Indigenous fodder trees and shrubs as feed resources for intensive goat production in Uganda

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Introduction

Goats play an important role in the food and nutritional (source of protein) security of the rural poor especially in the rainfed area where crop production is uncertain, and rearing large ruminants is restricted by acute scarcity of feed and fodder. Goat rearing has distinct economic and managerial advantages over other livestock because of its less initial investment, low input requirement, higher prolificacy, early sexual maturity, and ease in marketing. Goats can efficiently survive on available shrubs and trees in unfavourable environments. Goats are kept as a source of additional income and as an insurance against income shocks of crop failure. In addition, the farmers who cannot afford to maintain a cow find goat as the best alternative source of supplementary income and milk. Goat milk is more expensive (Ushs 6,000 per litre) than cow milk.

Unlike a cow, a few goats can be maintained easily and can be easily liquidated in times of distress. In recent years, goat enterprise has also shown promise of its successful intensification and commercialization. Owing to their greater socio-economic relevance, the growth in goat population in Uganda over the past five decades has been steady increasing. About 70 per cent of the landless farmers, marginal and small farmers in the country are associated with goat husbandry.

Many farmers in Uganda have adopted intensive feeding management practices where improved goats are stall-fed. The number of improved goats is expected to gradually constitute a larger percentage of the national herd over the next thirty years. This has increased the demand for feed due to the high genetic capacity of the breeds. Development of the goat industry could be a major catalyst to economic development through: i) generating significant regular income for producers; ii) creating employment through the production, processing and marketing of meat; and iii) improving the diets of rural and urban consumers. However, due to land shortage, grazing land is very limited and for most farmers not suitable for grazing their goats.

Elephant grass fodder (Pennisetum purpureum) is the most popular forage for stall-fed animals in Uganda. With rapid growth, and re-growth after harvesting, the quantity of fodder is not a limiting factor to fodder production. However, the quick maturing of elephant grass during the dry season leads to a rapid deterioration in its nutritive quality (less than 7 per cent crude protein).

The last four decades have seen vigorous promotion of exotic or foreign species of fodder trees and shrubs, e.g. Calliandra calothyrsus (calliandra), Leucaena
leucocephola (leucaena) and Gliricidia sepium (gliricidia) in intensive goat production systems.

These trees are easy to propagate, are ready for harvest within one year after planting and, unlike grasses, maintain their green foliage and protein content during the dry season. However, farmers need to diversify the tree species they use, both to enrich goat diets and to reduce the risk of a tree species succumbing to pests or disease. For example, Leucaena succumbed to the physillid (Heteropsylla cuban) pest while calliandra, now being widely promoted in Uganda, is being threatened by a die-back disease that has reduced biomass yields in some parts of Uganda.
Indigenous fodder trees and shrubs as livestock feed

Indigenous fodder trees and shrubs (IFTS) play an important role in bridging the gap in fodder supply during the critical dry months in Uganda. Being perennials, IFTS are able to withstand prolonged periods of moisture stress than grasses and herbaceous forage legumes such as Lablab. In many parts of Uganda, IFTS are the only source of green forage available during the dry season. In addition, many fodder trees and shrubs have high nutrient value that supplement the often-poor quality grasses and crop residues, the normal dry season feeds. The protein content of most IFTS is higher than 15 percent, compared to that of grasses (less than 12 percent). It is also higher than the required 13-16 percent of a cow and goat diet. When compared to the recommended rations of minerals, Calcium and Phosphorus, majority of the species sufficiently provide these minerals. Livestock owe their continuing good health, or indeed survival, to IFTS supplements. Many IFTS are valuable feed resources for goats.

Due to shortages of other feeds, loping is done during the dry season, thus providing a green supplement. It is estimated that IFTS contribute over 15 percent of the total diet during the dry season. However, very little IFTS is fed to goats during the wet season because there is plenty of green fodder.

