Indigenous Fodder Trees and Shrubs as Feed Resources for Goats in Uganda

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Introduction

Indigenous fodder trees and shrubs (IFTS) are important for dry season feeding of goats in Uganda. IFTS produce considerable amounts of high protein biomass during the dry season, and are highly adapted to the local environmental conditions. These attributes make IFTS important feed resources for goat keepers in Uganda to harness. They can significantly contribute to sustainable goat production by providing high value fodder. IFTS form an important dietary component, and especially energy and protein supplement to the low quality basal feeds. They also have medicinal values, and hence provide affordable and readily available remedies for certain goat diseases and conditions.

The purpose on this manual is to provide Ugandan goat keepers basic information about IFTS, and how they can integrate use of IFTS to improve the health and production of their goats. Due to variations in goat production and management systems in Uganda, the general principles of use of IFTS outlined in this manual may not apply to every situation. Users of this manual are advised to tailor these general principles to suit their individual situations.

2. IFTS as feed resources

A wide variety of IFTS are found in Uganda. Appendix 1 lists the most common IFTS available in Uganda for goat keepers to use. A total of 20 IFTS are listed. This list also shows the part of each IFTS that is used as fodder for goats. This list is not exhaustive. Goat keepers are advised to carefully choose among these IFTS, because some of them are poisonous to goats if fed inappropriately. The common parts of IFTS fed to goat are leaves, twigs, peels, immature fruits and seeds and pods.

IFTS play an important role in bridging the gap in fodder supply during the critical dry months in Uganda. Being perennial, IFTS are able to withstand prolonged periods of moisture stress than grasses and herbaceous forage legumes. In many parts of Uganda, IFTS are the only source of green forage available during the dry season. The crude protein content of most IFTS is higher than that of grasses and most forage legumes. When compared to the recommended rations of calcium and phosphorus, most species of IFTS sufficiently provide these minerals.

IFTS can contribute over 15 per cent of the total goat diet during the dry season. IFTS are normally fed to goats once a day in the afternoon. For the rest of the day, the goats can be feed on other grasses such as Setaria spp, giant *Panicum* (guinea grass), *Chloris gayana* (Rhodes grass), *Pennisetum purpureum* (elephant grass), crop residues such as banana stems, sweet potato vines and cassava peels.

The frequency of harvesting fodder from IFTS depends on species and the season. Most trees are harvested every 90 days during the wet season and every 4 to 6 months during the dry season. In

intensive goat production system, goat keepers can harvest the edible parts of IFTS and feed them to goats along with grass and other forages. Besides leaves and twigs, immature fruits and seeds, e.g., avocados, jack fruits and mangoes can also be fed to goats. The fruits should be first chopped or crushed to avoid chocking the goats.

3. IFTS treatment and value addition

Although fodder from IFTS is always fed fresh without treatment, some IFTS such as bitter leaf tree (*Vernonia amygdalina*), cassava leaves and peels are bitter and could be poisonous because of anti-nutritional compounds. These effects can be reduced by wilting or drying the leaves before offering them to goats. Wilting also improves palatability and intake of IFTS by goats. Feeding goats with mixed IFTS helps to overcome possible side effects that could result from feeding only one species large quantities.

Acacia tortillas is very suitable feed for goats. The goats only digest the outer shell while the seed passes out through the faeces. These pods are high in protein having a value of about 17 per cent crude protein. Their mineral content is also high. These pods can be sun dried and stored. A daily ration of half a kilogram is adequate for supplementation.

Goat keepers are advised to remove seeds and fruits from *Lantana camara* before feeding it to goats. This is because the seeds of *L. camara* are poisonous to goats. It is also not a good to feed large amounts of leaves and twigs of *L. camara* because it can cause blisters on the lining of the intestines, and may also damage the goat's teeth. It is advisable to mix leaves and twigs of *L. camara* with other IFTS when feeding goats.

4. IFTS as medicine for goats

The contribution of IFTS as sources of medicines for goats is difficult to quantify in most parts of Uganda. Some IFTS have medicinal uses. They offer affordable and alternatives inputs for veterinary care of goats, especially in rural areas where veterinary services are either not easily accessible or are very expensive for goat keepers. However, caution should be exercised in use IFTS as medicines for goats as they do not cure all ailments of goats. Some of the IFTS listed in Appendix 1 have medicinal values. Examples are *Vernonia amygdalina, Moringa oleifera,* and *Entadda abyssinica*. The leaves of *Vernonia amygdalina* can be crushed in water and drenched to goats for treatment of internal parasites. The leaves of *Moringa oleifera* can be used for symptomatic treatment of unthriftness, while leaves of *Entadda abyssinica* can be used to prevent abortion in goats.

5. Other uses of IFTS in Ugandan farming systems

Besides being fodder and medicines, IFTS provide income for goat keepers through sale of firewood, poles, fruits, seeds, and fibres. They also provide shade and shelter for people and goats, protect the environment, and enhance rural and scenic surroundings. Bushy, thorny hedgerows mark boundaries and channel herd access and movements. *Ficus* trees can be planted very close together to form live fences, and their clippings are used as fodder. Territorial boundaries can be demarcated by IFTS.

