International Scholars Journals

African Journal of Food Science Research ISSN 2375-0723 Vol. 7 (2), pp. 001-008, February, 2019. Available online at www.internationalscholarsjournals.org © International Scholars Journals

Full Length Research Paper

Facilitating food crop production in Lungwena, Mangochi District in Malawi: Lessons from a farmer-based pass-on seed support model

V. H. Kabambe*, W. G. Mhango, M. Msiska, W. A. B Msuku, G. K. C. Nyirenda and C. Masangano

University of Malawi, Bunda College of Agriculture, P.O. 219, Lilongwe.

Accepted 22 November, 2018

Lungwena extension planning area is a coastal community on the south end of Lake Malawi. Due to a unimodal rainfall pattern, food shortages are common for two to five months before the next harvest. In order improve food production, a farmer-based seed multiplication program was initiated in 2005/06 season in three selected villages. Focus group discussions (FGD's) were used to identify important crops for the area and their related constraints. A scaling-out program was then designed and implemented with farmer participation. The main research objective was to identify and test a mechanism for accelerating food crop production in a community where availability, use and production knowledge of improved main food crops are low. The guiding principles were to identify an easy-to-administer crop production intervention within reach of resources and management capacity of the researchers, extension system and farmers. The hypothesis was that by working with a few eager farmers to multiply seeds of improved varieties of cassava and legumes, the seed would spread out through organised or informal sales and sharing. The FGD's showed that maize (*Zea mays L*.), cassava (*Manihot esculent a* Crantz), pigeon peas (Cajanus cajan {L.}. Millspaugh), cowpeas (*Vigna unguiculata* {L.} Walpers) and bambara groundnuts (*Vigna subterranea* {L.} Verd) were main food crops. Poor access to seeds of improved crop varieties and knowledge of improved production technological packages were noted as main constraints. For maize, lack of inorganic fertilizers and poor soil fertility were other constraints. The results of the seed multiplication program showed that out of 63 farmers planned to participate in seed production, 21 took part. Some 38 farmers were identified for further multiplication. Those that participated were also trained, and indicated that they learned new skills and concepts quite useful to their farming. The low success rate was attributed to lack of commitment and unpreparedness to fence cassava and pigeon peas crops. Scaling out of seed amongst farmers may be enhanced through promotion of sales, rather than sharing. It was anticipated that the knowledge that new seeds, particularly of cassava cuttings, are available would prevail and farmers would transact with it further.

Key words: Food security, livelihoods, farmer participatory methods, community seed production, Mangochi District.

INTRODUCTION

Malawi is a small south east African country with a total land area of 118,484 km^2. There is a unimodal pattern of rainfall. Maize (*Zea mays* L.) is the staple food crop. Between 1998 and 2002 maize area has ranged between 1292,269 and 1,507,088 ha, with average production range of 1.137 to 1.650 t ha^{-1}. (Ministry of Agriculture, Irrigation and Food Security (MoAFS, 2005). In terms of area committed to a crop, the importance of various crops are in the following order: maize, tobacco (*Nico-tiana tobacum*) L., cassava (*Manihot esculenta* Crantz),

*Corresponding author. E-mail: kabambev@yahoo.com.

common beans (*Phaseolus vulgaris* L.), sweet potato (*Ipomea batatas* {L.} Lam.), groundnuts (*Arachis hypogea* L.) and pigeon peas (*Cajanus cajan* {L.}. Millspaugh) (MoAFS, 2007). The area planted to maize and maize mixtures by smallholder farmers was about 65% in the early 1960s, and increased to 70 - 85% of the land under cultivation in the 1990's (Heisey and Smale, 1995). Between 2000 and 2005 the country has experienced some serious food shortages due poor rainfall and other factors such as poor storage or excess sale of harvest. It is therefore a policy of government to encourage crop diversification so that food can be available at household level throughout the year (MoAFS, 2005).

