The McKnight Foundation

Collaborative Crop Research Programme: Improving Food Security and Nutrition through Edible Legume Research in Malawi, Mozambique and Tanzania

LEGUME BEST BETS TO ACQUIRE PHOSPHOROUS AND NITROGEN AND IMPROVE FAMILY NUTRITION 06-740

ANNUAL REPORT 2006-7

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1.WEBPAGE Summary

The "Legume Best Bets to Acquire Phosphorous and Nitrogen and Improve Family Nutrition" project is being implemented in Northern Malawi at Ekwendeni, and in Central Malawi at Kasungu. An innovative team of non-governmental partners and farmer research and extension teams have partnered with researchers to investigate 1) legume diversification options for improved soil nutrition and family health; and 2) participatory technology development approaches. Nutrition education with farm families' has markedly enhanced interest and farmer experimentation with legumes such as pigeon pea (*Cajanus cajan*) intercropped with groundnuts, and *Mucuna*.

- A baseline survey was carried out, including documentation of cropping systems, farmer utilization of legumes, and soil sampling
- An on-farm soil test kit provided immediate soil pH and texture results to facilitate discussions with farmers and soils were collected for laboratory analyses
- 94% of participating farmers are trying to grow pigeonpea in Ekwendeni, whereas the new sites in Kasungu have few farmers currently growing pigeonpea, but many interested in experimenting with this new legume system
- On-farm research trials were designed based on participatory planning and initial findings; these will be carried out in 2008 with 50 farmers to quantify nitrogen fixation, maize nutrition, cropping system performance and soil improvement from legume best bet technologies
- Innovative extension underway includes nutrition education through recipe days, on-farm testing of legume varieties and residue management practices, and farmer-to-farmer visits

2. RESEARCH REPORT

2.1 Authors – Research Team

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2.2 INTRODUCTION

Smallholder farmers in East and Southern Africa face considerable development challenges. In Malawi, at least 1 million households have chronic food deficits, 50 percent of children under 5 are severely malnourished (wasted or stunted), and 60 percent of the population subsist on less that $1 per day. A series of droughts over the past decade have exacerbated the food problem. Average farm sizes are around 1 hectare, necessitating continuous cropping primarily of maize, the main cereal crop. As a result soil fertility, especially on sandy soils, is low. Low incomes mean that few farmers can afford to use purchased inputs (in the absence of subsidies), and there is limited knowledge of organic matter technologies such as composting.

Legumes have been widely used in many African countries in part to improve soil health and in part to improve family nutrition. Legumes contribute towards soil nitrogen through their ability to fix atmospheric nitrogen. Similarly some legumes have the inherent capacity to increase phosphorous through their symbiotic association with mycorrhiza. Legumes also contribute to protein when included in the diet of family households. Various traditional legume recipes have been developed over centuries and new ones are still being developed with the view to enrich the diets, particularly child weaning foods. In Malawi several legumes are grown for the foregoing reasons. Some such legumes include ground nuts (Arachis hypogaea), velvet beans (Mucuna puriens), soybeans (Glycine max), Pigeon peas (Cajanus cajan), Bambara nuts (Vigna subterranea), and Cowpeas (Vigna unguiculata), among others. Grains from these legumes have been used in various recipe combinations for the purposes of enriching the diets of family households.

A project entitled “Legume Best Bets to Acquire Phosphorous and nitrogen and Improve Family Nutrition” is being implemented in Malawi using participatory approaches. The project is funded by the McKnight Foundation under the Grant Number 06-740. It covers the Northern and Central Regions of Malawi. In the North, it is being implemented in Ekwendeni area of Mzimba District in collaboration with the Soils, Food and Healthy

Communities Project of Ekwendeni Mission Hospital. The participating farm households are patrilocal with half of them being female headed. In Central Malawi, the project is being implemented in Kaluluma Extension Planning Area (EPA) of Kasungu Agricultural Development Division (KADD) in Kasungu District. The Malawi Enterprise Zone Association (MALEZA) is the main collaborating partner. In both study sites, Farmers have organized themselves into Farmer Research and Outreach groups which have leadership structures that guide in decision making and in the implementation of development activities.

2.3 NARRATIVE SUMMARY

The project started in November 2006. This report covers the first year of the project, 2006/07.

OVERALL OBJECTIVE: To improve household food & nutrition security by increased legume production and utilization and improved soil quality.

2.3.1 Objective 1: Determine sets of characteristics of 'best bet' legumes and legume combinations which address nutritional and soil requirements.

