



Baseline Study Report

Feed the Future Mozambique Improved Seeds for Better Agriculture (SEMEAR)

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List of Abbreviations

ANS	Autoridade Nacional de Sementes
CAPI	Computer Assisted Personal Interviewing
CIAT	International Center for Tropical Agriculture
FGDs	Focus Group Discussions
FTF	Feed the Future
FTF INOVA	Feed the Future Mozambique Agricultural Innovations Activity
FTFMS	Feed the Future Monitoring System
GAP	Good Agricultural Practices
GPS	Global Position System
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics
IIAM	Instituto de Investigação Agrária de Moçambique
IITA	International Institute of Tropical Agriculture
KII	Key Informant Interviews
MASA	Ministério da Agricultura e Segurança Alimentar
NGO	Non-Governmental Organizations
PARTI	Platform for Agricultural Research and Innovation
QDS	Quality Declared Seed
SEMEAR	Sementes Melhoradas para uma Agricultura Renovada, “ <i>Improved Seeds for Better Agriculture</i> ”
SSA	Sub-Saharan Africa
USAID	United States Agency for International Development
USD	United States Dollar
USEBA	Unidade de Semente Básica
ZOI	Zone of Influence

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EXECUTIVE SUMMARY

Rational and objective of the study

The Feed the Future Mozambique Improved Seeds for Better Agriculture (SEMEAR) project is a five-year initiative funded by the United States Agency for International Development (USAID) with the goal of improving incomes and food security among smallholder farmers in the Feed the Future (FtF) Zones of Influence (ZOI) in Manica, Nampula, Tete and Zambézia provinces. The initiative is being implemented by a consortium led by the International Institute of Tropical Agriculture (IITA) to increase availability of adequate quantities of improved seeds, scale up adoption of improved varieties and crop management practices, and facilitate the creation of enabling environment for the development of sustainable seed systems for common bean, cowpea, groundnut, pigeon pea, soybean and sesame. The baseline study provides reference point data on a set of output and outcome indicators against which the impacts of the initiative can be assessed. The output indicators of the project include the number of individuals trained, number of beneficiary households, number of organizations that benefit from the intervention, number of policy engagements undertaken and quantities of various categories of seeds produced and made available. The outcome indicators include the number of farmers who applied the technologies promoted, area under improved technologies, yields per ha, gross margin per ha and value of incremental sales. This study describes the seed system, adoption incidence, productivity levels, and food security status of households in the project operational areas.

Methodology

A total of 2,440 households from 18 districts across the project provinces were systematically selected for informal interviews using semi-structured questionnaires that adequately captured all the relevant information for the measurement of the status of the project indicators. Despite the systematic approach it was observed that the sampling procedure was unable to capture sesame producers. The study resorted to key informant interviews to fill the information gap on sesame. There were also key informant interviews with seed producers, input dealers and technical experts. Selected communities were engaged in focus group discussions for in-depth understanding socioeconomic setting in the study area. Literature was reviewed to provide additional insight and secondary information to support the findings of the study. Although the

study was conducted retrospectively in 2017, the field interviews required respondents to provide information for the 2014/15 cropping season. The study team therefore adopted measures to assure the reliability of the data generated.

Key findings

Legume production system

The seed sector of Mozambique involves actors in the public and private sectors and development agencies mainly non-governmental organizations. The Ministry of Agriculture and Food Security (*Ministério da Agricultura e Segurança Alimentar*- MASA), and the National Seed Authority (*Autoridade Nacional de Sementes*- ANS) play roles through policy regulations; the Instituto de Investigação Agrária de Moçambique (IIAM) through the Basic Seed Unit (*Unidade de Semente Básica* - USEBA) with support from the Consultative Group on International Agricultural Research (CGIAR) centres undertakes variety, technology development and early generation seed production. The private sector actors include seed companies, community-based seed producers, individual seed producers and input dealers. Their role involves the production and marketing of certified and quality declared seed. The non-governmental organizations support promotional activities and engage in advocacies that facilitate the development of the seed system.

The study confirmed the existence of formal and informal seed systems in the FtF ZOI. Actors of the formal system operate in an organized environment with capacities to cultivate up to 760 ha of seeds while the informal system include mostly unregistered and emerging community-based seed producers with limited technical and financial capacity. The study showed that legume seeds constitute about 10% of the seed portfolio, and low and uncertain effective demand for certified seeds was identified as the major constraint in the seed sector.

Grain production is largely undertaken by households who have access to an average of 3.6 ha of arable land, shared among cereals, roots, tubers and legumes. Among the legumes pigeon pea (1.1 ha) and soybean (1.0 ha) have the highest areas. The study indicated that farmers typically use seeds of local varieties obtained through recycling, and this has contributed to low yields. They identified adverse climatic conditions, incidences of diseases and pests, and lack of credit

for acquisition of inputs including seed, fertilizers and inoculants as important constraints that militate against their farm operations. Poor performance at the farm level is also reflected in their food security status. The results of the study indicated that 47% of the sampled households have inadequate food during the period between September and April.

Baseline for indicators

The baseline estimates the total number of farmers who applied improved technologies and management practices at 8,663. The estimated area under improved technologies was 5,722 ha, while the yields for the crops were 872.9 kg/ha, 668.7 kg/ha, 851.3 kg/ha, 1,060.3 kg/ha, 518 kg/ha and 1,066.7 kg/ha for common bean, cowpea, groundnut, pigeon pea, sesame and soybean respectively. The baseline gross margin shows that the households make economic gains despite the low productivity. For every hectare cultivated the households obtained gross margin of USD 171, USD 76, USD 215, USD 136, USD 141 and USD 133 for common bean, cowpea, groundnut, pigeon pea, sesame and soybean, respectively. The value of sales was estimated at USD 6,037,539 for the six crops. This will form the baseline from which subsequent changes will be assessed.

Conclusion and recommendation

The study showed that while farmers have limited access to good quality seeds, seed producers are constrained by limited demand. Improving the uptake of good quality seed will require significant system overhaul at the public and private sectors. The public-sector stakeholders require capacity building to improve their operations particularly with the supply of basic seeds, field inspection, certification and provision of extension service (which cuts across the seed and grain production system). At the same time the technical and financial capacities of emerging seed producers need to be enhanced through training and alternative sources of funding or even subsidized credit schemes. There is also the need for seed producers to partner effectively with input dealers to ensure that seeds produced reach farmers within the communities on time.

While the production of adequate quantities of improved seeds of high yielding crop varieties are essential, there is the need for aggressive demand creation activities through field demonstrations, electronic media campaigns and input/seed fairs to increase awareness and

demand for improved seeds. It is also important for investors in the seed systems to develop robust tools for predicting annual seed demand. Facilitating market access through partnerships with interventions like FtF INOVA will drive the sustainability of the seed system and will enable farmers to sell and reinvest in good quality seeds. Other approaches such as the multi-stakeholder platform systems can be harnessed to ensure effective linkages among actors in the legume commodity value chains and other stakeholders.

SEMEAR is well placed to provide solutions for seed producers and farmers to overcome the identified bottlenecks. The project is contributing significantly to the seed system by providing early generation seed technologies to produce certified seeds for farmers. Its demand creation activities will increase awareness and demand for improved seeds of high yielding varieties. These together with strategic partnerships for seed production and capacity building can increase uptake of improved technologies, increase yields and improve food security.

1. INTRODUCTION

1.1. Background and Rational for the Study

The Feed the Future Mozambique Improved Seeds for Better Agriculture (SEMEAR) project is a five-year initiative funded by the United States Agency for International Development (USAID) to disseminate improved seeds of common bean, cowpea, groundnut, pigeon pea, soybean and sesame, and complementary crop management practices among smallholder farmers in the Feed the Future Zone of Influence (FtF ZOI) of Mozambique. It builds on the gains from the Platform for Agricultural Research and Innovation (PARTI¹) and has a goal of improving incomes and food security of smallholder farmers, and thus contributing to the overall development goal of Mozambique.

SEMEAR is implemented by a consortium led by the International Institute of Tropical Agriculture (IITA) together with *Instituto de Investigação Agrária de Moçambique* (IIAM), International Center for Tropical Agriculture (CIAT), International Crops Research Institute for the Semi-Arid Tropics (ICRISAT). The activities of the project are designed to increase the availability of good quality seeds of improved legume and sesame varieties, most of which were developed through PARTI. The project also has activities to scale-up adoption of the improved varieties and crop management practices and facilitate the creation of enabling environment for the development of sustainable seed systems in selected districts of the FtF ZOI, which spreads across Manica, Nampula, Tete and Zambézia provinces.

A set of indicators have been identified to measure the performance of the project. These indicators provide quantitative measures of progress towards the overall goal of the project. There are standard indicators which were selected from the Feed the Future Monitoring System (FTFMS). Custom indicators were formulated, outside the FTFMS system, to provide additional information to support the evaluation of the project. Overall, the success of SEMEAR will be measured by the quantities of breeder, pre-basic and basic seeds made available to partners to produce certified seeds from which farmers will produce grains. In addition, the number of

¹ The PARTI collaboration lead to the development of high-yielding, drought and disease tolerant, and user preferred varieties of the six crops.

individuals who have received short-term agricultural sector productivity or food security training, the number of households who have benefited from the project and the number of organizations whose capacities have been strengthened to improve their operations will indicate the reach of SEMEAR. Facilitation of strong seed systems will be measured by the number of public-private partnerships established and the contributions to policy dialogues on seeds and agro-inputs. The number of farmers who apply improved technologies or management practices, the number of hectares of land under improved technology or management practices will be used to assess the outcome of the project. The impacts of the project will be examined by the yields of the crops in kilograms per ha obtained on farmers' fields, gross margin per ha and value of incremental sales.

The strategies and critical assumptions required for achieving the objectives, the intermediate and the sub-intermediate results of SEMEAR are outlined in the Results and Logical Frameworks of the project Monitoring and Evaluation Plan. Table 1 below presents an outline and brief description of the project indicators as well as their disaggregation.

Guided by these indicators, the performance of SEMEAR will be assessed through the generation of regular and up-to-date information on inputs used to undertake specific activities, and associated outputs, outcomes and impacts. Availability of reference point data on a set of output and outcome indicators is therefore necessary and can be compared to project results to examine progress towards achieving the objectives. This baseline study was therefore conducted to measure the status of selected indicators at the onset of the project. It estimates the incidence² and the extent³ of application of improved technologies and management practices, farm level performance (yields and gross margins) and food security status of the households. The baseline study also examines the structure and institutional framework of the legume and sesame seed systems in the FtF ZOI to understand the challenges within the system and identify options for improving the system.

² Incidence measures the number or proportion of the target population who apply a technology/practice

³ Extent measures the level of investment or resource allocated (e.g. land) to a technology/practice

Table 1: SEMEAR performance indicators

Indicator	Description	Disaggregation
G.3.2-1 Number of individuals who have received USG-supported short-term agricultural sector productivity or food security training (RAA) (WOG)	Counts the number of individuals to whom significant knowledge or skills have been imparted through interactions for imparting knowledge or skills.	Type of individual (producer, extension agent etc.) layered by sex
EG.3-1 Number of households benefiting directly from USG assistance under Feed the Future (RAA)	Counts the number of household with at least one individual who is a direct beneficiary.	New or continuing
EG.3.2-4 Number of for-profit private enterprises, producers' organizations, water users' associations, women's groups, trade and business associations, and community-based organizations (CBOs) receiving USG food security-related organizational development assistance (RAA) (WOG)	Counts the number of private enterprises, producers' associations, cooperatives, producer organizations, women's groups, trade and business associations, and community-based organizations that received U.S. Government assistance.	Type of organization
EG.3.2-5 Number of public-private partnerships formed as a result of USG assistance (RAA)	Counts the number of public-private partnerships (PPPs) in agriculture or nutrition formed during the reporting year due to a Feed the Future intervention.	Types of partnerships (production, capacity building etc.)
EG.3.1-12 Number of agricultural and nutritional enabling environment policies analyzed, consulted on, drafted or revised, approved and implemented with USG assistance (RAA)	Counts the number of agricultural policies for improved policy formulation, enabling environment for private sector investment, and agriculture input provision that have been analysed, consulted, drafted, received official approval or fully implemented	Stage of policy
Quantity of improved seed produced and made available (Customer Indicator)	Seeds of improved varieties of common beans, cowpea, groundnuts, pigeon peas, sesame, and soybean produced and made available to different categories of users.	Crops layered by seed category (breeder/pre-basic, basic and certified)
EG.3.2-17 Number of farmers and others who have applied improved technologies or management practices with USG assistance (RAA) (WOG)	Measures the number of direct beneficiary farmers that have applied improved technologies as a result of U.S. Government assistance.	Technology Sex Crops
EG.3.2-18 Number of hectares of land under improved technologies or management practices with USG assistance (RAA) (WOG)	Measures the area (ha) of land cultivated using U.S. Government-promoted improved technology (ies) or management practice(s) during the reporting year.	Technology Sex Crops
Yield per hectare of beans, cowpea, groundnuts, pigeon pea, soybean and sesame (Customer Indicator)	Measures the output (ton) per unit area (ha) for common beans, cowpea, groundnuts, pigeon pea, sesame and soybean on farmers' field.	Crop
EG.3-6,7,8 Farmer's gross margin per hectare, per animal, per cage obtained with USG assistance* (RAA)	Measures the difference between total value of smallholder production of the six crops and their respective production cost, divided by the total land area.	Crops
EG.3.2-19 Value of smallholder incremental sales generated with USG assistance (RAA)	Measures the value (USD) of six crops sold by smallholder direct beneficiaries relative to a base year, and is calculated as the total value of sales of a crop minus the total value of sales in the base year.	Crops

1.2. Objectives of the Baseline Study

The fundamental component of any evaluation process is the availability of baseline information about the indicators of interest. This baseline study provides adequate reference point for measuring changes in SEMEAR performance indicators. This reference point should be a period before the onset of the project to avoid the potential influence of the project activities on observed outcomes. The baseline study provides data that describes the status of key project outcome indicators in the FtF ZOI for the 2014/2015 production seasons, a year preceding the beginning of SEMEAR.

The data obtained from the baseline study can guide the implementation of project activities and provide a means for future measurements. It examines the livelihood activities and outcomes of the agricultural production systems and the structure of the legume and sesame seed systems in the study area. Specifically, the data collected was used to,

1. characterize the households and production systems of the six crops within the FtF ZOI,
2. examine awareness, access and adoption of quality seeds of improved varieties and crop management practices for the six crops;
3. estimate yields and gross margins of legumes, and their contribution to food security of legume producing households
4. describe the structure of legume seed system in the FtF ZOI
5. understand important production constraints and identify opportunities for improving legume production to meet demand and development opportunities for the legume subsector

2. METHODOLOGY

The study was designed to be as holistic as possible to generate adequate data for relevant indicators of the project. It was very participatory and provided the opportunity for the stakeholders to make inputs. The study proceeded with desktop study through field data collection, including Focus Group Discussions (FGD), Key Informant Interviews (KIIs) and informal interviews, data management and reporting.

The desktop study was one of the initial activities, and it continued until the report was processed. Relevant literature, including reports, journal articles and manuals on the agricultural production systems of Mozambique was reviewed. The review deepened the understanding of the study team on various concepts investigated. It also provided the needed justification for the team to streamline the proposed approach by providing contextual information to facilitate identification and profiling of districts and communities within the study area.

2.1. Study Site

The study was conducted in four provinces within the FtF ZOI, namely, Manica, Nampula, Tete, and Zambézia Provinces (Figure 1). Agriculture is the primary economic activity of the four provinces, and together they form the major backbone of the Mozambican agricultural sector. They are endowed with the necessary agro-climatic conditions that support different types of crop and livestock production systems. The four provinces together had an estimated population of 5,270,075 inhabitants (Table 2) (based on the 2007 census) when the study was conceptualized, out of which 500,000 individuals beneficiaries (including at least 30% female) are to be reached by SEMEAR interventions.



Figure 1: Map of Mozambique highlighting the four target – provinces⁴

Table 2: Population and crops cultivated in the project locations

Province	District	Population ⁵	Crop
Manica	Barue	188,444	Groundnut and pigeon pea
	Gondola	310,429	Common bean, cowpea, groundnut, pigeon pea, sesame and soybean
	Manica	257,419	Common beans
	Sussundenga	152,646	Common beans, cowpea, groundnut, pigeon pea, sesame and soybean
Nampula	Angoche	311,241	Cowpea, groundnut, pigeon pea and sesame
	Malema	185,839	Groundnuts, pigeon pea and soybean
	Meconta	178,468	Cowpea, groundnuts, pigeon pea and sesame
	Mogovolas	349,644	Cowpea and sesame
	Monapo	351,012	Cowpea and sesame
	Murupula	162,673	Common beans, cowpea, groundnuts, pigeon pea and sesame
	Rapale and Nampula	824,578	Common bean, cowpea, groundnuts, pigeon pea, and sesame
	Ribaué	228,411	Groundnuts and pigeon pea
Tete	Angónia	348,989	Common beans, groundnut, pigeon pea, and soybean
	Macanga	163,149	Common beans, groundnuts, and pigeon pea
	Tsangano	205,100	Common beans, groundnuts, pigeon pea, and soybean
Zambézia	Alto Molocué	332,775	Common beans, groundnuts, pigeon pea, and soybean
	Gurué	363,959	Common beans, cowpea, groundnut, pigeon pea, sesame, and soybean
	Mocuba	355,299	Groundnuts and pigeon pea
TOTAL		5,270,075	Common beans, cowpea, groundnut, pigeon pea, sesame, and soybean

2.2. Sampling

To generate information that adequately describes the legume and sesame production systems, the study targeted communities, farm households, seed producers, input dealers and technical experts with research institutions who operate within those production systems. Selection of communities and farm households was done through a multi-level sampling procedure. Upon consultation with the project team, 18 districts, where the project activities are being

⁴ Adopted from Google Maps

⁵ National Statistics Institute of Mozambique

implemented were selected for the study. Using a systematic random sampling procedure⁶ 2,440 households and members of 244 communities were interviewed (Table 3). Sampling was specifically designed such that any household or community selected produces at least one of the legumes or sesame crop varieties. Therefore, listing of communities was done on crop basis. Despite this systematic approach it was observed that the sampling procedure was unable to capture sesame producers. The study therefore resorted to KIIs and FGDs to fill the information gap on sesame.

Table 3: Sample frame

Actor	Overall	Province			
		Manica	Nampula	Tete	Zambézia
Districts	18	4	8	3	3
Communities	244	60	79	60	45
Households	2,440	600	790	600	450
Seed producers	20	5	5	5	5
Input dealers	8	2	2	2	2
Expert interviews	4		2	2	

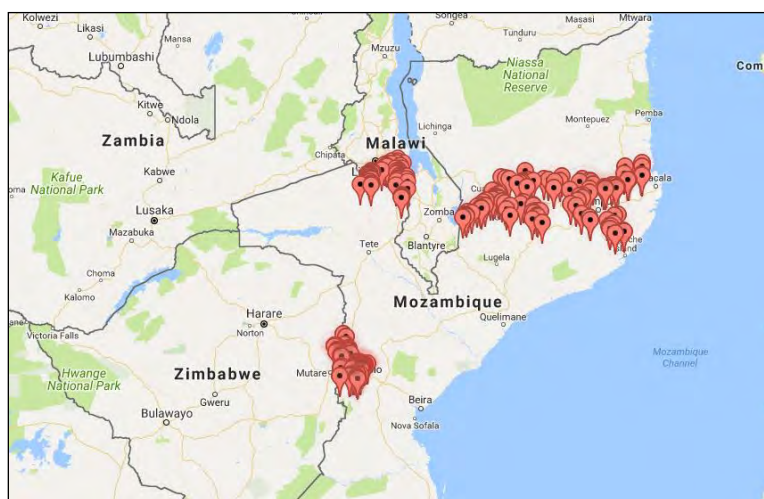


Figure 2: Map of the locations of survey communities⁷

The GPS locations of the survey communities are presented in Figure 2. The locations in Nampula and Zambézia are relatively spread out compared to Manica and Tete. This is attributed

⁶ Selection was done in two stages. In the first stage communities were randomly selected from a list of communities generated for each district. Within each community a list of households was also generated out of which 10 households were randomly selected.

⁷ Adopted from Google Maps

to the number and locations of project districts, which is mostly clustered in the latter provinces. Due to the relative spread of the communities in Nampula and Zambézia the results obtained were considered as representative of most parts of the provinces. That notwithstanding, the recommendations from the study is applicable to the FtF ZOI, which is the primary focus of the project.

2.3. Data and Data Management

Although the project started in the 2015/16 cropping season, the baseline study was conducted in the 2016/17 cropping season. The survey questionnaires were therefore designed to capture, retrospectively, data for the 2014/15 cropping season. This approach recognises the potential difficulties farmers had in terms of recalling information, so the questions were carefully organized to minimize errors. In addition, the questionnaires were designed such that very basic information on relevant indicator was collected to minimize the stress on respondents.

Field enumerators were recruited and trained in the process of informal interviewing and were sensitized on the need to systematically capture data on the 2014/15 cropping season. The enumerators were recruited from within the provinces where the field surveys were conducted to ensure that they were familiar with the cultures within the provinces and understood the local languages, particularly in locations where farmers could not speak Portuguese (the official language in Mozambique). In addition to the technical requirements of the interviews, the enumerators were sensitized on interview ethics and the use of the Surveybe Computer Assisted Personal Interviewing (CAPI) system. There were both in-class training and practical training sessions which gave the enumerators the opportunity to have hands-on experience with the CAPI system. Field tests allowed them to familiarise with the challenges associated with the CAPI system for them to develop strategies for resolving such challenges. In all, 16 enumerators (including 5 females) were recruited and trained for the survey. Field supervisors were also recruited to monitor and support the enumerators during the field interviews.

The interview tools and techniques varied across the category of respondents. At the community level, groups of up to 15 farmers with adequate knowledge about any of the six crops were engaged in Focus Group Discussions. The field team always ensured that the groups included

females and youth. Each discussion was guided by a semi-structured questionnaire (Appendix 1), which allowed enumerators to probe further into questions for clarifications and elaborations. The discussions lasted on average 90 minutes and were moderated by two enumerators (one led the discussions while the other took notes). The discussions generated additional information to support the findings from the household interviews. Two focus group discussions were conducted in each district giving a total of 36 community interviews.

Semi-structured questionnaires (Appendix 2), designed to capture all the relevant information for the measurement of the status of selected project indicators, were used at the household level. Specific data on household size, for instance, was useful for estimation of the total beneficiaries of the SEMEAR project. Agricultural production activities were also important in computing crop yields, gross margins and value of sales (revenue). Data on the extent and intensity of technology used also provided information on the baseline status of technology application. The questionnaires captured the distribution of members by gender and the role of gender in the different field operations.

Key informant interviews with seed producers, input dealers and experts in development organizations were conducted with check lists (Appendix 3, 4 and 5). The check-list for the seed producers captured their operating capacities, crop portfolio and sales strategies. In addition to these, the check-list for the input dealers captured data on the various agrochemicals sold and their sources. Experts shared their knowledge on the general operations of the seed systems and the constraints among actors.

The semi-structured questionnaires were installed on Surveybe CAPI system to ease informal discussions during the interviews, and minimize time spent and error associated with data entry. There were efforts to ensure ethical compliance using codes instead of names for farmer identification. Enumerators sought the consent of respondents before commencing the interviews. The respondents were also at liberty to end the interviews anytime during the discussions whenever they wish to do so. After the interviews, the data was transferred to STATA statistical application software for transformation, editing and analyses.

3. RESULTS AND DISCUSSIONS

The data generated from the field interviews examines the status of the project indicators at the onset. The reference points of key indicators are presented to form the basis for further discussions. In subsequent sections, the results and discussions are presented for each actor category to delineate the specific roles of the actors, their operating environment and the constraints they face. The results are further disaggregated by provinces to help unearth unique opportunities and challenges across the FtF ZOI.

In addition to the characterization of the actors, the discussions elaborate livelihood activities of the actors with special attention to indicators like production capacities (e.g. land area for farm households), access to information and participation in trainings, use of improved technologies, and crop performance (yields and incomes). Household food security status is also examined.

3.1. Characterizing the Legume Production System

The legume production system in the FtF ZOI include five major actors, namely, seed producers, input dealers, grain producers, traders and consumers. Other stakeholders who are not directly involved in the transactions of the production systems were also identified. These include extension, financial and input service providers, and technology disseminators (Figure 3). Per the mandate of SEMEAR, this report emphasis the operations during seed production (with a few remarks on input supply) and grain production.

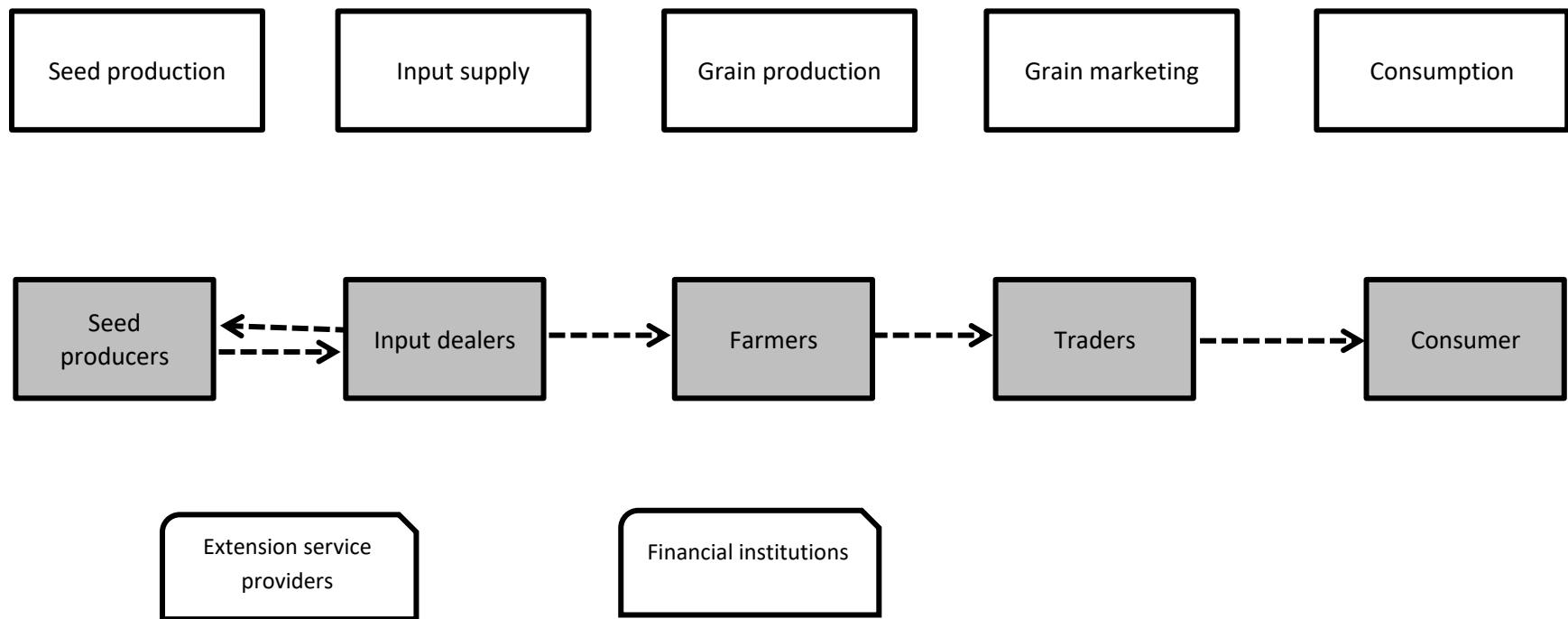


Figure 3: Legume production system

3.1.1. Seed production and supply

3.1.1.1. Brief overview of the seed system

A study on the Mozambique Early Generation Seed by AGRA (2017), identifies three categories of stakeholders in the seed sector of Mozambique (Figure 3). At the public sector the Ministry of Agriculture and Food Security (MASA) facilitates the development of policies that promote the development of the seed and agricultural sectors. In collaboration with international research organizations IIAM develops and makes available improved technologies, while the Rural Extension Services disseminates information on the technologies. Breeder seeds of improved crop varieties are channelled through the Basic Seed Unit (USEBA) for production of basic seeds for seed companies. The regulation of the seeds system is under the jurisdiction of the National Seed Authority (ANS) to assure production and marketing of quality seeds and vegetative materials of improved crops.

Private sector actors including seed companies, individual seed producers and input dealers are the core actors in the seed system. The seed companies and individual seed producers mostly produce certified seeds for sale to farmers or input dealers. The operations of registered multinationals and local seed companies are identified under the formal seed systems. This is because their operations follow the regulations set out by the ANS. Community seed production systems operated by farmers' associations or community members or as community seed banks and the use of farmer saved seeds constitute the informal seed system. While the formal system is highly regulated and assures the availability of good quality seeds, the informal system ensures that seed demand in the communities are met by the available seed produced in the communities which are mostly remote locations.

The public and private sectors both are supported by development programs and Non-Governmental Organisations (NGOs). The activities of these programs and organisations are financed by donors such as USAID and the Bill and Melinda Gates Foundation. They support the development and scale out of technologies, facilitate the effective operations of institutions and advocate for the formulation of sound policies for the seed systems.

3.1.1.2. The Legume seed production system

Since SEMEAR has major activities on seeds, the baseline study conducted a brief assessment of the legume seed production systems in the FtF ZOI. The results show that the legume seed systems have similar structural organization as described above and include private and public-sector actors and development partners (Table 4).

The private sector includes formal and informal actors. The formal actors include registered seed companies and seed businesses operating in the study area. They operate as fully functional business with a structured administrative and financial system, and with the capacity to produce up to 750 MT of seeds per annum. Legumes represent 5% of their seed portfolio with soybean dominating this category. The main challenge of these actors is low effective demand for improved seeds among farm households. They therefore establish partnerships with development interventions to ensure reliable demand for their seeds.

Table 4: Actors in the seed production system

Actors	Role
<i>Private sector</i>	
Registered seed producers	Certified seed production (90% maize; 5% legumes; 5% other cereals) with 750 MT production capacity.
Community seed producers	Quality declared and certified seed production (85% maize; 10% legumes; 5% other cereals). Capacity of 2-10 ha
Input dealers	Supply agro-chemicals for seed and grain production. They also sell improved seeds for grain production
<i>Public sector</i>	
IIAM and USEBA	Develop and disseminate seeds of improved varieties. Also produce and make available early generation seeds
MASA	Policy formulation
ANS	Regulation and certification of seeds
<i>Development agencies</i>	
International Research Organizations	Develop and disseminate seeds of improved varieties
NGOs	Disseminate improved technologies and advocacy

Informal seed producers are found within the farming communities and these seed producers are emerging as seed business owners. They obtained knowledge and experience as seed multipliers from development programs. Besides their training on seed production these actors lack the business skills to effectively manage seed businesses.