The studies in this report were a component of the Lungwena Health, Nutrition and Agricultural Multidisciplinary Project, which aimed at addressing problems of poverty, food insecurity, and ill-health through a multidisciplinary approach. The project was implemented by relevant academic departments of the University of Malawi, in collaboration with Norwergian Agricultural University (NUFU). The project geographically focused on Lungwena Extension Planning Area (EPA), in Mangochi District, Southern Malawi (Figure 1). In terms of administrative arrangement for extension delivery in Malawi, the country is divided into eight Agricultural Development Divisions (ADD), which are in turn divided into general District Agricultural Offices, then EPA's followed by sections.

With regard to national food security and nutrition, some areas of the country may experience food shortages due to distribution shortfalls and some local food production factors, particularly in rural areas. In 2004, rural women in Malawi were twice as likely to be thin as their urban women. Rural women in Mangochi were more likely to be thin than women in other districts (National Statistical Office {NSO} and ORC Macro, 2005). Nationally, 48% of children under 5 are stunted, 22% are under weight while 5% are too thin (NSO) and Macro 2005). According to Benson (2002), 70 - 80% of people in Mangochi, including Lungwena area were under the poverty line of US $ 0.43 a day. This is the case even though Mangochi, including Lungwena EPA, enjoys a fish-based economy and diet, as it lies along the lake.

The aim of the crop production component was to identify constraints to food crop production and design and promote appropriate production technologies with high potential for adoption impact on crop yields. This report provides results of farmer-participatory activities to identify production constraints and design community based intervention programme. The research question in the program was 'how can we accelerate a food production in a system where access, use and knowledge of improved varieties of cassava, pigeon peas or cowpeas is low? The hypothesis was that by working with a few eager farmers to multiply seeds of improved varieties of cassava and legumes, the seed would spread out through organised or informal sales and sharing.

MATERIALS AND METHODS

About Lungwena extension planning area

Lungwena Extension Planning Area (EPA) is found in Mangochi District, under Machinga Agricultural Development Division in southern Malawi. The total land area is 28,101 ha. Of this, 16,324 is cultivated arable land, 2,836 is marginal cultivated land, and 2631 is under waterlogged conditions while the rest is under Namizimu forest reserve. The area receives an average of 780 - 1000 mm rainfall per annum. In 2003 the EPA had about 20,340 farm families, with an average land holding size of about one hectare per household. The main crops grown in the area include maize, cassava, rice (*Oryza sativa* L.), cowpeas (*Vigna unguiculata* {L.} Walpers), sweet potato, pigeon peas, velvet beans (*Mucuna spp*) (Mr Chanza, Head of EPA, Personal Communication, December 2004)

Determining existing crop production systems and constraints - focus group discussions

Focus group discussions (FDG's) were conducted in February 2005 by a research team comprising an entomologist, pathologist and three agronomists. The focus group discussions were conducted in four villages as follows:- Mdalamakumba and Kwilasya (located away from the coast, - upland) and Chilonga and Mtumbula (coastal land). The objective of the focus group discussions was to collect information on crops and cropping systems in the Lungwena EPA, constraints to increased production to be used as a planning tool in the interventions. During the discussions, farmers were asked what crops they are growing, why they grow these crops, the problems they face, and what they do about these problems. Through a show of hands, percentages were calculated for some of the res-ponses. All meetings were facilitated by the local extension agent and village chiefs, who were accompanied by their assistants. There was very good participation by women in the discussions. In addition to the discussions, researchers made general observations in crop fields to identify agronomic, soil or pest situations.

Development of an intervention program

The intervention program was conducted in two phases. The first phase was a desk design by researchers, and the second, as a discussion with farmers in FDG's. The desk design outlined options for interventions for tabling to farmers in the FDGs. The guiding principle was to identify an easy-to-administer crop production intervention within reach of resources and management capacity of the researchers and of farmers. For resources, issues such as isolation distances in seed multiplication were considered. To increase maize seed, for example, isolation distances of 200 m are required, compared to only 5 m for groundnuts, cowpea, bambara groundnut and cassava (Muliokera, 1997).

