABSTRACT
Leucaena leucocephala (subabul) is known for its rich source of protein having high biological value and other nutrients like vitamins and minerals but also anti-nutritional factor, like mimosine limits its utilization by livestock. Leucaena leucocephala meal protein can replace oilseed protein in the ration of lactating animals up to 30% without any deleterious effect on nutrients utilization and milk production at economic price. The leaf-meal plant can also be used as a supplement in animal feed during the lean season and also in time of calamity. When animals are gradually introduced to leucaena, rumen microorganisms can break down the mimosine and toxic action of mimosine no longer poses a problem. In animals receiving rations containing high amount of leucaena, the general clinical signs of toxicity are alopecia, excessive salivation, loss of appetite, inco-ordination of gait, enlarged thyroid glands, poor breeding performance and production of goitrous calves. The toxicity is not acute under field conditions, while white clover and lucerne, which cause bloat in temperate pastures, are a far greater risk in terms of stock losses than leucaena.

Feeding covers more than 50 per cent of the cost of milk production. During last decade, prices of feedstuffs have gone up by 2-3 times and the quality of all these are generally poor. Apart from high cost, which is absorbable in the selling price of milk, cattle feed and fodder are in short supply. In our country the annual requirement of feeds and fodders estimated are 25.4 million tons of concentrates, 353.0 million tons of dry matter and 308.1 million tons of green fodder. The gap between the availability and requirements of concentrates and fodder is gigantic; viz., of concentrates 44% and of green fodder 36%. Scientists expressed great concern over the matter and felt that unless the supply of feed and fodder is greatly increased, the productivity of dairy cattle is not likely to improve.

Some feed mills in the region produce compounded feeds. Half of this is used for poultry. The balance is not sufficient for quality milch animals, against a large number of animals which are to be fed. Majority of the animals are, therefore, fed in a somewhat haphazard manner. The owners themselves buy individual items like oil cakes, bran, crushed lentil etc., the quality of which again is not standardized. These items are even adulterated. Feeding of salt or mineral mixture is, by and large, unknown. If one goes through the volumes of literature on dairying in submountainous tract of North-Western India, the theme on every occasion has been the same, namely that "submountainous tract of North-Western India has too many poor cattle. They produce too little milk, its price for the consumer is very high for the little quantity of the adulterated quality/head etc." In other words, the problem is well known for over half a century, but no strenuous efforts have been made to tackle it till date.

Submountainous tract of North-Western India currently produces millions tons of crop residues and there is an increasing trend every year with increase in crop production. These are commonly used as fuel and feeds. However, because of low bulk density and low market price of these residues, their handling,
storage and transportation have been found uneconomical. The requirement of feed and fodder in submountainous tract of North-Western India is increasing. Area under grazing land is decreasing due to increasing pressure of human population. Therefore, it is very important to select proper herbage or cropping system that can withstand or effectively adjust with the conditions of submountainous region. The submountainous undulating region, also locally known as Kandi area receives bulk of rainfall only in monsoon season and there is scarcity of water during rest of the year. Under such circumstances Leucaena leucocephala, because of deep root system, is able to draw water from deeper layers of soil and can survive around lasting for about 8 months. L. leucocephala provides fodder, fuel and pulp; besides having properties of soil conservation and soil fertility improvement by nitrogen fixation.

The Leucaena can be grown in lines 4-5m apart with 1m-plant distance and is maintained as bush by cutting back at the base. Gill (1993) reported the total fodder yield of crop and Leucaena is as under:

<table>
<thead>
<tr>
<th>Crop sequence</th>
<th>Kharif</th>
<th>Rabi</th>
<th>Fodder yield (q/ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>L. leucocephala+Bajra</td>
<td>L. leucocephala+Javi</td>
<td>349</td>
<td></td>
</tr>
<tr>
<td>L. leucocephala+Chari</td>
<td>L. leucocephala+Javi</td>
<td>325</td>
<td></td>
</tr>
<tr>
<td>L. leucocephala+Bajra</td>
<td>L. leucocephala+Taramira</td>
<td>307</td>
<td></td>
</tr>
<tr>
<td>L. leucocephala+Guara</td>
<td>L. leucocephala+Javi</td>
<td>268</td>
<td></td>
</tr>
<tr>
<td>L. leucocephala+Guara</td>
<td>L. leucocephala+Taramira</td>
<td>226</td>
<td></td>
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</tbody>
</table>

Agronomic characteristics

L. leucocephala grows well in a wide range of soils with the marked exception of very acid and waterlogged soils and is particularly well adapted to calcareous clay soils. It can grow anywhere in the tropics and subtropics within an annual rainfall range of 500 to 3000 mm. The tall, erect, sparsely branched L. leucocephala may also be grown as forest trees, are represented by the giant cultivars K8 and K28. The trees are palatable to livestock and regrow rapidly after cutting or grazing. By cutting L. leucocephala foliage at short intervals can be supplemented as green leaf manure (GLM) for economic fertilizer application, (Gill, 1993).

