CROP PROTECTION PROGRAMME

Project Title: Promotion of integrated pest management strategies of major insect pests of *Phaseolus* beans in hillsides systems in eastern and southern Africa

R No 8414 (ZA No 0646)

FINAL TECHNICAL REPORT

1 April 2005 – 31 January 2006

Project Leader: Eliaineny M Minja (PhD)

Project Leader's institution: International Centre for Tropical Agriculture (CIAT)

Date FTR completed 30 January 2006

"This publication is an output from a research project funded by the United Kingdom Department for International Development for the benefit of developing countries. The views expressed are not necessarily those of DFID." *[R 8414 Crop Protection Programme]*

Acronyms and Abbreviations

AHI	African Highlands Initiative
BFB	Bean Foliage Beetle
BRR	Bean Root Rots
BSM	Bean Stem Maggots
CABI	Centre for Applied Biosciences International
CBOs	Community Based Organisations
CIAT	International Centre for Tropical Agriculture
CPP	DFID Crop Protection Programme
DALDO	District Agriculture and Livestock Development Officer
DFID	Department for International Development of The United Kingdom
ECABREN	Eastern and Central African Bean Research Network
ERI	Enabling Rural Innovation
FPR	Farmer Participatory Research
INM	Integrated Nutrient Management
IPM	Integrated Pest Management
IPDM	Integrated Pest and Disease Management
KARI	Kenya Agricultural Research Institute
KDFA	Kabale District Farmers' Association
MFFS	Modified Farmer Field School
NAADS	National Agricultural Advisory Services
NARO	National Agricultural Research Organisation
NEMA	National environment Management Authority
NGOs	Non-Governmental Organisations
PABRA	Pan African Bean Research Alliance
PADEP	Participatory Agricultural Development and Empowerment Project
PFRG	Participatory Farmer Research Group
SABRN	Southern African Bean Research Network
SARI	Selian Agricultural Research Institute
SP	Service Provider
VEOs	Village Extension Officers
VIC	Village information Centre
VLPA	Village Level Participatory Approach
T&V	Train and Visit
WAFC	World Agroferestry Centre
WVI	World Vision International

Table of Contents

1. Executive Summary

The project has been successful in making farmers realise that they have the solutions to their problems themselves, that they are knowledgeable and such knowledge is useful and effective. The project has thus addressed the psychology of development in the target rural farming communities. The participatory approach and processes used in project implementation have worked successfully because of this psychology where farmer to farmer meetings and visits restored farmers' confidence and built their pride. Farmers are proud of what they did and discovered and are keen to share it with others who have also been empowered and respond with different information. The participatory approaches were thus used by the project as a means to an end and not an end in themselves.

Project outputs on learning through experimentation stand out as an appropriate capacity building tool for imparting knowledge and skills to farming communities. Filling knowledge gaps and blending indigenous with improved knowledge effectively helped the bean IPM project to address the issue of psychology of development where farmers were made to feel good about themselves, restoring their confidence and boosting up their morale in the participatory activities and adoption of technologies. This was the driving force in the MFFS that enabled the acquired knowledge and skills to be more usable and increased the chances for high probability in sustainability.

The approaches and processes used in scaling up integrated pest and disease management (IPDM) technologies with bean farming communities were evaluated in south western Uganda, Nyanza province in Kenya and northern Tanzania. Adoption of technologies and their influence on the livelihoods of the beneficiaries were studied and documented. The participatory farmer research group (PFRG) approach and processes (modified farmer field school - MFFS) used helped learners to understand better and acquire skills that they are currently disseminating and applying in bean production and other enterprises. The practical sessions and testing of technologies adopted in the MFFS allowed farmers and partners to adopt management strategies that are most suited to their localities. The approach further enabled beneficiaries and especially women who could neither read nor write to learn effectively and also train others informally. Partners and other stakeholders have used the organised farmer groups (including women groups) different development activities. The newly initiated links with the Farm Inputs Promotions Africa Ltd (FIPS) and Minjingu Mines & Fertilisers Ltd. has helped to increased farmers' awareness on the importance of small input packaging and use of fertilisers in bean production in northern Tanzania.

2. Background

The novel approach developed in Project R7965 for disseminating and promoting bean IPM options from community to community was in the past one year, incorporating the outputs from the other cluster projects into the promotion exercise to scale out to communities. While increasingly utilising the framework and uptake mechanisms of the bean networks (ECABREN, SABRN and PABRA), the participatory approach (modified farmer field school-MFFS) has helped to intensify and extend activities in Kenya, Malawi, Tanzania, Uganda, DR Congo and Rwanda, and helped to create awareness in Madagascar, Mozambique, Zambia and Sudan. Other specific achievements include:

- An increasing number of farmers have joined project activities and formed new research groups. The number of farmers using the technologies by the end of June 2004 were: Kenya- 3000, Malawi- 500, Tanzania- 15,000 and Uganda- 600
- Trained farmer research groups (MFFS) have in turn set themselves up as training and disseminating agents of IPM technologies to other new farmer groups in southwest Uganda.
- A number of approaches were developed and used by different farmers in disseminating technologies among community members. These include formal and informal participatory group training, individual farmer and group demonstrations, farmer organised meetings and field days, cross village and cross site visits, involvement of policy makers/local leaders and service providers, leaflets, posters, field manuals, drama, choir/poems, radio, TV, and setting up of village information centres (VICs)

- Farmer groups in Kenya, Tanzania, Uganda and Malawi have solicited their local village leaders to set aside rooms or pieces of land for constructing village information centres (VICs) through self-help-schemes and donations. Currently there are 10 VICs at project sites (Uganda- 1, Kenya- 2, Tanzania- 6, Malawi - 1).
- Farmers established seed multiplication plots for the improved pest tolerant bean genotypes in Kenya, south western Uganda, Malawi, and in northern and southern Tanzania, etc.
- Farmer groups experimented with botanicals, livestock products, green and animal manures, compost, commercial and locally mined fertilizers (such as *Rhizobia*, Diammonium phosphate-DAP and Minjingu Rock Phosphate) as sources of insecticides and soil fertility nutrients
- Farmers and other stakeholders have gradually gained knowledge and awareness that helped to increase their scope of experimentation from addressing one to a multiple number of constraints that limit farm production at their sites.
- Seed dissemination for bean pest tolerant varieties (outputs from the bean cluster projects- R 7568, R 7569, R 7965, R 8316, ECABREN & SABRN national programmes) progressed well in Malawi, Southern Tanzania, western Kenya and Kabale although most farmers lost the materials due to unreliable weather conditions in the March-July 2004 planting season
- Policy makers (government and political leaders) increasingly participated in dissemination and promotion activities by exchanging ideas with farmers and changing policy issues related to agricultural production. For example, the Government of Tanzania has adopted the group approach in all its community development activities. In May 2003, the ministry of agriculture and food security instituted a district focus policy where authorities have to sensitise their communities in setting up group demonstration plots for testing and evaluating new technologies. Local authorities have sensitised communities to form community based associations (CBAs) for access to information, technologies and farm inputs
- A radio programme on agriculture (including beans as one of the major crops) implemented by MEDIAE Company and broadcasted in 3 radio channels in Tanzania has in the past six months tremendously increased awareness among village communities

Promotional materials (few examples)

1. Booklet: Mviha, P., Sangole, N., Soko, L., Chidaya, H., Mlenga, H., Minja, E., Mziray, H. and Ngallo, E. (2004). Visit by Kasungu farmers to Bembeke EPA in Dedza district, Malawi, April 2004. Farmer group activity reports to CPP. CIAT, Arusha, Tanzania, 18pp. (English). Booklet for distribution to Village Information centres in eastern, central and southern Africa.
3. Leaflet: CIAT, 2004. Bean Stem Maggot Damage (Kifumbiiro and Rukiga versions). Two fold, A4 colour leaflet. NARO/CIAT Uganda.
4. Leaflet: CIAT 2004. Bean Root Rot Damage (Kifumbiiro and Rukiga versions). Two fold, A4 colour leaflet. NARO/CIAT Uganda
5. Leaflet: CIAT (2003) Farmer participation in bean integrated pest management (IPM). Two fold, A4 colour leaflet. CIAT Arusha, Tanzania (English).
6. Field guide: DJ Allen, JKO Ampofo na CS Wortmann (2003). Wadudu waharibifu, magonjwa na upungufu wa virutubisho vya mimea ya maharage katika maeneo ya Afrika. Kijitabu cha msaada kwa Bwana/Bibi Shamba. CIAT, Arusha, Tanzania. 108pp. ISBN 958-9439-55-1 [Kiswahili version of the field guide on bean insect pests, diseases and nutritional disorders].

3. Project Purpose

The purpose of the project was to contribute to the reduction of losses caused by bean pests through effective targeting, dissemination and adoption of integrated pest and disease management (IPDM) strategies that are acceptable to smallholder farmers in eastern, central and southern Africa.

Useful practical experiences have been gained, successes achieved and lessons learnt during the promotion of bean IPDM technologies at target sites. There was need to document farmer adoption behaviour and socio economic effects on adopters' livelihoods. Such information will form the basis for developing guidelines for adapting useful approaches, methods and processes to scale-up the adoption of IPM and allied technologies. The guidelines will be shared with partners to exchange positive and negative experiences and to train current and new partners in future active research.

The current project focused on impact studies and strengthened partnerships at strategic sites so as to increase the number of beneficiaries reached by information and technologies. Project activities also enhanced and strengthened linkages to new partnerships (such as innovative farmers, national research programmes, NGOs, CBOs, local authorities and the private sector) in new areas where the regional bean research networks are involved in technology dissemination.

Emphasis was placed in documenting the socio economic impact of IPDM technology adoption/rejection by participating and non participating farmers in target communities. The information was segregated by gender, wealth and age of farmer groups in project participation. The studies have indicated the extent to which farmers and especially women have gained empowerment through involvement in project activities as they are the main bean producers in the region. The studies have also indicated the level to which men and women farmers are able to make choices of appropriate technologies, participate and contribute in decision making on the management of their own resources and enabled them to demand, experiment, train others, adapt, disseminate and promote the technologies within their own communities. Project participating farmer groups shared information and exchanged experiences with farming communities in other locations, thereby catalysing farmer- to- farmer IPDM technology dissemination and adoption.

4. Research Activities and Outputs

4.1 Output 1. Novel/Innovative approaches and processes in scaling up and out of IPDM technologies evaluated and documented and capacity of strategic partners enhanced

Efforts were made to evaluate the novel approaches and processes adopted in scaling up IPDM technologies based on the experience in pilot sites. Community behaviour in technology uptake or rejection was monitored and documented.

Activities:

1.1 Evaluate novel / innovative approach in scaling up IPDM technologies. Novel approaches with potential for promoting IPDM technologies will be evaluated at selected target sites. In Kabale, (Uganda) the effectiveness of using a trained modified farmer field school (MFFS) group as an option of enhancing farmer knowledge and disseminating IPDM technologies to several peer groups will be assessed. The potential for participatory farmer research groups (PFRG) was assessed in Hai district (northern Tanzania) and a combination of MFFS and (PFRC) was assessed in Kisii-Kabondo (south western Kenya). Farmer / community behaviour in adopting or rejecting IPDM technologies was monitored and documented.

1.2 Conduct an impact study to assess effectiveness of approaches used in promotion of IPDM. Studies were conducted in Kisii – Kenya, Hai district in northern Tanzania and Kabale in south western Uganda on bean farmer communities to assess the effectiveness and impact of the adopted IPDM technology promotion approaches on the socio/ economic situation of participating and non participating farmers.

1.3 Develop guidelines and a manual to enhance capacity of strategic partners in technology dissemination approaches. Based on previous and current phases of the project, draft manual on guidelines for effective IPM promotion with smallholder farming communities is

in preparation for use by partners to scale up dissemination of IPDM and other technologies in the region.

Outputs

All intended project outputs were achieved for Uganda, Kenya and Tanzania despite unfavourable weather conditions and delays in activity take off. Additional outputs were achieved in linking some of the project participating farmer groups with new key partners at project sites.

4.1.1 Kabale site in south western Uganda

The socio-economic impact study was conducted to assess how the adoption of IPDM innovations introduced in Kabale district through the CIAT/NARO/DFID project had influenced the livelihoods of the beneficiaries. It would also examine knowledge of BRR, its management practices and how the IPDM technologies were diffusing into the communities. The study was further intended to analyze and compare the different approaches that researchers and development workers use in disseminating IPDM technologies (with particular emphasis on beans).

The study was conducted in Buhara and Rubaya sub-counties, Kabale district, south western Uganda where the CIAT/NARO/DFID project was operating since 2001. Semi-structured discussions were held with focus groups, key informants and individual bean farmers. A formal questionnaire was administered to 100 individual bean farmers (53 men, 47 women) with hands-on-experience in bean production. Among the respondents, 30 were drawn from Buhara and 70 from Rubaya sub-counties (Table 1.1).

Table 1.1 Questionnaire respondents segregated by gender per sub-county

Gender	**No of respondents**		
	Buhara	Rubaya	Total
Female	18	29	47
Male	12	41	53
Total	**30**	**70**	**100**

Information was pooled from 5 modified farmer field school (MFFS) groups, 1 farmer participatory research (FPR) group, 2 village level participatory approach (VLPA) groups, 2 groups representing the conventional approach (CA) and 1 national agricultural advisory services (NAADS) group. Data were analysed using the SPSS statistical computer package.

Description of respondents

Out of the 100 respondents interviewed, 50 were from CIAT/NARO, 19 from CARE/ISAMI, 6 from CIAT/FPR, 5 from NAADS and 15 from Africare and 5 were non-group members. In terms of location 70 were from Rubaya and 30 from Buhara. Ages of respondents ranged from17 to 70 with a mean of 42.72 (Std 13.6). Fifty three (53%) were males while 47% were females. Ninety percent (90%) of the respondents were from male-headed households, 7% were female headed and 3 were single. Education levels of respondents are presented in Table 1.2.

Table 1.2 Break down of education levels of respondents

Education Level	Percentage response
No formal education	5.0
Traditional school	11.0
Some primary school	47.0
PLE Certificate	18.0
O level certificate	16.0
A Level certificate	2.0
Technical school	1.0
Total	**100.0**

Major crops

Results indicate that the major crops grown by the study communities are also sources of on-farm income. In Rubaya beans is ranked second to sorghum as an important crop and also scores second position (after Irish potatoes) as a source of on-farm income. In Buhara beans ranked second important crop but scored third (or fourth) position as a source of income. This explains why beans are not considered quite enterprising in Buhara.

Seventy one percent of the respondents hire (51%) or borrow (21%) land either on a seasonal basis (47%) or once a year (18%). Crops grown on hired/borrowed land include Irish potatoes (61%), beans (60%) and sorghum (38%). Land access plays an important role in terms of which technologies to adopt. Considering that a bigger percentage of the respondents grow the valued crops on rented/borrowed land, it is no wonder that at community level, the numbers adopting soil fertility improvement technologies are fewer than those that do not.

Agricultural Problems Experienced in the Study Communities

Both Buhara and Rubaya experienced similar problems. A summary is presented in Table1.3.