The investigators held a meeting with the communities in the three villages where the intervention were targeted. The villages were Mdalamakumba, Chapola and Chilonga. The objective was to inform the communities about the seed multiplication program and discuss issues related to criteria for selecting farmers, land for the demonstrations, sharing of seed; whether seed should be given to individuals or a group of farmers. The discussions were held in September 2005. In Chilonga village a total of 39 farmers participated (17 men and 22 women), in Chapola village 195 farmers participated (76 men and 119 men) while in M'dalamakumba village there were 105 participants (no gender breakdown was recorded). In all meetings, the village leaders were present. The outcomes of these approaches are presented in the results section.

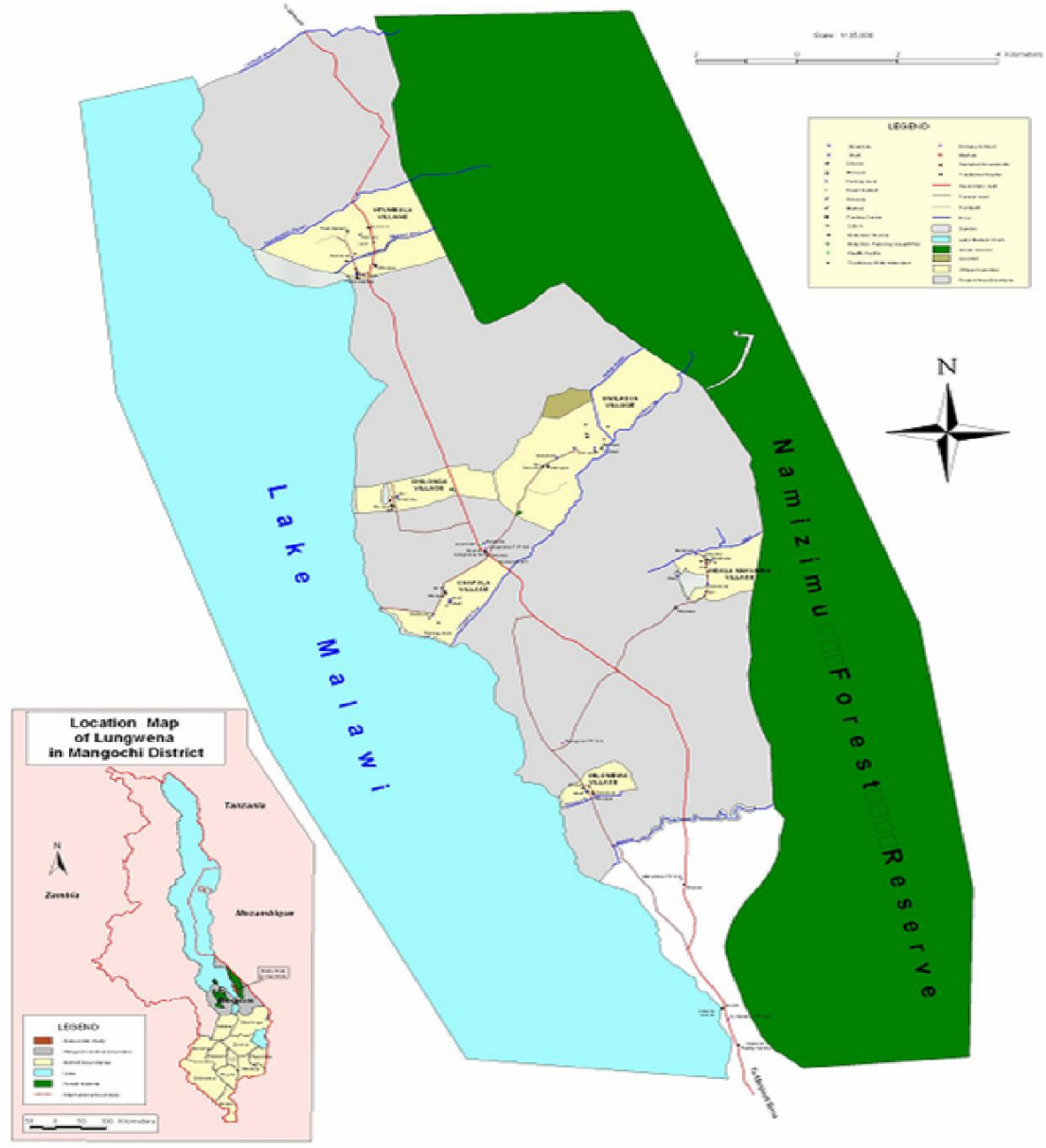

Figure 1. Map of Lungwena Project Area.

RESULTS AND DISCUSSIONS

Focus Group Discussions (FGD's) – crops grown and constraints to production

The numbers of farmers taking part in FGD's, major crops and proportion of farmers growing them are shown in Table 1. The crops include maize, groundnuts, rice, pumpkins (*Cucurbita maxima* Duch), cowpeas and sweet potatoes. The crops are usually grown in intercropping to maximize land and labour use. The reasons for growing the crops were narrow. In most cases crops were grown for food and sale. In some cases crops were grown as a food security measure (crop can provide food or cash at a time when maize is depleted and cash is rare). For crops not commonly grown, farmers cited poor seed shortage as reasons for not growing these, and said they would grow these for food as well (Table 2). Another serious problem was that of free- range goats during the dry season. The goats, which are set lose after the rains, destroy crops such as cassava and pigeon peas, which extend into the dry season. Other problems were wild animals, lack