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Household Annual Beneficiary Agricultural Outcome Survey

2014/15 Annual Evaluation of INVC

FINAL REPORT

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Yours sincerely,
Lawrence D. Mapemba and Assa M. Maganga

ACRONYMS

CADECOM	Catholic Development Commission
CSPro	Census and Survey Processing System
EPA	Extension Planning Area
FtF	Feed the Future
FtFMS	Feed the Future Management System
FUM	Farmers Union of Malawi
GHI	Global Health Initiative
GVH	Group Village Headman
IC	Input Costs
INVC	Integrating Nutrition in Value Chains
Kg	Kilogram
M&E	Monitoring and Evaluation
NASFAM	National Association of Farmers in Malawi
NGO	Non-governmental Organizations
PPS	Probability Proportion to Size
QS	Quantity of Sales
TP	Total Production
UP	Unit of Production
USAID	United States Agency for International Development
USD	United States Dollar
VS	Value of Sales

EXECUTIVE SUMMARY

Groundnuts and soybeans enterprise value chain

A total of 2120 beneficiary farmers were interviewed during the survey, of which, 62 percent were female and 38 percent were male. A total of 625 farmers grew groundnuts only, 811 farmers grew soybeans only and 684 farmers grew both groundnuts and soybeans. The average land under INVC promoted legumes among the beneficiary farmers was observed to be about 0.27 for groundnut and 0.25 for soybeans.

The results show that, of the 2120 beneficiary farmers, 1495 and 1309 beneficiary farmers applied at least one technology in soybeans and groundnuts fields, respectively. The total hectares that were applied to at least one of the promoted technologies were 737 hectares. Among the soybeans farmers and across the technologies, more female beneficiary farmers applied the technologies than their male counterparts except for pest management, and cultural practices. It appears the project needs to work hard on encouraging farmers to take up improved marketing technologies, as the numbers of farmers involved are very few. At most 100% of the farmers applied at least one but very few applied all of the technologies or management practices. Among the groundnuts farmers and across the technologies and gender it was observed that, in general, lower proportions of farmers applied the technologies compared to soybeans farmers. Contrary to soybean farmers, more male beneficiary farmers applied the technologies compared to female beneficiary farmers.

The results for gross margins were all positive. The groundnuts gross margins were higher for male (USD 261) than female (USD 188) farmers. Jointly the groundnuts gross margin was USD 215. These gross margins are much lower than those observed during the 2013/14 season (male decision makers reported an average gross margin of US$404/ha and female decision makers reported average gross margin of US$242/ha). For groundnuts the gross margin for farmers under FUM was the highest while for soybeans the gross margin for farmers under CADECOM was the highest. Total sales for groundnuts across partners were USD 23,335 that was much lower compared to the 2013/2014 reporting period (USD 55,079) and the yield was 0.43 metric tons per hectare compared to 0.87 metric tons per hectare in 2013/14 season. The lower yields were as a result of drought and floods that affected most parts of the country leading to lower gross margins than last growing season. Similarly, the soybeans gross margins were higher for male (USD 337) than female (USD 246) farmers compared to USD 260 and USD 129 for male and female decision makers, respectively, that was reported in 2013/14 growing season. When pooled over all partners the soybeans gross margin was observed to be USD 247 compared to USD 170 reported in 2013/14 growing season. Total sales for soybeans were USD 68,550 and the yield was 0.65 metric tons per hectare compared to USD 33,483 and yield of 0.67 metric tons per hectare reported during the 2013/14 growing season. Soy production and sells were higher in 2014/15 growing season, 250 mt and 159 mt, respectively, compared to 2013/14 growing season,196 mt and 113 mt, respectively. However, prices of soybeans during the 2014/15 growing period were reported higher than those reported during the 2013/14 growing season resulting in higher gross margins during the 2014/15 growing season than the 2013/14 growing season.

Conclusions and recommendations

1. Gross margins for soybean and groundnuts

The study found out that all gross margins for groundnuts were positive and when results were disaggregated by decision-making power, beneficiaries who reported male as decision-making person reported higher gross margins per hectare compared to their female counterparts. The same was observed for soybeans. Results disaggregated by INVC partners indicated that the gross margin for groundnuts was highest for beneficiaries under FUM while for soybeans was highest for beneficiaries under CADECOM.

Mchinji had the highest level of productivity for both groundnuts and soybean, the highest level of gross margins for groundnuts was realised in Mangochi while Mchinji had highest gross margins for soybean. Regardless of aggregation, all soybean farmer beneficiaries realized positive gross margins when all variable costs were included. The highest gross margins were realised by soybean farmer beneficiaries under CADECOM.

2. GACS on the application of new technologies

The results show that most GACs were engaged in post-harvest management technologies. Processing and value addition were the least adopted technologies under the post-harvest management with a proportion of 43 percent and 42 percent, respectively, and 33 percent utilized SMS messaging for market agricultural related information. Results also indicated that most GACs were knowledgeable of the improved technologies yet only a few practiced them. The low proportion of GACs that adopted processing and value addition could be because these technologies require capital investment hence access to reliable and adequate loan facilities that most smallholder farmers do not have access to. Value addition is important if farmers can get premium for their investment in value addition. Most rural farmers sell their products to vendors and consumers at local markets where buyers may not offer a good premium for value addition like grading and packaging hence farmers are discouraged to engage in value addition. For instance NASFAM buys farm produce as raw and does their own value addition before export or selling to supermarkets hence NASFAM farmers may not be encouraged to do value addition at farm level. Value addition would work well if farmers sell their produce direct to supermarkets.

