FODDER PLANTS FOR CATTLE IN KALIRO DISTRICT, UGANDA

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ABSTRACT The need for cultivating cattle feed in Uganda's Kaliro District has become urgent because the natural grazing areas are rapidly declining. The aim of this study was to generate information that would lead to the development and cultivation of livestock feed in the farming system. The specific objectives were (1) to describe cattle husbandry practices and (2) to document the indigenous cattle fodder and browse species. Our results show that 95% of the Kaliro households rear cattle, but are keeping fewer heads because of low fodder availability. They are also tethering animals as a direct response to the declining area of natural pastures. The cattle of Kaliro commonly feed on 42 plant species, dominated by grass and herb species. These species according to the respondents are becoming scarce because pasturelands have been converted to crop agriculture and to settlement. Fodder is also reportedly scarce in the dry season. Results of this study suggest that a diversity of plant species is available in Kaliro District from which to select some to cultivate in the variety of niches around the farm. Thirty of the fodder species reported here have other uses besides their use as fodder for cattle for the community. This may make them especially easy to select for cultivation by farmers around the farm.

Key Words: Livestock husbandry; Ethnobotany; Uganda.

INTRODUCTION

In Uganda agriculture is the most important economic activity, accounting for 43% of the Gross Domestic Product (NEMA, 1998; MAAIF & MFPED, 2000; UNDP, 2007). The livestock sub-sector of agriculture contributes 17% of the total agricultural production and 5% of the national Gross Domestic Product. This sub-sector adds significantly to the national food security and nutritional balance, provides raw materials such as milk and meat for the agro-processing industry, foreign exchange from the export of hides and skins, farm-yard manure, and draught oxen power for crop production (NEMA, 1998; MAAIF & MFPED, 2000). Cattle are the preferred livestock in the household economy of Uganda, and the national herds are dominated by indigenous stock.

Livestock in Uganda, as in many other parts of the world, is grazed on natural grass-based communal pastures, in land use systems that include forests, woodlands and swamps, and fallow lands. Many of the pasturelands located in these land use systems are declining in area because of conversion of land to

crop agriculture and settlements (NEMA, 1998). Feeding of livestock in natural systems is therefore becoming a challenge and is partly limiting growth in the livestock sub-sector. It is necessary, therefore, to initiate interventions leading towards the active management on the farm of fodder or browse species that are exploited by cattle in traditional grazing systems.

The first step in this direction is to generate information that will assist in making management decisions for pasture improvement leading to improved production from cattle. Such information includes knowledge of which species are currently exploited as fodder and the livestock management system. The main objective of this study was to document (1) the general animal husbandry practices, and (2) the cattle fodder species known to the farmers of Kaliro District in Uganda, where cattle husbandry forms a vital part of the people's livelihood.

METHODS

I. Study Area

Kaliro District is located between 33°20'-33°38' E and 0°58'-1°18' N at an altitude of 1,052-1,098 m. It covers an area of ca. 870 km^2. The climate is generally hot and dry. Rainfall ranges between 1,195-1,357 mm and is bimodal, falling in March-June and August-October (Uganda Bureau of Statistics, 2000). The soils of Kaliro have low fertility. The most extensive soil type is the Mazimasa-complex of catenas derived from ancient lake deposits. This soil type is usually a shallow grey or brown sandy loam on laterite base rock (Department of Lands & Survey, 1962). The other types are mineral hydromorphic soils influenced by permanent or seasonal waterlogging and organic hydromorphic soils.

Kaliro has four major land use categories: non-uniform small-scale farmland (67.4%), wetlands (16.4%) dominated by *Cyperus papyrus*, woodlands (3.6%) dominated by *Albizia zygia, Combretum* spp., *Hyparrhenia rufa* association and *Albizia zygia, Combretum gueinzii, Brachiaria decumbens* association, and grasslands (2.6%) dominated by *Sorghastrum rigidifolium*. All other categories including bushlands take up less than 1% of the land area; the remainder of the area is open water (Langdale-Brown, 1959; Forest Department, 1997).

The district has an estimated population of more than 155,000 people and a population density of ca. 180 people/km^2 based on the population census of 1990 (Statistics Department, 1992). The average family size of a household is eight members (Tabuti, unpublished data). From the above data we estimate that there are 18,750 households in Kaliro. The people of Kaliro are known as the Balamogi and are an agricultural community who practice subsistence crop and livestock agriculture as the main sources of livelihood. Landholdings are small and fragmented into pieces, ranging from 1-3 ha per piece (Tabuti, unpublished data).