of storage technology on crops such as cassava, and poor access to storage insecticides, lack of markets and prolonged dry spells during the season. Farmers mitigate food shortages by growing some short season crops or crop varieties in the dry season, using bucket irrigation. The irrigation water is drawn from ma-

Table 1. Crops grown and proportion of farmers growing them, by four villages, according to focus group discussions.

Crops grown	Village sample size (n) and % farmers growing crop			
	Mdala Makumba n = 51	Chilonga n = 67	Kwilasya n = 113	Mtumbula Village n = 57
Maize	100	100	100	10
Cassava	68	12	Yes+	21
Groundnuts	95	83	Yes	24
Rice	100	73	Yes	57
Tomatoes	82	50	Yes	14
Sweet potato	91	12	No	43
Sorghum	64	63	Yes	0
Finger millet	9	22	Yes	0
Cotton	0	0	Yes	0
vegetables	5	0	No	0
Cowpea	95	56	No	0
Bananas	36	60	Yes	0
Bambara nuts	68	0	No	0
Sugarcane	41	48	No	0
Velvet bean	65	0	Yes	24
Pumpkins	91	95	Yes	85
Pigeon pea	48	0	No	14
Dolichos beans	36	0	No	45

+ It was not possible to determine percentages due to continuous departures and arrivals of participants

Table 2. Reasons for not growing certain crops according to focus group discussions.

Reason for not growing	Crops associated with reason	Constraint classification
Goats and wild animals attacking crop in dry season	Cassava, dolichos bean, sugarcane, pigeon peas, sorghum	Natural, social
Lack of seed	Tomatoes, sugarcane, pigeon peas, Irish potatoes, cassava, finger millet, bambara groundnuts, cowpea, vegetables	Technical, economic
Shortage of family labour	Rice, sweet potatoes	Social, economic
Bird attack	Sorghum	Natural, social
Mid-season dry spell	Sweet potatoes, rice	Biophysical, technical
New crop for them	Cotton	Technical
Heavy clay soil not suitable	Groundnuts	Natural
Lack of market	Rice, pigeon pea, velvet beans	Economic

nually dug wells, in low river banks or areas with low water tables (dimbas) while other farmers irrigate using water from the lake.