Community seed bank systems were also identified in some of the study localities. This involves a group of farmers operating a banking system with seeds. Group members borrow seeds for multiplication and then pay back in kind with seeds. Different repayment arrangements are made depending of the group and the crop. In some cases, repayment is made with interest of double the amount borrowed. So, a farmer who borrows 10 kg of seeds is required to pay back with 20 kg after multiplication. In other cases, farmers pay an equivalent of the market value of seeds they received. The approach leads to an exponential increase in the amount of seed disseminated as well as the number of beneficiaries of the seeds loan. The initial seed is basic seed received from research institutions and the groups are expected to get fresh seed after two to three years.

In addition to low demand for seeds, the quantities transacted are relatively small and some seed producers indicated the lack of processing facilities as a huge challenge. Another constraint is lack of irrigation facilities for off season seed production. Ability to finance seed production operations is also limited by lack of credit facilities. All these pose challenges to the development of the seed system.

The seed inspection unit is responsible for verification and certification of seeds produced. For the emerging seed producers and community seed banks the unit is usually able to certify about 10% of the fields while the rest are classified as Quality Declared Seed (QDS⁸). Almost all the seeds produced by the formal sector are certified. A major challenge with the seed certification system is the lack of adequate number of personnel with the technical know-how. As such some fields are not inspected and in some cases fields with good quality seeds are disqualified.

3.2. Characteristics of legume grain producers

3.2.1. Legume producing communities

The community discussions identified nine main crops produced by members in the legume producing communities (Figure 4). It was revealed that all the crops are produced for cash and

⁸ QDS are seeds that meet the criteria for certification but could not be certified due to limited capacity of the seed inspection unit. They are therefore categorized this way to facilitate access to seeds among farmers.

food. Among these, maize stands out as the most important crop in all the provinces and in some cases cultivated in almost all the communities. The rest of the crops are cultivated in specific provinces depending on the agro-ecology. Common bean is the second most popular crop cultivated by many farmers in the communities in Manica (94%), Tete (96%) and Zambézia (55%). Similarly, cowpea is common in all the provinces except Tete where it is cultivated by about 5% of the farmers in the communities. Groundnut is most common in communities in Nampula province as well as Manica and Tete. While communities in Tete and Zambézia provinces dominate in the production of soybean, the production of sesame is popular in communities of Manica and Nampula. Other important crops identified by the study are cassava (produced in all provinces except Tete) and Tobacco (produced mostly in Tete and Zambézia).

The performance of these crops depends on the prevailing agro-climatic conditions, edaphic factors, biological factors, technologies applied and management practices. These factors can be sources of opportunities or limitations to the improvement of the production systems. As reported by World Bank (2006) agriculture in Mozambique is characterised by a long list of constraints ranging from institutional, structural, investor difficulty, climate and edaphic factors. The study identified a number of constraints that limit the transformation of the agricultural production system in the FtF ZOI. From the community discussions, it was clear that pest and disease attacks can cause up to 90% loss of a crop in the field. This presents additional financial burden to the members of the communities in terms of cost of agro-chemicals and labor for treatment.

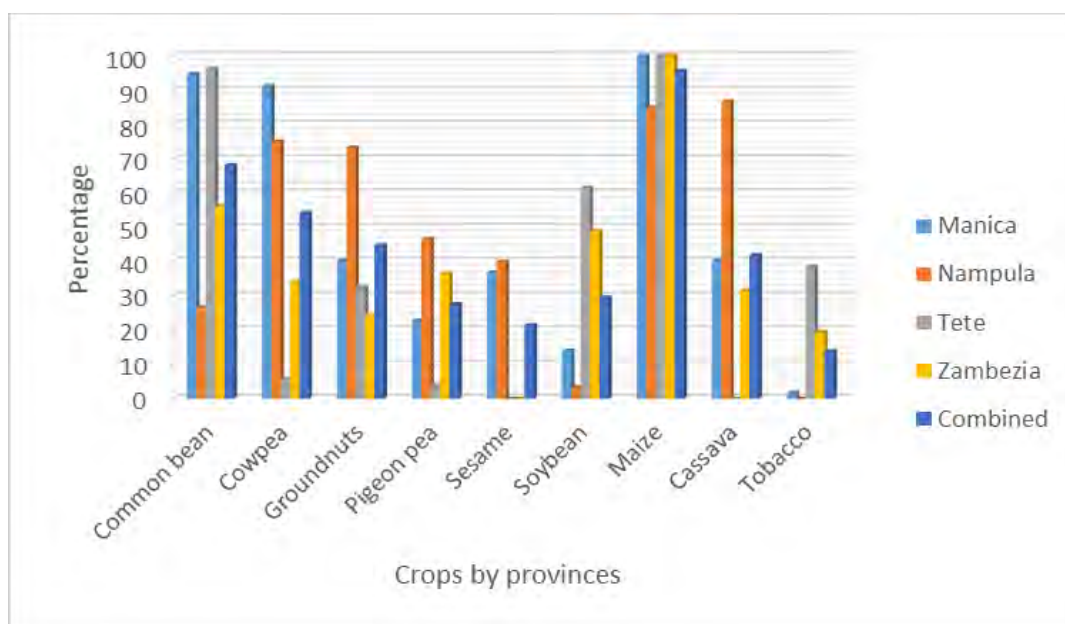


Figure 4: Crops produces within the communities of the FtF ZOI, Mozambique

Declining soil fertility is another important constraint faced by farmers in the study communities (Table 5). It limits the ability of farmers to increase productivity even where improved crop varieties are planted. This is compounded by population growth which reduces availability of productive land resources, thus limiting the ability of farmers to expand production.

Table 5: Identified constraints at the community level

Constraints	Effects
Disease and pest attacks	Depending on the severity there could be up to 90% crop losses
Declining soil fertility	Results in low yields of crops produced
Inadequate productive land	Limits ability to expand and increase production
Lack of tractor service	Field operations are delayed and limits expansion in farm size
High cost of inputs	Limits the amount of investment in improved technologies
Lack of credit	Limits the amount of investment in improved technologies
Inadequate skilled labor	Poor quality of field operations leads to reduced yield.
Inadequate extension service	Limits access to information on agricultural production and marketing
Lack of market for produce	Limited ability to sell produce at good price

Market factors such as lack of tractor services, high cost of inputs, lack of credit, inadequate skilled labor and lack of access to markets for produce limit productivity (Table 5). Farmers are unable to undertake field operations on timely basis because they do not have easy access to

tractor services on time. High input cost and lack of credit stall the ability of the households to invest adequately in field operations. In most cases low price of harvested produce does not offset the investment in inputs and credit.

3.2.2. Household characteristics

The characteristics of the legume producing households are presented in Table 6. The households across the provinces are similar in many respects such as the gender of the household heads, marital status, education, age distribution and the heritage of the households as reported previously by Findeis et al. (2016). Differences were observed in terms of religion and household composition. Delineating these differences and similarities can guide the development of specific interventions to meet existing needs.

The majority, about 77%, of the heads of the legume producing households are male. This is close to that of the 2007 National Census, which estimates about 75% male-headed households in the four provinces⁹. Household heads usually represent their households and serve as the primary link with members of communities. In most cases they are the bread winners, which make them assume the role of primary decision makers with regards to investments and innovation adoption. The design and implementation of community-based development interventions, like SEMEAR, should identify and leverage the potential benefits of these roles to communicate information to the members of households to motivate technology adoption.

Marriage is an important social institution, which in most cases elevates the social status of individuals and families especially in rural settings. The results of the study indicated about 74% married household heads. In agricultural based rural economies marriage provides households with the opportunity to access less expensive family labor for agricultural operations. This sometimes drives some male household heads to raise polygamous families. For the FtF ZOI, such families constitute about 14% of the population, with Manica and Zambézia having the highest proportions respectively.

⁹ National Statistics Institute of Mozambique

According to Adegbola and Gardebroek (2007) literate farmers are able to better process information, allocate inputs more efficiently, and more accurately assess the profitability of new technology, compared to farmers with no formal education. In general, education contributes to poverty reduction and improvement of social status of individuals and households (Etim, 2015). About 61% of the household heads obtained basic education. The human capital developed through education can drive farmers to make decisions on agricultural technology adoption, including improved varieties (Lopes, 2010). Indeed, education influences decision making of households by empowering them to understand basic and complex phenomena (Adegbola and Gardebroek 2007). It enhances their ability to acquire, synthesize and quickly respond to changes (Feder et al., 1985). As with the household heads, interventions that identify and work with educated members of communities or societies are more likely to succeed in terms of participation and adoption.

Table 6: Characteristics of households sampled in the FtF ZOI of Mozambique

Characteristics	Overall	Provinces			
		Manica	Nampula	Tete	Zambézia
<u>Household head</u>					
Male head (%)	77.0	68.2	78.7	85.3	77.4
Married heads (%)	74.4	64.7	76.4	81.8	76.5
Polygamous heads (%)	13.8	21.67	7.05	5.85	16.67
Educated head (%)	60.8	63.6	63.0	57.1	59.9
Religion of head					
Christians (%)	78.5	86.0	51.6	85.9	83.7
Islamic (%)	8.0	0.5	37.9	0.5	1.2
Traditional (%)	2.9	3.6	0	1.1	5.6
No religion (%)	10.5	9.9	10.6	12.6	9.7
<u>Composition (Number)</u>					
Household size	5	7	5	5	3
Number of males	3	4	3	3	2
Number of females	2	3	2	3	1
Economically active persons	2	3	2	2	2
Educated members	3	4	3	3	2
Educated male	2	2	2	1	1
Educated females	1	2	1	1	1

<u>Age distribution</u>					
Age of household head	44.4	47.6	46.4	45.2	39.9
Age of active persons	34.5	34.0	36.1	35.2	33.5
<u>Nativity</u>					
Natives	99.4	100.0	97.6	100.0	99.5
Settlers	0.4	0	2.4	0	0.0
Itinerant	0.1	0	0	0	0.5
<u>Domestic resources</u>					
Ownership of house	98.6	99.0	96.9	100	98.2
Rent house	0.3	0	0.8	0	0.5
Loan house	0.6	0.5	1.6	0	0.5
Donation	0.4	0.5	0	0	0.9

Religion is an important sociocultural characteristic of a society. Religious philosophies have proven effective in shaping norms, values and attitudes of members of societies. While some laws of economies are based on religious precepts, the fundamental Islamic norms and values encourages solidarity to the society and stipulates the types of interpersonal associations (Pakeeza and Chishti, 2012). Understanding the religious setup of a society can be useful for the design and implementation of development interventions. In Nampula Muslims constitute about 38% of the households (Table 6). Overall, Christianity is the dominant religion, practiced by over 78% of the households. A significant proportion of the households (about 11%) do not belong to any religion.

Households in Nampula and Tete provinces have five persons on average, while Manica and Zambézia provinces have seven and three members respectively. Overall, a household in the FtF ZOI has an average of five members confirming the reports by the World Bank (2016) and FAO (2007), which indicated household sizes between four and five members in the country. The earlier assertion that marriage can be a useful source of labor for farm operation (Palacios-Lopez et al., 2017) is not necessarily true for the FtF ZOI of Mozambique. With five members the results imply that each household on the average have three children, which will not be adequate to sustain the labor intensive farming systems in the zones.

Although there is one more male member in the households (Table 6), the distribution by sex nearly mirrors that of the communities. Follow up inquiries revealed that most female members are married-off early, usually in their teens, leaving behind the male members who tend to marry relatively later in life. In some cases, the male members remain home even when they get married. Again, interventions that address the needs of various gender groups will be useful to unearth the full potential of female and male in the socio-economic development of society.

Disaggregating the household composition by age revealed that two out of the five members are economically active or youths (i.e. between age 15 and 60). Economically active persons are in the position to undertake income generating activities or participate effectively in farm operations, and can thus, contribute to household livelihood and welfare. In recent times, the quest for job creation has given considerable attention to youth agri-entrepreneurships. The structure and composition of households in the FtF ZOI of Mozambique presents a unique opportunity for such interventions.

In addition to crop production the households are engaged in a wide range of income generation activities. Notable among them is trading (particularly in Nampula and Zambézia provinces), formal employment (mostly in Manica province), food processing, farm labor (mostly in Zambézia province) and artisanry (mostly in Tete province). The households of Nampula province have more diverse off-farm income generation activities giving an indication of the options available to them to increase household income. Those in Zambézia province, on the other hand, have limited options (Figure 5), putting them in a vulnerable situation during periods of significant crop losses. The situation presents opportunity for specialization and adequate planning against shocks.

The results show very few settlers or itinerant households in the FtF ZOI of Mozambique. This implies that the households are more likely to have stable access to productive resources such as land for agricultural production. They can therefore undertake investments with no concerns of being displaced. The situation is ideal for development interventions that require long-term investments. Further insights into land ownership in the FtF ZOI is provided in next session.

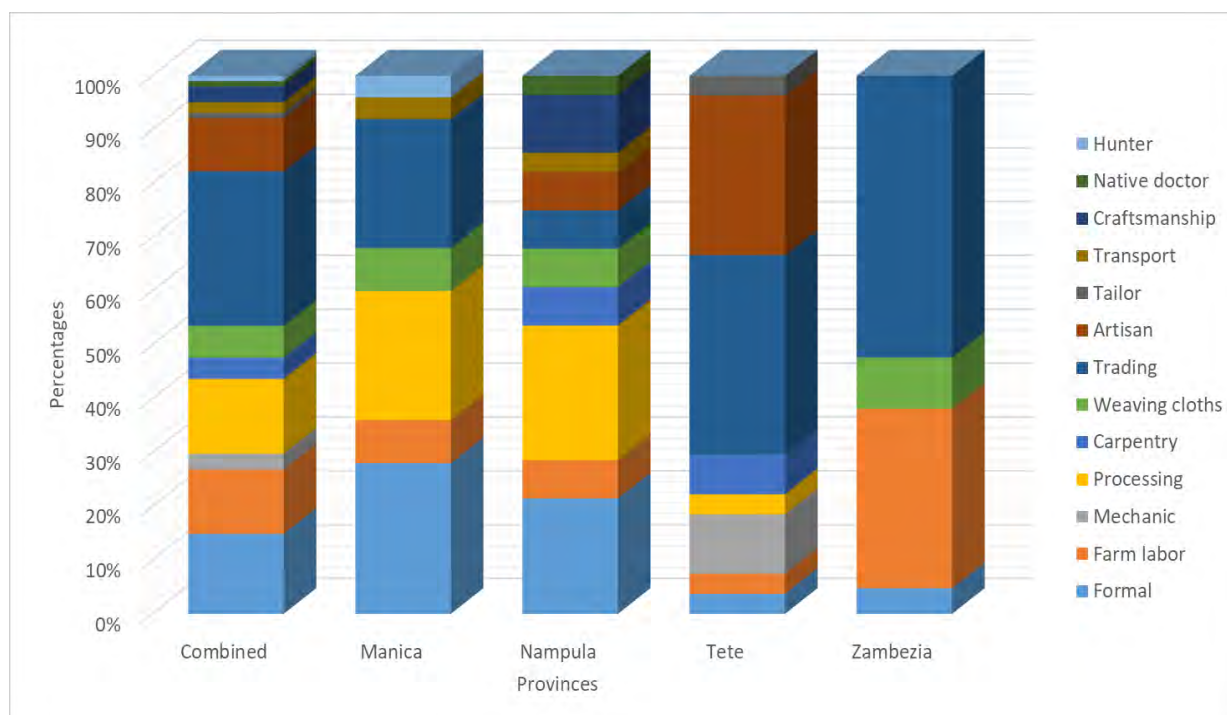


Figure 5: Off-farm income activities in the FtF ZOI in Manica, Nampula, Tete and Zambézia

3.2.3. Land resources

The legume producing households are endowed with domestic, production and social resources. All these constitute the wealth of the households and contribute significantly to their wellbeing. Observed changes in these resources can be an alternative measure of improvement in wellbeing.

Land is one of the basic factors in agricultural production systems. It is the source of soil for plant growth and provides space for construction of farm facilities like stores. The results of the study provide additional evidence to support the perception that native households have access to productive resources. Those who do not own land may be using family lands, community lands, rented lands, government lands or a neighbor's land (Figure 6). More than 60% of the households inherited the lands they cultivate. While shared cropping is a popular mode of land acquisition in Manica, Nampula and Zambézia, burrowing and receiving land as gift is popular in all except Nampula (Figure 7). Again, there is high motivation to undertake long-term investment when households as rural entrepreneurs are assured of secure land resources.

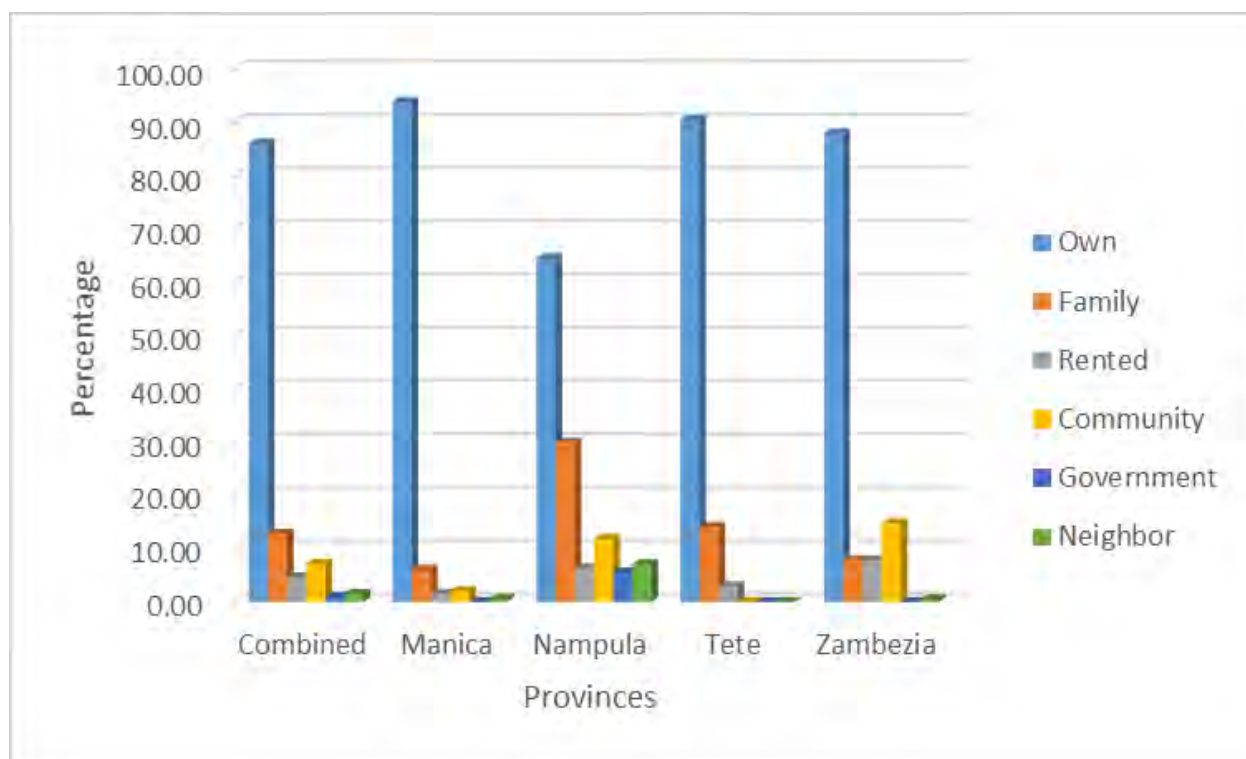


Figure 6: Land ownership

Further inquiries, however, revealed that most of the lands are not documented so the farmers only have user or customary rights. Lack of land rights can negatively impact uptake and investment in improved technologies such as soil amendments and mechanization. For instance, integrated soil fertility management including crop rotation and rhizobia inoculation of legumes have long-term positive effects on soil microbial population, biodiversity, soil fertility and health. Farmers are likely to invest in these technologies when they know they can reap the associated gains. In the case of land, they must be sure of their ability to continuously work on the land. Lack of secure land ownership can rather lead to exploitation of land resources, which will result in soil degradation and low soil productivity.

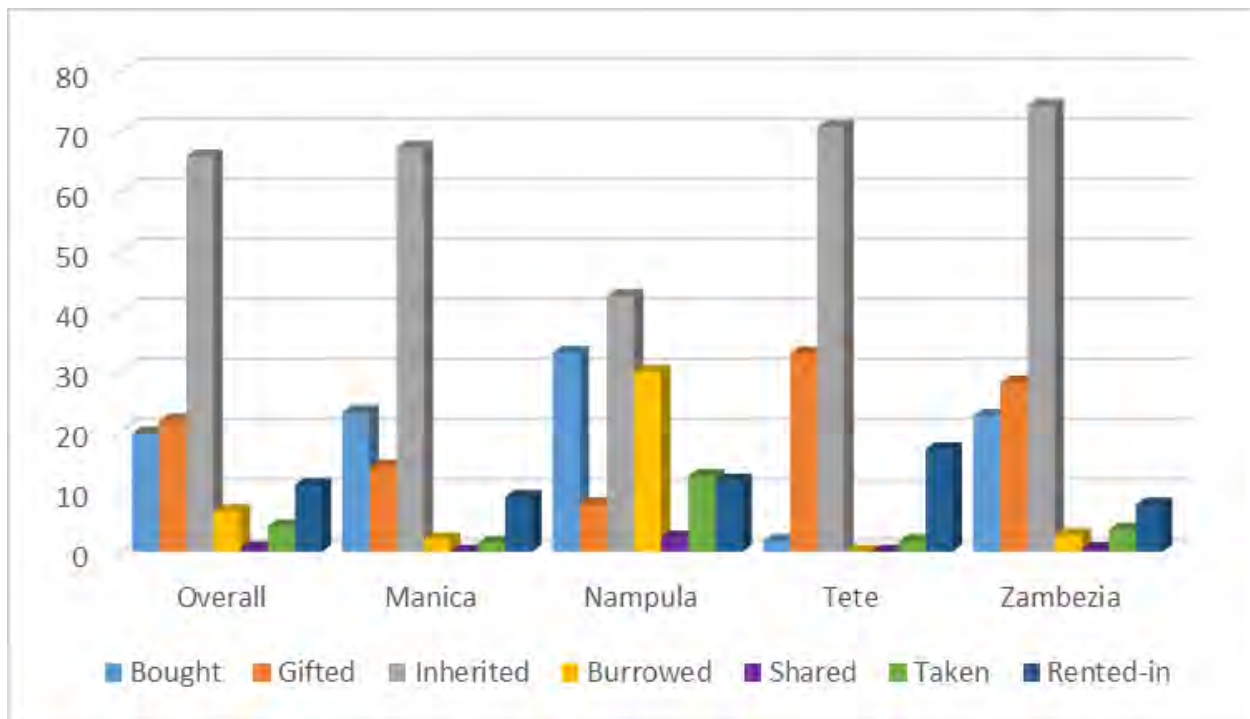


Figure 7: Mode of land acquisition

During the study, a simple experiment was conducted to assess the accuracy of reported land area by the farm household. Selected parcels of land were measured using a mobile phone application. The results showed that the reported land areas by farm households (an average of 6.2 ha) are higher than by about 4 ha. Overestimation, which is the most common case, results in erroneous computation of farm level performances (yields).

In general, a household in the study area acquired their lands about 18 years ago. Average distance from the homes to the parcels is 8 km, with the farthest of 13 km in Manica and as near as 3 km in Nampula (Table 7). The distance to the parcels has implications on effective monitoring and supervision of field operations, especially during the peak of the production season. Many scattered parcels and longer distances can have adverse consequence on crop management, including timely weeding and application of agro-chemicals; hence, yields and returns to investment. During the field visit, the survey team observed situations where farm households are compelled to abandon established crops fields because of the distance.

Table 7: Characteristics of land

	Overall	Province			
		Manica	Nampula	Tete	Zambézia
Years of acquisition	18.2	24.7	12.2	21.5	13.3
<u>Measurements</u>					
Average size by GPS (ha)	2.0	2.7	2.0	1.4	2.0
Average size by respondent (ha)	6.2	3.8	1.6	2.0	14.3
Average distance to parcels (km)	7.6	13.1	3.3	3.9	7.9
<u>Perceived soil type</u>					
Sandy	43.1	33.3	40.9	18.8	72.4
Loamy	47.8	45.5	25.2	68.8	46.5
Clayey	9.3	24.2	6.3	2.9	2.3
Laterite ¹⁰	1.8	0.5	8.7	0.6	0.0
<u>Perceived quality</u>					
Poor	15.5	0.5	4.7	21.8	30.4
Medium	77.4	89.4	61.4	84.7	70.1
Rich	26.5	16.7	58.3	1.2	36.9
No knowledge	1.7	2.0	3.9	0.6	0.9

Respondents consider most of the soils to be either loamy or sandy and rich in nutrients. A relatively higher proportion of the households in Zambézia perceived their soils to be sandy and low in nutrients. The opposite is true for Nampula where the soils are perceived to be loamy and rich in nutrients (Table 7). The perceptions of the farmers contradict preliminary results from on-going soil analyses, suggesting a critical knowledge gap. Interventions that can improve farmer knowledge about the characteristics of their soils can bridge the knowledge gap.

The results provide evidence that crop production in Mozambique is predominantly rain-fed. There are few farmers who depend on flood water or cultivate their crops in flooded swamps. Some divert run-off water while others apply water from boreholes (Figure 8). The two forms of irrigation schemes can be laborious, and the run-off still depends on rainfall. Availability of affordable irrigation facilities within the provinces can increase the possibility of year-round crop production and productivity.

¹⁰ Laterite is a soil and rock type rich in iron and aluminium and is commonly considered to have formed in hot and wet tropical areas.

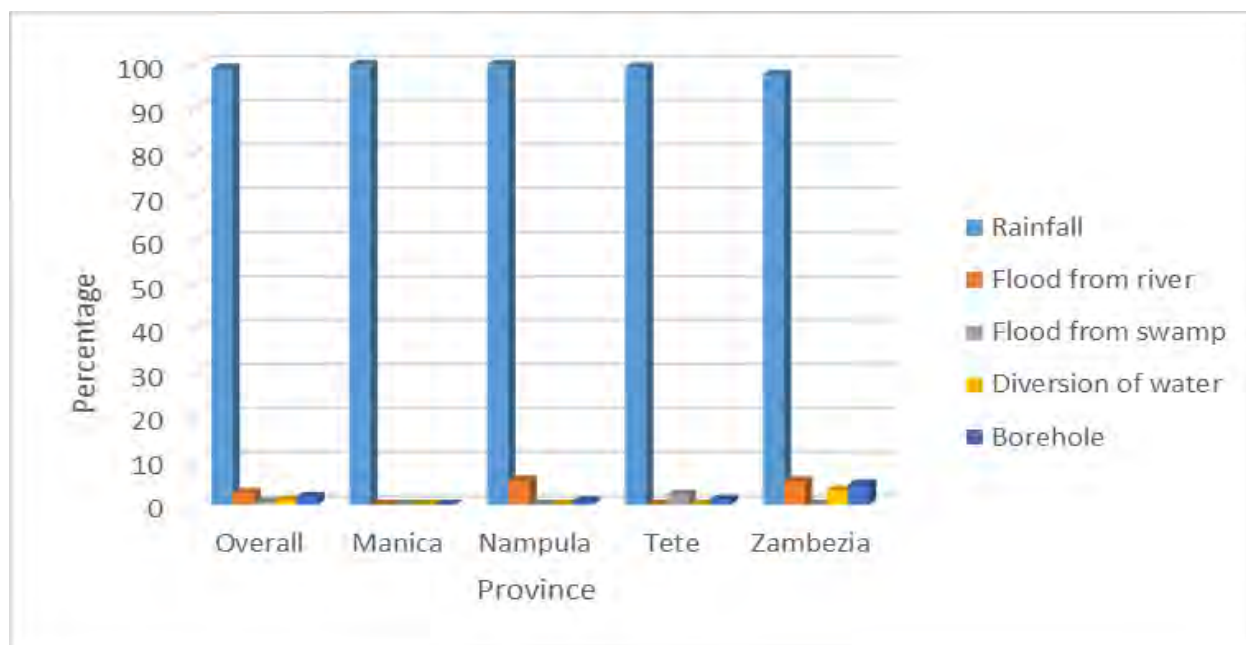


Figure 8: Sources of agricultural water

3.2.4. Social and institutional capitals

Social and institutional capitals are intangible benefits enjoyed by a household that belong to a society, a group or a community. A critical source of social support for farm household is farmer-based associations. Extension service, on the other hand is an important source of institutional capital. The activities of most development interventions, such as SEMEAR, are implemented with farmer-based associations as a conduit. The associations provide opportunities for farmers to benefit from development interventions and access information on improved technologies and markets. The results from the study, however, show that on average only 10% of the households in the FtF ZOI are members of farmer associations (Figure 9). Tete has the highest number of households (22%) who are members of associations, whereas Zambezia has the lowest of 4%. This suggests that most of the associations that SEMEAR is working with are relatively new and will need special attention to strengthen their capacities.

The households that belong to farmer associations have access to inputs, markets, credit support and extension services, and enjoy favourable prices negotiated on their behalf (Figure 10). The associations in Tete are better at facilitating access to inputs, markets and extension services and

favourable prices for their members. Those in Manica are good at facilitating access to markets, while the capacities of the associations in Nampula and Zambézia are very low.

