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Traditional agroforestry systems, tree uses and management in northern Uganda

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Abstract

A survey was conducted in Apac District, northern Uganda between September 1995 and December 1996 to assess the traditional agroforestry systems, tree uses and management. Tree and shrub species in the farming systems were identified and farmers' indigenous knowledge of agroforestry systems documented. Men (96%) headed most households. Both naturally growing and planted tree species were found on farmland and the farmers had clear reasons for protecting or planting the trees and shrubs on farms. Homegardens had more trees than farmland situated away from the homesteads. *Markhamia lutea* (Benth.) K. Schum., *Eucalyptus* and *Cassia* tree spp. dominated the zuned arrangements while *Ficus* spp., *Combretum collinum* Fressen. and *Lonchocarpus laxiflorus* Guill. & Perr. naturally grew among crops and/or near homesteads. The trees and shrubs provide fruits, shade, poles or firewood. Although over 98% of the household heads interviewed were aware of the advantages of planting trees, 65% planted trees. Inadequate supply of seedlings, poor extension services, and lack of land as well as restricted roles of women limited tree-planting activities. There are opportunities for improving and increasing agroforestry in the region through integrated research, adoption of better land management techniques and planting of trees /shrub species desired by farmers.An in-depth study of farmers' indigenous knowledge in protecting, planting and managing trees would help improve the existing agroforestry systems.

Key words: Agroforestry, Indigenous knowledge, Farming systems, Tree-management

Introduction

Increase in human population has changed farming systems in most developing countries including Uganda. Shifting cultivation, which farmers practised when the population was low, has become unsustainable due to reduction in the length of fallow periods. Continuous destruction of vegetation due to improper farming practices, brick making, charcoal production, fish smoking and erosion hazards have resulted in low food production and widespread poverty in most parts of Uganda, northern region inclusive. It has also reduced wood fuel and other forest products (Aluma, 1984; Hockstra and Djinide, 1988).

Although farmers in northern Uganda have tried to reverse the negative trends in farm production, there is a need to improve agricultural output. Moreover, traditional agroforestry practices have not been documented in many areas of Uganda. A study was conducted between September 1995 and December 1996 in Apac District, northern Uganda, to document traditional agroforestry, tree uses and management. The objectives were to (1) identify the preferred local tree species, their uses and management and (2) assess farmers' indigenous knowledge of farming systems where trees, crops and livestock interact.

Material and Method

Selection of respondents

The respondents of this study were household heads of farm families selected from parishes in Apac district.The counties in the district were stratified into zones I wilt and Maruzi counties (total number of farm families less than 20,000) and II of wilt (total number of farm families greater than 20,000). Kwania and Oyam counties were the sampled counties in zone I and II respectively. From each of these counties, two sub-counties were randomly selected using the ballot method. Ten household heads were selected from each of the

sampled parishes in each sub-county using a systematic sampling selection interval (Casley and Kumar, 1992). In all one hundred and eighty rural farm families with two zones were interviewed and their farms surveyed to document the farming practices, tree uses and management activities.

Data collection

A 'modified' Rapid Rural Appraisal (RRA) and Participatory Rural Appraisal (PRA) were used to get a general view of the farming systems, the farmers' needs and farming problems (Nabasa *et al.*, 1995). Multi-stage, systematic and stratified random sampling (Snedecor and Cochran, 1976; Walpole, 1982; Casley and Kumar, 1992) was used to select the farmers to whom the questionnaires were administered. During both farm walks and questionnaire administration information was collected on intensity of land uses, type of land tenure and ownership, tree species and their location, preferred local tree spp., uses of trees and management being applied to them on the farms, farmers' knowledge, awareness and need for modern agroforestry.

Data analysis

Questionnaire responses were coded, grouped and summarised into frequencies using Scientific Package for Social Scientists (SPSS, 1995) for windows. Proportional analysis technique and histogram (Sokal and Rolf, 1995; Zar, 1996) were used to determine and compare the proportion of farm families engaged in various farming and related activities (Ipara, 1993). Chi-square tests were used to show the associations between intensity of land uses, land tenure and ownership, availability of tree planting materials and sex of household heads.