Activities Year 1

2.3.1.1 Preferred legumes and characteristics

A baseline survey was conducted in Ekwendeni catchment of Mzimba district in northern Malawi and Kaluluma Extension Planning Area (EPA) of Kasungu district in Central Malawi to identify preferred legumes, cropping systems and characterize soils (Tables of preliminary findings are given in Appendix 1).

In Ekwendeni catchment, food legumes are already widely grown to improve family nutrition. This is in large part due to the existence of the SFHC project in the area, which has been promoting legumes, particularly for child nutrition, since 2000. The major

legumes found to be grown in Ekwendeni are groundnuts, pigeon pea and soybean. Cowpea, beans, bambara groundnut, velvet bean and *Tephrosia* are also grown. Groundnuts and pigeonpea are grown for consumption and soil fertility improvement. Soybean is used to enrich porridge which improves people's nutrition, especially children. Some farmers grow legumes on a larger scale but there are no reliable markets. In Kasungu, soybean, common beans and groundnuts are widely grown for food and sale. These are grown in pure stands. Since the promotion of compost making by MALEZA from 2004, application of compost manure can occasionally be found on maize fields to improve soil fertility.

In general, farmers have been found to prefer legumes that are edible, early maturing, high yielding, improve soil fertility and are resistant to diseases and pests. For some legumes, like groundnuts, varietal characteristics such as seed size, seed color, yield potential, oil content, growth habits and adaptation to drought, influence farmers' choice. Local varieties of groundnuts have excellent storage properties and quality traits to produce groundnut flour for consumption and local sales. However, local varieties tend to be moderate yielding, whereas improved types often have high oil content (thus do not store well as become rancid) and in some cases higher yield potential.

2.3.1.2 Legume combinations that address soil fertility

A participatory technology development (PTD) approach has been used to identify legume best bets for Kasungu and Ekwendeni involving farmer research and outreach teams, researchers and NGO partners. The approach is summarized in Appendix 2.

Groundnut and pigeonpea have been identified as potential one 'best bet' technology for Ekwendeni farmers, where land holding sizes average 1 to 2 ha. This new 'doubled up legume' technology has unique soil fertility improving potential and involves intercropping groundnut with pigeonpea by planting the seeds in the same row (in separate planting stations) in the first year. Crop residues from groundnut and pigeonpea are incorporated after harvest. In the subsequent season, ratooned pigeonpea crop is

intercropped with maize. The farmer obtains multiple benefits through efficient use of labor and land while improving soil fertility, yield and family nutrition.

Other potential 'best bets' for Ekwendeni appear to be soybean pigeonpea intecrops, and rotation of maize with groundnut. There is some interest in rotation of maize with mucuna, but only among farmers with larger land areas.

In Kasungu maize intercropped with common bean is a dominant practice, and new legume systems have been selected through the PTD process as potential best bets. These are maize intercropped with pigeon pea or soya, and maize – groundnut rotations. Compost manure is also being tried on some farms, having been promoted by MALEZA over the past 2 seasons. These technologies and other potential best bets will be tested on farmers' fields during the coming season (2007/8). Soil samples were collected from paired legume and non legume fields during the baseline survey for analysis of macro and micro nutrients and soil organic matter pools. A detailed assessment of nutrient flows in the farming systems will be carried out in 2007/2008 season where trials will be conducted.

2.3.2 Objective 2: Capacity building among participants

2.3.2.1 Farmer to farmer exchange visit and training on formation of Farmer Research and Outreach Training (FROTs)

Four representatives of farmer clubs in Chulu and Kaluluma EPAs of Kasungu District attended a field day organized by the SFHC farmers at Luhomero, Ekwendeni in April 2007. The group observed various legume-based soil fertility improving technologies being promoted such as the doubled up legume technology of pigeonpea and groundnuts, incorporation of residues from soybean and velvet beans (*Mucuna pruriens)*, and Fish bean *(Tephrosia volgelii)* improved fallows. The visiting farmers also observed the advantages of working in groups and farmer research teams (FRT).

A reciprocal visit was organized whereby a group of farmers' representatives from Ekwendeni SFHC project traveled to Kasungu in July 2007, hosted by MALEZA and Bunda College. Farmer groups from both areas learnt from each other's experiences on formation, roles and challenges facing their Farmer Research and Outreach groups.

Ekwendeni farmers also learnt how to make and apply different types of compost manure, and gained information on seed banks, enterprise development, and community based natural resource management.

