BASELINE DESCRIPTIVE ANALYSIS OF FARM AND HOUSEHOLD DATA COLLECTED IN THREE DISTRICTS IN MALAWI DURING 2017-2018

FINAL REPORT
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and
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1. INTRODUCTION

Improving agricultural productivity in Sub-Saharan Africa (SSA) is widely believed to be a required strategy for overall economic growth and development. Despite moderate productivity performance in recent decades, studies have concluded that accelerating agricultural productivity growth rates is needed in SSA (Fuglie and Rada 2012; Nin-Pratt 2015). Such acceleration requires sustained improvements in the two main drivers of productivity: technical progress which corresponds to an outward shift in the production frontier stemming from improved practices and technologies; and technical efficiency, a proxy for managerial effort or performance, which are movements away or closer to the frontier given input levels, the production environment and the technology (Bravo-Ureta 2014; Njuki et al. 2018).

Considering that productivity growth is closely tied to farm-level technological improvements, measuring the productivity of farm management practices is an essential step in generating the evidence and designing strategies required for the successful scaling of promising technological options. An essential initial step for such measurements is generating appropriate data sets using rigorous sampling and data collection procedures. Unfortunately, the data required to evaluate the potential impact of alternative technological packages is often lacking because it is expensive and challenging to generate (Waddington et al. 2012; Cameron et al. 2016).

In Malawi, policies focusing on agricultural development whether through publicly-funded production and marketing programs, such as maize input subsidies and export restrictions (Denning et al. 2009; Dorward and Chirwa 2011), or privately-driven agricultural support efforts, have been pursued. Over the past decade, Malawi has witnessed the operation of anchor farms, which is a privately-driven farm business model (e.g. Tukula farms, Exagris Africa, Horizon Farms). The model is based on the notion that a large commercial farm serves as a hub of best farming practices and is part of a network of surrounding smallholder farmers (referred to as outgrowers/ingrowers) with the ultimate goal of increasing agricultural productivity and incomes, and improving living standards (Alliance for Green Revolution in Africa 2015; Clinton Development Initiative 2018).

Outgrower farmers are members of village-based farmer clubs or organizations, who receive extension services from an anchor farm and cultivate their own plots, mostly in their villages. Ingrowers, are similar to outgrowers, but in addition they cultivate plots allocated to them within the anchor farm. The reliance on outgrower/ingrower networks in the anchor farm model bears some similarity with the well-established practice of contract farming operated by national and transnational companies, including grocery chains and processors (Bijman 2008; Otsuka et al. 2016).

A review of the available literature reveals the lack of rigorous research on the impact of anchor farms on smallholder outcomes. The few studies found suggest a positive role for anchor farms on the diffusion of technologies, multiplication of seeds, investment in

infrastructure, development of local capacity, and gains in yields and revenues (Alliance for Green Revolution in Africa 2015; Maertens and Michelson 2017). Considerable additional work is needed to carefully document the impact of anchor farms on the wellbeing of participating farm households in different environments and farming systems.

A recent project aiming to partner with anchor farms as part of its extension strategy is the USAID-funded Malawi Agricultural Diversification Activity. A key component of the collaborative arrangement between AgDiv, the Feed the Future Innovation Lab for Peanut (Peanut Innovation Lab) and the anchor farms (Exagris and Horizon Farms) is the transfer of research-based Good Agricultural Practices (GAPs) to outgrower and ingrower households working with Exagris and Horizon Farms. In the context of AgDiv, GAPs are agronomic techniques that promote the attainment of economically optimal output levels in a sustainable fashion. They include timely planting and harvest dates, optimal planting density and row spacing, inoculant and gypsum use, effective pest and weed management practices, efficient irrigation techniques (e.g. drip), and proper storage and drying practices (e.g. use of Purdue Improved Crop Storage (PICS) bags) (Bravo-Ureta et al. 2018a, b).

The relationship that both AgDiv and the Peanut Innovation Lab, and its predecessor the Peanut and Mycotoxin Innovation Lab (PMIL), have developed with Exagris and Horizon Farms, and the presence of a large number of outgrower/ingrower farmers presents a unique opportunity to undertake a rich research initiative. Accordingly, developing rigorous evidence of the role of anchor farms as channels for promoting adoption and scaling technologies solidifies the basis on which such farms could be strategic entry points for agricultural development initiatives.

The primary research questions pursued in this study include the following:

1) Do anchor farms promote the process of technology adoption and diffusion?
2) Are farmers associated with anchor farms (treated) more productive than those that are not (controls)?
3) Are there return, cost and yield differentials between treated (outgrower or ingrower farms) and control (farms not affiliated with an anchor farm) farmers?
4) Are there technology and management gaps between the two groups of farmers?

As an initial step to rigorously address the foregoing research questions, a baseline survey was conducted in three Districts in the Central Region of Malawi, namely Lilongwe, Mchinji and Salima. Data was collected from random samples of farm households producing groundnut and/or soybeans as well as from their corresponding villages. This report presents a descriptive statistical analysis of the baseline data, which was collected between August 2017 and April 2018.

The organization of this report contains four additional sections. Section 2 presents a discussion of the survey design, sample size determination and the implementation of the fieldwork required to collect the baseline data. Section 3 contains a detailed presentation of the baseline data along with descriptive statistics. Section 3 is divided into four major subsections which are aligned with the layout of the farm level survey (3.1 General Survey Information; 3.2 Socio-Economic Profile of the Farming Household; 3.3 Agricultural

Production Practices; and 3.4 Housing, Well-being, Shocks and Coping Strategies). Section 4 presents descriptive statistics derived from a survey at the village level in all villages where farmers were interviewed and is divided into two main subsections (4.1 Socio-Demographics, Basic Infrastructure and Services; 4.2 Agricultural and Economic Activities). Section 5 is a Summary of the key findings derived from the baseline descriptive analysis.

2. SURVEY DESIGN AND IMPLEMENTATION

This section presents a detailed definition and identification of the study population (Subsection 2.1), the determination of sample size and selection (Subsection 2.2), and the approach used for data collection, and survey implementation (Subsection 2.3).

2.1 Identification of the Study Population

Two study populations were defined for the study. The first is the population of all the farmers who cultivate groundnut and/or soybean in the *Lilongwe*, *Mchinji* and *Salima* Districts within the Central Region of Malawi. These three Districts were of initial interest to the Project[3] and represent three of four District sites in the Central Region where Exagris and/or Horizon Farms operate. The target sites are shown in Figure 1. The village heads of all the villages with groundnut- and/or soybean-producing farmers make up the second population, i.e., Village Leaders.

Based on a quasi-experimental evaluation design, potential study villages and farmers were defined as:

1) Treated villages - villages where farmers affiliated with Exagris/Horizon Farms live and farm.

2) Control villages - villages similar to the treated ones but outside the area of influence of Exagris/Horizon Farms.

Based on the village type and their access to anchor farm plots, four categories of farmers were identified:

1) Treated (T) farmers – they work for Exagris/Horizon Farms and consist of two sub-groups:
   a) Ingrowers (T1) – farmers that operate plots assigned by Exagris/Horizon Farms and their own[4] plots.
   b) Outgrowers (T2) – farmers that have no Exagris/Horizon Farms-assigned plots and operate only their own plots

2) Control (C) farmers – they do not work with Exagris/Horizon Farms, and also consist of two sub-groups:
   a) Neighbor Control (C1) – farmers that live in treated villages
   b) Pure Control (C2) – farmers that live in control villages

[3] "the Project" implies the AgDiv -PMIL/Peanut Innovation Lab-Anchor farms collaborative platform.

[4] The use of the word "own" also encompasses plots acquired through rental or usufructuary arrangements

2.2 Sample Selection

Power analysis was carried out to determine the minimum sample size required to allow for a detection of an effect (if truly present) attributable to participation in anchor farming (Wassenich 2007).

In Panel A of Table 1, parameter values assumed in the calculation are presented. Based on farm data from Malawi (Julien et al. 2018), we use an average farm income of $200 per hectare and a standard deviation of $287 as baseline values. In consultation with the Project's stakeholders, it was decided that a minimum detectable effect size of 17.5% would be appropriate for productivity and income changes from anchor farm participation.
The probability of detecting an effect when there is none (significance level, α) was set at 10%, and a statistical power of 80% was assumed. Thus, the probability of detecting an effect when there is actually one is 80%. An intra-cluster correlation coefficient of 0.026 was used to compute a cluster correction factor of 1.3612 since the more correlated farmer outcomes are within a village, the less power our design has (Glennerster and Takavarasha 2013). Following Wassenich (2007) and applying the cluster correction factor, a minimum size of 2,263 farmers was determined (see Panel C of Table 1).

The sample was divided evenly between the treated and control groups. Accordingly, the sizes for the control sub-groups (C1 and C2) were also evenly split given the control sample size. Initially we set the desired sample sizes per village for each treatment category as: 10 household (HH) per village for treated farmers; 5HH per village for neighbor controls; and 12 per village for pure controls. Thus, the total number of villages to be visited was 113 treated and 47 control. These numbers are consistent with the power calculations given the values of all assumed parameters.

Anticipating the need for replacements owing to challenges with identification of potential respondents, availability and cooperation of selected farmers, and the accuracy of records (e.g. lists), a sample buffer of 15% was applied (see Panel D of Table 1). This resulted in the addition of 17 more treated villages and 7 more control villages. Therefore, a total of 130 treated and 54 control villages would be needed to attain a buffered size of 2,598 farmers, with 1300 treated, 650 C1 and 648 C2.

A sampling frame was developed in collaboration with Exagris/Horizon Farms using a list of all the Treated and Control Villages in Lilongwe, Mchinji and Salima Districts. The required number of villages was randomly selected from the overall lists. Then, a list of all groundnut- and/or soybean-producing farmers in each of the randomly selected Treated and Control Villages in each District was developed.

The total number of villages and farmers are presented in the first Panel of Table 2. There were 199 villages in all (133 Treated; 66 Control), with 5,550 farmers in total (2,084 Treated; 2,293 C1 and 1,173 C2). Although these numbers seemed sufficient to accommodate the sample demands based on the power analysis, not all villages on the list had enough farmers to meet the target number of farmers per village. For instance, while some Treated Villages had more than 10 Treated farmers, others had just 1 Treated farmer. A similar scenario was

encountered for C1 and C2 farmers. Consequently, the Survey Management Team strategized to make up for the shortfalls from all villages with more than the required minimum number of farmers per village. For example, if Treated Villages A, B and C have 30, 40 and 2 Treated farmers, respectively, then clearly Village C falls short of the 10 farmers per village requirement for a Treated Village. Accordingly, the shortfall of 8 farmers would be sought from Villages A (+4 farmers) and B (+4 farmers). Hence, in this example 14 farmers would be selected from Villages A and B, without regard to the fact Village B has actually more farmers than Village A. This was the plan implemented in the field.

The second panel in Table 2 presents the number of planned samples for the study. Disparities between earlier Exagris/Horizon Farms records on total outgrower/ingrower enrollment and total number of villages and farmers on submitted lists resulted in the need to adjust the required number of farmers per village. For instance, for Mchinji District the target would no longer be 10 per village for treated farmers, but at least 11 per village as the total number of Treated Villages went down from 60 to 48 when the final list was elaborated.

2.3 Survey Implementation

To implement the survey, two main questionnaires were developed, one for individual farmers and the other for village leaders. The farmer questionnaire focused on household structure; farming activities (e.g. input use, cost of production, output produced and utilization, market integration, farm and non-farm income flows, irrigation technology adoption); institutional support to the farm (e.g. credit, extension); and resilience-related questions.

The Village Head questionnaire sought information about village level demographics, agricultural practices and challenges, and availability of key resources and amenities. The questions were broadly adapted from the World Bank's Living Standard Measurement Survey for Malawi and tailored to the objectives of this project. Draft questionnaires were prepared by the P.I. and R.A. and were then reviewed by the key Project stakeholders. Electronic versions of questionnaires were developed using the World Bank's Computer-Assisted Personal Interviewing (CAPI) Platform (Survey Solutions) as it was the Project's plan to automate the data collection and cleaning process.

The enumeration team was recruited by advertising the positions in Malawi's Capital (Lilongwe City). Potential enumerators submitted CVs that were screened by the PI and other members of the survey management team. Individuals shortlisted had at least a bachelor's degree in agricultural-related programs and had prior experience in large-scale farm data collection in Malawi. Shortlisted candidates were invited for training at the *Kumudzi* Eco Center (near the Lilongwe University of Agriculture and Natural Resources or LUANAR) over the period August 9–23, 2017. At the training, the team was introduced to the Project stakeholders, the objectives of the study and the structure of the field work. A presentation and discussion focusing on ethical standards of data collection involving human subjects was also part of the training. Then, the contents of the questionnaires were reviewed in detail (in the English language) to make sure individual enumerators

understood the logic of every question, and to verify the appropriateness of the framing of each question to the local context. In collaboration with our local partners on the ground, the team was taken through one-on-one mock sessions to practice on the appropriate way to pose the questions in the local language – *Chichewa*. Five rounds of field-testing of the farmer questionnaire were carried out. The first two rounds used the paper-based or hardcopy format and the subsequent three rounds were done with the tablet – electronic format. A debriefing session to gather feedback, incorporate questionnaire changes, and resolve bugs in the questionnaire codes followed each round of field-testing.

Three members of the group were selected to serve as supervisors based on their performance, experience and savviness with the electronic platform. Three enumeration teams were then constituted immediately after the training and placed under the charge of each supervisor. Supervisors were taken through the protocols of questionnaire assignment, review, rejection and approval using Survey Solutions. They were also trained to administer the village-leader questionnaire. Supervisors and their team members were each assigned log-on credentials to a secured server (https://bbu2017.mysurvey.solutions), acquired free of charge (for users of Survey Solutions) at the World Bank.

Eighteen GPS- and 3G/4G-enabled tablets (Samsung Galaxy S2) made available by AgDiv were linked to the server by means of the Survey Solutions Interviewer App. Fifteen of the tablets were assigned and linked specifically for each team member. Each enumeration team also had a spare tablet for unforeseen tablet-related challenges. The survey was headquartered (HQ) at the Agricultural and Resource Economics Department, University of Connecticut (UCONN). Daily or several times per week questionnaire assignments for randomly selected farmers and their replacements were sent to enumerators' tablets via their supervisors' accounts. This way, supervisors could reassign questionnaires to other members of the team if it became necessary. Completed questionnaires from enumerators' tablets were routed first to the relevant supervisor's portal for vetting before onward passage to the HQ for final validation. Questionnaires that required corrections were sent back through the same route they came to HQ (unless otherwise directed). At the HQ, periodic auditing of village and questionnaire assignments was undertaken to track inconsistencies and needs for replacements. Additionally, periodic download of the data to compute statistics for survey management purposes was carried out.

The target respondent was the farm manager. If not available, an alternative household member with knowledge about the household's farm operations (*viz*. spouse or adult household representative) was interviewed. In the case of the village-level interview, the target respondent was the village head. In his absence, any village elder with deep information about the village could respond. If a selected farmer would not be available for the interview for any reason throughout the day(s) the team was in the village, a pre-specified replacement was provided. Pre-specified replacements were assigned from the HQ. Usually, prior to the team's visit to a given village, the regional extension agent or Exagris/Horizon Farms officer would contact the village leader and farmers to let them know the day the enumerators would be visiting the village to undertake the interviews. On the day of the visit, the extension officers would also assist in the identification of the selected farmers or replacements as needed.

Data collection began on September 14, 2017 and ended on January 31, 2018 with intermittent delays during this period. From February 1 to the beginning of April extensive work was undertaken between HQ and the Exagris team to verify farmer treatment status and associated issues. Additional general data cleaning and consultations with the field continued through the beginning of July 2018.

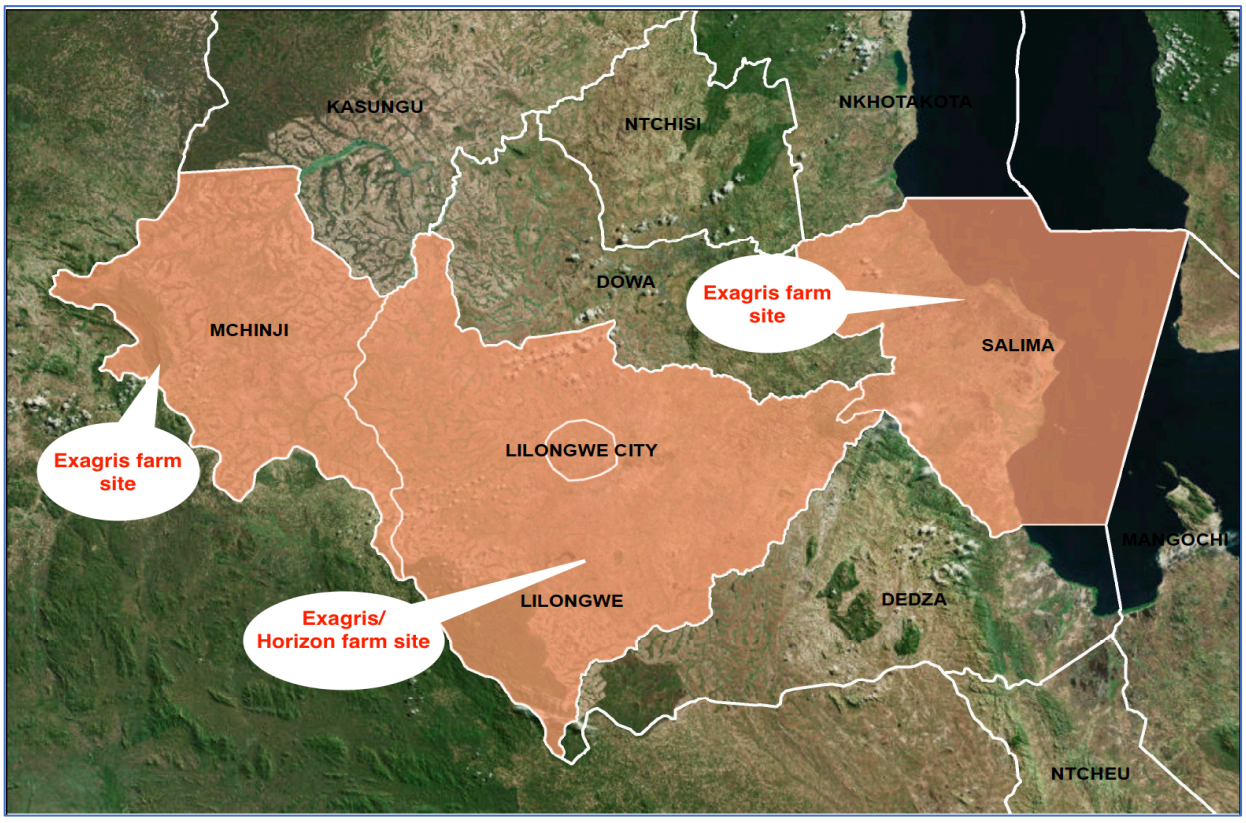


Figure 1: Anchor farm sites in the target districts

Table 1: Sample size determination

Panel A - Assumptions	Total	
Average farm income: baseline	200	
D = Effect size (17.5%)	35	
σ = Standard dev. of income	287	
α = Significance level (10%)	1.645	
β = Power (80%)	0.842	
ρ = Cluster correlation	0.026	
H = sample size per cluster (HH/village)	15	
Cluster correction	1.361	
Panel B - Sample Size	Farmers	
Total: N (W/O Cluster Correction)	1,663	
Treatment (N)	831	
Control: Neighbors	416	
Control: Non-Neighbors	416	
Panel C - Cluster Corrected	Farmers	Villages
Total: N Corrected*	2263	160
Treated Farmers: 10/Village	1132	113
Neighbor Controls (C1): 5/Treated Village	566	
Pure Controls (C2): 12/Control Village	566	47
Panel D - Buffer (15%)	Farmers	Villages
Total: N Corrected* + Buffer	2,603	
Treated Farmers: 10/Treated Village	1,300	130
Neighbor Controls (C1): 5/Treated Village	650	
Pure Controls (C2) 12/Control Village	648	54
Total Sample Size	**2,598**	**184**

* *Note*: 50% Treated and 50% Control. Source: Computations by authors.