Results and discussion

Traditional agroforestry

The major tree/crop combinations are in the home-gardens. The trees are scattered on cropland, planted on boundaries and in wood lots (Table 1). Windbreaks, alley cropping and silvopastoral systems were not common. Since some homes had many tree/crop combinations, the occurrence of each combination was considered separately at 100%. Most trees growing naturally were left purposely to meet farmers' needs especially fuel wood and building poles. Planted trees were around homesteads, in woodlots, at homestead boundaries and on croplands. Trees/shrubs growing on private compounds provided firewood, building poles, medicine and fruits. This finding agrees with a report by Hoekstra and Djinide (1988) that several trees found in the traditional farming systems are not deliberately grown together with the agricultural crops.

It also shows that traditional agri-silvicultural farming systems in the region have undergone gradual changes as farmers have now shifted from the tradition of complete clearing of trees when opening land for farming to protecting or planting trees in the garden or around the homesteads. The farmers' decisions to protect or plant trees on their farms were influenced by the perceived value of agroforestry to enhance farm production. Trees were planted for fruits, firewood, fodder, building poles, fibres, medicine, trellis for passion fruits, vines and to mark land boundaries (Table 2).

Several woodlots (94%) were less than one hectare compared to 1-4 ha for agricultural plots implying that little land was allocated to tree growing. *Eucalyptus* woodlots were planted in tobacco fields to provide firewood for curing tobacco. Flue curing of tobacco requires a lot of wood fuel (Aliro, 1993). Tobacco growing therefore needs to be accompanied by tree planting to reduce pressure on natural woodlands as a major source of fuelwood. Therefore, farmers need to be sensitised to accompany tobacco growing with planting of trees as flue-cured tobacco is considered to be of high quality and preferred by farmers because it fetches high prices (Aliro, 1993).

Patterns of trees identified on farms and their uses

Table1 Niches for agroforestry technology in Kwania and Oyam counties (N=180)

Natural growing tree niches	%	Planted tree niches	%
Homestead	80	Homestead	90
Cropland	70	Cropland	20
Boundary	60	Boundary	40
Grazing land	41	Grazing land	08
Swamps	24	Swamps	04
Public places	17	Public places	13
Woodlots	15	Woodlots	66
Roadside	09	Roadside	14
Windbreaks	05	Windbreaks	11
Fences/hedges	02	Fences/hedges	17

Table 2. Trees/shrubs cultivated in Kwania and Oyam counties.

Trees/shrub species	Functions/Uses
Euphorbia tirucalli	boundary demarcation
Citrus sinensis	fruit
Senna siamea	Medicine, building poles and firewood
Senna spectabilis	building poles and firewood
Eucalyptus spp.	building poles and firewood
Ficus natalensis	shade, fodder, support and boundary demarcation
Mangifera indica	fruit and firewood
Markhamia lutea	building poles and Firewood

Most tree and shrub species found on the croplands (Table 3), were randomly scattered and naturally growing. *Ficus* spp., *Combretum collinum* and *Lonchocarpus laxiflorus* were the most common. There was no systematic arrangement of the trees apart from those planted on the boundaries and in woodlots. Farmers had clear reasons for protecting or planting trees and shrubs. *Eucalyptus* species were planted by farmers in the swamps to reduce flooding. Other species were planted in woodlots for poles

and firewood. Although termites easily attack *Eucalyptus spp.*, which is a great hindrance to tree planting in most parishes in the district; this was not the case in the swamps. Unpalatability to livestock, vigorous coppicing, and depletion of soil moisture and reduction of crop yields discouraged some households from planting *Eucalyptus*. As such *Eucalyptus* was planted in pure stands or far from agricultural crops, on the poorest portion of farmland or on the boundaries.