2.3.2.2 MSc and PhD students enrolled at Bunda College and MSU

Austin Phiri (MSc student) and Wezi Mhango (PhD student) were enrolled at Bunda College and MSU, respectively, in August 2006. Both are taking courses and carrying out research concurrently. They have reviewed literature on previous work on different legumes grown by farmers under different farming systems, their role in improving human nutrition, soil quality and household income. In May-August 2007, the students conducted baseline surveys in Ekwendeni and Kasungu to characterize the farming systems, legume options and their role in improving soil and family nutrition. In the coming 2007/2008 season, they will conduct on farm research to quantify nutrient flows and identify legume technologies that improve soil quality in farming systems.

2.3.3. Objective 3: Best bet legumes form part of household diets

2.3.3.1 Recipe Days

Recipes have been developed for key legumes including soy beans, velvet beans, pigeon peas and groundnuts by Nutrition Research Teams (NRTs) from Ekwendeni. Recipe training and demonstration were conducted in villages, nursery schools and mobile clinics in Ekwendeni to promote and demonstrate diversified diets with different nutritious recipes. The days involve cooking, learning about and eating different meals. They are held at different times of the year to highlight different issues e.g. hungry season recipe days during the rainy season to demonstrate healthy recipes which can be made from available foods during the lean period. A total of 432 men, 567 women and 349 children attended recipe days during 2006/7. Recipe days have been planned to demonstrate legume recipe preparations to their counterpart farmers in Kaluluma EPA. The overall objective for the Project is to eventually promote a culture of legume integration in household diets.

2.3.4. Objective 4: Changes in soil P, N, organic matter and yield response documented in relation to legume bests bet

2.3.4.1 Soil sampling

During the baseline survey, a farm field survey was conducted after the household interviews. We collected soil samples paired legume diversified and non legume field of each farmer that was interviewed. The samples were collected from top soil (0-15cm) and sub soil (15-30cm). Soil pH and texture were done *in situ*. After the tests were carried out in the field, we discussed the results with the farmer and learned more about local soil improving practices. We provided a copy of soil test results from their fields to each farmer. This was an important step in building quality relationships, by conducting a transparent process of soil testing and through discussions of soil nutrient status and methods to improve fertility, both farmer practice and alternative technologies, including legume residue incorporation, compost and fertilizers.

We have started the next step which is to analyze the soils for macro and micro nutrients and organic matter pools at Michigan State University. Preliminary findings are presented in Appendix 3. These results have been used to select contrasting sites with high and low soil organic matter, for on-farm trials in the 2007/2008 season. Over the long term this will improve our understanding of how legume species influence soil nutrient dynamics, and which legumes should be recommended for different soil types.

2.4 IMPLICATIONS OF THE RESEARCH FINDINGS

2.4.1 Implications for next stage of research

Preliminary results of the baseline studies indicate that soils of farm households are low in essential nutrients including nitrogen and phosphorous. Soils of both study sites were moderately acidic, with a few sites being strongly acidic. In order to document the ability of different legume species to ameliorate the soil infertility problem, and to evaluate the impact of legumes as part of a range of soil fertility management practices, on-farm research will be implemented through this Legume Best Bets Project using participatory techniques and Mother and Baby Trial designs, in partnership with smallholder farmers.

Mother Trials will be replicated within a site, and will test a wide range of legume species and soil fertility enhancement technologies (see Appendix 5). Farmers will take the lead on 'baby trials' where each trial is managed by a farmer and is one replicate of a selected subset of technologies, including the legumes the farmers are most interested in testing and a farmer designed control. At Kasungu, farmers are interested in alternative fertilizers as well as legumes and will test compost and a locally available Tunduru Phosphate Rock (TPR), which will be included at selected sites to determine its effect on soil pH and the availability of nutrients, especially phosphorous. Details of the treatments and treatment combinations are presented in Appendix 5. Two mother trials are being conducted in each of the 5 villages in Kasungu, plus 20 on-farm baby trials and 20 trials will be carried out in Ekwendeni, for a total of 50 trials.

The baseline survey carried out in Year 1 of the project is currently being analysed and results will be presented by socioeconomic group as well as length of involvement in legume development programmes. This will be followed up by community profiling, wealth ranking and livelihood mapping activities in Year 2. These will guide the participatory research process and facilitate development of recommendations for different socioeconomic or livelihood groups across the research areas.

2.4.2 Implications for future development activities

It is envisaged that those best bets that show potential for adoption will be candidates for scaling up to other smallholder farmers especially in those areas of similar agro ecologies. The Farmers Union of Malawi, which is collaborating in this project, is expected to play a crucial role in scaling up the "best bet" technologies by virtue of their wide coverage of the country. The project is also working closely with the Ministry of Agriculture and Food Security (MoAFS) to ensure commitment and sustainability. MoAFS has indicated interest in piloting the FROT approach for selected technologies including soil fertility and nutrition, for example in each Extension Planning Area (EPA) in Kasungu Agricultural Development Division (ADD).