Table 1.3 Agricultural problems experienced and solutions being applied

Problem	Solutions
1. Lack of/inadequate/expensive quality seed	Multiplying little available Alternating supply of NAADS demo materials NGOs administer revolving seed schemes
2. Heavily depleted soils/NRM technologies not widely embraced	Soil fertility improvement innovations Enforcement of local bye-laws
3. Limited access to agricultural information	NGO & government interventions but limited in scope & numbers reached Policy in place to guide new NGOs to unexploited areas
4. Inadequate land holdings/land fragmentation	No solution. Able ones hire extra plots of land
5. Traditional beliefs and customs	Sensitising on best practices
6. Pests and diseases	Use of improved/resistant varieties Use of chemical sprays but few can afford Manure application
7. Inadequate food at HH level	Promoting adoption of improved practices/technologies
8. Men not productive due to excessive drinking (women overloaded)	Sensitisation of communities about the need to work together
9. Inadequate cooperation among	Sensitising people to join groups/form

community members	associations
10. Inadequate/expensive tools & inputs/divergent sources of inputs	Linking groups to other stakeholders Re-allocating available PMA budget into purchase of tools and materials
11. Inadequate income/lack of access to credit	NAADS introducing revolving fund at s/county to enable co-financing groups access credit
12. Lack of /inadequate market	ISAMI planning introduction of ware houses to enable bulk marketing
13. Unpredictable weather conditions	No solution yet. Trying to do timely operations but with disappointments
14. High expectations of beneficiaries	Sensitisation and promoting transparency

Although the list of solutions is long, many of them are being implemented at program level and administration is quite localized. For instance, solutions by NAADS are only limited to co-financing groups that are accessing services yet even these will not be able to access assistance at the same time or the required time. Groups have to wait until their turn comes and of course the distribution will also be affected by political interference. The current remedies to problems portray the "survival of the fittest" scenario where the swift groups can access as more assistance as possible while the "slow footed" lose out. There is therefore need to help groups develop a clear understanding that it is their role to source for support wherever it can be found. This idea should be inbuilt in the IPDM classes as a capacity building measure. Where possible communities could be assisted to initiate such linkages and develop strategies to sustain them.

Importance of Beans in the Farming System

Results indicate that the major crops grown by the study communities are also sources of on-farm income. In Rubaya beans is ranked second to sorghum as an important crop and also scores second position (after potatoes) as a source of on-farm income. In Buhara beans ranked second as an important crop but scores third (or fourth) position as a source of income (Table 1.4). This explains why beans are not considered quite enterprising in Buhara.

Seventy one percent (71%) of the respondents hire (51%) or borrow (21%) land either on a seasonal basis (47%) or once a year (18%). Crops grown on hired/borrowed land include Potatoes (61%), beans (60%) and sorghum (38%). Land access plays an important role in terms of which technologies to adopt. Considering that a higher percentage of the respondents grow the valued crops on rented/borrowed land, it is no wonder that at community level, the numbers adopting soil fertility improvement technologies are fewer than those that do not.

Table 1.4 Major crops grown and on-farm sources of income, segregated by sub-county

Major crops grown	**%age response**		**On-farm income (%age response)**	
	Rubaya	Buhara	Rubaya	Buhara
Sorghum	18	17	15	24.
Beans	**17**	**17**	**21**	**09**
Irish potatoes	17	15	26	20
Sweet potatoes	14	15	00	02
Peas	09	13	01	02
Maize	08	09	00	00
Bananas	00	04	00	09
Wheat	06	05	02	04
Sale of labour	N/A	N/A	02	02

a) Reasons for growing beans

In general terms there have been positive changes as to why people grow beans in Kabale. Table 1.5 shows a comparison of reasons before and after the project.

Table 1.5 Importance of beans in the farming system

Reason	Before project (2000)		After project (2005)	
	Frequency	Percent	Frequency	Percent
Food only	17	34	16	16
Food and sell some	33	66	72	72
Both food and cash	0	0	11	11
Mainly cash	0	0	1	1

The results in the table indicate that, there has been a shift from growing beans as a basic food requirement where only a surplus could be sold to a production status intended to earn income.

b) Division of labour in bean crop production

Although bean production is to a larger extent a woman activity in the south western region, there has been a rising trend in male participation. Before the project started, study results indicated that men were only helping women in activities such as harvesting and threshing and, to smaller extent storage and planting (with marked inconsistency). Ploughing, weeding and winnowing were traditionally considered women responsibilities. However, results of this study indicate that (i) women continue to have a larger share of roles in land preparation (18%), planting (15%), weeding (23%), harvesting and storage (23%) and to a relatively smaller extent cutting stakes/staking (8%). (ii) The participation of female children is comparable to that of women with only a difference of 1-2 percent lower. (iii) Except in the case of planting where participation is much lower than the female child (and woman), male children have comparable commitments to female children. They however have extra roles such as bush clearing (7%) and spraying (2%). Application of manure was the only responsibility that children did not share with adults. (iv) Men were responsible for bush clearing (21%), were actively involved in ploughing (17%), they did plant (6%), could weed (9%), actively involved in harvesting and storage (22%) and played a bigger role in cutting stakes/staking (16%), a role they share with children (male, 8% and female, 6%).

In addition to the variety of the socio-economic benefits realized by beneficiaries, the IPDM project has influenced change of gender related traditions. The increased involvement of men in the bean production enterprise could be related to the fact that beans is taking root as a promising source of household income especially at a time when the enterprise is recovering from serious pest and disease epidemics and the availability of seed as well as food is still not enough to satisfy demand.

Constraints to Bean Production

Farmers and extension service providers had reported high bean production reductions in Kabale district. A series of studies were conducted between October 1999 and December 2001 to appraise the presence and severity of bean production constraints where diseases and insect pests as well as management practices by farmers were assessed. Bean root rot (BRR) emerged as the most economically important constraint in bean production. However, results of the study indicated that farmers couldn't differentiate BRR, bean stem maggots (BSM) and the effects of soil and environmental factors.

Other than the general agricultural problems faced by communities, specific questions were asked to assess the insect pest situation and the diseases that had been identified as economically important to the study communities during earlier studies.

a) Insect pests

The economically important insect pests on beans in Kabale district are aphids, cutworms, bean stem maggots (bean fly) and various caterpillars (Table1.6).

Table 1.6 Key insect pests encountered by bean farmers and control practices in Kabale, south western Uganda

Insect	Responses	%Age responses	Related problems	Solutions
Aphids	89	60	Wrinkling of leaves	66% spray pesticides 16% manure before planting 5% use timely planting 3% rogue plants
Caterpillars	16	11	Holes in pods	
BSM	19	13	Tap root swells	
Cutworms	24	16	Plants wilt/dry	
General symptoms		Stunted growth, reduced pods/yields, flower fall, insects eat vegetative parts e.g. leaves and flowers, general wilting and drying up of plants (after sucking plant sap)		

Farmers were asked to explain the effects of insect pests on yield, seed and food. Thirty two percent (32%) of responses reported reduced yields, 31% said they cause low germination rate, 34% said insects caused food to smell bad, 30% were of the view that insect pests caused seed dormancy, 28% related insects to low food quality and 3% thought insects inhibited flowering. Among the control measures mentioned are Malathion dust (63%) (Locally called chlorine and used in storage), ambush spray (24%), timely planting (6%), manure application (2%) and use of ash (2%). Management of insect pests was not related to sex, age, and wealth status or education level of the beneficiaries.

Although farmers might not precisely explain which insect causes what effects, the above results show that they have a clear understanding of the extent to which these insect pests can be dangerous. All the identified symptoms point to scientifically proven damage by BSM, aphids, cutworms, foliage beetles, cotton bollworm, flower thrips and storage bean weevils (Allen, 1996). Either insect pests were increasingly becoming a big constraint to crop production in the area than before or the beneficiaries were better informed about their importance.

b) Bean Root Rot

Bean root rot (BRR) was and still is a major constraint in bean production. All respondents had experienced BRR problem in their fields, which the majority described as increasing (70%), 26% thought that it was reducing while 3% thought that there was no change. Although all respondents identified the disease by yellowing of leaves, generally there was an increased and detailed understanding of the symptoms. Respondents described BRR damage on roots as darkening (11%), rotting (36%), lack of nodules (9%), lateral roots missing (2%) as well as no root development (12%). Damage on stems was described as; stems become water soaked and rot (26%), develop red strips (4%), become hollow (22%) thus weakening and drying up (42%). Farmers also believed that BRR could lead to zero podding (45%), reduced pod size (21%), weak and folded pods (2%) and lack of seed development (2%). A higher percentage (79%) had experienced reduced yields due to BRR problem while 21% were not realizing any yields. Ninety four percent of the respondents observed the disease between 2-3 weeks (2-3 leaves) after germination. Sixty four percent (64%) of the respondents observed the disease during season A, 16% observed it during season B while 20% observed BRR during both seasons.

There has been an increased and more detailed understanding of BRR disease, its stages of development and the effects it causes. Farmers' description of damage caused on the

different plant parts is a combination of the different stages of disease development as well as the severity. However, it is not clear why the majority of farmers continue to observe BRR during season A when there is moderate rainfall. Perhaps some farmers are still mixing effects of bean stem maggot infestation with the wilting and drying due to BRR. There may be need to establish the uniqueness of such observations in the area.

Management of BRR

Eighty nine percent (89%) of respondents had observed practices that control BRR. These practices included manure application (80%), change of varieties (11%), digging of trenches and stabilizing bunds (12%), use of inorganic fertilizer (11%), farm yard manure and ash (12%), avoiding water logged places (19%), timely planting (17%), application of pesticides (11%), fallowing (29%).

Of the observed technologies, use of organic manure (21%), improved varieties, construction of trenches/bunds (6%) and fallowing (10%) were rated as very effective. The rest of responses rated these and other technologies as effective. Credited sources of information/technologies were mainly research institutions, NGOs, NAADS and to some extent traditional knowledge. Compared to other organizations, CIAT/NARO were considered a major source of specific technologies such as improved resistant varieties (8%), use of manure (36%) and organic fertilizers (8%) and avoiding waterlogged areas (6%). Africare/NARO/NAADS was outstanding for timely operations (3%) while fallowing was rated highest as traditional knowledge/experience (16%). Other sources of these and other technologies did not have significant differences. Generally respondents had difficulty in specifying the source of information since quite a number had worked with various service providers.

Generally there has been an increased effort in the management of BRR. The more farmers understood the disease the more they are investing efforts in managing it. The above statistics show that, even those who are not adopting certain practices, have evidence that the practices work. However, adoption of the technologies was more widely spread among group members but limited outside the groups. Management of BRR was not at all related to sex, age, and wealth status or education level of the beneficiaries. Land ownership on the other hand limited adoption of soil fertility management innovations, particularly with beneficiaries that rented or hired land for the production of beans.

Building on the beneficiaries' indigenous/cultural knowledge, interventions combining tolerant varieties, soil fertility improvement measures and other bean integrated pest and disease management (IPDM) technologies were introduced in Kabale district in 2001 in response to information and technology gaps that were identified with farmers in earlier studies. These were tested by the grass root beneficiaries through a modified farmer field school (MFFS) approach.

IPDM farmer research groups

All IPDM groups interviewed during the study shared a common characteristic: their founding was influenced by outside interventions. Either the service provider contacted the individual and asked him/her to mobilize a group or a community/village and required interested beneficiaries to form a group. The service providers were mainly two categories - those initiated by research institutions (research based groups) and those that were initiated by NGOs or government programs involved in agricultural extension. All groups had formed around experimenting with or demonstrating new technologies oriented towards solving agricultural production problems such as testing tolerant/improved crop varieties, pests and diseases management practices and/or NRM particularly soil fertility management.

The strength of the group seemed to be determined by a combination of mainly two factors; collaboration with other partners and age. Groups that had existed for a long time and had worked with more collaborators participating in a variety of activities were exposed to growth opportunities thus made various adjustments. Such groups are more cohesive and have

relatively more defined future plans than the groups that have existed without external collaboration. Groups such as Karambo Tukore and the Nyamabaale MFFS that started in 1995 and 1999 respectively seem to draw their strength from such history.

The activities of groups varied according to availability of other stakeholders/partners and the strength of networks that members were able to establish. In Rubaya for instance, where there are many NGOs, various research bodies and a number of Government programs, the evolution of groups has been very dramatic incorporating a lot more activities than the original interests. Buhara on the other hand is starved of NGOs and other development stakeholder thus the groups are less motivated and involved in limited activities. As a result, IPDM groups in Rubaya are more focused, boast of more achievements and have better capacity and concrete future plans compared to those in Buhara, regardless of the initiators.

Generally groups that have gone through experimentation activities have better capacities than those that have participated in or hosted demonstrations. Almost all members of experimentation groups seemed to have a precise knowledge of innovations compared to those that involve in demonstrations. This observation is independent of whether they are adopting the innovations or not.

Group membership did not have a specific trend as groups in either locality experienced reduced or increased membership. Factors influencing increment were due to significant achievements of the group that attracted originally non-participating individuals. Farmers attributed the reduction of membership to small quantities of demo/experimental materials that demoralized group members since such quantities did not spell a brighter future for the hard work. Other reasons included lack of commitment by some members, lack of co-operation and unfavourable attitudes and to a small extent, old age and/or inability to cope with the hard work involved or lack of money to pay subscription and/or contribute for material requirements e.g. hiring group land and purchase of spray chemicals. In the Buhara communities, farmers indicated that beans were not a profitable enterprise thus it was difficult to maintain cohesiveness among group members. In fact other than the CIAT/NARO groups, the rest of groups (AAMP/Africare) had completely done away with bean production. Their domestic consumption is reportedly supplied by purchases from the local markets. In Rubaya, the bean enterprise is valued for both cash and food so membership has mostly increased. The reductions of numbers that occurred were due to other reasons as indicated above.

IPDM Technologies that have been Accessed by Beneficiaries

Adopted technologies

Across approaches, many IPDM innovations have been adopted and were being practiced by the beneficiaries. Table 1.7 shows a break down of the technologies, how they have helped and strategies to sustain them.

Factors influencing choice of technology

As a way of finding out in-depth explanation as to why certain technologies were being adopted more than others, respondents were asked to explain what factors influenced choice of technology. The list consisted of:

- awareness about the technology
- costs involved in practicing
- ease of adoptability
- productivity-does it increase production
- can results/product be marketed
- need to be met
- Other minor factors included enabling policies in place, culture and beliefs, and the end use of the technology.

It was found that the more people are aware of given technology and its benefits and they recognize that it can address a felt need, the more they are likely to practice it. This would

also depend on whether the costs involved are manageable and the ease of implementing it. If the technology is going to result into more output, then beneficiaries consider the market important. Both beneficiaries and collaborators observed that according to the current service provision trends, it was much easier to access information and new technologies through groups rather than individual means. IPDM groups in particular had accrued numerous benefits to all development stakeholders.