The results presented in Table 3 agrees with an observation by Hoekstra and Djinide (1988) that trees have not yet been adequately integrated into most farming systems. However, it is a common practice to plant trees especially *Senna siamea* Lam. and *Senna spectabilis* DC., fruit trees such as sweet oranges (*Citrus sinensis* (L) Osbeck.), lemons (*Citrus limon* (L.) Burm. F.), grapefruit (*Citrus xparadisi* Macfad. (pro sp.) [maxima x sinensis]), pawpaw (*Carica papaya* L.) and mangoes (*Mangifera indica* L.) around homesteads. Shade and fruit trees planted in public places such as near government buildings, schools, markets places, churches and mosques serve an important function of windbreaks, shade, source of fruit and firewood.

According to Lovett and Haq (2000), the majority of trees and shrubs are always maintained on cultivated land because of their valuable non-timber products. In this respect, some species are used to protect livestock from intense heat and for tethering, for congregation during the day, and shades are also essential part of these environs.

A great diversity of species is found at such locations particularly introduced and ornamental species as protection of the planted species is relatively easy and questions of ownership are not a great problem (Fred and Carol,1986).

The farmers' views about the different tree species is consistent with the argument by Rocheleau *et al.* (1988) that researchers and development workers can learn from the local community by studying their indigenous knowledge about agroforestry systems or by observing and recording their actual practices. It also confirms that rural people have a great deal of useful information that can be incorporated into policies that farmers would easily benefit from. After all, the farmers' traditional farming practices are usually the outcome of repeated, well-organised and selective trials carried out over a long period of time. These selections always result in maintenance of those species that do not compete severely with crops for light, water and which even permit significant crop yield increases and other environmental benefits valued by the farmers (Leach and Mearns, 1988).

Even if farmers are not familiar with the production or ecology of a particular plant or groups of plants, information about local preferences and uses of plant products can help agroforestry/extension workers to identify the appropriate species for introduction in an area or the most important qualities of the species. Therefore full involvement of local people in the design and evaluation of new agroforestry technologies can improve the adoption of modern agroforestry. The fact that more trees were planted in the homegardens and home-compounds (Table 3) is an encouraging step, and an entry point when involving the farmers in any new practice(s).

Table 3. Naturally regenerating indigenous trees and shrubs including species locally preferred by farmers for planting

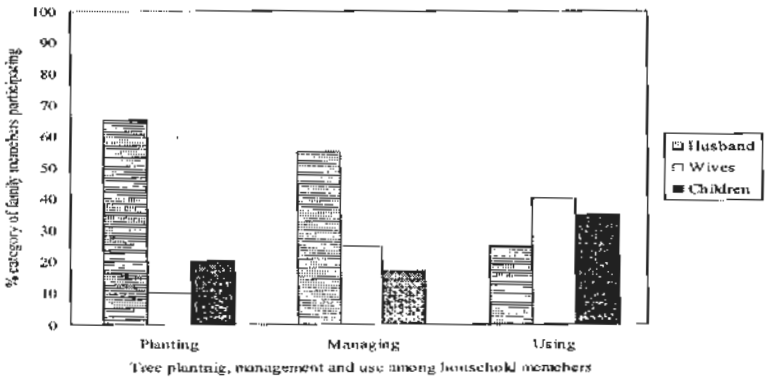
Tree/shrub species	Uses	Niche
Combretum collinum (n)	firewood, shade, charcoals medicine	home-compounds,croplands,public places
Terminalia macroptera (n) Guill & Perr	charcoal, poles, beekeeping	home-compounds, boundaries
Piliostigma thonningii (n) (Schumach.) Millne Redh	charcoal, fodder, crafts, firewood	home-compounds, grazing lands
Ficus natalensis (n)	soil fertility improvement	croplands, home- compounds
Lonchocarpus laxiflorus (n)	medicine (cough), soil fertility, spiritual ritual	croplands. home compounds
Vernonia amygdalina (n)	medicine (stomach-ache), reeds	boundaries, woodlands, home compounds
Albizia grandibracteata (n)	firewood, fodder (pods), reeds	home-compounds, croplands, woodlands
Albizia coriaria (n) Welw Ex Oliv	timber, shade, soil fertility improvement	croplands, homesteads, public places
Fagara chalybea (n)	Medicine	woodlands
Nuclea latifolius (n)	Medicine	woodlands
Acacia senegal (n)	medicine, fodder	Woodlands, swamp areas
Grewia mollis (n) Juss	crafts, firewood, fibre, and fruits	Woodlands, home compounds
Ficus natalensis (p) Hochst	shade, windbreak, boundary marking	public places, boundaries, home-compounds
Ficus thonningii (p) B L	shade, windbreak, boundary marking	boundaries, public places
Eucalyptus spp. (p)	medicine, timber, poles.	woodlots, croplands, home compound
Milicia excelsa (p) (Welw) C Berg	Timber	woodlands, woodlots, home compounds
Senna siamea (p)	poles, medicine, windbreaks, and crafts	woodlots, croplands, home compounds
Senna spectabilis (p)	poles, medicine, windbreaks, and crafts	woodlots, home compounds, boundaries
Markhamia lutea (p)	poles, windbreaks, crafts, and medicine	home-compounds, boundaries, woodlots
Mangifera indica (p)	fruits, charcoal, shade, windbreaks	home-compounds, croplands, public places
Eurphobia tirucalli (p)	boundary demarcation, gums	boundaries, home-compounds.