2.4.3 Implications for policy

In terms of policy the Legume Best Bets Project intends to facilitate the formation of the Legume Network whose primary objective will be to serve as a forum for promotion of legume research and extension through information sharing and dissemination including seed availability, marketing opportunities and community research and outreach approaches, among others.

3. TEAM REPORT

3.1 TEAM ACTIVITIES

3.1.1 Stakeholders planning meeting

A project planning meeting took place in February 2007 in Kasungu, Malawi to which all stakeholders were invited. Participants attended from Bunda College, Michigan State University, Farmers Union of Malawi (FUM), SFHC, farmers, Ministry of Agriculture Irrigation and Food Security, ICRISAT and PLAN International.

Objectives of the meeting were:

1) To sensitize stakeholders on the existence of the Legume Best Bets Project which is funded by the Mc Knight Foundation of the USA;
2) To discuss the roles for each prospective stakeholder; and
3) To map out the way forward in the planning, implementation, monitoring and evaluation of the Legume Best Bets Project.

Participants developed a work plan for year 1 project activities, institutions responsible and time frame (Appendix 4). The work plan has guided project activities over the year 2006/7.

3.2 INSIGHTS AND LESSONS LEARNT

3.2.1 Complementarity of partners:

Following the Stakeholder meeting in February 2007, roles of partners were reviewed and some revisions made to the collaborators as envisaged in the proposal. The notable change is the replacement of World Vision with MALEZA, an NGO that is very active in Kasungu. Partner organisations and their strengths are summarised below:

– SFHC – Human nutrition and community-based research and extension

- MALEZA – Soil nutrition and community-based research and extension
- Bunda – Research on legumes, soils, participatory approaches
- MSU – Research on organic matter technologies, soils, gender
- FUM – Community organisation, marketing
- MoAFS – Extension inputs

3.2.2 Project sites

The project proposal envisaged 4 research sites covering all regions of the country. However, due to resource constraints it has been necessary to reduce the number of project sites to focus on areas where work on identifying scaling up legume technologies for human and soil nutrition are already underway. These are the areas in which it was believed the Best Projects could add strategic and significant inputs. Thus the project is now focused on 2 sites:

- Ekwendeni, Northern Region
- Kasungu, Central Region (Kaluluma EPA).

It is hoped to extend activities to the other sites (Dedza and Zomba) in the final year of the project through collaboration with development organisations in the area.

3.2.3 Institutional structures

Effective community structures for carrying out participatory research and outreach activities are critical to the success of the project. Collaborating partners in both each sites have developed such organisations over a number of years: Farmer Research Teams by SFHC in Ekwendeni and Community Agricultural Workers by MALEZA in Kasungu. Thus, rather than creating parallel structures, the Best Bets Project is strengthening the capacity of these existing organisations to carry out effective research and outreach. Areas requiring support have been identified as: seed selection and storage, recipe development and nutrition training (Kasungu), composting and organic matter technologies (Ekwendeni). Activities have therefore been planned for 2007/8 including:

- Farmer exchange visits: farmers learn from each other
- Recipe days and demonstrations

- Seed selection and storage management

3.2.4 Family nutrition education and measurements

The goal of promoting nutrition outcomes were discussed by the project team and nutritionists at the CoP meeting in September 2007, and the importance of promoting nutrition education was agreed upon for Kasungu in 2007/8 (activities are already under way in Ekwendeni), including surveys evaluating legume presence in diets through food frequency assessment. The nutritional assessment component of the workplan has been revised to accommodate these activities. The importance of collaborating with other projects to promote anthropogenic measurements at the case study sites was agreed upon as well, with the understanding that it is a major undertaking to conduct research that documents the impact of dietary changes on anthropogenic responses and beyond the scope of our current activities. We acknowledge that our project goals are ambitious, including integrated research and extension using participatory approaches to understanding and improving diversification of farming systems with best bet legumes, and quantifying the impact on soil nutrition. We hope that we will be successful in building more collaborative partnerships with nutritionists at both sites.