Table 2: Total number of villages and farmers, and selected samples by district

	Total	Lilongwe	Mchinji	Salima
All Villages & Farmers				
All Villages	199	88	72	39
# Treated Villages	133	64	48	21
# Control Villages	66	24	24	18
All Farmers	5550	2018	2530	1002
# Treated Farmers (T)	2084	831	984	269
# Control Neighbors (C1)	2293	897	1081	315
# Pure Controls (C2)	1173	290	465	418
Selected Samples				
All Villages	172	69	72	31
# Treated Villages	118	49	48	21
# Control Villages	54	20	24	10
All Farmers	2598	1063	1100	435
# Treated Farmers (T)	1300	549	541	210
# Control Neighbors (C1)	650	274	271	105
# Pure Controls (C2)	648	240	288	120

Source: Exagris/Horizon Farms records (2017) and Authors' computations.

3. BASELINE DATA: DESCRIPTIVE STATISTICS

Section 3 consists of four subsections, which are aligned with the modules contained in the farm level survey. Subsection 3.1, General Survey Information, corresponds to Module A of the farm level survey. Subsection 3.2, Socio-Economic Profile of the Farming Household, is aligned with Module B of the farm survey. Subsection 3.3, Agricultural Production Practices, is associated with Modules C & D of the farm survey. Finally, Subsection 3.4 Housing, Well-being, Shocks and Coping Strategies, comes from Modules E & F of the farm survey. A copy of the full HH survey questionnaire can be found in *Appendix* A.

We note that for categorical multi-select variables with binary (yes/no) responses, indicated percentages are for "yes" responses; hence, the sum of percentages over the categories is *not* necessarily 100%.

3.1 General Survey Information: Farm Survey-Module A

Figures 2 and 3 show the actual number of villages visited and farmers interviewed, respectively in each district and in total. A total of 179 villages were visited, composed of 123 Treated Villages (TV) and 56 Control Villages (CV). The distribution by district is: Lilongwe with 85 villages and 1064 farmers; Mchinji with 64 villages and 1100 farmers; and Salima with 30 villages and 436 farmers (Figure 2). The number of treated villages in Lilongwe, Mchinji and Salima is 61, 42 and 20, respectively; the corresponding number of control villages is 24, 22 and 10.

Figure 3 shows that the sample is composed of 1331 treated farmers (T), 622 control farmers in treated villages (C1) and 647 controls in non-treated villages (C2). The distribution of T, C1 and C2 farmers by district is the following: Lilongwe-581, 245 and 238; Mchinji-541, 271 and 288; Salima-209, 106 and 121.

The data in Table 3 presents information regarding the assignment of plots within the anchor farms as well as data on the number of farms receiving PICs bags and inoculants. A total of 310 farms were assigned Exagris/Horizon Farms land in 2016/17 and 346 in seasons prior to 2016/17. Given our definition of treatment in Sub-Section 2.1, all farmers receiving plots are in the treated group. The largest number of farms in the sample receiving plots are located in Lilongwe, followed by Mchinji and then Salima. The average number of years with a plot is 2.8 for all treated, whereas those in Lilongwe, Mchinji and Salima reported, respectively 2.8, 2.6 and 3.1 years.

A total of 1500 farmers, including all three types of farmers (T, C1 and C2), received PICS bags in 2016/17 in Lilongwe and Mchinji (none in Salima) but, as would be expected, the numbers are considerably higher for the T group followed by the C1 group. The total number of farmers receiving inoculants is much smaller at 99, and again the largest figure is for Treated whereas no farmers were given inoculants in Salima.

In Figure 4, we show the number of farmers that were either permanent or day labor workers at the respective anchor farms. A total of 404 (139+231+34) farmers in the sample received a salary in 2016/17 from Exagris/Horizon Farms. Somewhat surprisingly we see that all three types of farmers in the three districts received such salary with the majority being in the T1 group in Lilongwe (75%) and Mchinji (55%). These numbers reveal that even farmers outside the area of influence of the anchor farms seek employment in such farms.

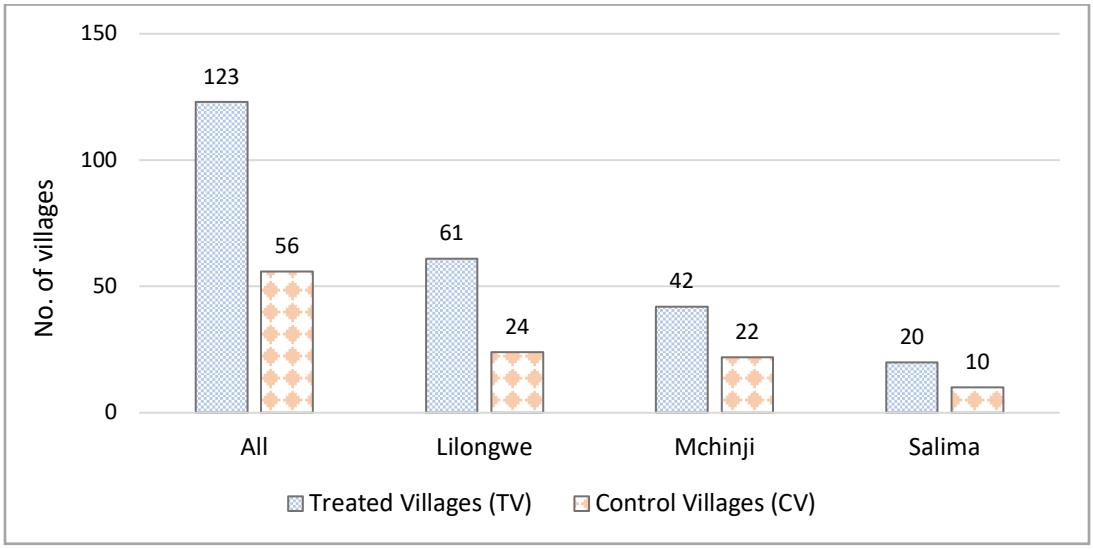


Figure 2: Number of villages visited by district

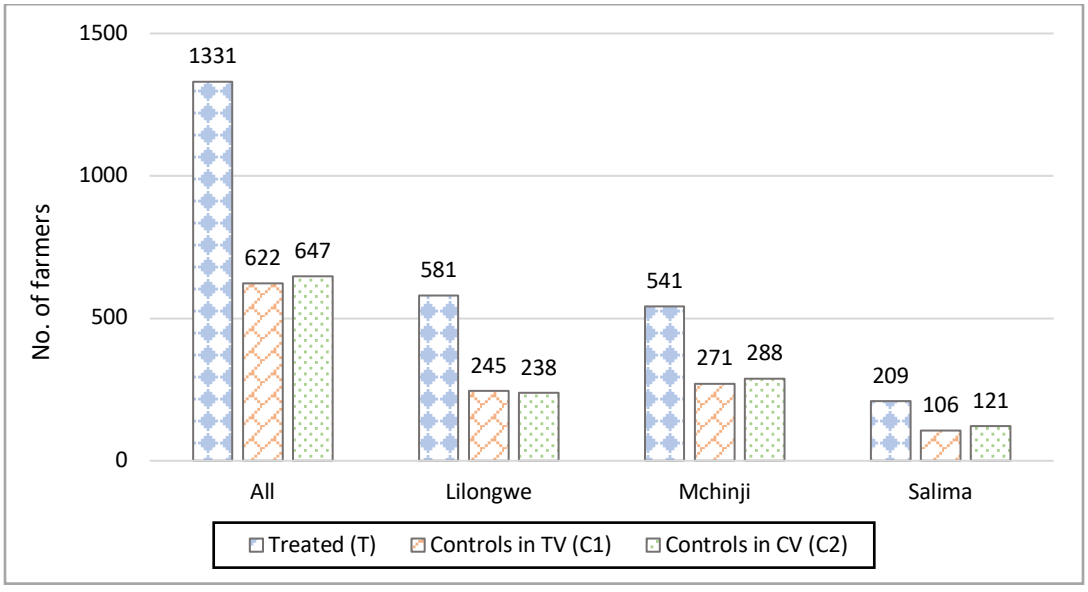


Figure 3: Number of farmers interviewed by district

Table 3: Number of farmers given anchor farm plots, PICS bags and inoculants, and the average number of years they had plots

	Total	Lilongwe			Mchinji			Salima		
		T	C1	C2	T	C1	C2	T	C1	C2
Plot in 2016/17 season	310	194	0.0	0.0	73	0.0	0.0	43	0.0	0.0
Plot prior to 2016/17	346	199	0.0	0.0	80	0.0	0.0	67	0.0	0.0
Average no. of years	2.8 *1.5*	2.8 *1.4*	0.0	0.0	2.6 *1.7*	0.0	0.0	3.1 *1.5*	0.0	0.0
PICS bags in 2016/17	1500	533	176	54	438	235	64	0.0	0.0	0.0
Inoculant in 2016/17	99	15	4	2	55	23	0.0	0.0	0.0	0.0

Note: Numbers in italics are standard deviations. (Source: Survey, 2017)

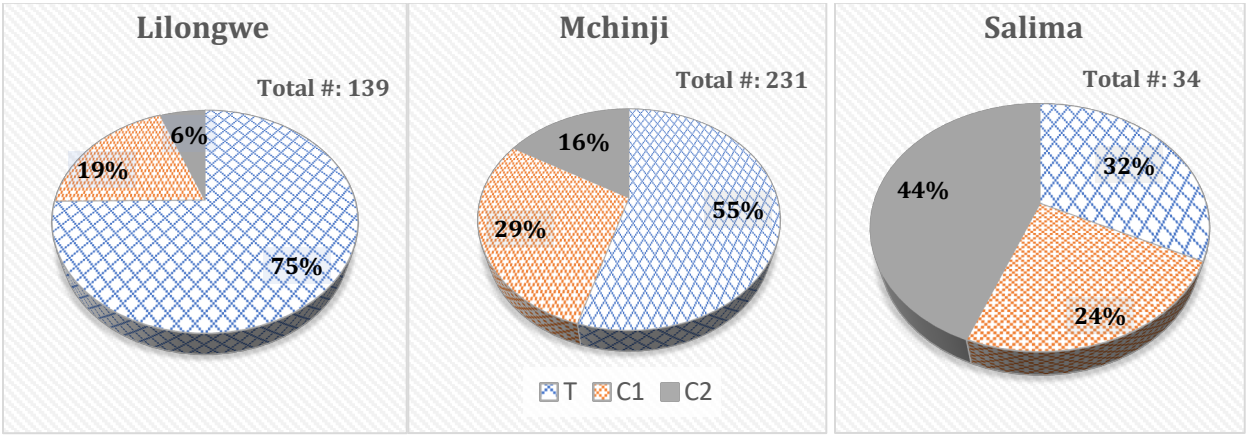


Figure 4: Proportion and number (#) of farmers who are workers of an anchor farm

3.2 Socioeconomic Profile of the Farming Household: Farm Survey-Module B

Table 4 shows the average (Avg.) socioeconomic profile of the farm managers including *Age*, *Schooling*, *Gender*, *Relationship to the household head* (HHH), *Marital status*, *Religion*, and the total *Number of days worked on his/her farm during the main season*.

The average *Age* of the farm managers is 42 years, ranging from a low of 39.0 for the C2 group in Salima to a high of 45.2 for the T group also in Salima. Average years of *Schooling* for all farm managers interviewed is 5.4 and this figure goes from a low of 4.4 for the C1 group in Lilongwe to a high of 6.0 for the T subsample in Mchinji. The overall sample is predominantly

Female (52.4%). This observed preponderance of females is dictated by the average female majorities of 61.3% in the T group from Lilongwe and 58.4%, 50.9% and 58.7% in the T, C1 and C2 sub-samples from Salima, respectively. In the majority of cases the farm manager for the overall sample is the *HHH* (67.9%) and this ranges from a low of 57.5% for the T group in Lilongwe to 78.2% in the C1 farmers in Mchinji. In terms of marital status, most of the farm managers are *Married* - 81.6% overall, with a low of 77.6% for C1 in Lilongwe and a high of 87.8% for C1 in Mchinji. By far the predominant *Religion* in all groups is *Christianity* with 87.1% for the overall sample. Finally, the *Number of days worked on the farm by the farm manager during the main seas*on is 96.6 for the entire sample and this ranges from 89.9 (C1 in Lilongwe) to 100.1 (T in Salima).

The data in Table 5 presents the average socioeconomic attributes of the HH in the sample, which are *Size*, *Dependency ratio*, *Years of schooling* within the HH, *Days worked on farm per HH member (adult male, adult female and child)* and *HH income* in Malawian Kwacha (MWK) generated from work outside the farm over the 12 months preceding the interview. The average exchange rate for 2018 was US $1 = MWK 714.

In the total sample, a HH has on average 5.3 persons, a figure ranging from 4.7 (C1 in Lilongwe) to 5.8 (C2 in Mchinji and C1 in Salima). The average *Dependency ratio*, calculated as the total number of HH members younger than 15 years and older than 64 years (economically dependent) divided by those aged 15 to 64 years (independent), is 1.1 for the overall sample. This figure is very similar across the subsamples except for the C2 group in Salima where the ratio is somewhat higher at 1.5. The average schooling in the HH for the entire sample is 4.3 years and this ranges from a low of 3.5 (C1 Lilongwe) to a high of 4.8 (T in Mchinji). The average number of days worked on the farm by an adult HH male is 84.6 for the whole sample, as opposed to 88.4 for females. Females, thus, appear to have slightly more days of engagement on-farm in the main season. A typical child on average worked 18.5 days, ranging from 12.4 for the C2 group in Lilongwe to 25.8 for the T group in Salima. The final set of numbers presented in Table 6 concerns the HH income generated by working outside the farm in the previous 12 months and the average for the overall sample is MWK 36,956. We should note that the total number of HHs reporting outside income is 1370 which amounts to 52.7%. The lowest averages are in Salima while the highest are in Lilongwe.

3.3 Agricultural Production Practices: Farm Survey-Modules C & D

This subsection is subdivided into the following four parts: 3.3.1 Land Holdings and Cultivation Choices; 3.3.2 Irrigation Use; 3.3.3 Rainy Season Farming; and 3.3.4 Extension, Credit, Inputs, Social Networks and Other Income.

3.3.1 Land Holdings and Cultivation Choices

Table 6 shows the average *Number of plots*, *Total land* and *cultivated areas*. For the entire sample, we see a total of 1.9 plots per HH with very small variation across the groups and districts. The largest number is for the T group in Mchinji with 2.1 and the lowest is 1.8 for T and C1 in Lilongwe, C2 in Mchinji and C1 in Salima.

The average of the total area covered by the plots including those rented in and/or out, is 1.1 ha for the overall sample and ranges from 0.7 ha for the T group in Lilongwe to 1.6 ha for the T group in Salima. The area cultivated is almost exactly the same as the total land area across the various groups, which suggest that farmers tend to use all their land. This is consistent with the small farm size that characterizes Malawian agriculture (Julien et al. 2018).

Table 6 also shows that the average farm in the overall sample rents in about 0.6 ha and pays MWK 17,182 in rent. The quantity of land rented exhibits limited variability across the groups whereas the variability in rent paid is somewhat higher. Regarding land rented out, the average for the overall sample is 0.7 ha going from 0.3 to 0.9 with some variability in the rental payments received. We note that the number of HHs renting in is considerably higher (745) than those renting out (21). One would have expected that these numbers would be similar. This suggests that many land owners might live outside the immediate area.

Table 7 reports the percentage of *Farmers cultivating* the different crops in the 2016/17 rainy season. The data reveals that 2589 of the 2600 HHs surveyed reported cultivating in the season. The most commonly grown crop is maize with 98% of the whole sample doing so. This percentage is very high for all groups going from a low of 97.1% (T in Lilongwe) to a high of 100% (C2 in Salima).

Groundnut ranks second with 71.1% of farms in the overall sample growing this crop and the range is from 61.4% (C1 in Lilongwe) to 87.1% (T in Salima). The next crop in importance is soybeans where 49.5% of the farmers in the whole sample reported cultivating it. Here we see much more variability across groups compared to maize and groundnuts with a low of 17.7% (T in Salima) to a high of 76.0% (C2 Mchinji). The next two most commonly grown crops are *Beans/cowpea* and Tobacco with 8.9% and 6% of all farmers, respectively.

The percentage of farmers cultivating both *Groundnut & Soybean* for the entire sample is 37.5%. The highest percentage (56.9%) is observed for the T group in Mchinji while the lowest (14.8%) is for T in Salima.

Table 8 shows that a total of 1211 farmers from the total sample cultivated in the 2016 dry season. This number is higher than what was expected at the beginning of the study. Maize is again, and by far, the most common crop with 89.5% of farmers growing this crop. Groundnut and soybeans are produced by a very small share of farmers except for the T group in Salima for both such crops and the C2 group also in Salima for groundnut. Focusing on the overall sample, other crops that are produced by a significant share of farmers are: pumpkin (46.2%); mustard (31.6%) tomatoes (24.5%); beans/cowpea (22.6%); rape (16.8%); and sweet potato (12.7%). The share for mustard and rape seems high but this may be the result of recent efforts to promote these crops (e.g. Armstrong 2012).

3.3.2 Irrigation Use

Table 9 presents data related to irrigation use by method and water source. Of the 1211 who cultivated in the 2016 dry season, a total of 1188 farmers (98.1%) reported using some type of irrigation. Geographically, very few farms irrigated in Salima in the dry season compared to the other two districts, which is consistent with agroecological and climatic conditions. By far, the dominant irrigation type used across all groups is *Watering can/bucket* with 98.4% of the 1188 farmers in the overall sample using this method. The next method in importance is *Treadle pump* used by only 1.6% of those irrigating.

The bottom of Table 9 shows the distribution of irrigation according to the water source used and here we see a clear dominance of *Wells* with 93.2% of the whole sample. However, these high percentages are observed in Lilongwe and Mchinji, but the use of *Wells* is much lower and varies across groups within Salima (14.3 for T, 20% for C1 and 57.1% for C2). The second source is *River/stream* (6.0%) followed by *Borehole* (1.3%). The use of *River/stream* is more common in Lilongwe and Salima, while the few farmers that irrigate in Salima are heavily reliant on *Boreholes*.

3.3.3 Rainy Season Farming

In Figure 5, the average cultivated area for the dominant crops (i.e. groundnut, soybean, maize) and the other crops in the major season (2016/17 production year) are depicted. Farms that cultivated the dominant crops did so on an average area of 0.39 ha, 0.37 ha and 0.52 ha, respectively. The average area devoted to other crops is slightly under half a hectare (0.49 ha).

District-level distribution of values is similar for groundnut and soybean with a range going from 0.20 ha for C1 in Salima to 0.44 ha for T and C2 groups in Mchinji. In general, Salima and Mchinji exhibit higher average cultivated areas for the dominant crops (with the exception of soybean), and ranges from a low of 0.36 ha to a high of 0.74 ha. Among the dominant crops, maize is cultivated extensively with areas ranging from 0.38 to 0.74 ha, which underscores the nutritional and economic significance of maize as a staple in Malawi.