Table 1.7 Technologies adopted by IPDM groups and how they have helped the farmers in Kabale district, south western Uganda

a) Technologies adopted (mostly for purposes of managing BRR)		
Technology	**How the technology has helped**	**Sustainability plan**
Application of compost manure (46%)	Increased production (26%), soil fertility improvement (6%), reduced disease (5%), cheap (4%) tasty bean leaves, controlled BSM	Dig compost pits (18%) Rare livestock (11%) Plant fodder (6%)
Changed varieties (8%)	Increased yield (4%)	Save own seed (5%)
Use of FYM (64%)	Increase yields (37%), increases soil fertility (8%), cheap (6%), controls pests/diseases (4%)	Rare livestock (19%) Dig compost pits (15%) Plant fodder for animals (6%)
Planting in lines (15%)	Use less seed (3%), get high yield (5%) and reduced time in weeding & harvesting	Continue practice (8%) Planning fields (2%)
Digging trenches & stabilizing bunds with agro-forestry trees and grasses (22%)	Stops erosion (3%), controls floods (9%) provide stakes, firewood and animal fodder & improves soil fertility	Construction of drainage channels (16%)
b) Technologies that were learnt but were being adopted on a relatively small scale		
Technology	***How the technology has helped***	***Why limited adoption***
Resting land/fallowing	Rejuvenates soil fertility, increases soil and crop production	Inadequate land, available is continually farmed
Seed selection & separating of varieties	Access to quality seed, increased demand in the market and by other farmers	Little seed available
Controlled soil & bush burning	Reduces erosion, adds manure to the soil	Inadequate knowledge
Use of chemical sprays	Control of pests and diseases, increased production	Inadequate income/expensive
Early weeding, defoliation of leaves.	Control of pests (cut worm) and diseases (Ascochyta blight)	
Crop rotation	Control soil exhaustion by limiting heavy feeders e.g. Irish potatoes & wheat	Inadequate land/need for all crops
Rouging volunteer plants (few people)	Controls diseases (mostly used in the Irish potato enterprise)	Volunteers are a source of early food during period of scarcity
Potting tree seedlings	Healthy seedlings produced, easy handling	
Use of inorganic fertilizers	Increased production	Expensive/Inadequate income

The adoption of technologies was not related to preferences but had a lot to do with access. Beneficiaries were simply adopting what they had leant and without significant adaptations. Except in cases where insecticides were mixed with fungicides for purposes of cost-cutting and timing operations, other innovations were adopted as learnt. When farmers were asked about what they wanted to modify next season, 29% wanted to mix organic and inorganic fertilizers, 25% would like to apply manure directly in the planting lines, 4% would like to stake beans using ropes rather than sticks, 8% want to adopt use of bio-rationals (plant extracts), 4% will fallow small pieces of land and 8% will adopt improved varieties.

There was however, a positive correlation between the use of manure and digging of trenches, and the size of land (Table 1.8).

Table 1.8 Relationship between size of land and adoption of selected soil fertility management technologies in Kabale district, south western Uganda

Innovation	% age adopting	Average land size (ha)*	%age not adopting	Average land size (ha)*
Use of FYM	60	2.5	18	2.3
Use of compost manure	43	2.7	35	2.3
Digging of trenches	12	2.7	66	2.5

* A hectare was interpreted to be an equivalent of the size of a football pitch. Respondents had difficulty in estimating the sizes of plots they owned, particularly where they needed to add more than 1 plot to make a hectare.

Results in the table indicate that the majority of beneficiaries adopting the use of manure and digging of trenches have more land than those not adopting. Although the strength of the relationship between the size of land and adoption of the above practices was not significant ($P>0.05$), it is very probable that such practices will be adopted by those who own land as opposed to those who rent or borrow. Investing resources in a piece of land which utilization changes according to rental fees limits adoption of innovations the returns of which are likely to be long term. It is important to note that the majority of beneficiaries hire/borrow land for the production of major crops, either because they own small holdings or the plots available are infertile.

In all cases, use of organic manure was limited to fields near homesteads due to transportation constraints across hills. An additional problem was that there was limited animal manure thus would not be enough for all fields. To solve this problem the Nyamabaale MFFS requires all members to own at least one animal for multiplication. They are also involved in application of green manure (Crotalaria) part of which they sell to Makerere University, Kampala.

Growing groups (weak & medium) practice row crop planting at group level but have not adopted at household level due to (i) small pieces of land thus farmers think they will plant less seed and harvest less produce. However the same farmers were aware that when they use high plant populations they get poor quality (small sized) seed, which is not very attractive. (ii) it was considered to be labour intensive (12%), time consuming (17%) and beneficiaries did not have the required labour. Strong groups, on the other hand, demanded that each member use row planting so all members are obliged to adopt. Those with reasonably bigger pieces of land and/or those with many plots were practicing resting land/fallows. However, a few serious farmers rest their land and hire from elsewhere.

Generally MFFS participating groups were implementing many more IPDM technologies than non participants. It was also found out that Rubaya groups were more innovative and keener at adoption than the Buhara groups. Many of the technologies that were learnt from the bean sessions were being adopted in other crop enterprises. However, as results show, the numbers of people adopting the technologies are fewer compared to those that do not.

Local service providers

Sixty nine percent of the IPDM beneficiaries had additional needs for services or technologies. They were encouraged to think through the potential service providers (SPs) they could contact. Table 1.9 shows a selected list of needs and their corresponding SPs.

Table 1.9 List of key needs and their corresponding service providers (SPs) in Kabale district, south western Uganda

Need	% Response	Potential SP
Improved seed	41	CIAT/NARO (8%), NAADS (8%), ISAMI (4%) Other NGOs (6%) and Sub-county (5%)
Agricultural inputs (pesticides & tools)	24	ISAMI (6%), CIAT/NARO (4%), NAADS (4%) Sub-county (3%), other NGOs
Credit & savings scheme	4	Village banks (3%), AAMP (1%)
Advisory services	24	NAADS (8%), Extension workers (5%), ISAMI (3%), Sub-county (2%), other NGOs (2%)
Bean wilt*	16	CIAT/NARO (5%), Extension workers (3%), ISAMI (2%)

* Bean wilt seems to be a new problem highlighted differently from BRR. It was identified at data analysis thus a detailed description is missing in the results. There may be need to find out what this problem is

The above results show that beneficiaries still depend on SPs to meet their needs. Although some IPDM groups suggested useful ideas on sustainability, there has not been significant effort invested in establishing structures/measures of sustaining what service providers have offered. As a way of phasing out activities CIAT/NARO may need to rethink possible ways of supporting the groups to concretise efforts in designing structures for seed production and the village information centre (VIC). Although access to credit and availability of inputs are very important aspects to the success of the wider dissemination of technologies, the remaining project time may not allow CIAT/NARO to offer realistic solutions to the affected beneficiaries. However, a process could be started and handed over to other collaborators.

Socio-economic benefits from IPDM research group participation

A variety of socio-economic benefits have been accrued by members participating in IPDM groups. Thirty two percent of responses indicated that beneficiaries had acquired free agro-inputs (chemicals, fertilizers and high yielding improved seed), 30% had acquired new knowledge and skills about improved technologies, 22% had realized increased production, 9% had realized increased incomes, 12% freely shared information, and 7% had learnt group dynamics. Additional/detailed benefits as explained by focus groups included:

- Increased food production/food security at household level. Examples: Evans Nyabukye of Nyamabaale MFFS planted 4.5 Kgs of a resistant climbing bean variety and harvested 260 Kgs while Reuben Zintura planted 80 Kgs of Irish potatoes and harvested 1,200 Kgs
- Increased incomes at household level “there is a ready market for the resistant bean varieties and premium price is offered right at the door step”. As at 19/08/05, the price of beans offered to farmers in the local market was 450 Ug Shs per kilogram compared to 1,000 Ug Shs paid for a kilo of improved/resistant beans at farm gate. Nyamabaale MFFS group has signed a contract with the ISAMI project to supply resistant bean seed
- Extra contacts/networks have been established with other service providers and groups can access more services
- Popularity among community members. Better relations have developed among groups and with outside communities. Members of strong IPDM groups (e.g.Karambo Tukore) sell labour at twice as much price as normal labour

- Active group members hold many more responsibilities outside their groups. A minimum of five members per MFFS group had leadership roles in other informal groups and/or local councils e.g. from Nyamabaale MFFS 3 women have been elected to the Local Council 1 executive. Findings also indicate that active groups have their leaders entrusted with roles by other NGOs or research bodies
- Have visited other places outside their sub-counties so feel more exposed and have a wider view of development issues than before
- Have become trainers of others. Although a few people conduct more formal or curriculum based trainings, many more of the group members carry out informal training of relatives, friends, neighbours and those who go to them for seed.
- Have reproduced and formed more IPDM groups
- Groups have enabled the disadvantaged (women, the elderly, children) to access learning and acquire skills
- Within a group it is easier to access trainers or other service providers. In fact service providers yearn to work with the IPDM groups that have shown themselves to be result oriented
- Original groups have scaled up IPDM of beans to include other crops such as maize and Irish potatoes
- There has been general change of attitudes. The chairman of Kigarama Tukore confesses that, "formerly we used to think that people who were doing well were practicing witchcraft. After trying out things and proving ourselves, we know it is hard work"
- The women in Nyarutojo-Muhende MFFS explained that men are now cooperating because the new varieties are yielding. The fertile fields of land are being set aside for beans and in some cases men can hire a plot for bean production. Earlier, men were disappointed and would rather use their money to purchase beans from the market than hire a plot of land or buy seed for planting.

In all cases, women did not indicate having problems that limited them from participating in any events or group activities. However, men mainly did formal training of other farmers. Women's limitation could be due heavy workload and the productive roles at household level but not competence related. Women were more involved in informal ways of sharing information and technologies compared to men.

As indicated by the above list, IPDM Project beneficiaries had accrued a lot of benefits. However, there are many individuals in the community who seemed not to be bothered by the successes of the groups. When farmers were asked to explain what they thought were the barriers, their responses pointed to ignorance, selfish interests, lack of discipline, laziness, general lack of interest, excessive drinking (men) and to some extent lack of money to commit on subscriptions and contributions for group activities. A small section of the group such as the elderly, weak/disabled would genuinely fail to participate. Most of these barriers are to do with behavioral attitudes, cultural beliefs and lack of exposure. They can to some extent be overcome by a concerted effort on sensitization.

Although the list of benefits is long, stakeholders as well as IPDM groups agree that a smaller percentage of the communities are adopting improved practices (Section 3.4). The higher rates of adoption were related to communities where strong IPDM groups existed. Generally adoption rates were higher in Rubaya than in Buhara. Community members who were not adopting IPDM technologies were still using traditional practices and would harvest limited produce or nothing at all thus are food insecure at household level.

Problems experienced by the IPDM groups

The problems being experienced are divided into two:
(1) General production constraints
(2) Problems related to dissemination of technologies

a) General problems

- Lack of/inadequate inputs (20%) e.g. spray chemicals, manure and fertilizer and spray pumps. The groups involved in NRM lacked implements such as spades and pick axes. Spray pumps were a constraint to all groups and it is interpreted as responsible for causing delays in crop protection thus making it difficult to control pests and diseases.
- Lack of credit (14%) for investing in agricultural production. Beneficiaries are already stretched in pooling money for renting land, purchasing chemicals, e.t.c so find it difficult to pool enough for further investment.
- Inadequate seed (13%). Small quantities of seed were given for experimentation and it takes long to multiply enough seed for group members.
- Late delivery of seed (15%), which causes beneficiaries to start activities late and lose the season. According to the beneficiaries, this de-motivates participants and sends wrong signals to observers.
- Pests and Diseases: Pests included aphids, BSM, cutworms, birds & rats. Diseases on the other hand included BRR, ascochyta blight, bacterial wilt and late blight in Irish potatoes. IPDM groups focusing on beans did not have trouble with BRR, but the rest of the groups had. Chemical sprays, though expensive, were effectively controlling aphids, but BSM was still a problem especially during season A. BRR was a significant problem in Buhara Sub -county particularly with other approach groups. There was no control measure being practiced except to give up on bean production.
- Lack of good markets (4%) especially for Irish potatoes. During the main cropping season, production is high and prices go very low. Beneficiaries also had limited access to market information and produce prices were very unstable.
- Unpredictable weather conditions: Every season has its challenges - too much rain (August–November), causes BRR and Ascochyta blight thus production costs increase. Prolonged drought causes high pest infestations; more chemical sprays which, in the majority of times is not directly proportional to yield. Season A (February-June) is most times not a good season.
- Diseased seed: This was recently more pronounced in the Irish potato enterprise. The beneficiaries seem to have no more reliable source of seed as all seed from Kalengyere was reportedly affected by bacterial blight.
- Eight percent of the responses indicated that trainers were arriving late or did not turn up.

b) Problems related to dissemination of IPDM technologies

- Social differences e.g. wealth, age, and education level. If a trainer is at a lower status, they are despised
- Passive participation/absenteeism/inconsistence among learners (15%)
- Unrealistic learner expectations; Historically, NGOs were giving participants hand outs or inputs or providing lunch during training sessions, This has been a hard habit to overcome such that people still expect rewards for coming to learn
- Poor community mobilization resulting in bounced programs and waste of time.
- Sometimes lose inputs as charity if the individual or group being trained has no inputs.
- Inadequate co-operation among community group members
- The Nyamabaale MFFS had specific problems; (i) Poor communication between the field and collaborators in Kabale and between Kabale and Kampala (ii) Inadequate means of transport used to reach other groups.

How agricultural stakeholders have benefited from IPDM groups

Different stakeholders had reaped different benefits from IPDM groups in general. Both direct and indirect benefits are listed below.

IPDM groups:

- Are organized thus easy to mobilize
- Are committed to attending meetings
- Easily implement new innovations and are exemplary

- Default less than non-group community members
- Do not demand for hand outs before participating in development programs
- Appreciate government efforts rather than criticize
- Attract businesses to the sub-county
- Have led to increased revenue collection due to increased incomes
- Contribute towards improved infrastructure that is well maintained because they volunteer to repair roads

The list above shows that it is not only IPDM groups that have accrued benefits but other stakeholders have benefited from the existence of groups. This is evidence as to why the IPDM are attracting more partners to work with. There is therefore every need to increase awareness about IPM technologies and farmer research groups in community development activities.

Increasing awareness about IPDM technologies

Based on the benefits of IPDM groups, respondents were asked to suggest ways of increasing awareness. Possible measures were suggested and included:

- Continued sensitisation
- Local leaders should support service providers more
- Mobilizing communities to articulate their needs and reflect them into development plans at all levels
- Local leaders to improve monitoring
- Enforcement of existing bye-laws
- Equitable distribution of available resources
- Longer contact between service provider and community rather than intermittent visits

Beneficiaries thought that with increased awareness, many people will participate and this would create impact on ground. However, they also noted that there could be barriers to scaling up and scaling out the technologies.

Barriers to scaling up IPDM technologies

Collaborators assessed possible barriers by analysing the current environment under which the IPDM groups are operating. Different partners raised different limitations owing to specific challenges being met in their organizations. The general list comprised of:

- Literacy levels of beneficiaries
- Peoples attitude – unwillingness to work
- Few extension workers and big areas of jurisdiction
- Lack of good market
- Inadequate inputs and tools
- Lack of supportive policies
- Poor/bad leadership. If a leader does not support a program, it will fail
- Political interference by local leaders
- Limited access to service providers
- Mis-use of funds/poor financial accountability
- Natural hazards
- Failure of groups to co-fund as required by Government programs
- Limited enterprise selection for technologies being accessed. Beneficiaries can only access services for a few enterprises while the rest of the enterprises are unattended to.

Sustainability strategies

a) General prospects

Sustainability was assessed in terms of continued use of IPDM technologies, promotion of IPDM technologies to new locations, seed production prospects and farmer-to-farmer training. So far there is no doubt that IPDM groups will continue to use the adopted technologies. The majority of group members are using these technologies because of the accrued benefits. The fact that they are being put to use in other enterprises is evidence that beneficiaries are convinced of the results. The external environment in Rubaya is more enabling for promotion and sustaining of introduced IPDM technologies. Cases in point include (1) NAADS is setting aside money to purchase spray pumps for groups (2) AAMP is planning credit programs to support farmers (3) Polices on NRM have been passed by local councils up to district level. Some likely barriers could be due to external factors such as unfavourable policies on seed production and other localized factors e.g. if Kulika succeeds in promoting organic agriculture in Rubaya sub-county, use of chemicals to control pests and diseases may be done away with but still that would be in the long term.