Many IFTS provide edible fruits that contribute to food security and human nutrition. Fruits of paw paws, avocados, mangos and guavas are rich in Vitamin C. They also provide simple snacks. In urban areas charcoal from IFTS, such as *Acacia* spp., is used extensively for as fuel for cooking purposes.
In most rural and urban areas, IFTS are still the main source of materials for building and fencing. Raw materials from IFTS can be used to make a wide range of household products. Many different species, such as *Sapium allipticum,* are used to make tools and utensils. Beekeepers place hives in carefully selected trees such as *Moringa oliefera* and *Acacia gerradai.*

Many IFTS are an integral aspect of the social structure, religion, art, history, and politics of rural communities of Uganda. In Masaka District, for example, *Ficus* spp. is used to make bark cloth used in cultural functions. Some IFTS are sources of, and protectors against, evil and as providers of fortune and power. In Masaka District, 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.

6. IFTS establishment, sources of planting materials and farm niches

IFTS can be established and propagated by natural regeneration, by cuttings and by direct sowing. Other IFTS such as cassava and *Cajanus cajana* are planted for food, while leaves and peels are fed to goats after harvesting the tubers. Trees such as *S. ellipticum, G. robusta,* and *Ficus* spp, can be panted using seeds, while roots and/or stem cuttings for *T. diversifolia, Manihot* spp (cassava), *M. alba, Sesbania sesban* and *Milletia tanaensis* are used for propagation.

Planting materials for most IFTS are obtained from the wild. Other sources are from fellow farmers and research institutes such as fhe Forestry Resources Research Institute at Kifu, Mukono district. Goat keepers are encouraged to visit this research institute to obtain planting materials of IFTS.

The main farm niches for IFTS are farm boundaries, edges of terraces, homestead fences, hedgerows or scattered in the fields. External boundaries are mainly for *L. camara, T. diversifolia, Commiphora zimmermanii* and *Acalypha fruiticosa*. Trees like *Ficus* spp are highly valued but they are large, occupy more space and are preferably maintained in open pasture or in external boundaries. Ficus can be planted at the edges of terraces to control soil erosion. Sometimes IFTS are intercropped food among crops. For example, *Ficus spp.* and *Moringa* can be intercropped with in cassava and banana fields.

Major IFTS that goat keepers can use in live fences are *Ficus natalensis,* and *Acacia*. *Ficus* 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.

7. Seasonal availability and management of IFTS

Most IFTS are deciduous, with their forage abundantly available for harvesting. If not harvested the leaves dry and are shed. The shed leaves can be added to grass fodder and used to preserve it. Some fodder shrubs are evergreen or do not lose leaves extensively and are valuable forage resources for the animals during the dry period. These included *B micrantha, T. diversifolia, Oriobota japonica* and *Manihot glaziovii*. Other plants such as *C. macrostachyus* and *G. robusta* are not quite palatable but since they do not lose their foliage, goat keepers can keep them as back up fodder sources.
Some IFTS can grow too big for easy harvesting. When in farm compounds shrubs and creepers such as *Ipomoea* spp can be harvested as weeds and fed to goats or left to stay and maintained, with occasional harvesting as need arises. A rather wide range of herbaceous creepers and shrubs can be collected as weeds singly or in mixtures, with or without grass types, for feeding goats. For bigger woody trees kept primarily for other purposes such as *S. ellipticum*, forage can be obtained by cutting branches, then feeding goats with the pruned leaves and twigs.

8. Positive and negative aspects of IFTS

The major positive aspects of IFTS are:

- Fodder from IFTS improves feed availability
- Leguminous IFTS such as *Cajanus cajana* improve soil fertility
- Some IFTS grow fast
- Most IFTS are drought resistant
- Most IFTS are highly palatable for goats
- Fruit trees improve food security and human nutrition

The major negative aspects of IFTS are:

- Big trees, like *Ficus* spp. grow to a great height, making their forage difficult to harvest.
- Slow growth hence low adoption by goat keepers
- There is a danger of creeping and climbing trees and shrubs smothering other crops.
- It is difficult to integrate most of the IFTS into the cropping system
- Some IFTS like *Vernonia* spp. have unpleasant taste to goats
- It is difficult to propagate some IFTS
- Thorns and spines (e.g. *Acacia)* can injure goats
- Some IFTS are poisonous (e.g. *Phytolaca* and *Lantana* spp.).

9. Conclusion and recommendation

Uganda is endowed with a wide variety of IFTS that can be used as feed resources for goats. Many species of IFTS available in Uganda have high levels of protein, and are suitable for feeding goats as supplements, especially in the dry season. We recommend goat keepers in Uganda to integrate and up-scale use of IFTS as feed resources for goats.