3. Number of hectares of land under improved technologies in soy and groundnut during 2014/15 reporting period

In the findings, for both legumes, the largest proportion of land (i.e. 637 hectares) was allocated to improved variety, and 352 hectares were allocated to double row and ridge alignment technologies. Similar observations were recorded across the districts. When disaggregated by gender, it appeared that female beneficiary farmers across the GACs for both legumes allocated more land to the improved technologies than their male counterparts.

4. **Number of male and female beneficiary farmers who have applied improved technologies in legumes during 2014/15 reporting period**

Most improved technologies increase yield per hectare, and hence the quantity of produce that farmers have at the end of the day. Results indicated that all beneficiary farmers applied at least one of the improved technologies for both soybean and groundnuts. A highest number of beneficiaries for both groundnuts and soybean had specifically adopted weeding, improved variety and improved storage technologies as they lead to an increase in quantity harvested. The results also show that there are minimal differences between the proportion of male and female beneficiaries who have adopted the improved technologies in both legumes when the analysis was disaggregated by gender.

CHAPTER 1

METHODOLOGY

1.1 Introduction

The following chapter gives the methodology that was used in the survey. The annual beneficiary agricultural outcome survey was quantitative.

1.2 Sample design and sample size determination

The sampling design proposed (for greatest power) was a systematic random sample from a complete list of INVC beneficiary households. A sample of 300 beneficiary households per district was determined to be representative enough. Using Probability Proportion to Size (PPS) the sample of 300 beneficiary households per district was allocated to the EPAs and GVHs where INVC partners are working. The list of all beneficiary households was obtained from the INVC Monitoring and Evaluation (M&E) Team. Using this list a random sample of beneficiary households, with replacements, was obtained for inclusion in the agricultural beneficiary outcome survey.

The sample size estimate of 300 beneficiary households was based on the anticipated 15% point change in yield among targeted beneficiaries as a result of FtF-INVC interventions. Therefore, a sample size of approximately 2100 should provide sufficient power to detect an anticipated 15% point change, with 95% significance and 90% power (2-tailed, 95% Z_α and 90% $Z_{1-\alpha}$), and a 10% non-response rate, derived from the formula below

$$n = \frac{\left[Z_{\alpha}\sqrt{2PQ} - Z_{1-\alpha}\sqrt{P_1Q_1 + P_2Q_2}\right]^2}{(P_2 - P_1)^2}$$

Where:

Z_α= probability that an observed change of magnitude would not have occurred by chance (i.e., significance)

$Z_{1-\alpha}$= probability of certainty to detect a change of the desired magnitude (i.e., power)

P = proportion of the population displaying a key outcome of interest

$Q = 1 – P$

P_1 = population proportion at time 1 (i.e. baseline)

P_2 = population proportion at time 2 (i.e. final)

$Q_1 = 1 – P_1$

$Q_2 = 1 – P_2$

INVC staff provided two data sets one for the farmer beneficiaries and one for producer organizations. The sample size for this survey of producer organizations was 200 organizations.

1.3 Survey instruments

A semi-structured questionnaire was used to capture all quantitative data from representative beneficiary households. The outcome indicator survey instrument captured key outcome data as stipulated in the purpose of the survey for reporting on annual agricultural outcome indicators, along with demographic and household socioeconomic characteristics, and other factors that may affect uptake of INVC interventions and exposure and utilization of program services. The household questionnaire was standardized for all households included in the survey. An additional instrument was utilized to gather data on "Number of private enterprises, producer organizations, women's groups, trade and business associations and community based organizations (CBOs) that applied new technologies or management practices as a result of INVC assistance." The sample for this portion of the survey was from the project list of private enterprise and producer organization beneficiaries.

1.4 Data entry, cleaning, and analysis

All collected questionnaires were entered in CSPro software. The data was then transferred into STATA for data cleaning and analysis. Tables were developed that were used to write a report.

1.5 Gross margin calculations

The study used gross margin analysis as the major analytical method. Since a direct beneficiary sample survey was used to collect gross margin data points, the sample survey estimates were extrapolated to total beneficiary estimated values before entry into FTFMS. Gross margins per hectare of groundnuts and soybeans were calculated. The gross margin is the difference between the total value of smallholder production of the agricultural product (soy bean and groundnut) and the cost of producing that item, divided by the total number of units in production (hectares of crops). Gross margin per hectare is a measure of net income for that farm. The INVC project focuses on three value chains—soybeans, groundnuts. Gross margin data points was collected and reported for groundnuts and soybeans. Input costs included were those significant cash costs that can be easily ascertained. Most likely cash input costs items were: purchased seed, fertilizer, pesticides, hired labor, hired enforcement, and hired machine. Capital investments and depreciation were not included in cash costs. Unpaid family labor, seed from previous harvest and other in-kind inputs were not valued and were not included in costs.

The following were units of measure that were used in the analysis.