4.0 WORKPLAN: Best Bets Outputs and Activities Year 2 – 2007/08

	Descriptor	Activities Year 2	Institutions responsible (Lead*)	Time -line	Cost	Observations
Overall objective	To improve household food & nutrition security by increased legume production and utilization and improved soil quality	•				
Objective 1[1]	Determine sets of characteristics of 'best bet' legumes and legume combinations which address nutritional and soil requirements					
Output 1.1	Recommendations developed in partnership regarding farmer preferred characteristics and tradeoffs associated with legumes (audience for recommendations: farmers, development agents, extension, researchers)	• Analysis of baseline survey in Ekwendeni and Kasungu • Identify best bets for testing - mother trials (researcher) & baby trials (farmers) • Lay out trials • Procure seeds -ICRISAT, Bunda, Seedco, Chitedze • Farmer managed trials – researcher, NGOs, CAWs, FRTs, MoAFS	*BC, MSU, SFHC, MALEZA, MoAFS, FRTs, CAWs, research students	Sept-Dec Dec-June		
Output 1.2	Specific legumes and combinations of legumes identified for niches - agroecologies, household types	• Community and farmer profile – mapping, wealth ranking • Farmer and researcher assessment of varieties (soil N, P, K, subsequent yields yield, maturation, soils, cookability – leaf and grain, storage, market, weaning food etc.)	BC* FRTs, CAWs, MoAFS, MSU, NGOs, research students	June-Aug		
Output 1.3	Training materials on best bet	• Socioeconomic study on	*BC, MSU,	May-		

[1]Combines original Objectives 1 and 2

	technologies and fertilizer equivalencies developed in partnership and disseminated	inorganic fertilizer costs/benefits, incl transport	MoAFS, UWO, MSc/PhD/BSc students, FROTs, NGOs	Sept		
Output 1.4	Publication of research materials on case study of legume best bet, including farmer adoption, economics, soil amelioration, nutrition and tradeoffs	Draft documents produced for review	*BC, MSU, NGOs, UWO			
Objective 2	Promote best bet legumes in diet to improve household food and nutrition		BC Nutritionist, UWO, HSAs, NGOs	Feb & Aug		Supplementary budget to be submitted
Output 2.1	Best bet legumes form part of household diets	• Dietary survey - frequency assessment for legume presence	*BC, FRTs, SFHC, Maleza, MoAFS, HSAs	Feb &July		
Output 2.2	Training materials for recipes and recipe days developed and disseminated	• Recipe development & adaptation • Training of CAWs	*SFHC, MoAFS, NGOs, BC			
Output 2.3	Farmer knowledge gained of legume nutritional contribution	• Documentation of process - Ekwendeni	*SFHC, FRTs, BC, MoAFS, NGOs			
Objective 3	Quantify the effect of legumes on soil P, N organic matter and yield of subsequent crops			Sept-Dec July		
Output 3.1	Changes in soil P, N, organic matter and yield response documented in relationship to legume best bets	• Analyses of baseline survey, soil samples	* MSU, BC	June-July		
Output 3.2	Training materials developed in partnerships and disseminated on the soil effects, fertilizer equivalencies and yields from best bet technologies	• Training on organic matter technologies (composting), seedbanks – Ekwendeni • Farmer exchange visits	*BC, FROTs, Maleza, MoAFS	Nov July		
Output 3.3	Knowledge enhanced and researchers sensitized through publications		*BC, MSU, relevant ministries			
Objective 4	Strengthen farmer, research, extension and NGO capacity in legume production and utilization, including gender issues	• Field days Kasungu farmers to Ekwendeni • Institutional stakeholder analysis,	SFHC, BC	June-July		

		community profiling				
Output 4.1	Farmer research and outreach teams' research skills in legume production and utilization and leadership in addressing community challenges strengthened	• Strengthening FRTs, CAWs - Exchange visits for volunteers, Plan activities • Seed banks: training in management (grading, storage, access)	FROTs, Farmers, *SFHC, FUM, HH/Maleza	June		
Output 4.2	Knowledge, information flows and skills on legume production and utilization among farmers, researchers and extension improved.	•	*MoAFS, NGOs, BC, MSU, ICRISAT			
Output 4.3	Capacity of research, extension and training institutions dealing with legumes increased.		*BC, MSU, UWO, ICRISAT			
Output 4.4	Students trained at BSc, MSc. And PhD level		*BC, *MSU			
Output 4.5	Strengthen linkages between legume researcher, extension, farmer groups, NGOs and private sector on production and utilisation					
Output 4.6	Policy makers sensitized about legumes best bets.		*BC, FUM, SHFC relevant ministries, NGOs, CISANET,			
Output 4.7	Strengthen gender equity in legume production and utilization. Gender awareness in division of resources, labour and decision-making in legume production and utilization promoted in communities, R&E and development organisations.	• Kasungu: Gender sensitization and farm association empowerment • Ekwendeni: Project level mainstreaming and planning • Sensitisation at community level and stakeholders	*BC, MSU, MoAFS, Ministry of Gender, NAC, OPC (Nutrition, HIV/AIDS) FUM, NGOs			