II. Data Collection

We employed an ethnobotanical approach to document traditional knowledge associated with livestock grazing and held by the local community of Kaliro District. Local people possess knowledge about useful plants species, how they are used, and their spatial and seasonal distributions in the ecosystem (Paterson et al., 1998; Etkin, 2002). Therefore, through ethnobotanical studies involving farmers, the most commonly grazed species for improving fodder can be identified (Paterson et al., 1998; Roothaert & Franzel, 2001).

Fieldwork for this study was carried out between June 2000 and June 2001. We used semi-structured interviews, guided questionnaires, and direct observations to collect the data. The study was conducted with the approval of the local administration, which agreed with the objectives, methods, and usefulness of the results of the study. The local political leaders assisted in gaining confidence and cooperation from the respondents. A small fee of UGX 5,000-30,000 (ca. USD 3-28) was paid to all respondents as a compensation for time spent answering our questions.

Household respondents were chosen using a stratified sampling strategy following administrative units as the units of strata. We selected at least one respondent from each of the villages of Kaliro District. In this way 126 household respondents were interviewed. We administered a questionnaire consisting of a mixture of open- and close-ended questions in face-to-face interviews. The questions were aimed at determining types of livestock reared in the district and how they are reared, who in the family does the rearing, the plant species grazed by cattle, and perceptions about fodder availability. Interviews were conducted in the local language (*KiLamogi*) and were supplemented by direct observations. Plant voucher specimens were collected and deposited at the Makerere University Herbarium.

Data from the field study was edited, and all incomplete responses treated as invalid and excluded from the analysis. Data was analyzed both qualitatively and quantitatively, and responses from open-ended questions were grouped into classes that expressed similar ideas. Percentages, based on valid responses only, were calculated from close-ended questions. All averages are based on the median, because the data did not follow a normal distribution (Zar, 1984).

RESULTS

I. General Characteristics of Animal Husbandry

Almost all respondents of Kaliro (95%) rear livestock. By extension a similar proportion of the households rear cattle. Cattle, goats and chicken comprise the main types of animal husbandry (Fig. 1a). A few households also keep pigs and sheep, but ducks and turkeys are seldom reared. Farmers keep low numbers of each livestock type, and on average have 4 heads of cattle, 4 goats and 3 pigs.

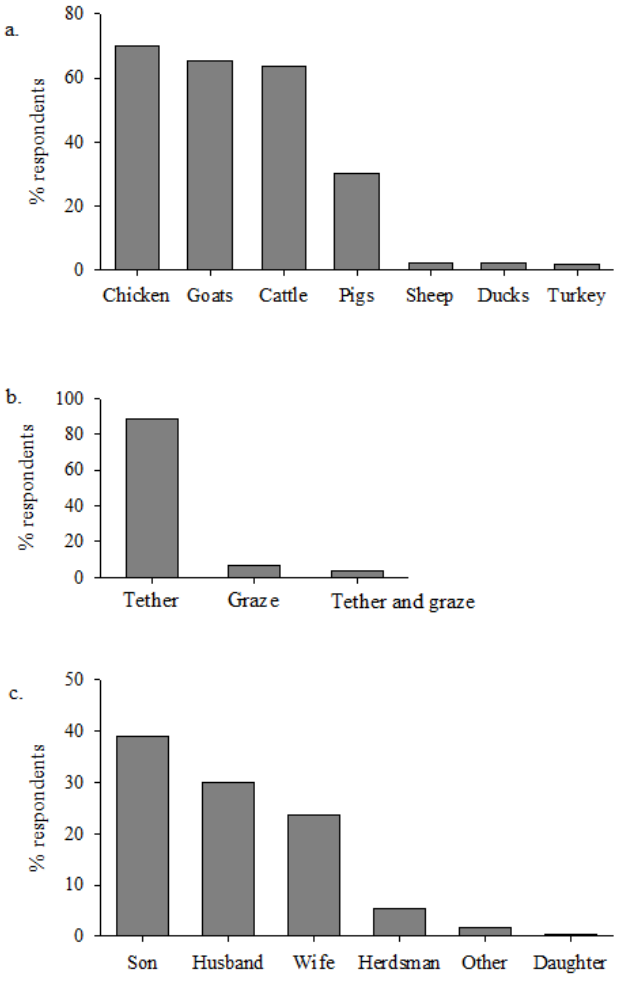

Fig. 1. Characteristics of animal husbandry in Kaliro District (n=126)
a: percentage of respondents rearing different livestock types;
b: percentage of respondents practicing different livestock husbandry types. Note that domestic birds are free ranging; and
c: percentage of different members of the household and 'abayi' participating in the rearing of animals. Included under others are the other members of the extended family and animal rearing groups.

