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 2007-8

By

Prof. George Kanyama-Phiri, University of Malawi
Dr. Sieglinde Snapp, Michigan State University
Lizzie Shumba, Soils and Healthy Communities Project
Dr. Kate Wellard Dyer, University of Malawi
Patrick Thawe, Malawi Enterprise Zone Association, Kasungu
Dr Anne Ferguson, Michigan State University
Wezi Mhango Michigan State University
Austin Phiri University of Malawi

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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 with 46 farmers**, 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
- Initial results have documented low soil fertility, and a wide range of soil texture and organic matter characteristics among participating farmer field sites
- **94% of participating farmers have experimented** with growing the multipurpose legume 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 carried out in 2008 at 42 field sites in Ekwendeni and 32 sites in Kasungu to assess legume technologies, quantify nitrogen fixation, maize nutrition, cropping system performance and soil improvement from legume best bet technologies. Hundreds more farmers are involved in participatory action research and conducted their own experimentation. The initial growing season demonstrated the high variability in rainfall that is becoming more common, and crop yield in this stressed environment ranged from 400 to 1000 kg/ha.
- **Innovative extension** underway includes nutrition education through recipe days, on-farm adaptation of legume varieties and residue management practices, and farmer-to-farmer visits. Training materials developed include **3 Extension Bulletins on Legume Technologies and 10 Farmer Flyers on Legume**

Recipes. This provides information on how to utilize legumes, and how to manage doubled up pigeonpea-groundnut and multipurpose legume technologies. These have been developed and distribruted and they are being reviewed as part of an on-going process of iterative evaluation by multiple partners and then will be disseminated broadly. Additional training materials on compost preparation and legume recipes are planned for 2009.

- **Research and extension plans for 2009** are to follow up for a second year of on-farm trials, quantifying nitrogen inputs from biological fixation and impact on soil organic matter fractions. Farmer assessment is on-going and an iterative process. Initial research results have been summarized and reported at farmer field days, and at other research and extension venues in Malawi and the region.
- **Policy input:** An exciting development is input into Malawi government policy on agricultural subsidies, which have been broadened to include legumes for the first time. A policy stakeholder briefing meeting is planned for February, 2009 to promote broader understanding of the soil and family nutritional benefits from legume diversified technologies.

2. RESEARCH REPORT

2.1 Authors – Research Team

Prof. George Kanyama-Phiri, University of Malawi, Bunda College, Lilongwe, Malawi – Principal Investigator

Dr. Sieglinde Snapp, Michigan State University, East Lancing, Michigan, USA - Collaborator

Lizzie Shumba, Soils and Healthy Communities Project, Ekwendeni Hospital, Ekwendeni, Malawi -Collaborator

Dr. Kate Wellard Dyer, University of Malawi, Bunda College, Lilongwe - Collaborator

Patrick Thawe, Malawi Enterprise Zone Association, Kasungu, Malawi - Collaborator

Wezi Mhango Michigan State University, East Lansing, Michigan, USA - PhD Student and Lecturer, Bunda College of Agriculture, Univ. of Malawi

Austin Phiri University of Malawi, Bunda College - MS. Student and Chitedze Agroforestry Scientist, Malawi Government Ministry of Agriculture

Dr Anne Ferguson, Michigan State University, East Lansing, Michigan, USA - Collaborator

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 second year of the project, 2007/08.

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

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

Activities Year 2:

2.4.1 Participatory on farm trials/demonstrations, Ekwendeni catchment of Mzimba District, Northern Malawi

In 2007/2008 season, the PhD student, Wezi Mhango established on farm trails on 21 farmers' fields working with the SFHC project in Ekwendeni catchment, Northern Malawi. Groundnut, CG7 variety; pigeonpea, ICEAP00040; and maize, ZM621; were planted in sole and intercrop systems to quantify biological nitrogen fixation of the two legumes (Fig 1 and 2). At planting, soil samples were collected from all fields of the participating farmers to characterize the soil chemical and physical properties. The

student and the participating farmers also mounted rain-gauges in the study area and rainfall data was collected by the participating farmers. During the season, the following data were collected: chlorophyll readings, rainfall amounts, nodulation efficiency, plant samples to assess residue quality and quantify biological nitrogen fixation, general crop performance, and assessment of technologies by the farmers. Maize and groundnut were harvested in June, 2008, pigeonpea harvesting is in progress (August/September). Residues were incorporated soon after harvesting in all plots to facilitate decomposition and also protect them from livestock grazing.

Soil characteristics and Rainfall, 2007/2008 season

Soils are sandy to sandy clay loams, pH=6.1. Total soil N and P average 0.07% and 10.5 ±1 ppm respectively, which documents the low soil fertility that farmers must manage. The area received too much rains during the on set of rains that led to loss of one field due to flooding and presumably considerable nutrient leaching. This was followed by a drought approximately 2.5 months after planting. The high variability of rainfall has been predicted by global warming modeling, and this illustrates the challenges that farmers must adapt to and risky environments that require testing and research over multiple years.