- Hectares planted (for soy bean and groundnuts)
- Dollars/hectare
- Total Production (metric tons for soy bean and groundnuts)

- Value of Sales (USD)
- Quantity of Sales (metric tons)
- Purchased input costs (USD)

The other indicators that required aggregation across the impact area were computed through extrapolation from sample data. These indicators included: number of farmers and others who have applied improved technologies or management practices as a result of INVC assistance; number of hectares of land under improved technologies or management practices as a result of INVC assistance (for soybeans and groundnuts); yields of soybean and groundnut; value of incremental sales (collected at farm-level) attributed to FTF implementation; total quantity of nutrient rich value chain commodities (soybeans and groundnuts) set aside for home consumption by direct beneficiary producer households. Whereas, information on number of private enterprises, producer organizations, women's groups, trade and business associations and community based organizations (CBOs) that applied new technologies or management practices as a result of INVC assistance was collected from key informants.

The Malawi Kwacha currency units were converted to USD at the average market foreign exchange rate for the year 2015, which was the reporting year. Data was entered disaggregated to the lowest level (i.e., by commodity then by sex under each commodity. FTFMS calculated gross margins per ha automatically).

Method of calculation:

Gross margin is calculated from five data points, reported as totals across all direct beneficiaries:

1. Total Production by direct beneficiaries during reporting period **(TP)**
2. Total Value of Sales (USD) by direct beneficiaries during reporting period **(VS)**
3. Total Quantity (volume) of Sales by direct beneficiaries during reporting period **(QS)**
4. Total Recurrent Cash Input Costs of direct beneficiaries during reporting period **(IC)**
5. Total Units of Production: Hectares planted (for soybean and groundnuts) **(UP)**

The INVC study disaggregated values for the five gross margin data points, disaggregated first by commodity, then by the sex disaggregate categories: male, female, and joint, as applicable. Commodity-sex layered disaggregated data are required because the most meaningful interpretation and use of gross margin information is at the specific commodity level, including the comparison of gross margins received by female and male farmers. FTFMS used the formula below to automatically calculate the average commodity-specific Gross Margin, and the average commodity-specific Gross Margin for each sex disaggregate:

Gross margin per ha = [(TP x VS/QS) – IC] / UP

For example, for the total production data point, total production during the reporting year on plots managed by female, groundnuts-producing, direct beneficiaries; total production on plots managed by male, groundnuts-producing, direct beneficiaries; total production during the reporting year on plots managed jointly by female and male groundnuts-producing, direct beneficiaries were calculated. And so forth for total value and total quantity of sales; total cash recurrent input costs; and total hectares, for groundnuts. Similarly for soybeans the five data points were calculated.

CHAPTER 2

GROSS MARGIN ANALYSIS

2.1 Introduction

In the study gross margin analysis was undertaken to determine the contribution of groundnuts and soybeans to household incomes. Gross margins assist in determining profitability of an enterprise. They may also aid in pricing decisions. Positive gross margins indicate that a particular enterprise is profitable while negative gross margins indicate losses.

2.2 Gross Margin analysis for groundnuts

Table 3.1 is a summary of results of the gross margin analysis in USD for groundnuts by decision-making power and INVC partner for groundnut beneficiaries during the 2014/15 reporting period. Generally all gross margins were positive and when results were disaggregated by decision-making power, beneficiaries who reported male as decision-making person reported highest gross margins per hectare of US$261 compared to beneficiaries who reported female as decision-making persons (i.e. gross margin of US$188). This result is expected as was the case in 2013/14 reporting period. Generally, households that reported male as a decision-making person also reported higher proportions of households that applied improved technologies than households that reported female as decision-making persons (refer to Table 3.1). Usage or adoption of improved technologies entail improvement in yields hence high gross margins. When results were disaggregated by INVC partners, the highest gross margin was observed among beneficiaries under FUM (i.e. US$257) followed by those under NASFAM (i.e. US$207) and then those beneficiaries under CADECOM (with gross margin of US$81). Compared to the 2013/14 outcome survey, gross margins for beneficiaries under FUM still maintain the highest while gross margin for beneficiaries under CADECOM has gone down from being second to third among the three partners. The study went further to analyse gross margins for farmers that grew groundnuts only. Similarly, beneficiaries whose decision-making power were male had the highest gross margins (USD 228) followed by those beneficiaries whose decision-making was in the hands of females (US$112). In general, all gross margins when disaggregated by decision-making power, partner organization and those who grew groundnuts only have gone down when compared to 2013/14 reporting period. This is because total production for 2014/15 was lower than that of 2013/14 which has led to reduced gross margins. The low production may partly be due to floods that hit some of the target districts, like Mangochi, Machinga, Balaka, Ntcheu and Dedza.

In terms of groundnut kept for consumption, male headed households kept more groundnut (13kg) than female headed households (6.6kg). This result can be attributed to the fact that male headed households have more land and can diversify to other cash crops than female headed households which are mostly poor and would mostly sale their surplus food for cash. Beneficiaries under NASFAM had the least amount of groundnuts (7.9kg) kept for

consumption among the three INVC partner organisations. This is because NASFAM buys the groundnuts from its beneficiaries.