In promoting use of IPDM technologies, groups will continue sensitising the communities using every available opportunity such as village meetings, using offices where group leaders/members have been elected as well as other informal pathways. Continued "formal" training will depend on whether other community members will demand the services. Informal training seems to be spontaneous and will continue at the natural pace.

Although the costs of conducting formal training for a season was not very high, group members did not seem to be committed to foot the bills considering that they currently have a burden of hiring land and purchasing inputs. There will be need to educate the groups about paying for services since they are already co-funding NAADS & AAMP activities (although contribution per group is much lower than the IPDM training budget).

Having the beneficiaries contribute some of the items above could still reduce this budget. For instance they could contribute for trainer's lunch or provide lunch in kind, could substitute paper bags with baskets or bring plastic containers from home and could also contribute spray chemicals as a requirement before starting on IPDM sessions.

Individuals currently involved in training additional groups were asked to explain how they would train once the project phased out. They were of the view that they will still train as long as communities or groups demand their services. Some seemed motivated by the prestige they were enjoying and confessed that they were already involved in voluntary work since some training was being conducted without external support. Although some experiences were shared on work achieved through voluntarism, it was rather difficult to judge the authenticity of such commitments when trainers are used to external motivation. A more realistic alternative should be sought by CIAT/NARO in collaboration with established groups to ensure that there will be sustainability in scaling up farmer-to-farmer training.

b) Groups being trained by farmer trainers

An in-depth discussion was held with the Kigarama Tukore MFFS, which seems to be doing quite well and was previously categorized as medium but turned out to be a fairly strong. The group started on bean IPDM in 2003 and has expanded to include I/Potato, soil &water conservation and fruits. Previously they worked with CARE and currently have networks with PMA, NAADS, and AHI. Membership has increased from 14 to 20 due to successes recorded. The group organization, performance and achievements are similar to other strong groups, for instance they have adopted almost all technologies they were taught though at different levels, train informally and estimate that about 50% of their village has learnt from the group members and share information and seed. They are scaling up technologies to other demand services from SPs and 5 of their members hold leadership roles outside the group. The only limitation they have is that plans for dissemination, acquisition of in-puts and

training other farmers are not well developed and the over-dependency on SPs (a common phenomenon in the area).

c) Stakeholders/partners involved in agricultural development issues

Collaborators in the agricultural development agenda in both Rubaya and Buhara could be divided into two broad categories namely the internal collaborators (local leaders), who live within the communities and are responsible for the development of their communities and the external collaborators, who live outside the communities but implement or support the implementation of agricultural development programs. The local leaders' category constitutes political leaders, civil servants (chiefs) and government program leaders. External collaborators include NGOs/CBOs, research institutions and government programs. NGOs operating in Buhara and Rubaya included CARE, Africare, KADFA, NEMA, Kigezi diocese, UNADA, KULIKA and ECOTRUST. Research institutions include CIAT, NARO, ICRAF, AHI and Makerere University. Government programs on the other hand include NAADS, AAMP, LGDP and PMA.

Local leaders had a role in agricultural production issues within their communities. Their responsibilities included identifying needs of farmers and forwarding them to higher levels, general sensitization on existing agricultural policies, mobilizing communities for agricultural development programs, soliciting for financial and material support, overseeing flow of funds, enforcement of local bye-laws and general monitoring of NRM and modern farming activities. Detailed duties were specific to offices but can still be categorized under the above broad roles.
Leaders who were members of IPDM groups had more pronounced and supportive roles in relation to agricultural production than those who were not. However, in all cases, they were aware of agricultural problems being faced in their communities.

Different external collaborators were involved in different programs ranging from health, water, infrastructure and agricultural development. A summary of their various activities is presented in Table 1.10.

Table 1.10 Collaborators involved in agricultural development issues, their area of operation and activities in Kabale district, south western Uganda

Collaborator	***Area of operation***	**Activities**
AHI	Rubaya	NRM issues, development of bye-laws
ISAMI (CARE/KADFA)	Rubaya	Bulk marketing, village banks, market linkage, climbing beans (seed loaning), I/potato
Africare (Phased out)	Rubaya/Buhara	Soil conservation, tree nurseries, I/potato seed & stores, climbing beans, s/potato vines, farm tools
CIAT/NARO	Rubaya/Buhara	Resistant bean varieties, bean IPDM, soil &water conservation, I/potatoes, Village information centre
NEMA	Rubaya	NRM-swamp and soil & water conservation
CARE-FIP (Phased out)	Rubaya	Developing work plans, cost-benefit analysis, I/potato & tree seed, agricultural inputs, group dynamics
CIAT FPR/Africare	Rubaya	Participatory planning, developing groups, NRM, farm tools, bridge construction
ECOTRUST	Rubaya	Collaborates with NAADS on NRM (new)
MUK	Rubaya/Buhara	Soil fertility management trials in Rubaya, reconstruction of terraces in Buhara (locals not aware)
NAADS	Rubaya	I/potatoes, sheep/goats, fruits

PMA	Rubaya/Buhara	I/potato, coffee, spray pumps, bush beans
LGDP	Rubaya/Buhara	Access roads, school furniture, health centres
AAMP	Buhara	I/potato, bee keeping, piggery, infrastructure, fruits
ICRAF (Phased out)	Buhara/Rubaya	Tree nurseries, soil conservation
Kigezi diocese	Buhara/Rubaya	Heifer project, gravity water flow scheme, protected springs

As indicated by the table above, Rubaya has many more collaborators than Buhara. This means that IPDM groups in Rubaya have had more exposure than those in Buhara. The groups in Rubaya have also worked with other partners for quite a long time. Possibly the level of commitment of the groups and capacity to make things happen is derived from this long exposure.

d) Seed production prospects

All bean IPDM groups are interested in bean seed production. Groups are going ahead to sell the seed available both at group and household level although they all showed concerns that they did not have enough seed. Their argument is that they are selling to pool money for renting land and purchase of inputs plus other needs. Although the weak and medium groups desire to scale up seed production and join the local markets when quantities are reasonable, they do not yet have concretised plans of achieving this. The stronger groups have already entered the market and laid out plans of seed production but these need reinforcing.

Whereas groups directly involved in the IPDM project ranked beans among the priority cash and food crops, the rest of the groups did not categorize it as either but only listed it among the main crops produced. In Buhara, for example, groups and individuals outside the MFFS did not list beans among the five major crops produced. The high infestation of pests and diseases and the persistent low or no production forced them out of the bean production enterprise.

The MFFS groups thus enjoy an added advantage of remaining in production when surrounding communities are giving up. The bean seed production idea should therefore be welcome if the bean IPDM groups can be supported to put in place structures that will help them achieve this dream. Particular emphasis should be placed on Buhara where the groups are not sure of the way forward.

Comparison of technology dissemination approaches used at Kabale site

The technology dissemination approaches studied at Kabale site included Village Level Participatory Approach (VLPA) which Africare used to enter communities in Buhara, Community Based Planning (CBP) through the visioning approach used by CARE in Rubaya, Farmer Participatory Research (FPR) approach used by CIAT in Karambo, Rubaya, the NAADS/AAMP approach and the Modified Farmer Field School (MFFS) used by CIAT/NARO in both Rubaya and Buhara sub-counties.

In all these approaches the service provider, entered communities through the help of local or opinion leaders. A variety of methods and processes, as names of approaches suggest, were used to “draw participants” into supporting the introduced program activities. Once the communities were mobilized, groups formed and set to start, the service provider regularly came in to deliver extension services. Except for the MFFS and FPR approaches, the rest adopted the training and visit system, which we shall treat in this study as the conventional extension approach. The FPR and MFFS incorporated a process of group testing/experimenting so that the beneficiaries had a chance of selecting what they knew would work for them.

Groups served by the conventional approach confess big successes at the beginning, especially the Irish potato enterprise and agro-forestry tree nurseries. However, over time there has been steady decline of quality output. Where there has not been any other activities added for instance in Buhara, the groups have weakened and shed off most of the IPM innovations they used to practice in the beginning. For instance, the Irish potato enterprise is thriving on chemical sprays mainly. With the alarming levels of bacterial wilt infections as witnessed last season, farmers seem to have no alternative management option. The beneficiaries of the MFFS approach on the other hand, seem to have started with no excitement as they had "only a few seeds to try out many seasons" before they were convinced that things could actually work. Although some seasons were not good and many varieties did not do well and were thrown out, time and effort has yielded results *"we are very glad that finally we got varieties of our choice which we are now multiplying"*. Another advantage is that they tried out many options, which they can use to manage pests and diseases, even in other enterprises. For instance, *they are aware and still insist on some practices such as seed selection, sorting, proper spacing, regular manure application, timely weeding and harvesting that have far reaching effects on the health of the plant compared to other groups that may practice such innovations routinely or not practice them at all*.

The MFFS gave splendid learning opportunity to the beneficiaries, which has helped them to treasure and own the innovations. It is amazing that beneficiaries still practice the majority of innovations learnt. It seems the MFFS benefited from building onto traditional/indigenous knowledge. Although farmers and groups using the other approaches acquired lots of inputs, enough to set up and maintain large demonstration/multiplication fields and, in some cases, every farm tool necessary, some of these materials are lying idle without any function.

The MFFS approach must be commended for having out-competed repetitive efforts of the widely spread conventional approach. It pioneered and revived an enterprise that was dwindling due to pest and disease epidemics. The fact that beneficiaries have consistently practiced the learnt innovations and have trained others who seem to be equally motivated suggests that the approach serves well as a capacity building tool.

With specific reference to the bean enterprise, the MFFS seems to be the only approach that has gained significant success in availing innovations that work and trying to disseminate to others in Rubaya and to a smaller extent Buhara. The approaches that gave the enterprise a try before ended up with disappointment, as the introduced varieties got diseased. Those trying now are making use of the varieties pioneered by the MFFS.

In the Kigezi region, and the great lakes region at large, beans are traditionally grown in mixtures, a strategy to minimize risk of crop failure. It is interesting to note that the MFFS bean groups have managed to maintain separate varieties to date. Other groups served by the PFR, KADFA and VLPA mixed the varieties after the trying period.

According to beneficiaries, the MFFS approach had extra advantages over the other approaches. Seventy one percent (71%) of the responses indicated that the MFFS was better than the rest of the approaches. Out of these, practical learning impressed fifty eight percent (58%), 10% confessed to have acquired better understanding while 3% liked the good interaction the approach accorded participants and trainers. Other additional advantages from focus group discussions were:

- The practical sessions helped learners to understand better and acquire skills that they are currently applying in other enterprises
- The testing allowed them a chance to adopt varieties that were doing well in their localities
- The approach enabled those who could neither read nor write to learn effectively and can also train others informally

Beneficiaries of the conventional approaches on the other hand regarded the different approaches differently. About ten percent of responses felt that KADFA had good practical demonstrations while 7% liked the regular follow up. Seven percent liked the big VLPA demonstrations while about 7% preferred the NAADS approach. Assessment of the

conventional approaches was limited by the fact that the beneficiaries had either interacted with one service provider as the case was in Buhara and a few cases in Rubaya, or all the service providers, e.g. in Rubaya, employed T&V system thus the only comparison was the size of demonstration, quantity of materials supplied and the frequency of visiting. Because of the many service providers in Rubaya, some individuals were confused and could not differentiate approaches and/or service providers.

On the negative side, the way the MFFS approach was administered in Buhara leaves much to be desired. Beneficiaries do not seem to have owned the learning process as they still exhibit a lot of dependency on the service provider. The beneficiaries feel that there was very limited contact between the groups and the community facilitator. Since there were no other collaborators in the area and the groups had never worked with any other development partner, the approach should have enabled a close and prolonged contact with the groups. The IPDM options could also have been designed to include skills on group dynamics. This would have helped group members to be more cohesive as well as relate positively with other groups. A deliberate effort should have been invested in linking the groups to other collaborators in agricultural development issues.

4.1.2 Kisii site in Nyanza province, Kenya

Community characteristics

Interviews conducted with 61 farmers (25 men, 36 women) in three divisions of Kisii and Rachuonyo districts showed that several different integrated pest, disease and soil amendment technologies such as tolerant crop varieties, timely planting and weeding, pest scouting, use of plant extracts and conventional pesticides and soil fertility management strategies had been tested and adopted. Over 85% of interviewed farmers had adopted at least one of the above technologies in their individual fields. Some 80.3% of the households were male headed, 52.5% owned small farms (2-4 acres) and 21.7% of the household heads had received no formal education (Table 10).

Table 1.11 Summary of descriptive characteristics of the survey sample at Kisii site, Nyanza province, Kenya

Characteristic	Count	Percent
1.Gender		
Male	25	41
Female	36	59
2. Household type		
Male headed	49	80.3
Female headed, absentee husband	5	8.2
Female headed, no husband	6	9.8
Single woman, no children	1	16
3. Education level of household heads		
No formal education (illiterate)	13	21.7
Primary education	23	38.3
Secondary education	22	36.7
High school education	1	1.7
Diploma education	1	1.7
4. Household employment status (such as civil servants and NGOs)		
Employed	11	18.3
Unemployed	49	81.7

Most of the interviewed households (98.4%) belong to a total of 48 different community groups/associations of which 89.6% are officially registered. Among the groups/associations, 77.1% have mixed membership, 6.3% were women only and 16.6% were men only. Some 32.8% of these groups are engaged in agricultural activities and those involved in IPDM activities accounted for 27.9% of the total number of groups. Twenty eight point three percent (28.3%) of all group members are leaders at various group positions and the remaining 71.7% are ordinary group members.

According to the interviewed farmers, maize was first as most important for food and cash while beans was second, sweet potatoes, bananas and vegetables were ranked third, fourth and fifth respectively. The major constraints to crop production were shortages of quality seed, insect pests and diseases, decline in soil fertility, lack of credit and inputs, high costs for conventional pesticides and fertilizers, land shortage, lack of improved skills and information, and unreliable weather conditions.

Farmers' knowledge of IPDM strategies

Results on adoption of IPDM technologies by farmers revealed that farmers had identified and ranked bean production constraints that included insect pests and diseases. Among the major insect pests in order of importance according to farmers' responses are aphids, cutworms, bean stem maggots (BSM) and bruchids while diseases in order of importance are bean mosaic viruses, blight, leaf rust, root rots, anthracnose and angular leaf spot. Farmers had also used their own traditional technologies in insect pests, diseases and soil fertility management and had reasons for adopting IPDM technologies (Table 1.12). The studies also showed the farmers tested and adopted several different technologies that include use of improved crop varieties, regular scouting of pests, timely planting, use of botanical plant extracts (such as *Tephrosia*, *Tithonia*, Marigold, Datura, Neem and dry sisal leaves) use of conventional chemical pesticides and fertilizers, timely weeding and harvesting, proper drying and clean storage and soil nutrient management (such as use of compost and manure).

