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Full Length Research Paper

Broadcasting pathways for measuring agroforestry technologies in western Tanzania

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Tumbi Agricultural Research Institute and International Council for Research in Agroforestry (ICRAF) have been working on agroforestry technologies to address the problems of soil degradation and shortage of food and fuel wood in Tanzania. Among the technologies developed, using improved fallows to replenish soil fertility is being adopted by farmers. The lack of an effective dissemination pathway has been an obstacle for scaling-up this technology. The Network of Farmer Groups in Tanzania (MVIWATA) facilitated co-ordination and streamlining of on-farm research, training and dissemination of improved fallows. Furthermore, it provided an analytical mechanism for participatory evaluation of promising technologies on farms and served as catalyst for their widespread dissemination in Tabora. The institute examined the effectiveness of different dissemination pathways, the government agricultural extension services, farmer trainers and traditional leaders for scaling-up of agroforestry technologies. Seventy-six percent of the farmers interviewed felt that farmer trainers were more effective in providing extension training on improved fallows than other channels. About 92% of the samples in the western zone of Tanzania were familiar with the concept of improved fallow technology. Farmers reported that government extension service and traditional leaders were not effective in dissemination of improved fallows. Farmer trainers are considered to be more effective in dissemination.

Key words: Extension, farmer trainers, network, traditional leaders

INTRODUCTION

The Tanzania/ICRAF project has developed appropriate agroforestry technologies to address the problems of low soil fertility, dry season fodder shortage and fuel wood scarcity. After a number of years of research on agroforestry, researchers had by 1996 generated various technologies to address these problems. Notable among these was improved fallow technology (Kwesiga et al*.,* 1999).

Traditional farming systems that relied on the use of natural fallows for restoring soil fertility have become impractical to practice due to increased population pressure on land. Fallow periods have become shorter and continuous cropping without substantial nutrient mining has become the norm. Inorganic fertilizers are not available to most smallholder farmers because of their high costs. Deforestation is accelerating as farmers clear woodlands for fuel wood and to expand the area of land available for agriculture. Deforestation of watersheds is causing serious environmental problems in the form of soil erosion, silting of rivers and dams and loss of biodiversity. All these changes are adversely affecting the welfare of rural families.

In order to address the problem of declining soil fertility in Tanzania, agroforestry research has focused on the problems mentioned previously. Technologies such as improved fallows, mixed cropping with trees and biomass transfer have been tested on farms; fodder banks using leguminous trees have been developed to overcome the shortage of dry season fodder; rotational woodlots have been proposed to address fuel wood shortage; and

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Table 1. Institutions collaborating in agroforestry research development as at 2006.

Type of institution	Name of institution
Government organisations	Extension Department of the Ministry of Agriculture Food and Cooperatives in Tabora, Tanzania; Region forests extension department; Tanzania Forestry Research Institute (TAFORI) Tanzania; HASHI Shinyanga
Primary and secondary schools	Primary and secondary schools
Non-governmental organisation	The World Vision International in Nzega district; AFRICARE in Tabora; Association of Tanzania Tobacco Traders (TTT) in Tabora; Tabora Development Trust Fund (TDTF); TACARE in Kigoma; VI Project in Musoma; World Vision Shinyanga

domestication of indigenous fruit trees has been introduced in an attempt to reduce loss of biodiversity in miombo ecosystems. These technologies are at different stages of the 'development cycle' from station testing to dissemination among farmers.

The overall goal of developing different agroforestry options for farmers is to reverse the degradation of the natural resource base and to make a positive impact on the livelihoods of rural people, particularly in terms of food security and poverty alleviation. In Africa, there are very few examples of successful adoption of tree legumes for multiple uses in land-use systems (Scherr and Franzel, 2002).

Recent attempts to achieve adoption of complex agroforestry technologies, such as alley cropping, have been only partially successful because of unrecognised failings in approach (Ajayi et al., 2003). Difficulties for achieving high levels of adoption of *Leucaena* were reported in Africa (Dzowela et al., 1998), South America and Asia (Moog et al., 1998). Although fodder banks were found to be feasible in tropical Africa, the rate of their adoption has been slow because of socio-economic constraints, such as insecure land tenure and lack of infrastructure support (Cromwell et al., 1996).

Simple innovations, such as the use of a new variety that can overcome specific problems, may be adopted relatively easily. Complex innovations, such as the introduction of new agroforestry systems, would require sustained high profile intervention. Despite intense promotion, farmer adoption is often lower than anticipated (Cromwell et al., 1996).