It was not always possible to count poultry. From the estimated number of households living in Kaliro and the average number of cattle owned per household, we estimate that there are 75,000 heads of cattle in the district.

From participant observations and informal conversations we determined that cattle and other livestock are reared, essentially, for economic reasons, i.e. to earn income from the sale of meat, diary products, and hides, and the sale of live animals. Some households keep oxen for their draught power. Livestock also feature highly in the cultural and social life of the Balamogi. Livestock

animals are killed during cultural rituals and local festivities such as weddings, burials, and last funeral rites.

Cows are tethered by most of the respondents (89.2%), and the rest of the farmers herd their livestock in communal grazing fields or practice both tethering and grazing (Fig. 1b). In the past, cattle were almost exclusively grazed. Tethering is a new phenomenon that has arisen as a response to pasture scarcities. Cattle are kept in fenced enclosures (*kilalo*) at night. The common grazing routine is to take cattle out to pasture early in the morning around 6 a.m. and bring them in at about 10 a.m. for milking, while the herdsman/farmer eats breakfast. Two hours later, they are returned to pasture until late evening around 7 p.m. They are milked once more in the evening. Goats and sheep are tethered in the home garden or fallow fields, and are rarely taken out to graze. Pigs are stabled or tethered, while, the domestic fowl are free-ranging.

All members of the family participate in rearing livestock. However, this activity is the primary work of the male members of the family, i.e. sons and husband, accounting for 74.2% (Fig. 1c). Some households hire professional herders (*abayi*) to help them herd their livestock. Other people form animal rearing groups and take turns to herd livestock.

II. Cattle fodder Species

Forty-two species of plants distributed in 37 genera and 15 families are commonly fed on by cattle in Kaliro. Four of the fodder species mentioned by the respondents were not found during the collection of specimens for identification, and remain unidentified. The majority of the fodder species are grasses (19). The other growth forms are: herbs (10), shrubs including lianas (6), trees (6), and one sedge. Family Poaceae contains the largest number of fodder species (19) followed by Fabaceae with four species, while Euphorbiaceae, Moraceae, and Asteraceae have three species each (Table 1). The genera with the highest number of fodder species is *Digitaria* with three species, followed by *Brachiaria*, *Ficus* and *Pennisetum* with two species each, and all the rest have one species each. We were told that cattle like to graze on *Panicum maximum*, and that when they graze on this plant their milk yield improves. Another plant, *Vernonia amygdalina* is preferred by cows when in calf. Almost all the fodder and browse species are native (36) apart from *Mangifera indica* that cattle feed on the fruit, *Bidens pilosa*, and *Euphorbia heterophylla* (Table 1). All the fodder species grow wild (41), except *Ficus natalensis* and *Mangifera indica* that are cultivated or are semi-wild. Cattle also feed on cultivated food plants, but these are not reported here.

The same species that are grazed or browsed by cattle also provide fodder for other livestock. Goats are known in the community as generalist feeders, and feed on more plants than cattle. No attempt was made to inventory fodder plant species for animals other than cattle because it was not the objective of this study, but farmers claimed that goats like to feed on *Panicum maximum*, *Brachiaria* spp., *Imperata cylindrica*, and pigs mainly on *Euphorbia hetero-*

Table 1. Fodder species reported by respondents of Kaliro District.