Table 1.12 Traditional technologies and farmer perception of IPDM technologies at Kisii site, Nyanza province in Kenya

Traditional technology	Percent responding	Farmers' perception of IPDM technologies		
		Technology	Percent responding	Rank
Intercropping	57.4	Increased crop yield	80.4 (n=51)	1 (highest)
Broadcasting	67.2	Pest reduction	70.4 (n=52)	2
Farm manure	24.6	Early crop maturity	69.9 (n=40)	3
Seed drying	21.3			
Used ash in crop storage	32.8			
Used botanical pesticides	34.4			

Acquisition and sharing information on IPDM technologies

Farmers acquired information on IPDM technologies from different sources. Up to 90.2% (n=61) of the respondents obtained information about IPDM technologies from groups followed by field days (86.9%), researchers (85.2%) and the extension services (Figure 1). Other sources of information mentioned by farmers include community based organisations (CBOs), friends, seminars/workshops, training sessions, demonstration and learning plots among others.

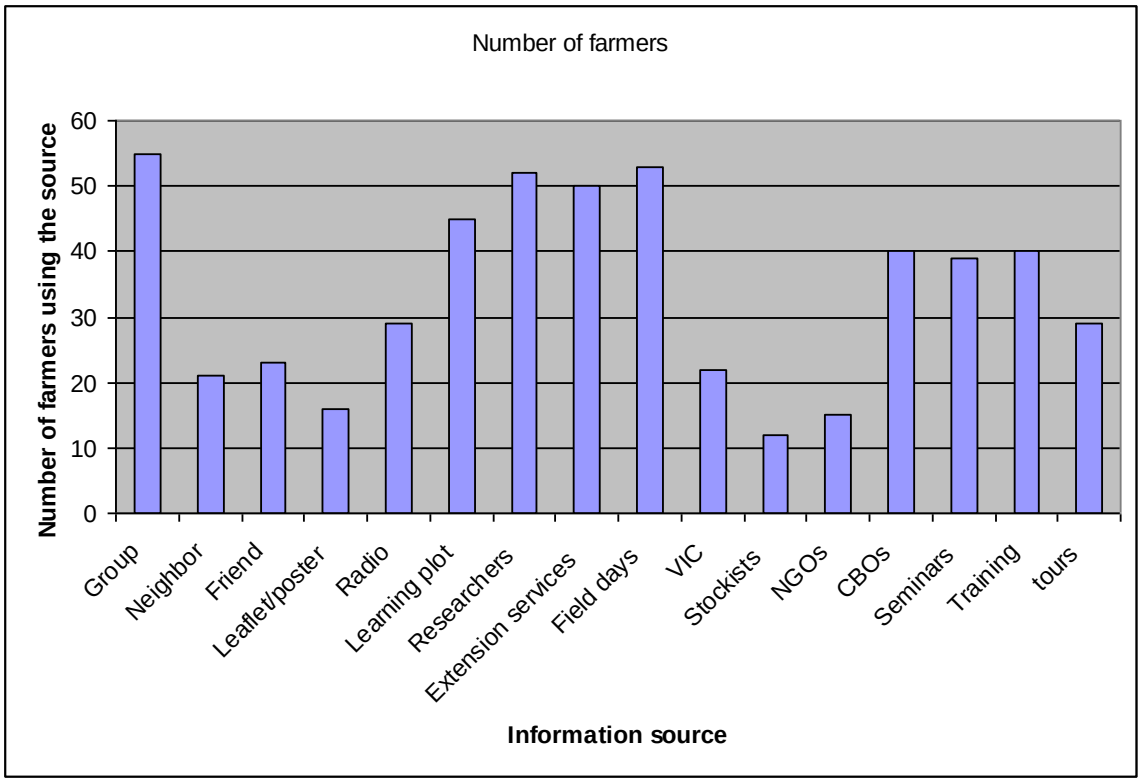

Figure 1. Sources of information on IPDM technologies in at Kisii site in Kenya

IPDM technology adoption

The studies further indicated that 85% of interviewed farmers had adopted several of the IPDM technologies that they had tested at a rate ranging from 92-95% for three of the technologies (Table 1.13). A detailed analysis showed that over 80% of the farmers had adopted more than 7 IPDM technologies on over 3 years while 65.4% (n=52), 71.7% (n=53) and 71.2% (n=52) had adopted the use of improved varieties, regular scouting and timely weeding, respectively for more than 4 years (Table 1.14, Figure 2).

Table 1.13 Overall farmer adoption of IPDM technologies at Kisii site, Nyanza province in Kenya

IPDM technology	Percent adoption	Number interviewed
Use of improved crop varieties	94.4	52
Regular scouting for pests	94.6	53
Timely weeding	92.6	52

Table 1.14 Adoption rate for three of the most preferred bean IPDM technologies by farmers in Nyanza province, Kenya between 2000 and 2004

Year	IPDM technology					
	Tolerant crop varieties		Timely weeding		Use of botanical pesticides	
	Count (n=49)	%	Count (n=49)	%	Count (n=43)	%
2000	15	31.9	15	30.6	13	30.2
2003	38	80.9	28	77.6	34	79.1
2004	46	97.9	48	98.0	42	97.7

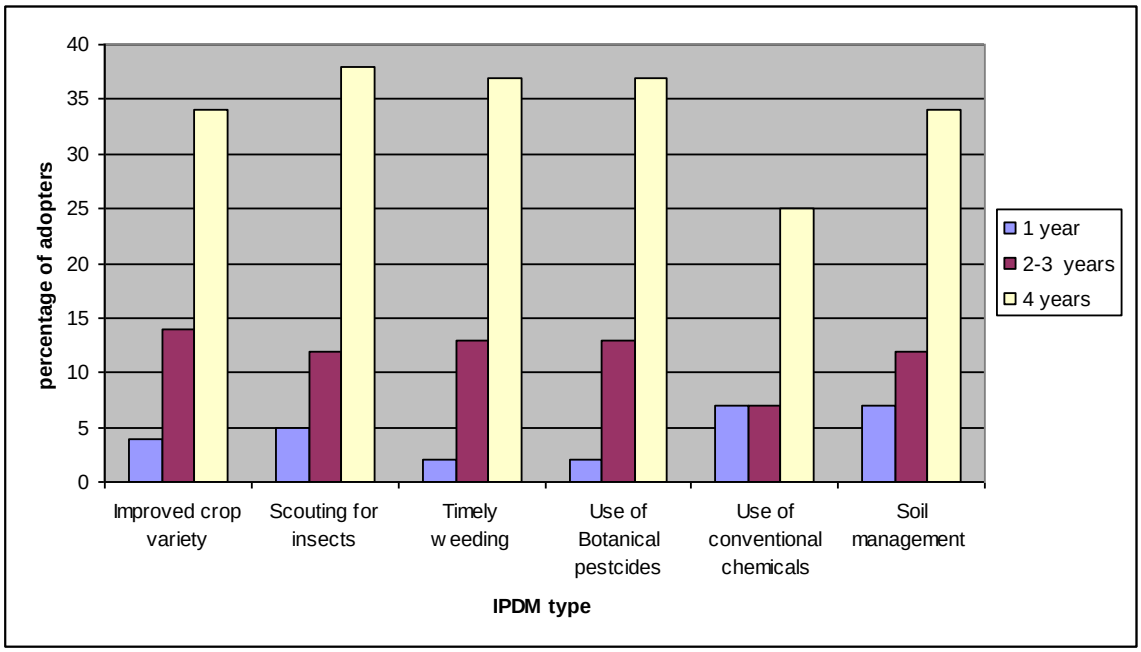

Figure 2: Comparison of the rate of adoption of selected IPDM technologies over the years in Kasipul, Mosocho and Kabondo divisions in Nyanza province

High bean grain yields and tolerance to insect pests and diseases were among the major reasons that farmers (76.2%, n=42) mentioned for their preference in the adoption of improved crop varieties compared to the other technologies. Low cost of application, timely weeding and use of botanical and other farm products were second most preferred. The major constraints to IPDM technology adoption that were mentioned by respondents include: high costs that was ranked first (62.5%, n=24), lack of skills by farmers ranked second (50%, n=24), lack of information on IPDM ranked third and labour intensiveness in using IPDM technologies ranked fourth.

Adoption of improved bean varieties

The studies indicated that 2004 and 2005 cropping seasons, farmers across 3 divisions at the Kisii site had grown several different types of bean varieties. These included Surambaya/Mwezi Moja (G8047), Red Hericcot/Nyaela Onyore, Nyaela Grade/Mwezi Mbili (EXL52), Wairimu, Sura Mbaya/Mwitemania (EXL55) and KK8 among others that were grown in relatively by a few farmers. Among specific bean varieties grown by most farmers G8047 was the most preferred and more widely grown variety (55.7%, n=61). EXL52 and Wairimu scored second (49.2%) and third (41%) for interviewed farmers who had planted the two varieties in 2004 and 2005 seasons, respectively. EXL55 came fourth in farmers' preference list (Figure3, Table 1.15).

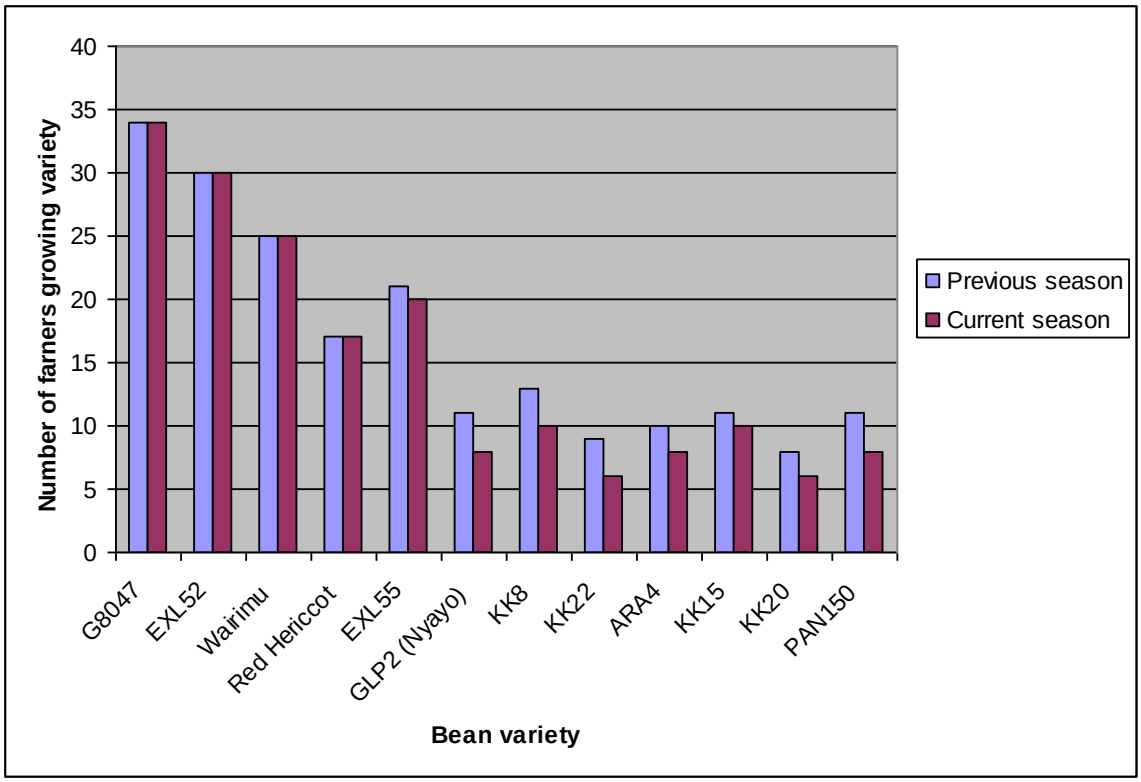

Figure 3. Scale of bean variety preference by farmers cultivating the same variety in 2004 and 2005 at Kasipul, Kabondo and Mosocho divisions at Kisii project site in Nyanza province, Kenya.

Table 1.15 Comparison of farmers growing the most preferred pest tolerant bean varieties in Kasipul, Kabondo and Mosocho divisions in Nyanza province, Kenya

Bean variety	Kasipul		Kabondo		Mosocho	
	Count	%	Count	%	Count	%
G8047	10	66.7	22	81.5	2	10.5
EXL52	5	33.3	20	74.1	5	26.3
Red Harricot	6	40	1	0.04	10	52.6
ARA4	4	26.7	6	22.2	10	52.6
KK15					7	36.8
Wairimu	13	86.7	9	33.3	3	15.8
EXL55	5	33.3	14	51.9	2	10.5
GLPS Nyayo (Lyamungo 85&90)	4	26.7	6	22.2	1	0.05
PAN150	3	20.0	4	0.2		
KK8					13	68.4
KK22					6	31.6
KK20					8	42.1

Benefits gained and problems faced by farmers in using bean IPDM technologies

Data analysis indicated that there were variations in the benefits and problems faced by farmers using the different IPDM technologies. In the case of improved crop varieties for example, increased yields was mentioned as the important benefit by the majority of respondents (84.6%, n=52) while tolerance to insect pests and diseases was ranked second (Table 1.16). The problems that were associated with improved crop varieties were that the seed was first, expensive and secondly, unavailable (Table 1.17).

Table 1.16 The two most important benefits from the use of selected IPDM technologies by farmers at Kisii project site in Nyanza province, Kenya

IPDM technology	First benefit	Count	%	Second benefit	Count	%
Improved crop varieties	Leads to high yields	52	84.6	Effective against insects & diseases	52	15.4
Regular scouting	Effective against insects & diseases	51	58.8	Leads to high quality seeds	51	21.6
Timely weeding	Reduce soil nutrient competition	53	52.8	Leads to high yields	53	43.4
Use of botanicals	Cheap and easy to use	55	69.1	Effective against insects & diseases	55	25.5
Use of conventional chemicals	Effective against insects & diseases	55	85.5	Leads to high yields	55	14.5
Soil nutrient management	Improved soil fertility	55	63.6	Leads to high yields	55	16.4
Cropping system	Effective against insects & diseases	53	62.3	Leads to high yields	53	24.5
Timely harvesting	Effective against insects & diseases	53	60.4	Leads to high quality seeds	53	32.1
Drying, cleaning & sorting	Cheap and easy to use	55	41.8	Leads to high	55	25.5
Type of storage facility	Cheap and easy to use	55	65.5	Leads to high quality seeds	55	16.4
Storage pest control	Effective against insects & diseases	50	54.0	Cheap and easy to use	50	34.0

Table 1.17 The two main problems associated with the use of selected IPDM technologies by farmers at Kisii project site in Nyanza province, Kenya

IPDM technology	First problem	Count	%	Second problem	Count	%
Improved crop varieties	Expensive	26	46.2	Difficult to get	26	42.3
Regular scouting	Time consuming	26	65.4	Need constant monitoring	26	34.6
Timely weeding	Need prompt labour	27	59.3	Expensive	27	40.7
Use of botanicals	Not very effective	32	68.8	Not easy to get	32	31.3
Use of conventional chemicals	Expensive	42	64.3	Needs skills to use	42	35.7
Soil nutrient management	Labour intensive	29	51.7	Expensive	29	48.3
Cropping system	Needs large land to practice	29	75.9	Labour intensive	29	20.7
Timely harvesting	Needs prompt labour	24	58.3	Not very effective	24	41.7
Drying, cleaning & sorting	Time consuming	29	51.7	Labour intensive	29	48.3
Storage pest control	Needs constant monitoring	26	65.4	Expensive	26	15.4

When farmers were asked to explain how they handled the above problems, 42.6% of the respondents mentioned soliciting additional ideas and skills from other groups and farmers to address the problems. Sale of other items including maize and beans, and hiring labour were the second and third options for addressing the problems. Out of 56 interviewed farmers, 6 of them (10.7%) had modified the bean IPDM technologies to suit their local conditions. Intercropping and appropriate plant spacing were the main modifications that farmers made.