n=naturally growing species, p=planted species

Farmers' participation in tree planting, management and uses

Ninety eight percent of households interviewed participated in planting, managing or using a tree or tree product. About 95% of the households had a member participating in tree planting activities of which 65% were husbands and household heads, 10% wives and 20% children. Ninety seven percent of the households had participated in tree management activities of which 55% were husbands; 25% wives and 17% children. At least a member of a household used tree and/or tree products; and by proportion 40% were wives; 25% husbands and 35% children (Figure 1).

Figure 1. Participation of family members in planting, managing or using tree/shrubs and/or their products.



The responsibility for planting trees/shrubs reflects a gender imbalance where only 10% of the wives compared to 65% of the husbands had planted trees (Figure1). This is due to local traditional beliefs that, planting trees is men's responsibility. Customarily, married Langi women live in their husbands' homes. Sex roles in tree planting activities as well as division of labour and responsibilities at household level are traditionally based on gender lines.

Table 4. Chi squared tests of association between tree planting and socio-economic factors

Parameters	X^2	df	Prob.	Sig.
Sex of household head	00.00	1	0.5445	ns
Land acquisition and type of tenure	15.57	8	0.0041	*
Sources of planting materials	16.29	7	0.0062	*
Lack of knowledge and level of extension	26.23	4	0.0000	*
Natural hazards	03.68	1	0.5914	ns

ns = not significant, * = Significant at P£0.05

The association between gender head (sex of household head) and tree planting tested using a Chi square was not significant ($x^2 = 0.00$, P=0.54, Table 4). Although the x^2 results show that the decision to plant trees on farm is not influenced by the sex of the household head, fewer women (10%) participated in tree planting activities than men (65%) (Figure1). According to Baxter (1994), owning a tree is a man's domain in the Uganda culture. Culture therefore has a big influence on the participation of women in tree planting activities. Household heads and individuals within the household had different rights to tree planting depending on gender, birth order or status in the family. The relationship between these factors and tree planting needs to be studied carefully; when introducing or promoting agroforestry interventions in the region.

Nearly, all the women in Uganda are responsible for routine tasks such as food production, tending of crops, procurement of firewood, taking care of children and attending to visitors. The men are responsible for farm activities such as cash crop farming, land ownership issues, resource allocation and major income generating activities. Changes in labour patterns and responsibilities as a result of elite men moving to town and urban centres in search of jobs and instability due to war and cattle rustling in northern Uganda have necessitated women to take over some functions traditionally performed by men. However, most men are still responsible for planting and management of trees. In the process, it has reduced women's participation in tree planting. A similar situation has been also reported in Kabale where some men have uprooted trees planted by women in fear that women may usurp their roles as men by planting trees (Baxter, 1994).