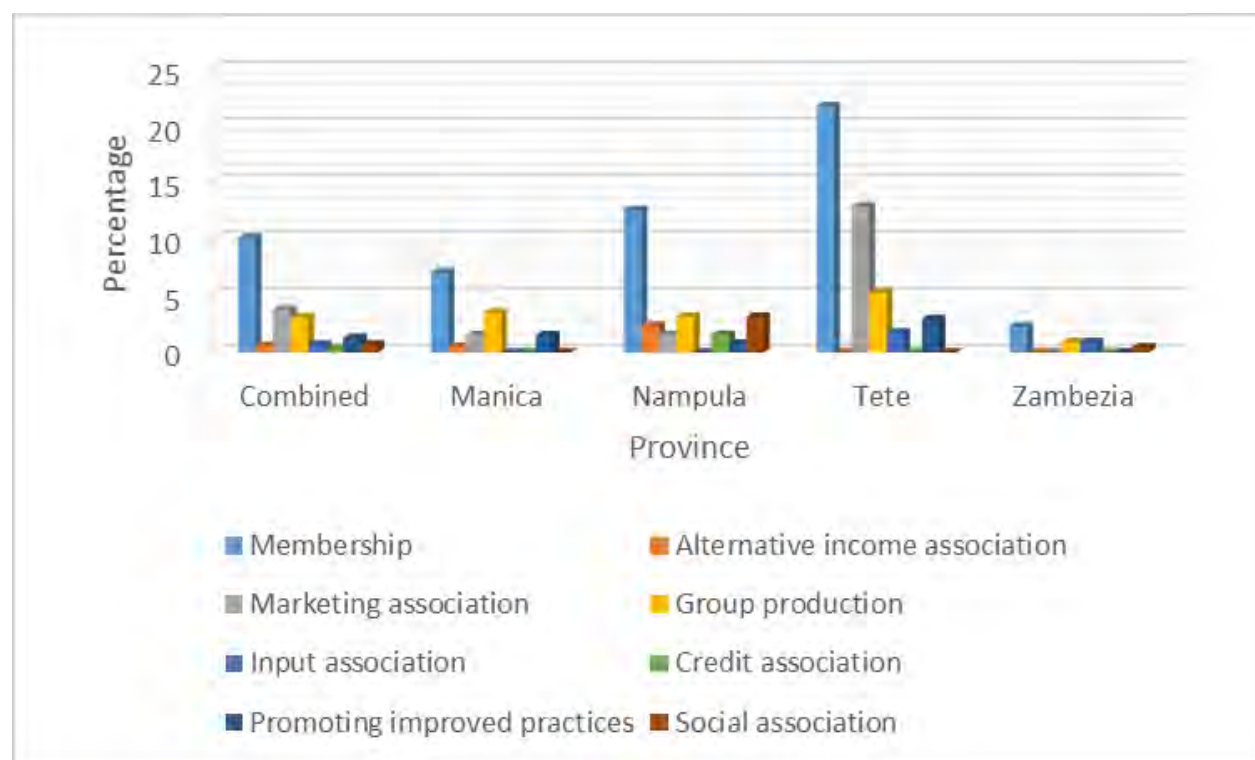


Figure 9: Membership of association

As indicated earlier, the results suggest the existence of fewer associations with low capacities to provide the needed benefits to the farm households. While there is the need to facilitate establishment of more farmers associations, development project can be successful when the associations are able to help farmers obtain information and other relevant resources to improve their agricultural operations. Meanwhile, SEMEAR for instance, can continue with efforts of identifying and working with existing associations so that set targets can be achieved. The results of the study together with experience on the field suggest the need for structured mentoring of existing associations to strengthen their organisational capacity.

The farm household have limited access to institutional support services such as extension advice and training. Lack of extension service, for instance, has been identified as a major constraint in a study by Aderinto et al (2017). Those who have access obtain the support from government

organizations, NGOs, private sector organizations and development projects. Access to the support services is higher among the households in Tete particularly from NGOs (Figure 11). The province is likely to be endowed with relatively higher numbers of NGOs. On the other hand, the government extension system is less effective because of very low staff to farmer ratio. In addition, the personnel available are poorly resourced to deliver on their mandate. Extension services delivered by NGOs are more popular because of their ability to attract external donor project funds.

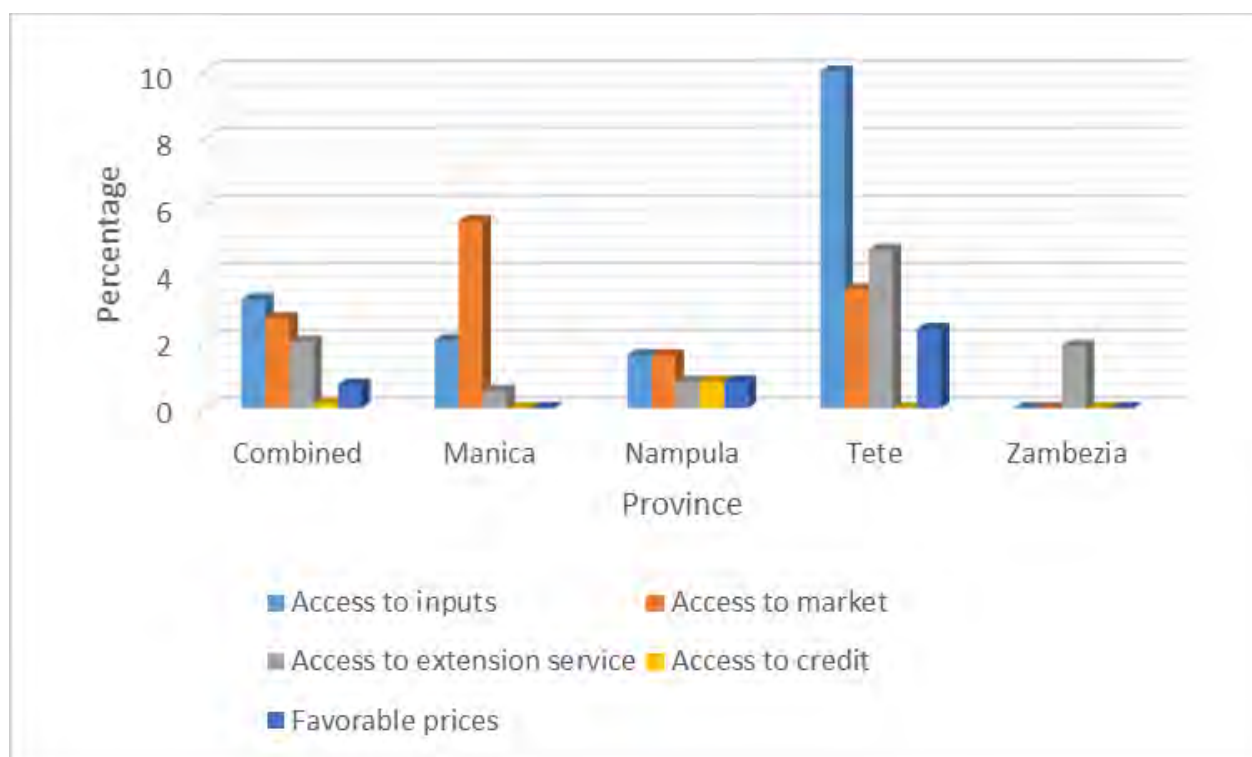


Figure 10: Benefits of association

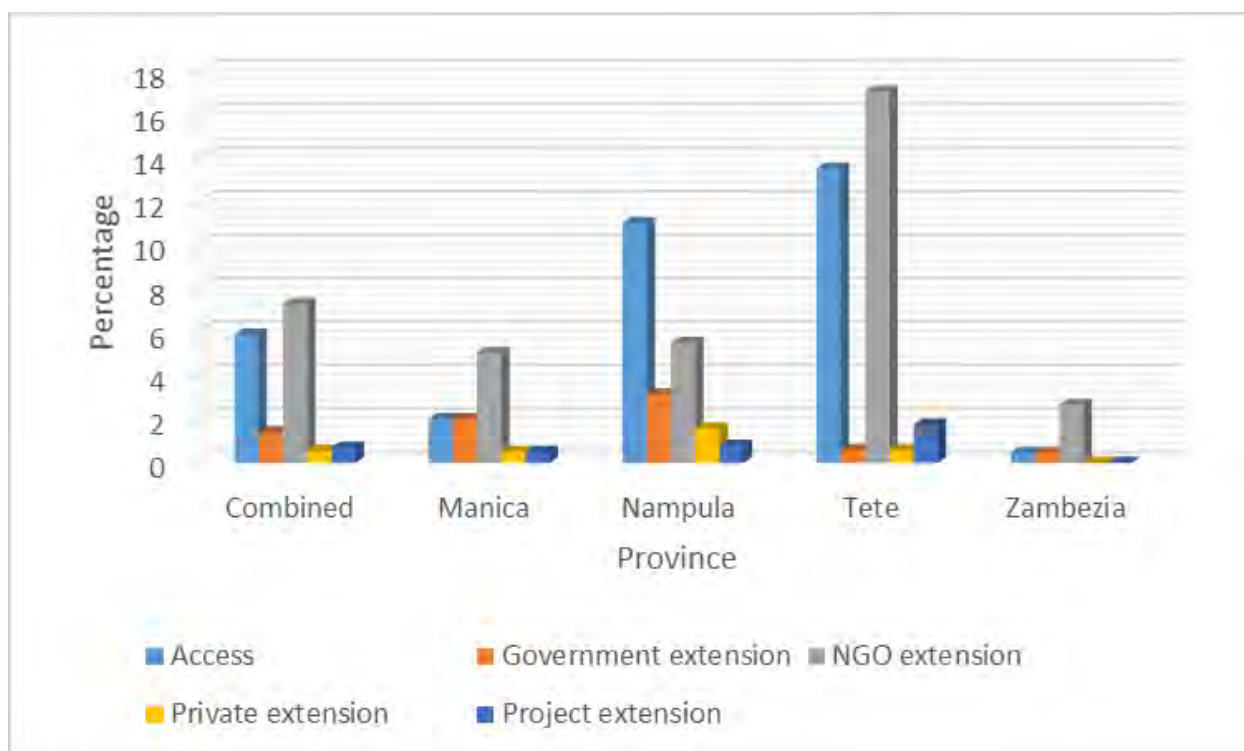


Figure 11: Access to extension service

Ideally, these institutions provide information that guide farmers to access and adequately apply improved technologies and practices, market information, and alert for impending disasters. They facilitate linkages among actors in commodity value chains by serving as negotiators. Farmers also receive training on good agricultural practices (GAP) through the extension services. More than 40% of the sampled households prefer early morning training or extension visits which last for few hours (Figure 12). This information is very useful for institutions that deliver extension and similar services. It can help with structuring of training programs.

Credit and contract farming arrangements are also important institutional resources for farming households. Credits provide the much-needed funds to finance the purchase of inputs and improved technologies, payment for labor resources and marketing of produce. The results of the study show that credit is lacking among the sampled households. The few who have access to credit obtained them from fellow farmers or from projects (Table 8). This situation can be detrimental to efforts at promoting adoption of improved technologies, which are mostly associated with additional investment requirement.

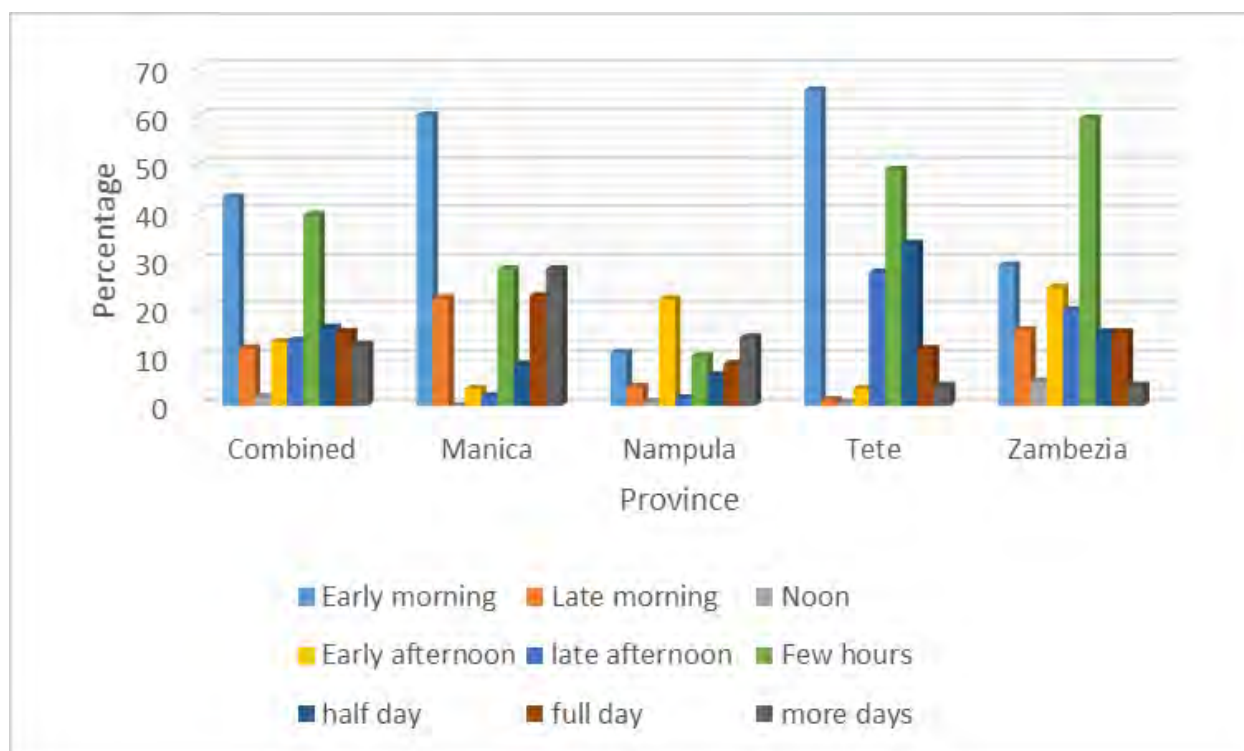


Figure 12: Preferred time for visitation

Table 8: Percentage of households with access to credit and contract arrangements

	Overall	Province			
		Manica	Nampula	Tete	Zambézia
<u>Credit</u>					
Access	3.1	2.0	7.1	3.5	1.4
<u>Source</u>					
Farmer	2.8	2.0	7.1	2.4	1.4
Project	0.3	0	0	1.3	0
<u>Contracts</u>					
Heard of contracts	28.7	58.6	15.0	13.5	21.2
Engaged in contract	2.0	1.5	1.6	4.7	0.5
Had contract in the season	1.7	1.0	1.6	4.7	0
<u>Why not</u>					
Not decided	0.3	0	0	0	0.9
Does not qualify	1.1	0.5	3.2	1.2	0.5
Lack of funds	1.0	2.0	0.8	0.6	0.5
Lack of information	5.5	8.1	8.7	2.4	3.7
Not available	23.2	24.2	17.3	6.5	38.7
Delayed payment	1.1	0	0	4.7	0

Just like credit, contract farming arrangements are sources of finance for farm operations and ready market for harvested produce. The practice is known among 29% of the farm households and awareness is relatively high in Manica, yet, participation in this arrangement is very low (Table 8). This is due to the fact that available contracts are for seed producers who are very few. Other reasons for non-participation are lack of adequate information on available facilities, delayed payments, crop portfolio and indecision.

3.2.5. Farm level characteristics

Farm level performance is a function of a combination of production factors (including land, labor and capital), the type and extent of technology application, the prevailing environmental conditions and managerial competence. Faced with this reality, the legume producing households are expected to make rational choices to improve their farm levels productivity, food availability and incomes.

Crop portfolio and variety adoption

A total of 16 arable crops are cultivated by the sampled households across the FtF ZOI, and these can be categorized as cereals, legumes, vegetables, roots and tubers. Maize stands out as the most important crop in all the provinces except Nampula, where, it comes after cassava and groundnuts. All the crops promoted by SEMEAR, except sesame are cultivated by the sampled households. Among the five crops, common bean is popular in Manica, Tete and Zambézia, while cowpea is more popular in Manica and Nampula. Soybean is popular in Tete and Zambézia. Pigeon pea is more popular in Zambézia with some farmers in Nampula and Manica producing it (Figure 13). This suggests that the SEMEAR crops do not grow everywhere but in areas where there are favourable agro-climatic conditions.

A household cultivates an average of 3.6 ha of arable land, with those in Manica and Zambézia having relatively larger areas. The average area for legume is 2 ha, and is dominated by pigeon pea, followed by soybean and groundnuts, cowpea and then common bean. Almost all the farmers (about 99%) have continuously cultivated their arable lands for more than 5 years. This practice can result in soil mining if appropriate soil amendment measures are not applied. For instance, continuous crop rotation can mitigate against complete loss of soil nutrient and other

properties. Indeed, a significant proportion of household (39%) rotate the crops on their fields, particularly in Zambézia province where two out of every three households apply the practice. Both mono- and inter cropping systems are practiced in the FtF ZOI. The latter is, however, popular in the zone especially in Nampula and Zambézia. On the reverse, mono-cropping systems are relatively popular in Manica (Table 9). While the practice allows for specialization, effective mechanization and improves efficiency, inter cropping improves biodiversity, allows for diversification and minimizes risk (Jacques and Jacques, 2012; FAO, 2001).

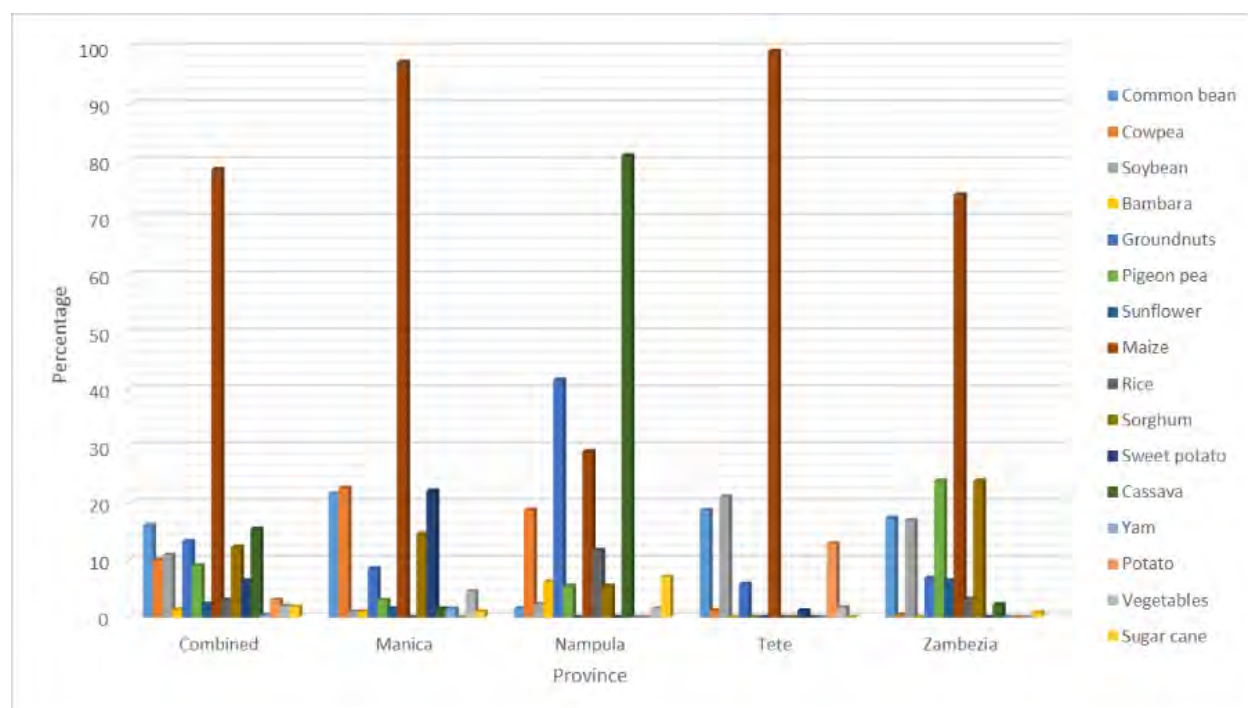


Figure 13: Crops produced by households

Good quality seeds of improved varieties together with best-bet cultural practices are critical for productivity increases in agricultural production systems. Apart from soybean where all varieties were recently introduced, a significant proportion of farmers cultivate local varieties of the legume crops. The popularity of a variety in a province depends on preference, adaptability to prevalent cropping systems, availability of seed and access to markets. For common bean, there is diversity in preference across the provinces. The variety called “Butter” is the most popular common bean cultivated by the households, followed by “Sugar” and then Bonus (Table 10).

Table 9: Area under crops and cropping system

	Overall	Province			
		Manica	Nampula	Tete	Zambézia
<u>Crop area (ha)</u>					
Crop area	3.6	4.6	2.7	2.8	3.9
Cereals	2.8	3.9	1.5	2.1	2.7
Roots and tubers	1.3	1.1	1.5	1.	0.8
Legumes	2.0	1.2	1.6	1.6	3.0
Common bean	0.4	0.8	0.5	0.3	0.1
Cowpea	0.6	1.3	0.5	0	0.1
Groundnuts	0.7	1.4	0.6	1.2	0.02
Pigeon pea	1.1	0	1.4	0	0.8
Soybean	1.0	0	1.4	0.6	1.0
<u>Cropping systems (%)</u>					
Continuous cropping	98.7	99.5	96.0	98.2	100.0
Crop rotation	39.2	29.3	18.9	31.2	66.4
Sole cropping	53.7	71.7	49.6	36.5	53.0
Inter-cropping	59.6	13.6	81.1	66.45	83.4

Apart from the local varieties, the households also produce two known improved varieties of cowpea, namely IT 16 (25%) and IT 18 (29%). While the former is popular in Manica province, the latter is widely cultivated in Nampula province. It is possible that cowpea is a relatively new crop in Zambézia, as shown by the low rate of cultivation (Figure 13). This may explain the reason why all the farmers who produce the crop in the province cultivate the two improved varieties (IT 16 and IT 18). In the case of groundnuts where local varieties are cultivated in all the provinces, the other identified varieties are limited to Nampula. According to the results, the legume producing households mostly cultivate local varieties of pigeon pea. The alternative to the local variety could not be identified by the respondents. In the case of soybean, there is a relatively wide range of varieties which are produced by the households (Table 10). The results suggest a significant gap in improved variety adoption among the households in the FTF ZOI, although improved varieties with superior attributes exist. The study team recognizes the unique challenge farmers face with variety identification due to similarities in appearance and the tendency for farmers to assign local names to such varieties. It is therefore possible that those that farmers identify as local are improved varieties recycled over many years. Similarly, some of the unidentified varieties may include improved varieties. The most accurate technique for

effective identification of varieties is DNA testing but there are limited facilities and expensive to undertake. It is therefore important for the project to identify alternative techniques which are less expensive and yet provide adequate results.

Table 10: Legume varieties cultivated by the households

Crop	Varieties	Overall	Province			
			Manica	Nampula	Tete	Zambézia
Common bean	White	0.9	0.0	0	0	2.6
	Butter	5.2	11.6	0	3.1	0
	Local	64.4	72.1	0	25.0	92.1
	Limpopo	0.9	0	0	0	2.6
	Magnu	0.9	0	0	0	2.6
	Sugar	2.6	0	0	9.4	0
	Bonus	1.7	4.7	0	0	0
Cowpea	IT 18	29.2	4.4	75.0	0	100.0
	IT 16	25.0	28.9	16.7	0	100.0
	Local	42.1	80.0	4.2	50.0	0
	Unidentified	1.4	0	4.2	0	0
	White	2.1	0	3.8	0	0
Groundnuts	Red cross	1.1	0	1.9	0	0
	Local	54.7	76.5	43.4	80.0	53.3
	Other improved varieties	4.2	0	7.6	0	0
	Thomo	14.7	0	26.4	0	0
	Tonca	6.3	0	11.3	0	0
	Unidentified	4.2	5.9	0	0	20.0
	Manipinta	1.1	0.0	0	10.0	0.00
Pigeon pea	Local	92.3	83.3	57.1	0	98.08
	Unidentified	1.5	0	0	0	1.92
Soybean	TGX 10 (TGx 1835-10E)	2.6	0	0	5.6	0.00
	TGX 20 (TGx 1740-2F or Wamini)	1.3	0	0	2.8	0.00
	Other improved varieties	5.1	100.0	0	0.0	5.41
	Safari	20.5	0	33.3	8.3	32.43
	Santa	5.1	0	0	11.1	0.00
	Storm	1.3	0	0	2.9	0.00
	Unidentified	50.0	0	66.7	44.4	56.76

*Note that the values in the Table are in percentages.

Nonetheless, there is still the need to explore alternative options to promote existing improved varieties, enhance access to good quality seeds of those varieties and effective product markets to stimulate adoption of the varieties and complementary practices. Access to such information is limited due to the weak extension delivery system in the FtF ZOI. In addition, more than 70% of the households obtain seeds from their own sources with questionable quality. It is however interesting to know that some farmers obtain seeds from market, while farmer-farmer seed exchange is also thriving, particularly in Nampula and for the seeds of groundnuts (Figure 14 and Figure 15).

The role of farmer associations in the seed system is insignificant. It was observed during field interactions that the strategy of seed distribution in the association can be harnessed to ensure access to quality seeds. Normally, enterprising individuals in the associations produce and sell seeds to their members and others within their communities. The project is capitalizing on this mechanism to ensure availability of both certified and quality declared seeds to farmers.

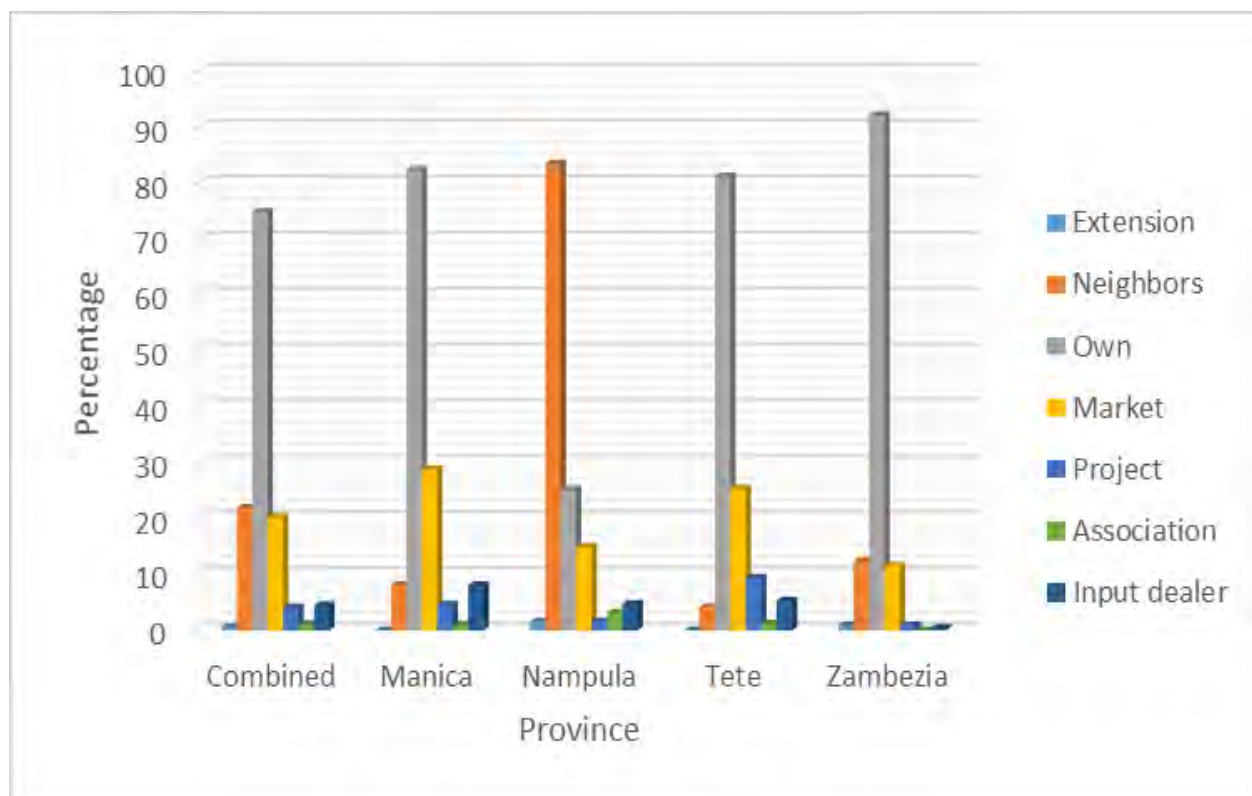


Figure 14: Seed sources across provinces

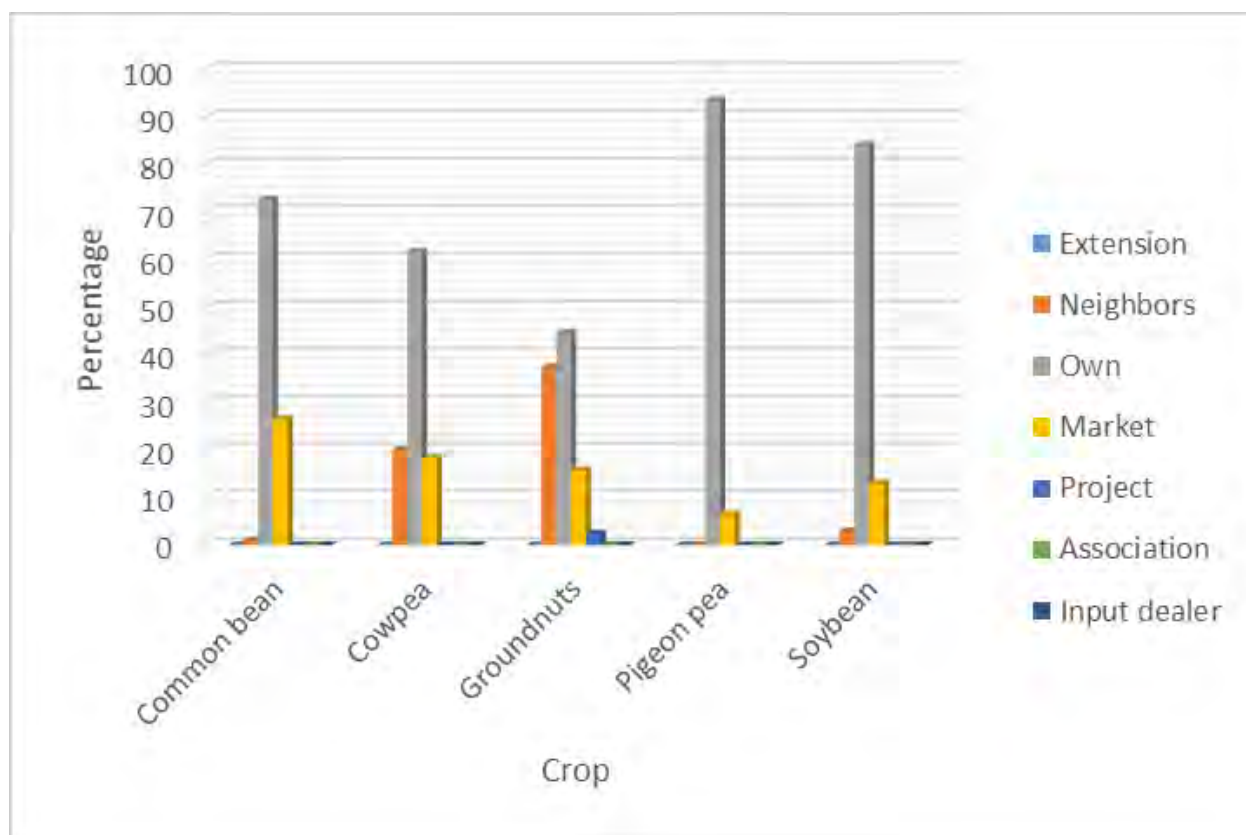


Figure 15: Seed sources by crop

The farm households who obtain seeds from their own sources usually recycle them from existing varieties by selecting ‘grain’ from vigorous crops. This may be attributed to unavailability of seeds of improved varieties or their high cost. The quality of recycled seeds can be questionable since farmers may not be applying the recommended principles for seed multiplication and storage. On the other hand, seeds may lose viability after multiple turns of production. Those who obtain from external sources mostly buy seeds either in cash or on credit. There are some who obtain seeds as gift from development projects, NGOs or government organizations (Figure 16). Researchers have lamented that free hand-out by some development organisations as part of their interventions causes market failure (Holden and Lunduka, 2012), since beneficiaries become comfortable with continuous gift. It is more prudent to facilitate access to input markets and seeds, while demonstrating the benefits of improved varieties. In that way the seed value chain can become more sustainable.