Nodulation efficiency, BNF, leaf characteristics and crop yields

There was very good establishment of legumes. Preliminary results indicate effective nodulation of all legume genotypes in sole and intercrop systems. The average nodule number per plant at ~8 weeks after planting was 9, 92 and 119 for pigeonpea, intercropped groundnut, and sole groundnut respectively. Plant analysis to quantify BNF is in progress. Legumes had higher chlorophyll levels than maize indicating better leaf quality (higher nitrogen content) with the highest readings in pigeonpea (Fig 3).

Grain yields were affected by drought that occurred when groundnut was at pod filling stage and maize at grain formation stage. Maize intercropped with pigeonpea yielded 829 kg ha^{-1} compared to sole maize 984 kg ha^{-1}. Grain yield from sole and intercropped groundnut averaged 645.70 kg ha^{-1} and 466.63 kg ha^{-1} respectively.

Preferred technologies - Ekwendeni

A questionnaire was administered to farmers get feedback on the preferred technologies and constraints. A scale of 1-4 was used to rate each technology whereby: 1= very good technology; 2= good; 3= very poor; and 4= very poor technology. The double up legumes (groundnut/pigeonpea intercrop) and sole groundnut were rated as the best because of good crop stand, high expected grain yields and soil fertility benefits (Fig 4). Sole pigeonpea was rated second, followed maize/pigeonpea and lastly sole maize. Farmers indicated that intercropping technologies save labor, provide diverse food products, and conserve soil moisture. The poor performance of maize was attributed to the dry spell and low soil fertility.

Farmers were also asked to list the technologies that they are willing to grow more of. Over 80% of the farmers indicated that they would like to grow more of the double-up legume technology, followed by maize+pigeonpea intercrop (20%). The major constraints to use of these technologies are lack of seed, unreliable rainfall, pests and diseases, labor availability, and high cost of inorganic fertilizer for maize production.

2.4.2 Dissemination and farmer outreach activities in Ekwendeni. Field days are one way of disseminating research findings by the Farmer Research Team, and the University led on-farm research. This year, field days were conducted in Emazinyeni and Ekwaiweni in April 2008. A total of 443 men, 607 women and 497 children attended the three field days. Participants included farmers who had not participated with the project or with trying out new legume varieties in the past, as well as hospital staff, village headmen, participating farmers (already experimenting with legumes), and farmers from Kasungu working with the MALEZA project. The activities included visits to new legume fields and fields which were managed with soil fertility enhancing practices, such as timely incorporation of crop residues.

2.4.2 Participatory on farm trials/demonstrations, Kaluluma EPA, Kasungu District, Central Malawi

The Masters student, Austin Phiri, conducted field trials during the 2007/2008 growing season with the overall objective of improving maize yields through the use of legume residues and Tundulu Phosphate Rock (TPR). The trials were conducted in villages which have been involved with the Malawi Local Enterprise Zone Association (MALEZA). The 'mother-baby' approach was used. Eight farmers were involved in the mother trial research and were treated as replicates. There with 11 treatments: with sole stand and intercropping of different combinations of maize/pigeonpea, maize/groundnuts, and pigeonpea/groundnuts with applications of pigeonpea leaf biomass, TRP and UREA. Baby trials were established in different fields of 24 farmers in the study area. Farmers selected up to 5 treatments to manage: intercropping pigeon pea, groundnut and maize and application of leaf biomass, TRP and UREA in different combinations, where the primary cropping systems of interest to farmers were the doubled up legumes and pigeonpea intercrops, as described below. This interest was based in large part on the observations of farmers who visited Ekwendeni and saw legume 'best bet' options there.

Baby Trials were based around the treatments of most interest to farmers: 1) Maize only (Control), 2) Maize + Urea fertilizer at 92 Kg N/ha (recommended rate), 3) Maize + *Pigeonpea* intercrop at 92 Kg N/ha, 4) *Pigeonpea + groundnut doubled up legume intercrop and* 5) Maize + *groundnut intercrop.*

Methodology

10m x 10m plots were laid where soil samples were collected. Composite soil samples from 0-15cm and 15-30 cm depths were collected for analysis of soil properties. Soil pH using Hellige TRUOG pH tester and texture using the feel method were done insitu in a participatory manner with farmers. Verification was done using lab tests at Bunda College. Inputs were sourced and distributed before the start of rain including: seed, Fertilizer, Pigeon pea biomass and the Rock phosphate. Planting was done in mid December and monitoring was done consistently. Leaf biomass (5g) and TRP (3g) were

applied at seedling emergence. Split application for UREA, at seedling emergence and after 3wks 0.6g on both occasions. Harvesting was done at physiological maturity.

The data was collected at mid- and end of the growing season, including soil sampling (samples analyzed for N, P, K, Fe, Organic Carbon, Mg, Ca and pH); plant samples for maize and ground nut during tasselling/podding stages and harvesting (analysed for N, P, K); stand count at harvest; average cob length; cob, grain, stover, groundnut haulms' and unshelled groundnut dry weight in a net plot. Data analysis is in progress and a summary of results to date are presented below.