Table 2. 1: Gross margin (GM) calculation for groundnut for direct beneficiaries during 2015/16 reporting period

	Gender		Partner			Pooled (*n* =1,309)	Who grew Groundnut only		
	Male (*n* =425)	Female (*n* =884)	FUM (*n* =318)	NASFAM (*n* =831)	CADECOM (*n* =160)		Male (*n* = 199)	Female (*n* =426)	Pooled (*n* =625)
Total Production (mt)	67.4	86.0	61.9	82.3	9.2	153.4	27.9	30.9	58.8
Total Value of Sales (USD)	10161	13190	10832	12103	416	23351	3594	3734	7328
Total Quantity of Sales (mt)	19.3	24.8	20.9	21.9	1.3	44	7.58	9.03	16.6
Total Cash Input Costs (USD)	2337.1	3105.0	1807.4	3371.5	263.3	5442	891.2	1427.3	2318.6
Total Hectares planted (ha)	127	227	118	204	32	354	54	101	155
GM /Ha of groundnut (USD/ha)	**261**	**188**	**257**	**207**	**81**	**215**	**228**	**112**	**153**
Yield of groundnut (MT/ha)	**0.5304**	**0.3790**	**0.5248**	**0.4035**	**0.2865**	**0.4333**	**0.5167**	**0.3059**	**0.3794**
Kept for consumption (kg) per beneficiary	**13.3**	**6.6**	**11.3**	**7.9**	**8.2**	**8.8**	**9.7**	**5.2**	**6.6**

2.3 Gross margin for soybean

Table 2.2 summarizes results of the gross margin analysis for soybeans. Results have been disaggregated by decision-making power on the farm, partner organization and by whether the farmer grew soybeans only. Results generally indicate that regardless of aggregation, all beneficiaries realized positive gross margins. This is evidenced by a pooled gross margin of $284. Of note, beneficiaries who reported that males had more decision-making power on soybean farms realized the highest gross margin i.e. US$310, while beneficiaries who reported females had more decision-making power realized less i.e. US$209. Among the INVC partners, farmers under CADECOM had the best soybean gross margins of US$281 followed by farmers under FUM (US$259). CADECOM operates in Dedza only and soy prices were higher in that district. Farmers under NASFAM had the least gross margin. One of the reasons commonly observed among NASFAM farmers during the past growing season was that most of the farmers were still waiting for NASFAM to buy their produce. For the few that had sold their produce to NASFAM, it depends at what price NASFAM bought the produce. It could be possible that the price offered by NASFAM was less than the prevailing market price. Another reason for the lower gross margin could be the cost of seed among the farmers belonging to different partners. NASFAM charges seed cost at an interest while all other partners allow their farmers to buy seed from other cheaper sources and do not charge the cost of seed to the farmers, which is one of the costs used in calculation of gross margin and could lead to the slight differences in gross margin among the farmers belonging to the partners. The study analysed further beneficiaries who grew soybean only. Similarly the results in Table 2.2 show that male beneficiaries realised higher gross margins (US$337) than female beneficiaries (US$246). In general, all soy bean gross margins when disaggregated by decision-making power, INVC partner organizations and those who grew soy only had gone up significantly when compared to 2013/14 reporting period. There is not much difference in the total production between 2014/15 reporting period and that of 2013/14 but there is a significant difference in total value of sales. Results show that total value of sales for 2014/15 had gone up compared to the 2013/14 period by about 105% when we consider the pooled results for partners. This implies that prices of soy bean were higher during the 2014/15 season than 2013/14 season and this increased the gross margin.

Similarly, male headed households kept more soy (11.1kg) for consumption than female headed households (7.6kg).

Table 2. 2: Gross margin (GM) calculation for soybean for direct beneficiaries during 2014/15 reporting period

	Gender		Partner			Pooled (*n* =1,495)	Who grew soy only		
	Male (*n* =548)	Female (*n* =947)	FUM (*n* =299)	NASFAM (*n* =1,144)	CADECOM (*n* =49)		Male (*n* =321)	Female (*n* =487)	Pooled (*n* =808)
Total Production (mt)	121	129	55	189	6	250	75	72	147
Total Value of Sales (USD)	34361	34189	16134	50511	1905	68550	21373	19786	41159
Total Quantity of Sales (mt)	81	78	38	117	4	159	50	44	94
Total Cash Input Costs (USD)	6115	6910	3412	9285	328	13025	3448	3885	7333
Total Hectares planted (ha)	146	238	77	298	9	384	85	116	201
GM /Ha of Soy (USD/ha)	**310**	**209**	**259**	**243**	**281**	**247**	**337**	**246**	**284**
Yield of Soy (MT/ha)	**0.8288**	**0.5420**	**0.7143**	**0.6342**	**0.6667**	**0.6510**	**0.8824**	**0.6207**	**0.7313**
Kept for consumption (kg) per beneficiary	**11.1**	**7.6**	**10.8**	**8.5**	**6.3**	**8.9**	**9.9**	**6.8**	**8.1**

2.4 Productivity and Gross margins by district

The gross margin analysis and land productivity were further disaggregated by districts. Table 2.3 is a summary of land productivity (yields) and gross margins per hectare of both soybeans and groundnuts. In terms of soy, the results show that Mchinji had the highest productivity of 0.85MT/ha followed by Mangochi (0.82MT/ha) and then Dedza (0.78MT/ha). Machinga had the least productivity (0.39MT/ha). Correspondingly, Mchinji had the highest soybean gross margin of USD339 followed by Mangochi (USD335) and then Dedza (USD282). Balaka had the least gross margin of USD141.

