FARMERS' SCREENING OF INDIGENOUS FODDER TREES AND SHRUBS IN KENYA.

R.L. Roothaert[1], H.K. Arimi[2] and E.N. Kamau[3]
[1]KARI/KEFRI/ICRAF, P.O. Box 27, Embu, Kenya
[2]MoLD, P.O. Box 792, Embu, Kenya
[3]MoENR, Gachoka, Kenya

ABSTRACT
The lack of fodder quantity and quality is a constraint for small scale livestock production systems in central Kenya which are intensive or are rapidly becoming so. This study examined farmers' knowledge about indigenous fodder trees and shrubs (IFTS) which are fed to livestock. The study consisted of a formal survey in three agroecological zones with mean annual rainfall varying from 750 to 1400 mm. Farmers rated IFTS for different qualities, which were analysed by Chi square. Differences of ratings among species for these qualities were significant ($p<0.05$). The most promising species for the sub-humid zone, in terms of what farmers want to plant and in terms of preliminary nutritive analysis, were: *Tithonia diversifolia, Commiphora zimmermanii, Ficus spp.* and *Trema orientalis.* The species that show promise for the same reasons, in the semi-arid zones, are: *Crotalaria goodiiformis, Aspilia mossambicensis, Indigofera lupatana, T. diversifolia, Grewia tembensis* and *Acacia ataxacantha.*

KEYWORDS
indigenous fodder trees and shrubs, indigenous knowledge, farmers' preference

INTRODUCTION

Ruminants play an important role in the farming systems of central Kenya. The livestock systems vary from intensive zero-grazing with improved dairy cows in the highland, to extensive grazing with Zebu cattle in the dry lowland. An important problem diagnosed in all areas is lack of fodder and reduced quality during the dry season (Minae *et al.*, 1988; Sutherland *et al.*, 1995).

Fodder from many trees that is eaten by livestock in the tropics has high nutritive value with crude protein content ranging from 15 to 30% of dry matter. The advantage of a tree crop is that it is deep rooted and can therefore produce green fodder during the dry season. The type of trees and shrubs that can be cultivated for fodder depends on the ecological conditions. At the same time, the farming system and cultural practices of the people determine the appropriateness of a fodder production technology. There is a need to screen indigenous fodder trees and shrubs (IFTS) for potential cultivation by farmers, taking the above mentioned factors in account. This paper presents the results of a survey that was carried out to know more about the use of indigenous fodder trees and shrubs in different agroecological zones (AEZ) in central Kenya.

METHODS

The survey was carried out in three AEZs: Upper Midland 2 (UM2) with mean annual rainfall between 1200 and 1400 mm and altitude between 1400 and 1600 masl; Lower Midland 3 (LM3) with 900 to 1000 mm rain and from 1070 to 1280 masl; and Lower Midland 5 (LM5) with 750 to 800 mm rain and from 830 to 1130 masl. Rainfall in the whole study area has a bimodal distribution. Soils in UM2 are predominantly humic Nitisols (FAO classification) or typic Palehumults (USDA classification); in LM3 they are Ferrasols and in LM5 they are complexes of Cambisols and Arenosols mainly derived from quartzite, well drained and stony in places. Average farm sizes in UM2 are 1.5 ha, in LM3 and LM5 they are 3.3 ha. In every AEZ 30 farmers were selected at random from a sample frame of 250 to 300 farmers. The frames consisted of a list of all households in some adjacent villages (UM2) or of all parents of a primary school student (LM3 and LM5). The owner of the farm, his wife, other relatives and employees were interviewed together. The respondents were female (46%), male (30%) or both of them during the same interview (24%). As precise information on cattle feeding was needed, one selection criterion was for a farmer to have at least one cow. The selected farmers were interviewed by a team with a pre-coded questionnaire, which had been pre-tested. The six most popular species were rated by the farmers for different qualities. Two qualities, growth after establishment and regrowth after cutting, were determined by the researchers in order to obtain information about biomass production potential. The other qualities (Table 2) were determined by a group of seven farmers in each AEZ and varied among the AEZ's. Farmers rated the species through the use of a *bao* game (a traditional African board game involving the moving of seeds among pockets on the board; Franzel, 1993). One to three seeds were put in the pocket next to a branch of each species; three equalling "good", two equalling "medium" and one equalling "poor". Differences among species were analysed by Chi square with the computer package SPSS.

RESULTS AND DISCUSSION

Use of IFTS and desire to plant them. Compared to other feeds, IFTS make up less than 50% of the diet for cattle and more than 50% of the diet for goats. An exception is UM2, where 44% of the respondents said the contribution of IFTS for goats is less than 50% of the diet. A total of 160 different species are used by farmers in the three zones to provide tree fodder. Percentages of farmers that would plant IFTS if they were given seedlings were 63, 76 and 90%, for UM2, LM3 and LM5, respectively. The most preferred species for planting are presented in Table 1.