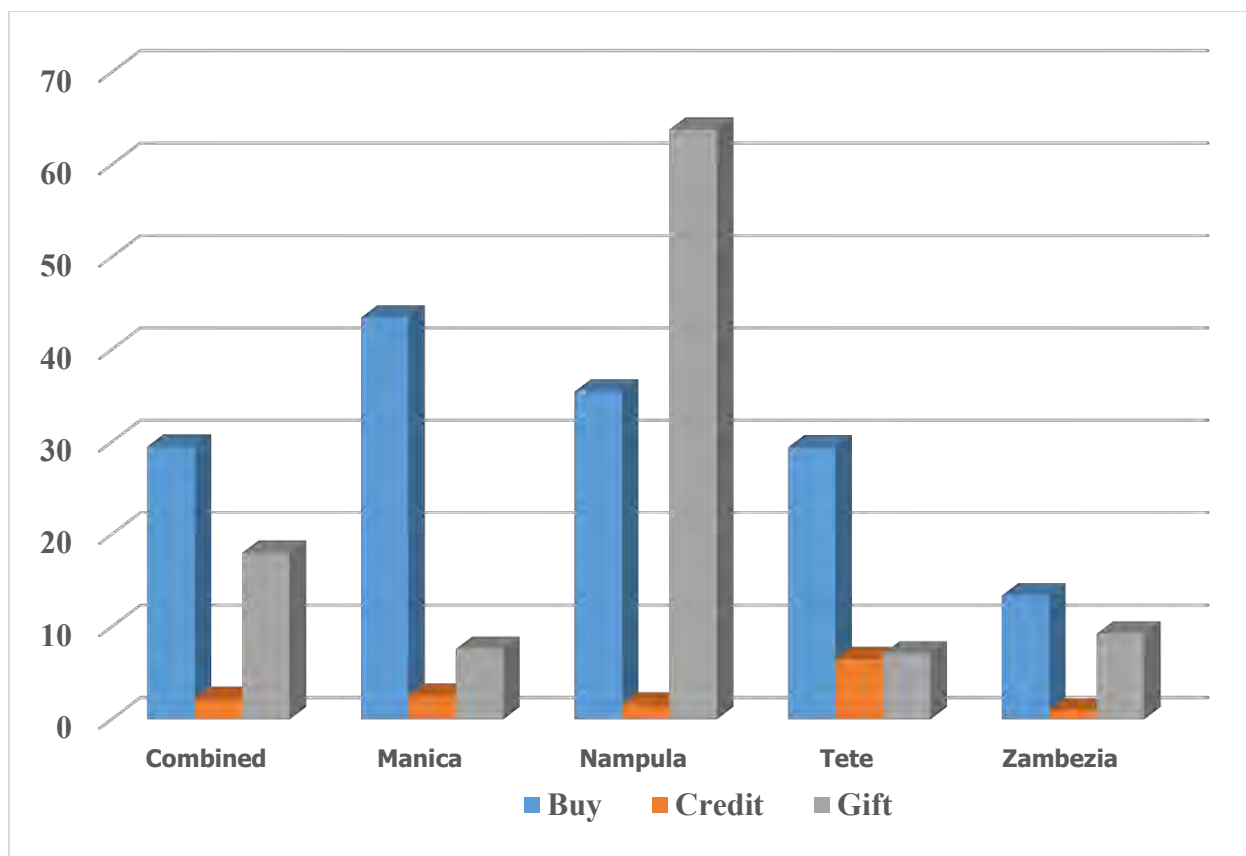


Figure 16: Means of acquiring the seed

Based on the results, seeding rates for the legume crops in the FTF ZOI is below the recommended rates. For instance, the households plant an average of 21 kg/ha as opposed to the recommended 70 kg/ha of common bean seeds. Instead of 25 kg/ha the households plant about 9 kg/ha of cowpea seeds. Similarly, they plant about 19 kg/ha of groundnuts instead of 80 kg/ha and 30 kg/ha of soybean instead of 60 kg/ha. Interestingly, the reported seeding rate for pigeon pea, 16 kg/ha (Table 11), is higher than the recommended rate of 10 kg/ha. According to KIIs, the observed low seeding rate is due to the wide spacing regime adopted by the farm households. Lack of knowledge about existing recommendations as well as inadequate quantities of seeds may explain this occurrence, which lead to sub-optimal plant population and low productivity.

The results highlight the important role that the interventions under SEMEAR will play in the seed industry of the FtF ZOI by creating awareness about available improved varieties through field demonstrations and other media campaigns and increasing access to the seeds of improved

varieties to seed companies, seed producers, and community-based organizations. Effective linkage to market is also required to guarantee the highest impact of the interventions.

Table 11: Seeding rate (kg/ha) reported by households

Crop	Overall	Province				Recommended rates
		Manica	Nampula	Tete	Zambézia	
Common bean	21.2	25.1	0	15.6	21.7	70.0
Cowpea	9.3	8.5	11.2		3.0	25.0
Groundnuts	18.6	13.5	19.2	27.6	16.2	80.0
Pigeon pea	16.2		16.0		16.2	10.0
Soybean	31.5		31.3	25.0	37.3	60.0

Crop management practices

Once an appropriate germplasm is acquired it is the responsibility of the production unit to ensure the application of sound management practices to secure maximum benefits from their investments. These includes proper land preparation, seed treatment, timely planting, fertilizer and other agro-chemical application, the right harvesting period and effective post-harvest management. It must be mentioned that none of the farmers applied organic or inorganic fertilizers to their legume fields. It is possible that farmers do not appreciate the returns to fertilizer application or may have limited access. These require prudent policy measures to address the input access by farmers.

To prepare their fields, the farm households mostly slash and burn the vegetation. Burning and ploughing is most common in Manica, while harrowing and levelling of fields is very limited. The story is the same across crops, with slashing and burning as common fields operations. The two practices are more common with soybean, groundnuts and pigeon peas. Cowpea producers also plough and harrow their fields during land preparation (Figure 17 and Figure 18).

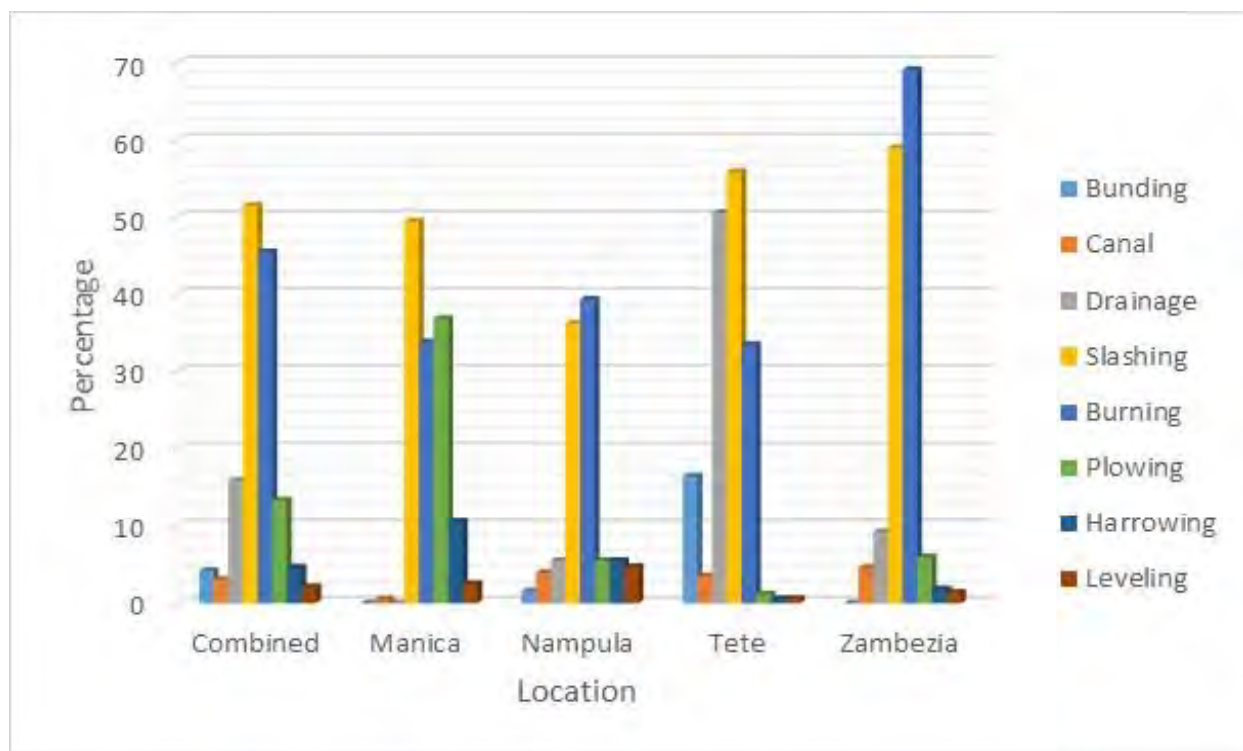


Figure 17: Field preparation by provinces

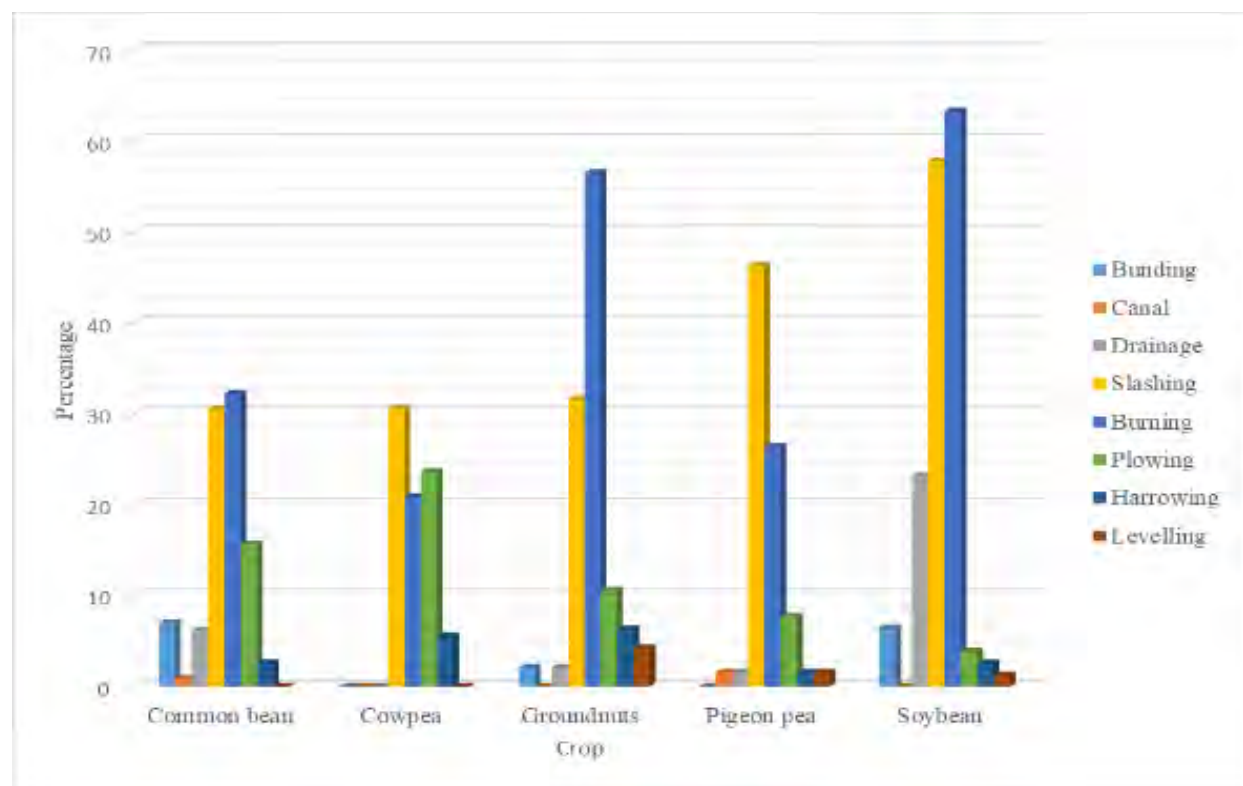


Figure 18: Field preparation by crop

About 40% of the households process their seeds before sowing. The process includes cleaning, soaking and application of fungicides and insecticides (Figure 19). Cleaning by picking out debris is a common practice in all provinces. Soaking of seeds and application of fungicides is relatively popular in Manica. Chemical seed treatment is not practiced by the sampled households in Zambézia. KII with input dealers revealed that they only supply inputs that they are sure of market. Due to perceived high cost of chemicals the farmers only purchase agro-chemicals during severe disease and pest attacks.

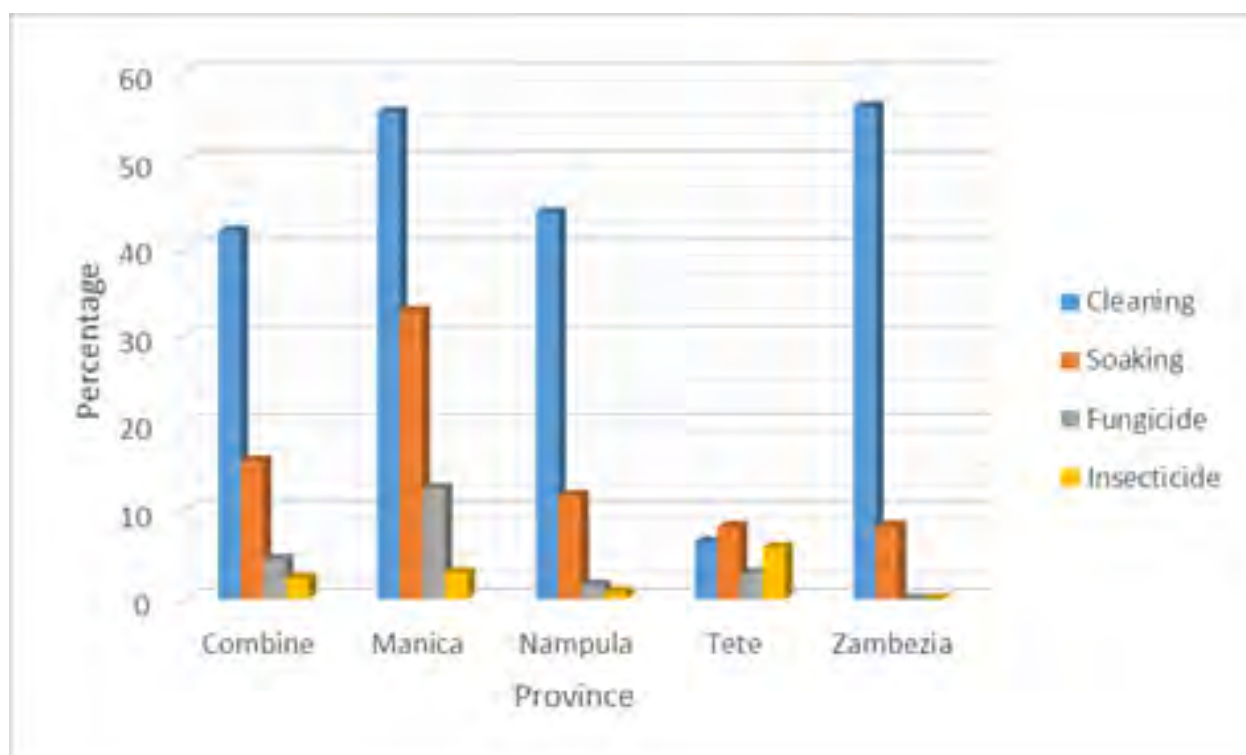


Figure 19: Seed treatment

Labor use

The households explore various sources of labor resources. Overall, male family labor dominates in terms of the proportion of labor employed, probably because of the laborious nature of most field operations (Figure 20). This is followed by female labor, hired labor, child and exchange labor. The households in Manica apply relatively more exchange labor than those of the other provinces. The proportion of females labor employed in Tete is also relatively higher.

On the average the households employ 23 man-days per ha of labor for legume production. Labor use is much higher for common bean, cowpea and groundnut, an indication of the amount of care required for those crops and the frequency of operations. Pigeon pea has the least labor use probably because it is cultivated as an intercrop, so it benefits from the canopy of companion crops which are planted first and harvested earlier. By the time the companion crop is harvested, the pigeon pea has developed adequate amount of vegetation cover to control weeds. It is also relatively tolerant to disease and insect attacks and is typically not sprayed.

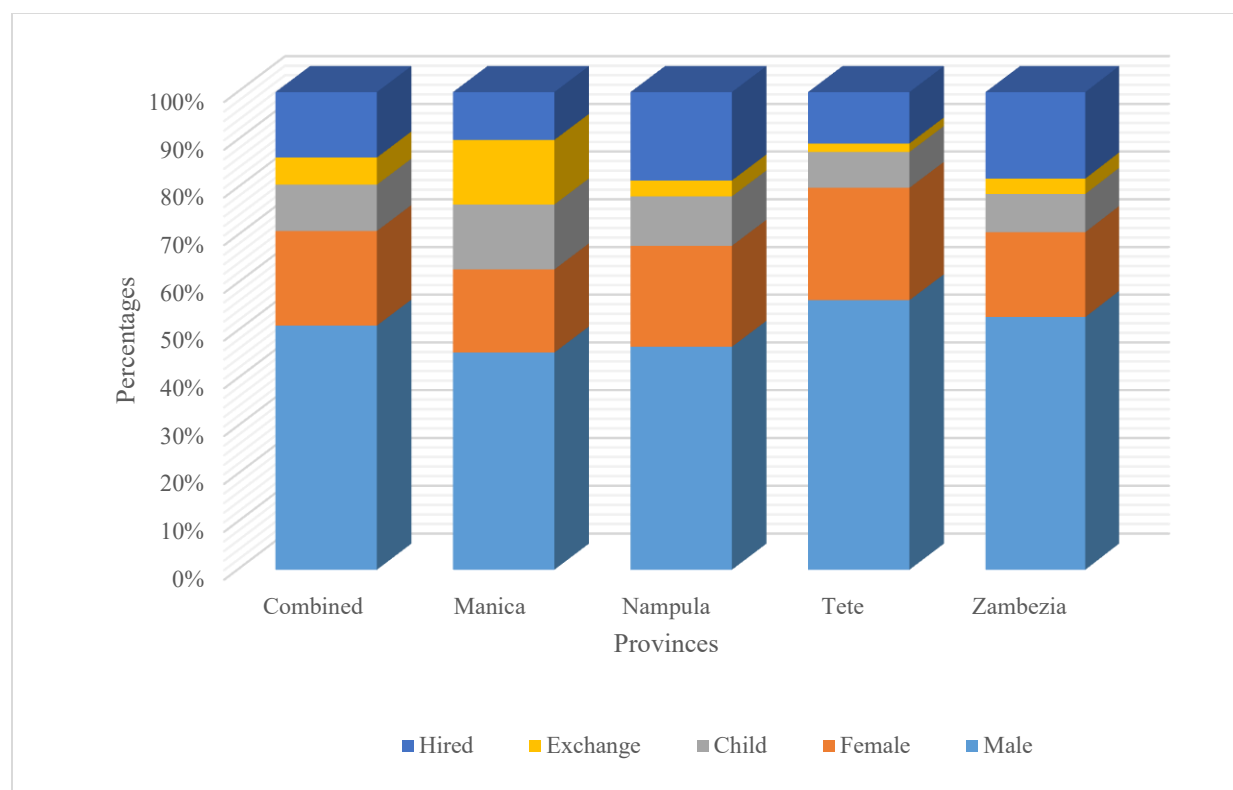


Figure 20: Distribution of labor use by type

Harvest and post-harvest activities

The average yields in the study area for 2015 are presented in Table 12. Averaged across provinces, yields ranged from 669 kg/ha for cowpea to 1,067 kg/ha for soybean. The yields were 12-41% below the yield potentials of the crops on farmers' fields. Common bean and cowpea yields were 33% below their yield potential, whereas groundnut and pigeon pea were 29 and 12%, respectively. Pigeon pea yield was higher than expected compared to the other crops and could be due to favourable growing conditions in 2015. Soybean had the highest yield among the

crops but also had the highest yield gap of 41% in terms of the yield potential on-farm. Sesame yields obtained from KIIs for the 2015 season were 35% below the potential yield. There were observable differences in yield levels among the provinces indicating that yields in Tete province were higher, whereas those for Manica were generally the lowest.

The performance below achievable yields can be attributed to low adoption of improved varieties of the legume crops and associated technologies. The low seeding rate, about 40% below the recommended rate, suggests that the canopies will not be adequately closed to smother weeds, hence an increased need for labor for weed control. The results further affirm the important role SEMEAR plays in providing access to technologies that can improve yields.

Table 12: Yield per ha for each province

Crop	Combined	Province				Potential/ Target ¹¹
		Manica	Nampula	Tete	Zambézia	
Common bean	872.9	719.1	928	1032.6	902.9	1,300.0
Cowpea	668.7	624.1	668.4		713.7	1,000.0
Groundnuts	851.3	851.1	849.9	889.0	836.4	1,200.0
Pigeon pea	1,060.3	.	1,061.0	.	1,059.6	1,200.0
Sesame ¹²	518.0	553.0	421.0		580.0	800.0
Soybean	1,066.7	.	922.0	1,188.0	1,090.2	1,800.0

The results in Table 13 show that the farm households obtain positive returns to the investments they make into legume production. Among the five crops groundnuts provided the highest returns to investment with an average gross margin of USD 215 per ha, followed by soybean and common bean. Common bean production in Tete ranks first in terms of profitability with USD 31 more profit than the zonal average.

¹¹ Potential at farm level as indicated by the targets in the SEMEAR MEL plan.

¹² These estimates were obtained from Key Informant Interview during verification exercise

Table 13: Gross Margin (USD/per ha) for each province

Crop	Combined	Province			
		Manica	Nampula	Tete	Zambézia
Common bean	171	141	182	202	177
Cowpea	76	71	76		81
Groundnuts	215	214	214	224	211
Pigeon pea	136	.	136	.	136
Sesame	143	153	116		160
Soybean	183	.	159	188	188

Although the estimated gross margins suggest good financial performance in the legume production systems, the information is not enough to draw implications on the extent of contribution to household income. However, if the households can still make positive returns to investment in the legume production system, which is shown to be associated with minimal application of improved technologies and practices, then they can equally obtain modest profit from other enterprises. Together with the income from off-farm activities the households would be in a better position to improve their wellbeing.

The distribution of harvested produce is presented for each commodity in Figure 21-25. Harvested produce are either consumed, given out as gifts, sold, used as seeds or loss during storage. The results in the figures suggest that storage is an important post-harvest operation for the households. Apart from the proportions that are sold immediately during the harvest period, the rest of the grains or seeds are stored before they are allocated to various uses. Losses are generally low for the legume producing households because of the options available for disposing-off harvested crops. Looking at the trends it appears the choice of distribution options depends on the commodity and the location. Other possible factors are the availability of storage and market facility as well as the period of harvesting.

In general, the common bean producers consume around 30% of their harvest, stores 16% as seeds, gives out 6% as gifts and lose 4% during postharvest processes (Figure 21). The rest, 44%, are either sold during the harvesting period or stored and sold later. The distribution of harvested common bean varies across the provinces although that for Manica follows the aggregate trend. Availability of markets explains the high proportion of common bean sold in Zambézia, Manica

and Nampula provinces. On the other hand, about 50% of common bean produced by households in Tete are for home consumption.

The distribution of harvested cowpea varies widely across the provinces. In Zambézia, the farm households consume 90% of the cowpea because it is not produced in large quantities, while those of Nampula sell up to 68% of their harvest and consume about 8% (Figure 22). While the role of market explains the proportion of cowpea sold in Manica and Nampula, the crop is a major food crop in Zambézia. This however deviates from the expectations of experts who believe consumption of cowpea should be higher. This will require further interrogations to ascertain the reason behind the finding. The distribution in Manica is nearly the same for consumption and sales. However, the households in Manica can store a significant proportion of their produce and sell later. If prices follow the usual trend of rising after the peak of harvest, the households in Manica would enjoy relatively higher prices. On the other hand, limited access to storage facilities among the households in Nampula may compel them to sell their produce immediately after harvest.

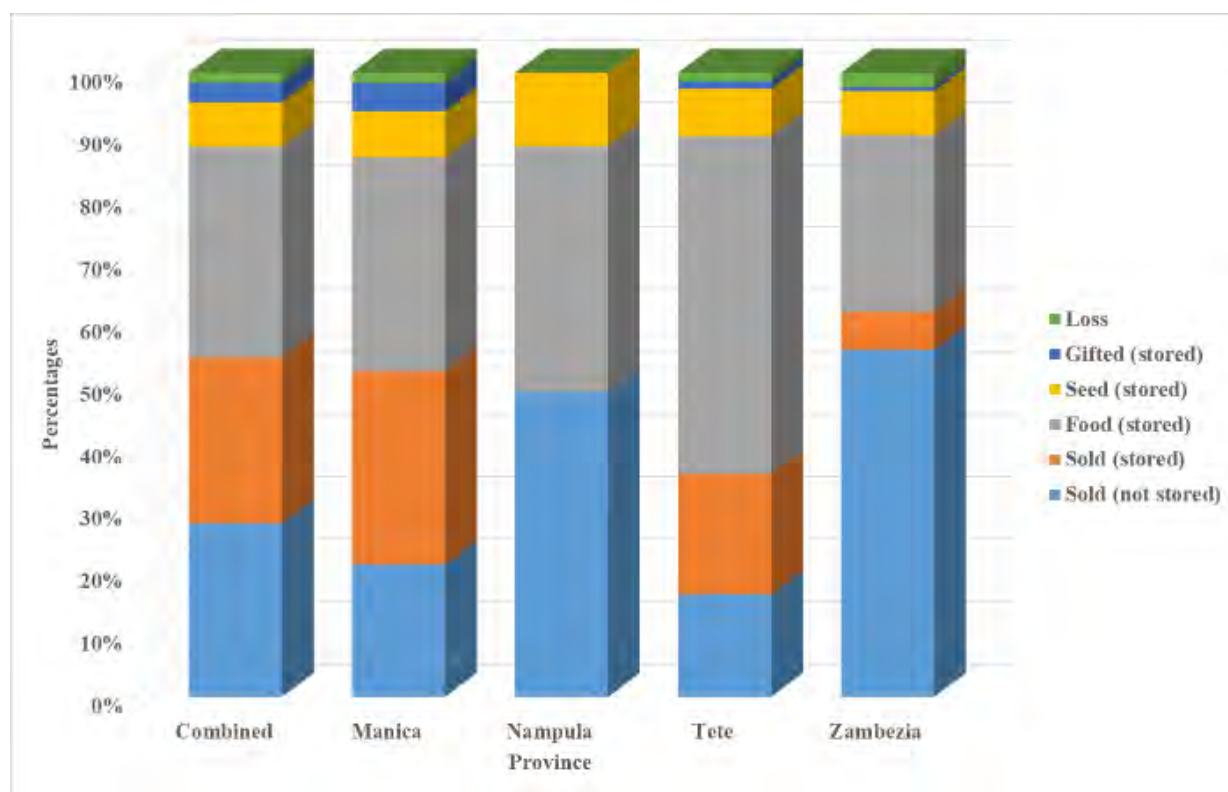


Figure 21: Distribution of harvested common bean

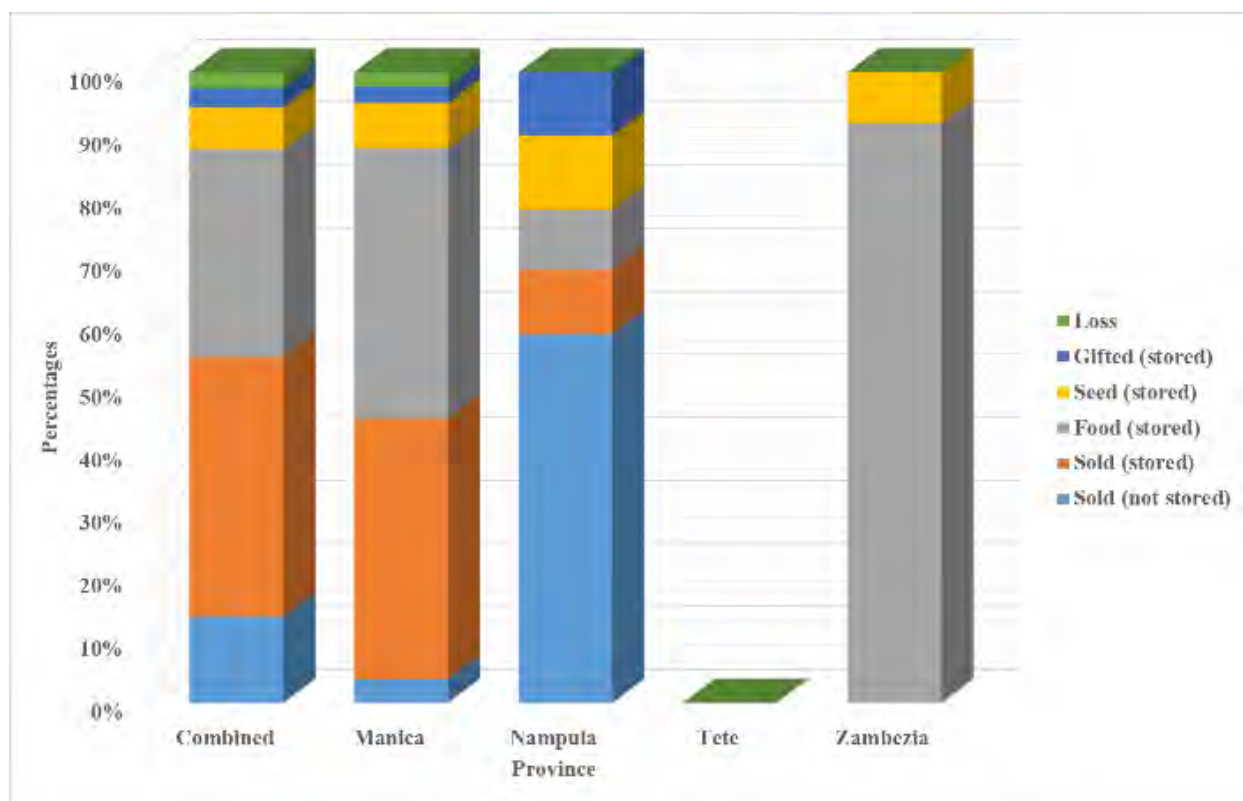


Figure 22: Distribution of harvested cowpea

Distribution of harvested groundnuts also varies across the provinces. About 70% of harvested groundnuts in Tete province was sold. Twenty-eight percent was sold immediately after harvest and 42% was stored and sold after the peak of the season. They consume 12% and recycle the remaining 18% as seeds. Again, the households in Nampula province sell about 36% of harvested groundnuts and store 28% as seeds (Figure 23). Unlike cowpea and common bean, the households in Nampula are able stagger sales of groundnuts. The relatively high proportion of harvested groundnuts stored for seeds presents an opportunity to SEMEAR and other development agents to meet existing seed demand gap, particularly in Nampula where most groundnuts are grown.