Similarly for groundnuts, Mchinji had the highest productivity of 0.58MT/ha followed by Lilongwe with 0.46MT/ha and then Mangochi with 0.44MT/ha. In terms of gross margins, Mangochi had the highest gross margin of USD345 followed by Lilongwe and then Mchinji. Note that Mangochi realised higher gross margins than Mchinji although it had lower productivity. Generally, prices of groundnuts are higher in Mangochi than in Mchinji. In addition, Mangochi has higher population than Mchinji, coupled with lower groundnuts yields in Mangochi than Mchinji then the value of a kilogram of groundnuts was higher in Mangochi than Mchinji.

Table 2. 3: Productivity and Gross margins by district

District	Yield per Hectare (MT/ha)		Gross margins per Hectare (USD/ha)		Sample (n)	
	Soy bean	Groundnut	Soy bean	Groundnut	Soy bean	Groundnut
Mchinji	0.8530	0.5865	339	243	246	187
Lilongwe	0.4962	0.4689	179	272	220	209
Dedza	0.7865	0.3507	282	184	154	270
Ntcheu	0.5740	0.3157	197	109	190	130
Balaka	0.4154	0.3250	141	181	178	213
Machinga	0.3927	0.3746	142	162	261	151
Mangochi	0.8261	0.4435	335	345	246	149

2.5 Gross Margins by Specific Technology

The gross margin analysis was further disaggregated by different specific technologies practiced by the beneficiaries. Table 2.4 below is a summary of the results. Beneficiaries that practiced pest management realised the highest gross margin of US$313 for soy bean. This could be because pest management practices ensure that crops/pods are not destroyed, increase yield and quality. Notice that the farmers that applied pest management also applied other technologies like double row that further reinforced attainment of high yields and hence high gross margins. Pest management was followed by those that practiced the recommended plant spacing (US$300) and then double row (US$272). Plant spacing ensures the right plant/crop population in a field which reduces competition for nutrients among the plants and ensures optimal use of land resources while double row increases level of production on the

same piece of land. Adoption of these technologies may lead to increased gross margin. Furthermore, the results show that soy crop responds more when all technologies are applied.

Similarly, in groundnuts, those who applied pest management realized highest gross margins (US$304). Pest management was applied by few farmers but a further investigation show that those that adopted most of other technologies, pest management was the other technology that was also adopted. This was also noticed in soy bean enterprise. This along with the role of pest management in maintain high yield could be reason for higher gross margin. Further, the results indicate that beneficiaries who practiced double up technology realised the second highest gross margins i.e. US$293. In double up technology there is double fixation of nitrogen in the soil and the increased biomass from both crops (i.e. top level and lower level crops) also improves the structure and fertility of the soil which allows both crops to benefit through increasing yields.

Table 2. 4: Gross Margins by Specific Technology

Technology	Soy bean (US$/Ha)	Groundnut (US$/Ha)	**Sample (n)**	
			Soy bean	**Groundnut**
1. Crop genetics	251	213	1,356	1,069
2. Double row	272	222	1,010	491
3. Double up	195	293	210	234
4. Ridge alignment	265	231	730	574
5. Plant spacing	300	236	840	707
6. Weeding	247	239	1,495	1,309
7. Inoculum	267	-	823	-
8. Pest management	313	304	82	26
9. Improved storage	257	239	1,397	1,091
10 At least one technology	247	215	1,495	1,309
11. Applied 1 technology	64	69	50	76
12. Applied 2 technologies	155	166	288	441
13. Applied 3 technologies	240	251	438	766
14. Applied All technologies	282	211	77	19

CHAPTER 3

ADOPTION OF IMPROVED TECHNOLOGIES

3.1 Adoption of improved technology across gender in legumes

Table 3.1 summarises the proportion of beneficiary farmers who have applied improved technologies in legumes. In general, all beneficiary farmers applied at least one of the improved technologies for both soybean and groundnuts. The next highly adopted technology were weeding (100%), followed by improved varieties (over 80%), and improved storage (over 80%). Weeding reduces competition in plants thereby increasing productivity, improved varieties increase crop yields and improved storage technologies reduce post-harvest losses thereby maintaining the quantities and quality of stored food. Since all the above increase quantities harvested hence being very attractive to farmers and therefore highly adopted.

However, low proportions of soya beneficiary farmers applied pest management and double up technologies as compared to groundnut farmers. Soybean is a newer crop compared to groundnut, hence adoption of new technologies could easily be in groundnuts than would be in soybean. When the analysis is disaggregated by gender, there are minimal differences between the proportion of male and female beneficiaries who have adopted the improved technologies in both legumes.