Soil characteristics and Rainfall, 2007/2008 season

Soil pH ranged from 5.2 to 5.8 for topsoil while the subsoil ranged from 5.1 to 5.7. (strong to medium acidity, Brady 1974). Texture classes ranged from Loamy Sand, Sandy Loam to Sandy Clay Loam with Sand loam being the most dominant texture class across sites. Soils have low to medium levels of OM, mean=1.5% top soil and 1.4% sub soil available P (2 to 62 ppm). There is high variation in available P across sites (2 to 60ppm). Overall, soil available P was low to very low, in top soils (mean=18ppm) and subsoil (mean= 9.6ppm), where available phosphorus at 40ppm would be an adequate phosphorus level. Across sites total N was low, 0.07% for both top and sub-soil. This is consistent with earlier findings that these soils are very depleted in both phosphorus and nitrogen.

Rainfall for the 2007/8 cropping season averaged 1068mm across 3 sites in Kaluluma EPA, with considerable internal variation (Figure 5). This is above the 7-year average of 889mm (Figure 6), but the precipitation was not distributed well. Heavy rains were experienced in December-February, after which precipitation fell sharply, resulting in a shorter than average growing season.

Crop performance and yields

Performance of maize was negatively affected by poor seed germination which necessitated replanting, and by the early cessation of rains. Data analysed from the baby trials to date (n=8) shows maize intercropped with pigeonpea+leaf biomass applied yielded more (1014 kg ha^{-1}) than sole maize (836 kg ha^{-1}) but less than maize+urea (1902

kg $ha^{-1)}$. Maize intercropped with groundnuts yielded only 410kg ha^{-1}, which indicates that moisture competition between maize and groundnuts was high, not surprising in a year with rainfall ending early. Average groundnut yield from maize-groundnut and pigeonpea-groundnut were 1081 kg ha^{-1} and 1110 kg ha^{-1} respectively, and pigeonpea harvest data is in the process of being finalized.

Preferred technologies - Kasungu

Farmer assessment of the technologies was carried out mid-season using a checklist and ranking (Figure 7). End of season farmer assessments will be carried out after harvesting of pigeonpea. A scale of 1-4 was used to rate each technology whereby: 1= very good technology; 2= good; 3= very poor; and 4= very poor technology. Farmers' preferred technology was the 'doubled-up' legume pigeonpea/groundnut which was rated as very good or good by 85 and 8 percent of farmers, respectively. This was followed by maize/pigeonpea intercrop which was ranked as very good by 60 percent and good by a further 18 percent of farmers. These rankings exceed those of sole cropped maize with urea which was ranked as very good by 55 percent and good by 35 percent of farmers. Maize intercropped with groundnuts was the least preferred technology with 40 percent ranking it as very good and 15 percent as good. Reasons given by the farmers for their preference include: production of two crops (the staple, maize, and relish, pigeonpeas) on the same plot without compromising maize yields; soil fertility boosted for next year's maize crop; vigorous maize plants and good yields expected.

Farmers were also asked which technologies they would be interested in growing more of (Figure 8). Over 70 percent of farmers involved in the trials were interested in pigeonpea-groundnut intercrop and 50 percent in maize-pigeonpea, which is quite similar to the findings from Ekwendeni. Fifty-two percent would be interested in growing more maize with fertiliser, if the fertilizer was affordable. A minority (15 percent) expressed interest in maize-groundnut intercrops. Constraints faced by farmers during the 2007/8 season included: poor seed viability (85 percent), pests (50 percent), diseases (30 percent), striga – weed (18 percent) and inadequate rainfall (40 percent).

2.5 Objective 2. Promoting legume diversification of farm family diets

2.5.1 Nutrition training

Recipe days are organized by the Nutrition Research Team and the Farmer Research Team of the Soil Food and Healthy Communities working in different villages, and in mobile clinics to promote and demonstrate diversified diets with nutritious recipes in Ekwendeni. The days involve cooking, learning about and eating different meals. This year, primary school teachers requested our services to train their students in nutrition and processing of soybean. Training was done in two primary schools. About 105 and 98 male and female students respectively, 7 female teachers and 5 male teachers have been trained in soya processing. In preparation are recipe and nutrition training materials; 15 recipe training materials 'farmer pamphlets' were developed with input from the farmer researcher team including drawings and recipes, and have been shared with some farmers. More will be developed, and all will be distributed broadly next year. Further innovative approaches are being explored with farmers to develop in a participatory manner training materials, including poems, drama and pamphlets.

2.5.2 **Farmer to farmer exchange visit and training on food recipes**

Recipe training days were held in order to teach farmers from Kasungu and non participating farmers different recipes, processing and utilization of different locally available foods including legumes.

In April 2008, five farmers (3 women and 2 men) from Kaluluma EPA of Kasungu district, working with MALEZA project participated in a field day organized by the Soils, Food and Healthy Communities Project (SFHC) in Ekwendeni. The group was accompanied by staff from Bunda College. Field day activities included visit to Mc Knight Legume best bet demonstrations on legume and maize technologies, SFHC demonstrations, food recipes and preparation (Fig 9 and 10). Farmers learnt about planting pattern in intercropping versus sole stands, field hygiene, and how the community deals with the problem livestock grazing in pigeonpea. They appreciated the good crop stands, clean fields and associated high yields. On utilization of legumes, both men and women were actively involved in food preparation and documentation of recipes. The role of legumes in diets and human nutrition was highlighted. On the way

forward, the visiting farmers from Kasungu held a field day to share their experiences with a larger community back home, and plan a second farmer exchange in 2008 (Table 2).

