Promoting Bean IPM Technologies through Participatory Research and Development Methods: Experiences with AHI Collaborating Farmers in Lushoto District, Tanzania

Minja[1], E.M, Ampofo[1], J.K.O., Mziray[1],H.A., Hollenweger[1], U., Mowo[2], J.G. and Matosho[2], G.A.

[1]International centre for Tropical Agriculture (CIAT), Arusha, Tanzania (e.minja@cgiar.org) and [2]AHI Lushoto, Tanzania

Abstract

The history of research work on common beans (Phaseolus vulgaris L.) in farmers' fields in Lushoto District, Tanga region in north eastern Tanzania dates back to over 25 years. Farmers have identified suitable bean varieties and agronomic practices for their various circumstances. Current observations show that as the human population increased, the average household land size decreased from 0.7-1.2 to 0.2-0.8hectares and soils have increasingly become unproductive due to soil erosion and nutrient mining. Recently, unreliable weather conditions have rendered bean and other crops more vulnerable to damage by insect pests and diseases leading to poor crop yields, food insecurity and lowered incomes. When AHI started activities in Lushoto in 1998, farmers in Kwalei water catchment area requested for research assistance on a number of issues. SARI and CIAT had already worked extensively in the district, so it presented an opportunity to incorporate bean integrated pest management (IPM) into the farmer-led research program that was looking into other options to address soil and water conservation issues. The research teams promoted participatory pest management activities with farmer groups in Kwalei and 12 other village communities. Farmer groups participated in training, field experimentation and exchange visits to other practicing farmers. The excellent collaboration fostered by Lushoto Extension Services and SARI's research group with both AHI and the bean IPM projects supported by CIAT and ECABREN enhanced participatory dissemination of technologies. This experience showed that combining research with training and exposing farmer groups, helps to build farmers' and extensionists' confidence and keenness to learn, fine-tune and adapt more complex technologies like IPM, leading to wide-spread dissemination. There has been increasing demand from new farmer groups to get involved. Some of the notable outcomes are: Farmers are able to train others, organize their own demonstrations and field days, and contribute to the preparation and dissemination of extension materials at village level, leading to the evolving Village Information Centres-VICs. Once farmers learn from each other they adopt the technology without experimentation. The major lesson gained is that the participatory approach and processes have helped communities to develop strong confidence and sense of ownership. This creates an enabling environment for different partners to use the "social capital" (farmer groups) for other development activities.

Introduction

Studies at Kwalei catchment area have shown that the farming community ranked common beans second to maize as an important food crop (Lyamchai *et al*., 1998) (Table 1). Surplus bean grain is traded in the local markets. Other food crops in order of importance include bananas, sweet potato, cassava, yams, fruits, vegetables and round potatoes. Farmers have selected different bean cultivars based on a number of criteria including yield, marketability, palatability, thick broth, time to maturity, tolerance to different stresses (e.g. diseases, insect pests, drought, etc.), colour, cooking quality, etc. The most preferred bean cultivars were Soya, Lyamungu 85&90, Kabuku (Kibumbuli), Maharage Fito, Ukorogwe, etc. in that order.

Table 1. Farmer ranking of food crops at Kwalei catchment area

Crop	Scores (9 highest)	Rank (1 most important)
Maize	9	1
Beans	8	2
Sweet potato	6	4
Banana	7	3
Cassva	3	7
Yams (white flesh)	5	5
Yams (red flesh)	4	6
Vegetables	2	8
Wheat	0	10
Round potato	1	9

Source: Lyamchai *et al.* 1998

Farming systems

The focus of the farming systems in Lushoto district is in sufficient household food production and surplus to market for income. Farmers practice mixed farming system where crops and livestock are produced by the same household. Due to land shortage, most crops are intercropped except for tea which is grown as a sole crop. Common intercropping systems include banana and coffee based system, maize intercropped with beans, and a variety of horticultural crops (tomatoes, cabbage, carrots, potatoes, onions, okra, peas, spinach, eggplants, cassava, fruits, spices, etc.). Land allocation to different crops is mostly influenced by the economic importance, food preference by individual farmers and seasons. In Kwalei catchment area for example, cash crops are allocated 60% of the arable land and the area for tea and coffee has almost remained the same over the years. Recently however, most of the coffee bushes have been replaced by food crops due to high input costs and low market prices for coffee. Beans take up 10% of the arable land area (Table 2). The average under bean production ranges between 750-1250 kg/ha.