In addition to problems noted in Table 2, farmers identified several pest problems, such as wireworms and stalk borers in maize, bean beetles, mice, crickets, cassava mosaic virus, and cassava mealy bug. Farmers also mentioned lack of low lying wet lands (dimbas) for winter crop production. To further understand and analyse the production constraints, the problems stated by farmers were re-classified according to nature of problem, such as natural, biophysical economic and social, or in terms of possible solution such as technical, social, economic administrative. Notably, lack of seed was a constraint prevailing across many cross, and was considered technical and economic problem.

The prevailing cropping system was mixed cropping. Maize and pumpkin intercropping was the most predominant, followed by maize and cowpeas, dolichos beans (*Lab lab*), or velvet beans. Amongst the many crops, only rice or cassava was planted in pure stands, because these are grown under water-logged conditions. For the cassava, very large mounds are used for planting in order to avert the water logging.

Researcher observations

Field observations indicated that crops were differently affected by the dry spell. Early maturing hybrid maize varieties that were planted with first rains and grain legumes such as cowpea performed better than local maize or late planted crops. In maize there was general lack of knowledge on improved production practices such as importance of early planting, plant spacing within the row was too narrow, and plants per station were greater than four. The recommendation is to plant maize in ridges at 75 cm apart, 75 cm between stations with three seeds per station. Local, late-maturing maize varieties were commonly planted and there was lack of knowledge on improved varieties of cassava and legumes. The observations showed that a training component on general principles of crop production, such as use of improved varieties, early planting, weeding and fertilizer use and management would be necessary. Such training would have to show how these management factors link to drought escape, improved fertilizer use efficiency, pest management and higher yield. It was also clearly indicative that the introduction of any crops to be harvested beyond the month of May would suffer from goat attack.

Developing and intervention strategy for 2005/06 season

The research team then considered the results of FGD discussions and field observations and identified areas where feasible interventions were possible, with reference to Table 2. Shortage and lack of access to improved seed was a pertinent problem for many crops. As a technical constraint, the team considered that it was feasible to furnish certain seeds to the community, thereby simultaneously providing the economic empowerment needed to kick-start the systems. Therefore the team proposed to multiply seed for various crops in the 2005/2006 cropping season. At the design stage, seed multiplication involved cassava, cowpeas, bambara groundnuts and pigeon peas. The objective was to increase availability of seed for the various technologies to the people in Lungwena. Although maize is the staple for the area, the research team believed that the type of food shortage required the use of alternate crops. One common reason for food shortage is that farmers sell their crops soon after harvest, since many traders go into households to lure farmers into selling. Under such circumstances, crops such as cassava, which can actually be harvested during the food insecure periods of September to February, may be advantageous as they may not be prone to such unplanned sell, and that farmers are much better minded not to sale at such times. Also, the crops chosen do not require inorganic (chemical) fertilizer inputs (MoAIFS, 2005) and would therefore be easier to administer. Further, these crops required minimum isolation distances for permissible seed production purposes (Muliokela, 2005) . The legume crops were also preferred by women in that they were valuable relish for the home. In terms of nutrition, they are recommended as complimentary diet to starchy cereals or cassava. Maize was also excluded because, being a staple food, it is already promoted through many other national wide programs, such as the starter pack program (Blackie and Mann, 2005) and the fertilizer subsidy in 2005/06 and 2006/07 (MoAIFS, 2007). Many agricultural programs tackle food productions issues from the poverty point of view (Blackie and Mann, 2005). Lack of seed has previously been reported as the main reason for farmers' failure to adopt improved crop varieties (Masangano and Miles, 2005). The design of a seed production must be guided by the objective of the program (Setimela et al., 2004). In this case, the aim was not to organize commercial seed production, but rather to introduce seeds into the area, to be circulated by a range of systems, which could include selling, gifts and facilitated sharing (pass-on system).