SFHC and FRT members conducted a number of meetings where research findings were disseminated to farmers through drama, poems, power point presentations. Farmers have are working on pamphlets to document their activities in agriculture or nutrition. These pamphlets will be distributed to farmers, and a number of organizations that attended the dissemination meetings including World Vision International, Hospital, Plan International, and ASMUG.

Objective 2.5.3 Anthropogenic measurements

We did not submit for a supplementary budget for this activity as was suggested by a Mcknight visiting nutritionist, as this is a difficult research area which our team does not have expertise and it would require a substantially funded, long-term research effort with low probability of useful results, further many farmers find this type of research intrusive - so it was excluded.

2.6 Objective 3: Quantify the effect of legumes on soil P, N organic matter and yield of subsequent crops

This on-farm research effort is being conducted in conjunction with the trials and on-farm monitoring and farmer experimentation described for objectives above. Soil samples were collected from baseline survey transects, and from farmers' fields in the on-farm trials underway in Ekwendeni and Kasungu. Analysis of soils is in progress, but preliminary results are promising.

Crop residues from groundnut, maize and some dry senesced pigeonpea leaves were incorporated in June-July 2008. In Ekwendeni, this season, we will examine the effect of legumes on maize yield, soil organic matter and N dynamics. In Kasungu, the studies will include a comparison of best bets from legumes (soybean, pigeonopea, groundnuts) and different types of compost manures.

Maize response trials will be conducted in 2008-09 growing season of fields previously planted to legumes. We will examine the effect of legumes and cropping systems (sole

and intercropped legumes) on maize and soil organic matter and N, and we will evaluate legume performance in a second year, while continuing to assess farmer evaluation over time as well as agronomic performance.

2.7 Objective 4: Strengthen farmer, Research, Extension and NGO capacity in Legume production and Utilization including Gender Issues

Capacity building/training

2.7.1 Field day and farmer exchange visits and demonstrations on legume soil fertility technologies and crop residue incorporation training. The FRT members and SFHC staff carried out this activity in each to promote crop residue incorporation. Farmers met in a central location and FRT members demonstrated how to bury crop residues and its role in soil fertility.

2.7.2 MSc and PhD students at Bunda College and MSU

Austin Phiri (MSc student) and Wezi Mhango (PhD student) are studying at Bunda College and Michigan State University, respectively. In 2007/2008 season, the students conducted on farm participatory trials on food legumes and maize in Central and northern Malawi. The MSc student has finished his course work, and is currently finalizing soil and plant analysis and writing his thesis. The PhD student is analyzing plant and soils samples to quantify biological nitrogen fixation and assess soil quality. During the same year that she supervised trials and worked on-farm in Malawi over the spring term and later in the summer, the PhD student has made rapid progress in her acadmic studies, as she has successfully completed courses in Fall 2007 and Summer 2008 at Michigan State University and is currently preparing for her comprehensive exams.

2.4 Implications of the Research Findings

2.4.1 Implications for next stage of research

- This season, at both sites we will continue to investigate the effect of legumes on soil organic matter, N, P and subsequent maize yields; and tradeoffs between grain production from legumes versus soil quality enhancement. In Kasungu,

where a number of farmers have compost heaps supported by MALEZA, and the Ministry of Agriculture and Food Security are also piloting composting to reduce dependence on inorganic fertiliser and improve benefits from both legume residues and fertilizer. It is planned to include integrated nutrient management through legumes, fertilizer and composting, farmer and researcher experimentation within the baby trials in 2008/9.

- Preference for the double legume technology and the maize/ pigeonpea intercrop by farmers indicate the importance of legumes in their livelihoods. There is need for continued attention to and improving availability and access to seed inputs.
- Slightly lower grain yield from intercropped maize than from sole cropped maize may indicate belowground competition for water between maize and pigeonpea, although this drought year was unusual and multiple years of study are required. The intercropped systems provided more calories overall as both crops (legume and maize) yielded grain. Pigeonpea can survive under low soil moisture and provides important supplemental food in a variable rainfall year due to a deep root system.
- Grain yields were reduced due to unreliable rainfall distribution. Future research should incorporate climate modeling and crop response over time, and for different agroecologies. The range of soil types present at these two sites provide unique opportunities to quantify nitrogen fixation and yield for sole and intercropped systems.
- During the coming season input requirements and outputs achieved will be compared for each of the best bet technologies using input-output ratios and economic gross margin analysis. This will assist decision-making by farmers, extension and have import for policy makers, who will be engaged with through field days and a policy workshop. Choices of technology mixes for different agroeconomic and socioeconomic niches is an important focus.
- Community meetings with MALEZA, SFHC, and communities in Kasungu and Ekwendeni and farmer exchange visits will be used to facilitate improved pigeonpea management, goat damage prevention/feeding control and proper

residue management, and related resource technologies, integrating compost with legumes and targeted, small efficient fertilizer doses.

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).