Table 2. Land allocation to different crops at Kwalei catchment area

Crop	**(%) land allocated**
Coffee/Banana	25
Tea	20
Maize	15
Tomato	15
Beans	10
Other crops	15

Source: Lyamchai *et al.* 1998

Main crop production constraints

Farmers reported that food crop production trends have declined in recent years. For some crops like maize, the decline has been at the expense of tomato production due to soil fertility degradation and land fragmentation. High human population pressure (450 persons /km^2) has been one of the major causes of land fragmentation in Lushoto (Meliyo, *et al.*, 2004). Farmers have therefore, opted to invest soil fertility improvement measures to produce the more marketable vegetables including tomatoes, cabbages, common and snap beans, spices, etc. The decline in bean production was reported by farmers to be due to insect pests and diseases, poor farm practices, low yielding varieties, infertile soils and unavailability of farm inputs (such as quality seed, commercial pesticides and fertilizers) that are also associated with high costs (Table 3). In the case of beans, diseases include leaf diseases, root rots and nutritional disorders while the widespread insect pests are bean stem maggots, bean foliage beetle, bean bruchids, aphids, pod borers and sucking bugs. Other

key constraints include low yielding varieties and poor cultural practices (inappropriate spacing, absence of pest scouting, untimely weeding and harvesting, lack of soil erosion and fertility improvement measures).

Table 3. Key constraints to bean production at Kwalei and resulting effects

Key constraints to bean production	Resulting effects
1. Incidences of insect pests and diseases	1. Poor crop yields
2. Low yielding bean varieties	2. Low household food and income
3. Poor cultural practices	3. Lack of livestock feed
4. Eroded soils	4. Poor human health
5. Low soil fertility	
6. Unavailability and high prices for farm inputs particularly seed, inorganic fertilizer and pesticides	

Source: Lyamchai *et al.* 1998

Background

Lushoto district is located in the north eastern highlands of Tanzania in Tanga region. The district covers the western part of the Usambara mountains at 40 22' and 50 08' south and 380 5' and 380 38' east of the Equator, with land area of 3500 km^2 (2000 km^2 is arable and 340 km^2 is forest reserve). The human population in 1988 was 357,531 at a 2.8% growth rate while estimates for 1998 were 471, 240. According to Pheiffer (1990), Lushoto district is in the humid-warm agro-ecological zone that lies between 800- 1500 metres altitude with an annual rainfall of 800-1700 mm. Most soils in the zone are classified as humic ferralitic. The main crops include tea, coffee, vegetables, fruits, spices, maize, beans, bananas, cassava, yams, sweet and Irish potatoes. Livestock farming (dairy cows and goats, piggery and poultry) and trading with agricultural products has gained widespread adoption in recent years.

Historical events show that Kwalei catchment in Lushoto district has since 1934 experienced 3 major famines, 2 locust infestations, 3 major human diseases including chicken pox, measles and meningitis, floods and drought (Lyamchai *et al.* 1998). The national research programme (Selian Agricultural Research Institute-SARI) and the Lushoto district extension services, the International Centre for Tropical Agriculture-CIAT and the African Highlands Initiative-AHI realized that participatory technology development and dissemination with farmers and active partners would be the most appropriate approach to empowering the farming communities in sustainable resource management.