APPENDIX 1: SOME PRELIMINARY FINDINGS FROM BASELINE SURVEY

Table 1. Farmers Growing Legumes, Ekwendeni (%)

Legume	Freq (n=44)	Active % (n=32)	Control % (n=13)	% Growing
P/pea	38	94	69	86.4
G/nut	43	97	100	97.7
Soybean	39	100	62	88.6
Climbing bean	11	26	23	25.0
Dwarf bean	31	68	77	70.5
Cowpea	17	39	38	38.6
Ground bean	11	32	8	25.0
Mucuna	16	35	38	36.4
T.v.	7	23	0	15.9

Table 2 Farmers' reasons for growing legumes (%)

Legume	N	Soil Fert.	Food/relish	Child Food	Sale	Other
P/pea	38	89.5	100.0	2.6	42.1	10.4
G/nut	43	70.0	100.0	13.9	93.0	0.0
Soybean	39	71.7	30.7	87.1	71.8	2.6

Table 3: Information required by farmers on legumes (%)

Information	P/pea	G/nut	Soybean	Bean	Mucuna
Planting	15.0	15.4	30.7	9.5	16.7
Crop system	15.0	7.7	3.9	9.6	8.3
Agronomy	20.0	23.1	34.6	19.1	16.7
Soil fertility	10	3.9	0.0	9.6	8.3
Seed	10	3.9	7.7	4.8	0.0
Post-harvest	35	27.0	15.4	9.5	0.0
Marketing	15	11.5	19.2	4.8	8.3
Utilisation	15	30.8	50.0	9.6	58.3

APPENDIX 2: PARTICIPATORY TECHNOLOGY DEVELOPMENT APPROACH

The project has adopted a participatory approach with farmers to ensure:

- food, nutrition and soil fertility needs of target households within the community (food insecure, malnourished, those with children) are addressed;
- farmer preferences and existing practices are included in Best Bet Technologies
- Best Bet technologies are tested under field conditions with farmer management
- Farmers monitor and evaluate their trials to complement researcher soils and crop measurements
- Farmers support recommendations for further testing and uptake (may be tailored to specific groups)

Basic steps of the PTD approach:

Step 1. Selection of communities
Step 2. Agreeing on issues to work on (Participatory Diagnosis)
Step 3. Search for technology options - Technology selection (Best Bets)
Step 4. Testing technology options (Farmer Baby trials)
Step 5. Evaluating Technology Options
Step 6. Reporting back to the community
Step 7. Integrating promising options into farms
Step 8. Extending to other farmers in the village
Step 9. Scaling-up successful technologies to other villages

3. Farmer Selection of Best Bet Technologies for testing

The first 3 steps of Participatory Technology Development were carried out in Year 1:

Step 1. Selection of villages - MALEZA villages with an interest and experience in legume cultivation and other soil fertility technologies (composting)

Step 2. Agree on issues to work with - through initial village meeting, baseline survey, discussions with farmers on soil fertility and nutrition problems, existing and potential technology options.

Step 3. Technology selection

Baby trials: Farmers choose 1 or more technology options (in addition to pure stand maize) for trying out on 10m x 10m plots.

Mother trials: 2 farmers per village test the whole range of technologies on their plots. (11 10x10m plots).

Step 4. Technology testing and monitoring etc **(Year 2)**

i. Measure out plots for mother and baby trials (researcher/CAWs).
ii. Source seed – researcher. Farmers will receive e.g. 1 kg seed and return 5 kg after harvest (MALEZA practice)
iii. Land preparation, including ridge realignment as necessary (farmer/CAWs)
iv. Cultivation – researcher recommendations on spacing etc and farmer management
v. Farmer monitoring of trial – technologies, planting dates etc. (provide notebooks)
vi. Researcher monitoring
vii. Farmer and researcher evaluation. Criteria for farmer assessment to be drawn up with the group.

APPENDIX 3: FINDINGS FROM BASELINE SOIL ANALYSIS

Characterization of soils from Ekwendeni

Soil pH from legume field top soil ranged from 5.5 to 7.0 with a mean of 6.5 and SE =0.056. Top soils from maize diversified fields had a pH of 5.5 - 7.0, mean=6.3 and SE= 0.069. Top soils vary from sandy to sandy clay loams while sub soils are dominated by clay loam to clay. Sandy soils contain low organic matter and have high leaching potential in case of heavy rains. Organic soil fertility technologies such as incorporation of legume residues can help to improve soil quality.