Access to markets continues to drive the proportion of harvested produced sold by households in Nampula. Unlike the case of Manica and Zambézia, the households in Nampula store a very small proportion of harvested pigeon pea as seeds, implying that they obtain seeds from other sources which may include the seed markets. A considerable proportion (40%) of harvested pigeon pea in Manica is consumed. Just like cowpea in Zambézia, pigeon pea may be relatively

preferred by the households in the province. The households are again able to sell effectively after the peak of harvest.

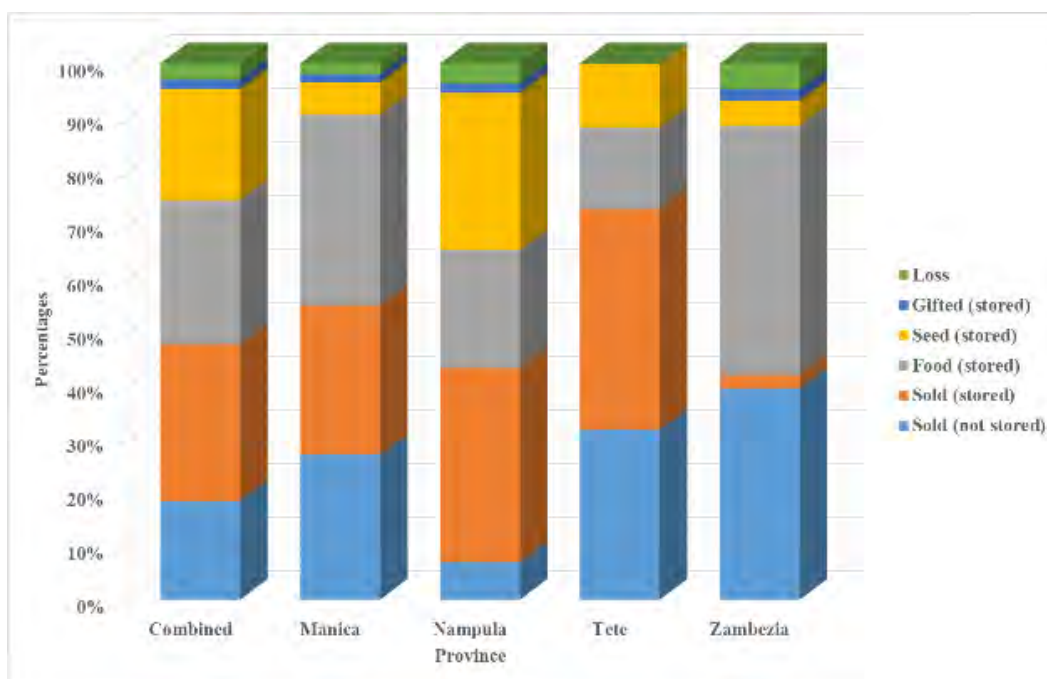


Figure 23: Distribution of harvested groundnut

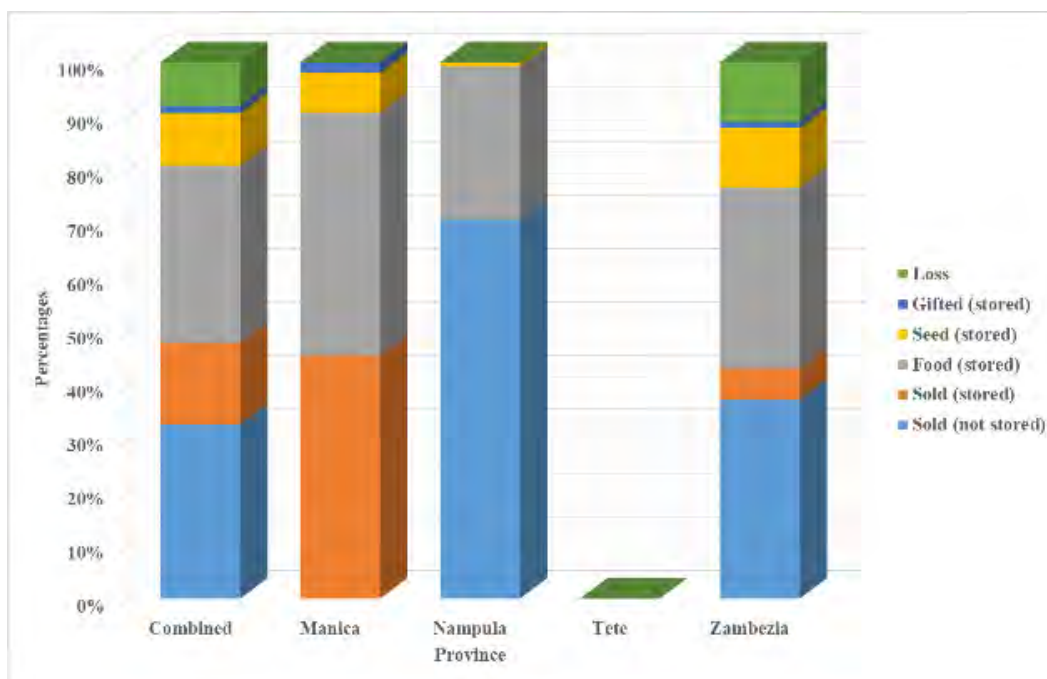


Figure 24: Distribution of harvested pigeon pea

About 88% of soybean is sold after harvest while 4% is consumed domestically. Except for Tete province, the households in Manica, Nampula and Zambézia sell soybean during the peak of harvest. The results show that the farmers in Nampula lose about 10% of harvested soybean during storage. This suggests that there is a potential challenge with the soybean storage systems in Nampula, which will require further investigation.

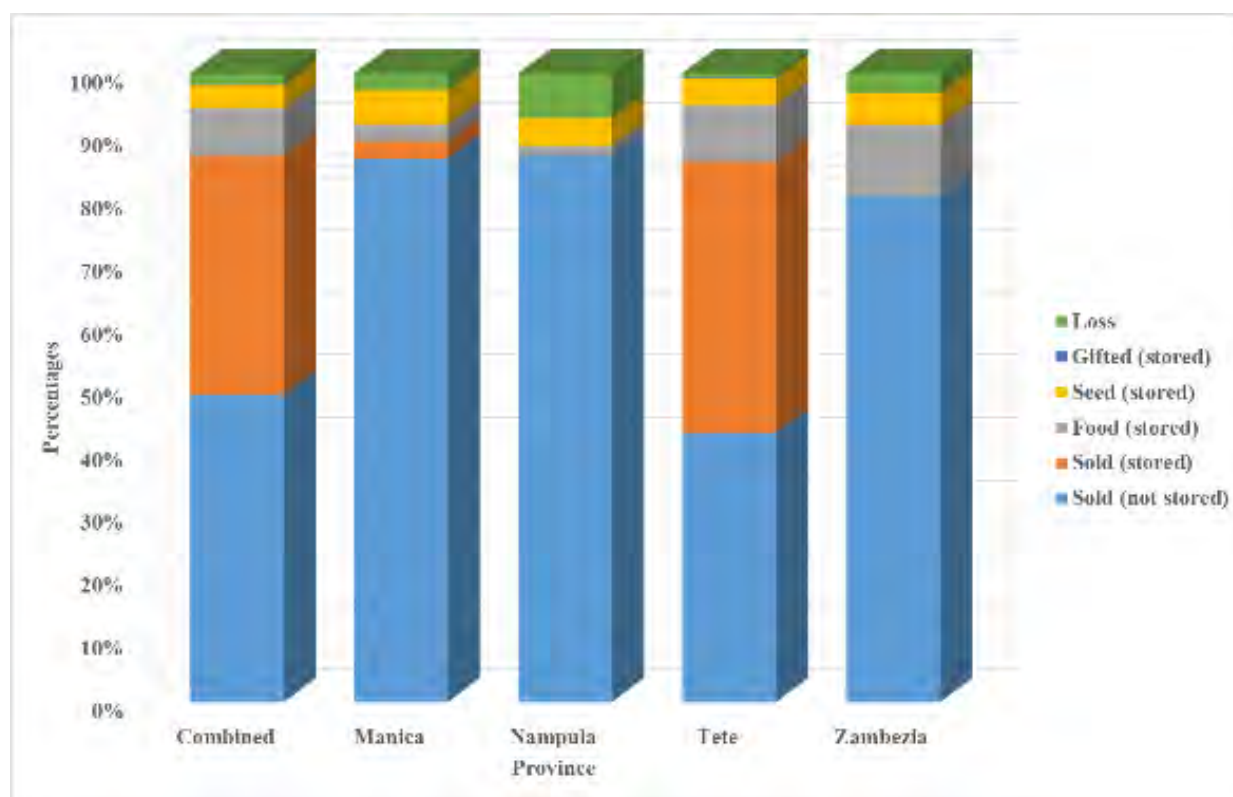


Figure 25: Distribution of harvested soybean

The foregoing discussions show that the households sell a significant proportion of their harvested produce immediately after harvest or stored for some time before sales. There are also harvested produce that are stored for seed. The storage location, packaging materials and treatment of stored products are presented in Table 14. Most of the households (70%) who store their produce do so in their homes, particularly for those in Tete and Zambézia. Others store on-farm and in government or private storage facilities. Without adequate storage facilities most of the households are compelled to dispose-off their produce through various channels identified earlier.

The harvested produce is usually packaged in sacks, double bags¹³, drums or metal containers. These materials can keep the produce longer when they are treated. However most of the households do not treat stored products. Some apply chemicals, dry them regularly or keep them in the kitchen for smoke treatment. There is the need to improve the post-harvest storage processes to enable the farmers store their produce for longer periods. This requires the identification, design and promotion of cost effective and affordable storage facilities and storage treatment options. This can help the households to stabilize food availability and prolong sales to meet higher prices after the peak harvest.

Table 14: Storage practices

Attributes	Overall	Province			
		Manica	Nampula	Tete	Zambézia
<u>Location (%)</u>					
On farm	3.9	10.6	2.4	0.6	1.4
Home	69.8	53.0	58.3	84.7	80.2
Government store	0.7	1.5	1.6	0	0
Private store	0.1	0.5	0	0	0
<u>Packaging (%)</u>					
Sack	46.8	28.8	44.9	53.5	59.0
Double bag	1.7	0.5	0	1.2	4.2
Drum	1.4		0	0	4.6
Metal containers	0.6	0.5	0	0	1.4
<u>Treatment (%)</u>					
General treatment	18.4	4.6	2.4	69.4	0.5
Chemical treatment	15.0	4.6	0	57.1	0.5
Dry treatment	3.9	0.5	2.4	14.1	0
Smoke treatment	1.3	4.6	0	0	0

Livestock production

In addition to crop production the farm households (about 71%) own livestock. Overall, households own an average of 1.4 total livestock unit. Rearing of livestock is common in Manica and Tete province (Table 15). Poultry is a predominant livestock enterprise followed by goats, cattle and pigs. Zambézia province has fewer households rearing these livestock but the poultry

¹³ This is an adapted version of the triple hermetic bagging innovation promoted by the Purdue Improved Crop Storage. For this case the farmer use the technology to store cowpea.

enterprise is still popular (Figure 26). Goats are also important in most of the provinces. In addition to the meat from the livestock, the households also produce eggs from the poultry enterprise, milk from the ruminants, and manure from their wastes. Some of the households in Manica use their animals for farm operations (Table 15).

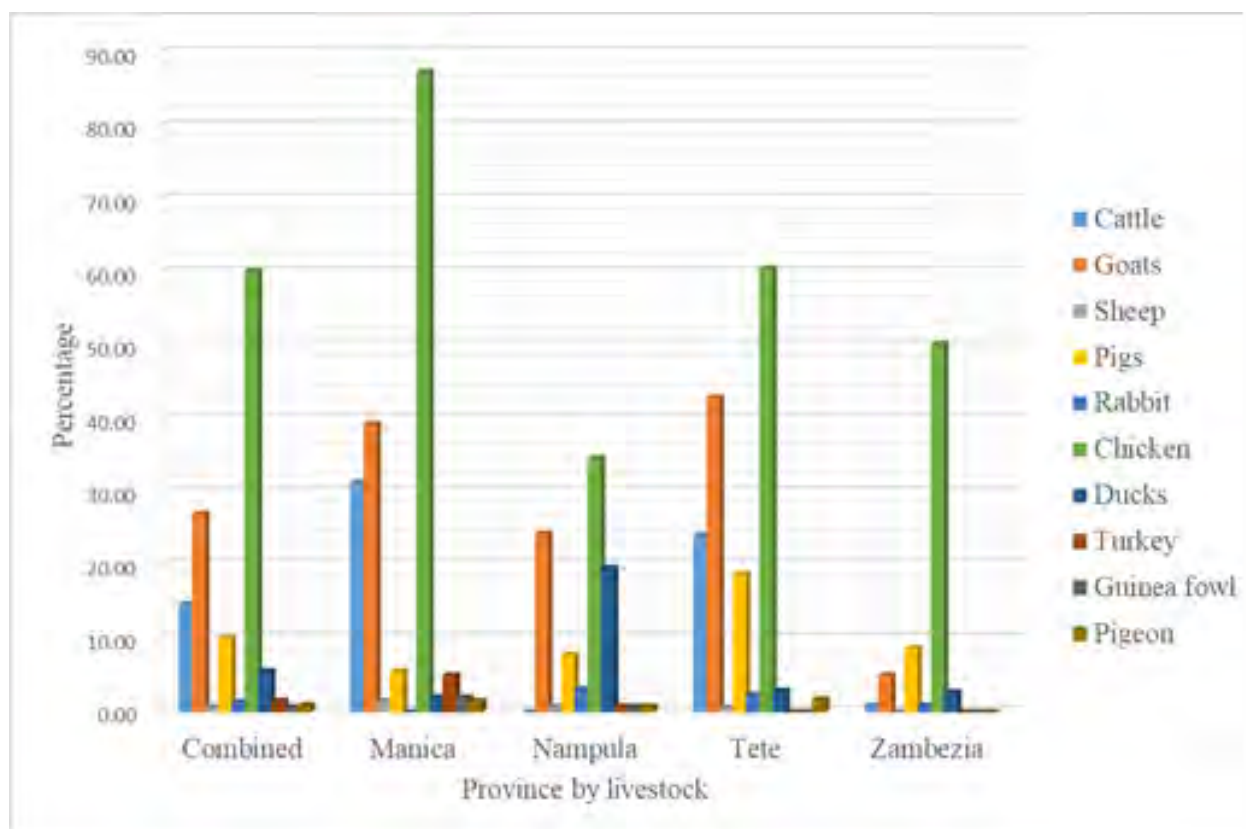


Figure 26: Livestock raised by households

The livestock enterprise is a source of livelihood as sales of animals and their products can finance other household expenses or farm operations. The meat from the animals is an important source of protein for the households, and potentially contributes to their food security status. The households can sell livestock and invest the proceeds into improved crop technologies or add to their incomes.

Table 15: Production of livestock and products

Products	Combined	Province			
		Manica	Nampula	Tete	Zambézia
Livestock (%)	70.79	90.40	48.82	81.76	57.14
Total Livestock Units (index)	1.40	1.84	2.02	1.53	0.31
<u>Products</u>					
Milk (%)	0.28	1.01	0.00	0.00	0.00
Eggs (%)	28.65	56.06	16.54	1.18	32.26
Hide (%)	0.14	0.51	0.00	0.00	0.00
Meat (%)	45.22	80.30	37.80	20.59	36.87
Manure (%)	0.42	0.51	0.79	0.59	0.00
Draft animal (%)	1.54	5.56	0.00	0.00	0.00

Constraints to productivity maximization

Every production system faces a set of challenges that can minimize output and performance. Identification of such constraints is critical for the design of effective interventions to alleviate the negative effects on the system. The respondents identified 13 production constraints that can be classified as natural or institutional (Figure 27 and Figure 28). Among the naturally occurring constraints, pest and disease problems are the only biotic constraints that are common to farm households in all the four provinces. Despite these problems, the households use limited pesticides due to the high cost of these chemicals and this contributes to low yields. During the dissemination of improved technologies for the legume-based system, facilitators are encouraged to identify pest control options that have very mild effects on the environment, since unguarded use can upset soil biotic balance and soil health (Frampton et al., 2009).

Climate change, which is associated with frequent droughts, floods and erratic rainfall, is identified as important set of constraint for farm operations. The phenomenon can be related to frequent bush fires and low soil fertility. Drought is a major constraint for farmers in Manica and yet less important in Tete. The farmers in Manica and Zambézia, on the other hand, consider floods as a problem. The most important constraint among farmers in Tete province is erratic nature of rains. The observed variations may be due to the ability of the households to adapt to the changes or their relative importance from the farmers' point of view. Poor soil fertility is the only edaphic constraint identified by the households. It is not a major constraint, as indicated by about 22% in Manica and 29% in Tete. We are, however, aware of the constraints related to soil

acidity in some locations such as Gurué, Angónia, Macanga and the highlands of Manica and among other locations. The ongoing soil mapping exercise can provide more evidence to confirm the veracity of these perceptions or otherwise.

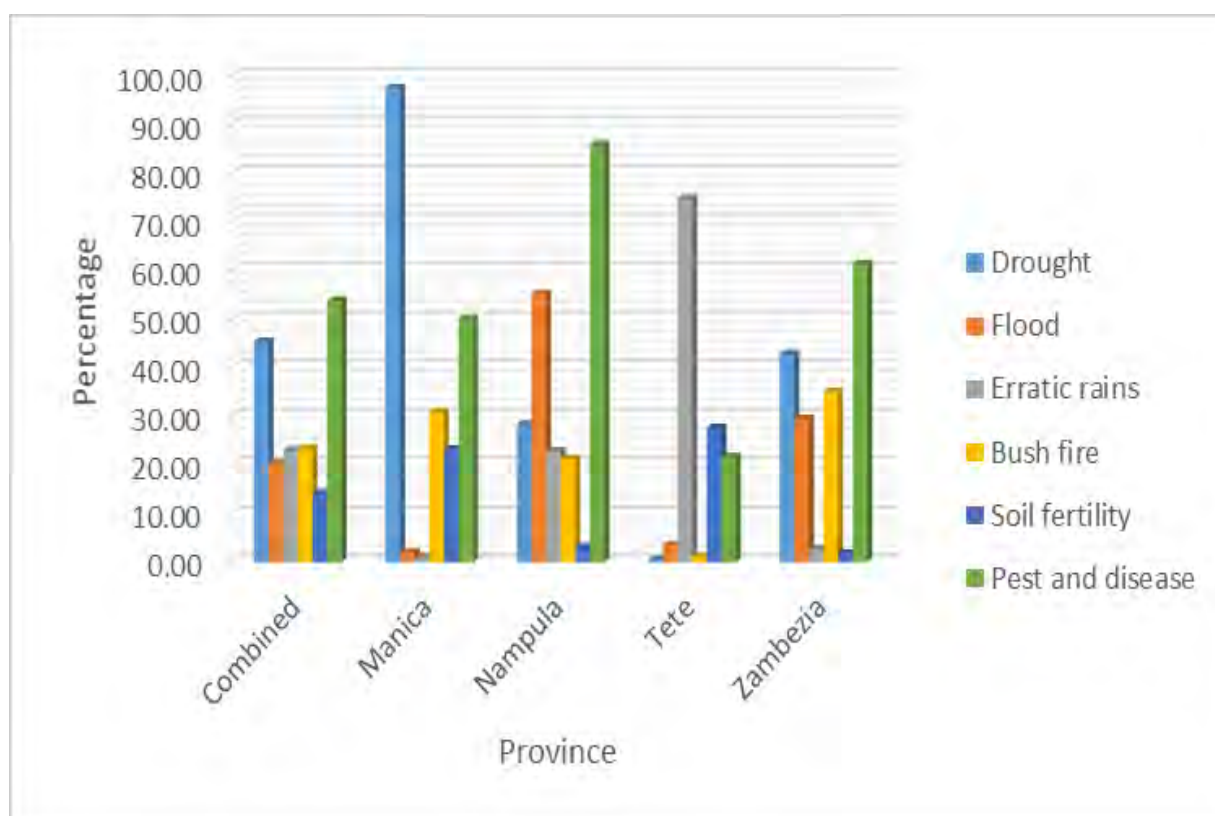


Figure 27: Climatic, biotic and edaphic constraints

The rest of the constraints are considered institutional, with inadequate access to information standing out as the main cause. Ironically, the sampled households do not consider it as a major constraint. Due to inadequate information the households are unable to identify alternatives to diversify their crop portfolio, and this increases the vulnerability of the households to shocks. Inadequate information limits the ability of farm households to secure credit and register their lands (for those who purchased land) and are therefore unable to invest adequately in improved technology. Access to skilled labor and tractor service is a constraint to farmers who do not possess adequate information on where and how to find them. Adequate access to information can improve their ability to identify sources of planting materials and agro-inputs at a good price, and access markets and negotiate good produce prices. Currently farmers have limited access to

extension either from the government, private or NGOs. Moreover, the observed low participation in farmer-based organizations further limits access to information. At best all these sources of information can be strengthened to facilitate access to relevant production information.

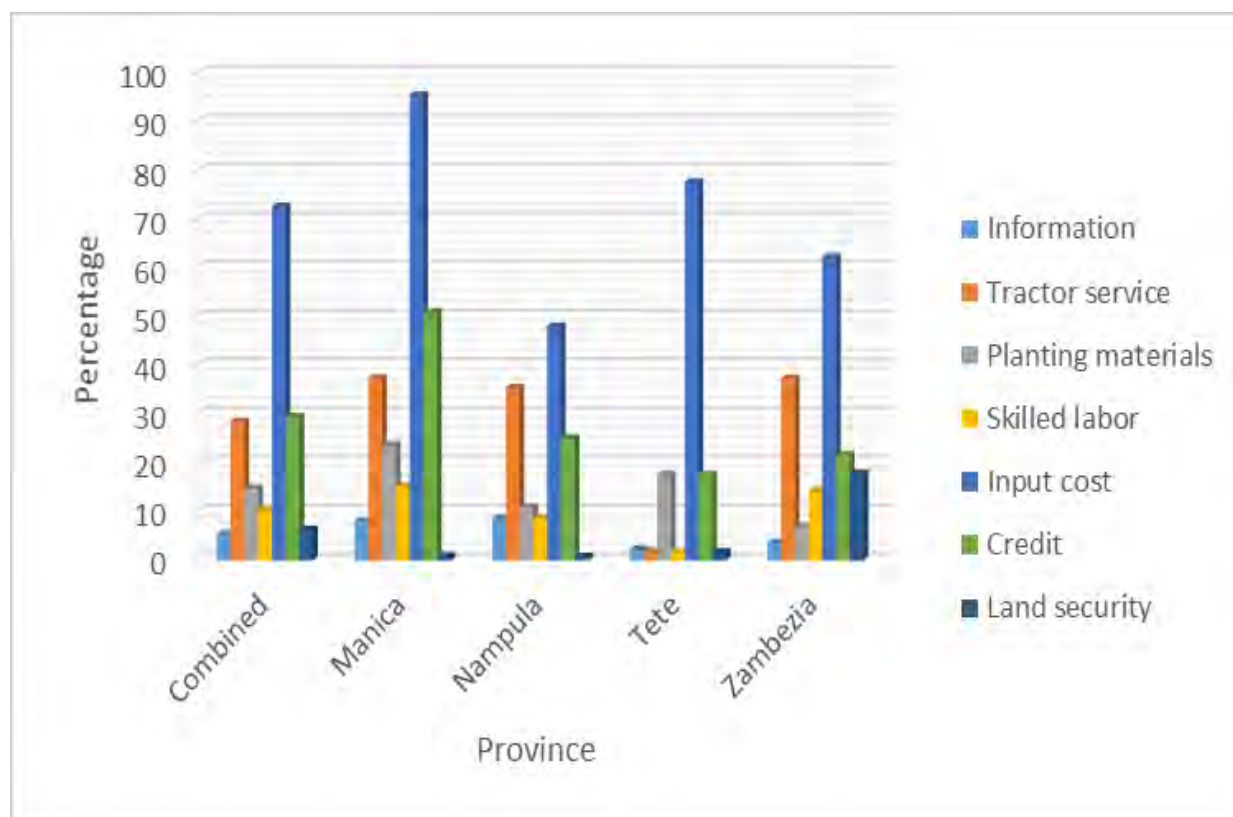


Figure 28: Institutional constraints

Further discussions with some of the legume producing households revealed that they are already taking measures to mitigate the effects of these constraints. For instance, some farmers are working off-farm and leasing unused lands to obtain additional income to invest in their farm businesses. There are however some constraints that they had no strategies to combat their effects. Meanwhile SEMEAR is promoting technologies to address some of these constraints. The varieties SEMEAR is promoting for instance, are early maturing to avoid terminal droughts, and management practices that are climate smart with elements of conservation agriculture.

Food security

Improving food security in the FtF ZOI is a major indicator of success for the SEMAR project. According to the results of this study, 47% of the households have inadequate food during some periods of the year (Table 16). The incidence of food insecurity is relatively lower in Tete province. During the period of inadequate access to food the household eat twice a day. Most households reduce the quantity of food consumed by adult males during the period of food shortage. Some households reduce the food of adult females and very few reduce the food for children (Table 16).

Table 16: Food security situation

Issues	Combine	Province			
		Manica	Nampula	Tete	Zambézia
Inadequate food (%)	47.3	53.5	44.1	16.5	67.7
Number of meals (N)	2	2	2	2	2
<u>Which member's food is reduced (%)</u>					
Male child	0.8	2.5	0.8	0.0	0.0
Female child	0.5	0.0	0.0	0.0	0.0
Adult male	29.1	31.3	19.7	10.0	47.5
Adult female	13.5	4.0	0.8	2.4	38.3

Further investigation led to the identification of periods of food shortages as shown in Figure 29. The general trend shows that the households experience food shortages at the beginning of the year and begin to enjoy adequate access to food in the middle of the year. The shortages start to pick up towards the end of the year. The cycle coincides with the planting season in the study area. Harvesting of produce starts in March during which period access to food improves. At the peak of harvest, April and May, where there is adequate or abundance of food the households report little to no food insecurity incidence. The households continue to enjoy adequate access to food until the beginning of the planting season when stores are exhausted. The trend rises and peaks in January and then the cycle continues.

To smoothen the cycle and ensure stable access to food at all times, the following options can be considered. Within the households, there should be the drive to increase production through expansion of crop area or intensification. The latter is preferred as it has minimal consequences on environmental resources. Another option is to increase crop portfolio to include off-season

commodities that can be produced to cater for the lean periods. Members of farm households can explore off-season employment to generate additional income that can be used to purchase food.

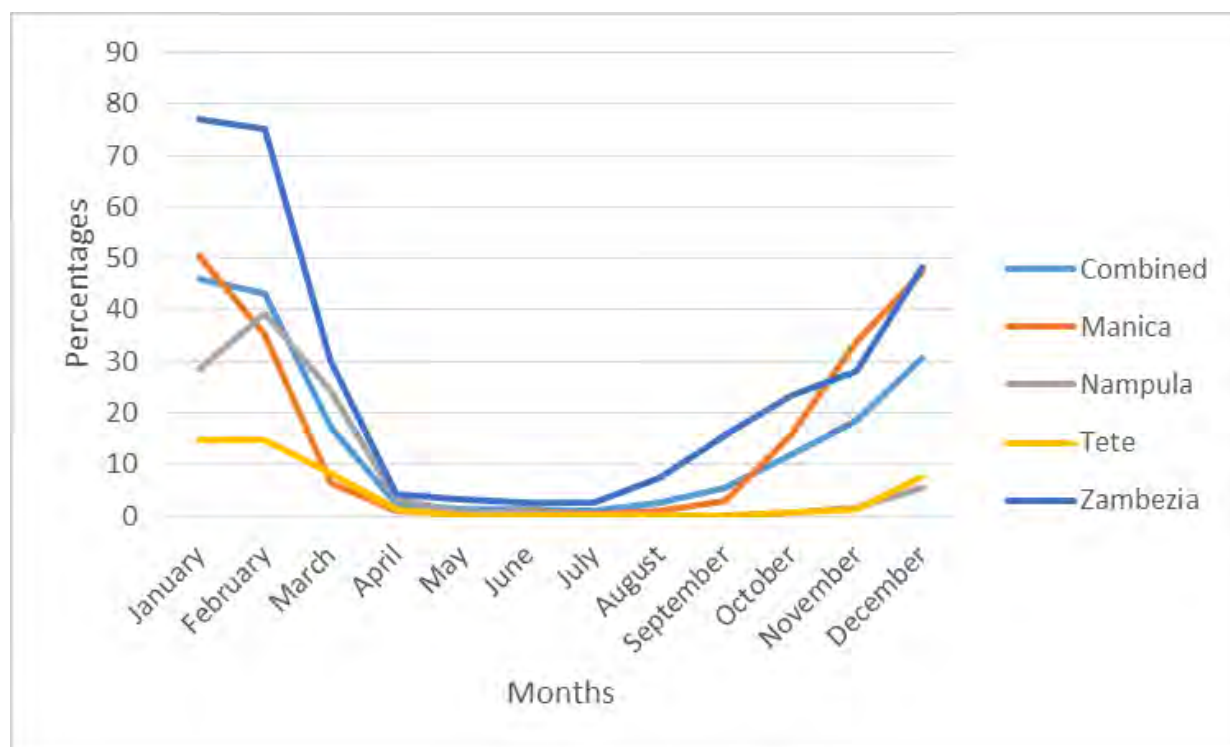


Figure 29: Periods of food shortage

The implication of the results is that the farm households have unstable access to food throughout the year. An intervention that can make food available during the lean periods will be useful. Exploring irrigation and provision of storage facility to extend the shelf life of harvested produce plus small-scale cottage processing are available options.