In some instances, women have to consult or wait for instructions from their husbands before planting any tree/shrub. If a woman planted a tree she would equate herself to the husband and challenge his authority and supremacy. As head of the household, no man would be willing to allow a woman to freely participate in tree planting activities. In order to avoid these problems, women elude any direct involvement in tree planting activities. Most women thus go through these taboos and beliefs by using their sons (who may not be schooling), male relatives or hired labourers to plant trees. This is always costly for a

rural woman who is often overloaded with household chores. In all the households, women (40%) participated in tree/shrub management and more use than men (25%) because of their roles in providing family needs.

Farm level tree management issues

From the aforementioned scenario, farm level tree management issues in northern Uganda can be said to be linked to farmers' livelihood strategies and dynamics of rural change such as meeting growing demand for fuelwood, fruits, poles and windbreaks, together with petty cash to supplement household income from traditional agricultural crops. Most of the trees were selected and maintained on the land when farmers opened land for cropping. On crop fields intercropping takes the form of scattered trees mostly providing protection as wind breaks (e.g. in gardens planted with simsim and lands with bananas) and poles for building construction.

Farmers practiced a number of options for controlling the form of a tree or shrub either protected or planted on the farms. The following are among the options identified: removal of dead or unwanted branches, manipulation of canopy sizes and shapes to either avoid competition with an understorey crop or to maintain biomass. In some species like *Mangifera indica* (mangoes) where the proportion of wood on which flowers would be initiated became less over the years, renewal pruning were observed as a practice to stimulate new growth and maintain vigor and productivity of the trees. Selective pruning of branches for fuelwood and/or poles were also evident. For trees grown for timber, some form of pruning (in order to reduce the number of upright stems to one) was also practiced. However, most of these were carried out haphazardly and as pointed out by Huxley (1999), well and proper training especially for selective pruning that requires the most knowledge and experience to do, would be very beneficial to the farmers.

Other poles of species for timber such as *Milicia excelsa*, *Albizia coriaria*, *Albizia grandibracteata* and some *Acacia* spp. were pruned and managed for longer years to develop into timber trees. In some cases trees were managed as farm woodlots for provision of poles (*Cassia* spp), fruit orchards (oranges) and fire wood (*Eucalyptus* and *Senna* spp). Majority of trees were however, managed around homes and near compounds as multiple species compound farms, homegardens and tree crop mixtures as component of the overall farm systems.

In general, farm visits revealed that tree protection and planting and management on farms have become progressively more intensive with transitions of land to permanent cropping; the disappearance of communal tree resources, and the rise of local cash markets for fuelwood (due to urbanisation), poles, seedlings and fruits. During the early 1990's, Canadian Physician for Aid and Relief (CPAR), a community responsive extension service substantially increased the "menu" of tree related options available to household in the project sub counties in Apac district. This enabled farmers to grow and manage a large number of tree species (Tables 1-3 & Figure 1) to satisfy consumption needs, for example, which would otherwise have to be purchased and also to diversify their sources of cash income and sustain food security in the face of declining crop yield.

It has been observed that, even when farmers increasingly exploit opportunities to generate additional income through sales of tree products, the farmers' production of wood products for urban and industrial markets is often limited by competitions for low cost supplies from natural forest and government restrictions on private harvesting and sales of wood. These could be a possible explanation for the limited occurrence of private production of fuelwood and poles for urban and industrial markets; a situation also reported by Huxley (1999).

Constraints to tree planting

The problems that households faced in tree management are given in Table 5. Natural hazards, improper land rights and poor extension services hindered tree planting activities. Although natural hazards did not significantly influence farmers' participation in tree planting (Table 4), the relationship between land acquisition and tenure system was highly significant ($x^2 = 15.57$, $P = 0.0041$).