Characterization of soils from Kasungu

Soil pH from the top soil of legume fields ranged from 5.0 to 6.0 with mean of 5.8 (SE=0.050) whereas that from the sub soil of the same fields ranged from 4.5 to 6.0 mean = 5.5 (SE=0.064), suggesting that the soils in question are slightly acidic. In the maize diversified fields, the soil pH from the top soil (pH=5.0-6.0 with mean = 5.7 and SE=0.052) did not differ from that of the sub soil (pH=5.0-6.0 with mean =5.6and SE=0.057). Again these soils could be described as slightly acidic to acidic. Soil texture for the legume and the maize diversified fields ranges from sandy to sandy clay loam. Soils are currently being analyzed by Michigan State University and Bunda College for other macronutrients including potassium and micronutrients such as zinc.

APPENDIX 4: Year 1 Workplan revised at Stakeholder Workshop, **Kasungu, Feb 2007**

	Descriptor	Activities Year 1	Institutions responsible for outputs (Lead*)	Time-line
Overall objective	To improve household food & nutrition security by increased legume production and utilization and improved soil quality	• Project Planning Meeting – Stakeholder sensitization meeting in Kasungu	*BC	April
Objective 1,2[2]	Determine sets of characteristics of 'best bet' legumes and legume combinations which address nutritional and soil requirements			
Output 1.1	Recommendations developed in partnership regarding farmer preferred characteristics and tradeoffs associated with legumes (audience for recommendations: farmers, development agents, extension, researchers)	• Literature review by PhD and MSc students • Baseline survey in Ekwendeni and Kasungu	*BC, MSU, MoAFS, FROTs	June-July
Output 1.2	Specific legumes and combinations of legumes identified for niches - agroecologies, household types, etc.	• Procure seeds from ICRISAT, Bunda, Seedco, Chitedze, ASMAG, WVM, ICRAF, LRC • Initial assessment of varieties	*FROTs, BC, MoAFS, MSU, ICRISAT, NGOs	
Output 1.3	Training materials on best bet technologies and fertilizer equivalencies developed in partnership and disseminated		*BC, MSU, MoAFS, UWO, MSc/PhD students, FROTs, NGOs	
Output 1.4	Publication of research materials on case study of legume best bet, including farmer adoption, economics, soil amelioration, nutrition and tradeoffs		*BC, MSU, NGOs, UWO	
Objective 3	Promote best bet legumes in diet to improve household food and nutrition			
Output 3.1	Best bet legumes form part of household diets		*BC, FROTs, HH/Maleza MoAFS, other relevant ministries	
Output 3.2	Training materials for recipes and recipe days developed and disseminated		* FROTs, MoAFS, NGOs, BC, HH/Maleza	
Output 3.3	Farmer knowledge gained of legume nutritional contribution		*SFHC, BC, MoAFS, NGOs	
Objective 4	Quantify the effect of legumes on soil P, N organic matter and yield of subsequent crops	• Literature review by MSc and PhD student		
Output 4.1	Changes in soil P, N, organic matter and yield response documented in	• Baseline survey in Ekwendeni and Kasungu and soil	*BC, MSU	June-July

[2]Combines Objectives 1 and 2

	relationship to legume best bets	sampling		
Output 4.2	Training materials developed in partnerships and disseminated on the soil effects, fertilizer equivalencies and yields from best bet technologies		*BC, FROTs, MSU, MoAFS	
Output 4.3	Knowledge enhanced and researchers sensitized through publications		*BC, MSU, relevant ministries	
Objective 5	Strengthen leadership, outreach and research on legumes among farmers, extension and researchers.	• Project planning meeting, Ekwendeni and Kasungu (Ekwendeni FRTS participating) • Field day Kasungu farmers to Ekwendeni • Institutional stakeholder analysis, community profiling	SFHC, BC	April June
Output 5.1	Farmer research and outreach teams formed and community mobilised.	Formation of FROTS in Kasungu: • Seek permission from village authorities • Conduct sensitization meetings • Criteria for selecting members • Villages elect volunteers • Exchange visits for volunteers • Formation of FROTS • Planning for activities	FROTs, Farmers, *SFHC, FUM, HH/Maleza	June
Output 5.2	Farmer leadership improved in legume research and outreach and in addressing community challenges.		*SFHC, NGOs, FUM	
Output 5.3	Farmer research capacity on legumes improved		*BC, MoAFS, SFHC, HH/Maleza	
Output 5.4	Knowledge, information flows and skills on legume production and utilization among farmers, researchers and extension improved.		*MoAFS, NGOs, BC, MSU, ICRISAT	
Output 5.5	Capacity of research, extension and training institutions dealing with legumes increased.		*BC, MSU, UWO, ICRISAT	
Output 5.6	Students trained at BSc, MSc. And PhD level		*BC, MSU, UWO	
Objective 6	Strengthen linkages between legume researcher, extension, farmer groups, NGOs and private sector.			
Output 6.1	Malawi legume network promoted.		*MoAFS (Extension, Research, Crops) ICRISAT, OPC (Nutrition HIV/AIDS), NGOs, Seed Sector, FUM, CIAT	
Output 6.2	Existing structures dealing with legumes at district, area and village levels strengthened or new ones		*MoAFS, FUM, District Assembly, NGOs	