Qualities of fodder trees. Most qualities that were determined by farmers are directly related to animal nutrition, others are agronomic or general. "Satisfaction of the animal" was mentioned often but it can be argued whether this is a quality since it does not imply anything beyond the filling of the alimentary tract. The ratings of qualities are presented in Table 2. The variation of ratings among species found significant ($p< 0.05$) for qualities related to growth, palatability and milk production. It was expected that the qualities defined by the farmers would have the highest variation among species. This was the case for palatability for both cattle and goats and milk production for goats. Drought resistance, compatibility with crops, health and fattening of animals were not significant. These parameters might be more difficult to assess than palatability and milk production. For example, good health and fattening of animals are a result of many factors and cannot be attributed to only one ingredient of a diet. Assessments for growth after establishment and regrowth were significant; these parameters were not defined by farmers, but were rather easily assessed by them. In UM2 *Lantana camara, Tithonia diversifolia* and *Commiphora zimmermanii* have high ratings for growth after establishment and regrowth; in LM3 and LM5 *L. camara, Aspilia mossambicensis and Acacia ataxacantha* scored high for these parameters. The species that scored high for palatability for cattle were *L. camara* (UM2), *C. zimmermanii* (UM2) and *Crotalaria goodiiformis* (LM3 and LM5). In LM3 and LM5 almost

all species were highly palatable for goats. *C. goodiiformis* is the only species that has a good average score for both milk production for goats and fattening of animals in LM3 and LM5. Of the 27 browse species that were analysed in the study by Backlund and Bellskog (1991) in central Tanzania, *Crotalaria spp.* was among the five species with the highest digestible crude protein and digestible organic matter percentages (21.5 and 90 respectively), and had a low amount of anti-nutrients (proanthocyanidine 4.8 abs/g NDF). Although fresh pods of *C. goodiiformis* are readily eaten by livestock in LM5, the mature seeds of some crotalaria species are poisonous (Cheeke and Shull, 1985). This should be borne in mind when the fodder is promoted for cultivation. Leaves of *L. camara, C. zimmermanii, Trema orientalis, Bridelia micrantha* and *Triumfetta tomentosa*, in UM2, were analysed by Thijssen *et al*. (1993). Protein contents (dry matter basis) were 21.4, 14.1, 27.1, 17.3 and 17.7% respectively and the *in vitro* organic matter digestibility was 71.8, 37.6, 78.8, 28.1 and 52.4% respectively. These data suggest high nutritive value for fodder of *L. camara* and *T. orientalis*, even though soft edible twig material was excluded from the samples. *L. camara* can be toxic to livestock, but there seems to be a difference in toxicity between local and imported lines of *L. camara*; the local type might be less toxic (Munyua *et al*., 1990). If the fodder is used as a supplement rather than a sole diet, toxic substances are likely to be diluted to harmless levels. *Melia volkensii* not only provides good fodder but is also a very good timber tree. However, difficult propagation prevents farmers from planting the tree (Kidundo, unpub.) and therefore deserves further research. Future research is also needed to compare fodder yields, nutritive, and anti-nutritive qualities of *T. diversifolia, C. zimmermanii, Ficus spp., T. orientalis, C. goodiiformis, A. mossambicensis, I. lupatana, G. tembensis* and *A. ataxacantha*.

ACKNOWLEDGEMENT

The authors want to thank their colleagues in the KARI-KEFRI-ICRAF National Agroforestry Research Project in Embu and the farmers in the study area for their precious co-operation. Funds for the project were provided by NRI, Sida and DGIS.

REFERENCES

Backlund, M. and J. Bellskog. 1991. The role of trees and shrubs in livestock production in central Tanzania - A survey of their nutritive value during the dry season. Working Paper 175. Swedish University of Agricultural Sciences. International Rural Development Centre. Uppsala, Sweden. 27 pp.

Cheeke, P.R. and L.R. Shull. 1985. Natural Toxicants in Feeds and Poisonous Plants. AVI Publishing Company, Inc. Westport, Connecticut.

Franzel, S. 1993. Use of the Bao game for obtaining farmers' evaluations of tree species in farmer-designed trials. International Centre for Research in Agroforestry (ICRAF). Nairobi, Kenya.

Kidundo, M. (unpublished). Propagation of Melia volkensii - a potential agroforestry tree in semi-arid Kenya: the current status. Paper presented at the KARI/ODA Conference on Participatory Dryland Agricultural Research East of Mount Kenya, 21-24 January, 1997. KARI - Regional Research Centre. Embu, Kenya.

Minae, S., S. Kaumi, M. Avila, J. Okorio, S. Kaboneka and A. Ghahamanyi. 1988. Agroforestry Research Project Proposal for the Coffee Based System in the Bimodal Highlands, Central and Eastern Provinces, Kenya. AFRENA Report No. 16. International Centre for Research in Agroforestry (ICRAF). Nairobi, Kenya.