- A number of extension materials were drafted in 2008 by Bunda researchers on legume best bets, MALEZA on composting, and SFHC on legume recipes. These were produced in several local languages to be understood by farmers and researchers, and will be reviewed with a wide range of partners – including NGOs and farmer research groups - and the information revised based on comments and incorporating research findings, then disseminated widely.
- 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. SFHC and MALEZA, which are collaborating in this project, are expected to play a crucial role in scaling up the “best bet” technologies in their mandated areas of Ekwendeni (Northern Region) and Kalulma, Kasungu (Central Region).
- The project is also working with the Ministry of Agriculture and Food Security (MoAFS) to ensure commitment and sustainability, both through invitations to field days and periodic interaction with extension staff in the field. MoAFS has indicated interest in piloting the Farmer approach for selected technologies including soil fertility and nutrition in at least one site in each Extension Planning Area (EPA) in Kasungu Agricultural Development Division (ADD).

2.4.3 Implications for policy

- Research findings on farmer preferences for the 'doubled-up' pigeon pea/groundnut legume technology and the maize/pigeonpea intercrop by farmers indicate the importance of legumes in people's livelihoods. A supportive policy environment is needed to promote the technologies and improve availability and access to seed inputs. A policy workshop is one way we will start the process of engaging with policymakers in Malawi in 2008-09 regarding best bet legume technologies, where we will invite collegues in Extension, Ministry of Agriculture, NASFAM, Farmers Union and others.
- **Legume seeds have now been included in the 'flexible voucher' distributed to up to 1 million farmers to purchase seed.** The best bets project team will continue efforts to engage in dialogue and provide technical input working with the Ministry of Agriculture, Ministry of Finance and seed companies through the Input Task Force on varieties, location and the seed subsidy.
- Inorganic fertilizer landed in Malawi is currently priced at $1200 per tonne– this is now prohibitively expensive for the majority of smallholder farmers, unless in receipt of a subsidy voucher. At the same time the Government is increasingly looking for options to reduced dependency on fertilizer as the subsidy scheme is becoming increasingly expensive to operate. Composting and legume residue management is being actively promoted by the Ministry of Agriculture in a number of districts including Kasungu, as well as by NGOs, as a means of improving soil structure and reducing requirements for inorganic fertiliser, as well as returns from small doses of fertilizer. Research by the project in the coming season on different composting technologies will be **important in informing policy on fertilizer alternatives, and on improving fertilizer efficiency** (which can make it more affordable)

3. TEAM REPORT

3.1 Team Activities

3.1.1 Stakeholders review meeting **January 30, 2008**

A project review meeting took place in 2007/8 at Bunda College, Malawi to which project partners were invited. 11 participants attended from Bunda College, SFHC, MALEZA.

Objectives of the meeting were:

1) To review progress of the Legume Best Bets Project;

2) To discuss workplan for 2007/8 season; and

3) Identify challenges and potential solutions in implementation of the project.

Participants reviewed work plan for Year 2 project activities, institutions responsible and time frame. The work plan is a guide to project activities over the year 2007/8.

3.2 Insights and lessons learnt

- Responsibilities were reviewed for project activities and fine-tuneing of planned activities.
- Inclusion of soya bean baby trials in 2008/09 season. The SFHC and MALEZA farmers should take lead in the baby trials.
- We are still about how to meet multiple objectives with extension, farmer training, supporting innovations by farmers and research questions such as nitrogen fixation. We still need to engage the Extension department, Ministry of Agriculture.
- Need to involve the chiefs in natural resource management issues such as protection of long duration legumes from livestock.
- Anthropometry studies take long and are not be feasible with our team and within this funding budget

Appendix 2: Photos, Figures, Tables

Fig 1: Groundnut+ pigeonpea double legume technology at 8.5 weeks after planting

Fig 2: Maize intercropped with pigeonpea

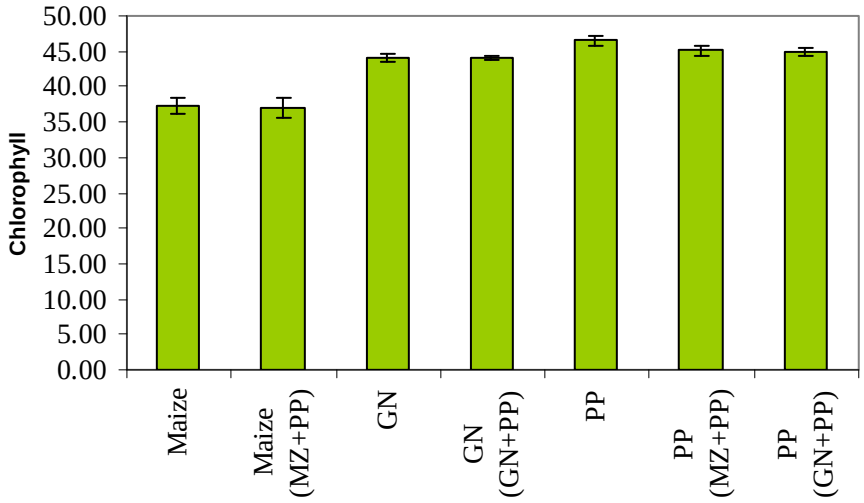

Fig 3: Chlorophyll levels as affected by cropping system at 8 weeks after planting: Ekwendeni