Family, species, local name, voucher number, (other uses)	Status	Form	Freq.
Acanthaceae			
Asystasia schimperi T. Anders., Nyante, JRST 414 (1,2)	W, I	H	1
Anacardiaceae			
Mangifera indica L., Muyembe, JRST 99 (2)	C, Int	T	1
Asclepiadaceae			
Secamone africana (Oliv.) Bullock, Nakasando, JRST 319 (3)	W, I	L	1
Asteraceae			
Bidens pilosa L., Kalala, JRST 456 (1)	W, Int	H	1
Conyza bonariensis (L.) Cronq., Kayala, JRST 457	W, Int	H	1
Vernonia amygdalina Delil, Lubilili, JRST 81 (1,2,4)	W, I	S	2
Combretaceae			
Combretum collinum subsp. *elgonense* (Exell) Okafor, Mikoola, JRST 58 (1,3,5)	W, I	T	6
Commelinaceae			
Commelina benghalensis L., Ilanda, JRST 16 (1,2)	W, I	H	2
Cyperaceae			
Cyperus papyrus L., Bitooko, NC (3)	W, I	Se	2
Euphorbiaceae			
Acalypha bipartita Muell. Arg., Helele, JRST 315 (1,2)	W, I	H/Ss	1
Euphorbia heterophylla L., Kafadanga (Dengu), JRST15 (1)	W, Int	H	17
Flueggea virosa (Willd.) Voigt, Lukandwa, JRST 43 (1)	W, I	S/T	1
Fabaceae - Faboïdeae			
Indigofera arrecta A. Rich., Byeyo, JRST 358 (1,7)	W, I	H	1
Sesbania sesban (L.) Merr., Kasilya silya, JRST 170	W, I	S/T	1
Fabaceae - Mimosoïdeae			
Acacia hockii De Wild., Kashiono, JRST 44 (1,5)	W, I	S/T	3
Albizia zygia (DC.) Macbr., Mulongo, JRST 261 (1,3,5)	W, I	T	10
Moraceae			
Ficus natalensis Hochst., Mukosi (1,3,5,6)	C, I	T	13
Ficus sp., Mutonto, JRST 467	W, I	T	1
Milicia excelsa (Welw.) C. Berg., JRST 500, Muvule (1,2,4)	W, I	T	2
Nyctaginaceae			
Boerhavia diffusa L., Jojokelo, JRST 11 (4)	W, Int	H	1
Pedaliaceae			
Sesamum angustifolium (Oliv.) Engl., Mugosegose, JRST 252 (1)	W, I	H	1
Poaceae			
Brachiaria brizantha (A. Rich.) Stapf, Kiryama, JRST 245	W, I	G	31
Brachiaria decumbens Stapf, Kilyama, JRST 130	W, I	G	31
Cymbopogon nardus (L.) Rendle, Ikungu, NC (1)	W, I	G	2
Cynodon dactylon (L.) Pers., Lufafa, JRST 46 (1)	W, I	G	59
Dactyloctenium aegyptium (L.) Willd., Bukuuku, JRST 216 (2)	W, I	G	6
Digitaria abyssinica (A. Rich.) Stapf, Lumbugu, JRST 128	W, I	G	43
Digitaria longiflora (Retz.) Pers., Kobyo, JRST 131	W, I	G	37
Digitaria sp., Sokonolye, JRST 132	W, I	G	1
Echinochloa pyramidalis (Lam.) Hitchc. & Chase, Kaheheile/(Kishi), JRST 39,168	W, I	G	4
Hyparrhenia rufa (Nees) Stapf, Museke, JRST 141 (3,7)	W, I	G	30

Imperata cylindrica (L.) P. Beauv. Lubembe, JRST 124 (1,3)	W, I	G	67
Melinus repens (Willd.) Zizka, Bukuuku, JRST 127	W, I	G	1
Panicum maximum Jacq., Bitinde/mikonzi, JRST 2 (1,7)	W, I	G	90
Paspalum sp. JRST 492 (7)	W, Int	G	17
Pennisetum polystachion (L.) Schult., Idulyenke, JRST 17 (1)	W, I	G	1
Pennisetum purpureum Schumach., Bigada, JRST 463 (3)	W, I	G	22
Setaria megaphylla (Steud.) Th.Dur. & Schinz, Kibwala, JRST 408	W, I	G	1
Sporobolus pyramidalis P. Beauv., Nakaselye, JRST 76(1,7)	W, I	G	45
Vossia cuspidata (Roxb.) Griff., Kishi/bisege, JRST 289	W, I	G	19
Simaroubaceae			
Harrisonia abyssinica Oliv., Lushaike, JRST 64(1,4)	W, I	S/T	1
Typhaceae			
Typha domingensis Pers. Musaala, NC (1,7)	W, I	H	2
Unidentified (local name only)			
Kafunge			3
Nende/nkoba gya Lyada			3
Bisibanyike			1
Kolokosimbo			1

* Frequency (Freq.) refers to number of respondents that mentioned the species to be edible to cattle. Information of uses other than fodder is also provided in the first column. C: cultivated, Freq.: frequency, G: grass, H: herb, H/Ss: herb/subshrub, I: indigenous, Int: introduced, L: liana, S/T: shrub/tree, Se: sedge, T: tree, W: wild.
Other uses: (1) Medicinal uses (Tabuti et al., 2003a), (2) Edible uses (Tabuti et al., 2004), (3) Construction use, (4) Veterinary medicine (Tabuti et al., 2003b), (5) Firewood use (Tabuti et al., 2003c), (6) Cultural use, (7) Miscellaneous uses.

phylla and *Boerhavia diffusa*. Poultry feed for the most part on crop cereals such as *Zea mays* and young plants at the seedling stage, e.g. *Phaseolus vulgaris*.