Table 3. 1: Number of male and female beneficiary farmers applying improved technologies in legumes during 2014/15 reporting period

Technology	Soya Farmers						Groundnut farmers						Both
	Male		Female		All		Male		Female		All		
	%	n	%	n	%	N	%	N	%	n	%	n	
Improved variety	91	499	91	857	91	1,356	78	331	84	738	82	1,069	1,959
Double row	71	387	66	623	68	1,010	34	139	41	352	39	491	1,306
Double up	17	90	13	120	14	210	20	85	17	149	18	234	389
Ridge alignment	53	289	47	441	49	730	48	203	42	371	44	574	1,031
Plant spacing	58	316	55	524	56	840	55	234	53	473	54	707	1,282
Weeding	100	548	100	947	100	1,495	100	425	100	884	100	1,309	2,120
Inoculum	56	306	54	517	55	823	-	-	-	-	-	-	823
Pest management	8	45	4	37	6	82	3	11	2	15	2	26	102
Improved storage	93	512	93	885	93	1,397	88	374	81	717	83	1,091	91
At least one technology	**100**	**548**	**100**	**947**	**100**	**1,495**	**100**	**425**	**100**	**884**	**100**	**1,309**	**2,120**

3.2 Total land in hectares under improved technologies across gender

Table 3.2 gives a summary of hectares of land under improved technologies in soy and groundnuts. For both legumes, the largest amount of land (737 hectares) were applied with weeding followed by 637 hectares that was allocated to improved variety. Application of inoculum was reported to be done on 495 hectares of land, recommended spacing was done on 406 hectares of land. About 352 hectares of land were allocated to double row and ridge alignment technologies. As observed earlier that most farmers adopted the use of improved varieties, it would follow that the most land would be allocated to improved varieties. Furthermore weeding directly enhances yields by reducing competition for nutrients between crops and weeds, therefore most farmers weed their farm land.

Double up technology had the lowest amount of land allocated to it with only 114 hectares for both groundnuts and soybean. However, when disaggregated by gender, it appeared that female beneficiary farmers for both legumes allocated more land to the improved technologies as compared to males. The total number of hectares allocated to both plant could be attributed to higher number of female beneficiaries and that female farmers grow more leguminous crops while males concentrate on cash crops.

Table 3. 2: Number of hectares of land under improved technologies in soy and groundnut during 2014/15 reporting period

Technology	Soy Hectares				Groundnut Hectares				Hectares for both
	Male	Female	Joint	Total	Male	Female	Joint	Total	
Improved variety	3.54	49.8	290.2	344	2.3	49.3	241	293	637
Double row	3.12	32.13	193.8	229	0.7	22.2	100	123	352
Double up	0.465	5.15	45.85	51	0.2	10.8	52	63	114
Ridge alignment	2.99	21.83	166.24	191	1.01	22.2	138	161	352
Plant spacing*	2.27	26.3	171.9	200	1.4	30.1	174	205	406
Weeding*	4.05	52.2	327.25	384	2.4	57.3	294	354	737
Inoculum*	3.11	29.68	198.3	231	1.71	34.9	227	264	495
Pest management*	0.36	2.9	27.3	31	0	0.95	15	16	46
Improved storage*	0	52.2	327	379	1.71	34.91	227	264	643
At least one technology	4.05	52.2	327.2	383	2.46	57.3	294	354	737

*****Proxy hectares from total area under legume for the adopter of the specific technology

3.3 Adoption of technologies by PIRS definition of FtF

Table 3.3 below presents a summary of male and female beneficiaries that applied these technologies. In general, results show that the largest proportion of soya and groundnuts farmers applied post-harvest handling and storage technologies, cultural practices technologies and crop genetics technologies (at least 90 percent for soybean farmers and at least 80 percent for groundnuts farmers). Both crop genetics (planting of improved varieties) and cultural practices directly increase levels of crop yields and post-harvest handling and storage technologies help reduce post-harvest losses, thereby retaining the quantities of produce in storage. The least applied technologies were soil related fertility and conservation,

marketing and value added processing. These technologies have not been widely promoted among farmers (see Table 3.5) and as such, not many farmers are familiar with them.

The results also show that most farmers across gender in both crops applied 3 technologies, thus: crop genetics, cultural practices, and post-harvest handling and storage which as discussed above increase yield level and maintain the quality and quantity of stored produce.

Table 3. 3: Number of male and female beneficiary farmers who have applied improved technologies in legumes during 2014/15 reporting period

Technology	Soya Farmers								Groundnut farmers								All farmers	
	Male		Female		Joint		Total		Male		Female		Joint		Total			
	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n
1. Crop genetics	86	12	93	227	90	1117	91	1356	92	11	85	217	81	841	82	1069	92	1,959
2. Cultural practices	86	12	85	207	89	1105	89	1324	83	10	84	213	88	923	88	1146	90	1,917
3. Pest management	7	1	3	8	6	73	5	82	0	0	0	1	2	25	2	26	4	102
4. Soil related fertility and conservation	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		-
5. Marketing	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		-
6. Post harvest handling and storage	93	13	93	226	94	1158	93	1397	67	8	75	190	86	893	83	1091	91	1,934
7. Value added processing	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		-
8. Applied 1 technology	7	1	3	7	3	42	3	50	8	1	8	20	5	55	6	76	6	117
9. Applied 2 technologies	14	2	24	58	18	228	19	288	17	2	39	99	33	340	34	441	31	660
10. Applied 3 technologies	7	1	35	85	28	352	29	438	67	8	52	133	60	625	59	766	44	930
11. Applied all technologies	0	0	3	8	6	69	5	77	0	0	0	1	2	18	1	19	4	91

3.4 Adoption of technologies among GACS/Clusters (202 GACs surveyed)

Summarised in table 3.4 is the proportion of GACS that applied improved technologies in the area of member services. In general, the results show that most GACs were engaging in post-harvest management technologies. Under post-harvest management technologies, processing and value addition were the least adopted technologies with a proportion of 43 percent and 42 percent, respectively. The two technologies involve changing form of the product and hence require a good investment. As such only a few GACs would adopt them, as most do not have the level of investment that would be required.