Effect of IPDM technologies on households

Interviewed farmers' responses to the effect of the IPDM technologies on their households were that, first- the increased yield enabled them to have sufficient food available at household level during periods of scarcity (59.6%, n=52), secondly- improvement in the family general health (53.9, n=45) and thirdly- general increases in household income (41.7, n=48). Other positive effects included increased household food all year round (53.9, n=13), increase in the income controlled by women and improvement in farmer and community relationships. Based on the overall survey sample, the positive changes perceived and mentioned by farmers using the IPDM technologies are shown in Figure 4.

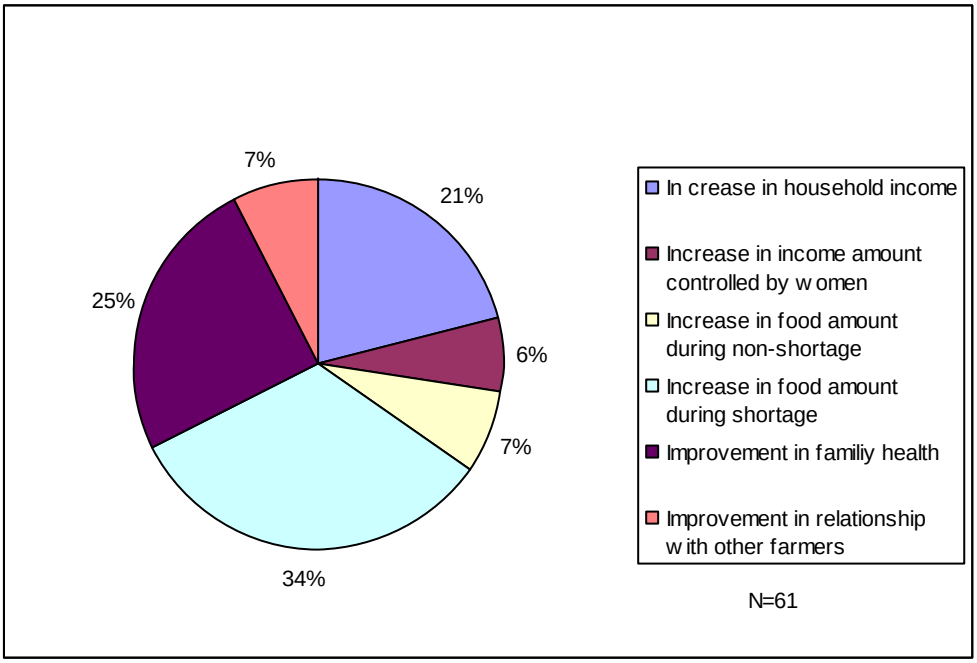

Figure 4. Positive changes perceived and mentioned by farmers from the use of IPDM technologies (based on overall survey sample)

The negative changes experienced by farmers from use of IPDM technologies included, increase in the amount of work done by women (ranked highest at 78.6%, n=42) while increase in domestic fights between husbands and wives was ranked second (70.4%, n=27). Control of the increased household income resulting from increased yields could be the main cause for the domestic fights. Reduction in prices offered for beans at the local market was ranked third most negative change (63.9%, n=23). It is most likely that use of IPDM technologies that helped to increase yields in most households resulted in market price reduction as mentioned by the farmers. This observation shows the need for appropriate storage facilities and formation of credit and savings associations to enable farmers to store their grain and use loans for settling household needs until market prices become favourable.

Benefits from farmer research groups (FRGs)

Farmer research groups at the study area were composed of women groups, youth groups and mixed groups. Farmers' views on whether they saw the need to form new IPDM groups showed that an overwhelming majority (93.2%, n= 59) were supporting the idea while the rest didn't see the need. All respondents drawn from Kasipul division were in support of the idea whereas 92% (N=23) of the Kabondo division did the same. Only two respondents from Mosocho division were not in support of the idea. The need to create awareness about IPDM technologies was the main reason given for formation of new IPDM groups accounting for 69.1% (n=61) of the cases mentioned by respondents. Introduction of new IPDM techniques/skills and reduction of poverty accounted for 50.8% and 13.1% respectively, of the cases mentioned by respondents on the need to form new IPDM groups.

Impact of IPDM technologies on gender relations and decision making

Decisions on various agricultural activities ranging from farm activities, identification of agricultural problems, implementation of activities to doing research on agriculture showed that various forums were used to make different decisions pertaining to agricultural activities. In making decisions pertaining to selection of groups for research, for instance, forums involving researchers and farmers, jointly through organized communication accounted for highest cases (33.9%, n=59) mentioned by respondents followed by forums involving researchers alone with organized communication with farmers (20.3%, n=59). In making decisions pertaining to identification of problems, forums involving researchers alone without organized communication with farmers and those involving researchers alone with organized communication with farmers accounted for equal and the highest cases (30.5%, n=59) as reported by respondents. Table1.18 gives a summary of the forums commonly used to make decisions pertaining to agricultural activities.

Table 1.18 A summary of the forums commonly used in making decisions pertaining to agricultural activities by farmers in Kasipul, Kabondo and Mosocho divisions at Kisii project site in Nyanza province, Kenya

Decision	Most used forum	%	Second most used forum	%
Formation of group for research	Researchers and farmers jointly through organized communication	33.9% (n=59)	Researchers alone with organized communication with farmers	20.3% (n=59)
Problem identification	Researchers alone with organized communication with farmers	30.5% (n=59)	Researchers alone without organized communication with farmers	30.5% (n=59)
What to do to solve problem	Researchers and farmers jointly through organized communication	30.2% (n=58)	Researchers alone without organized communication with farmers	32.8% (n=58)
Selecting experiments	Researchers alone with organized communication with farmers	30.5% (n=59)	Researchers and farmers jointly through organized communication	28.8% (n=59)
What crop to plant,	Farmers alone without organized	35.6%	Farmers alone with organized	32.2%

how & where	communication with researcher	(n=59)	communication with researcher	(n=59)
Implementing activities	Farmers alone without organized communication with researcher	40.7% (n=59)	Farmers alone with organized communication with researcher	30.5% (n=59)
What data to collect & record	Researchers and farmers jointly through organized communication	30.5% (n=59)	Farmers alone with organized communication with researcher	22% (n=59)
When to plant, weed & harvest	Farmers alone without organized communication with researcher	47.5% (n=59)	Farmers alone with organized communication with researcher	27.1% (n=59)
Who to give outputs & share information	Farmers alone without organized communication with researcher	59.3% (n=59)	Farmers alone with organized communication with researcher	18.6% (n=59)
When to stop experiments	Farmers alone without organized communication with researcher	36.2% (n=58)	Researchers and farmers jointly through organized communication	19% (n=58)

The extent to which different sexes (men and women) participated in making decisions on various agricultural activities ranging from farm activities, identification of agricultural problems, implementation of activities to doing research on agriculture showed that joint decisions dominated in all activities. Decisions made by men and women separately came second after joint decisions with each sex coming second in making decisions pertaining to specific activities after decisions taken jointly. For instance, in making decision pertaining to formation of groups for research, women came second (15.3%, n= 59) after joint decisions (78%) while decisions by men in selection of IPDM experiment plots came second (20.3%, n=59) after decisions made jointly (71.2%). Table 1.19 below gives a summary of the extent to which different sexes participate in making of decisions on different agricultural activities.

Table 1.19 Summary on the participation of both men and women in making decisions on different agricultural activities at study site in Nyanza province, Kenya

Decision	**% by decision maker**		
	Man	**Woman**	**Both**
Formation of group for research	5.1% (n=59)	15.3% (n=59)	78% (n=59)
Problem identification	6.8% (n=59)	6.8% (n=59)	84.7% (n=59)
What to do to solve problem	10.2% (n=59)	8.5% (n=59)	81.4% (n=59)
Selecting experiments	20.3% (n=59)	8.5% (n=59)	71.2% (n=59)
What crop to plant, how & where	1.7% (n=58)	8.5% (n=58)	82.8% (n=58)
Implementing activities	13.6% (n=59)	16.9% (n=59)	69.5% (n=59)
What data to collect & record	8.6% (n=58)	10.3% (n=58)	81% (n=58)
When to plant, weed & harvest	5.1% (n=59)	11.9% (n=59)	83.1% (n=59)
Who to give outputs & share information	3.4% (n=59)	13.6% (n=59)	83.1% (n=59)
When to stop experiments	22% (n=59)	8.5% (n=59)	69.5% (n=59)

Women's participation in making decisions on various agricultural activities such as problem identification and suggestion of solutions, decision on time to plant, what to plant and when, time to weed and harvest, participation in research among others is a significant positive impact as far as future application and the rate of adoption IPDM technologies and subsequent agricultural productivity in the survey site and its neighbourhood is concerned.

When respondents were asked to rank the abilities of both men and women in performing various activities that influenced development and adoption of IPDM technologies, responses focusing on the understanding that both sexes can explain IPDM concepts were ranked the highest (41.7%, n=60). This however, was slightly higher than the rating of men's ability in the same (38.3%). Regarding the modification of IPDM technologies, men were ranked as the most able (61.7%, n=60) as revealed in Table 1.20.

Table 1.20 Ability of both men and women in performing various activities that influence adoption of IPDM technologies at study site in Nyanza province, Kenya

	Most able	%	Second most able	%	Main reason
Ability to explain IPDM concepts	Both	41.7% (n=60)	Men	38.3% (n=60)	Both have same skills in IPDM
Ability to adopt IPDM technologies	Both	35% (n=60)	Women	33.3% (n=60)	Both have same skills in IPDM
Ability to experiment	Men	68.3% (n=60)	Both	30% (n=60)	Both have same skills in IPDM
Ability to disseminate information	Women	38.3% (n=60)	Men	35% (n=60)	They are social
Ability to modify IPDM technologies	Men	61.7% (n=60)	Both	26.7% (n=60)	They want to gain more from IPDM
Ability to play leading role	Both	36.7% (n=60)	Women	36.7% (n=60)	Both have same skills in IPDM

When farmers were asked to compare the use of industrial insecticides with traditional methods, up to 50.9% (n=61) of the respondents reported that industrial inputs (such as fertilizers and chemical pesticides) were expensive compared to 51.8% (n=61) who reported that traditional methods were cheap. Applicability of both industrial insecticides and traditional methods were reported to be easy as mentioned by 56.9% (n=58) in both cases. Industrial insecticides were rated as effective against pests (98.3%, n=59) unlike traditional methods whose effectiveness was reported to be low (91.5%, n=61). Table 1.21 gives a summary of comparisons between the use industrial insecticides and traditional methods as reported by farmers.

Table 1.21 Comparison betweene use of industrial insecticides and traditional methods at Kisii project site in Nyanza province, Kenya

Characteristic	Industrial insecticide	%	Traditional method	%
Cost	Expensive	50.9% (n=61)	Cheap	51.8% (n=61)
Applicability	Easy	56.9% (n=58)	Easy	56.9% (n=58)
Effectiveness	High	98.3% (n=59)	Low	91.5% (n=59)
Accessibility	Low	54.2% (n=60)	High	63.3% (n=60)
Time demand	Low	79.7% (n=59)	High	76.3% (n=59)
Labour requirement	Less	93.1% (n=58)	High	89.8% (n=58)
Skills	High	57.6% (n=59)	High	61% (n=59)

4.1.3 Northern and southern Tanzania

Farmer experimentation with soil fertility management strategies

Most of the socio-economic study results for Hai district in northern Tanzania were reported in the FTR for project R7965 (ZA 0465) in April 2005. As farmer groups continue to be innovative, they have demanded additional services and in 2005 they tested traditional and locally available organic fertilizers on different bean varieties at Sanya Juu village in Hai district. The fertilisers were the locally available Minjingu Rock Phosphate, farm yard manure and a combination of the two. Despite erratic rainfall patterns the farmers observed increases in bean grain yields of 1.5 - 2.0 times with the use of Minjingu + farm yard manure compared to the control plots (Table 1.22).

Table 1.22 Bean grain yield response to on-farm organic fertilizer trials at Sanya Juu village, Hai district, northern Tanzania in March-July 2005 planting season

Organic fertilizers	Mean bean grain yields on 3 varieties (tons/ha)		
	Lyamungu 90	JESCA	Selian 94
Unfertilised control	3.5d	4.1c	4.2d
Minjingu Rock Phosphate (MRP)	4.3c	5.8b	5.0c
Farm yard manure (FYM)	4.9b	7.1a	6.3b
Minjingu + Farm yard manure	6.8a	7.5a	7.1a
LSD at 0.05	0.006	0.007	0.006
CV (%)	13.8	14.3	12.8
Columns followed by the same letter are not significantly different (P=0.05)			

During a field day conducted by Sanya Juu bean IPM groups, farmers noted and were impressed by the vigorous stand and foliage retention of the fertilised bean plants (Figure 5), the pod and seed setting and the larger seed size compared to unfertilised plants. The data in the table shows the advantages of combining farmer yard manure and the rock phosphate where the moisture retention, nitrogen and other contents in the farm yard manure enhances the solubility of the rock.

Bean plants with Minjingu Bean plants without Minjingu

Figure 5. Bean plants response to Minjingu rock phosphate application at Sanya Juu village, Hai district in northern Tanzania

New partner links with Farm Input Promotions Africa and Minjingu Mines & Fertilisers

Links with Farm Inputs Promotions Africa Ltd- FIPS (an NGO) and Minjingu Mines & Fertiliser Ltd (private company) has helped to create awareness with farmers in Arumeru, Moshi and Tarime districts in northern Tanzania. Bean farmer groups in the 3 districts experimented with Minjingu Rock Phosphate (MRP) that has been fortified with Ca at 16%, K9%, N7% and S 5% help in the solubility of the rock and enable it to become available to short duration and fast growing crops including beans and vegetables. The company further agreed to pack the fertilizer in small packets (1kg) for distribution to bean farmer groups for demonstrations in their home gardens.

More than 200 samples (@ Ikg) of the fertilizer mixture was distributed to farmers in the three districts. Experiments in Arumeru and Tarime were conducted on bush beans while in Moshi it was tested on bush and climbing beans. The currently ending short rain season was characterised by erratic rainfall (Moshi and Tarime) and irrigation water shortages (Arumeru and Moshi) but generally farmers are impressed with the vigorous bean plant growth and larger biomass (Figure 6), improved tolerance to water stress, higher grain yield (1.5-3.0 times) compared to the unfertilised plants (Figure 7), larger seed size, higher number of seeds per pod and plot (such as 260 compared to 80 seeds per farmer plot in Arumeru).