3.3. Status of Selected Indicators in the 2014/15 Production Season

The baseline study essentially measures the status of selected SEMEAR indicators prior to inception in October 2015. This section builds on the sampling frame and the summary from key findings of the study to estimate the 2014/15 values of corresponding indicators presented in Table 17.

Table 17: Baseline status of selected indicators

Indicator	Disaggregates	Baseline	Target
EG.3.2-17 Number of farmers and others who have applied improved technologies or management practices with USG assistance (RAA) (WOG)	Total	8,663	300,000
	<u>Gender</u>		
	Male	7,364	188,500
	Female	1,299	101,500
	<u>Technology</u>		
	Crop genetic	4,207	87,000
	Cultural practices	4,456	203,000
	<u>Crops</u>		
	Common bean	840	43,500
	Cowpea	4,481	58,000
	Groundnut	2,171	43,500
	Pigeon pea	65	43,500
	Sesame	-	14,500
	Soybean	1,106	87,000
EG.3.2-18 Number of hectares of land under improved technologies or management practices with USG assistance (RAA) (WOG)	Total	5,722	400,000
	<u>Gender</u>		
	Male	5,201	260,000
	Female	521	140,000
	<u>Technology</u>		
	Crop genetic	2,776	185,000
	Cultural practices	2,946	215,000
	<u>Crops</u>		
	Common bean	336	60,000
	Cowpea	2,689.2	80,000
	Groundnut	1,519.0	60,000
	Pigeon pea	71.5	60,000
	Sesame	-	20,000
	Soybean	1,106.0	120,000
Yield per hectare of beans, cowpea, groundnuts, pigeon pea, soybean and sesame (Customer Indicator)	Common bean	872.9	1,300
	Cowpea	668.7	1000
	Groundnuts	851.3	1200
	Pigeon pea	1,060.3	1200
	Sesame	518.0	800
	Soybean	1,066.7	1,800
EG.3-6,7,8 Farmer's gross margin per hectare, per animal or per cage obtained with USG assistance (RAA)	Common bean	171	255
	Cowpea	76	114
	Groundnuts	215	302
	Pigeon pea	136	154
	Sesame	143	221
	Soybean	133	310

EG.3.2-19 Value of small-holder incremental sales generated with USG assistance (RAA)	Common bean	1,069,303	4,042,500
	Cowpea	211,755	1,045,000
	Groundnuts	1,340,798	6,063,750
	Pigeon pea	848,240	2,200,000
	Sesame	1,191,400	6,325,000
	Soybean	1,376,043	6,325,000

Given the adoption incidence rate presented earlier and the intended target population, the total number of farmers who apply improved technologies and management practices is estimated at 8,663. To meet the target of 300,000 the activities of the project should increase adoption incidence rate by about 35 folds. When disaggregated by gender, the results show that female applicants include about 15% of the total. The project's goal of increasing female participation and impacts by 35% is well thought out to ensure that more female benefit from the project. Further disaggregation includes type of technology and crops.

The project activities must increase the land area under improved technologies 70 times the baseline estimate of 5,722 to 400,000 in 2020. This requires a lot of effort for motivating technology application and for capturing the area under the technologies. The area that female farmers allocate to improved technologies is about 9%, confirming the perception that females have limited access to land resources. Increasing this to 35% will be a remarkable achievement of the project.

The estimated baseline yields for six of the crops promoted by SEMEAR suggest that yields must be increased by about 30%, on the average, to meet the five-year target. With the expected adoption of good quality seeds of improved varieties and good agricultural practices, this target should be within the reach of the project. Similarly, gross margins must increase by an average of about 33% for the five-year target to be achieved.

At the baseline, we estimated value of sales instead of value of incremental sales. Based on this the additional sales can be easily discounted to obtain the value of incremental sales for each season and for the five-year period. This will depend on the changes in yields, number of beneficiary reached, prevailing market prices and foreign exchange rate.

4. CONCLUSION AND RECOMMENDATION

The SEMEAR initiative has the goal of improving incomes and food security among smallholder farmers in the FtF ZOI of Mozambique. Working through a consortium consisting of IITA, IIAM, CIAT and ICRISAT, SEMEAR is building on the achievements of PARTI to improve access and adoption of improved legume seeds and support the development of a sustainable legume seed system in the FtF ZOI. This baseline study provides reference point data on a set of output and outcome indicators for evaluation purposes. It characterises the legume production systems from the seed sector setup to the grain production system. The productivity and food security of farm households is also examined.

4.1. Conclusions

Three categories of stakeholders were identified in the seed sector of Mozambique. The public-sector actors include MASA, IIAM, USEBA and ANS. They facilitate the development of policies and guidelines, improved varieties and their availability. Private sector actors include seed companies, community-based seed producers, individual seed producers and input dealers. They are responsible for the production and marketing of certified and other classes of seeds in the country. The two sectors are supported by NGOs, financed by donors to develop technologies, facilitate the effective operations of institutions and advocate for the formulation of sound policies for the seed systems.

The study identified formal and informal private seed actors. The formal actors include registered seed companies and businesses with capacities to produce up to 750 MT of seeds. Due to low demand for seeds they form partnerships with development interventions/projects to ensure reliable demand for their seeds. The informal actors include community seed producers and operators of community seed bank system who produce quality declared seeds for farmers in remote communities. The quality declared seeds options is the only way they can make seeds available to farmers because not all their fields are adequately inspected and certified.

The legume production system is characterised by male dominated family units. Agriculture is the primary occupation in the study zones, and the source of much needed incomes for all the

households. The type of crop produced varies across the provinces, giving an indication of the effect of agro-ecological influence on the cropping system. The agro-ecology also influence the type of farming systems identified in the provinces. For instance, intercropping is common in Nampula and Zambézia province while sole/mono-cropping is common in Manica. With regards to farm business, majority of the households use local varieties and recycle their seed, even where they cultivate improved varieties. Soybean is an exception since it's relatively new, so the farmers have improved varieties as the only option. The major challenge with this type of assessment is the proper identification of the technologies, which can lead to under estimation or overestimation of adoption incidence. The households have diversified their sources of livelihood by taking up formal employment, farm labor, trading and craftsmanship among other things to supplement the output from their farms.

Production and incomes from agriculture and other off-farm activities is unable to provide the food needs of all households in the FtF ZOI, such that 47% of the households in the zones are food insecure at some point in time. The situation is even worse in Zambézia, where 68% of the households are food insecure. Multiple factors may account for this, but the main possible explanation is the low farm-level productivity which is in turn driven by low use of improved technologies, especially good quality seeds. None of the legume crops assessed had yields close to the potential. In some cases, the households will have to increase yields by 40% to reach the potentials of the crops. With low yields, the estimated gross margins are low questioning the ability of the farming operation to provide living wage.

Inadequate investment in improved technologies by the farm households is a plausible explanation for the low productivity. As shown by the result of the study, majority of the households cultivate local varieties of the legume crops. Even where they use improved varieties, for instance for soybean, they recycle seeds or obtain from their friends and relatives. In addition, the households do not undertake proper crop husbandry such as application of fertilizer, insecticides and inoculants. The farm households have identified institutional factors like lack of credit, planting materials and extension services as constraints they face. These institutional constraints are the results of inadequate information flow through the existing extension system. Due to the low extension- farmer ratio very few farmers have access to extension service. Most

of the farmers are also not members of association, and this further limits their ability to gain information through farmer-farmer exchanges.

Summaries of the results supported the computation of the baseline values of selected project indicators. According to the results a total of 8,663 farmers in the FtF ZOI are currently applying improved technologies on their fields. SEMEAR on the other hand has an ambitious target of 300,000 and will therefore require more effort to meet this target. Similarly, the project activities must increase the land area under improved technologies by about 70-fold from the baseline estimate of 5,722 ha to 400,000 ha in 2020. Baseline yields and gross margin are about 30% and 33% below the five-year target indicating the need for more effort to increase yields and incomes from the commodities. The baseline value of sales instead of value of incremental sales was computed so that the additional sales for 2016 onwards can be used to measure the incremental sales. This however depends on the number of farmers the project can reach, farm level performance and market prices.

4.2. Recommendation

The activities of SEMEAR address the identified constraints in the legume production systems in the FTF ZOI. SEMEAR employs various channels to disseminate information on improved technologies and extension services to farmers in their communities. To improve the outcomes of SEMAR specific recommendations for seed and grain production are presented below.

While the production of adequate quantities of improved seeds of high yielding crop varieties are essential, the challenge lies in the availability of demand for the seeds and ensuring that the required seeds are delivered to farmers in time. There is the need for aggressive demand creation activities through various media to increase awareness and demand for improved seeds. This should include encouraging the private seed producers (formal and informal) to establish demonstration fields, conduct electronic media campaigns and host input/seed fairs. The capacities of the seed producers, particularly those of the informal sector, need to be upgraded through training in seed production and business management.

SEMEAR is exploring community-based seed production systems to complement the formal seed system. The process requires continued supervision and coaching. It is also important for investors in the seed systems to develop robust tools for predicting annual seed demand. A digital map of the location of all sales outlets of seed producers, seed companies and input dealers will be a useful tool to share with farmers on the mobile messaging platform. A similar approach can be adopted to show the geographical locations of farmers/groups and their needs so that input dealers and seed growers can target their supplies accordingly.

The seed producers should be encouraged to also establish effective partnerships with input dealers, who most of the time have elaborate network for delivering fertilizers. This will ensure that the seeds reach farmers in remote communities.

Development agencies should partner with the government to re-engineer the operations of USEBA to make it more effective and efficient. Similarly, the capacities of staff of ANS must be enhanced through training on various released seed technologies to improve their inspection procedures. Moreover, government should partner with the private sector to identify ways of ensuring that all seed fields are inspected and registered to guarantee that seeds provided to farmers are of standard quality.

At the production level SEMEAR's partnership with Cooperative League of the United States of America (CLUSA) to disseminate information to farmers through the mobile phone messaging platform should be strengthened. Other partnerships that seek to create awareness about improved technologies through the establishment of joint demonstrations and training sessions to build capacities of government extension agents should be explored. Sustaining this approach will require SEMEAR to facilitate partnerships between the government extension systems and those organizations with the capacity to effectively deliver extension messages. At the policy level, the government of Mozambique should consider strengthening the capacities of the extension agents through trainings and provision of the necessary resources for their operations.

In addition to these, farmers associations have been identified as effective channel of information dissemination. To reduce transaction cost per capita, SEMEAR should continue working closely

with farmer organizations. It is also important for development interventions in general to identify and mentor existing farmer associations to enable them to operate effectively and become attractive to members of the communities. In places where such organisations do not exist, there will be the need to organize farmers into groups, and subsequently upgrade the groups.

Access to product market is critical for the sustainability of the legume seed system. If farmers can sell the excess produce they harvest, they can continue to buy improved seeds. In addition to promoting improved technologies, the SEMEAR team should also consider forming partnerships with interventions like Feed the Future Mozambique Agricultural Innovations Activity (FTF INOVA) to facilitate access to markets among the beneficiary farmers.

Farmer associations and associations of other actors in specific commodity value chains can be organized into multi-stakeholder platforms. In addition to facilitating the exchange of information across actors and within actor groups, these platforms serve as an avenue for the establishment and strengthening of linkages among actors. In effect, farmers can easily determine the kinds and quality products required by the market. Input dealers will also understand the needs of farmers and work to provide them. Where financial institutions are represented the platforms can also facilitate access to credit.

These propositions are expected to increase awareness and adoption of available crop technologies among the farm households. The technologies together with good agricultural practices can result in doubling yields. With the availability of ready market through the established linkages the farmers can easily sell their produce and obtain the highest benefit that can be used to purchase extra food needs and inputs.

Food security situation in the FtF ZOI can be improved through the propositions above. In addition, interventions that can also ensure the availability of food year-round, including provision of irrigation, proper storage facilities, and implementation of buffer store systems are options that can be explored to ensure a food secured population in the FtF ZOI.

SEMEAR is well placed to provide solutions for seed producers and farmers to overcome the identified bottleneck. The project contributes significantly to the seed system by providing early generation seed technologies to produce certified seeds for farmers. Its demand creation activities are increasing awareness and demand for improved seeds of high yielding varieties. These together with strategic partnerships for seed production and capacity building can increase uptake of improved technologies, increase yields and improve food security.

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APPENDICES

Appendix 1: Questionnaire for Community FGD

Consent form

Good morning/Afternoon. My name is _____, I am coming from IITA Mozambique. IITA and its partners (including IIAM) are currently conducting a study on the agricultural production systems in Mozambique. The primary goal of this study is to know how farmers make production and sales decisions. Your community has been selected as one of those to which the questions will be asked. You were not selected for any reason. Simply, your name was on a list of all communities and have been chosen randomly. We would like to ask the questions from this form to you. These questions will take about 1 hour to complete. All of your answers will be held in confidence. The answers which you might give us will only be used by IITA and IIAM. Please note that you have the right to stop this interview at any moment if you feel uncomfortable in the process. Before we start, do you have any question or is there anything that we have said for which you would like further clarifications?

May we proceed with the interview? 0=No; 1=Yes

MODULE 1. Community identification

Community Identification	Response/Name/Code	Interview details	Response
1. Province:		13. Name of enumerator	
2. District:		14. Name of supervisor:	
3. Administrative post:		15. Date of interview	
4. Locality:		16. Start time	
5. Community:		17. End time	
6. GPS reading of community meeting point		18. Date transmitted	
5. Way point number		19. Date reviewed	
10. Latitude (South)		20. Date updated	
11. Longitude(East)		21. Date validate and stored	
12. Altitude (meter above sea level)			

MODULE 2. Community population (2016 and 2006)

Population characteristics (Code 1)	Current estimates (2016)			2006			Code 1: 1= Number of Houses; 2=Number of Households; 3=Number of population; 4=Number of farming households; 5=% of adult; 6=% of adult literate; 7=% who completed High school; 8=% who completed tertiary education
	Male	Female	Total	Male	Female	Total	
22	23	24	25	26	27	28	

If censuses data is available use them.

MODULE 3. How do members of this community travel to the provincial capital City? Select the most popular or combination of media where applicable.

Medium (Code 1)	Time (minutes)	Fare (one adult)	Code 1: 1=Walk; 2=Bicycle; 3=Motor tricycle; 4=Taxi; 5=Bus; 6=Truck; 7=Other 1, specify
29	30	31	

MODULE 4. Indicate if your community has access to the following services/infrastructure/assets

Services/facilities (Code 1)	Distance to the facility (km) (Zero if within the community)	Who constructed this/ provided? (Code 2)	Who operates this facility? (Code 2)	Is this operational? (1=Yes; 2=no)	Proportion of households who access it (%)	Proportion of individuals who access it (%)
32	33	34	35	36	37	38

Code 1: 1=Electricity; 2=All-weather road; 3=Pipe-borne; 4=borehole water; 5=Input distribution shop; 6=Market place/post; 7=Health center/post; 8=Basic school; 9=Grain mill; 10=Larges storage facility (large); 11=Formal irrigated scheme; 12=Television service; 13=Radio service; 14=Television; 15=Bicycle; 16=Motor cycle; 17=automobile; 18=tractor; 19=mobile phone

Code 2: 1=government project; 2=other project (NGO, donor); 3=community; 4=District Assembly; 5=Individuals; 6=Other (specify

MODULE 5. Name the various projects or programs implemented in this community.

Name of project/program	Activities of project/program (Code 1)	Did the project focus on agriculture?	If yes which commodity? (Code 2)	Start year	Who facilitated this? (Code 3)	Did community members form group(s) for this project? (0=No; 1=Yes)	If yes, how was the group(s) formed? (Code 4)	What was the role of the groups? (Code 5)	Is the project over? (0=No; 1=Yes)	End year	If yes, are the participants still keeping the groups? (Code 6)	If yes, what are the roles of the groups? (Code 5)
48	49	50	51	52	53	54	55	56	57	58	59	60

Codes1: 1=Construction of bunds; 2=Demonstration management practices; 3=Demonstration on improved varieties; on land preparation; 4=Demonstration fertilizer application 5=Training on use and disposal of chemical; 6= Demonstrations on post-harvest handling; 7=Demonstrations on soybean inoculation; 8=Training on agribusiness; 9=Training on value chain participation; 10=Demonstrations on Integrated soil fertility management (ISFM); 11=Other specify	Code 2: 1=Common beans; 2=Cowpea; 3=Soybean; 4=Bambara; 5=Groundnut; 6=Pigeon pea; 7=Sesame; 8= Castor oil seed; 9=Seed cotton; 10=Sunflower seed; 11=Maize; 12=rice; 13=Millet; 14=Sorghum; 15=Wheat; 16=Yam; 17=Cassava; 18=Sweet potato; 19= Potatoes; 20=Coconuts; 21=vegetables; 22= Sugar cane; 23=Cows; 24=Bulls; 25=Young bulls; 26=Heifer; 27=Calves; 28=Goats; 29=Sheep; 30=Chicken; 31=Pigs; 32=Donkeys; 33=Ducks; 34=Turkeys; 35=Guinea Fowls; 36=Rabbits; 37=Other specify (Other, specify)	Code 3: 1=government; 2=IITA; 3=Local NGOs; 4=International NGO; 5=Donor; 6=community; 7=Individuals; 6=Other (specify)	Code 4: 1= randomly assigned; 2= based on traditional groups that had existed in the community; 3= based on geographical closeness (i.e. neighbourhood); 4= based on friendship; 5= based on kinship; 6= other way, explain	Code 5: 1=keeping group account in a bank; 2=utilization of group credit to purchase inputs; 3=labor exchange crop production; 4=group marketing of produce; 5= Other roles, specify	Code 6: 0=Not at all; 1=Yes 100%; 2=Yes, some of them
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MODULE 6. General agricultural calendar in 2014/15 and 5 years ago (tick appropriately)

Event (Code 1)	2014/15												2009/10											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85

Codes1: 1=Rainy period; 2=Nursing of seedlings; 3=Land preparation/transplanting; 4=Planting/sowing of seeds; 5=Fertilizer application (mark period for first followed by second application); 6=Herbicide application (mark period for first followed by second application); 7=Insecticide application (mark period for first followed by second application); 8=Weeding (mark period for first followed by second application); 9=Paddling (only for rice); 10=Scaring of birds (only for rice); 11=Maintenance of mounds (only for rice); 12=Harvesting; 13=Threshing; 14=Drying period; 15=Storage period; 16=Sales periods

MODULE 7: Adoption of crop technologies (General) (a)

Varieties identified in community surveys will be loaded here.

Technology or Innovation (Code 1)	Knowledge				First adoption		Discontinuation		Re-adoption		Proportion of households who currently use it
	Know (1=yes; no=2)	Year	Introduced by (Code 2)	How introduced? (Code 3)	Proportion of households who started to use it	If <100, why did others not use it? (Code 4)	Proportion of households adopted who stopped using	If >0 why? (Code 4)	Proportion of disadopters who readopted?	If <100 why? (Code 4)	
86	87	88	89	90	91	92	93	94	95	96	97

Code 1: 1=Improved varieties; 2=Hybrid varieties; 3=Improved seeds; 4=Herbicides; 5=Bunding; 6=Implement; 7=Dibbling in line; 8=Drilling; 9=Fertilizer; 10=Manuring; 11=Composting; 12=Fungicide; 13=Triple bagging; 14=Terracing; 15=Mulching/cover cropping; 16=Minimum tillage; 17=Crop rotation; 18=Fallow; 19=Use of farm yard manure; 20=Slash and burn; 21=Use of inoculants; 22=Use of lime

Code 2: 1=Self-discovery; 2=neighbouring farmers; 3=extension agents; 4=media; 5=NGOs; 6=private institutions; 7=others, specify

Code 3: 1=own experimentation; 2=observation of neighbouring farmers (without direct instructions); 3=taught by neighbouring farmers; 4=Demonstration; 5=media program; 6=Others, specify

Code 4: 1=Unaware; 2=lack of technical know-how; 3=lack of finance; 4=not profitable; 5=labor constraint; 6=unavailability; 7=complementary technology not available; 8=others, specify

MODULE 7: Adoption of crop technologies (General) (b)

Technology or Innovation (Code 1)	Access within community			Access within outside village			Preference			
	Access (1=yes; no=2)	Source (Code 2)	Price (MT/kg)	Access (1=yes; no=2)	Source (Code 2)	Price (MT/kg)	Traits (Code 3)	Rank trait (Code 4)	Reason for choice rank	Preferred attribute of trait (Code 5)
98	99	100	101	102	103	104	105	106	107	108

Code 1: 1=Improved varieties; 2=Hybrid varieties; 3=Improved seeds; 4=Herbicides;

Code 2: 1=farmer or relative from the village, 2= farmer or

Code 3: 1=Color; 2=Grain size; 3=Grain shape; 4=Plant height; 5=Plant structure;

Code 4: 1=Not important; 2=least

Code 5: 1=White; 2=Yellow; 3=Brown; 4=Mottled; 5=Large/big size; 6=Medium size; 7=Small

5=Bunding; 6=Implement; 7=Dibbling in line; 8=Drilling; 9=Fertilizer; 10=Manuring; 11=Composing; 12=Fungicide; 13=Triple bagging; 14=Terracing; 15=Mulching/cover cropping; 16=Minimum tillage; 17=Crop rotation; 18=Fallow; 19=Use of farm yard manure; 20=Slash and burn; 21=Use of inoculants; 22=Use of lime	relative from another village, 3=NARS, 4=Grains & Legumes Board, 5=Private Seed Comp. 6=another NGO (specify name),7=farmers' organization, 8=another facility (specify), 9=local market, 10 =other (specify)	6=Cob/pod/fruit/root size; 7=Cob per plant; 8=Cob fill; 9=Maturity; 10=Drought resistance; 11=Pest and disease resistance; 12=Striga resistance; 13=Grain yield; 14=Soil nutrient efficiency; 15=Nutritional value; 16=Flour quantity; 17=Texture of cooked meal; 18=Consistency of cooked meal; 19=Price; 20=Access to seeds; 21=Fertilizer response; 22=Time to cook; 23=Pound-ability; 24=Other specify	important; 3=moderately important; 4=important; 5=very important	size; 8=Smooth; 9=Rough; 10=Tall; 11=Short; 12=Medium; 13=Erect; 14=Creeping/spreading; 15=Slender; 16=Stout; 17=Single; 18=Double; 19=Multiple; 20=Full; 21=Moderately full; 22=Sparse; 23=Early maturing; 24=Late maturing; 25=Intermediate maturing; 26=Resistance; 27=Highly resistant; 28=Moderately resistant; 29=High; 30=Moderate; 31=Low; 32=Very efficient; 33=Moderately efficient; 34=Inefficient; 35=Heavy; 36=Light; 37=Intermediate ; 38=Hard; 39=Soft; 40=Lumpy; 40=Gritty; 41=Hardens; 42=No change; 43=Heavy; 44=Constant; 45=Fluctuating; 46=No trend
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MODULE 8: Constraints and ranking, mitigation strategy

Do you observe this constraint (Code 1)	Rank constraints (0=not applicable; 1=least; 2=low; 3=moderate; 4=High; 5=highest)			% loss to yield/revenue	Mitigation strategy (Code 2)	Success of strategy (%)
	Incidence/spread	Intensity/concentration	Severity of damage			
109	110	111	112	113	114	115

Code 1: 1=High cost of inputs; 2=Lack of skilled labor; 3= Lack of access to credit; 4=Lack of access to productive land; 5=Lack of access to tractor; 6=Lack of weather information for planting; 7=Lack of quality of planting materials of improved crop varieties; 8=Low soil fertility; 9=Pest; 10=Disease; other specify	Code 2: 1=Make advance plans; 2=seek support through association; 3=seek the help of experts; 4=Other specify
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MODULE 13: Labor

Question	Response
157. What are the sources of labor for farmers in this community? (Multiple choice) 1=Labor within the community; 2=Labor from neighbouring community; 3=Immigrants from other towns/districts	
158. What are the types and percentage of labor use in this community? 1=Family labor%; 2=Hired	

labor%; 3=Communal labor%	
159: Are there constraints in accessing labor within the communities? 0=No 1=Yes	
160: If yes, mention three of the most common constraints	
161: Is there any contractual agreement of labor in this community? 0=No 1=Yes	
162: If yes, state the type of contract.	

MODULE 14: Food security situation

Question	Response
166: Does all members of this community have access to adequate amount food throughout the year? 1=Yes; 2=No	
167: Which months of the year do you experience severe shortages (multiple choice)? 1=January; 2=February; 3=March; 4=April; 5=May; 6=June; 7=July; 8=August; 9=September; 10=October; 11=November; 12=December	
168: Which months of the year do you experience adequate food availability (multiple choice)? 1=January; 2=February; 3=March; 4=April; 5=May; 6=June; 7=July; 8=August; 9=September; 10=October; 11=November; 12=December	
169: Which months of the year do you experience abundance of food availability (multiple choice)? 1=January; 2=February; 3=March; 4=April; 5=May; 6=June; 7=July; 8=August; 9=September; 10=October; 11=November; 12=December	
170: How do you cope with the shortage? (multiple choice) 1=reduce consumption; 2=ration food; 3=buy more food; 4=sell assets to buy food; 5=sell livestock to buy food; 6=work off farm to generate income; 7=other (specify)	

Appendix 2: Questionnaire for Household interviews

Good morning/Afternoon. My name is _____, I am coming from IITA Mozambique. IITA and its partners (including IIAM) are currently conducting a study on the agricultural production systems in Mozambique. The primary goal of this study is to know how farmers make production and sales decisions. You have been selected as one of those to which the questions will be asked. You were not selected for any reason. Simply, your name was on a list of all households and have been chosen randomly. We would like to ask the questions from this form to you. These questions will take about 2 hour to complete. We will allow intermittent break periods whenever necessary. All of your answers will be held in confidence. The answers you give us will only be used by IITA. Please note that you have the right to stop this interview at any moment if you feel uncomfortable in the process. Before we start, do you have any question or is there anything that we have said for which you would like further clarifications?

May we proceed with the interview? 0=No; 1=Yes

MODULE 1. Household identification

Household Identification	Response/Name/Code	Interview details	Response
1. Province:		12. Name of enumerator	
2. District:		13. Name of supervisor:	
3. Administrative post:		14. Date of interview	
4. Locality:		15. Start time	
5. Community:		16. End time	
6. Household (Head's surname, Given name)		17. Date transmitted	
5. Respondent (Name if different the from head)		18. Date reviewed	
10. Cell phone number:		19. Date updated	
11. Gendered Household		20. Date validate and stored	
Male & Female Adults (M&F) 1 Adult Female No Male (FNM) 3		21. GPS reading of homestead	

Adult Male No Female Adult (MNF) 2	Child No Adults (CNA) 4		
Nativity (1=Native; 2=Settler; 3=Itinerant)		22. Way point number	
		23. Latitude (South)	
		24. Longitude(East)	
		25. Altitude (meter above sea level)	

MODULE 2: Household composition and characteristics (Human assets)

MID	Name of household member (start with the head of the household)		Sex (1=Male; 2=Female)	Age (years) indicate 1 for individuals <1	Marital status (Codes 1)	Education (years)	Highest grade (Code 2)	Still in school (1=Yes; 2=No)	Relation to HH head (Codes 3)	Religion (Code 4)	Labor availability		
	Surname	Given names									Fitness (Code 5)	Number of months living at home in the last 12 months?	Give reason if less 12 months (Code 6)
26	27	28	29	30	31	32	33	34	35	36	37	38	39
01													
02													

Codes 1: 1=Never married; 2=Married living with spouse/s; 3=Married but spouse away; 4=Separated; 5=Divorced;	Codes 2: 0= None 1=Primary; 2=Junior high; 3=Senior high; 6=Post-secondary (Training/vocational); 7=Diploma; 8=Bachelor;	Codes 3: 1=Head; 2=Spouse; 3=Son/daughter; 4=Parent 5=Brother/sister; 6=Son/daughter in-law; 7=Father/mother-in-law; 8=Brother/sister-in-law; 9=Grandparent; 10=Grandchild;	Code 4: 1=Catholic; 2=Protestant; 3=Muslim; 4=Traditional; 5=Animism;	Codes 5: 1=able bodied 2=partly disabled 3=fully	Code 6: 1=To find a job/working; 2=To attend school; 3=Married away; 4=Passed away; 5=Born-in; 6=Married-in; 7=Visiting relatives/gone back home;
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6=Widow/ widower; 7=Never married; 8=Other, specify.....	9=Master; 10=Doctorate; 11=Adult education; 12=Religious	11=Uncle/Aunt; 12=Cousin (father); 13=Cousin (mother); 14=Other relative; 15=Hired worker; 16=Other, specify.....	6=Other, specify	disabled 4= aged 5=sick	8=Medication/hospitalized; 9=Missing; 10=Worker left; 11=Other (specify)
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MODULE 3: Physical assets (housing) (a)

No.	ITEM	Response
40	Accommodation status {1= landlord, 2= tenant, 3= loan, 4= donation room; 5= other (specify)}	
41	Number of huts/houses for the household	
42	Total number of piece rooms/bedrooms in accommodation	
43	Main material used for the hut/house walls {1= wood; 2= clay without roughcasts ; 3= clay rough casted; 4= land bricks without roughcast ; 5= rough casted land bricks; 6= hard no roughcast; 7= hard with roughcast, 8= half hard (clay rough casted in cement), 9= other (specify)}	
44	Main roof material {1= straw/raffia leaves/thatch, 2= sheet aluminum, 3= tiles, 4= concrete slab roof, 5= banco, 6= other specify}	
45	Household water supply (1= river/pond, 2= wells, 3= bare hole, 4= water conveyance, 5= other)	
46	Main source of lighting {1= storm lamp, 2= candle, 3= generator, 4= electricity, 5= solar panel, 6= torch, 7= oil lamp, 8= other (specify)}	
47	Source of fuel for cooking {1= agricultural by-product, 2= charcoal, 3= firewood, 4= gas, 5= electricity, 6= other (specify)}	
48	Type of bathroom facilities used {1= none, 2= latrines; 3= modern restroom, 4= other (specify)}	

MODULE 3: Physical assets (excluding land) (b)

Asset (Code 1)	Does your household have this asset? (1=Yes; 2=No)	Number of items currently owned	In the past 12 months		How did this household acquire this parcel? (Code 2)	Purchase price (MT/unit)	How much will you sell it now	Current value (MT/unit)
			Number of items purchased	Number of items sold				
49	50	51	52	53	54	55	56	57

Code 1: 1=Tractor; 2=Plough sets; 3=Carts; 4=Wheelbarrows; 5=Borehole; 6=Motorized Sprayer; 7=Diesel pumps; 8=Water tanks; 9=Beehives; 10=Trailers; 11=Grinders; 12=Hand hoe; 13=Milking churns; 14=Storage facility (building); 15=Bicycle; 16=Radio; 17=(Car) Battery; 18=TV; 19=Mobile Phone; 20=Solar panel; 21=Chair; 22=Table; 23=Bed; 24=Mosquito net; 25=Motorcycle; 26= Cars; 27=shotgun; 28=moped; 29=straw mattress; 30=modern mattress; 31=mat; 32=stools; 33=chairs; 34=dishes; 35=bowl; 36=pots; 37=canary/jar; 38=radio cassette player/tape recorder; 39= armchair; 40=cupboard/buffet; 41=bookcase; 42=mirror; 43=basin; 44=bucket; 45=spoon/fork; 46=bedsheets/blanket; 47=carpet; 48=broom; 49=can; 50=barrel; 51=television; 52=video tape recorder/DVD; 53=suitcases/metallic cases; 54=Ox-Cart; 55=Ox-plough; 56=Axe; 57=Hoe; 58=Knapsack sprayer; 59=Water pump; 60=Spade or shovel; 61=Wood stove; 62=Kerosene stove; 63=Gas stove; 64=Electric stove; 65=Small Truck (Picks-ups); 66=Big trucks (lorry); 67=Motorized grain mill; 68=Panga knife; 69=Thatch roofed house; 70=Iron sheet roofed house; 71=Other specify.....