Table 3. 4: Improved technologies or management practices in the area of member services

Technology	Per cent (%)	N
SMS Messaging utilization	33	68
Aflatoxin control and management training	64	131
Post-harvest management-storage	94	189
Post-harvest management-processing	43	99
Post-harvest management-Grading	88	177
Post-harvest management-Sorting	87	176
Post-harvest management-Value addition	42	85
At least one technology	97	196

3.5 Marketing practices and technologies for groundnuts and soybeans

Table 3.5 presents a summary of the proportion of GACs who reported having knowledge of various marketing practices, those that use them as well as their preference. In general, the results show that most farmers were knowledgeable of at least one practice. Most of the GACs (92%) were, however, knowledgeable about collective marketing, yet only few practiced it. A large proportion of the GACs were also knowledgeable about association led selling, though only a few practiced it. This is as a result of the competition that exists among smallholder farmers and hence reduces the willingness to participate in collective marketing.

Very few GACs were knowledgeable about bid volume offer, forward contracts and market information point (MIP) and most neither used nor preferred them. This would have been a result of lack of information on the marketing practices that affected the preference of the GACs as well as their willingness to use them. In other cases, like that of warehouse receipt system, farmers would have had knowledge of the practice, but it was not available thus reducing the proportion of those that practices.

A large proportion (82%) were also knowledgeable about association led selling as they were trained on it, yet only a few practiced it because only NASFAM work with farmers groups to buy produce from farmers.

Table 3. 5: Marketing practices

Marketing Practice	Knowledgeable		Practised		Preferred	
	%	N	%	N	%	N
Warehouse Receipt System	63	128	7	14	38	76
Bid Volume Offer	17	34	1.5	3	18	36
Marketing Information Point (MIP)	20	41	10	21	21	42
Forward contracts	25	50	4	8	19	38
Village Aggregation Centre	44	88	10	21	25	51
Collective marketing	92	185	44	88	84	171
Association led selling	82	165	29.7	60	69	140
Direct Sales to Processors/Traders	82	165	54	108	30	61
At least one practice	99	200	88	179	98	199

3.6 Improved production technologies among GACs

Table 3.6 below present a summary of GACs engaging in improved technologies in the area of technology. With the exception of inoculum, over 75 percent of GACs applied improved technologies, which is a good sign. The proportion of GACs that were applying inoculum was slightly above 50 percent as it only applied to a smaller number of GACs since it can only be applied on soybean, hence could not apply to all GACs.

Table 3. 6: Total number applying improved production technology/management practices

Technology	Per cent (%)	N
Ridge Spacing (75cm)	78	159
Plant Depth	76	154
Plant Spacing	92	187
Improved Seed	89	180
Inoculum	58	118
Double Row	93	189
Double up Legume	69	139
Ridge Width	83	167
Ridge Height	79	159
At least one technology	98	198

3.7 Total land in hectares under improved technologies across districts

Table 3.7 below summarises the number of hectares of land under improved technologies in soy and groundnuts. The aggregated results indicated that the most hectares of land were allocated to improved varieties in both legumes. As discussed above, improved varieties enhance yields hence increased adoption among farmers. The next highest allocation was made to double row technology in soybean and ridge alignment in groundnuts. Being an old crop, most groundnut beneficiary farmers would have allocated that land to ridge alignment as the technology has been promoted for a longer period of time rendering the farmers more familiar to it. Double rows on the other hand increase productivity and as such was highly adopted by farmers, hence the number of hectares of land allocated. Double up technology reported the least number of hectares allocated to it in both soybean and groundnuts since it is a new technology and, as such, farmers may not have better knowledge of it.

Table 3. 7: Number of hectares of land under improved technologies in soy and groundnut during 2014/15 reporting period by districts

District	Technology	Soy		Groundnut		Total Hectares under improved technology	Total Hectares under soy and groundnut
		Hectares under improved technology	Total Hectares under Soy	Hectares under improved technology	Total Hectares under Groundnut		
Mchinji	Improved variety	91	96	56	81	147	177
	Double row	48	96	16	81	64	177
	Double up	7	96	8	81	15	177
	Ridge alignment	46	96	39	81	85	177
	At least one technology	96	96	78	81	174	177
Lilongwe	Improved variety	42	70	54	72	96	142
	Double row	21	70	13	72	34	142
	Double up	5	70	7	72	12	142
	Ridge alignment	24	70	24	72	48	142
	At least one technology	70	70	72	72	142	142
Dedza	Improved variety	29	37	62	67	91	104
	Double row	21	37	40	67	61	104
	Double up	1	37	5	67	6	104
	Ridge alignment	18	37	40	67	58	104
	At least one technology	37	37	66	67	103	104
Ntcheu	Improved variety	37	35	28	32	65	67
	Double row	24	35	12	32	36	67
	Double up	2	35	13	32	15	67
	Ridge alignment	15	35	12	32	27	67
	At least one technology	35	35	32	32	67	67
Balaka	Improved variety	34	36	42	40	76	76
	Double row	24	36	12	40	36	76
	Double up	5	36	8	40	13	76
	Ridge alignment	29	36	20	40	49	76
	At least one technology	36	36	39	40	75	76
Machinga	Improved variety	50	49	25	29	75	78
	Double row	38	49	15	29	53	78
	Double up	12	49	11	29	23	78
	Ridge alignment	27	49	14	29	41	78
	At least one technology	48	49	29	29	77	78