III. Farmers' Perceptions about Fodder Availability

According to the respondents, there are seasonal variations in fodder availability: fodder is abundant in the wet season, but becomes scarce in the dry season. The respondents reported that because of the abundant fodder in the wet season, the cattle are observed to attain a healthy look and gain weight. In the dry season, farmers herd their cattle, goats, and sheep to distant communal grazing fields or to lakeshore swamps. Even those farmers who normally rear animals by tethering turn to herding, while others feed their livestock on browse, i.e. branches and leaves of trees and shrubs, notably of the *Ficus* spp.

Overall, the respondents reported that it was becoming hard to find fodder for cattle because of reductions in grazing areas. Farmers attributed the decline in pastoral area to several causes: (1) conversion of communal grazing lands to agricultural use, (2) shortening of fallow periods or absence of fallowing, and (3) weed invasion. The allocation of more land to crop agriculture to increase agricultural production and the shortening of fallow periods by farmers has made animal herding difficult, because animals stray into crop fields to eat cultivated

crops, and this results in prosecution of the animal owners. The weed, *Hyptis suaveolens* (L.) *Poit.* (Lamiaceae) known as "*Lukohe*" has invaded pasturelands and out-competed favored fodder species. Farmers stated that low fodder availability has forced them to keep fewer cattle and tether the few that they possess.

At the end of the dry season, grass pastures are usually set on fire to stimulate new growth of grass. The new growth grass was reported to be palatable to cattle but was also known to make them diarrheic.

DISCUSSION

The general husbandry practices by the farmers of Kaliro District, such as the keeping of few heads of cattle, correspond with those observed for other farmers elsewhere in Uganda (UNDP, 2007). Similarly, the social functions of cattle among the local community of Kaliro confirm those observed in other parts of Uganda where cattle were valued as an economic asset and tool for agricultural production (NEMA, 1998; MAAIF & MFPED, 2000).

As has been observed elsewhere (NEMA, 1998), fodder/browse availability and access is becoming limited. The feeding of cattle in pastures has therefore become a problem. The response by farmers to this reduction in feed availability has been to keep fewer heads of cattle and to change their rearing patterns to tethering. In Uganda tethering is common with people rearing small herds of livestock, and also in areas of intensively cropped land (NEMA, 1998). Tethering as a livestock rearing system stops animals from straying and appears to be functional in areas where land is in short supply (IIRR, 1988).

Forty-two fodder species are reportedly exploited as fodder or as browse by cattle. The greater proportions of the grazed species are grasses and herbs. This diet may limit growth and yield of meat and milk from cattle, because some tropical grass species have relatively low contents of crude protein and some minerals, compared to browse species (Dzowela et al., 1997; Paterson et al., 1998; El Hassan et al., 2000; Ibewiro et al., 2000). In addition the growth of tropical grasses is limited by the dry season and droughts, resulting in decline in both their quantity and quality (Paterson et al., 1998). Woody species on the other hand are less affected by seasonal climatic changes because they possess a deep root system.

Twenty four of these species are widely exploited by livestock in other parts of Uganda (Mpairwe et al., 1998) and elsewhere in Africa, for example, Kenya (Roothaert & Paterson, 1997), Zimbabwe (Dzowela et al., 1997), Ethiopia (El Hassan et al., 2000), Nigeria (Ibewiro et al., 2000), Rwanda (Niang et al., 1998), Mozambique (Muir & Alage, 2001), and other parts of Africa (Burkill, 1997). A substantial amount of chemical and nutrition value data has been generated on some of these species (Dzowela et al., 1997; Paterson et al., 1998; El Hassan et al., 2000; Ibewiro et al., 2000). The species *Tithonia diversifolia* observed to be browsed by cattle in Kenya (Roothaert & Franzel, 2001) was not known to be grazed by cattle according to farmers of Kaliro District.

CONCLUSIONS

To counter the long term impact of declining fodder/browse feed for cattle, farmers should cultivate or protect browse species around the homestead, along hedge rows or other niches around the farm which do not compete with land uses on-farm. Candidate species may include species known to have many uses. According to Etkin (2002) and Paterson et al. (1998), species with many uses are more preferred by farmers and may, thus, be easier to adopt for the farmers. Thirty of the pasture species reported here have other uses besides being feed for cattle. They are used among the Balamogi as traditional medicines for both people and cattle, and as human food (Table 1). They are also used for construction, as firewood, in the cottage industry to make brooms, for example, and in cultural religio-medico rituals. The plants also provide fodder for livestock other than cattle. Leguminous species have the potential to improve soil quality by introducing nitrogen to the soil (e.g. Paterson et al., 1998; Ibewiro et al., 2000).

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