Figure 6 reports average yields for groundnut, soybean and maize. Yield is computed as the total output in kilograms per hectare. The overall average yields for the three crops are 912 kgs/ha, 923 kgs/ha and 1,673 kgs/ha, respectively. Mchinji exhibits the highest average yields for groundnut, with 1,084 kgs/ha (C2), and soybean at 1,060 kgs/ha (C1). Groundnut yields obtained from our sample are consistent with those reported by the African Institute of Corporate Citizenship (2014). For maize, the highest yield of 1,987 kgs/ha is obtained by the T group in Salima.

Table 10 shows that the overall average output (quantity per cultivated area of land) for groundnut, soybean and maize are respectively 366.4 kg, 341.0 kg and 928.2 kg. The Value of Total Production (VTP), computed as the sum of the value of groundnut, soybean, maize and all other crops valued with their respective prices, is also presented in Table 10. The average VTP for the relevant sample of 2372 farms is MWK 269,653, ranging from a low of MWK 162,281 for T in Lilongwe to a high of MWK 410,381 for T in Salima.

Table 10 also presents the average cash costs of production for all crops, which accounts for expenses on hired labor and purchased inputs and excludes non-cash costs such as the opportunity costs of family labor, free inputs and own seeds. The average cash cost for the entire sample is MWK 54,954 going from a high of MWK 104,827 to a low of MWK 26,990.

The bottom of Table 10 contains farm-level gross margins (GM) computed as *VTP* less *Cash costs*. The average *GM per total cultivated area* for the relevant sample is MWK 202,575, and ranges from a low of MWK 128,522 for the T group in Lilongwe to a high of MWK 287,422 for the T group in Salima. Normalizing to per hectare basis, the average *GM per hectare* for the relevant sample is MWK 225,264. The range is from MWK 190,390 (C2 in Mchinji) to MWK 241,035 (T in Salima).

Table 4: Average socioeconomic profile of farm managers

	All	Lilongwe			Mchinji			Salima		
		T	C1	C2	T	C1	C2	T	C1	C2
Age (yrs.)	42.0 *14.6*	40.8 *14.7*	44.6 *17.4*	40.3 *14.1*	43.1 *14.2*	40.8 *14.9*	41.2 *13.2*	45.2 *13.8*	42.2 *13.0*	39.0 *15.5*
Years of schooling	5.4 *3.6*	4.8 *3.4*	4.4 *3.6*	5.2 *3.4*	6.0 *3.7*	5.9 *3.7*	5.4 *3.4*	5.4 *3.8*	5.8 *3.7*	5.4 *3.7*
Gender (%):										
Female	52.4	61.3	41.2	46.2	42.7	31.7	40.3	58.4	50.9	58.7
Male	47.6	38.7	58.8	53.8	57.3	68.3	59.7	41.6	49.1	41.3
Relationship to HH Head (%):										
Head	67.9	57.5	76.7	64.7	71.4	78.2	75.0	63.1	65.1	60.3
Spouse	31.2	41.0	22.5	33.6	28.1	21.0	24.3	36.4	34.9	38.9
Other	0.9	1.5	0.8	1.7	0.5	0.8	0.7	0.5	0.0	0.8
Marital Status (%):										
Married	81.6	77.8	77.6	83.6	81.7	87.8	85.8	79.0	84.9	82.6
Separated/ divorced	8.4	11.0	8.6	6.7	8.7	5.9	7.6	8.1	4.7	8.3
Widowed	7.8	8.3	11.8	6.7	7.0	5.2	5.6	11.5	8.5	6.6
Never married	2.2	2.9	2.0	3.0	2.6	1.1	1.0	1.4	1.9	2.5
Religion (%):										
Christianity	87.1	84.2	81.2	84.4	94.1	92.6	92.3	80.9	78.3	81.0
None	5.8	8.4	11.9	10.1	3.0	5.9	4.2	1.4	0.9	1.7
Islam	4.1	0.7	0.0	0.0	2.4	1.1	3.5	16.3	20.8	16.5
Traditional/ Animism	3.0	6.7	6.9	5.5	0.5	0.4	0.0	1.4	0.0	0.8
No. days worked on farm in main season	96.6 *37.1*	94.8 *37.7*	89.9 *40.5*	96.7 *36.3*	99.7 *34.5*	99.9 *37.4*	98.4 *35.9*	100.1 *34.2*	92.6 *40.6*	91.6 *40.9*

Note: Numbers in italics are standard deviations. (Source: Survey, 2017)

Table 5: Average socio-economic attributes of households (HH)

	All	Lilongwe			Mchinji			Salima		
		T	C1	C2	T	C1	C2	T	C1	C2
HH size	5.3 *2.1*	4.8 *1.8*	4.7 *2.0*	5.0 *1.9*	5.6 *2.3*	5.4 *2.1*	5.8 *2.3*	5.6 *2.1*	5.8 *2.0*	5.2 *1.8*
Dependency ratio	1.1 *0.9* [2525]	1.1 *0.8* [566]	1.1 *0.8* [229]	1.0 *0.7* [231]	1.1 *0.8* [525]	1.2 *0.9* [261]	1.2 *0.8* [283]	1.2 *1.1* [204]	1.2 *1.0* [105]	1.5 *1.0* [121]
Avg. years of schooling in HH	4.3 *2.0*	3.9 *1.9*	3.5 *2.0*	4.1 *2.0*	4.8 *2.1*	4.3 *1.9*	4.4 *1.8*	4.7 *1.9*	4.6 *2.3*	4.5 *2.2*
Avg. days worked on farm per adult male	84.6 *37.0* [2305]	84.1 *36.8* [490]	84.0 *36.4* [206]	86.5 *35.7* [215]	85.6 *35.6* [500]	86.8 *38.2* [250]	85.4 *37.0* [262]	85.8 *38.0* [181]	76.9 *39.3* [96]	77.6 *40.5* [105]
Avg. days worked on farm per adult female	88.4 *35.7* [2492]	87.6 *36.4* [554]	87.9 *35.5* [231]	84.9 *34.6* [228]	90.9 *34.0* [513]	90.7 *36.5* [259]	88.3 *34.9* [282]	90.5 *36.6* [207]	83.1 *38.2* [104]	85.5 *38.5* [116]
Avg. days worked on farm per child	18.5 *20.5* [858]	15.8 *15.5* [154]	20.8 *23.1* [63]	12.4 *9.2* [60]	17.4 *19.3* [175]	15.1 *17.5* [78]	18.6 *21.2* [119]	25.8 *27.6* [107]	21.2 *22.2* [53]	20.7 *23.9* [49]
HH income (MWK) from work outside of farm in past 12 months	36956 *31,165* [1370]	45,161 *37,632* [326]	40,867 *34,901* [127]	48,723 *36,037* [119]	37,895 *27,358* [257]	34,286 *22,300* [155]	30,580 *24,077* [170]	22,886 *21,311* [93]	20,913 *23,170* [57]	20,415 *19,616* [66]

Note: Numbers in italics are standard deviations, and those in square brackets are the relevant number of observations. (Source: Survey, 2017)
US $1 = MWK 714.3.

Table 6: Household land holdings, total cultivated area and rentals

	All	Lilongwe			Mchinji			Salima		
		T	C1	C2	T	C1	C2	T	C1	C2
No. of plots	1.9 *0.9* [2590]	1.8 *0.9* [579]	1.8 *0.8* [241]	1.9 *0.9* [236]	2.1 *1.0* [541]	1.9 *1.0* [271]	1.8 *0.9* [287]	2.0 *1.0* [209]	1.8 *0.9* [106]	2.0 *1.0* [121]
Total land area (ha)	1.1 *0.9*	0.7 *0.5*	0.8 *0.7*	0.9 *0.7*	1.3 *0.8*	1.1 *0.9*	1.4 *1.1*	1.6 *1.2*	1.3 *0.9*	1.3 *0.9*
Total cultivated area (ha)	1.1 *0.8* [2589]	0.7 *0.5* [578]	0.8 *0.7* [241]	0.9 *0.7* [236]	1.3 *0.8* [541]	1.1 *0.9* [270]	1.3 *1.0* [287]	1.5 *1.0* [209]	1.2 *0.8* [106]	1.3 *0.9* [121]
Rented in (ha)	0.6 *0.4* [745]	0.5 *0.4* [197]	0.6 *0.4* [77]	0.5 *0.3* [95]	0.7 *0.4* [151]	0.8 *0.6* [74]	0.8 *0.6* [57]	0.7 *0.4* [47]	0.5 *0.4* [21]	0.6 *0.4* [26]
Amount paid (MWK)	17,182 *11,918*	12,423 *7,607*	13,117 *7,914*	12,474 *7,675*	24,036 *14,114*	23,980 *14,489*	22,544 *12,432*	16,543 *9,271*	13,843 *11,552*	15,423 *11,371*
Rented out (ha)	0.7 *0.4* [21]	0.9 *0.4* [2]	0.0	0.3 *0.0* [1]	0.3 *0.1* [2]	0.8 *0.6* [2]	0.6 *0.4* [6]	0.9 *0.3* [4]	0.8 *0.0* [1]	0.5 *0.2* [3]
Amount received (MWK)	14,786 *11,330*	20,500 *707*	0.0	6,000	11,500 *4,950*	20,000 *14,142*	18,250 *17,279*	14,250 *11,147*	6,000	9,333 *3,055*

Note: Numbers in italics are standard deviations, and those in square brackets are the relevant number of observations. (Source: Survey, 2017)

Table 7: Farmers cultivating (%) in the 2016/17 rainy season, and by crop (%)

	All	Lilongwe			Mchinji			Salima		
		T	C1	C2	T	C1	C2	T	C1	C2
Farmers cultivating	99.6 [2589]	99.5 [578]	98.4 [241]	99.2 [236]	100 [541]	99.6 [270]	99.7 [287]	100 [209]	100 [106]	100 [121]
Groundnut	71.1	63.8	61.4	70.3	78.9	68.2	71.4	87.1	72.6	74.4
Soybean	49.5	41.4	25.3	51.3	71.9	63.0	76.0	17.7	19.8	26.5
Groundnut & Soybean	37.5	28.9	20.3	38.1	56.9	43.3	54.4	14.8	17.9	24.8
Maize	98.0	97.1	97.9	97.9	97.8	98.2	98.6	99.5	97.2	100.0
Beans/ cowpea	8.9	10.0	4.2	10.2	5.4	7.4	7.7	17.7	15.1	10.7
Tobacco	6.0	5.4	6.6	10.2	5.9	7.0	5.6	3.4	1.9	6.6
Pumpkin	5.8	9.2	4.2	5.1	2.3	3.7	8.0	6.7	6.6	5.0
Sweet potato	5.3	7.3	5.4	5.9	5.0	3.3	10.1	1.4	0.9	0.0
Chilies/ Pepper	4.9	1.6	0.8	1.3	11.7	3.3	0.4	11.5	7.6	7.4
Cotton	3.9	0.0	0.0	0.0	0.0	0.0	0.0	26.8	22.6	16.5
Cassava	1.4	0.2	0.0	0.0	0.7	0.4	1.1	3.4	9.4	9.1
Pigeon pea	0.9	0.2	0.0	0.9	0.2	0.0	1.1	4.8	2.8	1.7
Sunflower	0.5	0.2	0.0	0.0	1.1	0.0	1.4	1.4	0.0	0.0
Paprika	0.4	0.7	0.4	0.9	0.2	0.4	0.0	0.5	0.0	0.8
Pea	0.4	0.2	0.0	0.0	0.0	0.0	0.0	2.9	0.9	2.5
Ground bean	0.3	0.4	0.8	0.4	0.0	0.4	0.0	1.0	0.0	0.0
Rice	0.3	0.0	0.0	0.0	0.2	0.0	1.1	1.0	0.9	0.8
Sorghum	0.3	0.0	0.0	0.0	0.0	0.0	0.0	2.9	0.9	0.8
Irish potato	0.2	0.4	0.0	0.0	0.2	0.0	0.4	0.0	0.0	0.0
Okra	0.2	0.2	0.0	0.0	0.0	0.0	0.4	0.5	0.0	0.8
Tomato	0.2	0.2	0.0	0.0	0.4	0.0	0.4	0.5	0.0	0.0
Finger millet	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.7
Mustard	0.04	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0
Other	4.6	1.4	0.0	0.4	0.7	0.7	2.1	24.9	25.5	16.5

Note: The number of farmers that cultivated are in square brackets (Source: Survey, 2017).

Table 8: Farmers cultivating (%) in the 2016 dry season, and by crop (%)

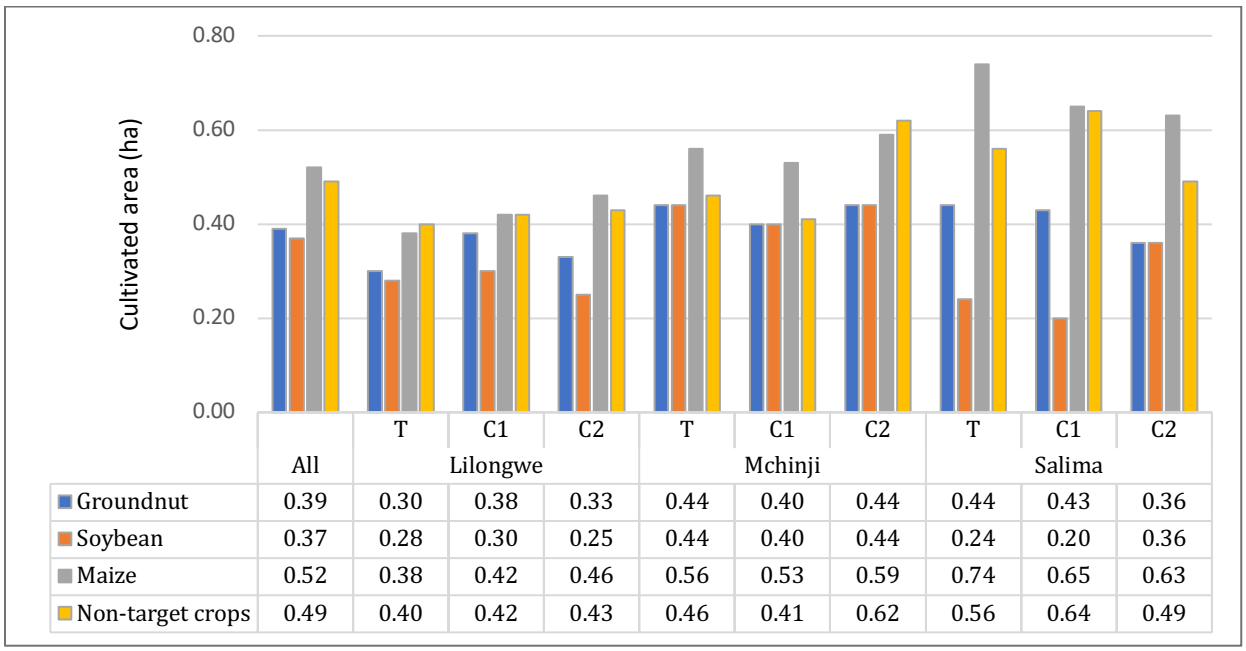
	All	Lilongwe			Mchinji			Salima		
		T	C1	C2	T	C1	C2	T	C1	C2
Farmers cultivating	46.6 [1211]	53.9 [313]	51.4 [126]	55.0 [131]	56.4 [305]	50.6 [137]	59.0 [170]	7.2 [15]	4.7 [5]	7.4 [9]
Groundnut	0.7	0.3	0.0	0.8	0.3	0.0	0.0	26.7	0.0	11.1
Soybean	0.9	0.6	0.0	0.0	1.0	0.7	1.2	20.0	0.0	0.0
Maize	89.5	90.7	91.3	92.4	90.8	96.4	86.5	40.0	20.0	11.1
Pumpkin	46.2	40.3	50.8	38.9	53.4	48.9	45.3	33.3	60.0	44.4
Mustard	31.6	32.3	24.6	29.0	31.8	24.8	42.9	33.3	20.0	33.3
Tomato	24.5	21.7	18.3	35.9	25.6	20.4	25.3	6.7	40.0	44.4
Beans/ cowpea	22.6	32.9	21.4	29.0	18.7	13.1	18.2	0.0	0.0	0.0
Rape	16.8	16.9	17.5	16.8	21.0	11.7	14.1	0.0	0.0	22.2
Sweet potato	12.7	5.8	7.9	6.1	17.7	15.3	24.1	13.3	0.0	0.0
Chinese cabbage	5.0	8.3	8.7	10.7	1.3	0.7	1.8	0.0	0.0	22.2
Irish potato	3.6	2.9	4.0	3.1	4.9	0.0	6.5	0.0	0.0	0.0
Cabbage	2.5	3.2	7.1	2.3	1.3	0.7	1.8	0.0	0.0	0.0
Sugar cane	2.1	1.6	2.4	2.3	2.6	0.0	3.5	0.0	0.0	0.0
Onion	1.9	1.3	0.8	5.3	2.6	0.7	1.2	0.0	0.0	0.0
Rice	1.3	0.3	0.0	0.8	2.0	2.2	2.4	6.7	0.0	0.0
Okra	1.2	2.6	2.4	1.5	0.0	0.0	0.6	0.0	0.0	0.0
Paprika	1.2	2.2	2.4	0.0	1.3	0.7	0.0	0.0	0.0	0.0
Chilies/ Pepper	1.1	1.0	0.0	0.8	2.0	0.0	0.0	13.3	0.0	11.1
Cassava	0.7	0.6	0.8	0.0	1.3	0.7	0.0	0.0	0.0	0.0
Tanaposi	0.7	0.0	1.6	0.0	0.3	0.0	2.9	0.0	0.0	0.0
Pea	0.3	0.6	0.0	0.0	0.3	0.7	0.0	0.0	0.0	0.0
Pigeon pea	0.3	0.0	0.0	0.0	1.3	0.0	0.0	0.0	0.0	0.0
Tobacco	0.3	0.0	0.0	0.8	0.3	0.0	0.6	0.0	0.0	0.0
Cotton	0.1	0.0	0.0	0.0	0.0	0.0	0.0	6.7	0.0	0.0
Ground bean	0.1	0.0	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sorghum	0.1	0.0	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sunflower	0.1	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.0	0.0
Other	0.2	0.0	0.0	0.0	0.3	0.7	0.0	0.0	0.0	0.0

Note: The number of farmers that cultivated are in square brackets (Source: Survey, 2017).