Research work on common beans (*Phaseolus vulgaris* L.) in farmers' fields in Lushoto dates back to over 25 years (Karel *et al*. 1980). Farmers have identified suitable bean varieties and agronomic practices for their various circumstances. Current observations show that as the human population increased, the average household land size decreased from 0.7-1.2 to 0.2-0.8 hectares. This has led to high fragmentation of farm fields where households can own several small plots in varied distances. Such land is used intensively for the production of high value and short duration crops (beans, vegetables, spices, potatoes, fruits, etc.) and zero grazed animals (cows, goats, piggery, poultry, etc.) in place of the traditional coffee, tea, maize and bananas. Household members have also diversified their activities into trading with agricultural and other products and travelling out to seek employment elsewhere.

The intensively cultivated soils have increasingly become unproductive due to soil erosion and nutrient mining resulting from the removal of some of the contour bands, bushes and trees from the fields to avail more arable land for crops and pasture. Soil infertility is also due to the fact that most farmers have not been using organic or inorganic fertilizers (due to unavailability at the required time and high prices) to replenish soil nutrients

after successive cropping. Soil erosion and nutrient mining is particularly dominant on the sloppy terrain in the district. Recently, the situation has been compounded by unreliable weather conditions that have rendered bean and other crops more vulnerable to damage by insect pests and diseases leading to poor crop yields, food insecurity and lowered household incomes. The major insect pests on beans include the bean foliage beetle (BFB)- *Ootheca* spp., bean stem maggots (BSM)- *Ophiomyia* spp., bean aphids (*Aphis fabae* and *A. craccivora*), bean bruchids (*Acanthoscelides* sp. and *Zabrotes* sp.), cutworms, pod borers, sucking bugs, etc. Diseases include bean anthracnose (*Colletotrichum* sp.), leaf rust (*Uromyces* sp.), angular leaf spot (*Phaeoisariopsis* sp.), bean common mosaic virus, root rots, etc. There are also various nutritional disorders depending on soil types at various locations (Bean IPM Project reports, Allen *et al*. 1996).

When the African Highlands Initiative (AHI) activities commenced in Lushoto in 1998, farmers in Kwalei catchment area requested for research assistance on a number of issues. Mlingano and Selian Agricultural Research Institutes (in Tanga and Arusha, respectively) and the International Centre for Tropical Agriculture (CIAT) had worked extensively in Lushoto district. This presented an opportunity to incorporate bean integrated pest management (IPM) into the farmer-led research program that was looking into other options to address soil and water management issues. The research teams promoted participatory pest management activities with farmer groups in the district. While AHI concentrated their efforts at Kwalei, Mbelei, Kwekitui and Kwamdoe, the bean IPM promotion projects involved farmers from Kwalei and 12 other village communities (Ubiri, Mbuzii, Nyasa, Mbelei, Kizara, Kwekitui, Kwangwenda, Mponde, Mombo, Mailitano, Soni and Vuga).

Farmer group representatives, district, and ward extension officers have participated in training, field experimentation and exchange visits to other practicing farmers in Kilimanjaro, Arusha and Manyara regions. Farmer groups in Kwalei, Mbuzii, Nyasa and Ubiri have hosted visiting bean IPM project participating farmers from Kilimanjaro and Mbeya regions (Bean IPM Project reports, July 2002, February 2003, June 2003). AHI and district extension personnel in Lushoto, and farmer groups at Ubiri and Kwalei have had the opportunity to share information and exchange knowledge with the bean IPM project donor representative (DFID Crop Protection Deputy Manager) in March 2003 (Bean IPM Project report, March 2003). In October 2004, the bean IPM project shared costs to facilitate 20 AHI participating farmer group representatives from Lushoto to conduct a 2 day visit to Babati bean IPM participating farmer groups after their learning tour of Arusha town markets. Babati farmer groups collaborated with Farm Africa in various agricultural production activities including intensified intercropping (such as beans + maize/sorghum + sunflower + pigeopea) and livestock production, all for food security.