	established			
Output 6.3	Technical linkages between project and stakeholder ministries established.		*BC, MoAFS, relevant ministries	
Output 6.4	Communication and networking among stakeholders in project area increased.		*SHFC, HH/Maleza, other NGOs, FROTs	
Output 6.5	Policy makers sensitized about legumes best bets.		*BC, FUM, relevant ministries, NGOs, CISANET, SHFC	
Objective 7	Strengthen gender equity in legume production and utilization.	•		Sept
Output 7.1	Gender equity of division of resources, labour and decision-making in legume production and utilization promoted.	• Kasungu: Gender sensitization and farm association empowerment • Ekwendeni: Project level mainstreaming and planning • Sensitisation at community level and stakeholders	*BC, MSU, MoAFS, Ministry of Gender, NAC, OPC (Nutrition, HIV/AIDS) FUM, NGOs	
Output 7.2	Gender equity mainstreamed throughout project activities.		*BC, MSU, MoAFS, Ministry of Gender, NAC, OPC (Nutrition, HIV/AIDS) FUM, NGOs	

APPENDIX 5: PLANNED TRIALS FOR 2007/8

Ekwendeni Trials – 20 trials on low and high fertility soils

1. Maize sole cropped
2. Maize intercropped with Pigeonpea
3. Pigeonpea (Cajanus cajan) intercropped with groundnut (maize in year 2)
4. Pigeonpea (Cajanus cajan) intercropped with groundnut (maize intercropped with pigeonpea in year 2)
5. Pigeonpea sole cropped
6. Groundnut

Nitrogen fixation by natural abundance method (maize reference plant) and nutrient budgets will be carried out in 2008

Kasungu Trials – 10 `mother` trials;

1. Maize sole cropped
2. Maize plus P fertilizer 52 Kg TRP/ha
3. Maize plus N fertilizer 62 kg N/ha
4. Maize intercropped with Pigeonpea (Cajanus cajan)
5. Groundnut sole cropped (maize in year 2)
6. Pigeonpea (Cajanus cajan) intercropped with Groundnut (maize in year 2)
7. Groundnut + TRP at 52 kg P/ha
8. Maize plus N fertilizer 62 kg N/ha plus TRP 52 Kg P/ha
9. Maize + Pigeonpea + TRP at 52 Kg P/ha
10. Maize + Groundnut + TRP at 52 Kg P/ha
11. Pigeonpea sole cropped

Kasungu - 50 `baby` trials:

1. Maize only
2. Maize + N fertilizer
3. Legume intercrop (Farmers choose Maize intercropped with Pigeon pea or Pigeonpea intercropped with Groundnut)
4. Maize + compost manure*

* Compost to be included in Baby trials where available on-farm (10+ farmers)
TRP = Tundulu Rock Phosphate. TRP is now being mined and crushed under government license by Optichem in Phalombe.
'Mother' trials have the complete set of treatments.
'Baby trials': Farmers' have 10m x 10m plots with up to 4 treatments.
All systems will be planted to maize in year 2 of the trial
Maize planting stations 0.9 m planting station, 3 plants per station

Appendix 6 Photos from Year 1 activities

More food, improved soil fertility!

Fig 1: Pigeonpea that was intercropped with groundnuts in one of the farmers' field in Ekwendeni. Groundnut has already been harvested.

Fig 2: Compost manure works! A farmers in Kaluluma EPA explains how to make and apply compost manure during a farmer exchange visit

Farmers on exchange visit to Kasungu

Farmers assisting with soil sampling, Ekwendeni