Table 9: Percentage of farmers that irrigated in the 2016 dry season, and by irrigation method and water source

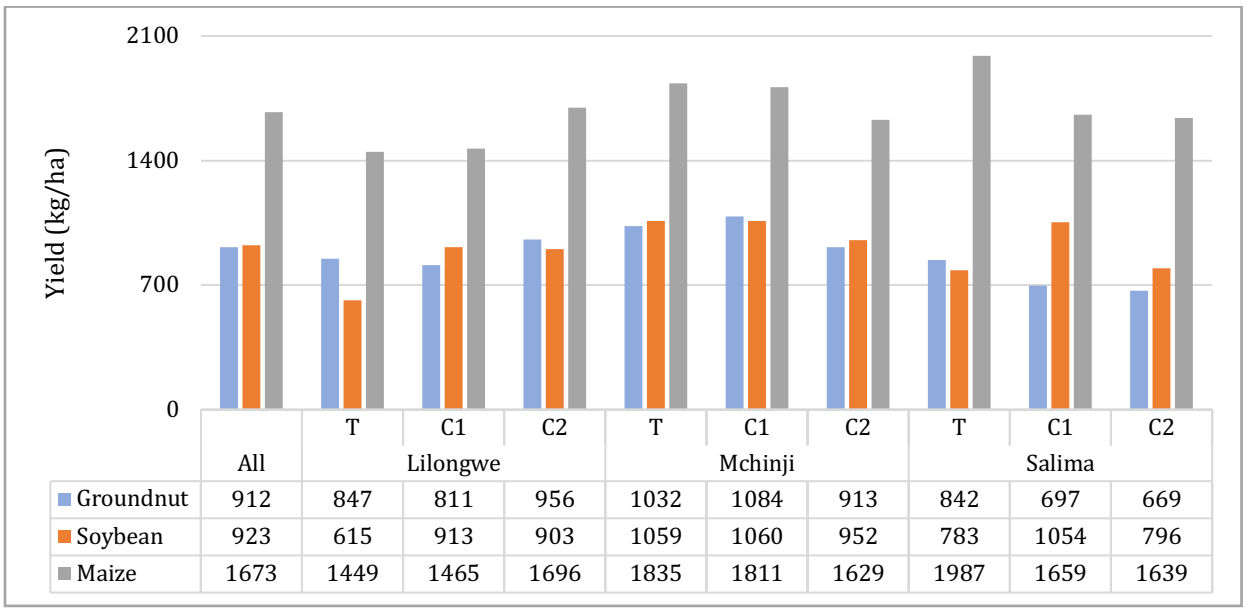
	All	Lilongwe			Mchinji			Salima		
		T	C1	C2	T	C1	C2	T	C1	C2
Irrigated	98.1 [1188]	99.7 [312]	98.4 [124]	98.5 [129]	99.3 [303]	98.5 [135]	97.7 [166]	46.7 [7]	100.0 [5]	77.8 [7]
Method:										
Watering can/bucket	98.4	99.0	98.4	100.0	98.7	98.5	97.0	71.4	80.0	100.0
Treadle pump	1.6	1.6	1.6	0.8	0.7	1.5	3.6	0.0	0.0	14.3
Residual moisture	0.8	1.3	0.0	0.0	0.3	0.7	1.2	14.3	0.0	0.0
Solar pump	0.4	0.0	0.0	0.0	1.0	1.5	0.0	0.0	0.0	0.0
Motorized pump	0.3	0.3	0.0	0.8	0.0	0.0	0.0	0.0	20.0	0.0
Stream diversion/ gravity flow	0.3	0.3	1.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Flexi pump	0.2	0.0	0.0	0.0	0.7	0.0	0.0	0.0	0.0	0.0
Hand pump	0.1	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.0	0.0
Sprinkler	0.1	0.0	0.0	0.0	0.0	0.0	0.0	14.3	0.0	0.0
Drip	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Water source:										
Wells	93.2	88.8	93.6	93.0	97.7	97.8	96.4	14.3	20.0	57.1
River/ stream	6.0	12.8	5.7	10.1	1.7	1.5	1.2	14.3	20.0	0.0
Borehole	1.3	0.3	0.0	0.0	0.3	0.0	1.8	57.1	60.0	42.9
Lake/ pond/dam	0.6	0.0	0.8	0.0	0.3	1.5	1.2	14.3	0.0	0.0

Note: The number of farmers that irrigated are in square brackets (Source: Survey, 2017).



	All	Lilongwe			Mchinji			Salima		
		T	C1	C2	T	C1	C2	T	C1	C2
Groundnut	0.39	0.30	0.38	0.33	0.44	0.40	0.44	0.44	0.43	0.36
Soybean	0.37	0.28	0.30	0.25	0.44	0.40	0.44	0.24	0.20	0.36
Maize	0.52	0.38	0.42	0.46	0.56	0.53	0.59	0.74	0.65	0.63
Non-target crops	0.49	0.40	0.42	0.43	0.46	0.41	0.62	0.56	0.64	0.49

Figure 5: Average cultivated area (ha) for groundnut, soybean, maize and other crops



	All	Lilongwe			Mchinji			Salima		
		T	C1	C2	T	C1	C2	T	C1	C2
Groundnut	912	847	811	956	1032	1084	913	842	697	669
Soybean	923	615	913	903	1059	1060	952	783	1054	796
Maize	1673	1449	1465	1696	1835	1811	1629	1987	1659	1639

Figure 6: Average yields of groundnut, soybean and maize

Table 10: Average output (kg), value of total production (VTP), cash cost and gross margin (GM) for major season's production

	All	Lilongwe			Mchinji			Salima		
		T	C1	C2	T	C1	C2	T	C1	C2
Output (kg)										
Groundnut	366.4 *457.2* [1848]	267.6 *334.5* [369]	290.5 *295.7* [148]	319.9 *392.4* [166]	474.6 *593.2* [427]	447.3 *506.9* [184]	409.7 *447.0* [205]	394.1 *459.1* [182]	257.5 *307.1* [77]	240.6 *330.7* [90]
Soybean	341.0 *425.9* [1288]	134.6 *114.7* [239]	259.8 *309.4* [61]	196.3 *168.9* [121]	461.8 *539.3* [389]	444.2 *501.0* [170]	432.3 *425.3* [218]	184.3 *144.1* [37]	190.0 *127.9* [21]	224.5 *206.3* [32]
Maize	928.2 *1131.8* [2537]	567.4 *701.1* [561]	712.5 *1261.8* [236]	832.5 *958.3* [231]	1086.4 *1150.0* [529]	1030.3 1225.*3* [265]	1042.1 *1238.6* [283]	1431.5 *1429.3* [208]	1074.0 *1171.3* [103]	1033.6 *1062.9* [121]
VTP	269,653 *226,840* [2372]	162,281 *134,292* [532]	167,527 *151,805* [217]	205,142 *157,259* [198]	335,284 *245,523* [497]	294,802 *223,711* [252]	309,424 *244,029* [267]	410,381 *270,729* [190]	331,293 *244,514* [101]	350,308 *254,653* [118]
Cash costs	54,954 *57,137* [2300]	26,990 *28,383* [521]	27,473 *30,859* [209]	37,207 *34,888* [192]	65,906 *55,250* [240]	57,624 *49,231* [240]	61,805 *49,490* [257]	104,827 *80,881* [190]	79,674 *78,220* [99]	91,220 *82,566* [115]
GM per total cultivated area (MWK)	202,575 *172,169* [2377]	128,522 *105,106* [533]	130,686 *113,993* [219]	155,016 *112,159* [198]	255,934 *195075* [499]	229,752 *180,151* [255]	226,457 *181,480* [266]	287,422 *191,806* [187]	234,852 *184,567* [102]	249,711 *207,914* [118]
GM per hectare (MWK)	225,264 *140,370*	228,096 *143,172*	220,823 *156,047*	240,082 *126,043*	223,379 *127,578*	236,511 *140,908*	190,390 *110,075*	241,035 *147,334*	234,397 *182,099*	225,233 *166,974*

Note: Numbers in italics are standard deviations, and those in square brackets are the relevant number of observations. Value of Total Production, cost and the GMs are summarized for cases with modified z-scores within ± 3.5 (Source: Survey, 2017).

3.3.4 Extension, Credit, Inputs, Social Networks and Other Income

Table 11 exhibits the access and source of extension services to the farming households in the sample. A total of 36.5% of all farmers in the sample reported having received extension in the 12 months preceding the survey and in all cases this figure is larger for the treated compared to the C1 and C2 groups. In all three districts the lowest share is for C1.

In terms of the source(s) of extension, the dominant category for the overall sample *is NGO/private* at 52.3%. In this case, the T group clearly dominates with 73.1%, 77.5% and 61.4% for Lilongwe, Mchinji and Salima, respectively. The C1 group is consistently in second place and the C2 group is considerably lower. We note that farmers could provide multiple responses and the percentages are for "Yes" responses.

The second source in relative importance is the *Government* and here we have 50.8% of the overall sample. Interestingly, across the three districts we see the T group with the lowest share (37.9% to 62.4%) reporting the *Government* as the primary source, then it goes up for the C1 group (52.1% to 64.3%) reaching a maximum with C2 (79.2% to 77.8%).

Table 11 also shows several other sources with a much lower participation in the provision of extension services including: *Electronic media* (7% of all farmers receiving extension); *Lead farmer* (4.9%); *Neighboring farmer* (2%); and several other categories all with less than 2%.

The data displayed in Table 12 reveals that 36.1% of all farmers in the sample reported having *Borrowed money in the past 12 months*. The higher share of farmers is in the T1 group in the three districts with 34.6%, 42.7% and 41.6% in Lilongwe, Mchinji and Salima, respectively. The share of farmers reporting having received credit in the C1 and C2 groups ranged from 29.4% (C1 and C2 in Lilongwe) to 38.7% (C2 in Salima).

According to Table 12, the most common credit source is *Microfinance* (includes village banking) with 52.8% of all farmers, and this figure ranges from a low of 30.9% (T in Lilongwe) to 78.2% (T in Salima). The second most important source is *Neighbor* with 26.7% of farmers reporting this source followed by *Relative/friend* (14.0%) and *Money lender (Katapila)* (5.5%). The Table includes a few other categories with a share of all farmers below 3%.

In Table 13 we show the source of purchased inputs used by the farmers in the sample. The highest proportion of farmers (47%) source their inputs from the *Local market*, while 42.5% rely on *Agro-input dealers*. About 1 in 3 farmers (33.9%) depend on *Other farmers* for inputs. Other less popular markets include more organized urban *Regional markets* (13.5%), *NGOs* (6.8%) and *Seed growers* (2.6%).

Table 14 exhibits farmer membership in various types of organization or clubs. At the top of the Table we see that 37.3% of all farmers in the sample belong to the *Exagris outgrowers association* and this, as would be expected, is predominant in the T groups in all three regions. Membership in the *Horizon Farms outgrowers association* is observed in only 3% of

the farmers and this is by far most important on the T group in Lilongwe where the collaborating Horizon Farms farm is found.

The most important membership category, aside from the outgrowers associations, is *Savings and credit coop.* reaching 20.6% of the overall sample followed by *Religious group* (14%), *Farmer's group* (7.7%), *NGO* (6.2%), *Village development committee* (5%), *Ag coop.* (4%) and several other groups with less than 4% from which we highlight *Tobacco club* (2.7%).

Figures 7 and 8 are the last in this subsection and here we present data concerning livestock farming and associated income. A total of 51.9% of the sample reports having *Reared livestock in the past 12 months preceding* (see Figure 7). The figures for Lilongwe are similar across groups (around 46%) and the same are true for Mchinji (around 50%). Livestock is more important in Salima ranging from 77.0% for group T to 67.9% for C1.

From Figure 8, the average annual Gross Margin from livestock for the overall sample is MWK 1,541.2 with considerable variability across groups and districts. The range of values goes from MWK -608.3 (C2 in Lilongwe) to MWK 7,268.2 (T in Salima).

Table 11: Percentage of farmers who received extension in the preceding 12 months and by extension source

	All	Lilongwe			Mchinji			Salima		
		T	C1	C2	T	C1	C2	T	C1	C2
Extension access	36.5	45.4	19.6	30.3	43.4	18.5	34.4	48.3	26.4	42.2
Source:										
NGO/ private	52.3	73.1	16.7	8.3	77.5	26.0	13.1	61.4	32.1	19.6
Government	50.8	37.9	52.1	79.2	32.3	52.0	77.8	62.4	64.3	78.4
Electronic media	7.0	2.7	6.3	8.3	8.5	18.0	8.1	7.9	7.1	5.9
Lead farmer	4.9	2.7	6.3	4.2	8.5	2.0	1.0	7.9	3.6	3.9
Neighboring farmer	2.0	1.5	8.3	1.4	0.9	0.0	4.0	2.0	3.6	2.0
Ag cooperative/ farmer club	1.6	0.4	4.2	1.4	2.6	2.0	3.0	1.0	0.0	0.0
Farmer field days	1.4	0.0	6.3	2.8	1.7	0.0	3.0	0.0	0.0	2.0
Village Ag meeting	1.4	1.5	4.2	0.0	1.7	2.0	1.0	1.0	0.0	0.0
Paper media	0.3	0.0	2.1	0.0	0.0	0.0	0.0	1.0	3.6	0.0
Ag course	0.1	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0
Other	1.5	0.4	6.3	1.4	2.1	2.0	3.0	0.0	0.0	0.0

Source: Survey (2017)

Table 12: Percentage of farmers who sought credit in the preceding 12 months and by credit source

	All	Lilongwe			Mchinji			Salima		
		T	C1	C2	T	C1	C2	T	C1	C2
Borrowed money	36.1	34.6	29.4	29.4	42.7	36.2	35.4	41.6	38.7	29.8
Source:										
Microfinance	52.8	30.9	34.7	37.1	64.5	52.0	58.8	78.2	75.6	63.9
Neighbor	26.7	38.8	41.7	34.3	17.3	21.4	25.5	18.4	12.2	27.8
Relative/friend	14.0	20.4	19.4	17.1	11.3	15.3	9.8	5.8	12.2	8.3
Money lender (Katapila)	5.5	9.5	6.9	4.3	5.6	6.1	4.9	1.2	0.0	0.0
Formal bank	1.3	0.5	0.0	1.4	2.6	3.1	0.0	0.0	0.0	2.8
Religious institutions	0.2	0.0	0.0	0.0	0.4	0.0	1.0	0.0	0.0	0.0
Other	1.0	0.5	0.0	5.7	0.4	3.1	0.0	0.0	0.0	0.0

Source: Survey (2017).

Table 13: Percentage of farmers by source of purchased input

	All	Lilongwe			Mchinji			Salima		
		T	C1	C2	T	C1	C2	T	C1	C2
Local market	47.6	50.6	46.9	55.5	47.3	43.9	50.7	43.1	38.7	36.4
Agro-input dealer	42.5	36.3	36.3	40.0	43.8	44.3	41.3	53.1	45.3	61.2
Other farmers	33.9	37.4	38.0	29.0	36.8	44.7	33.3	18.7	17.9	22.3
Home saved	33.1	41.0	38.8	37.0	36.8	42.4	26.0	13.9	9.4	9.9
Regional market	13.5	7.4	9.4	15.6	11.7	21.8	16.0	18.7	17.9	17.4
NGO	6.8	7.6	3.7	2.5	17.0	4.1	0.0	3.8	5.7	0.8
Seed growers	2.6	1.2	0.8	1.7	3.9	0.7	6.3	2.4	2.8	5.0
Extension/ research	1.6	1.0	0.0	0.4	4.3	0.7	0.7	1.4	2.8	1.7

Source: Survey (2017)

Table 14: Percentage of farmers in different organizations/clubs

	All	Lilongwe			Mchinji			Salima		
		T	C1	C2	T	C1	C2	T	C1	C2
Exagris outgrowers association	37.3	69.2	3.7	0.0	73.6	4.8	0.0	64.6	7.6	3.3
Savings and credit coop.	20.6	12.6	13.5	13.0	28.7	26.2	22.9	31.6	18.9	17.4
Religious group	14.0	3.1	4.1	2.9	16.3	11.8	27.4	35.9	25.5	23.1
Farmers group	7.7	3.6	5.7	10.5	6.7	2.2	11.8	18.7	7.6	14.1
NGO	6.2	2.8	4.5	3.4	15.0	4.1	8.3	2.4	0.9	2.5
Village development comm.	5.0	2.4	2.6	1.7	4.1	5.5	7.3	14.4	9.4	5.8
Ag coop.	4.0	1.7	0.4	0.4	6.3	2.2	6.9	11.5	5.7	2.5
Health committee	3.2	2.6	2.9	2.1	2.6	1.5	5.2	6.2	5.7	4.1
School committee	3.2	0.5	0.4	1.7	3.3	3.3	6.6	9.6	3.8	3.3
Horizon Farms outgrowers association	3.0	12.1	1.2	0.0	0.2	0.0	0.0	1.4	0.0	0.0
Women's group	3.0	1.4	1.6	3.4	1.5	1.5	4.5	10.1	2.8	7.4
Tobacco club	2.7	2.1	2.9	2.9	3.1	3.7	1.4	2.4	5.7	2.5
Political group	2.1	0.5	0.4	2.1	2.4	2.2	4.5	2.4	3.8	4.1
Sports group	1.8	0.3	0.0	0.4	2.6	3.0	1.7	2.9	1.9	6.6
Cultural group	1.5	1.6	2.5	1.3	0.9	0.0	0.7	3.8	4.7	1.7
Parent-Teacher Association	1.1	0.7	0.4	0.0	1.1	2.2	1.7	1.9	0.9	0.8
Business association	0.8	0.3	0.0	0.4	0.2	0.4	1.0	4.8	1.9	0.8
Youth group	0.7	0.3	1.6	0.0	0.4	0.4	1.4	0.5	2.8	0.8
Comm. child protection committee	0.5	0.5	0.0	0.4	0.2	0.4	1.4	1.0	1.9	0.0
Comm. Police/ watch dog	0.4	0.0	0.0	0.0	0.2	0.0	1.4	0.5	2.8	0.0
Victim support unit	0.4	0.2	0.0	0.0	0.4	0.7	0.7	0.0	2.8	0.0
Disabled assoc.	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.9	0.0
Other	2.0	0.5	0.8	0.4	1.9	1.9	7.3	3.8	0.9	1.7

Source: Survey (2017).

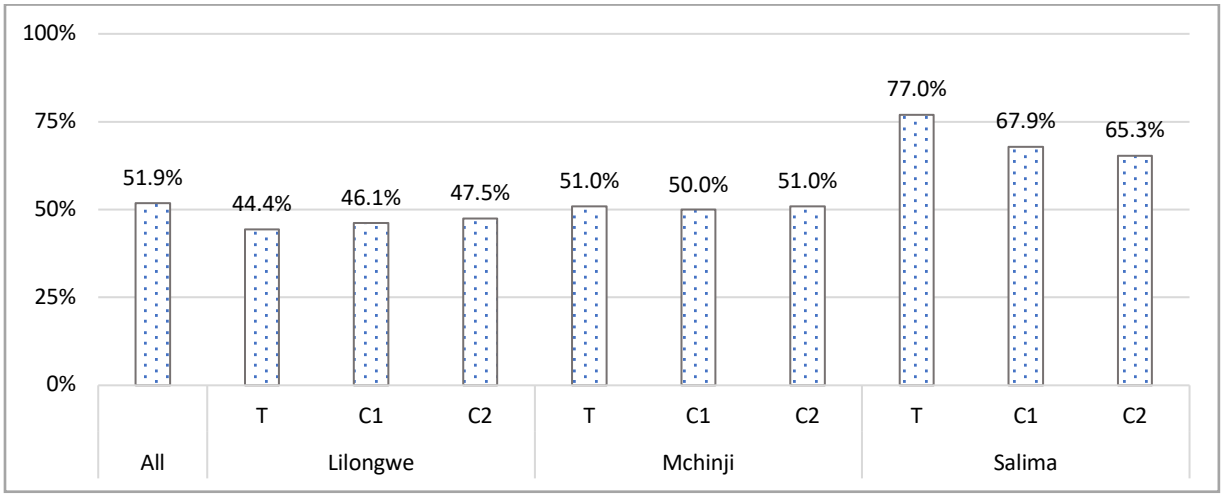


Figure 7: Percentage of farmers who kept livestock in the preceding 12 months

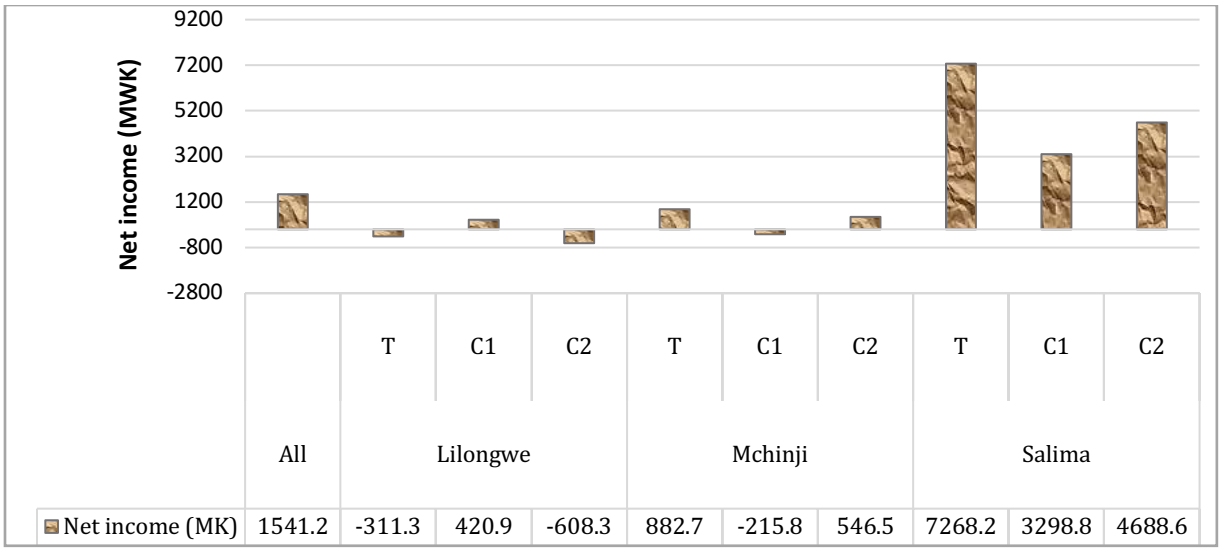


Figure 8: Annual gross margin (MWK) from livestock keeping
Note: Annual GM is the *total livestock income* less *cash costs*, and is summarized for cases with *modified* z-scores within ± 3.5

3.4 Housing, Well-being, Shocks and Coping Strategies: Farm Survey-Modules E & F

This subsection is composed of the following four parts: 3.4.1 Housing Characteristics; 3.4.2 Household Consumption, Expenditure and Savings; 3.4.3 Household Food Availability and Wealth, and 3.4.4 Shocks and Coping Strategies.