The Lushoto farming communities have traditionally developed various strategies for management of pests and diseases in humans, domestic animals and crops. The national research programmes and partners in collaboration with farmers have also developed management strategies for crops, livestock, forestry, soil and water conservation, etc. These traditional and improved technologies have mostly been used by participants at specific pilot sites and have not been widely disseminated and adapted by neighbouring and other farming communities. A participatory group approach and different processes/methods were adopted in the current research activities to disseminate and promote bean integrated pest management (IPM) options from community to community while incorporating research outputs from other projects into the promotion exercise.

AHI and the bean IPM projects have shared costs involved in several farmer groups exchange visits by Lushoto farmer representatives to enable them share information and exchange experiences with other bean IPM practicing farmers in Manyara, Arusha, Mbeya and Kilimanjaro regions (Bean IPM project reports). Thus, bean IPM technologies developed in Lushoto particularly the use of botanicals *(Lushoto is mostly referred to as the home for herbs and spices!)* and other traditional products for pest management in crops (including sources of pesticides and organic fertilizers especially from such plants as *Vernonia*, *Tetradenia*, *Pycnostachys*, *Tithonia* species), livestock and human medicines have been shared and adopted by farmers in Arusha, Kilimanjaro, Manyara and Mbeya regions in Tanzania. In addition, such information and farmer technology adoption has crossed borders to Dedza district in central Malawi, Kisii district in western Kenya

and Kabale in south western Uganda. The excellent collaboration fostered by Lushoto Extension Services, Mlingano and SARI research groups with both AHI and the bean IPM projects have greatly enhanced participatory group dissemination of IPM and other technologies to bean farming communities in Tanzania and the region at large.

Methodology

- *Participatory farmer research group approach*- Modified Farmer Field School-MFFS where each individual in the group including partners actively participate in different activities taking note of gender equity (men and women are involved in decision making, planning, training other farmers and partners, implementation of field activities including demonstrations/field days/visits, monitoring, evaluation, preparation of extension materials, dissemination of technologies and information)
- *Techniques used*- Formal and informal group training, planning meetings, field demonstrations, field days and exchange visits, sensitising and involvement of policy makers and other key partners, preparation and dissemination of promotional materials, setting up VICs, linking to different projects/NGOs/private sector and other service providers, displays and exhibitions, drama, choir, poems, radio, TV, and magazines/newsletters
- *Involvement*: Farmers, extension officers, local leaders, government policy makers, NGOs (TIP, Lishe Trust, etc.), other district focused projects (AHI and SECAP), private sector (Irente Farm, etc.), individual innovative farmers and other local service providers.

Justification for the above methodology

Farmers viewed collective group action as an effective and sustainable method to access information and technologies to solve the widespread bean pests, diseases, soil fertility and other production constraints at household and community levels. Local leaders and government officials have participated, supported and adopted the participatory group approach as an efficient, effective and sustainable means of reaching out to the rural small scale farmers to improve their capacity and empower them to own and manage their resources. Researchers and extension agents viewed the participatory group approach as effective in promoting the adoption of the complex and knowledge intensive IPM practice not only for beans but also for other farm and household production systems.

Results

Farmers are keen to learn by doing in their community groups. They are very careful in planning and conducting research, monitoring and evaluating the results. Farmers were also very flexible in changing their methodologies if things do not work out the way they were initially planned. Participating farmers were most willing to train others, exchange experiences, and share information and other resources. The participating farmers, farmers groups and active communities have identified pest problems and named them in their local languages (Table 4). In the course of research and experimentation, farmer groups have increased in number, diversified their farming systems by growing more high valued market crops, provided better care for their livestock (for example, production of vegetables, beans, potatoes and construction of animal shelters) and improved their household welfare. Farmers have also experimented with different bean genotypes including local selections (Table 5). More new farmers are continuing with evaluation and selection of more bean genotypes in their research groups and individual fields.