Table 5. Constraints to tree planting (N=180)

Constraints	Frequency	%
Lack of land/no proper land rights	43	23.90
Cultural beliefs/taboos	11	06.10
Poor supply of planting materials	38	21.10
Lack of knowledge/low level of extension	41	22.80
Natural and man made hazards[a]	47	26.10

[a](termites, weeds, other pests and diseases)

Household heads that inherited land from parents said they had not got enough land because they shared it among brothers. They added that it was not necessary to plant trees on land where tree tenure was insecure. The sharing of inherited lands from the parents through generations leads to land fragmentation and insecure tree ownership. This has got a negative impact on promotion of tree growing. In this study, eighty percent of the households who cultivated communally owned land were reluctant to plant trees. It was equally difficult for farmers to plant trees in cultivated areas where land are being temporarily used for settlement of the displaced people from eastern part of Lira district. According to Baxter (1994) and Tegnäs (1993 & 1994), the introduction of hedgerows, windbreaks or individual tree planting in such areas is often considered as anti-social and limits the flexibility of these innovations.

Tree tenure was however, not the same as land tenure because rights to tree products such as fruits, firewood, and medicine were considered separately from rights to tree removal. For example, permits are required in many areas of the Uganda if one wishes to sell or fell trees. Such demands for permits have been based on the Forest Act of 1964 (GOU, 1964). Farmers therefore do not see the use of planting trees when one has to pay for the permit in

order to harvest them. Even though the immediate intention of the Forest Department is to prevent indiscriminate felling of trees, such restrictions can make farmers lose the benefits of growing trees and thus choose not to grow as many trees as they otherwise might. This, coupled with government regulations of protecting valuable tree species like *Milicia excelsa*, discourages farmers from planting the species and when planted, very little or no protection is given. Similar cases were also reported by FA (FAO, 1986). Species like *Thevetia peruviana* Schumann., Dovalys *cappra* (Hook.f. & Harv.) Warb., *Euphorbia tirucalli* and *Bischovia javanica* Blume. were, however, planted for purposes of securing land because the trees can be planted to demarcate borders or boundaries (Neumann, 1983).

Man-made hazards such as careless grazing of cattle are one of the factors limiting tree growing in agro-pastoral areas. In such an area, post-harvest grazing of fields is a common practice where after harvest; the fields are often opened up for grazing on a communal basis. The cattle and goats are often free to graze on whatever they find at such times. Tegnäs (1994) reported that where such practices exist, it is very difficult for farmers to establish new trees in croplands. He also noted that live fencing help to protect homesteads and control post-harvest grazing in small scale farming areas. Live fencing is therefore a practice worth exploring to minimise tree damage by animals in agro- pastoral areas.

The influence of cultural beliefs and taboos on tree planting has declined due to strong growth of modern religions. Most of the advanced myths about tree planting in the region are aimed at regulating the social behaviour of women in the community. Traditionally in northern Uganda, a man is the most influential member in a family and he is also regarded as the owner of land the family occupies. This implies that tree planting in the area is clearly dominated by the men (Figure 1). This is further supported by the fact that the majority (96%) of the household heads were males and land owners. Since men and women have different views on the most favoured tree species (Tegnäs, 1994), conflicts often arise and these hinder tree growing.

Women in the region usually have longer workdays than men, and the time devoted to tree planting is limited. When tree planting intervention is to be implemented, division of labour according to gender needs to be considered. Apart from the Canadian Physician Aid and Relief (CPAR) and the Agency for Sustainable Development Initiatives (ASDI) projects, no initiatives have been undertaken to plant trees taking into account gender and age factors. This has limited the adoption of modern agroforestry technologies.

Most farmers in the district generally lack access to improved sources of planting materials. Ninety percent of the households lacked access to improved seeds of most tree species such as pines, Eucalyptus and fruit trees. Seeds and/or seedlings of trees that are compatible with crops at the early establishment stages such as *Grevillea robusta* A.Cunn. Ex. R. Br., *Calliandra calothyrsus* Meissner. and *Leucaena leucocephala* (Lam.) de Wit. were not available because of lack of knowledge of how to raise or buy them. In many respects, this has affected the adoption of agroforestry in the region.