The research team established tentative seed output targets and the estimated land requirements. It was planned that seed would be multiplied in Lungwena by farmers themselves to ensure farmer participation in the project and dissemination of the technologies. However, some seed would also be multiplied at Bunda College Crop Science Research Farm and at Lungwena EPA office field plot in order to provide a back up, in case demand would be very high. The planned total area was 2 hectares for cassava, bambara nuts and cassava and 3 hectares for pigeon peas. Researchers noted the need to discuss with the chiefs on issues related to land, criteria for selecting farmers, sharing of seed and whether seed should be given to individual or a group of farmers. As a framework it was envisaged that suitable farmers would be willing to participate, have land that is accessible to the community so that people should be able to visit the plots, and be able to explain to others what technologies are being shown and the associated cultural practices.

Participatory program design

During the program development discussions, all the 3 villages (Chilonga, Chapola and M'dalamakumba) accepted that a seed multiplication program, involving the proposed crops (Cassava, cowpeas, bambara groundnuts and pigeonpea should start in the 2005/2006 crop season. It was also agreed that all crops would be grown in pure stand. Participants indicated that the programme would assist them to acquire seed of various crops and were willing to actively participate. They expressed gratitude to the researchers for taking their problems into consideration. The discussions also included issues on

Table 3. The agreed plot sizes and numbers of farmers to be involved for each crop.

Crop	Plot area (ha)	Number of plots/village	Total number of plots (farmers) in the 3 villages	Total area in the 3 villages (ha)
Cassava	0.12	5	15	1.8
Bambara nuts	0.12	5	15	1.8
Cowpea	0.12	5	15	1.8
Pigeonpea	0.12	6	18	2.2
Total		21	63	7.6

Table 4. The sharing arrangements for the pass-on system.

S/N	Crop	% To Owner	% To Pass-on
1	Cassava	i). Roots: All roots go to owner ii). Stems: 30%	i). Roots: none ii). Stems: 70%
2	Bambara	70%	30%
3	Cowpea	70%	30%
4	Pigeonpea	70%	30%

land area to be allocated to the various crops, criteria for selection of fields for seed multiplication, sharing of crop produce/seed, criteria for selection of participating farmers, organizational and model for sharing seed yield. The agreed plot sizes and numbers of farmers to be involved for each crop were as shown in Table 3.

Regarding criteria for selection of participating farmers, all communities agreed that the participating farmers should be willing to participate, hard working and energetic, be able to follow all cultural practices as instructed, have land that is accessible to the community so that people should be able to visit the trials and should be able to share with others the technologies that are being shown and the associated cultural practices.

On organisational structure, farmers agreed to have their names written including those on the waiting list. Farmers also decided to form groups but would work individually on their plots. Each group would have a chairperson, secretary and treasurer. Farmers resolved that a fence should be built on cassava and pigeon pea plots to protect the crops from animals such as goats. The participating farmers agreed to complete land preparation by mid October, 2005. After debate, it was agreed that seed would be passed on as shown in Table 4.

In addition, farmers requested that seed should be delivered timely (that is, by end of October 2005 for all the 3 legumes) and onset of rains for cassava. Farmers also permitted the researchers to visit Lungwena in mid-October to assess progress on land preparation.

Implementation of the seed multiplication activities

All seeds, except bambara groundnuts, were delivered on time. As there is no research programme on Bambara groundnuts in Malawi, it was difficult to find large quantities of seed. The objectives of this exercise was to increase production of basic or foundation seed of cassava, cowpea and pigeon peas, hence these were obtained from research responsible institutions. The ultimate goal was to extend the period in which the seeds can be used, and to provide seeds of high yield potential and improved pest resistance. For cassava the variety supplied was Mbundumali. It is high yielding variety with sweet taste. It is suitable for local markets, since most farmers consume cassava in raw form or after direct boiling. Cassava in the area is not processed into flour, hence bitter varieties would not be suitable. The cowpeas varieties used were Pinkeye and 418, obtained from Bunda College. The pigeon pea variety was ICP9145, with resistance to fusarium wilt, a fungal disease which causes die-back of stems. Field technicians from Lungwena EPA supported the farmers with advice on management of their plots.