To achieve greater impact, our strategy focused on working through existing government, non-government and other development organisations and farmer groups. It aimed to influence partner organisations and their policies through networking, lobbying and collaboration (Scarborough et al., 1997). Collaboration with partners offered us the opportunity to assess the potential for successes and failures and to estimate the transaction costs to find an effective way of scaling-up of agroforestry technologies.

Tumbi Agricultural Research in the regions of Shinyanga, Tabora and Mara were involved in wide dissemination of agroforestry technologies. Several institutions were collaborating in the processes (Table 1). The main dissemination activities have been sensitisation of farmers and policy makers (seminars, workshops, field days, field visits) and development of extension and training materials. Extension staff and farmers who have been trained in agroforestry have increased their knowledge and accelerated their adoption of technologies.

Agroforestry research and dissemination network

Farmers groups in Tabora and Shinyanga were linked to farmer groups in Tanzania (*Mtandao wa Vikundi vya Wakulima* Tanzania, MVIWATA). The network of farmer groups in Tanzania facilitated co-ordination and stream-lining of on-farm research, training and dissemination of improved fallows and rotational woodlots. The network was open to members with a wide range of background; partners included farmers groups, government departments and local leaders. The network acted as a catalyst and action-oriented group for widespread dissemination of agroforestry innovations in pilot areas and provided co-ordinated and analytical mechanisms for participatory evaluating of the new technologies. The network facilitated identification of the technical and socio-economic issues necessary in adapting agroforestry options.

The network held workshops and exhibitions in which 20 farmers participated. The interventions helped participants plan for wider testing of improved fallows, review problems and the state of knowledge about them and develop a draft extension manual. In the workshops, representatives of extension services and non-governmental organization (NGO) reported on their work progress and outlined the problems they encountered in disseminating agroforestry options, farmers presented their experiences and researchers reported the results of on-station and on-farm trials.

Networking benefits people and organisations through exchanging information and sharing knowledge and skills. The network has created a forum for organisations

to share their knowledge, skills and assets and assess the current knowledge on agroforestry. The network meetings highlighted the constraints to wider adoption of technologies: limited awareness of agroforestry options, inadequate capacities of partners and farmers and lack of access to adequate germplasm (Bohringer et al., 1999).

A major task of the network at each meeting was to plan for scaling-up of activities for subsequent seasons. Network members decided on the type of activities, developed schedules for implementation, assigned responsibilities to partners and explored resources for the activities. At the meeting, scaling-up strategies were elaborated which included farmer to farmer training, field days, farmer exchange visits, establishing demonstrations and networking with local leaders.

Courses for training of trainers were conducted; five partner organisations are now working with a network of approximately 168 farmer trainers. Often farmers and partners lose interest in participating in agroforestry innovations if there is a shortage of seed. The issue of seed supplies needs proper planning in terms of which partner wants what kind of seed, how much they want and names of the suppliers. The network provided a good forum for establishing the demand for seed among partners and discussing the modalities of timely supply to them.

At stakeholders' workshops, most partners requested seed of *Sesbania sesban, Gliricidia sepium and Tephrosia vogilii*, which was provided by the Tumbi Agricultural Research Institute. However, as partners got more experience with the technology over the years, the issue of labour was highlighted as a constraint in establishing the fallows. Consequently, they asked for seed of species such as *T. vogili*i that can be planted by direct seeding in order to reach out to more farmers. The demand for improved seed, especially for *T. vogilii, Cajanus cajan* and *Gliricidia sepium,* has increased over time. Consequently, the Tumbi Agricultural Research Institute established seed orchards of *G. sepium, S. sesban and T. vogilii* with farmers groups throughout the western zone.

Research institutions are often accused of driving research agendas that are not relevant to farmers' needs and are poorly linked to extension. However, the most outstanding feature of the network has been its ability to provide feedback into the research process, enabling researchers to refine their experiments and designing new ones to answer the needs of the farmers and partners.

The objectives of this study were to review different dissemination pathways used to scale out agroforestry options in western Tanzania and assess their relevancy.

METHODOLOGY

The study was carried out in five districts of Tabora region: Tumbi, Malolo, Isikizya, Kigwa and Magiri in Uyui district. One village was purposely chosen for the study (that is, a total of five villages) from each district. The major reason for selecting these villages was that Tumbi/ICRAF had earlier made them focal villages for agroforestry experimentation. Most on-farm testing of agroforestry technologies were first done in these villages before the technologies were spread to surrounding areas. All households in these villages were involved in the study.