Nutritive value of L. leucocephala

The foliage harvested after 50 days gives highest yield of herbage and crude protein. Gill (1993) reported that a topping interval of 50 days (7 times/year) is optimal for L. leucocephala to obtain maximum yield of nutritious, yet low in iodine and sodium. Leaf meal of L. leucocephala is very similar to alfalfa or lucerne leaf meals in terms of protein and minerals except for higher isoleucine contents of the leucaena leaf-meal. As far as the ruminants concerned, tannins in Leucaena may also have important nutritional implications. These tannins may also have an important role in the protection of protein from degradation in the rumen and therefore, in making it more available in the small intestine.

The calcium concentration in Leucaena appears to vary considerably, depending on the location. For example, under Australian conditions, the calcium concentration rarely exceeds 1 per cent in the dry matter due to a variety of soils whereas in the material grown in India, more than 2 per cent calcium is found in leucaena leaf meal. Leucaena leaf-meal is also an excellent source of beta-carotene, which is a valuable characteristic, particularly during the dry season when leucaena foliage remain green than many other pastures species (Jones, 1979).
Milk production from *leucaena*

*Leucaena* can help to produce milk at economical price because it is cheap and rich source of protein beta-carotene. During summer, scarcity of green fodder can be partly met by *leucaena*. Its use would improve the physiological status of the animals and also reduces the cost of feeding. There may be improvement in milk production when dairy cows are fed small supplements of *leucaena* leaf-meal in addition to the well-fertilized Rhodes grass pastures as reported by Jones (1979). It is estimated that feeding 2 kg *leucaena* leaf/cow/day is equivalent to feeding 250g/cow/day of protected protein (formal casein). *Leucaena* leaf meal (LLM) may replace oil seed protein in the rations of lactating animals to the extent of 30 per cent without affecting nutrient utilization and milk production (Garg and Kumar, 1994).

Toxicity problems

The toxic amino acid mimosine occurs in all parts of the leucaena plant. Generally, concentration in the growing tips attain a level of 12 per cent of the dry matter, in young leaves/pods 3-5 per cent and in seeds 4-5 percent of the dry matter. Green stem contains up to 2 per cent mimosine but older stem that has become suberous has usually 1 per cent of mimosine in dry matter. If animals are gradually introduced to leucaena, rumen microorganisms can adapt to break down the mimosine and toxic action of mimosine no longer poses a problem.

The general clinical sign of mimosine toxicity in animals is alopecia (hair loss), which occurs sporadically when animals are introduced to leucaena for the first time or when they receive rations containing high amounts of lacuna forage. Other clinical signs of toxicity are loss of appetite, excessive salivation, incoordination of gait, enlarged thyroid glands, poor breeding performance and the production of goitrous calves that die at birth. (Hamilton, et al., 1971).

Usually, the toxicity is not acute under field conditions. In fields, if sick animals are recognized and may be removed to non-*leucaena* pastures. In this respect, white clover and lucerne, which causes bloat in temperate pastures, are a far greater risk in terms of stock losses than leucaena.

Limitation of acceptance of *leucaena*

A fodder tree which has such a high potential for producing proteins is not being utilized to any great extent for animal production, must have certain limitations that prevent its potential use. Several factors limiting its usefulness as forage are:

1. The plant is slow to grow as compared to other pasture legumes.
2. Growth of plants can be hindered dramatically because of its extreme palatability to ruminants and marsupials.
3. There is fear about the adverse affects of *leucaena* on grazing livestock
4. Management and utilization of *leucaena* may be very different from that of the traditionally used legumes in pasture development.
5. Lack of information about *leucaena* regarding animal production.

*Leucaena* block lick for animals

*Leucaena* block has been made for dairy animals in submountainous tract of North-Western India, famine or drought affected regions to combat the protein and mineral deficiency oftenly observed in these regions. For the preparation of block, take 300g urea in a big iron pan and add 1000g molasses. Mix the two and simmer for 30 minutes. Add 1200g-*leucaena* *leucocephala* leaf-meal, 420g mineral mixture, 30g benotonite and 50g acetic acid and mix whole material thoroughly. Press this material while hot in a machine. After hardening; take out the block from machine. It contains 42 per cent crude protein and negligible amount of mimosine. A block of 3
kg is sufficient for a week and can meet a partial protein and mineral requirement of one dairy animal.

Future strategy

The advantages of *leucaena* may be real, but unless they are documented in terms of increased animal productivity and economic gain in submountainous tract of N-W India, there will be very little incentive for wider utilization. Therefore, there is real need for further studies to assess the animal production potential of *leucaena* especially under the climatic conditions of submountainous tract of N-W India.

In submountainous tract, the use for improved cultivators of *leucaena* could provide valuable protein and mineral supplementation to the cereal crop residues fed to animals. Under these conditions the low proportions of *leucaena* fed would obviate any toxicity problems (Jones, 1979).

REFERENCES