IFTS are normally fed to livestock once a day in the afternoon. For the rest of the day, the animals feed on other grasses (Signal grass; Giant Guinea grass, Rhodes grass, Napier grass), crop residues or they are allowed to graze. The frequency of harvesting from the trees depends on the species and the season. Most trees are harvested every 90 days during the wet season and every 4-6 months during the dry season.

Freely grazing or browsing goats will eat twigs, leaves, young shoots, and fruits of these plants. In most areas intensification of production systems means forage is brought to confined animals. In these systems, farmers harvest the edible parts (soft branches or top twigs pollarded or pruned) of IFTS and feed them to animals along with grass and other forages.
Major indigenous fodder trees and shrubs in crop/livestock farming systems

<table>
<thead>
<tr>
<th>Scientific name</th>
<th>Common name</th>
<th>Part used as fodder</th>
<th>Propagation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Persea americana</td>
<td>Avocado pear</td>
<td>Leaves and seeds</td>
<td>Seed and commercially propagated by cleft or grafting or budding</td>
</tr>
<tr>
<td>Moringa oleifera</td>
<td>Horse-raddish tree</td>
<td>Leaves</td>
<td>Direct seedlings, seed and cuttings</td>
</tr>
<tr>
<td>Entada abyssinica</td>
<td></td>
<td>Leaves</td>
<td>Wildings</td>
</tr>
<tr>
<td>Cajanus cajana</td>
<td>Pigeon peas</td>
<td>Leaves, twigs and seed</td>
<td>Seed</td>
</tr>
<tr>
<td>Securinega virosa</td>
<td>White berry bush</td>
<td>Leaves and twigs</td>
<td>Wildings</td>
</tr>
<tr>
<td>Psidium guajava</td>
<td>Guava</td>
<td>Leaves and fruits</td>
<td>Seed, wildings</td>
</tr>
<tr>
<td>Morus alba</td>
<td>Mulberry</td>
<td>Leaves and fruits</td>
<td>Seed and cuttings</td>
</tr>
<tr>
<td>Ficus natalensis</td>
<td>Fig tree, Back-cloth fig</td>
<td>Leaves</td>
<td>Cuttings and seedlings</td>
</tr>
<tr>
<td>Alibizia coriaria</td>
<td>Alibizia</td>
<td>Leaves</td>
<td>Seed, wildings</td>
</tr>
<tr>
<td>Senna occidentalis</td>
<td>Coffee senna, septic weed</td>
<td>Leaves</td>
<td>Seed, wildings</td>
</tr>
<tr>
<td>Acacia spp.</td>
<td>Acacia</td>
<td>Leaves and pods</td>
<td>Seed, direct sowing, wildings</td>
</tr>
<tr>
<td>Lantana camara</td>
<td></td>
<td>Leaves</td>
<td>Wildings</td>
</tr>
<tr>
<td>Tithonia diversifolia</td>
<td>Mexican sunflower</td>
<td>Leaves and young shoots</td>
<td>Direct seedlings, seed and cuttings</td>
</tr>
<tr>
<td>Vernonia amygdalina</td>
<td>Bitter leaf tree</td>
<td>Leaves and young shoots</td>
<td>Seed</td>
</tr>
<tr>
<td>Manihot spp</td>
<td>Cassava</td>
<td>Leaves and young shoots</td>
<td>Cuttings and seed</td>
</tr>
<tr>
<td>Sesbania sesban</td>
<td>Sesbania, Riverbean</td>
<td>leaves</td>
<td>Seed</td>
</tr>
<tr>
<td>Artocarpus heterophyllus</td>
<td>Jackfruit</td>
<td>Leaves, twigs and seeds</td>
<td>Seed</td>
</tr>
<tr>
<td>Mimusops baghawei</td>
<td>Mimusops, Red milkwood</td>
<td>Leaves</td>
<td>Seed</td>
</tr>
</tbody>
</table>
Mexican sunflower