Table 4. Common pests and management strategies used by farmers and discussed in the training workshop in June 2003

1. Insect pests			
Local name	Common / Scientific name	Damage on plants	Management
Kiindi	Bean foliage beetle-*Ootheca* spp.	Feed on foliage and roots	Use botanicals Use wood ash and cow urine Cultural practices Use synthetic pesticides
Kifizi	Aphids- *Aphis* spp.	Growing points and transmission of viruses	As for *Ootheca* spp. Conserve natural enemies
Inzi wa maharage	Bean stem maggots – *Ophiomyia* spp.	Feed on within stems	Use tolerant bean varieties Use botanicals Cultural practices
Visaga	Bruchids	Seed in field and storage	Cultural practices Use botanicals
Futu	Caterpillars and pod borers	Foliage, pods and seed	Use botanicals and other traditional practices
Zukizi/Sota	Cutworms	Feed on seedlings	Use botanicals (e.g. *Euphobia* spp.- Muui or Mnyaa)
Kozwe	Snails	Feed on seedlings and pods	Use salt and botanicals
Mpasi/Ngeda	Grasshoppers	Feed on foliage	Baboons and Monkeys feed on them Smell from crushed elegant grasshoppers repels them from feeding on the crop
Shongo	Cereal stem borers	Feed on cereal stems	Some farmers use push-pull with elephant grass (Ngugu) Most farmers intercrop maize with legumes
2. Rats			
Nkuhe - Panya buku	Mole rats	Open bean pods and feed on seed	Use of smoke Use traditional traps (Ughogho) Use botanicals, e.g. *Tephrosia*- Mkaa or Utupa) Use rattax in baits
3.Diseases			
Ghojo	Wilt on tomatoes		Crop rotation Mixed cropping Use of fresh milk mixed with a filtrate from ash and water

Table 5. Some varieties and genotypes that Lushoto farmers have experimented with and selected or adopted for production

Local cultivars	Improved varieties and genotypes	Adopted/selected varieties and genotypes
EXLs 52, 55, 158, Kabuku (Kibumbuli), Maharage Fito, Ukorogwe	Soya, Lyamungu 85&90, G series- 21153, 23333, 8047, 1106, 22501, 11746, PAD 3, BAT 125, IKI (SINON), MLM 49, MLM 127, ZPV 292, IZO 201297, BESHBESH, Rojo, SUA 90, ZAA 12, Selian 94&97, Jesca, etc.	EXLs 52&158, Lyamungo 85&90, Rojo, SUA 90, Selian 94, G 21153, etc.

Women farmers participating in project activities have become very active and more of them have increasingly become interested in participatory group activities. A number of women have taken up key group leadership positions (Chairpersons, treasurers, secretaries). Some of these women are also local leaders in their villages (village chairpersons).

A number of dissemination processes/methods have been developed and used by different farmers and groups in target locations. These include training (formal and informal), field demonstrations, farmer meetings, exchange visits, involvement of local leaders/policy makers (District leaders including the Area Commissioner, District Agriculture and Livestock Development Office teams), NGOs (Lishe Trust, Traditional Irrigation Project-TIP), the private sector (for example, Irente Farm for bean seed production) and other service providers. Promotional materials have been developed with farmer participation and distributed to target offices and villages (leaflets, posters and field manuals). Other dissemination channels include drama, poems/songs, displays, visits, setting up village information centres-VICs). Some of the activities and technologies shared and exchanged during farmer group meetings and exchange visits are indicated in Tables 6.

Table. 6 Technologies shared by participating farmer groups in Lushoto, Hai, Arumeru, Babati, Mbeya, Dedza (Malawi) and Kisii sites