Appendix 1: Common IFTS found in Uganda

Scientific name	Common name *(Luganda local name)*	Part used as fodder for goats	Other uses	Major constraints	Propagation	Farm niches
1. *Vernonia amygdalina*	Bitter leaf (*Mululuza*)	Leaves and twigs	The leaves are used to treat fevers in humans and livestock and to stimulate the digestive system	Low fodder yields; Pests and diseases; Bitter probably due to anti-nutritional compounds	Cuttings	Scattered
2. *Ficus natalensis*	Fig tree, Back-cloth fig (*Mutuba*)	Leaves and twigs	For making bark cloth, live fence, shade	Slow growth and low fodder yield, High content of lignin	Cuttings and seedlings	Boundary
3 .*Mangifera indica*	Mango tree (*Muyembe)*	Leaves	Leaves and bark used to treat cough, fruits are source of vitamin C	Slow growth and low fodder yield	Grafting and from seedlings	Scattered
4. *Manihot spp*	Cassava *(Muwogo*)	Leaves and peels	Tubers are used as human food and leaves used as vegetables	Cassava mosaic, low fodder yield and high content of cyanide	Cuttings and seed	Scattered
5. *Sepium ellipticum*	*(Musasa)*	Leaves	Poles, timber, anti-viral properties, roots are used to treat chronic coughs and colds, the tree provides shade, firewood and charcoal	Slow growth, low fodder yield and competes with other crops	Seed	Scattered
6. *Sesbania sesban*	Sesbania, Riverbean	Leaves and twigs	Roots are used to treat fever and contraceptive	Slow growth and low fodder yield	Seed	Scattered
7..*Artocarpus heterophyllus*	Jackfruit (*Ffene*)	Leaves, twigs and seeds	The roots are used to treat fever, the seeds can be roasted	Slow growth and low fodder yield	Seed	Scattered
8. *Mimusops bagshawei*	Mimusops, Red milkwood (*Musaali*)	Leaves	The wood is used for timber, firewood, charcoal and carvings. The tree provides good shade. The fruits provide vitamin C	Slow growth and low fodder yield	Seed	Scattered

Scientific name	Common name *(Luganda local name)*	Part used as fodder	Other uses	Major constraints	Propagation	Niche
9. *Persea americana*	Avocado pear (*Ovakedo*)	Leaves and seeds	Boiled leaves are used to treat dehydration in humans and livestock. Avocado oil is used for treating hair and skin care in humans	Slow growth, low fodder yields and many seedlings never produce fruits and sometimes the quality of fruits is very low	Seed and commercially propagated by cleft or grafting or budding	Scattered
10. *Moringa oleifera*	Horse-raddish tree	Leaves	Treats high blood pressure in humans. Used as firewood, poles, charcoal, shade, bee forage, live stakes, seeds are used to purify water	Competes with humans for medicinal purposes	Direct seedlings, seed and cuttings	Scattered
11. *Entada abyssinica*	*n.a**	Leaves	Prevents abortion in cows	Low fodder yields and slow growth	Wildings	Scattered
12.*Cajanus cajana*	Pigeon peas *(Nkolimbo*)	Leaves, twigs and seed	Food and fodder	Low fodder yields and slow growth	Seed	Scattered
13.*Securinega virosa*	*n.a*	Leaves and twigs	Prevents abortion in cows, the slender branches are used to make fish traps while an infusion of various parts of the plant is used to relieve malaria	Low fodder yields and slow growth	Wildings	Scattered
14. *Psidium guajava*	Guava (*Mupeera*)	Leaves and fruits	Leaves are used to treat cough. The wood makes excellent firewood and charcoal. The fruits are very good source of vitamin C.	Low fodder yields and slow growth	Seed, wildings	Scattered
15. *Morus alba*	Mulberry (*Nkenene)*	Leaves and fruits	Juice is made from fruits. An antidotal, astringent and bactericide	Low fodder yields and slow growth	Seed and cuttings	Scattered
16. *Ficus ovata*	Ficus	Leaves	Poles, shade, soil conservation, live fence, boundary demarcation, white barkcloth, latex is used to treat ringworms	Low fodder yields and slow growth	Seed, wildings	Scattered

Scientific name	Common name	Part used as fodder in goats	Other uses	Major constraints	Propagation	Farm niches
17. *Alibizia coriaria*	Albizia	Leaves	Firewood, charcoal, poles, posts, medicine and soil fertility improvement	Low fodder yields and slow growth	Seed, wildings	Scattered
18. *Senna occidentalis*	Coffee senna, septicweed	Leaves	Used to treat constipation, worms, edema, asthma high blood pressure and a substitute for coffee	Low fodder yields and slow growth	Seed, wildings	Scattered
19.*Acacia spp.*	Acacia	Leaves and pods	Firewood, charcoal, poles and medicine	Low fodder yields and slow growth	Seed, direct sowing, wildings	Scattered
20. *Lantana camara*	*n.a*	Leaves	firewood	Harbours snakes, seeds are poisonous	Wildings	Scattered

**n.a.= the common and local name of plant is not available*