Jack fruit leaves

Ficus natalensis branches

Vernonia amygdalina (Bitter leaf tree)
Fodder treatment, value adding and conservation of IFTS

Fodder from IFTS is always fed fresh and is not treated. However, some IFTS such as Mexican sunflower are bitter because of anti-nutritional compounds which are dangerous to livestock. The effects can be reduced by wilting or drying the leaves before offering them to the animals. Wilting also improves their palatability and intake. Feeding IFTS in mixtures can help to overcome possible side effects that could result from feeding species, known to be poisonous, such as Phytoleca (*Oluwoko*) and *Lantana camara* (*Kayukuyuki*) in large quantities.

![Lantana camara](image)

The major parts that are fed to animals are the leaves and twigs although some farmers feed immature fruits, seeds of jackfruits, avocado and mangoes. Animals feed on the bark of *Ficus* and *Morus alba* (mulberry).

In many parts of Uganda, farmers remove seeds and fruits from *Lantana camara* and *Sodom* spp before feeding them. Farmers reported *Lantana camara* to be toxic to animals if fed with seeds. It is also not a very good feed if fed frequently and in large amounts as it causes blisters on the lining of the intestines and the leaves and twigs do damage the animal’s teeth.

**IFTS as a medicine for livestock**

Some IFTS have medicinal uses, with leaves, roots and bark providing the raw materials for medicinal and veterinary products.

- The leaves of *Vernonia amygdalina* (Bitter leaf) are used as: medicine to treat fevers in humans and livestock; vegetables and to stimulate digestive system;
- Mango tree leaves and bark are used to treat cough, fruits are source of vitamin C, mangoes are used in preservatives.
- Roots of sesbania are used to treat fever.
- Boiled leaves of avocado are used to treat dehydration in humans and livestock.
- Guava leaves are used to treat cough. The fruits are very good source of vitamin C. Guava fruits

IFTS do not offer a 100 percent solution but it is a means of administering first aid to animals and family members, especially in rural areas where veterinary and medical services are either not easily accessible or are very expensive. Plant material is used either singly or in combination. Farmers use a combination of several IFTS to increase the chance of recovery. Moreover, a disease can be cured by one or more medicinal formulae and one formula can be used for the treatment of several diseases.

Other uses of IFTS in the farming systems

- Farmers have been able to generate some income by selling firewood, poles, fruits, seeds, fibres and medicine.
- Shade and shelter for people and animals.
- Environmental protection and enhancement of rural and scenic surroundings.
- Bushy, thorny hedgerows are planted to mark boundaries and channel herd access and movements.
- Fig trees are planted very close together to form living fences, and their clippings are used as fodder.
- Territorial boundaries, a first stage in land appropriation, can be demarcated by IFTS.
- Many IFTS provide products that enhance food security and also help to promote dietary balance, diversity and good health. Trees such as pawpaws, avocados, mangos and guavas are rich in Vitamin C. They also provide simple snacks during work or travel.
- The IFTS also play a key environmental role. Firewood is the main source of energy for rural households, especially for cooking in rural areas of Uganda. In urban areas charcoal from IFTS, such as *Acacia* spp., is used extensively for household cooking and also in restaurants and hotels.
- In most rural and urban areas, IFTS are still the main source of materials for constructing houses, fences etc.
- Raw materials from IFTS are used to make a wide range of products that can broadly be classified as household utensils, tools, and equipment. Many different species, such as *Sapium alpticum*, are used to make tools and utensils.
- Traditional beekeepers make their living from IFTS, by placing hives in carefully selected trees such as *Moringa oleifera* and *Acacia gerradai*. Honey is a unique product in that it does not compete with other land uses or cause land degradation, although burning has been mentioned as an adverse effect of traditional bee-keeping practices.
- Many IFTS have been, and are still, an integral aspect of the social structure, religion, art, history, medicine, and politics of a community. In Masaka District, *Ficus* tree is used to make bark cloth used in cultural functions, including witchcraft, death and funerals. In rural areas, the cloth is used to make bed
sheets and traditional costumes.