Code 2: 1 = Inherited;
2 = Received from NGO/Pass on;
3 = Bought with cash;
4 = Bought on credit
5= Own established;
6 = Rented
7=received as gift
8=borrowing from relatives
9=other (specify)

MODULE 4: Land resource (parcel identification) (a)

Make sure to include all the parcels owned/operated (owned-and-operated, owned-but-not-operated, and not-owned-but-operated parcels) by the HH.

Parcel Name	Parcel ID	Size (ha)	Distance to home (km)	Way point number	Latitude (South)	Longitude (East)	Size by GPS (ha)	Size by household's estimation (ha)	Number of plots	Main water source for crop production. (Code 1)	Do you use a pump to get water from the source? (1=Yes, owned 2=Yes, rental 3=No)	What is the major type of soil of this parcel? (Code 2)	What is the local name of the soil of this parcel?	Perceived fertility (Code 3)	Rate of soil erosion (Code 5)
58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73

Code 1: 1=rain-fed; 2=flood from river; 3=flood from swamp; 4=diversion of river water; 5=water stored in pond/tank; 6=borehole/well; 7=dam; 8=other (specify)	Code 2: 1=sandy; 2=loamy; 3=clay; 4=laterite; 5=other, specify	Code 3: 1=poor; 2=medium; 3= very fertile	Code 4: 1=No erosion; 2=medium; 3=severe
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MODULE 4: Land resource (Land Tenure) (b)

Program will be designed to show all parcels mentioned in Module 3

Parcel ID	Tenure System (Code 1)	How was this parcel acquired? (Code 2)	Year of acquisition?	Did you rent-out any part of this parcel in 2015/16? 1=Yes 2=No	If rented-in or rented-out				If you were to buy/rent-in this parcel		Are you allowed to do this without getting permission from others?		
					How much was paid to the land owner or receive from the tenant? (MT)	How many years have you been renting-in/out this parcel continuously ?	Relation with land owner/tenant (Code 3)	Residence of land owner/tenant	How much GHC are you willing to pay to buy?	How much GHC are you willing to pay to rent-in per season?	To sell this parcel? (1=Yes; 2=No)	To rent out this parcel? (1=Yes; 2=No)	To inherit this parcel? (1=Yes; 2=No)
74	75	76	77	78	79	80	81	82	83	84	85	86	87

Code 1: 1=owned family land; 2=allocated family land; 3=rented-in; 4=village chief; 5=government; 6=other (specify)	Code 2: 1=purchased; 2=rented-in for fixed payment; 3=received as gift; 4=received as inheritance; 5=borrowing from relatives; 6=sharecropping-in; 7=just walk-in; 8=other (specify)	Code 3: 1=relative; 2=friend; 3=neighbour; 4=other (specify)	Code 4: 1=same village; 2=same district; 3=other
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MODULE 4: Land resource (Identification of plots within parcels) (c)

Program will be designed to show all parcels mentioned in Module 3: Note that each parcel has several plots. Each plot must be identified

Parcel ID	Plot ID	Plot size (Ha)	When was the first time you used this plot? year	Since then did you continue to use the plot? (1=Yes; 2=No)	If no give reasons	Primary use plot in last 5 cropping seasons (Code 1)					Activities in 2014/15 season					Member responsible for the plot	
						2014/15	2013/14	2012/13	2011/12	2010/11	If crop production, name cropping system in (Code 2)	Main crop? (Code 3)	Crop used as intercrop (Code 2)	Do you rotate crops on this plot? (1=Yes; 2=No)	Rotation crop in previous season to...	MID	Years of experience
88	89	90	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105

Code 1: 1=rented-out; 2=borrowed-out; 3=fallow; 4=tree plantation; 5=virgin land; 6=grazing; 7=livestock rearing	Code 2: 1=Pure stand; 2=Inter-cropping	Code 3: 1=Common beans; 2=Cowpea; 3=Soybean; 4=Bambara; 5=Groundnut; 6=Pigeon pea; 7=Sesame; 8= Castor oil seed; 9=Seed cotton; 10=Sunflower seed; 11=Maize; 12=rice; 13=Millet; 14=Sorghum; 15=Wheat; 16=Yam; 17=Cassava; 18=Sweet potato; 19= Potatoes; 20=Coconuts; 21=vegetables; 22=Sugar cane; 23=Livestock rearing; 24=Residential; 25=(Other, specify)
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MODULE 5: Crop production (Land preparation-repairs and clearing of on plot in 2014/15) (a)

Program will be designed to show all parcels and respective plot

Parcel ID	Plot ID	Was plot already bunded? (Code 1)	If yes, who constructed the bunds? (Code 2)	If yes, did you repair bunds? (1=Yes; 2=No)	If there were no bunds, were bunds constructed in the years? (Code 1)	If yes, who constructed the bunds? (Code 2)	Did plot have water inlet canals? (1=Yes; 2=No)	If yes, who constructed the inlet canals? (Code 2)	If yes, did you repair the inlet canals? (1=Yes; 2=No)	Did plot have water drainage canals? (1=Yes; 2=No)	If yes, who constructed the drainage canals? (Code 2)	Did you cut trees and/remove stumps on the plot? (1=Yes; 2=No)	Did you burn crop residue before ploughing? (1=Yes; 2=No)
106	107	108	109	110	111	112	113	114	115	116	117	118	119

Code 1: 1=Yes, big bund; 2=Yes, mini bund; 3=No, no bund	Code 2: 1=Project; 2=MOA; 3=Farmer association; 4=Farmer him/herself; 4=Other farmer who cultivated the land
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MODULE 5: Crop production (Land preparation-seed be preparation on plot) (b)

Program will be designed to show all parcels and respective plot

Parcel ID	Plot ID	Did you plough with tractor before sowing seeds? (1=Yes; 2=No)	Did you plough with animal cart before sowing seeds? (1=Yes; 2=No)	Did you harrow with tractor before sowing seeds? (1=Yes; 2=No)	Did you harrow with animal before sowing seeds? (1=Yes; 2=No)	Did you level with tractor before sowing seeds? (1=Yes; 2=No)	Did you level with animal before sowing seeds? (1=Yes; 2=No)	Did you apply herbicides before sowing seeds? (1=Yes; 2=No)	Did you apply fungicides before sowing seeds? (1=Yes; 2=No)	Did you apply insecticides before sowing seeds? (1=Yes; 2=No)
120	121	122	123	124	125	126	127	128	129	130

Code 1: 1=Extension worker; 2=Other farmer in the village; 3=Other farmer outside the village; 4=Own production; 5=Local market; 6=Trader; 7=Project; 8=Farmer association; 9=Input shop; 10=Other(specify)	Code 2: 1=Purchased; 2=In-kind credit; 3=Gifted; 4=Own production; 5=Other specify	Code 3: 1=No cleaning; 2=By water; 3=By salt water; 4=By visual inspection and hand picking; 5=Winnowing; 6=Other (specify)	Code 4: 1=broadcasting before plowing; 2=broadcasting after plowing; 3=dibbling randomly; 4=dibbling in a line; 5=drilling; 6=transplanting (exclude cases Where transplantation was used for only small part of the plot); 7=Other, specify
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MODULE 5: Crop production (Sowing of seeds in 2014/15 season) (c)

Program will load all parcels, the respective plot and crop as well as intercrop where applicable. Varieties will be loaded from community survey. There will be opportunity to add-on

Parcel ID	Plot ID	Planting material								Sowing of seeds						
		Crop	Variety	Source of seeds (Code 1)	Mode of acquisition of seeds (Code 2)	Quantity acquired (kg)	Price (MT/kg)	Is the price subsidized? (1=Yes; 2=No)	Did you receive voucher (1=yes; 2=no)	Quantity sown (kg)	How did you clean seeds (Code 3)	Did you soak seeds before planting? (1=Yes; 2=No)	Did you treat seed with chemical before planting? (1=Yes; 2=No)	Did you apply inoculant? (1=Yes; 2=No)	How did you sow seeds (Code 4)	Seeding rate (number)
131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147

Code 1: 1=Extension worker; 2=Other farmer in the village; 3=Other farmer outside the village; 4=Own production; 5=Local market; 6=Trader; 7=Project; 8=Farmer association; 9=Input shop; 10=Other(specify)	Code 2: 1=Purchased; 2=In-kind credit; 3=Gifted; 4=Own production; 5=Other specify	Code 3: 1=No cleaning; 2=By water; 3=By salt water; 4=By visual inspection and hand picking; 5=Winnowing; 6=Other (specify)	Code 4: 1=broadcasting before ploughing; 2=broadcasting after ploughing; 3=dibbling randomly; 4=dibbling in a line; 5=drilling; 6=transplanting (exclude cases Where transplantation was used for only small part of the plot); 7=Other, specify
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MODULE 5: Crop production (Fertilizer application 2014/15 season) (d)

Program will load all parcels, the respective plot and crop as well as intercrop where applicable. There will be opportunity to add-on

148. Did you apply fertilizer in 2014/15 season? 1=Yes 2=No: (If yes, questions in the table will be opened. Otherwise it skips to another section)

Parcel ID	Plot ID	1 st Application								2 nd Application							
		Type (Code 1)	Quantity (kg)	Price (MT/kg)	Is the price subsidized? (1=Yes; 2=No)	Did you receive voucher (1=yes; 2=no)	Source (Code 2)	Mode of acquisition (Code 3)	Application method (Code 4)	Type (Code 1)	Quantity (kg)	Price (MT/kg)	Is the price subsidized? (1=Yes; 2=No)	Did you receive voucher (1=yes; 2=no)	Source (Code 2)	Mode of acquisition (Code 3)	Application method (Code 4)
149	150	151	152	153	154	155	156	157	158	159	160	161	162	163	164	165	166

Code 1: 1=NPK; 2=Urea; 3=ammonium sulphate; 4=Compost; 5=Farm yard manure; 4=other, specify	Code 2: 1=Extension worker; 2=Other farmer in the village; 3=Other farmer outside the village; 4=Own production; 5=Local market; 6=Trader; 7=Project; 8=Farmer association; 9=Input shop; 10=Other(specify)	Code 3: 1=Purchased; 2=In-kind credit; 3=Gifted; 4=Own production; 5=Other specify	Code 4: 1=broadcasting before ploughing; 2=broadcasting after ploughing; 3=broadcasting after crop establishment; 4=dibbling randomly; 5=dibbling in a line; 6=drilling; 7=Other, specify
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MODULE 5: Crop production (Herbicides application 2014/15 season) (e)

Program will load all parcels, the respective plot and crop as well as intercrop where applicable. Varieties will loaded from community survey. There will be opportunity to add-on

167. Did you apply Herbicide in 2014/15 season? 1=Yes 2=No: (If yes, questions in the table will be opened. Otherwise it skips to another section)

Parcel ID	Plot ID	1 st Application							2 nd Application						
		Type I (timing) (Code 1)	Type II (action) (Code 2)	Quantity (kg)	Price (MT/kg)	Source (Code 3)	Mode of acquisition (Code 4)	Application method (Code 5)	Type I (timing) (Code 1)	Type II (action) (Code 2)	Quantity (kg)	Price (MT/kg)	Source (Code 3)	Mode of acquisition (Code 4)	Application method (Code 5)
168	169	170	171	172	173	174	175	176	177	178	179	180	181	182	183

Code 1: 1=Pre-emergence; 2=Post emergence; 3=Universal; 4=Other specify	Code 2: 1=Contact; 2=systemic; 3=Universal; 4=Other specify	Code 3: 1=Extension worker; 2=Other farmer in the village; 3=Other farmer outside the village; 4=Own production; 5=Local market; 6=Trader; 7=Project; 8=Farmer association; 9=Input shop; 10=Other(specify)	Code 4: 1=Purchased; 2=In-kind credit; 3=Gifted; 4=Own production; 5=Other specify	Code 5: 1=broadcasting before ploughing; 2=broadcasting after ploughing; 3=broadcasting after crop establishment; 4=spraying on leaves; 5=on soil; 7=Other, specify
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MODULE 5: Crop production (Insecticides application 2014/15 season) (f)

Program will load all parcels, the respective plot and crop as well as intercrop where applicable. Varieties will be loaded from community survey. There will be opportunity to add-on

184. Did you apply Insecticides in 2014/15 season? 1=Yes 2=No: (If yes, questions in the table will be opened. Otherwise it skips to another section)

Parcel ID	Plot ID	1 st Application							2 nd Application				
		Type (action) (Code 1)	Quantity (kg)	Price (MT/kg)	Source (Code 2)	Mode of acquisition (Code 3)	Application method (Code 4)		Type (action) (Code 1)	Quantity (kg)	Price (MT/kg)	Source (Code 2)	Mode of acquisition (Code 3)
185	186	187	188	189	190	191	192	193	194	195	196	197	198

Code 1: 1=Contact; 2=systemic; 3=Universal; 4=Other specify	Code 2: 1=Extension worker; 2=Other farmer in the village; 3=Other farmer outside the village; 4=Own production; 5=Local market; 6=Trader; 7=Project; 8=Farmer association; 9=Input shop; 10=Other(specify)	Code 3: 1=Purchased; 2=In-kind credit; 3=Gifted; 4=Own production; 5=Other specify	Code 4: 1=broadcasting before ploughing; 2=broadcasting after ploughing; 3=broadcasting after crop establishment; 4=spraying on leaves; 5=on soil; 7=Other, specify
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MODULE 5: Crop production (Rodenticides application 2014/15 season) (g)

Program will load all parcels, the respective plot and crop as well as intercrop where applicable. Varieties will be loaded from community survey. There will be opportunity to add-on

199. Did you apply Rodenticides in 2014/15 season? 1=Yes 2=No: (If yes, questions in the table will be opened. Otherwise it skips to another section)

Parcel ID	Plot ID	1 st Application							2 nd Application				
		Type (action) (Code 1)	Quantity (kg)	Price (MT/kg)	Source (Code 2)	Mode of acquisition (Code 3)	Application method (Code 4)		Type (action) (Code 1)	Quantity (kg)	Price (MT/kg)	Source (Code 2)	Mode of acquisition (Code 3)
200	201	202	203	204	205	206	207	208	209	210	211	212	213

Code 1: 1=Contact; 2=systemic; 3=Universal; 4=Other specify	Code 2: 1=Extension worker; 2=Other farmer in the village; 3=Other farmer outside the village; 4=Own production; 5=Local market; 6=Trader; 7=Project; 8=Farmer association; 9=Input shop; 10=Other(specify)	Code 3: 1=Purchased; 2=In-kind credit; 3=Gifted; 4=Own production; 5=Other specify	Code 4: 1=broadcasting before ploughing; 2=broadcasting after ploughing; 3=broadcasting after crop establishment; 4=spraying on leaves; 5=on soil; 7=Other, specify
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MODULE 5: Crop production (Fungicides application 2014/15 season) (h)

Program will load all parcels, the respective plot and crop as well as intercrop where applicable. Varieties will be loaded from community survey. There will be opportunity to add-on

214. Did you apply Fungicides in 2014/15 season? 1=Yes 2=No: (If yes, questions in the table will be opened. Otherwise it skips to another section)

Parcel ID	Plot ID	1 st Application							2 nd Application						
		Type I (timing) (Code 1)	Type II (action) (Code 2)	Quantity (kg)	Price (MT/kg)	Source (Code 3)	Mode of acquisition (Code 4)	Application method (Code 5)	Type I (timing) (Code 1)	Type II (action) (Code 2)	Quantity (kg)	Price (MT/kg)	Source (Code 3)	Mode of acquisition (Code 4)	Application method (Code 5)
215	216	217	218	219	220	221	222	223	224	225	226	227	228	229	230

Code 1: 1=Pre-émergences; 2=Post emergence; 3=Universal 4=Other specify	Code 2: 1=Contact; 2=systemic; 3=Universal; 4=Other specify	Code 3: 1=Extension worker; 2=Other farmer in the village; 3=Other farmer outside the village; 4=Own production; 5=Local market; 6=Trader; 7=Project; 8=Farmer association; 9=Input shop; 10=Other(specify)	Code 4: 1=Purchased; 2=In-kind credit; 3=Gifted; 4=Own production; 5=Other specify	Code 5: 1=broadcasting before ploughing; 2=broadcasting after ploughing; 3=broadcasting after crop establishment; 4=spraying on leaves; 5=on soil; 7=Other, specify
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MODULE 5: Crop production (Labor use 2014/15 season) (i)

Program will be designed to show all parcels and the respective plot. Activities will also be preselected from community survey. There will be opportunity to add-on

Parcel ID	Plot ID	Activity (Code 1)	Timing of activity						Family Labor Use						Exchange Labor			Hired labor				Tractor operation and transportation				Feeding cost						
									Adult Men		Adult Female		Children (<15 years)																			
			Month started (1-12)	Month ended (1-12)	Week started (1-4)	Week ended (1-4)	Day started (1-7)	Day ended (1-7)	Number	Days	Hours a day	Number	Days	Hours a day	Number	Days	Hours a day	Number	Days	Cost	Unit (Code 2)	Number	Days	Cost	Unit (Code 2)	Number	Days	Cost	Unit (Code 2)			
231	232	233	234	235	236	237	238	239	240	241	242	243	244	245	246	247	248	249	250	251	252	253	254	255	256	257	258	259	260	261	262	263

Code 1: 1=clearing field; 2=repairing bunds; 3=repairing canals; 4=1st ploughing; 5=2nd ploughing; 6=1st harrowing; 7=2nd harrowing; 8=sowing/planting; 9=soil covering; 10=1st weeding (manual); 11=2nd weeding (manual); 12=water management (opening canals); 13=water management (closing canals); 14=watering; 15=pumping; 16=scaring birds; 17=harvesting; 18=threshing; 19=bagging; 20=transporting inputs; 21=transporting outputs; 22=fertilizer application; 23=herbicide application; 24=pesticide application; 25=fungicide application; 26=maintaining livestock; 27=other (specify)

Code 2: 1=MT/ha;
2=MT/day; 3=MT/kg
(produce/input)

MODULE 5: Crop production (Farm equipment) (j)

Program will be designed to show all parcels, plots, and equipment. There will be opportunity to add-on

Parcel ID	Plot ID	Use in 2014/15 season			Use in 2014/15 season		
		Activity (code 1)	Equipment (Code 2)	Percent us of plot (total=100%)	Activity (code 1)	Equipment (Code 2)	Percent us of plot (sum for all plots must equal 100%)
264	265	266	267	268	269	270	271

Code 1: 1=clearing field; 2=repairing bunds; 3=repairing canals; 4=1stploughing; 5=2ndploughing; 6=1st harrowing; 7=2nd harrowing; 8=sowing/planting; 9=soil covering; 10=1st weeding (manual); 11=2nd weeding (manual); 12=water management (opening canals); 13=water management (closing canals); 14=watering; 15=pumping; 16=scaring birds; 17=harvesting; 18=threshing; 19=bagging; 20=transporting inputs; 21=transporting outputs; 22=fertilizer application; 23=herbicide application; 24=pesticide application; 25=fungicide application; 26=maintaining livestock; 27=other (specify)

Code 2: 1=Tractor; 2=Plough sets; 3=Carts; 4=Wheelbarrows; 5=Borehole; 6=Motorized Sprayer; 7=Diesel pumps; 8=Water tanks; 9=Trailers; 11=Grinders; 12=Hand hoe; 13=Storage facility (building); 14=Solar panel; 15=Motorcycle; 16=Cars; 17=shotgun; 18=moped; 19=Ox-Cart; 20=Ox-plough; 21=Axe; 22=Knapsack sprayer; 23=Water pump; 24=Spade or shovel; 25=Wood stove; 26=Small Truck (Picks-ups); 27=Big trucks (lorry); 28=Motorized grain mill; 29=Panga knife; 71=Other specify.....

MODULE 5: Crop production (Distribution of harvested product in 2014/15) (k)

Program will be designed to show all parcels, plots, and crops. Additions are not allowed at this moment

Parcel ID	Plot ID	Distribution of harvested produce of main crop								Distribution of harvested produce of intercrop							
		Crop (Code 1)	Harvested	Consumed	Sold	Given out as gift	Stored as grain	Stored as seed	Loss in store	Crop (Code 1)	Harvested	Consumed	Sold	Given out as gift	Stored as grain	Stored as seed	Loss in store
272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289

Code 1: 1=Common beans; 2=Cowpea; 3=Soybean; 4=Bambara; 5=Groundnut; 6=Pigeon pea; 7=Sesame; 8= Castor oil seed; 9=Seed cotton; 10=Sunflower seed; 11=Maize; 12=rice; 13=Millet; 14=Sorghum; 15=Wheat; 16=Yam; 17=Cassava; 18=Sweet potato; 19= Potatoes; 20=Coconuts; 21=vegetables; 22=Sugar cane; 23=(Other, specify)

MODULE 6: Marketing (Marketing of harvest from main crop 2014/15) (a)

Program will be designed to show parcel, plot, and main crop. Additions are not allowed at this moment

290. Did this household sell produce from the main crop produce from the 2014/15 cropping season? 0-No 1-Yes (if No please skip to the next section)

Parcel ID	Plot ID	Main crop (Code 1)	Quantity sold (kg)	Place sold (Code 2)	Buyer (Code 3)	Price (MT/kg)	Who decides on the price (Code 4)	How is price determined (Code 5)	Packaging material (Code 6)	Price of package material (MT/unit)	Means of transportation (Code 7)	Transportation cost per unit (MT/kg)	Road tax (MT/kg)	Sales tax (MT/kg)	Main person who controls revenue from sales (MID)
291	292	293	294	295	296	297	298	299	300	301	302	303	304	305	306

Code 1: 1=Common beans; 2=Cowpea; 3=Soybean; 4=Bambara; 5=Groundnut; 6=Pigeon pea; 7=Sesame; 8= Castor oil seed; 9=Seed cotton; 10=Sunflower seed; 11=Maize; 12=rice; 13=Millet; 14=Sorghum; 15=Wheat; 16=Yam; 17=Cassava; 18=Sweet potato; 19= Potatoes; 20=Coconuts; 21=vegetables; 22=Sugar cane; 23=(Other, specify)	Code 2: 1= Farm gate; 2=at home; 3= market in neighbouring village; 4= market in bigger town; 5=district market; 6=provincial market; 7=national market; 8=others specify	Code 3: 1=Farmer; 2=Local trader; 3=Institution; 4=NGO; 5=Consumer at local market; 6=aggregator; 7=company; 8=retailer; 9=wholesaler; 10=other (specify)....	Code 4: 1=Trader; 2=Farmer; 3=Joint by arbitrage; 4=Government price; 6=other specify	Code 5: 1=Prevailing market price; 2=National price (announced); 3=Bargaining; 4=Arbitrage	Code 6: 1=No packaging; 2=Sacks (jute); 3=Other specify	Code 7: 1=Walking; 2=Bicycle; 3=Motorbike; 4=Moped; 6=mini-truck; 7=big truck; 8=cargo truck; 9=animal cart
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MODULE 6: Marketing (Marketing of harvest from intercrop 2014/15) (b)

Program will be designed to show parcel, plot, and main crop. Additions are not allowed at this moment

307. Did this household sell produce from the intercrop produce from the 2014/15 cropping season? 0-No 1-Yes (if No please skip to the next section)

Parcel ID	Plot ID	Main crop (Code 1)	Quantity sold (kg)	Place sold (Code 2)	Buyer (Code 3)	Price (MT/kg)	Who decides on the price (Code 4)	How is price determined (Code 5)	Packaging material (Code 6)	Price of package material (MT/unit)	Means of transportation (Code 7)	Transportation cost per unit (MT/kg)	Road tax (MT/kg)	Sales tax (MT/kg)	Main person who controls revenue from sales (MID)
308	309	310	311	312	313	314	315	316	317	318	319	320	321	322	323

Code 1: 1=Common beans; 2=Cowpea; 3=Soybean; 4=Bambara; 5=Groundnut; 6=Pigeon pea; 7=Sesame; 8= Castor oil seed; 9=Seed cotton; 10=Sunflower seed; 11=Maize; 12=rice; 13=Millet; 14=Sorghum; 15=Wheat; 16=Yam; 17=Cassava; 18=Sweet potato; 19= Potatoes; 20=Coconuts; 21=vegetables; 22=Sugar cane; 23=(Other, specify)	Code 2: 1= Farm gate; 2=at home; 3= market in neighbouring village; 4= market in bigger town; 5=district market; 6=provincial market; 7=national market; 8=others specify	Code 3: 1=Farmer; 2=Local trader; 3=Institution; 4=NGO; 5=Consumer at local market; 6=aggregator; 7=company; 8=retailer; 9=wholesaler; 10=other (specify)....	Code 4: 1=Trader; 2= Farmer; 3=Joint by arbitrage; 4=Government price; 6=other specify	Code 5: 1=Prevailing market price; 2=National price (announced); 3=Bargaining; 4=Arbitrage	Code 6: 1=No packaging; 2=Sacks (jute); 3=Other specify	Code 7: 1=Walking; 2=Bicycle; 3=Motorbike; 4=Moped; 6=mini-truck; 7=big truck; 8=cargo truck; 9=animal cart
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MODULE 6: Marketing (Distribution of Marketing of harvest from main crop 2014/15) (c)

Program will be designed to show parcel, plot, and main crop. The total sales across the year must equal that in table 17.

Parcel ID	Plot ID	Crop (Code 1)	January			February			March			April			May			June			July			August			September			October			November			December		
			Quantity sold (kg)	Price (MT/kg)	Reason for selling (Code 1)	Quantity sold (kg)	Price (MT/kg)	Reason for selling (Code 1)	Quantity sold (kg)	Price (MT/kg)	Reason for selling (Code 1)	Quantity sold (kg)	Price (MT/kg)	Reason for selling (Code 1)	Quantity sold (kg)	Price (MT/kg)	Reason for selling (Code 1)	Quantity sold (kg)	Price (MT/kg)	Reason for selling (Code 1)	Quantity sold (kg)	Price (MT/kg)	Reason for selling (Code 1)	Quantity sold (kg)	Price (MT/kg)	Reason for selling (Code 1)	Quantity sold (kg)	Price (MT/kg)	Reason for selling (Code 1)	Quantity sold (kg)	Price (MT/kg)	Reason for selling (Code 1)	Quantity sold (kg)	Price (MT/kg)	Reason for selling (Code 1)			
324	325	326	327	328	329	330	331	332	333	334	335	336	337	338	339	340	341	342	343	322	323	324	325	326	327	328	329	330	331	332	333	334	335	336	337	338	339	340

Code 1: 1=Common beans; 2=Cowpea; 3=Soybean; 4=Bambara; 5=Groundnut; 6=Pigeon pea; 7=Sesame; 8= Castor oil seed; 9=Seed cotton; 10=Sunflower seed; 11=Maize; 12=rice; 13=Millet; 14=Sorghum; 15=Wheat; 16=Yam; 17=Cassava; 18=Sweet potato; 19= Potatoes; 20=Coconuts; 21=vegetables; 22=Sugar cane; 23=(Other, specify)

Code 1: 1=Good price; 2=Buy food items; 3=School fees; 4=Medical fees; 5=Buy other household items(eg. soap); 6=To avoid pest attack; 7=Difficult to store; 8=Other(Specify)

MODULE 6: Marketing (Distribution of Marketing of harvest from intercrop 2014/15) (d)

Program will be designed to show parcel, plot, and main crop. The total sales across the year must equal that in table 17.