Sampling technique

Purposive sampling procedure was done; it focussed on respondents who are involved in agroforestry technologies. This activity was done in three steps: selection of villages, farmer trainers and focus group discussions (FGDs). Five villages were selected purposely from the study area. In each selected village, a random sampling technique was used to select farmers. Two villages were selected from each ward. Each village, ten (10) farmers were selected, making a total of 100 farmer trainers whereby 40 were female and 60 were men.

Data collection

Primary and secondary data were collected from the selected study area. A semi–structured questionnaire was developed, pre-tested and administered to all households in the five selected villages, with the help of agriculture extension officers. The pre-test work was done by interviewing farmers at two villages. From this exercise modifications were made by deleting and rephrasing questions which did not accomplish the study objectives. Interviews were administered at farmers' homes, fields or on the way from home to the field.

Data analysis

Collected data were processed and analysed quantitatively and qualitatively. Quantitative data analysed using statistical package for social sciences (SPSS) software version 14.0 was used to analyse the data. Descriptive statistic was employed and frequency distributions and percentages were used to summarise the information.

RESULTS AND DISCUSSION

The failure of agricultural extension services to make an impact on the adoption of new technologies has stimulated interest in alternative approaches to extension (Duvel, 2002). Farmer participation in agricultural development plans is becoming a central issue of our time. The use of farmers as extension agents has been tried in many developing countries.

Scarborough et al. (1997) reports on such cases in Latin America and Asia where farmer extension agents were used not only in areas where agricultural extension has failed, but also where no such services existed. However, the study indicated that the number of farmers in planting improved fallow increased from 987 in 1997 to 4850 in 2004, the difference could be attributed by awareness creation of agroforestry technologies by Tumbi agricultural research by training extension workers and to provide training materials for the farmers (Table 2).

Table 2. Number of farmers who had planted agroforestry tree species during 1997 to 2004 in western Tanzania.

Year	Number of farmers planting improved fallow
1997	987
1998	1000
1999	1450
2000	3000
2001	3004
2002	3985
2003	4000
2004	4850

Table 3. Initial source of information for farmers about improved fallows in the study area, western zone Tabora, Tanzania.

Initial source of improved fallow knowledge	Frequency	Percentage (%)
Fellow farmers	7	9
Farmer trainer	35	43
Extension trainer	18	21
NGO partner	9	11
Radio/TV	1	2
Tumbi/ICRAF	6	8
No information	4	6
Total	80	100

Survey data (2002).

In the case of improved fallows in western Tanzania, the use of farmer trainers and local leaders has been considered for reaching more farmers effectively and in a sustainable manner. The use of farmer trainers as a dissemination pathway requires that specialist in various aspects of the technology train selected farmers, so that they can train fellow farmers.

A study was conducted on 80 farmer trainers to examine their potential in spreading information about improved fallows. Of these farmer trainers interviewed, 78% were male and 22% were female. Seventy-six per cent of the farmers felt that farmer trainers were more effective than government extension staff in disseminating improved fallows. They were the source of information on improved fallows to 43% of the farmers interviewed, in comparison with the government agricultural extension officers who provided the information to only 21% of the farmers.

Despite working for only two years, farmer trainers surpassed the agricultural extension service who had been promoting the technology for over ten years in spreading the technology. In spite of department of extension under the Ministry of Agriculture Food and Co-operatives organising radio programmes in Swahili for four weeks, just 2% of farmers indicated the radio as their initial source of information on improved fallows (Table 3). Only 8% of respondents identified that Tumbi Agricultural Research Institute and ICRAF as their source of information on improved fallows, those were mainly that had been involved with on-farm trials.

Training of farmers on improved fallows spanned from 1995 to 2002. Up to 1997, only 9% of the farmers had heard about improved fallows (Table 4). There was a significant increase after 1997, the study findings show that in 2001 the majority (23%) of respondents had heard improved fallow, which could be attributed to the involvement of farmer trainers.

The greatest strength of farmer trainers is their ability to try out technologies with farmers that is effective in technology promotion. Farmer–trainers have become more convincing to farmers than extension staff. In a monitoring exercise in Uyui district, it was observed that farmer-trainers who had prior experience of planting improved fallow on their own farms had influenced more farmers to plant fallows compared with newly trained farmers, this was noted by Katanga et al. (1999).