Figure 6. Response of bean plants to organic fertilizers (Minjingu mazao and farmyard manure) at Mogabiri in Tarime district, northern Tanzania

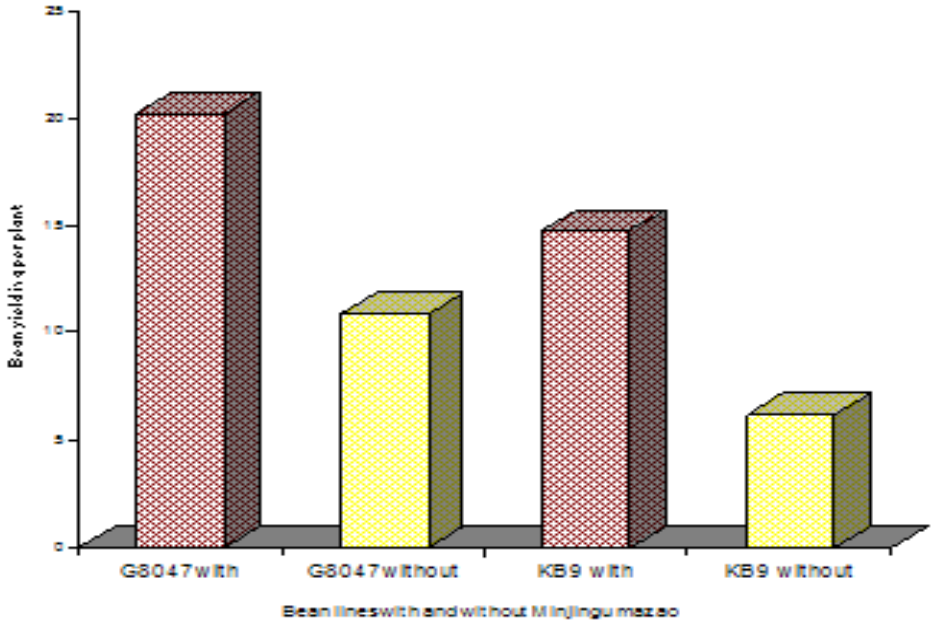

Figure 7. Grain yield response to Minjingu mazao fertilizer in screen house experiment

The exact data will be presented by FIPS when the results from farmers' plots have been assembled and processed. Three farmer field days (one in Moshi and two at different location in Arumeru) have been organised and implemented by farmers and partners (including the national bean research programme, seed companies and stockists). Farmers participating in setting up the demonstrations and those invited to the field days have demanded for the fertiliser to be availed in shops in small quantities for them to purchase and such task has been left to Minjingu mines. These activities have further helped to stretch linkages to new farmers in Tarime district through the Inter University Council of East Africa VicRes project on legume bruchid management in Lake Victoria Basin, the Evangelical Lutheran Church of Tanzania in Arumeru and Mbozi districts, Mogabiri Farm Extension Centre of the Anglican Church of Tanzania- Mara Diocese, other locally active NGOs and CBOs, seed companies- SIMLOW, Kibo, FICA, and some stockists.

Benefits from participation in bean IPDM promotion activities

The studies in Hai showed that the participatory community group approach and processes have catalysed and facilitated community participation, resulting in the formation of dynamic farmer research groups (FGRs) and enhanced the empowerment of rural smallholder bean farmers including the old women who have had no formal education. The FRGs have been setting up demonstration and learning plots that allowed farmers to select and adopt suitable bean and other crop varieties. The group approach enabled farmers and communities to be accessed by different service providers interested in rural livelihood improvement.

Among the interviewed farmers, 91% considered IPDM technologies to be advantageous in farm production, 86% reported increases in bean and maize production, 18% reported that the technologies were safe and relatively cheap compared to conventional chemical pesticides and fertilizers and 17% indicated that the technologies were easy to use. Farmers reported social economic benefits such as access to inputs, improved skills, information and new technologies that have helped them to increase farm production, resulting in increased household income and food security. The increased income was used to pay children school fees, purchase extra and better food, acquire better building materials and clothing, hired additional land for cultivation and some farmers were able to purchase livestock. Other benefits included reduced use of conventional chemical pesticides and fertilizers and links to new partners for information and services.

4.2 Output 2. More bean farmers' and other stakeholders' access to a wider range of IPDM technologies (pest tolerant bean genotypes, control strategies for stem maggots, foliage beetles, bean bruchids, root rots, etc. and soil nutrient requirements) enhanced across a wider area in the region

The current IPDM project promotion efforts have shown that once farmers and other stakeholders understand the pest problems and participate in developing options for management, they gain knowledge, experience and confidence that enable them to disseminate the information using diverse pathways at different sites. The project continued to strengthen partnerships with innovative farmers, NGOs, the regional bean networks, NARES, policy makers, local leaders and the private sector, and used these as the dissemination vehicles capitalising on institutional capabilities and synergies in technology promotion.

Activities:

2.1 Collaborate with partners in facilitating farmer to farmer knowledge and technology exchange through strategic meetings and visits

Experience in the CPP supported bean IPM promotion project has shown that once farmers and partners understand the constraints and solutions, they can select, evaluate, adapt and disseminate the evolving technologies. Farmers and partners become confident of their results and effectively disseminate them to other farmers using various traditional (drama,

songs, poems, etc.) and conventional pathways (training seminars, field days, radio, displays, etc.). New farmers adopt technologies with slight or no modifications. Linkages with active NGOs at project sites were strengthened to enable them continue to support farmer activities including seed and other inputs distribution, setting up demonstrations and field days, farmer cross visits, preparation and dissemination of promotional materials.

2.2 Strengthen existing and new village information centres (VICs) to enhance farmers' and service providers' access to information and technologies

Village information centres (VICs) appear be one of the effective and low-cost process that supports horizontal dissemination of information at local level. Sensitisation to set VICs has been on-going in the IPM promotion process. This was strengthened and enhanced in new and current sites to provide relevant information and retain documented local knowledge at community level.

2.3 Develop and distribute more promotional materials to strengthen awareness and management of bean pests, diseases and soil nutrients

Farmer/end user participatory learning processes were facilitated by developing more learning and promotional materials to extend pest and soil management technologies both nationally and regionally. Farmers and local partners in new sites participated in developing and adapting (e.g. in local languages, etc.) learning materials and decision guides. These have been used in enhancing farmers' understanding and knowledge of bean pests and soil nutrient deficiencies through meetings, demonstrations, field days, strategic farmer visits, village information centres (VICs), and others. The national programmes and bean research network partners (such as NGOs and the private sector) have played a catalytic role in facilitating this activity by virtue of their coverage.

Outputs

4.2.1 Kabale Project Site

Sources of information on technologies and how information diffuses into the communities

Collaborators in agricultural development issues listed a number of agricultural information sources on available technologies. The sources included extension staff, radio programs, local leaders, group representatives, farmer forum leaders, trading centres, places of worship, schools, NGOs and other service providers, exchange visits, workshops and seminars. Although fewer people/groups may access information through each of the listed source, this information with time diffuses into the communities and beyond. It was found out that diffusion takes place mainly through informal pathways such as farmers learning from farmers by observing successful technologies, through trying out new innovations (testing), cross visits and purchasing or exchange of new seed. Generally, farmer-to-farmer contacts were considered to have more impact than extension worker-farmer contacts. This was because the extension worker can only reach a few localized groups while farmers reach more and have more avenues of informal sharing. This implies that it is more logical to build capacities of farmers so that they can train other farmers, an idea that has worked well with the pioneer bean IPDM groups.

Beneficiaries were asked to suggest improvements in the way they access information and technologies. Responses included using radio for dissemination (19%), increasing number of demonstration trials (16%), more training (14%), provision of training manuals/books (13%), use of exchange visits (10%), emphasis on resistant seed (10%) and effective monitoring so as to rectify problems on ground (7%).

Village Information Centre

The village information centre idea seems to be a new venture that is being pioneered with support from CIAT and NARO in the area. The construction of the information centre was being planned by Nyamabaale MFFS. At the time of conducting the study, the group members had assembled bricks at the site. When members were asked about what they plan to use the centre for, they explained that it was intended to help the community members' access agricultural information and technologies. They hope to stock it with reading materials in popular version and they will promote the centre through radio announcements, local newspapers, schools and places of worship. More sensitization will be done during training sessions (i.e. group members training other groups). The group will post their work plans on the notice board to enable their stakeholders' plan well. Asked how they will maintain the centre and the personnel managing it, the group chairperson explained that at a later stage when the centre is operational, they will put in place a method of work that will enable access by intended users.

There is a lesson to learn: A smaller portion of respondents (36%) thought they knew the existence of information centre (Rubaya Telecentre). When asked whether they found it useful, 10% said they accessed information from there, 12% had attended seminars and workshops in the centre premises and 2% accessed notices of collaborators from the centre. Those that did not find it useful had never gone there (6%), did not know it existed (4%), the information in the centre was in English (4%), did not know its use (3%), and it was very far (3%). The VIC being planned with the Nyamabaale MFFS could draw lessons such as the need to publicize, importance of popular languages and the various uses the centre can provide.

Dissemination of technologies

All IPDM group members were informally sharing technologies and information. Seventy nine percent of the interviewed respondents were sharing innovations. Seventy percent of the responses had shared information on manure application, 20% shared chemical spraying, 17% had shared planting in lines, 11% improved varieties, and 8% shared bund construction. The major technology uptake channel was farmer-to-farmer where 70% of responses had shared out of their own initiative, 27% were answering farmer requests, 26% were facilitated by an external agency to share and 25% combined both requests and own initiative.

Bean seed was being shared with relatives, friends, neighbours plus any individual/group/agency that sought improved seed. Modes of sharing included selling, gifts or exchange with local varieties. In some instances seed was being given as donation by trainer to a training group for demonstration purposes. In Buhara seed was being exchanged at a ratio of 1: 1 while in Rubaya the ratio was 1 improved to 2 local. Modes of sharing were to a large extent not influenced by gender although women tended to give to fellow women. Since all groups have more women than men, men still solicited improved seed from women especially where men are involved in bean production. [The Muhende-Nyarutojo group had 1 man amidst 13 women; Nyamabaale group had twice as many women as men while the female to male ratio in the rest of the groups was 3:2].

The survey results suggest that wider dissemination of information took place through informal pathways and out of peoples' initiative, particularly during social gatherings such as communal digging, credit group meeting and market days. It is also interesting to note that community members were making deliberate requests to learn. Additionally, they were free to visit and observe the IPDM group fields according to their convenient times although owners and local leaders reported some unauthorized bean pod harvesting. Generally sharing (and its various forms) was not dependent on sex, age and education level or wealth status of beneficiaries.

Groups that had networks with other NGOs and other government and research programs shared more technologies and information was more widely spread in Rubaya than in Buhara.

This is because in Rubaya group members have extra avenues for dissemination. For instance members of Nyamabaale FFS and Karambo Turoke are being used by NAADS and other NGOs to train other farmers and research programs. Group leaders have also been selected into other offices to head other sub-county programs. Such positions give them extra opening to disseminate skills and information. The strong groups were encouraging individuals that have been coming to them for help to form groups, register with sub-county authorities such that they are able to access more services from existing structures and programs.

Different external collaborators were involved in different programs ranging from health, water, infrastructure and agricultural development. A summary of their various activities is presented in Table 2.1.

Table 2.1 Collaborators involved in agricultural development issues, their area of operation and activities in Kabale district, south western Uganda

Collaborator	Location	Responsibilities
AHI	Rubaya	NRM issues, development of bye-laws
ISAMI (CARE/KADFA)	Rubaya	Bulk marketing, village banks, market linkage, climbing beans (seed loaning), Irish potato
Africare (Phased out)	Rubaya/Buhara	Soil conservation, tree nurseries, Irish potato seed & stores, climbing beans, sweet potato vines, farm tools
CIAT/NARO	Rubaya/Buhara	Resistant bean varieties, bean IPDM, soil &water conservation, I/potatoes, Village information centre
NEMA	Rubaya	NRM-swamp and soil & water conservation
CARE-FIP (Phased out)	Rubaya	Developing work plans, cost-benefit analysis, Irish potato & tree seedlings, agricultural inputs, group dynamics
CIAT FPR/Africare	Rubaya	Participatory planning, developing groups, NRM, farm tools, bridge construction
ECOTRUST	Rubaya	Collaborates with NAADS on NRM (new)
MUK	Rubaya/Buhara	Soil fertility management trials in Rubaya, reconstruction of terraces in Buhara (locals not aware)
NAADS	Rubaya	Irish potatoes, sheep/goats, fruits
PMA	Rubaya/Buhara	Irish potato, coffee, spray pumps, bush beans
LGDP	Rubaya/Buhara	Access roads, school furniture, health centres
AAMP	Buhara	Irish potato, bee keeping, piggery, infrastructure, fruits
ICRAF (Phased out)	Buhara/Rubaya	Tree nurseries, soil conservation
Kigezi diocese	Buhara/Rubaya	Heifer project, gravity water flow scheme, protected springs

As indicated by the table above, Rubaya has many more collaborators than Buhara. This means that IPDM groups in Rubaya have had more exposure than those in Buhara. The groups in Rubaya have also worked with other partners for quite a long time. Possibly the level of commitment of the groups and capacity to make things happen is derived from this long exposure.

4.2.2 Kisii project site

Dissemination of IPDM technologies and partnerships

The most effective bean IPDM technology dissemination channels that were mentioned by farmers include use of farmer research groups, setting up demonstration and learning plots, organising and conducting field days, facilitating tours, conducting seminars and training workshops, using media particularly local radio, preparation and distribution of promotional materials (such as posters, leaflets, field guides, manuals), setting up village information centres (VICs), neighbourhood and friendly exchanges, and consultations with researchers, extension and other service providers including NGOs, CBOs and stockists.

When farmers at Kisii site were asked whether other people came for help from the respondents, more than three-quarters of the respondents drawn from each of the three divisions admitted to have received farmers approaching them for help. These constituted 76.7% of the overall survey sample. Some of these farmers had helped other farmers in reportedly many times (60.9%, n=46) while others had helped them a few times (32.6%). Those who had helped farmers once accounted for 6.5% of the cases mentioned by respondents. Advice on IPDM technologies was the most common form of assistance (45.7%, n=61) offered to farmers who approached the interviewed respondents for help. Selling of improved pest tolerant bean seeds to farmers as a form of assistance came second, accounting for 36.1% of the cases mentioned by respondents.

When farmers were asked whether they shared or disseminated IPDM technologies, a significant majority (86.4%, n=59) of the respondents indicated that they shared IPDM technologies with other farmers and the channels used included groups, training, field days, CBOs, NGOS and extension services. Groups were the most common channel for sharing IPDM technology accounting for 87.3% of the total cases mentioned by farmers followed by field days (81.5%) and training (73.4%) respectively. Other channels mentioned in order of importance included CBOs, friends and Community Barazas. The number of people sharing information largely depended on the type of channel used. While channels such as training, groups, Barazas, seminars, CBOs, and field days were used to share information among large number of farmers (in excess of 30 farmers on the average), channels such as friendship and neighbours were used to share information with an average of less than 10 farmers. Women were involved in sharing IPDM technologies more than men in all the three divisions.

The distance within which IPDM technologies were shared indicated that friendship and neighbours channels were commonly used within a distance of 2 km on average. This differed largely with sharing of information using channels such as training, seminars, field days, visits and tours. Sharing information using the latter group of channels occurred within a distance of 8 km on the average. Information sharing using CBOs occurred within a distance of 3-4 km as mentioned by majority of the respondents. It is most likely that NGOs or government agencies organized IPDM technology sharing channels such as training, seminars, field days, visits and tours for farmers thus accounting for the long distance within which these channels were used to share IPDM technologies. This information is vital in the development of guidelines and manuals for technology promotion among farming communities. Some of the collaborators involved in technology development and dissemination of information to bean farmers at Kisii site are indicated in Table 2.2.