3.4.1 Housing Characteristics

Table 15 reports on data regarding the ownership of the household's dwelling. A total of 93.4% of the sample reports that the dwelling is *Owned* with a maximum value equal to 97.6% for the C2 group in Mchinji. The next category is *Free, authorized* at 3.6% for the overall sample with a low of 1.4% for C2 in Mchinji and a high of 6.6% for C2 in Salima. Three other categories are listed with *Rented* (1.5%), *Employer-provided* (1.4%) and *Being purchased* (0.1%).

The dwelling type is reported in Figure 9 and the most common is *Traditional* with an overall mean of 49.2% with a range going from 38.8% (T in Salima) to 54.7% (C1 in Salima and Lilongwe). *Semi-permanent* is in second place with 32.8% of the sample reporting this type of dwelling and then *Permanent* at 18.1%.

Table 16 displays the source of drinking water and the most common is *Borehole* with 65.8% reporting this source. The lowest rate for the latter is 48.8% (C2 Salima) and the highest is 82.9% (C1 Lilongwe). The next source in importance is *Well* at 32.2% for the entire sample and the range is 12.2% (C1 in Lilongwe) to 52.9% (C2 in Salima). In third place we see *Piped water* (2.6%) followed by five other categories each at 2% or lower.

The last variable examined regarding household characteristics is toilet facilities shown in Table 17. A total of 71.9% of the households sampled indicated having a *Traditional toilet (with roof)*. Overall, this latter category is more prevalent in Lilongwe compared to the other two districts. The next type of toilet in importance is *Traditional (no roof)* with an overall share equal to 24.1% and its prevalence is higher in Mchinji and Salima. A total of 4.0% of the farmers report having *No toilet*, followed by 0.1% having *Flush toilet* and the same share *VIP latrine*.

Table 15: Percentage of HH by ownership of dwelling

	All	Lilongwe			Mchinji			Salima		
		T	C1	C2	T	C1	C2	T	C1	C2
Owned	93.4	91.7	93.5	94.5	92.4	93.4	97.6	93.8	93.4	93.4
Free, authorized	3.6	5.3	5.3	3.8	1.7	3.3	1.4	3.8	5.7	5.0
Rented	1.5	1.4	1.2	1.7	2.4	1.1	0.7	1.9	0.9	0.8
Employer-provided	1.4	1.6	0.0	0.0	3.5	2.2	0.3	0.0	0.0	0.8
Being purchased	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0

Source: Survey (2017)

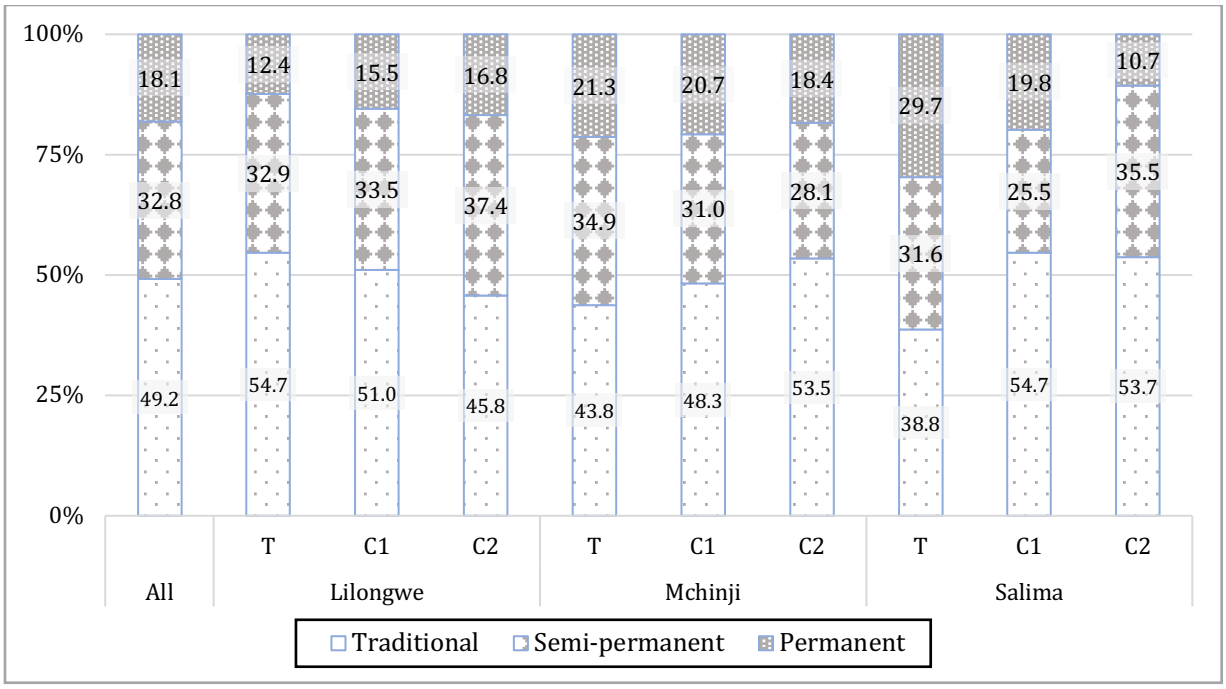


Figure 9: Percentage of farmers by dwelling type

Note: Traditional – dwelling made of mud and grass; Permanent – dwelling made of modern materials e.g. bricks, cement, iron sheet; Semi-permanent – dwelling is a mix of traditional and modern materials.

Table 16: Percentage of farmers by drinking water source

	All	Lilongwe			Mchinji			Salima		
		T	C1	C2	T	C1	C2	T	C1	C2
Borehole	65.8	78.7	82.9	64.7	57.7	53.1	52.4	75.6	68.9	48.8
Well	32.2	13.6	12.2	33.2	42.9	46.1	49.7	24.4	33.0	52.9
Piped water	2.6	5.7	1.2	2.1	1.9	1.9	0.4	4.3	1.9	0.0
Spring/River/Stream	2.0	5.0	4.5	3.4	0.2	0.7	0.0	0.0	1.9	0.0
Pond/Lake	0.2	0.0	0.4	0.0	0.2	0.7	0.0	0.0	0.0	0.0
Dam	0.1	0.0	0.0	0.4	0.2	0.0	0.0	0.0	0.0	0.0
Rainwater	0.1	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Other (Dambo)	0.1	0.0	0.0	0.0	0.0	0.0	0.7	0.0	0.0	0.0

Source: Survey (2017).

Table 17: Percentage of farmers by toilet facility

	All	Lilongwe			Mchinji			Salima		
		T	C1	C2	T	C1	C2	T	C1	C2
Traditional (with roof)	71.9	88.8	82.9	74.0	62.3	60.9	68.4	66.0	60.4	59.5
Traditional (no roof)	24.1	7.8	10.2	19.8	34.2	35.1	29.9	28.2	36.8	37.2
No toilet	4.0	3.4	6.9	6.3	3.1	4.1	2.1	5.3	2.8	3.3
Flush toilet	0.1	0.0	0.0	0.0	0.2	0.7	0.0	0.0	0.0	0.0
VIP latrine	0.1	0.0	0.0	0.0	0.4	0.0	0.0	0.5	0.0	0.0

Note: Numbers are percentages. (Source: Survey, 2017).

3.4.2 Household Consumption, Well-being, Expenditure and Savings

This subsection comprises descriptive statistics for data on household food consumption and associated expenditures, general well-being and savings.

The number of times various foods and food groups were consumed over the preceding 7-day period are summarized in Table 18. On average, *Maize* and *Condiments* are the most often consumed foods, 6.9 and 6.7 times, respectively, for the entire sample. While figures for *Maize* display little variation across districts, those for *Condiments* range from a low of 5.3 for C2 in Salima to 7.0 for C2 in Lilongwe and Mchinji and C1 in Salima. On average, *Vegetables* are consumed 5.3 times in a week for the entire sample, although, consumption frequency varies from 5.0 to 5.9 times in Lilongwe and Mchinji, and less than 4.5 times in Salima. *Sugar, honey or sweets* and *Oils & fats* are on average consumed 4.6 and 4.0 times per week, respectively. In both of these last two food groups, Salima is associated with higher frequencies, 5.0 to 5.3 and 4.8 to 5.8 times, respectively. *Groundnut* and *Soybean/soy product* have the same average consumption frequency for the entire sample (3.6), with minor variation across districts. *Fruits* and *Orange-fleshed sweet potato* are each consumed moderately at about 3.4 and 3.2 times a week on the basis of the entire sample. Average consumption frequencies of all other food types are less than thrice a week for the entire sample, with *Egg, milk & other animal products* and *Meat* being consumed least often (less than 2.2).

Table 19 presents information concerning the last time HH member(s) ate fewer meals than usual because there was no food. For the whole sample, a little under 3 out of 10 households (27.3%) have never had a HH member gone through this experience. The proportion ranges from 19.8% for C2 in Mchinji to 35.5% for C2 in Salima. Of the 72.7% of HH whose member(s) ever had this experience in the entire sample, 21.5% experienced it in the *Week* preceding the survey, 16.5% in the preceding *Year*, and 11.8% in the preceding *Month*. Fewer than 10% of HHs had the experience in the preceding *3-6 months* and *2-5 years*. No discernible pattern in the distribution of percentages is immediately obvious across districts.

The middle and bottom panels of Table 19 relate to the 21.5% and 11.8% of HHs that had at least one member eating less meals than usual in the *Past week* and *Past month*, respectively. In both periods, about 55% of HHs experienced this sort of shortage 2-3 times on the basis of the entire sample. Again, in both cases, almost all HHs (92.9% and 91.8%, respectively) experienced the kind of shortage 1-6 times.

Another issue relating to food availability is the last time there was an episode of food shortage due to constraints on household resources to acquire food, and this is summarized in Table 20. Here, a substantial majority of HH (63%) in the entire sample has experienced a situation in which there was no food to eat at home in the *5 years* preceding the survey, and this observed distribution is fairly consistent across districts. Among the HHs in the entire sample, 15.9% experienced it in the *Year* preceding the survey, 13% in the preceding *Week*, and 11.6% in the preceding *Month*.

In terms of the last time a HH member(s) went to sleep at night hungry, shown in Table 21, again a slight majority (55.6%) of HH in the main sample has had a member(s) gone through this experience in the *5 years* preceding the survey, and in the case of the T group in Salima lesser than 50% (100-56%) had the experience. Again, for the entire sample, 15.9% had this experience in the *Year* preceding the survey followed by the preceding *Week* in which 11% had the experience, and then the preceding *Month* (8.9%).

In the case of the last time a member(s) of the HH went whole day and night without eating, Table 22 suggests that slightly less than half (49.4%) of HHs in the entire sample experienced it in the half-decade preceding the survey, although for T, C1 and C2 in Salima, T and C1 in Mchinji, and C2 in Lilongwe, less than half of the relevant HHs had the experience. For HHs that experienced this sort of shortage, a similar pattern in the periods is also evident here. That is, 15.1% faced it in the preceding year, 9.1% in the preceding *Week*, and 7.9% in the preceding *Month*.

In Table 23, respondents were asked to compare the amount of money held by the HH at the time of the survey with the situation the past month, 6 months, 12 months and 1 year. The data shows that a majority of HH (69.8%, 77.2%, 77.9% and 76.3%, respectively) reported *Lower* amounts of money holdings/savings at the time of the survey compared to previous points in time. This observation is consistent across treatment subgroups and districts. However, it appears that as the number of periods of comparison increases from 1 month to 5 years, the number of HHs reporting *Higher* money holdings increases while the number with money holdings being *About same* decreases, although both still remain below 30%.

Table 24 displays information on the self-rating of the wealth status by farm managers, and rating of wealth status of their *Neighbors,* and that of *Most of their friends*. Note that the *First step* denotes the "poorest" and the *Sixth step,* the "richest". A little over a third of farm managers (34.8%) consider themselves being on the *First step* compared to 24.2% of *Neighbors* (middle panel of Table 25) and 19.4% of *Most of their friends* (bottom panel), with the same wealth standing. Just a handful of farmers (7% = 5.7+1.1+0.2) consider themselves as having an above average wealth status, although more farm managers tend to ascribe this level of wealth standing to their *Neighbors* (13.8%) and *Most of their friends* (19.5%). In

general, it is obvious that as wealth standing improves the number of farm managers considering either themselves, *Neighbors* or *Most of their friends* as non-poor tends to decrease.

Table 25 presents information on HH expenditures, savings and debt. The average *Food expenditure per week* for all the sample is MWK 2,525, and that for *Non-food expenditure per quarter* is MWK 34,967. Weekly food expenditures go from MWK 1,997 for C1 in Mchinji to MWK 4,014 for C1 in Salima. Quarterly non-food expenditures vary from MWK 13,774 for C1 in Lilongwe to MWK 55,183 for T in Salima. In general, average values of food and non-food expenditures in Salima are the highest among the districts, ranging from MWK 3,888 to MWK 4,014 and MWK 46,724 to MWK 55,183, respectively.

The middle panel of Table 25 shows information on savings and borrowing practices of the HH in the month preceding the survey. For the entire data, 24.5% of HHs *Saved*, 19.9% *Used savings to meet expenses*, 22.1% *Borrowed money or food*, and 23.4% *Skipped expenses on needed items*. The distribution of average values varies across districts, such that in Lilongwe less than 25% engaged in any of these practices as opposed to less than 33% in Mchinji and less than 50% in Salima.

Average *Total savings* and *Total debt* are presented at the bottom of Table 25. For the relevant sample of 627 HH, the average *Total savings* was MWK 15,897 versus an average *Debt* value of MWK 13,375 for a sample of 702 HH. The range of average savings goes from a low of MWK 9,727 for the T group in Lilongwe to a high of MWK 19,844 for the T group in Salima. Average HH *Debt* ranges from MWK 11,279 for C2 to MWK 15,505 for T, both in Salima. The data shows that Salima may be associated with the highest savings and debt figures.

Table 18: Number of times food was consumed in the preceding 7-day period

	All	Lilongwe			Mchinji			Salima		
		T	C1	C2	T	C1	C2	T	C1	C2
Maize	6.9 *0.7* [2575]	6.9 *0.5* [576]	6.8 *0.7* [244]	6.9 *0.5* [237]	6.9 *0.5* [540]	6.9 *0.5* [270]	6.8 *0.8* [283]	6.8 *0.7* [205]	6.6 *1.3* [101]	6.6 *1.2* [119]
Condiments	6.7 *1.2* [259]	6.6 *1.4* [65]	6.6 *1.5* [32]	7.0 *0.0* [27]	6.8 *1.0* [56]	6.8 *0.8* [23]	7.0 *0.0* [20]	6.6 *1.3* [23]	7.0 *0.0* [7]	5.3 *2.7* [6]
Vegetables	5.3 *1.8* [2504]	5.9 *1.5* [574]	5.8 *1.5* [239]	5.3 *1.6* [239]	5.3 *1.7* [517]	5.1 *1.7* [262]	5.0 *1.8* [271]	4.2 *2.1* [192]	4.4 *2.1* [101]	4.1 *2.1* [113]
Sugar, honey or sweets	4.6 *2.2* [802]	4.2 *2.2* [182]	4.9 *2.1* [80]	4.4 *2.0* [96]	4.6 *2.2* [128]	4.2 *2.1* [48]	3.9 *2.2* [64]	5.3 *2.1* [113]	5.3 *2.1* [39]	5.0 *2.3* [52]
Oils & fats	4.0 *2.1* [1451]	3.6 *1.9* [302]	3.5 *1.8* [125]	3.5 *1.8* [152]	4.1 *2.1* [305]	3.8 *1.9* [142]	4.0 *2.3* [158]	5.8 *2.0* [134]	4.8 *2.3* [53]	4.8 *2.2* [80]
Groundnut	3.6 *1.9* [1531]	3.1 *1.8* [249]	3.2 1.*7* [101]	3.5 *1.8* [169]	3.8 *1.9* [335]	3.6 *1.9* [168]	3.6 *1.8* [176]	4.3 *2.0* [165]	3.6 *2.1* [77]	3.7 *2.0* [91]
Soybean/ soy product	3.6 *2.1* [822]	3.4 *2.0* [196]	3.7 *2.1* [63]	3.7 *2.0* [96]	3.7 *2.0* [176]	3.1 *1.9* [64]	3.7 *2.2* [92]	3.7 *2.4* [73]	3.4 *2.5* [24]	3.2 *2.5* [38]

Notes: Numbers in italics are standard deviations, and those in square brackets are the relevant number of observations. (Source: Survey, 2017).