Site	Technologies shared
Lushoto	• Use of botanicals in bean pest, livestock and human disease management • Use of botanicals as sources of organic fertilizers (*Vernonia* spp.- Leaflet prepared) • Soil erosion and soil fertility management strategies (Fanya Juu, Fanya chini terrace construction) • Livestock forage establishment on terrace bands • Experimentation and selection of suitable bean cultivars, etc. • Integrated bean pest management strategies • Furrow construction and use of furrow irrigation for dry season high value vegetables, beans and fruit crop production • Bean seed production groups • Setting up and running village information centres (VICs)
Hai	• Mixed Crops and livestock farming (free and zero grazing) • Use of livestock products (urine, cowshed slurry, cow dung) for bean pest and soil nutrient management • Use of botanicals in bean pest, livestock and human disease management (e.g. *Tetradenia* sp., *Vernonia* spp., etc.) - Village focused armyworm forecasting and control - Integrated bean pest management strategies • Intercropping different crops in the same fields (maize, beans, sunflower, pigeonpea, etc.) • Use of Minjingu rock phosphate for soil nutrient management • Dry season livestock forage management • Setting up and running village information centres (VICs)

Arumeru	• Participatory breeding and selection of bean genotypes • Bean seed production groups • Use of animal products (cow urine and manure) for bean pest management • Integrated management of bean stem maggots
Babati	• Mixed crop and livestock production • Intensified intercropping for coping up with drought (beans, maize, sunflower, pigeonpea, *Dolichos*, sorghum, etc.) • Minimum cultivation and sub-soiling for soil water and nutrient conservation • Pigeonpea production for niche markets
Mbeya	• Bean and soy bean seed production groups • Use of botanical leaves (*Vernonia* spp., *Tephrosia* sp., etc.) and root (*Neuratenania* sp.) crude extracts for bean pest management • Bean production for the market • Dry season of bean leaf (spinach) production for high value vegetable market • Setting up and running village information centres (VICs)
Dedza	• Use of botanical leaf (*Tephrosia* sp., etc.) and root (*Neuratenania* sp.) crude extracts for bean pest management • Bean seed production groups • Dry season "Dambo" bean leaf, seed and grain production • Forest tree nursery production • Cultural ridge cultivation in all fields for soil erosion and water conservation • Establishment and use of green manures (e.g. *Mucuna*, *Tephrosia*, etc.)
Kisii	• Crop and livestock production (free range and zero grazing) • Forage production and push pull technology for cereal stem borers • Indigenous vegetable production • Setting up and running village information centres(VICs) • Bean seed production and distribution to community members • Bean seed selection for bean stem maggot and root rot tolerance • Involvement of adult education and primary school teachers in IPM technology dissemination

Farmers have accessed more improved bean (climbers and bush types) genotype seeds that enabled them to establish seed multiplication plots for improved pest tolerant bean genotypes. Some of these farmers (, e.g. Ubiri, Kwekitui, Kwalei, etc. communities) have been able to sell the seed and grain and increased household income. Such income has been used to pay school fees for the children and purchase household items

Farmers, researchers and the extension services have analysed and experimented with botanicals and animal products as sources of pesticides and fertilizers, e.g. analysis and use of *Vernonia* spp. leaves, wood ash, cow urine (insect pests) and fresh dairy milk (leaf diseases) (Tables 7 and 8).

Farmer to farmer knowledge sharing and exchange has proved to be faster than research to extensionist to farmer pathway. Farmers learn from fellow farmers and adopt, in some cases without experimentation, while most information from the researchers and the extension personnel has to be demonstrated and evaluated before adoption/rejection. Policy makers and local leaders (at district, ward and village levels) have supported and participated in technology development and dissemination (participation in group training workshops, farmer meetings, exchange visits, etc. to share ideas with farmers and other participants). This has influenced changes in national policy issues related to agricultural production (e.g. farmers in Tanzania have to organize themselves and form groups to receive agricultural information, credits, farm inputs, and other services)

Table 7. Some botanicals and other traditional materials commonly used by Lushoto bean IPM farmer groups and their different uses