According to Evans (1992), tree-planting activities especially in agroforestry systems is a new practice to many rural farmers. Many people seem to be doubtful that trees can be integrated with agricultural crops. Two thirds of the respondents stated that they lacked knowledge of seed collection, species selection and planting techniques. Nearly all of them indicated that they had knowledge of tree/crop relationships and local uses of medicinal species. This finding is important for enhancing agroforestry development and adoption (Nair, 1990 & 1993).

Access to sources of tree planting materials and availability of extra labour influenced tree planting (Table 4). Tree- planting activities in the region have been triggered by the decline in tree products such as firewood, poles, timber and fruits. As pointed by Leach and Mearns (1988), where human survival is often marginal and there is little of anything in cash, labour or risk-taking confidence to spare, successful tree planting occurs. Nevertheless, extension education by CPAR in Oyam and Kwania counties and/or little knowledge of how to incorporate trees on farmland affected tree planting. Consequently, the level of education of the farmers and extension had a great impact on the farmers' participation in tree planting activities.

Another important factor that needs to be considered is the provision of credit to farmers. As reported by FAO (1985), credit is related to land because loans are often secured by use of land as collateral. Tenure rules are also important because if tenure is not secured then borrowers would be denied access to capital with which to improve agricultural productivity (MISR and Land Tenure Centre, 1989). In this study, only 3.5% of the farmers interviewed obtained loans for agricultural purposes and none used land as collateral as they never had land titles. At the same time, the farmers who obtained loans for agricultural purposes had increased farm outputs and also made some profits. Although, credit is a new intervention in the area, it could contribute to reluctance of farmers to adopt modern agroforestry. It is therefore important to emphasise the need for farmers to obtain loans and use them for agricultural productivity. In addition, soft loans where no collaterals are required could be provided. The 'Entandikwa' (the beginner type of loan instituted by the National Resistance Movement government for the alleviation of poverty of rural people) type of loans and Youth Entrepreneur Scheme (YES) should be encouraged and the interest rate lowered from the present 16% to between 5% and 10% to attract farmers. This should also be made easily accessible as short term loan during production periods.

Conclusions and recommendations

1. Most naturally growing trees are protected by farmers to meet their needs and many trees were on boundaries of homesteads and in crop fields, woodlots and homegardens. The selected species that are always maintained for crop yield increases and other environmental benefits valued by the farmers should therefore be promoted for on-farm planting.

2. The traditional agroforestry systems in the region have undergone gradual changes because individual farm families facing environmental and economic problems are forced to make choices between production systems. This, however, has not given the farmers full benefits of agroforestry as most of the rural development programmes have not tackled this probably due to lack of knowledge of its existence, lack of technical staff and/or poor extension.
3. The existing traditional farming systems, which include some agroforestry, should be improved by introducing and encouraging modern farming technologies.
4. There is also a need to study the indigenous agroforestry knowledge in order to improve the existing knowledge and technologies into suitable tools.
5. Most rural development programmes should encourage farmers to adopt the use of multipurpose tree species such as *Grevillea robusta*, *Leucaena leucocephala* and *Calliandra calothyrsus* and also herbaceous legumes like *Mucuna* spp., *Lablab purpereus* (L.) Sweet and *Canavalia ensiformis* (L.) DC. as cover crops on the farms. These would help supplement the indigenous pastures besides improving fertility of the land. Teaching farmers that these cover crops have valuable uses besides maintaining soil fertility can help sustain the widespread use and adoption of green manuring practices.
6. Other agroforestry technologies should be introduced for the rural farm families who are smallholder subsistence farmers to meet their basic needs for food, shelter, building poles and fuelwood. This should be done through integrated research, adoption of better land management techniques and planting of tree/shrub species desired by farmers.
7. Because the development of more sustainable and more productive agricultural systems must rely on farmers' participation, it is important that their individual production strategies and decision regarding tree management be well understood. Only then can technical innovations, improvements or developments be successfully introduced. Their identified tree and farming variables should be taken into consideration by research/development and extension workers in order to define agroforestry technology propositions and farmer group targets more successfully.

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