Table 18: Continued

	All	Lilongwe			Mchinji			Salima		
		T	C1	C2	T	C1	C2	T	C1	C2
Fruits	3.4 *2.1* [1113]	3.9 *2.2* [324]	3.9 *2.1* [117]	2.7 *1.6* [120]	2.7 *1.8* [172]	2.8 *1.9* [97]	3.0 *2.0* [107]	3.8 *2.4* [82]	4.4 *2.4* [41]	4.5 *2.5* [53]
Orange-fleshed sweet potato	3.2 *1.9* [846]	1.9 *1.0* [36]	2.6 *2.1* [15]	2.4 *1.4* [26]	3.2 *1.8* [266]	3.1 *1.8* [116]	4.0 *2.1* [175]	3.0 *2.0* [120]	2.8 *1.9* [44]	2.8 *2.0* [48]
Fish/ Seafood	2.5 *1.4* [1762]	2.0 *1.1* [314]	2.2 *1.2* [127]	2.1 *1.0* [152]	2.5 *1.3* [392]	2.3 *1.2* [209]	2.4 *1.5* [193]	3.2 *1.8* [182]	2.9 *1.6* [90]	3.3 *1.8* [103]
Other grains & cereals	2.4 *1.7* [325]	1.8 *0.9* [39]	2.2 *1.4* [19]	2.2 *0.8* [16]	2.0 *1.2* [64]	2.3 *1.3* [31]	2.3 *1.8* [39]	2.7 *1.9* [57]	3.6 *2.3* [30]	3.2 *2.5* [30]
Other roots & tubers	2.4 *1.5* [829]	2.4 *1.4* [248]	2.3 *1.3* [112]	2.3 *1.2* [122]	2.4 *1.7* [150]	2.3 *1.7* [65]	2.8 *1.9* [53]	2.3 *1.5* [35]	1.9 *1.2* [17]	2.2 *1.8* [27]
Other pulses, legumes & nuts	1.9 *1.1* [1008]	2.0 *1.3* [215]	1.9 *1.0* [99]	1.9 *1.0* [126]	1.8 *1.0* [184]	1.8 *1.0* [80]	1.6 *0.8* [104]	2.2 *1.3* [104]	2.2 *1.3* [45]	1.9 *1.0* [51]
Egg, milk & other animal products	1.8 *1.2* [609]	2.0 *1.2* [100]	2.1 *1.6* [44]	1.7 *1.0* [67]	1.8 *1.2* [134]	1.4 *0.5* [42]	1.6 *0.9* [58]	1.7 *1.4* [88]	1.9 *1.6* [34]	1.8 *1.5* [42]
Meat	1.7 *0.9* [918]	1.8 *1.1* [188]	1.9 *1.0* [73]	1.6 *0.8* [108]	1.6 *0.7* [189]	1.5 *0.7* [89]	1.6 *0.8* [86]	1.8 *0.9* [95]	2.2 *1.4* [45]	1.6 *0.8* [45]

Notes: Numbers in italics are standard deviations, and those in square brackets are the relevant number of observations. (Source: Survey, 2017)

Table 19: The last time HH member(s) ate fewer food

	All	Lilongwe			Mchinji			Salima		
		T	C1	C2	T	C1	C2	T	C1	C2
Never, always have enough	27.3	25.0	26.1	34.0	25.3	28.0	19.8	33.5	34.0	35.5
Past week	21.5	30.0	27.4	16.4	17.7	20.7	21.5	10.1	20.8	17.4
Past month	11.8	17.2	14.3	13.0	9.1	8.1	10.8	7.2	10.4	9.9
Past 3 months	5.4	5.7	7.8	5.0	5.4	4.4	2.4	4.3	4.7	11.6
Past 6 months	8.2	2.6	3.7	2.5	12.4	8.5	15.3	12.0	9.4	12.4
Past year	16.5	13.6	15.1	18.5	17.4	19.9	19.4	19.6	13.2	8.3
Past 2 years	6.0	3.3	5.3	7.1	8.9	6.6	5.2	7.7	5.7	4.1
Past 5 years	3.3	2.8	0.4	3.4	3.9	3.7	5.6	5.7	1.9	0.8
No. of times in past week										
Once	16.7	16.1	14.9	12.8	14.6	10.7	24.2	14.3	18.2	38.1
2-3 times	55.4	53.5	47.8	66.7	58.3	55.4	50.0	66.7	68.2	52.4
4-6 times	20.8	25.9	28.4	15.4	22.9	25.0	11.3	14.3	0.0	0.0
7-10 times	6.3	4.0	9.0	5.1	3.1	7.1	12.9	4.8	13.6	4.8
> 10 times	0.9	0.6	0.0	0.0	1.0	1.8	1.6	0.0	0.0	4.8
No. of times in past month										
Once	23.2	28.0	28.6	16.1	26.5	9.1	25.8	6.7	18.2	16.7
2-3 times	55.2	60.0	45.7	54.8	51.0	50.0	48.4	80.0	54.6	58.3
4-6 times	13.4	9.0	8.6	19.4	16.3	27.3	12.9	6.7	18.2	16.7
7-10 times	4.6	1.0	5.7	6.5	2.0	13.6	12.9	0.0	0.0	8.3
> 10 times	3.6	2.0	11.4	3.2	4.1	0.0	0.0	6.7	9.1	0.0

Note: Numbers are percentages, based on the entire sample for first panel entries. Percentages in the second and third panels are based on cases for which the "last time HH ate fewer meals" was *past week* and *past month*, respectively. (Source: Survey, 2017).

Table 20: The last time there was no food to eat in the HH due to lack of resources

	All	Lilongwe			Mchinji			Salima		
		T	C1	C2	T	C1	C2	T	C1	C2
Never, always have enough	37.0	30.3	30.2	39.9	39.0	37.6	37.9	47.4	46.2	39.7
Past week	13.0	16.4	15.9	12.2	9.8	11.1	13.9	8.6	20.8	9.1
Past month	11.6	17.9	16.7	11.8	8.3	9.2	8.0	5.3	10.4	10.7
Past 3 months	6.2	7.2	6.5	5.5	5.9	5.5	4.2	6.2	3.8	12.4
Past 6 months	7.2	2.2	3.3	3.4	10.7	6.3	12.2	12.4	5.7	14.1
Past year	15.9	17.2	19.6	16.4	15.9	21.4	16.3	9.6	8.5	5.0
Past 2 years	5.0	4.7	4.9	7.6	5.7	3.3	3.5	5.3	2.8	6.6
Past 5 years	4.1	4.1	2.9	3.4	4.6	5.5	4.2	5.3	1.9	2.5

Note: Numbers are percentages, based on the entire sample. (Source: Survey, 2017).

Table 21: The last time HH member(s) went to sleep at night hungry

	All	Lilongwe			Mchinji			Salima		
		T	C1	C2	T	C1	C2	T	C1	C2
Never, always have enough	44.4	38.6	35.7	47.9	48.4	45.0	46.7	55.0	48.1	45.5
Past week	11.0	14.1	16.3	9.2	7.8	7.0	13.5	5.7	20.8	6.6
Past month	8.9	14.3	13.9	10.9	6.1	7.8	2.1	3.8	7.6	9.1
Past 3 months	4.1	4.0	4.1	3.8	4.1	3.3	4.2	4.3	2.8	8.3
Past 6 months	7.4	2.4	3.7	2.9	10.9	8.1	11.5	12.0	6.6	12.4
Past year	15.9	19.1	18.4	14.7	12.9	20.3	19.8	10.1	10.4	6.6
Past 2 years	4.7	3.4	5.3	7.1	5.4	3.7	2.4	4.8	3.8	9.9
Past 5 years	3.8	4.1	1.6	3.4	4.4	4.8	4.9	4.3	0.0	1.6

Note: Numbers are percentages, based on the entire sample. (Source: Survey, 2017).

Table 22: The last time a HH member went whole day and night without eating anything

	All	Lilongwe			Mchinji			Salima		
		T	C1	C2	T	C1	C2	T	C1	C2
Never, always have enough	50.6	44.6	42.5	54.2	53.6	51.3	46.2	64.6	57.6	53.7
Past week	9.1	12.2	15.5	8.4	5.7	5.9	10.4	3.8	15.1	5.8
Past month	7.9	12.4	9.8	10.1	6.5	6.3	2.8	3.4	6.6	9.1
Past 3 months	2.7	2.8	3.7	2.9	3.0	1.9	1.4	2.4	1.9	4.1
Past 6 months	6.4	3.1	3.7	1.7	9.6	7.0	11.5	7.2	3.8	9.9
Past year	15.1	17.7	18.8	13.9	12.6	19.6	17.0	10.5	7.6	8.3
Past 2 years	4.6	3.3	4.5	5.9	5.0	3.3	4.9	5.3	6.6	5.8
Past 5 years	3.7	4.0	1.6	2.9	4.1	4.8	5.9	2.9	0.9	3.3

Note: Numbers are percentages, based on the entire sample. (Source: Survey, 2017).

Table 23: Percentage of HH rating changes in current monetary wealth compared to past month, past 6 months, past 12 months and past 5 years

	All	Lilongwe			Mchinji			Salima		
		T	C1	C2	T	C1	C2	T	C1	C2
1 month ago:										
Higher	8.6	6.7	8.6	7.6	7.8	8.1	9.4	12.9	9.4	14.9
Lower	69.8	70.7	71.4	62.6	70.8	67.2	76.1	63.6	76.4	67.8
About same	21.6	22.6	20.0	29.8	21.4	24.7	14.6	23.4	14.2	17.4
6 months ago:										
Higher	11.0	7.9	7.4	9.7	11.3	8.5	13.5	15.3	16.0	21.5
Lower	77.2	80.6	83.3	73.1	76.7	77.5	78.1	70.8	81.1	64.5
About same	11.8	11.5	9.4	17.2	12.0	14.0	8.3	13.9	2.8	14.1
12 months ago:										
Higher	12.9	10.0	9.0	9.7	14.1	10.0	14.6	17.7	29.3	16.5
Lower	77.9	79.7	81.6	80.7	76.7	79.0	79.5	70.8	68.9	75.2
About same	9.2	10.3	9.4	9.7	9.2	11.1	5.9	11.5	1.9	8.3
5 years ago:										
Higher	15.0	10.3	10.2	13.9	14.4	12.6	17.0	28.2	22.6	23.1
Lower	76.3	79.9	82.9	77.7	75.8	76.4	77.4	62.7	72.6	68.6
About same	8.7	9.8	6.9	8.4	9.8	11.1	5.6	9.1	4.7	8.3

Source: Survey (2017).

Table 24: Percentage of farm managers rating their own wealth status, that of their neighbors, and that of most of their friends

	All	Lilongwe			Mchinji			Salima		
		T	C1	C2	T	C1	C2	T	C1	C2
Self										
First step	34.8	41.7	43.7	31.5	33.1	36.9	32.3	19.1	31.1	28.9
Second step	38.5	38.2	35.5	45.4	38.8	42.4	37.2	32.1	35.9	38.0
Third step	19.7	15.7	14.3	19.3	20.5	15.5	23.6	29.2	26.4	24.8
Fourth step	5.7	3.6	6.1	2.5	6.3	4.4	5.2	13.9	5.7	7.4
Fifth step	1.1	0.3	0.4	1.3	0.9	0.7	1.7	4.8	0.9	0.0
Sixth step	0.2	0.5	0.0	0.0	0.4	0.0	0.0	1.0	0.0	0.8
Neighbors										
First step	24.2	25.8	27.4	21.9	25.9	24.4	26.7	18.2	17.9	17.4
Second step	39.1	46.3	46.1	42.9	35.9	35.1	31.6	36.4	30.2	36.4
Third step	23.0	20.0	19.6	23.1	20.3	24.7	25.4	26.8	33.0	32.2
Fourth step	7.4	5.3	5.3	5.9	9.8	7.8	8.3	7.2	10.4	7.4
Fifth step	4.0	1.2	1.2	2.5	5.0	6.3	5.6	6.2	5.7	6.6
Sixth step	2.4	1.4	0.4	3.8	3.1	1.9	2.4	5.3	2.8	0.0
Most of their friends										
First step	19.4	23.8	23.3	16.8	19.6	17.7	17.7	12.9	17.0	15.7
Second step	37.1	42.0	43.3	42.0	34.2	40.2	32.6	27.3	34.0	27.3
Third step	24.1	22.7	23.3	24.8	24.0	24.0	24.3	26.3	25.5	26.5
Fourth step	11.9	7.1	6.5	10.5	12.8	10.3	14.9	23.0	17.9	16.5
Fifth step	4.8	2.8	3.7	3.4	5.4	3.3	7.3	7.7	1.9	11.6
Sixth step	2.8	1.7	0.0	2.5	4.1	4.4	3.1	2.9	3.8	2.5

Note: Numbers are percentages, based on the entire sample; "First step" = "poorest" and "Sixth step" = "richest" (Source: Survey, 2017).

Table 25: Expenditure on food and non-food items, and the preceding month's savings practices

	All	Lilongwe			Mchinji			Salima		
		T	C1	C2	T	C1	C2	T	C1	C2
Food expenditure/ week (MWK)	2,525 *2,079* [2500]	2,327 *1,680* [557]	2,258 *1,674* [235]	2,588 *1,618* [230]	2,223 *1,723* [519]	1,997 *1,541* [268]	2,038 *1,585* [272]	3,888 *3,024* [198]	4,014 *3,396* [102]	3,924 *3,059* [119]
Non-food expenditure/ 3months (MWK)	34,967 *37,287* [2325]	16,307 *17,141* [510]	13,774 *15,647* [206]	19,373 *17,832* [202]	46,832 *42,086* [488]	38,354 *36,198* [254]	47,299 *39,688* [261]	55,183 *46,300* [192]	54,948 *46,228* [96]	46,724 *40,427* [116]
% of HH that…										
Saved	24.5	14.3	15.1	11.3	29.9	24.0	26.4	45.9	39.6	41.3
Used savings to meet expenses	19.9	19.6	15.1	8.8	19.0	22.9	21.9	27.8	23.6	28.1
Borrowed money or food	22.1	18.4	16.7	16.8	26.1	23.3	24.0	25.4	34.0	19.8
Skipped expenses on needed items	23.4	21.3	19.6	12.6	22.0	26.2	29.5	26.8	30.2	34.7
Total savings (MWK)	15,897 *13,900* [627]	9,727 *8,277* [100]	12,436 *10,892* [36]	16,483 *13,231* [35]	17,288 *14,113* [150]	15,413 *13,298* [53]	15,752 *14,701* [77]	19,844 *15,548* [88]	19,138 *16,794* [47]	17,107 *14,384* [41]
Total debt (MWK)	13,375 *10,579* [702]	11,922 *9,163* [111]	12,779 *9,966* [51]	14,626 *11,785* [66]	14,224 *10,642* [169]	12,521 *10,438* [82]	13,305 *10,088* [76]	15,505 *12,105* [73]	12,300 *10,261* [40]	11,279 *11,029* [34]

Notes: Numbers in italics are standard deviations, and those in square brackets are the relevant number of observations. Expenditures, savings and debt are computed for cases with respective modified z-scores within ± 3.5. (Source: Survey, 2017).

3.4.3 Shocks and Coping Strategies

Table 26 presents data on whether the HH was affected negatively in the past 12 months (prior to the survey) by a number of different events. The category with the highest response rate is *Crop diseases* with 33.6% for the overall sample, ranging from 18.0% (C1 Lilongwe) to 51.2% (C2 Salima). The next item is *Crop pest* at 28.7% for the overall sample and here we see similar responses for Lilongwe and Mchinji but much higher rates in Salima. The third item in importance is *Heavy rains* at (18.7% overall) and the rates for Lilongwe are considerably lower than those for Mchinji and Salima. For the sample as a whole*, Livestock diseases* is in fourth place (11.2%), followed by *Floods* (5.5%), *Dry spells < 1 month* (5.0%) and a few other categories all below 5%. The data show considerable variability of the relative importance of different categories across the three regions.

The data in Table 27 focuses on whether the HH received early warning regarding various environmental or weather-related shocks. This Table has a number of instances in which no early warning was received (zero entries). On the basis of the entire sample, the most commonly cited category is *Heavy rains* (18.7%), and all the responses are from Mchinji and Salima. The next category in relative importance is *Livestock diseases* (8.9%) with data from only Mchinji and Salima, followed by *Crop pest* (8.2%), then *Crop diseases* (7.2%), *Floods* (6.3%), *Dry spells* (4.7%), *Soil erosion/ gully formation* (4.5%) and *Drought* (3.3%). Not a single HH in Lilongwe received warning on *Heavy rains*, *Livestock diseases*, *Floods*, *Soil erosion or gully formation*, *and Drought*. Similarly, no HH in Mchinji was pre-warned about imminent *Drought*.

Table 28 displays data on whether the HH was affected negatively in the past 12 months by various non-environmental/non-weather-related sources. Here we will only provide the rates for the whole sample and the most important categories. The top category is *High cost of farm inputs* (60.6%), followed by *Low prices for crops* (56.0%), *Serious illness or accident of a HH member* (36.7%), *High food prices* (22.4%), Reduction in earnings in HH (13.6%), *Theft of money/valuables/assets/farm output* (7.1%), and *Death of HH member* (7.0). The Table shows several other categories with rates below 7%. Overall, the reported ratings are quite consistent across the various farm groups and regions.

Table 29 reports data on coping strategies used by HH in the preceding 12 months. The Table contains many categories so again we will highlight the rates for the whole sample and the most important categories. The most frequently cited coping strategy is *Sold crop stock* (53.7%), followed by *Obtained credit* (29.3%), *Relied on own-savings* (24.0%), *Received unconditional help from relatives and friends* (20.1%), *Sold livestock* (19.3%), *Change in crop variety* (17.3%), *Increased use of irrigation* (16.3%), *Changed eating patterns* (14.0%), *Change in crop types* (12.3%), *Received unconditional help from NGO/religious institution* (11.9%), and *Change in the timing of seeding/planting* (10.2%). Several other categories below 10% are listed in the Table.

Table 30 shows the perception that the farmers interviewed reported pertaining to various climatic effects. We will only summarize here the dominant answer (*Higher, Lower* or *Same*) for each question for the overall sample. The first such variable in Table 30 is a rating of current *Temperature* compared to the past 10 years and 70.6% answered *Higher*. A total of

51.4% responded *Higher* current *Rainfall* compared to past 10 years. When asked about current *Floods* compared to past 10 years 39.2% responded *Lower*. A total of 39.6% of the sample indicated *Lower* current drought compared to past 10 years. Finally, 55.9% replied that current *Landslides* compared to past 10 years were the *Same*.

Table 26: Percentage of households affected negatively by environmental and other shocks in the preceding 12 months

	All	Lilongwe			Mchinji			Salima		
		T	C1	C2	T	C1	C2	T	C1	C2
Crop diseases	33.6	25.7	18.0	36.6	36.2	33.2	31.3	49.3	50.0	51.2
Crop pest	28.7	25.3	19.6	23.5	19.8	19.6	25.0	61.2	58.5	60.3
Heavy rains	18.7	3.1	4.9	10.1	28.1	28.8	31.9	28.7	26.4	19.0
Livestock diseases	11.2	7.2	7.8	5.5	7.4	10.0	19.1	24.9	25.5	13.2
Floods	5.5	2.1	1.6	2.1	6.5	4.4	7.6	12.4	8.5	14.9
Dry spells < 1 month	5.0	6.7	3.3	1.3	3.1	1.1	5.9	8.6	10.4	10.7
Soil erosion/ gully formation	4.3	6.2	4.1	0.4	1.9	2.6	7.3	8.1	3.8	4.1
Drought >= 1 month	3.5	4.3	2.9	0.0	2.2	4.1	3.5	5.7	8.5	5.0
Landslides	0.1	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8

Note: Numbers are percentages, based on the entire sample. (Source: Survey, 2017).

Table 27: Percentage of HH receiving early warning on environmental or weather-related shocks

	All	Lilongwe			Mchinji			Salima		
		T	C1	C2	T	C1	C2	T	C1	C2
Heavy rains	18.7	0.0	0.0	0.0	15.1	12.8	12.0	40.0	42.9	47.8
Livestock diseases	8.9	0.0	0.0	0.0	10.0	0.0	9.1	26.9	3.7	12.5
Crop pest	8.2	1.4	0.0	10.7	2.8	1.9	6.9	14.8	17.7	19.2
Crop diseases	7.2	3.7	0.0	5.8	5.6	4.4	10.0	14.6	17.0	8.1
Floods	6.3	0.0	0.0	0.0	0.0	0.0	4.6	7.7	22.2	22.2
Dry spells	4.7	2.6	0.0	0.0	5.9	0.0	0.0	5.6	18.2	7.7
Soil erosion/ gully formation	4.5	0.0	0.0	0.0	0.0	0.0	9.5	5.9	25.0	20.0
Drought	3.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	11.1	33.3

Note: Numbers are percentages, based on cases experiencing environment/weather-related shocks. (Source: Survey, 2017).