Plant/Material	Local name (Kisambaa)	Pesticide use	Fertilizer use	Target pest
Vernonia spp.	Mhasha	Crude leaf extract + Chilli + water		Foliar/pod feeding pests including *Ootheca* spp. and aphids
Vernonia spp.	Tughutu	Crude leaf extract + water + soap	Chopped or pounded fresh or fermented leaves	Foliar feeding pests
Euphorbia sp.	Muui	White sap drops in water		Cutworms
Solanum incanum	Ndulele	Crushed fruits + water		Cutworms
Datura sp.	Mnanaa	Crude leaf extract + Chilli + water		Foliar feeding pests
Tithonia sp.	Alizeti pori	Crude leaf extract + water + soap	Chopped fresh leaves	Foliar/pod feeding pests
Ocimum suave	Mzumbasha	Crude leaf extract + Chilli + soap + water		Foliar feeding pests
Cow urine	Mkojo wa ng'ombe	Fermented urine + water + soap	Improves plant vigour after repeated use	Foliar/pod feeding
Fresh milk	Maziwa ya ng'ombe	Fresh milk + ash + water		Potato and vegetable leaf diseases
Wood ash	Majivu	Wood ash + various aromatic plant leaves e.g. *Tagetes* sp., *Cyprus* sp., *Eucalyptus* sp., etc.		Bruchids and weevils in stored grain

Table 8. Chemical analysis for NPK (data from ARI Mlingano) content in the leaves from *Vernonia* sp. and *Tithonia* sp.

Plant	**Nutrient content percentage of**		
	N	P	K
Vernonia	3.6	0.25	4.7
Tithonia	3.2	0.23	4.4

Conclusion

The experience in Lushoto and the other project sites have shown that combining research with training and exposing farmer groups through cross village and cross site visits, helps to build farmers' and extensionists' confidence and keenness to learn, fine-tune and adapt more complex technologies like IPM, leading to wide-spread dissemination within short periods. There has been increasing demand from new farmer groups to get involved. Some of the notable outcomes are: Farmers are able to train others, organize their own demonstrations and meetings, and contribute to the preparation and dissemination of extension materials at village level, leading to the evolving Village Information Centres-VICs. Farmers indicated clearly their

intention to retain the knowledge that they were generating through these activities at village level. They sensitised their village leaders to set aside premises for keeping the promotional materials and all available reports and information (named village information centres- VICs). All community members can access such information easily and at minimum or no cost compared to searching for the same from extension officers and district offices. The same information can be used by the local schools and as a reference for the village community in future. The communities are happy to manage the information and knowledge relating to their local area and that from other communities that relate to their activities and can be shared.

The cross village and cross site visits organised and conducted through costs sharing between the bean IPM projects, AHI, national programmes and other partners have shown that such visits are cost effective and help to motivate participating groups. It has been observed that once farmers learn from each other they adopt the technology without or with minimum experimentation. The major lesson gained here is that the participatory group approach and processes developed and promoted with farmers and partners have helped communities to develop strong confidence, opened farmers to learn and experiment on more solutions to various local production constraints and created a strong sense of ownership of their resources including the knowledge that they generated. This has created an enabling environment for different partners to use the "social capital" (farmer groups) for other development activities. Some of the farmer groups in the four countries (Malawi, Tanzania, Kenya and Uganda) have united to form community based associations/organisations (CBAs/CBOs) that are helping members to access various services (information, credits, farm inputs, training, etc.) from different partners. Partners, particularly the NGOs, other ministries and the private sector are supporting the community farmer group approach because it is providing them with a platform for delivering such services like information on credits, inputs, markets, health and education services

Researchers and extension agents can now let go some of the key responsibilities in R&D because some of the participating partners including the NGOs and the private sector have shown keenness in taking up key roles that address farmers' needs. Some of these partners have comparative advantages and capacity to support such activities as dissemination of varieties and other technologies to farming communities, training (for farmers, researchers and extension personnel), support to farmer cross visits, credit and input facilitation and even subscription to basic research that meets farmers' needs in areas that are under their development mandate. The national governments, NGOs and other rural development projects in the region are using project farmer groups to plan and implement rural development activities at target sites.