Munyua, S.J.A., M.J. Njenga, T.P. Karitu, C. Kimoro, J.E. Kiftoon and I.B.J. Buoro. 1990. A note on clinical-pathological findings and serum enzyme activity in sheep, goats and Fresian calves with acute *Lantana camara* poisoning. Bull. Anim. Hlth. Afr. **38**:275-279.

Sutherland, A., J. Ouma and J. Ndubu. 1995. Farming in Mbeere. Report of an Informal Diagnostic Survey of the Farming Systems of Lower Embu, Kenya. Volume 1. Kenya Agricultural Research Institute, Regional Research Centre - Embu, Kenya. 73pp.

Thijssen, H.J.C., F.M. Murithi, O.Z. Nyaata, J.N. Mwangi, I.O.O. Aiyelaagbe and D.N. Mugendi. 1993. Report on an ethnobotanical survey of woody perennials in the coffee zone of Embu District, Kenya. AFRENA Report No. 62, International Centre for Research in Agroforestry (ICRAF). Nairobi, Kenya.

Table 1

Indigenous fodder trees and shrubs that farmers want to plant on their farms and percentage of those who want to plant in each AEZ.

Species Rank	UM2	% (n=19)	LM3	% (n=22)	LM5	% (n=27)
1	Masiso, Mugiso (Triumfetta tomentosa)	26	Mucimoro, Mucirigu (Lantana camara)	45	Mukao (Melia volkensii)	67
	Mururi (Commiphora zimmermanii)	26				
2	Mugumo (Ficus spp.)	21	Muuti (Aspilia mossambicensis)	23	Mucimoro, Mucirigu (L. camara)	41
	Muvevu (Trema orientalis)	21				
3	Kirurite (Tithonia diversifolia)	16	Mucugucugu (Crotalaria goodiiformis)	18	Mutuva, Muruva (Grewia tembensis)	33
4			Kirurite (T. diversifolia)	14	Muuti (A. mossambicensis)	26
			Mugiti (Indigofera spp.)	14		
			Muthunthi (Maytenus putterlickioides)	14		

Table 2

Average rating of qualities of IFTS (3 = good, 2 = medium, 1 = poor, (s.d.)).

Species in UM2	Growth after establishment	Regrowth	Palatability for cattle	Compatibility with crops	Health
Lan. cam	2.7 (0.47)	2.8 (0.40)	2.7 (0.50)	1.6 (1.00)	3.0 (0.00)
Ver. las.	2.4 (0.79)	2.5 (0.69)	2.1 (0.90)	2.2 (1.10)	2.5 (0.76)
Tit. div.	2.9 (0.33)	3.0 (0.00)	1.6 (0.98)	2.2 (1.00)	2.8 (0.50)
Tri. tom.	2.2 (0.93)	2.3 (0.86)	2.1 (0.90)	1.9 (1.07)	2.4 (0.81)
Com. zim.	2.9 (0.34)	2.9 (0.33)	2.6 (0.53)	3.0 (0.00)	2.7 (0.65)
Bri. mic.	1.6 (0.73)	2.1 (0.90)	2.1 (0.69)	1.8 (0.98)	2.4 (0.73)

Species in LM3 + LM5	Growth after establishment	Regrowth	Palatability for cattle	Palatability for goats	Fattening of animal	Milk prod. of goats[1]
Lan. cam	2.8 (0.46)	2.8 (0.48)	2.1 (0.97)	2.4 (0.82)	2.5 (0.78)	-
Asp. mos.	2.6 (0.69)	2.6 (0.70)	2.3 (0.95)	2.6 (0.70)	2.5 (0.71)	2.5 (0.52)
Cro. goo.	2.4 (0.78)	2.3 (0.75)	2.4 (0.84)	2.9 (0.45)	2.9 (0.25)	3.0 (0.00)
Ind. lup.	2.4 (0.82)	2.0 (0.76)	2.3 (0.70)	2.7 (0.59)	2.8 (0.40)	2.4 (0.55)
Mel. vol.	2.1 (0.91)	2.6 (0.76)	2.3 (0.85)	2.7 (0.57)	2.4 (0.72)	2.1 (0.88)
Aca. fru.	2.4 (0.67)	2.0 (0.89)	1.5 (0.85)	2.1 (0.60)	2.1 (0.83)	2.0 (1.00)
Aca. ata.	2.8 (0.69)	2.8 (0.44)	1.6 (0.70)	2.3 (0.82)	1.8 (0.83)	2.4 (0.55)
Gre. tem.	2.1 (0.85)	2.3 (0.73)	2.1 (0.97)	2.7 (0.46)	2.6 (0.76)	2.9 (0.38)
May. put.	2.0 (0.84)	2.5 (0.70)	1.4 (0.81)	2.2 (0.81)	2.2 (0.79)	-

Key: [1] for LM5 only.
- only two cases