Table 28: Percentage of households affected negatively by non-environmental/non-weather-related sources in the preceding 12 months

	All	Lilongwe			Mchinji			Salima		
		T	C1	C2	T	C1	C2	T	C1	C2
High cost of farm inputs	60.6	75.4	71.0	63.5	56.8	56.8	55.2	51.7	45.3	30.6
Low prices for crops	56.0	49.2	46.1	50.8	66.4	65.7	68.8	51.7	44.3	38.0
Serious illness or accident of a HH member	36.7	42.2	37.6	29.4	36.8	38.4	42.7	28.7	26.4	27.7
High food prices	22.4	16.5	21.6	16.0	18.5	26.6	31.3	26.3	44.3	25.6
Reduction in earnings in HH	13.6	18.9	17.6	2.5	12.0	12.9	14.2	10.5	15.1	13.2
Theft of money/ valuables/ assets/ farm output	7.1	4.5	6.9	5.0	5.7	7.8	10.1	13.4	11.3	7.4
Conflict/ violence	3.5	4.1	2.9	2.1	2.4	3.7	3.5	5.3	7.6	3.3
Death of a HH member	7.0	5.9	9.0	6.3	5.9	4.1	9.0	9.1	9.4	11.6
Break up of HH	2.4	3.8	3.3	0.8	2.0	1.1	2.8	1.4	0.9	2.5
Birth in the HH	3.7	1.9	2.5	4.6	3.7	3.0	4.9	4.3	6.6	7.4
End of assistance/aid/ remittance	1.0	0.3	1.2	0.4	0.9	0.7	0.4	2.4	3.8	3.3
Failure of HH's non-agric. business	1.0	1.4	1.6	0.4	0.4	0.0	1.4	1.4	1.9	0.8
Death of income earner(s)	1.0	0.9	1.2	1.3	0.9	0.7	0.4	1.4	0.9	2.5
Reduction in earnings of salaried HH member	0.3	0.5	0.4	0.0	0.0	0.7	0.0	0.5	0.0	0.0
Loss of employment of previously salaried member(s)	0.4	0.3	0.0	0.4	0.6	0.7	0.0	0.0	0.0	0.8
Other	7.0	5.5	6.5	7.6	10.0	5.9	10.4	1.4	3.8	6.6

Note: Numbers are percentages, based on the entire sample. (Source: Survey, 2017).

Table 29: Percentage of HH by coping strategy used in the preceding 12 months

	All	Lilongwe			Mchinji			Salima		
		T	C1	C2	T	C1	C2	T	C1	C2
Sold crop stock	53.7	51.0	46.9	51.3	65.6	61.6	62.9	37.8	31.1	39.8
Obtained credit	29.3	23.8	22.5	22.7	35.3	31.7	36.5	34.5	24.5	28.9
Relied on own-savings	24.0	22.0	18.4	13.9	25.7	26.9	25.0	34.0	29.3	27.3
Received unconditional help from relatives/friends	20.1	20.8	22.5	18.1	19.2	24.4	17.7	20.6	17.0	18.2
Sold livestock	19.3	13.3	12.7	14.7	20.5	16.2	21.9	39.2	25.5	26.5
Change in crop variety	17.3	16.7	13.1	5.9	23.1	23.3	20.1	13.9	12.3	14.9
Increased use of irrigation	16.2	22.0	20.4	13.5	19.0	18.5	19.4	1.0	0.0	0.8
Changed eating patterns (relied on less preferred food options, reduced the proportion or number of meals per day, or household members skipped days of eating, etc.)	14.0	13.6	8.6	4.6	14.6	13.7	23.3	10.1	21.7	20.7
Change of crop types	12.3	6.9	7.4	5.9	17.2	15.9	20.5	12.0	14.2	10.7
Received unconditional help from NGO/religious institution	11.9	15.0	4.5	4.6	19.6	16.2	10.8	3.8	5.7	3.3
Change in the timing of seeding/planting	10.2	10.5	6.5	0.8	9.6	13.3	13.9	12.9	14.2	12.4
Engaged in spiritual efforts e.g. prayer, sacrifices, diviner consultations	7.8	6.4	9.8	5.0	7.6	11.8	8.3	9.6	4.7	5.8

Note: Numbers are percentages, based on the entire sample. (Source: Survey, 2017).

Table 29: Continued

	All	Lilongwe			Mchinji			Salima		
		T	C1	C2	T	C1	C2	T	C1	C2
Change in crop storage methods	6.7	8.4	4.9	1.7	8.7	9.6	5.2	4.3	5.7	5.0
Received unconditional help from government	5.4	7.2	5.7	5.5	6.7	6.6	1.7	1.9	3.8	2.5
Change in method of tillage or field preparation	2.6	0.9	0.0	0.4	2.6	3.7	3.8	7.7	5.7	4.1
Change in the timing of tillage or field preparation	3.7	0.9	1.2	0.4	4.1	6.3	4.9	9.6	6.6	6.6
Employed household members took on more employment	3.3	7.2	4.5	2.1	1.9	1.1	2.1	1.4	0.9	3.3
Adult household members who were previously not working had to find work	3.1	6.7	6.1	4.6	0.7	0.7	1.4	0.5	2.8	1.7
Sold agricultural assets	1.9	0.7	0.4	1.7	2.2	1.1	1.0	5.7	4.7	4.1
Household members migrated	1.7	3.1	1.2	0.4	0.7	1.5	1.0	1.4	0.9	5.8
Reduced expenditures on health and/or education	1.4	1.7	0.8	0.4	0.9	2.2	0.7	1.0	3.8	3.3
Sent children to live elsewhere	0.9	0.7	0.8	1.7	0.4	0.4	0.4	1.9	0.9	4.1
Sold household assets	0.7	0.3	0.0	0.0	0.7	0.4	1.0	2.4	0.0	2.5
Sold land/building	0.5	0.2	0.0	0.4	0.9	0.4	1.0	0.5	0.9	0.0
Intensified fishing	0.3	0.2	0.0	0.0	0.6	0.0	0.0	1.0	0.9	0.0
Other coping/ adaptation strategy	12.9	16.0	14.7	14.7	16.1	13.7	10.1	4.3	2.8	5.8

Note: Numbers are percentages, based on the entire sample. (Source: Survey, 2017).

Table 30: Percentage of farmers rating current perceptions of climatic variables compared to 10 years ago

	All	Lilongwe			Mchinji			Salima		
		T	C1	C2	T	C1	C2	T	C1	C2
Temperature										
Higher	70.6	60.2	63.3	75.6	89.1	86.4	64.6	53.6	57.6	62.8
Lower	22.0	32.2	31.0	18.9	7.8	8.5	24.0	32.5	29.3	26.5
Same	7.4	7.6	5.7	5.5	3.1	5.2	11.5	13.9	13.2	10.7
Rainfall										
Higher	51.4	31.7	44.1	65.6	64.5	62.7	63.2	38.3	52.8	42.2
Lower	44.9	64.9	54.3	28.2	33.3	35.1	33.0	54.6	40.6	52.9
Same	3.7	3.4	1.6	6.3	2.2	2.2	3.8	7.2	6.6	5.0
Floods										
Higher	36.5	29.4	28.6	27.7	48.2	48.3	35.4	34.0	38.7	30.6
Lower	39.2	50.4	45.3	56.3	28.7	29.9	33.7	38.3	33.0	27.3
Same	24.3	20.1	26.1	16.0	23.1	21.8	30.9	27.8	28.3	42.2
Drought										
Higher	33.0	33.1	29.0	19.3	31.2	33.2	34.7	45.5	47.2	36.4
Lower	39.6	43.9	46.9	48.7	40.1	36.9	29.5	31.6	38.7	28.1
Same	27.5	23.1	24.1	31.9	28.7	29.9	35.8	23.0	14.2	35.5
Landslide										
Higher	2.8	5.9	2.5	6.7	1.1	0.4	0.0	2.4	2.8	0.8
Lower	41.3	37.5	43.7	46.2	38.3	40.2	42.0	46.4	51.9	41.3
Same	55.9	56.6	53.9	47.1	60.6	59.4	58.0	51.2	45.3	57.9

Source: Survey (2017)

4. DESCRIPTIVE ANALYSIS: VILLAGE-LEVEL DATA

The village-level data is composed of four modules: General Information – Module A; Socio-Demographics – Module B; Basic Infrastructure and Services – Module C; and Agricultural and Economic Activities – Module D. In addition, common support between Treated and Control Villages are examined through propensity score matching. Appendix B presents the complete Village-Level questionnaire.

The general information (Module A) comprises the distribution of villages by district and treatment status, and this information has been summarized already in Figure 2, Subsection 3.1. Therefore, this section is composed of three subsections: subsection 4.1, Socio-Demographics, Basic Infrastructure and Services (Modules B & C); subsection 4.2, Agricultural and Economic Activities (Module D); and subsection 4.3, Village-Level Matching.

Although farmer-level interviews were conducted in 179 villages, village-level interviews were carried out in 178 villages. No information was collected for the Mchaisi farms/Taulo, which is an anchor farm settlement without established village headship. Accordingly, the analysis is based on 178 villages distributed as follows: 61 Treated Villages (TVs) and 24 Control Villages (CVs) in Lilongwe; 41 TVs and 22 CVs in Mchinji; and 20 TVs and 10 CVs in Salima.

We again note that for categorical multi-select variables with binary (yes/no) responses, indicated percentages are for "yes" responses; hence, the sum of percentages over the categories is *not* necessarily 100%.

4.1 Socio-Demographics, Basic Infrastructure and Services - Modules B & C

This subsection is further organized into two parts: 4.1.1: Socio-Demographics of Surveyed Village (Module B), and 4.1.2: Access to Basic Infrastructure and Services (Module C).

4.1.1 Socio-Demographics of Surveyed Villages

Village-level socio-demographic attributes such as total population, total land area of village in hectares, distance from village to the District Capital, to the Regional Capital, and to the closest town, all in kilometers, and religions practiced, as reported by village heads or chiefs are presented here.

Table 31 and Figure 10 provide summaries of these attributes. For the entire village sample, the average number of residents per village is 401 with a widely dispersed distribution. Average population values range from 115 for CVs in Lilongwe to 907 for TVs in Salima.

The overall land area on average is about 92 ha, and goes from a low of 23.6 ha in Lilongwe for CVs to a high of 172.9 ha in Salima for TVs.

In terms of proximity to the relevant District and Regional capitals, the average distance is 44.9 km and 92.7 km, respectively. In Lilongwe, as expected, the distances to both District and Regional capitals are about the same: 46.6 km and 46.3 km for TVs, and 39.5 for CVs, as the Regional capital (Lilongwe city) also doubles as the District capital. Thus, in this district, on average, CVs appear to be 7km closer (46.5 minus 39.5) to the city of Lilongwe than are TVs. Mchinji and Salima, however, have different capitals for the District and Region. Treated Villages in Mchinji appear closer to the District and Regional capitals (59.2 and 142.7 km, respectively) than are CVs (65.7 and 151.9 km, respectively). For Salima, while TVs are on average 9.7 km and 118 km away from the District and Regional capitals, respectively, CVs seem further away, 12.5 km, from the District capital but 117.5 km from the Regional capital.

On average, a sampled village is 10.8 km away from the *Closest town* and proximity ranges from a low of 7.5 km for TVs in Salima to a high of 12.5 km for CVs in Mchinji.

As evidenced in Figure 10, all three major religions in Africa are practiced in the sampled villages, with *Christianity* being practiced in 99% of villages, followed by *African traditional religion* (62.4%), and then *Islam* (27.5%). In 1.1% of villages, *Unbelief/atheism* is also reported. A similar distribution is observed in all districts except that in Salima there is a slightly higher proportion (80%) of TVs and CVs (60%) with *Islam* relative to *African traditional religion*.

Table 31: Average socio-demographics of surveyed villages

	All	Lilongwe		Mchinji		Salima	
		TV	CV	TV	CV	TV	CV
Total population	401 *768* [178]	275 *603* [61]	115 *70* [24]	581 *707* [41]	384 *359* [22]	907 *1614* [20]	140 *118* [10]
Total land (ha)	92.0 *195.8*	47.7 *87.6*	23.6 *19.2*	160.8 *275.8*	114.9 *133.3*	172.9 *352.5*	31.4 *14.5*
Distance to District capital (km)	44.9 *20.9*	46.6 *15.3*	39.5 *4.1*	59.2 *11.5*	65.7 *10.7*	9.7 *3.6*	12.5 *6.6*
Distance to Regional capital (km)	92.7 *49.7*	46.3 *14.2*	39.5 *4.1*	142.7 *19.6*	151.9 *16.6*	118.0 *16.8*	117.5 *9.7*
Distance to closest town (km)	10.8 *9.0*	12.1 *7.5*	9.1 *3.7*	10.4 *8.7*	12.5 *16.9*	7.5 *4.1*	11.0 *10.0*

Note: Numbers in italics are standard deviations, and those in square brackets are the relevant number of observations. (Source: Survey, 2017).

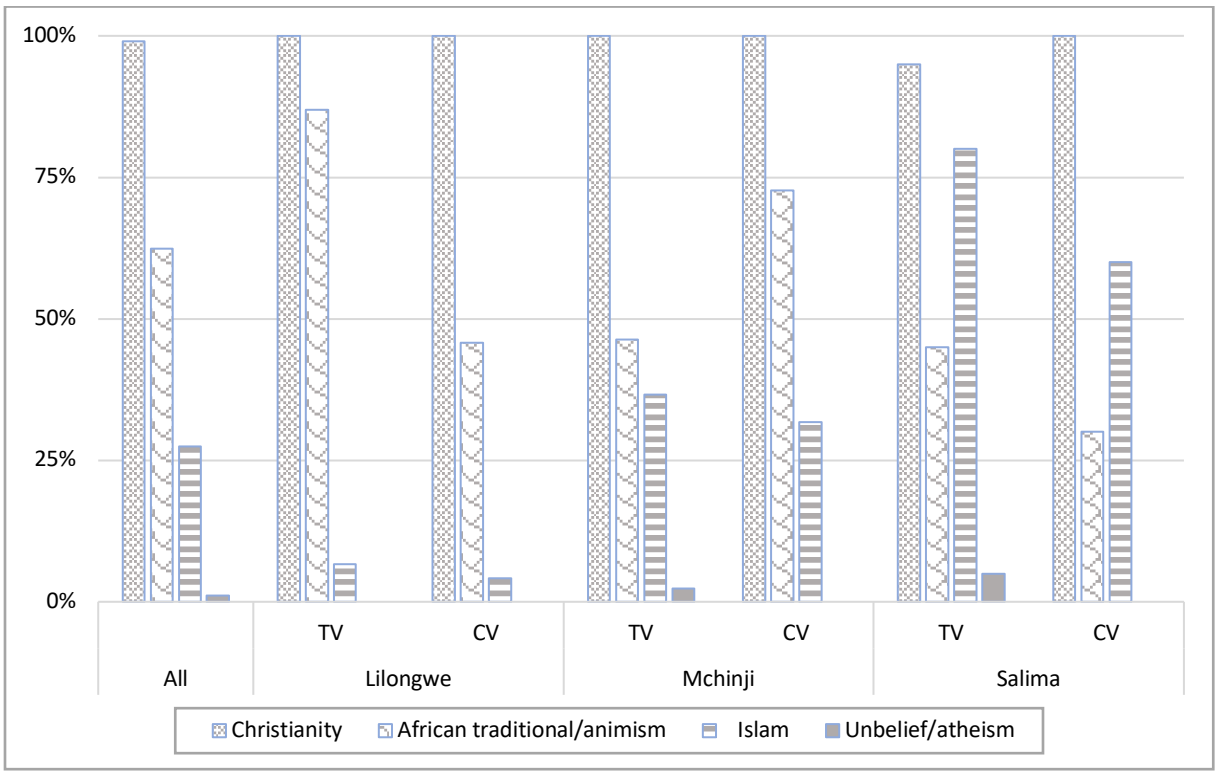


Figure 10: Percentage of villages by religion

4.1.2 Access to Basic Infrastructure and Services

Table 32 presents information on the provision of basic services. For the entire sample, only 15.2% of villages have *Potable water* (viz. treated piped source), typical of rural areas in developing areas. In Lilongwe, no CV has *Potable water* as opposed to 6.6% of TVs. In Mchinji, just about 2.4% of TV have access as opposed to 22.7% of CVs. In Salima, 65% and 40% of sampled TVs and CVs, respectively, have access to *Potable water*.

The various energy sources relied on for lighting, cooking, processing and other uses include *Firewood* (97%), *Battery/torch* (90.5%), *Candle* (26.4%), *Grass* (11.8%), *Electricity* (8.4%) and *Paraffin/kerosene* (1.1%). *Firewood* and *Battery/torch* are overwhelmingly popular in all districts. There is limited access to *Electricity* in general with no access at all in CVs in Mchinji and Salima.

In the middle of Table 32, information on the presence of health facilities and the kind available in sampled villages are presented. In the entire sample 87.6% of villages has no health facility, and the situation is even grimmer in Salima where no health facility was reported for any village. Among villages with some facilities (12.4%), 5.1% reported having *Traditional healing* centers, 4.5% a *Hospital* and 3.9% a *Clinic*.

In relation to the presence of educational facilities in sampled villages, 39.9% has *Primary school* while just about 5.6% has a *Secondary school* facility. The percentage of villages with a *Primary school* ranges from 31.2% for TVs in Lilongwe to 65% for TVs in Salima. There are no *Secondary school* facilities reported for CVs in Lilongwe and Salima.

The bottom of Table 32 presents data on the availability of *Telephone/landline* and *Television/cable* services. In both cases very few villages (0.6% and 11.8%, respectively) has any of these facilities. *Telephone (landline)* services are only present in 2.4% of TVs in Mchinji, while *Television/cable* services are present in all but CVs in Lilongwe and Salima.

The nature of access routes to villages and the level of accessibility are presented in Table 33, Figures 11, 12 and 13. Overall, 68.5% of villages have *Dirt road with maintenance* as the main access route followed by *Dirt road with no maintenance* (23.6%) and then *Paved/black top road* (7.9%). This pattern is generally reflected in all three districts except in Mchinji where more TVs (22%) have better access roads (*Paved/black top road)* than *Dirt road with no maintenance* (19.5%).

In Figure 11, accessibility of *Dirt road with maintenance* are examined. For the entire data, 56% of villages find such routes accessible with only *Occasional interruption in rainy season*, while 32% has *Year-round accessibility with no interruption* at all. Only 12% experience *Frequent interruption in the rainy season*. In all three districts, there is better accessibility (*Year-round* + *Occasional interruption*) for *Dirt road with maintenance*, ranging from 63% for CVs in Lilongwe to 100% for TVs in Mchinji and CVs in Salima.

In Figure 12**,** 81% of villages that has *Dirt road with no maintenance* experiences *Frequent interruption in rainy season* as opposed to 14% with *Occasional interruption in rainy season* and only 5% with *Year-round* access and no interruption. For at least 50% of all village categories, except TVs in Salima, access to *Dirt road with no maintenance* is frequently interrupted in the rainy season.