References

Allen, D.J., Ampofo, J.K.O., C.S. Wortman, 1996. Pests, diseases, and nutritional disorders of the common bean in Africa: A field guide. Cali Colombia. International Centre for Tropical Agriculture; wageningen, The Netherlands: technical centre for Agricultural and Rural Cooperation, 1996, 132 p. (CIAT publication ; no. 269) ISBN 958-9439-55-1 *(English and Kiswahili versions)*

Karel, A.K., Ndunguru, B.J., Price, M., Semuguruka, S.H., and B.B. Singh, 1980. Bean Production in Tanzania. Pages 122-154, *in:* Proceedings of a regional workshop on Potential for Field Beans in Eastern Africa, 9-12 March 1980, Lilongwe, Malawi. Centro Internacional de Agricultura Tropical, CIAT, Apartado 6713, Cali, Colombia.

Lyamchai, C., Owenya, M., Ndakidemi, P., Massawe, N., Lyimo, S. and R. Ndondi, 1998. A Participatory Rural Appraisal (PRA) in Kwalei Catchment, Lushoto District, Tanzania. August 1998. African Highlands Initiative, Selian Agricultural Research Institute (SARI), Arusha, Tanzania. 79pp.

Meliyo, J.L., Mansoor, H.A., Masuki, K.F. and J.G. Mowo, 2004. The Baga characterization: A step for successful scaling out of technologies. In: Proceedings of the African Highlands Initiative Conference on- Integrated natural resources management practice: Enabling communities to improve mountain landscapes and livelihoods, 12-15 October 2004, Nairobi, Kenya. World Agroforestry Centre, P O Box 30677, ICRAF Campus, Nairobi, Kenya.

Minja, E.M., Ampofo, J.K.O. and H.A. Mziray, 2002. Bean Farmers' Day at Lushoto. Northern and Southern Tanzania bean farmer day held at Lushoto, Tanga, northern Tanzania. Farmer group activity reports for the DFID Crop Protection programme (CPP) Bean IPM Promotion Project in eastern and southern Africa. Lushoto, June 2002. Booklet for distribution to village information centres (VICs) in

bean growing areas in eastern, central and southern Africa, 22p., CIAT, PO Box 2704, Arusha, Tanzania

Minja, E.M., Ampofo, J.K.O., Mowo, J.G. and H.A. Mziray, 2003. Integrated pest management training workshop report: Training of bean farmers and village extension officers, Lushoto district, Tanga region, north eastern Tanzania. Farmer group activity reports for the DFID Crop Protection programme (CPP) Bean IPM Promotion Project in eastern and southern Africa. Lushoto, February 2003. Booklet for distribution to village information centres (VICs) in bean growing areas in eastern, central and southern Africa, 23p., CIAT, PO Box 2704, Arusha, Tanzania

Minja, E.M., Ulicky, E. and H.A. Mziray, 2003. Hai and Lushoto- Crop Protection Programme (CPP) Visit. Farmer group activity reports for the DFID Crop Protection programme (CPP) Bean IPM Promotion Project in eastern and southern Africa. March 2003. Booklet for distribution to village information centres (VICs) in bean growing areas in northern Tanzania. 18p. CIAT, PO Box 2704, Arusha, Tanzania

Minja, E.M., Ampofo, J.K.O., Mziray, H.A. 2003, Mowo, J.G. and T.M. Kizuguto, 2003. Integrated pest management training workshop report: Training of bean farmers and village extension officers, Lushoto district, Tanga region, north eastern Tanzania. Farmer group activity reports for the DFID Crop Protection programme (CPP) Bean IPM Promotion Project in eastern and southern Africa. Lushoto, June 2003. Booklet for distribution to village information centres (VICs) in bean growing areas in eastern, central and southern Africa, 15p., CIAT, PO Box 2704, Arusha, Tanzania

Pfeiffer, R. 1990. Sustainable Agriculture in Practice- The Production Potential and Environmental Effects on Macro-contour lines in the West Usambara Mountains of Tanzania. PhD Dissertation, University of Hohenheim, German. pp. 195.

Leaflet: Use *Vernonia* spp. for increased production. CIAT Arusha, P O Box 2704, Arusha, Tanzania.