*Sapium ellipticum*

(Persea americana-Avocado pear)

*Fig tree*

- Some IFTS are viewed as both sources of, and protectors against, evil and as providers of fortune and power. In some districts, certain trees, such as *Ficus ovata* and *Commiphora* spp. are used to link the living with their ancestors. Sometimes gifts are given as a means of showing ancestors that they have not been forgotten. Gifts such as flowers or alcohol are placed at the foot of the tree as an offering which is symbolic of giving food to the ancestors through the tree. *Dracaena afromontana* is known as a “peace” plant and mostly used to mark graveyards, begging for forgiveness and for decorations during public ceremonies.
Indigenous fodder tree establishment, sources of planting materials, propagation and farm niches

Indigenous fodder trees and shrubs are established and propagated either by natural regeneration, by cuttings or direct sowing on site. Sometimes the seeds are carried out by birds to the host trees where they germinate. However, the seeds also germinate in the ground. Other IFTS such as cassava and Pigeon peas are planted for food while leaves and peels are fed to livestock after harvesting the tubers. Major source of planting materials for IFTS are from the wilderness. Other sources are from fellow farmers. Major methods of propagation are natural regeneration (Vernonia), cuttings (cassava and Ficus) and direct sowing (papaws, mangos and sesbania).

The main niches are farm and field boundaries, edges of terraces to control soil erosion, live fences, hedgerows or scattered in the fields. Some times IFTS are scattered among crops e.g. Fig tree. and moringa are left scattered in the cassava and banana fields to provide wind breaks.

![Moringa tree planted in banana plantation](image)

This is a form of mixed intercropping. Major IFTS used in live fences are Fig trees, and *Acacias*. Fig tree poles are used in fencing where they regenerate easily thus forming permanent fencing poles that are cheaper than Eucalyptus poles. The trees are also planted in paddocks or compounds to provide shade to livestock and humans. Some trees such as *Acacia senegal* and *Ficus* spp are planted at the boundary of the houses, fields and demarcating land.

**Availability seasonality and abundance**

Most of the IFTSs are deciduous, with their forage abundantly available and best used during rainy seasons when the twigs are soft and edible; if left un-used leaves dried and were shed soon into the dry season. Such IFTSs are useful because when harvested
and added to grass they improve the quantity of the available forage, and sometimes used in order to preserve the grass for longer use.

Some other shrubs are evergreen or do not lose leaves extensively and are valuable forage resources for the animals during the dry period. These include Mexican sunflower. Other plants are not quite palatable but since they do not lose their foliage, farmers greatly appreciate their availability during the dry season.

Thus, the forage of IFTS is available and used throughout the year with proportions in the livestock’s’ diet varying depending on availability of all varieties the farmer has access to offering the advantage of provision of forage in all seasons.

Positive aspects of IFTS

Major positive aspects of IFTS are:

- Fodder from IFTS improves feed availability
- Leguminous IFTS such as Pigeon pea improves soil fertility
- Some IFTS have fast growth rate
- Most IFTS are drought resistant
- Highly palatable
- Fruit trees improves food security and nutrition

Negative aspects of IFTS

Major negative aspects connected with IFTSs are:

- Big trees, like Ficus spp. grow to a great height, making their forage difficult to harvest.
- Slow growth
- There is a danger of creeping and climbing trees and shrubs smothering other crops.
- Variation in fodder availability (quantity) across seasons Difficulty of integrating most of the IFTS into the cropping system Bitter taste (e.g. Vernonia spp.)
- Competition between humans and animals
- Difficulty in propagating planting materialThorns and spines (e.g. Acacia) affecting intake
- Pests and diseases
- Low fodder yields
- Some IFTs are poisonous (e.g. Phytolaca and Lantana spp.).