Parcel ID	Plot ID	Crop (Code 1)	January			February			March			April			May			June			July			August			September			October			November			December		
			Quantity sold (kg)	Price (MT/kg)	Reason for selling (Code 1)	Quantity sold (kg)	Price (MT/kg)	Reason for selling (Code 1)	Quantity sold (kg)	Price (MT/kg)	Reason for selling (Code 1)	Quantity sold (kg)	Price (MT/kg)	Reason for selling (Code 1)	Quantity sold (kg)	Price (MT/kg)	Reason for selling (Code 1)	Quantity sold (kg)	Price (MT/kg)	Reason for selling (Code 1)	Quantity sold (kg)	Price (MT/kg)	Reason for selling (Code 1)	Quantity sold (kg)	Price (MT/kg)	Reason for selling (Code 1)	Quantity sold (kg)	Price (MT/kg)	Reason for selling (Code 1)	Quantity sold (kg)	Price (MT/kg)	Reason for selling (Code 1)	Quantity sold (kg)	Price (MT/kg)	Reason for selling (Code 1)	Quantity sold (kg)	Price (MT/kg)	Reason for selling (Code 1)
341	342	343	344	345	346	347	348	349	350	351	352	353	354	355	356	357	358	359	360	361	362	363	364	365	366	367	368	369	370	371	372	373	374	375	376	377	378	379

Code 1: 1=Common beans; 2=Cowpea; 3=Soybean; 4=Bambara; 5=Groundnut; 6=Pigeon pea; 7=Sesame; 8= Castor oil seed; 9=Seed cotton; 10=Sunflower seed; 11=Maize; 12=rice; 13=Millet; 14=Sorghum; 15=Wheat; 16=Yam; 17=Cassava; 18=Sweet potato; 19= Potatoes; 20=Coconuts; 21=vegetables; 22=Sugar cane; 23=(Other, specify)

Code 1: 1=Good price; 2=Buy food items; 3=School fees; 4=Midical fees; 5=Buy other household items(eg. soap); 6=To avoid pest attack; 7=Difficult to store; 8=Other(Specify)

MODULE 7: Livestock production (production) (a)

Program will be designed to show all plots where livestock is kept

Parcel (code)	Plot (Code)	Livestock (Code 1)	Number Owned	Total value in MT	Number bought	Number sold	Number consumed	Cost of feed (MT/Month)	Cost of veterinary	maintaining facility (MT/Month)	Number Owned	Total value in MT	Number bought	Number sold	Number consumed	Cost of feed (MT/Month)	Cost of veterinary	maintaining facility (MT/Month)
380	381	382	383	384	385	386	387	388	389	390	391	392	393	394	395	396	397	398

Code 1: 1=Cows; 2=Bulls; 3=Young bulls; 4=Heifer; 5=Calves; 6=Goats; 7=Sheep; 8=Chicken; 9=Pigs; 10=Donkeys; 11=Ducks; 12=Turkeys; 13=Guinea Fowls; 14=Rabbits; 15=Other specify	Code 2: 1=Storage facility on the farm; 2=Storage in the field; 3=Storage facility at home; 3=Government storage facility/warehouse; 4=Private storage facility/warehouse	Code 3: 1=No packaging; 2=Sacks (jute); 3=Double bag; 4=Triple bag; 5=Drum; 6=Bottle; 7=Other specify	Code 4: 1=Chemical treatment; 2=Drying; 3=Smoking; 3=Other specify
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MODULE 7: Livestock production (product) (b)

Program will be designed to show all plots where livestock is kept

Parcel (code)	Plot (Code)	Products (Code 1)	Number of months producing this product in the last 12 months	Average Production and price per month during production months					
				Quantity	Unit (Code 2)	Quantity sold	Price per unit	Who controls revenue from sales (MID)	Cost of package and marketing per month (MT/month)
399	400	401	402	403	404	405	406	407	408

Code 1: 1=Milk; 2=Eggs; 3=Honey; 4=Butter; 5=Goat milk; 6=Hides/skin; 7=Meat; 8=Manure; 9=Draft animal rental service; 10=Other specify	Code 2: 1=kg; 2=liter; 3=tray (30 eggs); 4=number; 5=90 kg bag; 6=tons; 7=wheelbarrow; 8=cart
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MODULE 8: Storage of harvest produce in 2014/15

Program will be designed to show all crops to show up in the module and allow entry for those that were stored.

409. Did you store some of the harvested produce? 1=Yes; 2=No

Parcel ID	Plot ID	Crop (Code 1)	Quantity stored (kg)	Where did you store (Code 2)	How much did you pay to store a unit (kg) per week (MT/kg/week)	In which container do you store? (Code 3)	Did you treat the produce before storage? (1=Yes; 2=No)	What kind of treatment? (Code 4)	How many weeks do you store the produce
410	411	412	413	414	415	416	417	418	419

Code 1: 1=Common beans; 2=Cowpea; 3=Soybean; 4=Bambara; 5=Groundnut; 6=Pigeon pea; 7=Sesame; 8= Castor oil seed; 9=Seed cotton; 10=Sunflower seed; 11=Maize; 12=rice; 13=Millet; 14=Sorghum; 15=Wheat; 16=Yam; 17=Cassava; 18=Sweet potato; 19= Potatoes; 20=Coconuts; 21=vegetables; 22=Sugar cane; 23=(Other, specify)	Code 2: 1=Storage facility on the farm; 2=Storage in the field; 3=Storage facility at home; 3=Government storage facility/warehouse; 4=Private storage facility/warehouse	Code 3: 1=No packaging; 2=Sacks (jute); 3=Double bag; 4=Triple bag; 5=Drum; 6=Bottle; 7=Polyethylene sacks; 8=Jute sacks; 9= Metal container; 10=Nylon sacks; (5) Other, specify_____	Code 4: 1=Chemical treatment; 2=Drying; 3=Smoking; 3=Other specify
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MODULE 9: Farming/marketing contract

420: Have you heard about contracts with an input dealer, trader or processor in exchange for crop? 1= Yes; 0= No (If yes continue in the table below... if no skip to next module)

421: Give three main reasons if you had no contract: (1) (2) (3)

Parcel (code)	Plot (Code)	Do you have contract on the following crop or animal or animal product? (Code 1)	Contractor (Code 2)	Type of contract			Components of agreement					Support from contractor				Conflicts		Main challenge	Main benefit	Would you like to continue?	
				Participants (1=Group; 2=Individual)	Agreement (1=written; 2=verbal)	Duration (months)	Quality (1=Yes; 2=No)	Quantity (1=Yes; 2=No)	Quantity under contract (Kg)	Price (1=Yes; 2=No)	Price under contract (MT/kg)	Credit (Code 3)	Value (MT)	Training (1=Yes; 2=No)	Number of trainings	Occur? (1=Yes; 2=No)	Solution (Code 4)			Such contract (1=Yes; 2=No)	Similar contractor (1=Yes; 2=No)
422	423	424	425	426	427	428	429	430	431	432	433	434	435	436	437	438	439	440	441	442	443

Code 1: 1=Common beans; 2=Cowpea; 3=Soybean; 4=Bambara; 5=Groundnut; 6=Pigeon pea; 7=Sesame; 8= Castor oil seed; 9=Seed cotton; 10=Sunflower seed; 11=Maize; 12=rice; 13=Millet; 14=Sorghum; 15=Wheat; 16=Yam; 17=Cassava; 18=Sweet potato; 19= Potatoes; 20=Coconuts; 21=vegetables; 22=Sugar cane; 23=Cows; 24=Bulls; 25=Young bulls; 26=Heifer; 27=Calves; 28=Goats; 29=Sheep; 30=Chicken; 31=Pigs; 32=Donkeys; 33=Ducks; 34=Turkeys; 35=Guinea Fowls; 36=Rabbits; 37=Milk; 38=Eggs; 39=Honey; 40=Butter; 41=Goat milk; 42=Hides/skin; 43=Meat; 44=Manure; 45=Draft animal rental service; 46=Other specify (Other, specify)

Code 2: 1= Trader, 2= Processor, 3= Collector, 4= NGO, 5= Project, 6= Input dealer, 7= Governmental agency, 7= Other

Code 3: 0= No; 1= Input credit in cash; 2= Input credit in kind; 3= Consumption credit; 4=Others

Code 4: 1=None; 2=Negotiation; 3=Other specify

MODULE 10: Financial transactions (Receipt of credit) (a)

444: Did you receive credit in cash or in kind? 1=Yes; 2=No. If no skip to the next module.

Parcel (code)	Plot (Code)	Did you have financial transactions with this crop, livestock, or product? (Code 1)	Did you request for credit in kind? (1= Yes, 0= No)	Receipt							Payment						
				Source (Code 2)	Type (1=Cash; 2=Kind)	Item received in kind (Code 3)	Value (MT)	Did you receive all requested (1=Yes; 2=No)	Agreed payback time (months)	Use of credit	Did you pay back?	Mode of repayment (Code 5)	Form of payment (1=Cash; 2=Kind)	Value paid back (MT)	Payback time (months)	Consequence for default (Code 4)	
																Delayed payment	Non- payment
445	446	447	448	449	450	451	452	453	454	455	456	457	458	459	460	461	462

MODULE 10: Financial transactions (Lending) (b)

463: Did you give out credit in cash or in kind? 1=Yes; 2=No. If no skip to the next module.

No.	Did you give out credit? (1=Yes; 0=No)	Lending out									Payment				
		Recipient (Code 2)	Type (1=Cash; 2=Kind)	Item given in kind (Code 3)	Value (MT)	Did you give all requested (1=Yes; 2=No)	Agreed payback time (months)	Use of credit	Did recipient pay back?	Mode of repayment (Code 5)	Form of payment (1=Cash; 2=Kind)	Value paid back (MT)	Payback time (months)	Consequence for default (Code 4)	
														Delayed payment	Non- payment
464	465	466	467	468	469	470	471	472	473	474	475	476	477	478	479

Code 1: 1=Common beans; 2=Cowpea; 3=Soybean; 4=Bambara; 5=Groundnut; 6=Pigeon pea; 7=Sesame; 8= Castor oil seed; 9=Seed cotton; 10=Sunflower seed; 11=Maize; 12=rice; 13=Millet; 14=Sorghum; 15=Wheat; 16=Yam; 17=Cassava; 18=Sweet potato; 19= Potatoes; 20=Coconuts; 21=vegetables; 22=Sugar cane; 23=Cows; 24=Bulls; 25=Young bulls; 26=Heifer; 27=Calves; 28=Goats; 29=Sheep; 30=Chicken; 31=Pigs; 32=Donkeys; 33=Ducks; 34=Turkeys; 35=Guinea Fowls; 36=Rabbits; 37=Milk; 38=Eggs; 39=Honey; 40=Butter; 41=Goat milk; 42=Hides/skin; 43=Meat; 44=Manure; 45=Draft animal rental service; 46=Other specify (Other, specify)	Code 2: 1=Fellow farmers; 2=Farmer association; 3=project; 5= NGO; 6=traders; 7= seed company; 8= other (specify)	Code 3: 1= Pesticide; 2= Seed; 3= Herbicide; 4=Other	Code 4: 0= No action; 1=civil suit; 2=Assets sold to make payment; 3=Produce sold make payment; 4 =Others	Code 5: 1= pe... insta... 2=pe... term... bulk...
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MODULE 10: Financial transactions (Savings) (c)

480: Did members of your household set aside money for future use? 1= Yes 0= No If yes provide answers for the following questions. Otherwise skip to the next module.

MID				Provide three most savings point, amount and interest												
	Location 1 (Code 1)	Why this location? (Code 2)	Amount 1 (MT)	Interest 1 (MT)	Location 2 (Code 1)	Why this location? (Code 2)	Amount 2 (MT)	Interest 2 (MT)	Location 3 (Code 1)	Why this location? (Code 2)	Amount 3 (MT)	Interest 3 (MT)	Rest of saving (MT)	Interest rest (MT)	Main reason for saving	Was the objective met? (1=yes; 2=No)
481	482	483	484	485	486	487	488	489	490	491	492	493	494	495	496	497

Code 1: 1= MFI, 2= bank, 3= credit program, 4= projects, 5= NGO, 6= traders, 7= inhabitant of the village, 8= inhabitant of another village, 9= farmers' organization 10= other (specify)	Code 2: 1= no banking or microfinance institution, 2= no confidence, 3= confidence, 4= other (specify)
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MODULE 11: Off-farm employment and income (Self-employment and wage/salaried labor activities) (a)

Program will be designed to show all members in the household. If one is engaged in more than one activity, select the 3 most important activities the one is engaged in.

MID	Activity (Code 1)	Years of experience	If s/he is regular monthly wage earner		If s/he earns seasonal earnings/sales, classify each month’s gross earnings/sales from <u>business</u> or <u>seasonal labour employment</u> as: (Code 2)												Low rates (MT/month)		High rates (MT/month)	
			Number of months worked in the last 12 months	Monthly wage in MT													Earning	Cost*	Earning	Cost*
					Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec				
498	499	500	501	502	503	504	505	506	507	508	509	510	511	512	513	514	515	516	517	518

Code 1: 1= Wage earner; 2= Farm labor; 3= Bicycle repair/mechanic; 4= Brewing; 5= Brick making; 6= Butcher; 7= Carpentry; 8= Charcoal burning; 9= Clothes business (weaving); 10= Clothes business (trading); 11= Construction; 12= Driver; 13= General-kiosk owner; 14= Miller; 15= Taylor; 16= Trading farm produce; 17= Trading fish; 18= Trading firewood; 19= Trading livestock; 20=Trading non-food goods; 21= Trading timber; 22= Transport business; 23= Other (Specify)	Code 2: 0= No Earning/Sales Month; 1= Low Gross Earning/Sales Month; 2= High Gross Earning/Sales Month
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MODULE 11: Off-farm employment and income (Remittance) (b)

519: Did any member of this household receive remittance, credit or food aid in the past 12 months?

1=Yes

2=No (skip this section)

Type (Code 1)	Classify each month according to the amount received: (Code 2)												Average amount received per month in a high amount month	Average amount received per month in a low/medium amount month	Major source (Code 3)	Main purpose (Code 4)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec				
520	521	522	523	525	526	527	528	529	530	531	532	533	534	535	536	537

Code 1: 1=Remittance/cash assistance from inside Ghana; 2=Remittance/cash assistance from foreign countries; 3=Rent revenue (housing, shops, land, etc.); 4=Pension; 5=Susu; 6=Credit (cash); 7=Food Aid; 8=Other (Specify)	Code 2: 0= No Earning/Sales Month; 1= Low Gross Earning/Sales Month; 2= High Gross Earning/Sales Month	Code 3: 1= Commercial Bank; 2= Micro finance Institutions; 3= NGO; 4= Local organization (communal); 5= Private organizations (individual); 6= Self-help group; 7= Friends; 8= Relatives; 9= Money lender; 10= Government; 11= Tenant; 12= Other (specify)	Code 4: 1= School fee; 2= Medical fee; 3= Funeral; 4= Wedding; 5= Input purchases (seeds, fertilizers, etc.); 6= To purchase land/use rights, or to pay land rents; 7= Household use; 8= Business; 9= Gift; 10= Restocking; 11= Construction; 12= Dowry; 13= Bails and fines; 14= Clear debts; 15= Other (specify)
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MODULE 12: Consumption expenditure on non-durable goods

Item (Code 1)	Frequency of purchase/ acquisition	Total consumption per period including own production/gift/purchase. Then, the respondent estimates its total value in the market.		
		Quantity	Unit (code 2)	Total Value (GHC)
538	539	540	541	542

Code 1: 1=Maize grain; 2=Maize meal/flour; 3=Millet/Sorghum; 4=Wheat flour; 5=Rice; 6=Cassava (Fresh form); 7=Cassava (Processed); 8=Sweet potatoes; 9=Irish potatoes; 10=Yam; 11=Beans; 12=Bread; 13=Ground nuts; 14=Green Peas; 15=Chicken; 16=Meats (any); 17=Fish; 18=Eggs; 19=Milk; 20=Vegetable; 21=Fruit; 22=Sugar; 23=Cooking oil/Butter; 24=Salt; 25=Coffee/Tea: powder; 26=Drinks (including alcohol); 27=Tobacco/Cigarettes; 28=Electricity; 29=Cellular phone charge; 30=Firewood; 31=Cow dung; 32=Charcoal; 33=Kerosene/Gas; 34=Soap/washing products; 35=School fee, textbooks, etc; 36=Medical care; 37=Transportation; 38=Clothing/Shoes; 39=Susu; 40=Remittances to relatives; 41=Mosques/Churches; 42=Credit repayments; 43=Mutual support group (funeral); 44=Mutual support group (non-funeral); 45=Other local organizations	Code 2: 1=daily; 2=weekly; 3=Monthly; 4=bimonthly; 5=quarterly; 6=-6 monthly; 7=Annually; 8=Other specify	Code 3: 1=kg; 2=litres; 3=tones; 4=numbers; 5=bunch (banana); 6=wheelbarrow; 7=cart load; 8=head load; 9=other (specify)
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MODULE 13: Extension and Training (Participation in the Last season) (a)

543: Did any member of this household receive agricultural support (training or extension contacts) in the last two years (2013/14 and 2014/15)? 1=yes; 2=no

(skip this section)

MID	Training or extension? (1=training 2=extension)	Provider of training or extension (Code 1)	What kind of training or extension? (Code 2)	Number of days/ visits	Rank 1=least; 2; 3; 4; 5=Best					Have you applied the knowledge? 1=Yes; 2=No	Willing to apply? 1=Yes; 2=No
					Rank Relevance	Rank Informative	Rank Training method	Rank applicability	Rank clarity		
544	545	546	547	548	549	550	551	552	553	554	555

Code 1:1=agricultural extension agents from government (e.g. MOFA staff), 2=extension worker from NGO, 3 =extension worker from private companies, 4=fellow farmers, 5=other (specify)

Code 2:1= crop production; 2=livestock rearing; 3= other (specify)

MODULE 13: Extension and Training (preferences) (b)

MID	Which language(s) do you speak? (Code 1)	Which languages can you read? (Code 1)	Which kind of training do you prefer? Rank 1=least; 2; 3; 4; 5=Best				How useful are these training materials? Rank 1=Not Useful; 2; 3; 4; 5=Very Useful					What is the best time of the day for trainings? (Code 2)	How long should be the trainings? (Code 3)	Can you prevent you to attend a training? (Code4)
			formal training with presenter (class room)	formal training with group discussions (class room)	practical field days	demonstrations (demo-plots)	Oral presentations	Visual presentations (power point)	Printed manuals and leaflets	Videos	Audios			
556	557	558	559	560	561	562	563	564	565	566	567	568	569	557

Code 1: 1 = English; 2= French; 3=Portuguese; 4=Other specify	Code 2: 1= early morning, 2= late morning, 3=noon, 4= early afternoon, 5= late afternoon	Code 3: 1=a couple of hours, 2= half a day, 3= full day, 4= more than one day	Code 4: 1= schedule, 2=distance, 3= weather, 4= daily tasks, 5= other (describe)
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MODULE 14: Membership in Farmers' Group and/Local Organization

558: Is any member of this household a member or has been a member of an association or group 2 years? 1=yes; 2=no

MID	Name of Group/ Organization	Primary activity of this Group/ Organization (Code 1)	Year you became a member	Month you became a member	Number of members in the group/ organization	Number of meetings in a year (2014/15)	Annual membership fee (MT) for 2014/15	Major benefit received from this group/ organization (Code 2)	Are you still a member? (1=Yes; 2=No)	Year you stopped being a member	Month you stopped being a member	Reason for resigning from the group /organization (Code 3)
559	570	571	572	573	574	575	576	577	578	579	580	581

Code 1: 1=Income generating for group members; 2=Group marketing of products; 3=Group production of products; 4=Group access to inputs and extension services; 5=Mobilizing saving and credit for group members; 6=Promotion of improved farming practices; 7=Mutual support/Social services; 8=Other (specify)

Code 2: 1=Easier access to inputs; 2=Easier access to markets of products; 3=Easier access to extension services; 4=Easier access to credit; 5=Easier access to transport; 6=Better input and output prices; 7=Other (specify)

Code 3: 1=No benefits; 2=Time consuming; 3=Group dissolved; 4=Failed to raise subscription; 5=Internal conflicts; 6=Other (specify)

MODULE 15: Adoption of crop technologies (General) (a)

Varieties identified in community surveys will be loaded here.

Technology or Innovation (Code 1)	Knowledge				First adoption			Discontinuation			Re-adoption		
	Know (1=yes; no=2)	Year	Introduced by (Code 2)	How introduced? (Code 3)	Ever adopt (1=yes; no=2)	Year	If no why? (Code 4)	Ever discontinue (1=Yes; 2=No)	Year	If yes why? (Code 4)	Did you readopt? (1=Yes; 2=No)	Year	If no why? (Code 4)
582	583	584	585	586	587	588	589	590	591	592	593	594	595

Code 1: 1=Improved varieties; 2=Hybrid varieties; 3=Improved seeds; 4=Herbicides; 5=Bunding; 6=Implement; 7=Dibbling in line; 8=Drilling; 9=Fertilizer; 10=Manurinig; 11=Composing; 12=Fungicide; 13=Triple bagging; 14=Terracing; 15=Mulching/cover cropping; 16=Minimum tillage; 17=Crop rotation; 18=Fallow; 19=Use of farm yard manure; 20=Slash and burn; 21=Use of inoculants; 22=Use of lime	Code 2: 1=Self-discovery; 2=neighbouring farmers; 3=extension agents; 4=media; 5=NGOs; 6=private institutions; 7=others, specify	Code 3: 1=own experimentation; 2=observation of neighbouring farmers (without direct instructions); 3=taught by neighbouring farmers; 4=Demonstration; 5=media program; 6=Others, specify	Code 4: 1=Unaware; 2=lack of technical know-how; 3=lack of finance; 4=not profitable; 5=labor constraint; 6=unavailability; 7=complementary technology not available; 8=others, specify
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MODULE 15: Adoption of crop technologies (Varieties) (b)

Varieties identified in community surveys will be loaded here.

Crop (Code 1)	Variety name	Access within village			Access within outside village			Did you use own seed (1=Yes;	Did you buy seeds? (1=Yes;	Did you sell seeds? (1=Yes;	Did gift seeds? (1=Yes;	Did you receive seed gift? (1=Yes;	Did you exchange seeds? (1=Ye
		Access (1=yes	Source (Code 3)	Price (MT/kg)	Access (1=yes	Source (Code 3)	Price (MT/kg)						

		; no=2)			; no=2)			2=No)	2=No)	2=No)	2=No)	2=No)	2=No)
596	597	598	599	600	601	602	603	604	605	606	607	608	609

Code 1: 1=Common beans; 2=Cowpea; 3=Soybean; 4=Bambara; 5=Groundnut; 6=Pigeon pea; 7=Sesame; 8= Castor oil seed; 9=Seed cotton; 10=Sunflower seed; 11=Maize; 12=rice; 13=Millet; 14=Sorghum; 15=Wheat; 16=Yam; 17=Cassava; 18=Sweet potato; 19= Potatoes; 20=Coconuts; 21=vegetables; 22= Sugar cane; 23= =Other specify (Other, specify)	Code 2: 1=farmer or relative from the village, 2= farmer or relative from another village, 3=NARS, 4=Grains & Legumes Board, 5=Private Seed Comp. 6=another NGO (specify name),7=farmers' organization, 8=another facility (specify), 9=local market, 10 =other (specify)
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MODULE 16: Constraints and ranking, mitigation strategy

Parce 1 (Code)	Plot (Code)	Do you observe this constraint (Code 1)	Rank constraints (0=not applicable; 1=least; 2=low; 3=moderate; 4=High; 5=highest)			% loss to yield/ revenue	Mitigation strategy (Code 2)	Success of strategy (%)	Are you willing to pay for effective solution (1=Yes; 2=No)	How proportion of your current capital are you willing to allocate to this? (%)
			Incidence/ spread	Intensity/ concentration	Severity of damage					
618	619	620	621	622	623	624	625	626	627	628

Code 1: 1=High cost of inputs; 2=Lack of skilled labor; 3= Lack of access to credit; 4=Lack of access to productive land; 5=Lack of access to tractor; 6=Lack of weather information for planting; 7=Lack of quality of planting materials of improved crop varieties; 8=Low soil fertility; 9=Pest; 10=Disease; other specify	Code 2: 1=Make advance plans; 2=seek support through association; 3=seek the help of experts; 4=Other specify
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MODULE 17: Food security (Experience of food insecurity in the household (2014/15)) Respondent must be the person in charge of cooking (a)

629: Are there time in the year when the household have inadequate food supply due to low income or poor harvest or other factors? 1=Yes; 2=No. If no skip to Module 27 (b).

Period (Code)	In which month of the year does the household have Abundance food supply/just adequate food supply/barely have enough food												Average number of meals per day	If less than 3, what is the main reason	Number of days per month you took only two meals per day because of lack of money/food	Number of days per month you took only one meal per day because of lack of money/food	Number of days without food in the period because of lack of money/food	Whose meals were reduced during these months? (Code 2)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec						
629	630	631	632	633	634	635	636	637	638	639	640	641	642	643	644	645	646	647

Code 1: 1=Abundance period; 2=Normal period; 3=Lean period

Code 3: 5 1=son; 2=daughter; 3=adult male; 4=adult female; 4=Other (specify)

MODULE 17: Food security (Dishes eaten and ingredients for each dish in the last 24 hours and last 7 days) (b)

Ingredient (Code 1)	Does the household consume this ingredient? (1=Yes; 0=No)	Consumption recall 24 hours				Consumption recall 7 day				
		If yes did you consume it in the last 24 hours? (1=Yes; 0=No)	Quantity	Unit (Code 2)	How long does it take to cook? (minutes)	If yes did you consume it in the last 7 hours? (1=Yes; 0=No)	No. days consumed within this week (1-7)	Quantity	Unit (Code 2)	How long does it take to cook? (minutes)
648	649	650	651	652	653	654	655	656	657	658

Code 1: 1=rice; 2=maize; 3=millet; 4=sorghum; 5=cassava; 6=ground nut; 7=fonio; 8=cowpea; 9=onion; 10=tomato; 11=sweet

Code 2:

potato; 12=sesame; 14= eggplant; 6=okra; 17=banana; 18=mango; 19=orange; 20=cashew nut; 21=potatoes; 22=yam; 23=Bambara nut; 24=leafy vegetables; 25=peanuts; 26=okra; 27=palm nut; 28=cowpea (leaves); 30=fish and seafood; 31=meat; poultry, offal; 31=insects/caterpillars; 32=snail; 33=egg; 34=oil/fats; 35=milk and milk products; 36=Guinea sorrel (bissap); 37=lettuce; 38= spaghetti/macaroni, couscous; 39=Salt; 40=pepper; 41=garlic; 4=Other specify	1=Kg; 2=gram; 3=litres; 4=numbers (indicate the average weight of 1); 5=other specify
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MODULE 17: Food security (Dishes eaten and ingredients for each dish by period (2014/15)) (c)

Ingredient (Code 1)	Abundance period					Normal period					Lean period				
	Do you consume this ingredient in this period?	No. days consumed within a week (1-7)	Quantity per day	Unit (Code 2)	How long does it take to cook? (minutes)	Do you consume this ingredient in this period?	No. days consumed within a week (1-7)	Quantity per day	Unit (Code 2)	How long does it take to cook? (minutes)	Do you consume this ingredient in this period?	No. days consumed within a week (1-7)	Quantity per day	Unit (Code 2)	How long does it take to cook? (minutes)
659	660	661	662	663	664	665	666	667	668	669	670	671	672	673	674

Code 1: 1=rice; 2=maize; 3=millet; 4=sorghum; 5=cassava; 6=ground nut; 7=fonio; 8=cowpea; 9=onion; 10=tomato; 11=sweet potato; 12=sesame; 14= eggplant; 6=okra; 17=banana; 18=mango; 19=orange; 20=cashew nut; 21=potatoes; 22=yam; 23=Bambara nut; 24=leafy vegetables; 25=peanuts; 26=okra; 27=palm nut; 28=cowpea (leaves); 30=fish and seafood; 31=meat; poultry, offal; 31=insects/caterpillars; 32=snail; 33=egg; 34=oil/fats; 35=milk and milk products; 36=Guinea sorrel (bissap); 37=lettuce; 38= spaghetti/macaroni, couscous; 39=Salt; 40=pepper; 41=garlic; 4=Other specify	Code 2: 1=Kg; 2=gram; 3=litres; 4=numbers (indicate the average weight of 1); 5=other specify
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Appendix 3: Questionnaire for Seed producers

Check list for seed interviews

Companies/communities/individuals

Introduction

We provide a brief overview of the purpose of our visit and seek permission for interview
Possibly include permission for recording.

M1: *Setup of primary business*

1. Provide a brief description of seed production by your set up
 - a. Objective/value proposition
 - b. Location(s)
 - c. Key activities
 - d. State (operational?)
2. Management profile
3. Capacity (land/processing facility)
 - a. Installed capacity
 - b. Operating capacity
4. Market share
5. Estimated establishment cost (depreciation)
6. Components of facility (% breakdown)
7. Crop portfolio (% for crops and % for varieties within crops)
8. Reasons for choice of portfolio
9. Operating cycle
10. Production cost for different categories of crops/seeds
11. Staffing (quality and quantity): total and distribution
 - a. Permanent (expertise)

b. Casual

12. Source of early generation seeds and arrangements

13. Sources of other inputs

14. Structure of cost (items and most important component). Total per unit and breakdown (%)

15. Prices of output

16. Price mechanism

17. Marketing strategies and channels

18. Customers

M2: Institutional structure

Partners or collaborators

Nature of relationships

Constraints and mitigation strategies

Appendix 4: Questionnaire for Input dealers' interviews

Check list for input dealer interviews

Input dealers

Introduction

We provide a brief overview of the purpose of our visit and seek permission for interview
Possibly include permission for recording.

M1: Setup of fertilizer business

1. Provide a brief overview of the setup of your fertilizer business
 - a. Objective/value proposition
 - b. Location(s)
 - c. Key activities
 - d. State (operational?)
2. Capacity (production)
 - a. Installed capacity
 - b. Operating capacity
3. Describe the facility
4. Input portfolio (% for type)
5. Reasons for choice of portfolio
6. Marketing strategies and channels (outlets)
7. Do your channels reach farmers at the communities?
8. If no, why don't they go to the farming communities where the fertilizers are needed most?
9. Who are your customers?
10. How many outlets/shops do you have? What plans do you have to increase your network of distributors?

11. How many dealers do you have? What plans do you have to increase your network of distributors? (distributers)

Appendix 1c: Questionnaire for Expert interviews

Appendix 4: Questionnaire for Expert interviews

Check list for expert interviews

Research Institutions/NGOs

Introduction

We provide a brief overview of the purpose of our visit and seek permission for interview
Possibly include permission for recording.

M1: Setup of primary objectives

1. Provide a brief description your operations
 - a. Objective/value proposition
 - b. Location(s)
 - c. Key activities
 - d. State (operational)
2. Role in the seed system of Mozambique
3. Actors in the seeds systems
4. Sources of seeds
5. Mode of acquisition
6. Average area of common bean, cowpea, groundnuts, pigeon pea, sesame and soybean in Manica, Nampula, Tete and Zambézia.
7. Average yields (kg/ha) of common bean, cowpea, groundnuts, pigeon pea, sesame and soybean in Manica, Nampula, Tete and Zambézia.
8. Constraints faced by actors in the seed systems
9. Mitigation strategies
10. Partners or collaborators
11. Nature of relationships