After delivery of inputs, a monitoring trip was undertaken, which revealed that only a small proportion of the planned number of farmers actually participated (Table 5). Many registered farmers did not pick up seed for planting at all. For crops such as pigeon pea and cassava, farmers cited the need to fence as cause for lack of interest. No clear reason was given for cowpeas.

A visit was conducted in August 2006 to get feedback from the farmers involved in seed multiplication and assess their yields, and to facilitate sharing arrangements. A summary of actual seeds grown and estimated yield is shown in Table 6.

Training of participating farmers

A one-day training session was conducted for all partici-

Table 5. The number of farmers involved in seed multiplication and the land area planted, including field at Lungwena EPA centre.

Village	Crop	Total area planted	No. of farmers by gender	
			Male	Female
Chilonga	Cassava	0.64 ha	3	1
Chapola	Cassava	0.53 ha	6	2
	Cowpeas	0.2 ha	0	11
	Pigeon peas	?	1	0
Mdala-Makumba	Cassava	0.79	3	3
	Cowpeas	0.72	1	5
	Pigeonpeas	0.10	0	1
Total			15	15

Table 6. Numbers of seed growers, estimated yield, and sharing arrangements at end of season.

Village name	Crop	No. of Farmers	Estimated production	Sharing arrangements
Chilonga	Cassava	2	-	7 farmers identified to share seed with
Chapola	Cowpea	9	141 kg	No farmers identified for sharing. Farmers to plant in own fields
	Cassava	3	-	One farmer identified for sharing
Mdala Makumba	Cassava	2	-	Seed already shared with 11 farmers. Encouraged to find 3 other farmers.
	Cowpeas	3	150 kg	Encouraged to find 8 farmers.
	Pigeon peas	1	-	Not harvested then, no farmer identified for sharing

pating farmers. The aim of the training was to improve the knowledge of farmers on general principles of crop management and to explain to them the importance of these for higher yields. Farmers were also taught general principles of pest and disease management. The crop plots at the EPA were used for field demonstration. The link between pest management and general management was emphasised. After the training session, farmers indicated that the training session was beneficial to their knowledge of integrated crop and pest management. Since the training took part within the growing season, it was not possible to monitor its impact on the way farmers manage their crops or on yields.

DISCUSSION AND CONCLUSION

The paper has presented a description of the complete process of problem identification and identification of possible solutions. A review of the project shows that only 20 growers took part, out of a planned 63 growers. Many seed programs tend to be community based. Farmers grow seed as a club, or schools are used (Setimela et al., 2004). In this study, farmers opted to grow seed individually, the main reason being to avoid 'free riders' and 'drop-outs'. The view of the researchers is that farmers did not have commitment and desire for improved seed, and researchers and development agents should develop mechanisms to identify such farmers and communities. One possible way to raise enthusiasm would be to conduct awareness campaigns on the potential yields and other advantages of improved varieties, market opportunities, utilization, and storage. Another lesson learnt was that having effective local leadership is important for such programs. For example, the chief in M'dalama-kumba village helped to coordinate our activities, and it ensured initial farmer and confidence in the program. As a contrasting example, there was the smallest number of participants in group discussions in Chilonga village, where we also had the least number of farmers growing seed. Some of the farmers that took part planted out larger areas than planned, indicating that the programme was most suitable for them. It was also noted that farmers had high enthusiasm with cassava because it has a double role as a food security crop and cash crop. Even then, the need to fence fields of cassava and pigeon peas against goats deterred some farmers. Some farmers transferred their cuttings to dimba (wet areas) as a means of seed preservation. Cowpea was easy to manage in this respect, however, in the field it was very susceptible to a range of insect pests and weevil attack in storage.

ACKNOWLEDGEMENT

We would like to acknowledge the financial support of the Norwegian Centre for International Coorperation. We also like to thank staff of Lungwena EPA and Mangochi District Agriculture Office for their splendid support and collaboration during the project.

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