Key: GN= groundnut; PP= Pigeonpea; MZ=maize

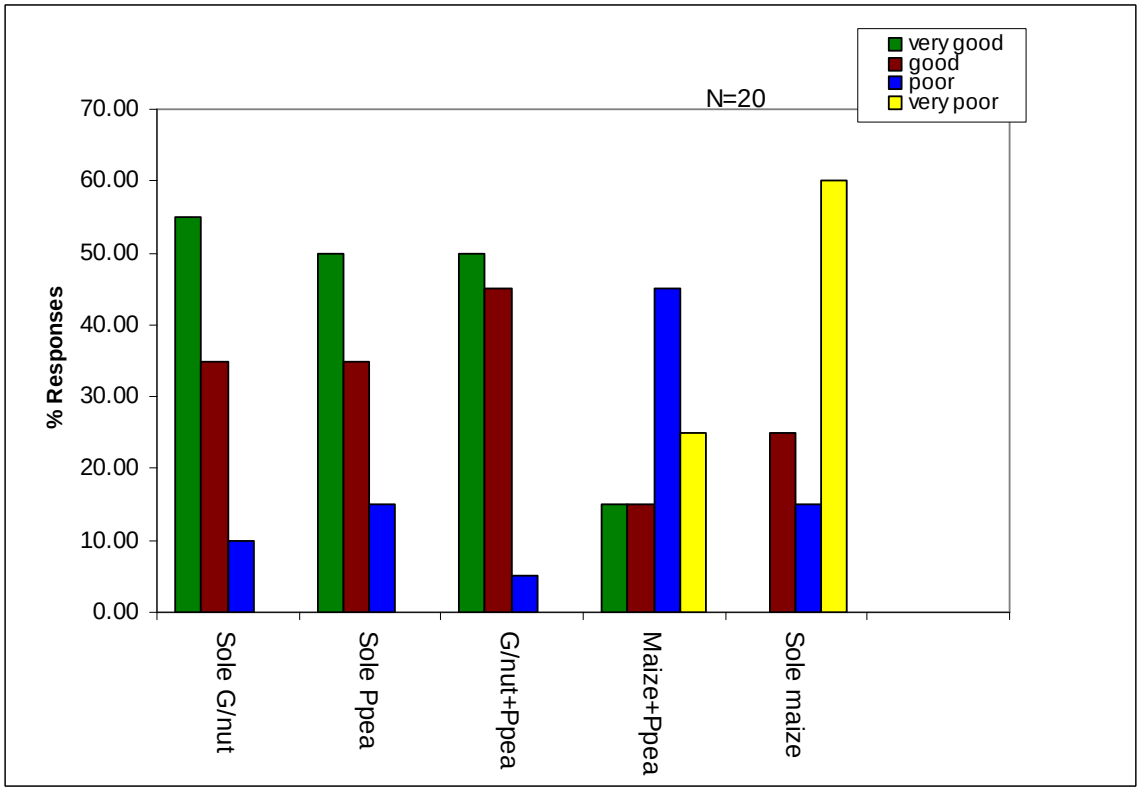

Fig 4: Farmer evaluation of technologies, 2007/2008 season: Ekwendeni

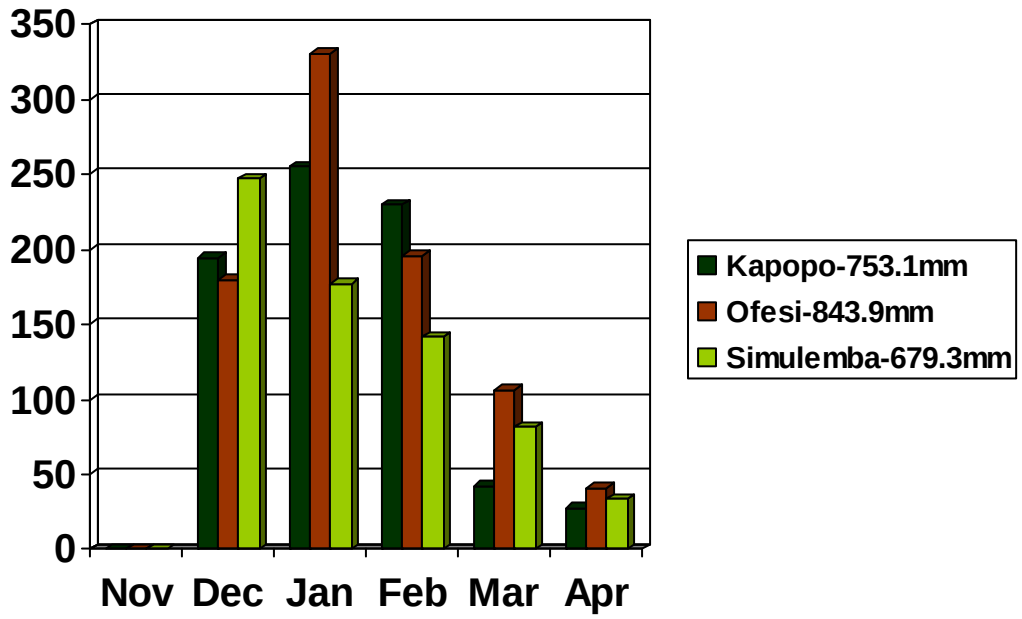

Figure 5: Rainfall in Kaluluma: 2007/8

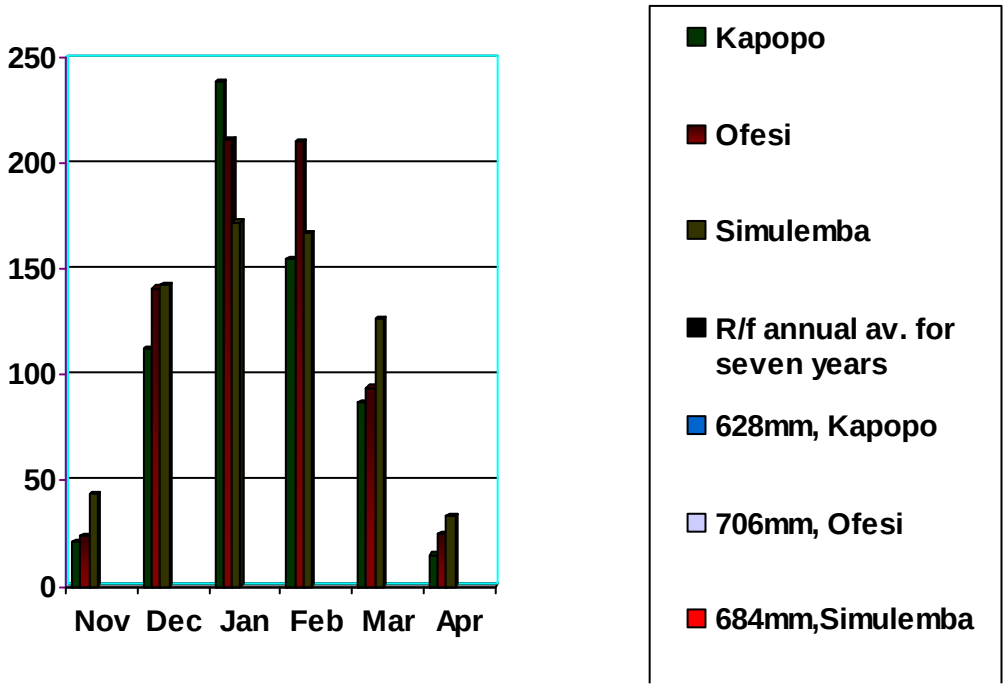

Figure 6: Rainfall in Kaluluma EPA: 7 year average 2000-2007

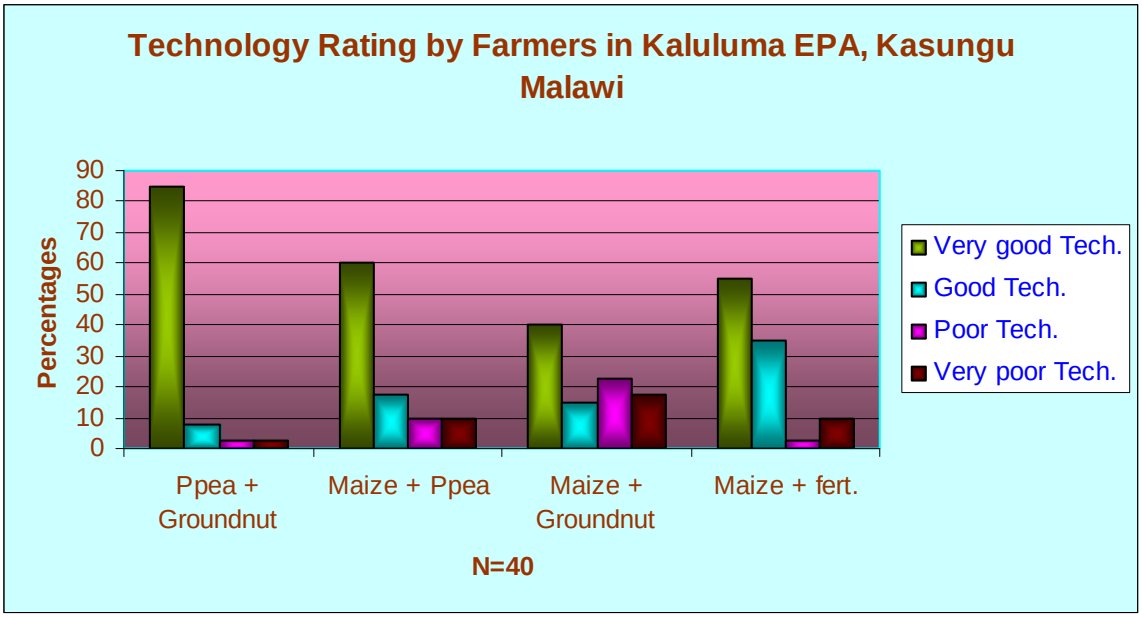

Figure 7: Farmer rating of technologies: Kaluluma

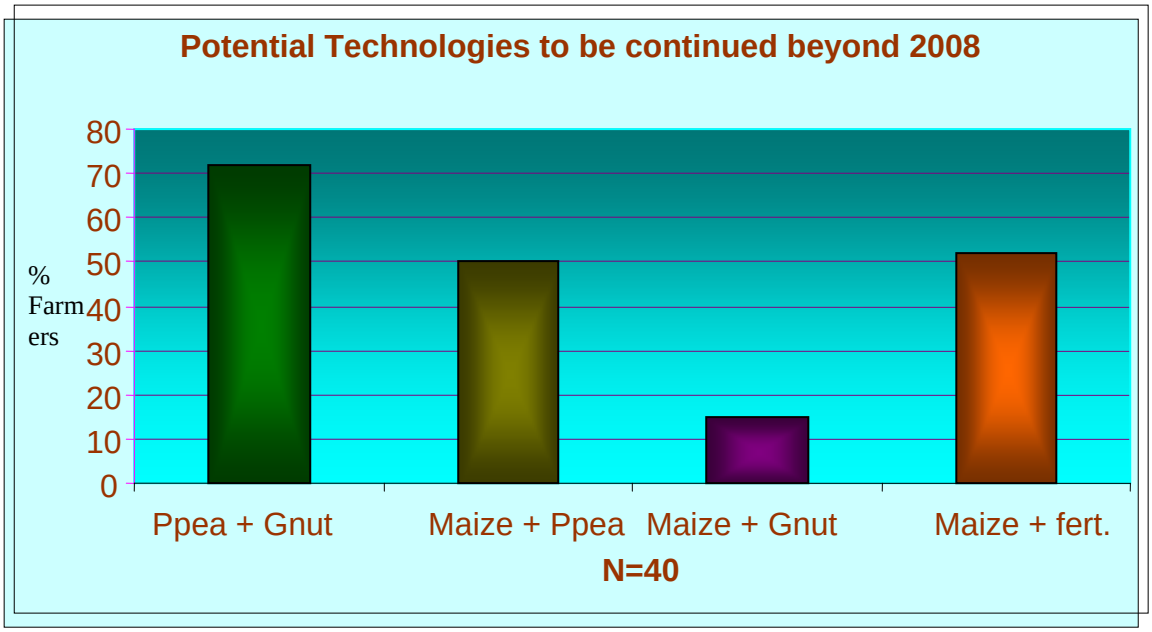

Figure 8: Farmer interest in technologies for 2008/9 season: Kaluluma

Fig 9: Visit Legume Best bet plots, Ekwendeni during the field day

Fig 10: Food testing session, recipe day, Ekwendeni.

Table 1: Field day lessons learnt by visiting farmers from Kaluluma EPA, Kasungu

Farmer	LESSONS LEARNT		
	RECIPES	FIELD and OTHER ACTIVITIES	WAY FORWARD
1	Preparation for relish Preparing 'soy coffee', soy milk, soy pieces, soy powder, baking cakes from 'madeya', bean meat preparation, relish from soy and boiled soy.	Planting of Mucuna	Soy relish preparation and boiled soy preparation