The use of the farmer trainers instead of government staff for dissemination is more economical as there are no salary costs for farmer trainers. They can reach more farmers as they are widely spread out, even in remote areas where agricultural extension services do not exist. Their word carries more weight than government staff as they live with farmers and speak the same language as their colleagues (Scarborough et al., 1997).

Table 4. Year-wise numbers of farmers heard improved fallow technology for the first time in the study area in western zone, Tanzania.

Year	Respondents (%)
1995	3
1996	6
1997	9
1998	11
1999	13
2000	15
2001	23
2002	20

Survey data (2002).

Farmers and trainers face similar constraints as they both have similar potentials and aspirations. This makes the job of understanding the difficulties of fellow farmers easier for farmer trainers compared to extension staff. As the farmer trainers among other farmers, other farmers will approach them whenever they face problems. Some of the agricultural extension officers live a long distance from the areas they were expected to operate in. This made it difficult for farmers to reach them, and they only met at planned meetings. Some of the challenges that farmers faced required immediate attention which could be addressed easily by farmer trainers who were available to farmers at all times.

Dissemination of new technologies has traditionally been the government's responsibly through the Ministry of Agriculture Food security and Cooperatives (MAFC). Agricultural extension officers based at village level execute the extension tasks. They are capable of disseminating agroforestry innovations as they are well trained and experienced in working with farmers. However, lack of resources limited their work.

The focus group discussions (FGDs) revealed that extension staff experienced many constraints in their daily operations, such as lack of: transport, spare parts, stationery, teaching aids, fuel and finances. Such findings are supported by the study done by Katanga et al. (1999) who concluded that these limitations affected training of farmers on new technologies. Hedden-Dunkhorst and Mollel (1990) reported on how the unfavourable structures and lack of financial resources, skills and motivation of extension personnel negatively affect agricultural development in Southern Africa.

The survey further highlighted the negative perceptions farmers held on extension officers, although they acknowledge the difficult conditions under which they operate. The extension officers are demotivated lacking resources and support.

The network identified local leaders as being capable of organising local meetings. It was hoped that such gatherings could provide opportunities for disseminating agroforestry technologies. The study revealed that majority (78%) of the farmers was against involving local leaders acting as extension agents for fear that they might misuse their authority. FGDs explained more that, local leaders could help mobilise farmers to attend meetings but could not disseminate the technologies. They saw themselves more as facilitators and not disseminators.

Disseminators should be accessible to farmers at all times. The government extension staff and farmer trainers could collaborate with local leaders whenever they work and not necessarily involve them in activities that would jeopardise their authority. However, local leaders could contribute to disseminating improved fallows by taking up the new technology so that their subjects could emulate them with confidence. While farmers appreciated the involvement of local leaders in decision-making by virtue of their authority over the land, their role as disseminators was considered less effective, while their role as facilitators was rated very highly.

Conclusion

The ongoing work on dissemination of improved fallows and other technologies in the western zone of Tanzania emphasises the importance of communication, training, extension and follow-up research. The formation of the network, frequent meetings and workshops involving all the stakeholders resulted in greater scaling-up. There should be a continuous and accurate flow of technical information among collaborating partners when disseminating complex agroforestry technologies. Access to technical information has enabled most partners to disseminate agroforestry options to farmers with confidence. The primary challenge of the agricultural system in Tanzania is its inability to meet the demands of the field staff due to limited budgets. The strength of the government extension system lies in its extensive spread throughout the country, from national to village level, with staff working at all of the different levels.

Demonstration of new technologies by farmer trainers was more convincing and meaningful to farmers than by professional extension agents, because of the similar conditions in which both groups lived and worked. Farmer trainers should therefore be the first ones to experiment with new technologies on their farms so that others can see the benefits. They should work towards building local foundations, such as groups and associations, which would allow them to continue to practice agroforestry, even without external support. Local leaders are not effective disseminators as they are not easily accessible to the farming community. However, when participatory approaches are adopted, they can encourage full participation of people in activities. From this study, we conclude that farmer trainers are effective in dissemination of agroforestry innovations. However, local leaders, NGOs, collaborating partners and government departments need to be closely involved in the process

and there must be frequent contact among all players. All of the participating partners should assume ownership of the project and must be respected for their contribution and innovation.

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