Table 2.2 Collaborators involved in agricultural development activities at Kisii site, Nyanza province in Kenya

Collaborator	Location	Responsibilities
SIMLOW	Ouru Masawa	Private seed company promoting improved bean seed production at farmer level
KARI	Regional Res. Centre	Planning and implementation of all agricultural research and promotion activities
CIAT/KARI	Nyanza, Western, Eastern, Central and Rift Valley provinces, Kenya	Improved bean production, bean breeding for tolerance to stresses, soil fertility, promotion and dissemination of bean integrated management technologies
Ministry of Agriculture	All districts	District agriculture extension services
Ministry of Education	All districts	Education services, Adult education and other literacy campaigns, dissemination of agricultural technologies, support to VICs
Ministry of Health	All districts	HIV/AIDS awareness campaigns, nutrition for health, support to VICs
UCCIP	CBO in Rachuonyo district	Improved livelihoods through promotion and training in horticulture, animal draft, bee keeping and home care
Local chiefs	Local administration	Awareness creation among local communities, farmer meeting organisation, by-law institution and implementation

4.2.3 Northern and southern Tanzania sites

Partnership with other stakeholders

Most of the information for northern Tanzania was reported in the R7965 FTR of April 2005. New partnerships has involved with Farm Input Promotions Africa (FIPS), a not- for- profit non governmental organisation (NGO) promoting small packaging of farm inputs (seed and fertilizers) with smallholder farmers in Kenya and recently in Tanzania. Linked to this is the private company Minjingu Mines based at Arusha and involved in mining and marketing the naturally occurring Minjingu Rock Phosphate. Other partners in this initiative are listed in Table 2.3.

Table 2.3 Partners involved in agricultural development issues, their location and responsibilities

Collaborators	Location	Responsibilities
FIPS	Kenya and Tanzania	Promotion of farm input small packaging for access by smallholder farmers
Minjingu Mines & Fertilizer Ltd.	East and southern Africa	Mining and marketing Minjingu Rock Phosphate

SARI Bean research programme	Northern zone	Bean research activities in northern Tanzania
Ministry of Agric.- Armyworm project	Tanzania	Armyworm research and promotion of improved practices for pest control
Local government	Authorities in Tarime, Arumeru, Moshi and Arusha districts	Policy issues and farmer community mobilisation/sensitisation
HEM- Himo Environmental Management	Moshi district, Kilimanjaro	Promotion of agro-forestry, fruit and food crop production with smallholder coffee farmers in Moshi district
ELCT- Evangelical Lutheran Church of Tanzania	Arumeru and Mbozi districts	Mobilisation of bean farmer research groups in experimentation and bean seed distribution
Anglican Church of Tanzania, Mara Diocese	Tarime district	Access to farmer training facilities and mobilisation of bean farmer research groups
World Vision	Sanya ADP	Farm input stockists for Hai district farmer group associations

Sources of information

The study in Hai district showed that, every IPDM group member was knowledgeable on a number of IPDM practices and technologies. The source of information on such technologies varied between groups and mostly the groups claimed to obtain information from village extension officers (VEOs), researchers from different institutions, field days conducted by other IPDM groups, participation in different seminars and village information centres (VICs) (Figure 2.1). The chart below describes sources of information on the IPDM technologies as explained by farmers interviewed during the study.

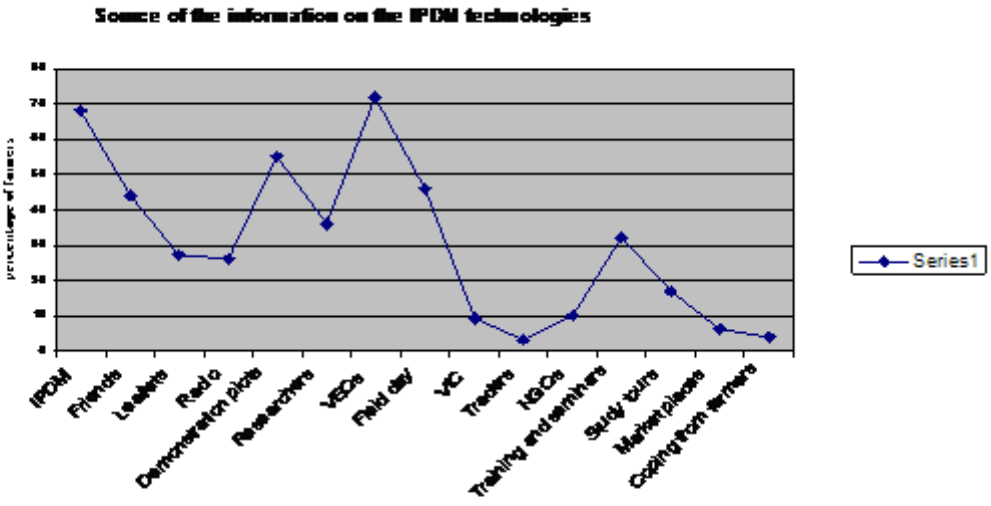

Figure 2.1 Sources of information on bean IPDM technologies in Hai district, northern Tanzania

The data shows that 72% of farmers interviewed mentioned village extension officers (VEOs) to be their sources of information on the technologies, 68% mentioned IPDM groups, 55% demonstration plots and 46% field days. The majority of interviewed community members

(96%) had access to village extension officers (VEOs) who work and live in the villages to support farmers at the village level. VEOs have used the farmer group working strategy because it is very easy to access a large number of farmers while in groups. To facilitate the dissemination of the technologies within and outside the community the stakeholders (such as farmers, IPDM project, DALDOs office, other local service providers and donors) recognise the importance of training and empowering village extension officers to facilitate the quick dissemination of technologies and to achieve sustainability. It was observed that about 97% of the VEOs live in the district and engage in agriculture activities. CIAT in collaboration with DALDO's office organized and facilitated different seminars and exchange visits to enhance the dissemination of bean IPDM technologies.

Dissemination of IPDM technologies in Hai district, northern Tanzania

Participation of the local community members and partners (farmers, farmer groups, local leaders, DALDO's office, active NGOs and CBOs and IPDM project) was essential for effective dissemination of the IPDM technologies in the community. Strong commitment by government, CIAT and farmer groups to promote the participation of farmers from within and outside of the district to learn and adopt the technologies played a key role in the success of the project objective. The data shows that 83% of the groups and 79% of the farmers interviewed participated in the dissemination of the information on IPDM technologies using different methods that facilitated the flow of the information regarding the technologies. Different methods and processes were used by stakeholders to facilitate the flow of information on the technologies. Various tools and techniques were used in technology dissemination including: training seminars, farmer meetings, learning and demonstration plots, field days and visits, promotional materials (leaflets), VICs, songs and drama, all facilitated by the IPDM project and partners.

According to survey results, IPDM groups and group members are fully participating in the transmission of the information on the technologies to other farmers by using different ways that facilitate the information flow. One member of the Kiengia village group stated, "*Since every farmer likes to have better life, the simplest way we do is to have demonstration plots along the road where every person passes and can see whatever we do. Normally, these plots differ from other plots, by seeing; people can predict the best production from the plots. This makes other people to seek for the technologies*".

IPDM group members used different methods to disseminate information on IPDM technologies. The first approach was farmer research groups where group members organise meetings, attend seminars and workshops, set up learning and demonstration plots, monitor pests problem and control them, evaluate technology performance and organise field days and visits to share and disseminate information. Secondly, individual approach where each farmer talks to other farmers or demonstrate different technology options in their individual fields and train other farmers. The different methods used by IPDM groups and group members to disseminate the information on the technologies are indicated in Table 2.4 .

Table 2.4 Dissemination methods for IPDM technologies in Hai district, northern Tanzania

Dissemination method	IPDM groups		Participating farmers	
	Number	Percentage *	Number	Percentage**
Demonstration plots	7	58%	124	92%
Field day	4	33%	-	-
Radio	2	17%	-	-
Markets	1	8%	-	-
Religious places	3	25%	-	-
Village meetings	4	33%	-	-
Talk to other farmers	9	75%	118	87%
Leaflets	-	-	3	2%

* Percentage of groups interviewed (n=12), * *Percentage of participating farmers interviewed (n=136)

The IPDM farmer research groups were supported by project partners (DALDO office, research institutions and locally active NGOs) to organise field days where group members were enabled to share information about the technologies. Farmers from different villages, districts and regions, and researchers, NGOs, political, government, religious leaders and community leaders were invited to participate in the field days.

The groups mentioned other dissemination methods such as advertising in mosques or churches, talking to neighbours and relatives from within and outside the village, radio messages and participation in agricultural shows such as Nane Nane (National Farmers' Day). As the result of these efforts, the focus group discussion members estimated the number of farmers who are knowledgeable and use some of the IPDM technologies as it ranged from 40% to 80%. These figures varied depending on the year that the IPDM groups were initiated in the village. For example, in the first generation villages the percentage was high and the same was relatively low in villages with third generation groups.

Means of technology dissemination in Hai district, northern Tanzania

Dissemination of the technologies is the process that requires a certain level of understanding and processes that could be accepted by both the provider and receiver of the information. The data shows that 114 (84%) which was composed of 54 (40%) men and women 60 (44%) of interviewed participating farmers used different methods/channels to disseminate the information on the technologies t the community (Table 2.5)

Table 2.5 Dissemination methods/channels used by IPDM farmer groups segregated by gender in Hai district, northern Tanzania

Dissemination method/channel	Male (n=54)	Female (n=60)	Total farmers (n=114)
Demonstrate on my own/group plot	42(78%)	38 (63%)	80 (70%)
Talk to other farmers	27(50%)	38(63%)	65 (57%)
Leaflets	10(18%)	3(5%)	13 (11%)

The data shows that about 70% of the participating farmers interviewed used demonstration/learning plots to disseminate IPDM information. Here farmers mentioned that they sometimes demonstrated the technologies at their own farms or at the group demonstration plots. Fifty seven percent (57%) met with other farmers and discussed about the technologies. Mostly this happens when farmers experience agricultural problems and seek for advice from the participating farmers. Eleven percent (11%) mentioned leaflets as their dissemination channel. The data clearly shows that the majority of farmers prefer the system of learning by seeing and not reading. Lack of materials for reading and poor conditions of some of the VICs can be the part of the reasons few farmers (10%) to select leaflets as the means of disseminating information.

Dissemination of improved bean seed in southern Tanzania

Several improved bean seed varieties and lines from Uyole Agricultural Institute have been distributed to farmers in collaboration with partners in southern highlands of Tanzania. The improved bean variety seed was purchased by farmers through the Evangelical Lutheran Church of Tanzania (ELCT) in Mbozi (Table 2.6). Bean variety demonstrations are conducted by ELCT farmer communities under the supervision of Mbozi extension and ARI Uyole personnel.

Table 2.6 Improved bean seed distribution and variety demonstrations in Mbozi district, southern Tanzania during 2005/06 planting season

Bean variety/line	Amount of seed (kg) purchased and distributed	Number of varieties/lines in on-farm trials	Key partners
Uyole 96	2050	-	Farmers (19 women, 48 men) in 13 villages
Uyole 98	350	-	ARI Uyole, Extension personnel
Uyole 94	100	-	ELCT Mlowo congregation
Wanja (G22501)	200	-	
Urafiki	30	-	
Calima lines	-	6	ARI Uyole, Extension personnel
DRK lines	-	3	Farmers in 4 villages (26 women, 22 men)
Sugar lines	-	2	ELCT
Yellow type	-	1	

Promotional materials developed

New and previous project promotional materials were prepared and distributed to partners and existing village information centres and participating primary and secondary schools at project sites. The VIC management committees acquired additional reading materials according to local needs. The Bototo B VIC in Kisii have set up a defined timetable for visits: Groups members visit to read and borrow materials on Thursdays 1400-1600 hours while schools (3 primary and 1 secondary) visit on Saturday at 1400-1600 hours. The following materials were prepared during the current project:

1. Draft IPM Training Guide: IPM Learning and Practicing Guide: Farmer- to- Farmer dissemination of bean IPM technologies - The Approach, Processes and Tools
2. Posters

- Management of bean foliage beetles (BFB) (*Ootheca* spp.)
- Management bean stem maggots (BSM) (*Ophiomyia* spp.)

3. Farmer group activity reports (Small booklets)

- Farmer field day report for Kisii site, Kenya: Bean farmer field day at Ouru-Masawa, Nyanza Province, Kenya, May 2005. Farmer Group Activity Reports to CPP. CIAT, Arusha, Tanzania. 23pp. [English] [booklet for distribution to Village Information Centres in bean growing areas in Eastern, Central and Southern Africa]
- Farmer field day report for Sanya Juu site, Tanzania: Field day for bean IPDM farmer groups at Sanya Juu village in Hai district, northern Tanzania, June 2005. Farmer Group Activity Reports to CPP. CIAT, Arusha, Tanzania. 19pp. [English] [booklet for distribution to Village Information Centres in bean growing areas in Eastern, Central and Southern Africa]
- Visit by Tarime farmers to Kisii bean IPM farmer research groups in Kenya, November 2005
- Training workshop for Tarime farmer representatives on bean production and bean pest (bruchids) management, November 2005

4. Conference and workshop presentations
5. Contribution to book chapter
6. Contribution to CIAT Annual report

5. Contribution of Outputs to developmental impact

The project outputs on learning through experimentation stand out as an appropriate capacity building tool for imparting knowledge and skills to farming communities. Filling knowledge

gaps and blending indigenous with improved knowledge effectively helped the bean IPM project to address the issue of psychology of development where farmers were made to feel good about themselves, restoring their confidence and boosting up their morale in the participatory activities and adoption of technologies. This was the driving force in the MFFS that enabled the acquired knowledge and skills to be more usable and increased the chances for high probability in sustainability.

Increased knowledge of bean pest management technologies

Project participating farmers and groups and outside adopters were knowledgeable of local bean production constraints including insect pests, diseases and soil fertility factors. Knowledge gaps were identified during training, group meetings and field practical experimentation. The participatory farmer research group approach helped to fill in knowledge gaps and the blending of traditional and improved strategies in the practical demonstrations, field days and visits enhanced farmers' capacity and restored their confidence in the effectiveness of local pest and soil management strategies. Farmers' confidence and skills have enabled them to become effective formal and informal trainers.

Improved farmer capacity in resource management

Older farmer research groups that had worked with various partners were more organised, knowledgeable and less dependent on partners in searching for information, demand for services, testing technologies, training others and in management of constraints. Most groups required training in group dynamics and links with different development partners. The newly initiated links to NGOs, other projects and the private fertilizer and seed companies will create awareness and improve on farmers' capacity in acquisition of appropriate inputs for effective farm production and target farm products to market for improved household income.

Increased adoption of IPM technologies

Group members adopted innovations to significant levels (over 60%) without major modifications. Adoption within participating groups was higher than in outside groups. Dissemination of technologies was taking place through various formal and informal pathways. Farmer to farmer dissemination was very effective. Farmers learned much faster from each other, field learning plots and demonstrations, field days and visits than from researchers, extension services and reading in the village information centres.

Increased bean production and household income

All interviewed farmers in Kabale (Uganda), Kisii (Kenya) and Hai (Tanzania) reported increased bean and food production at household level, group members confessed increased household incomes and that the vulnerable members (women, children and the elderly) in their groups were able to access information and learning opportunities and they also acquired skills. There were indications in Uganda of shifting from producing beans for food only to food and cash income and a rising male participation since the onset of the project. For the first time, farmers in Kabale have agreed to establish bean sole crop field as a change from the traditional bean mixtures. There was a general change in attitudes from traditional beliefs and rituals to believing and practicing proven scientific facts. Men were becoming more cooperative with women in land use decisions.

6. Biometrician's Signature

The project sourced biometric services from CIAT, NARO, IITA/NARO and KARI scientists based in Uganda and Kenya, respectively.