2	Relish from soy and boiled soy, Preparing 'soy coffee', soy milk, soy snack, baking cakes from 'madeya', soy mayonise, nsima from millet powder, porridge from sweet potatoes plus pumpkins	Spacing in maize pigeon pea intercrop, existence of communal village plots, village seed banks Commitment, Unity and good organization	Training others on soy recipe preparation.
3	Preparation of soy milk, soy pieces, boiled soy, nsima from soy powder, porridge from millet powder, bean meat, soy coffee, muccuna as a relish seasoning sweet potatoes with groundnut powder and soy plus cassava combination	Mucuna leafy biomass incorporation into the soil, soy pigeon pea intercropping, spacing in maize pigeon pea intercrop	Will train others on how to prepare boiled soy, soy relish, soya pieces and soya milk.
4	Preparation of soy milk, soy relish, soy coffee, soy snacks, nsima from millet flour.	Spacing in maize pigeon pea intercrop, soil fertility improvement using mucuna and soy pigeon pea intercrop.	Will train others how they can make soy milk, soy coffee, soya meat and porridge from millet flour
5	Preparation of soy milk, relish, pieces, boiled soy and bean meat	Application of fertilizer to maize in grooves that are mark along the ridge length, planting maize at 90cm apart with three seeds on a planting station when inter cropped with pigeon peas	Group organization, keeping clean fields Will call for a meeting and brief others of the trip. Will train others on soy milk, soy pieces preparation and boiling soy (chuwa)

Table 2: List of people who traveled from Kasungu and Bunda to Ekwendeni to attend the field day, in addition to hundreds of farmer participants

Name of participant	Institution	Village	Post
Dr Kate Wellard Dyer	Bunda College	-	Collaborator
Wezi Mhango	Bunda College/MSU	-	PhD student
Austin Phiri	Bunda College	-	MSc student
Mai Nkhoma	MALEZA	Kaunda	CAW member
Mai Yosephine Chunga	MALEZA	Ndaya	CAW member
Mr G. Mangani	MALEZA	Ndaya	CAW member
Mr Titus Chaguma	MALEZA	Chaguma	CAW member
Mr Godfrey Phiri	MALEZA	Chisazima	CAW member

Key: CAW= Community Agricultural Worker