Mangochi	Improved variety	58	60	24	31	82	91
	Double row	51	60	12	31	63	91
	Double up	17	60	10	31	27	91
	Ridge alignment	31	60	11	31	42	91
	At least one technology	60	60	31	31	91	91
Aggregate	Improved variety	344	384	293	354	637	738
	Double row	229	384	123	354	352	738
	Double up	51	384	63	354	114	738
	Ridge alignment	191	384	161	354	352	738
	At least one technology	375	384	337	354	712	738

CHAPTER 4

CONCLUSIONS

4.1 Gross Margin

The study found out that all gross margins for groundnuts were positive. When the results were disaggregated by decision-making power, beneficiaries who reported male as decision-making person reported highest gross margins per hectare of US$261 compared to their female counter part who reported US$188. The highest gross margins was observed for beneficiaries under FUM followed by those under CADECOM and then NASFAM, when results were disaggregated by INVC partners. The study found out also that groundnuts beneficiaries whose decision-making power were male had the highest gross margins (USD 228) followed by those beneficiaries whose decision-making was in the hands of females (US$112).

The results on productivity and gross margins by district for groundnuts shows that Mchinji had the highest productivity of 0.58MT/ha followed by Lilongwe with 0.46MT/ha and then Mangochi with 0.44MT/ha. In terms of gross margins, Mangochi had the highest gross margin of USD345 followed by Lilongwe and then Mchinji.

The results shows that regardless of aggregation, all soybean beneficiaries realized positive gross margins when all costs were included. Similar to groundnuts, the highest gross margins of US$310 were observed on beneficiaries who reported that males had more decision-making power on soybean farms than beneficiaries who reported females had more decision-making power (US$209). When results were disaggregated by INVC partners, beneficiaries under CADECOM had the best soybean gross margins of US$281 followed by beneficiaries under FUM (US$259) and then NASFAM who attained the lowest gross margin. On the beneficiaries who grew soya beans only, the results showed that male beneficiaries realised higher gross margins (US$337) than female beneficiaries (US$246).

On productivity and gross margins by district for soybeans, the study found out that Mchinji still had the highest productivity of 0.85MT/ha followed by Mangochi (0.82MT/ha) and then Dedza (0.78MT/ha) while Machinga had the least productivity (0.39MT/ha). Mchinji also had the highest soybean gross margin of USD339 followed by Mangochi (USD335) and then Dedza (USD282) while Balaka had the least gross margin of USD141.

Furthermore, when gross margins was disaggregated by different specific technologies practiced by the beneficiaries, pest management realised the highest gross margin of US$313 for soy bean. This was followed by those that practiced the recommended plant spacing (US$300) and then double row (US$272). In terms of groundnuts, the results indicate that beneficiaries who practiced double up technology realised the highest gross margins i.e. US$304.

4.2 Application of new technologies by GACS

The results showed that most GACs were engaged in post-harvest management technologies. Processing and value addition were the least adopted technologies under the post-harvest management with a proportion of 43 percent and 42 percent, respectively.

The study found out that 92 percent of the GACS were, however, knowledgeable about collective marketing, yet only few practiced it. Eighty two percent of the GACS were also knowledgeable about association led selling, yet only a few practiced. Nevertheless, very few GACs were knowledgeable about bid volume offer, forward contracts and market information point (MIP). About 75 percent of GACs practised the improved

technologies in the area of technology with the exception of inoculum but the proportion of GACs that were applying inoculum was slightly above 50 percent.

4.3 Number of hectares of land under improved technologies in soybean and groundnut

In the findings, for both legumes, the largest amount of land (637 hectares) was allocated to improved variety, 352 hectares were allocated to double row and ridge alignment technologies, and only 114 hectares were allocated to double up technology. When the hectares of land were disaggregated by gender, it appeared that female beneficiary farmers for both legumes allocated more land to the improved technologies than their male counterpart.

The aggregated results across the districts indicated that most hectares of land were allocated to improved varieties in both legumes followed by ridge alignment. Double up technology had the least number of hectares allocated to it in both soybean and groundnuts.

4.4 Number of male and female beneficiary farmers who have applied improved technologies in legumes

All beneficiary farmers applied at least one of the improved technologies for both soybean and groundnuts. Highest number of beneficiaries, for both groundnuts and soybean, had specifically adopted weeding followed by improved variety, and improved storage. These improved technologies led to an increase in quantity harvested but still more there was low proportions of soybean beneficiaries who applied pest management and double up technologies as compared to groundnut beneficiaries.

The results showed that there are minimal differences between the proportion of male and female beneficiaries who have adopted the improved technologies in both legumes when the analysis is disaggregated by gender.