In the case of *Paved/black top road*, Figure 13 shows that 91% of villages in the entire sample have *Year-round* usage of the road with no interruption, and 7% experience *Occasional interruption* in the rainy season. For this type of access route, no village has ever had *Frequent interruption* in the rainy season. There are, however, no CVs with *Paved/black top route* in Lilongwe. The same is true for any sampled village in Salima.

The types of transportation available in sampled villages are summarized in Table 34. The predominant mode of transportation in the entire sample is *Bicycle* (98.3%), and this is the case in all village categories across the three districts. There is also reliance on *Motor cycle/scooter* (30.9%), *Ox-cart* (30.3%), *Truck/bus* (20.8%), and *Other* means (3.9%) e.g. on foot.

Table 32: Percentage of villages by basic amenities and services

	All	Lilongwe		Mchinji		Salima	
		TV	CV	TV	CV	TV	CV
Potable/ safe water	15.2	6.6	0.0	2.4	22.7	65.0	40.0
Energy sources:							
Firewood	97.2	98.4	100.0	97.6	86.4	100.0	100.0
Battery/torch	90.5	91.8	95.8	92.7	100.0	60.0	100.0
Candle	26.4	37.7	45.8	19.5	18.2	5.0	0.0
Grass	11.8	24.6	8.3	7.3	4.6	0.0	0.0
Electricity	8.4	6.6	4.2	7.3	0.0	35.0	0.0
Paraffin/ kerosene	1.1	0.0	0.0	0.0	4.6	5.0	0.0
Health facilities:							
None	87.6	95.1	70.8	85.4	86.4	85.0	100.0
Traditional healing	5.1	3.3	0.0	9.8	9.1	5.0	0.0
Hospital	4.5	1.6	25.0	0.0	0.0	5.0	0.0
Clinic	3.9	0.0	4.2	4.9	9.1	10.0	0.0
Educational facilities:							
Primary school	39.9	31.2	37.5	43.9	31.8	65.0	50.0
Secondary school	5.6	4.9	0.0	7.3	9.1	10.0	0.0
Info. & Communication facilities:							
Telephone/ land line	0.6	0.0	0.0	2.4	0.0	0.0	0.0
Television/ cable	11.8	6.6	0.0	24.4	4.6	30.0	0.0

Source: Survey (2017)

Table 33: Percentage of villages by nature of access routes

	All	Lilongwe		Mchinji		Salima	
		TV	CV	TV	CV	TV	CV
Dirt road with maintenance	68.5	73.8	79.2	58.5	54.6	85.0	70.0
Dirt road with no maintenance	23.6	24.6	20.8	19.5	36.4	15.0	30.0
Paved/black top road	7.9	1.6	0.0	22.0	18.2	0.0	0.0

Source: Survey (2017)

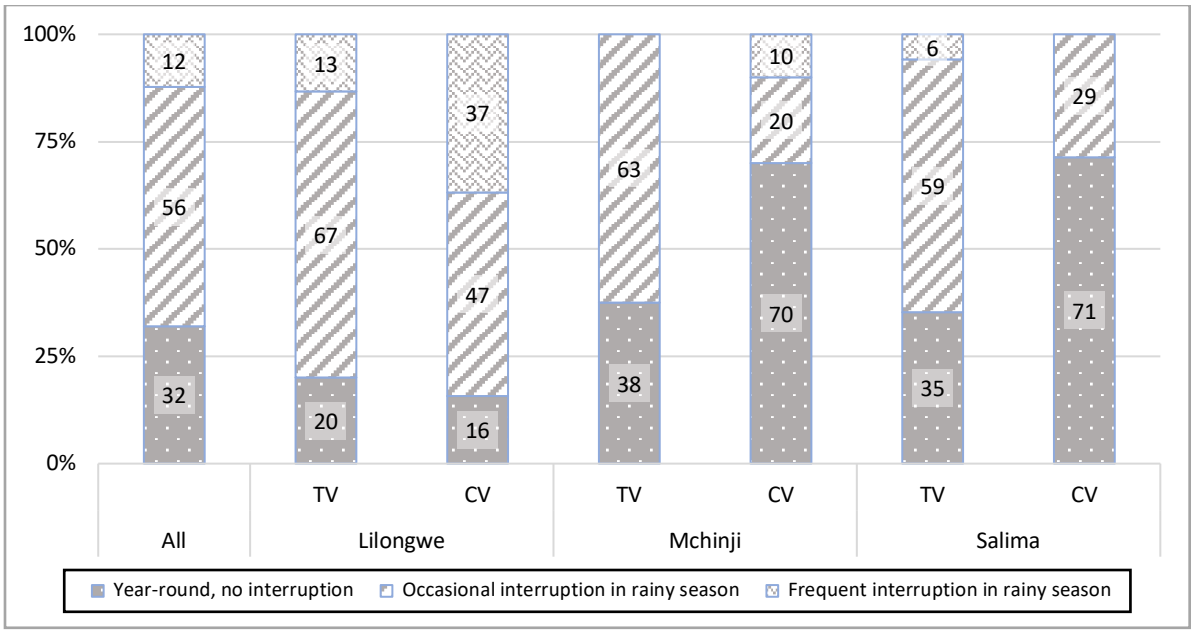


Figure 11: Percentage of villages rating accessibility of dirt road (with maintenance)

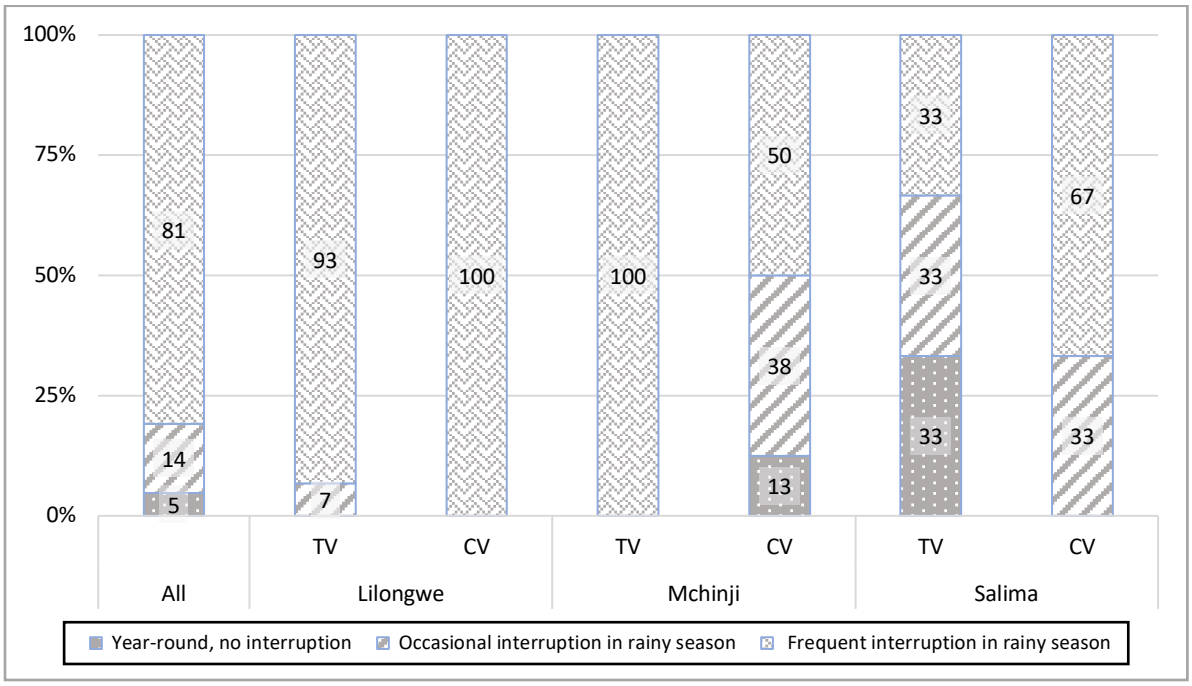


Figure 12: Percentage of villages rating accessibility of dirt road (No maintenance)

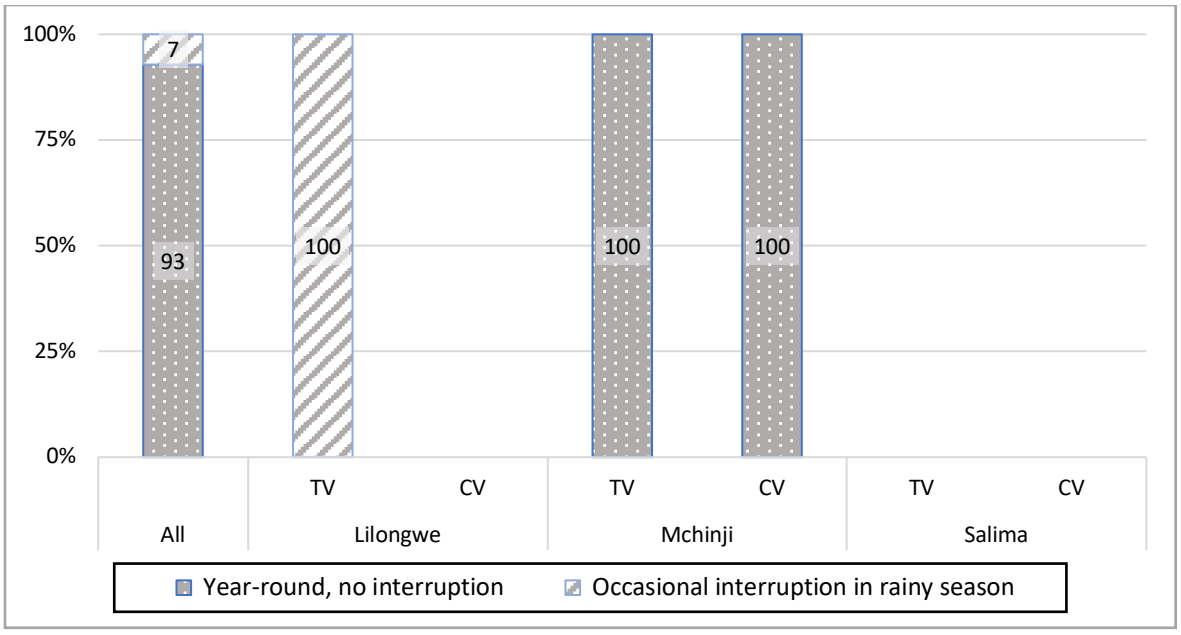


Figure 13: Percentage of villages rating accessibility of paved/black top road

Table 34: Percentage of villages by type of transportation

	All	Lilongwe		Mchinji		Salima	
		TV	CV	TV	CV	TV	CV
Bicycle	98.3	100	100	95.1	95.5	100	100
Motor cycle/ scooter	30.9	39.3	45.8	17.1	9.1	50.0	10.0
Ox-cart	30.3	36.1	41.7	22.0	27.3	30.0	10.0
Truck/ bus/ mini-bus	20.8	9.8	0.0	53.7	40.9	0.0	0.0
Other	3.9	1.6	0.0	7.3	4.6	5.0	10.0

Source: Survey (2017)

4.2 Agricultural and Economic Activities - Module D

In this section, information on village-level agricultural practices and economic activities under Module D of the questionnaire are described. The subsection is also divided into two - 4.2.1: Land Tenure, Rentals, Value and Uses, and 4.2.2: Access to Extension, Input, Credit and Storage.

4.2.1 Land Tenure, Rentals, Values and Uses

In Table 35, average values of land tenure, land rental rates and purchase values are summarized. Several land tenure arrangements exist in the sampled villages but the most common type is via *Inheritance* (62.4%), followed by allocation by *Local leaders* (60.7%), then *Leasehold/rent* (56.2%), and *family* allocation (44.9%). The rest are utilized in less than 10% of villages and includes *Purchase*, *Borrowing without charge* and *Illegal "squatting"*.

In the bottom of Table 35, *Average rental rates* are shown. The *Rental rate per acre per season* is MWK 12,198 and ranges from a low of MWK 9,934 for TVs in Lilongwe to a high of MWK 15,665 for TVs in Mchinji.

Also, the average *Purchase value per acre* is MWK 263,8112 for the entire sample with the lowest value of MWK 136,167 recorded for TV in Mchinji and a highest value of MWK 378,422 for TV in Lilongwe.

Table 36 shows the common uses to which land is put in the survey villages aside building (residential) purposes. Consistent with expectation, *Crop farming* attracts the overwhelming use for land with a percentage of 98.9% in the entire dataset, and at least 95% across districts. Other uses include *Forestry/woodlot* (17.3%), *Public infrastructure* (11.2%) and *Business/trading* (8.9%). The least common uses of land include *Recreation* (5.6%) and *Grazing* (4.5%).

Table 35: Percentage of villages by land tenure, average rental rate and purchase value of land

	All	Lilongwe		Mchinji		Salima	
		TV	CV	TV	CV	TV	CV
Inheritance	62.4	72.1	100	46.3	45.5	35.0	70.0
Local leaders	60.7	34.4	58.3	85.4	63.6	75.0	90.0
Leasehold/ rent	56.2	52.5	45.8	63.4	72.7	55.0	40.0
Family	44.9	39.3	16.7	56.1	63.6	55.0	40.0
Purchase	9.6	4.9	0.0	24.4	18.2	0.0	0.0
Borrow without charge	6.7	1.6	0.0	12.2	13.6	15.0	0.0
Squatting (illegally)	0.7	0.0	0.0	2.4	0.0	0.0	0.0
Rental rate per acre per season (MWK)	12,198 *3,104*	9,934 *1,247*	10,458 *1,179*	15,665 *2,279*	14,909 *2,617*	11,700 *2,658*	11,000 *2,000*
Purchase value per acre (MWK)	263,812 *198,410* [154]	378,421 *206,828* [57]	356,087 *241,764* [23]	136,167 *55,206* [30]	137,056 *67,568* [18]	161,389 *95,760* [18]	176,250 *81,930* [8]

Note: Numbers in italics are standard deviations, and those in square brackets are the relevant number of observations. Purchase value of land is summarized for villages with positive values and with respective modified z-scores within ±3.5. (Source: Survey, 2017).

Table 36: Percentage of villages by land use

	All	Lilongwe		Mchinji		Salima	
		TV	CV	TV	CV	TV	CV
Crop farming	98.9	100.0	100.0	95.2	100.0	100.0	100.0
Forestry/ woodlot	17.3	13.1	4.2	35.7	22.7	5.0	10.0
Public infrastructure	11.2	13.1	25.0	7.1	4.6	5.0	10.0
Business/ trading	8.9	1.6	4.2	11.9	13.6	30.0	0.0
Recreation	5.6	8.2	4.2	4.8	0.0	5.0	10.0
Grazing	4.5	3.3	0.0	2.4	9.1	10.0	10.0

Source: Survey (2017).

4.2.2 Availability of Extension, Input, Credit and Storage

Access to agricultural information and the modes of delivery are presented in Table 37. In the entire data, 87.6% of villages has some form of extension service. For these villages, information is mostly delivered through *Public agricultural extension* (80.9%) by the Government of Malawi. Considerable proportions of villages receive agricultural information from sources such as *Anchor farms/NGO*s (40.5%), *Electronic media* (34.8%), *Lead farmers* (34.8%), *Neighboring/other farmers* (34.3%), and *Farmer field days/school* (10.1%). Other less popular (<10%) sources include *Village extension meeting*, *Friends/family*, *Agricultural extension course*, and the *Print media*.

Village-level access to purchased inputs such as improved seeds, agro-chemicals, implements, etc. was also elicited and summarized in Table 38. Overall, just 9% of villages are able to access these inputs within the village. For CVs in Mchinji, there are no avenues of acquisition of purchased inputs locally. In the entire sample, 85.2% of villages acquire inputs from the *Next village/town*, as opposed to 17.9% that do so from the *District capital*. While at least 90.9% of villages in Lilongwe and Mchinji districts access their inputs from the *Next village/town*, in Salima, only 23.5% of TVs and 22.2% of CVs depend on the *Next village/town for* purchased inputs.

The average distance covered from village to the closest point of input purchase is shown at the bottom of Table 38. For the entire sample, villages are situated about 9.8 km away from their closest purchase source, and this ranges between 7.6 km for TVs in Salima and 11.2 km for TVs in Lilongwe.

In terms of credit access, 54.5% of villages have *Credit availability* locally (see Table 39). However, access could be limited more for TVs in Lilongwe where just 31.2% has access, and more enhanced for CVs within the same district, in which case 83.3% of villages have credit availability within village. For villages with credit availability, 81.4% have *Microfinance*, 19.6% have access through *Neighbor*, 16.5% have it through *Relative*, 13.4% through *Agricultural cooperative*, and 13.4% through *Tobacco outgrower company* e.g. Limbe leaf, Alliance one, Japan Tobacco International, etc. Other less popular (<10%) avenues include *Money lender*, *Formal bank*, and *Religious institutions*.

As regards *Storage infrastructure*, summarized in Table 40, just 3.9% of villages have warehouses that farmers could utilize to store their produce. For the 96.1% without such public infrastructure, farmers resort to *chitandala in house* (81.4%), *traditional nkhokwe* (19.6%) and *improved nkhokwe* (16.5%) for storage[5].

[5] *Chitandala* is a wooden pallet; traditional *nkhokwe* is storage with woven reeds and bamboo; improved *nkhokwe* is made of corrugated metal and/or reed and bamboo.

Table 37: Percentage of villages with access to agricultural extension services, and by source

	All	Lilongwe		Mchinji		Salima	
		TV	CV	TV	CV	TV	CV
Has extension service(s)	87.6	91.8	91.7	75.6	90.9	90.0	90.0
Public ag. extension	80.9	85.3	91.7	68.3	86.4	70.0	90.0
Private ag. extension	40.5	50.8	16.7	48.8	0.0	80.0	10.0
Electronic media	34.8	29.5	37.5	36.6	50.0	35.0	20.0
Lead farmer	34.8	26.2	33.3	41.5	50.0	35.0	30.0
Neighboring/other farmers	34.3	32.8	33.3	46.3	45.5	15.0	10.0
Farmer field days/school	10.1	1.6	8.3	21.9	18.2	5.0	10.0
Village ag. extension meeting	7.9	1.6	4.2	17.1	18.2	0.0	10.0
Friends/family	7.3	4.9	0.0	14.6	4.6	10.0	10.0
Ag. cooperative/ farmer club	3.9	1.6	4.2	9.8	4.6	0.0	0.0
Ag. extension course	1.7	0.0	0.0	7.3	0.0	0.0	0.0
Print media	1.1	1.6	0.0	2.4	0.0	0.0	0.0

Source: Survey (2017)

Table 38: Percentage of villages by purchased input source

	All	Lilongwe		Mchinji		Salima	
		TV	CV	TV	CV	TV	CV
Purchased input in village	9.0	13.1	12.5	2.4	0.0	15.0	10.0
A market/shop in next village or town	85.2	98.1	95.2	100.0	90.9	23.5	22.2
Market/shop in District capital	17.9	1.9	4.8	7.5	9.1	88.2	77.8
Distance to closest source from village (km)	9.8 *7.7*	11.2 *7.7*	8.5 *3.6*	9.4 *8.2*	10.3 *12.3*	7.6 *4.6*	9.1 *3.2*

Source: Survey (2017)

Table 39: Percentage of villages with credit availability and by source

	All	Lilongwe		Mchinji		Salima	
		TV	CV	TV	CV	TV	CV
Credit available	54.5	31.2	83.3	68.3	63.6	55.0	50.0
Microfinance	81.4	94.7	85.0	71.4	57.1	100.0	100.0
Neighbor	19.6	10.5	45.0	14.3	7.1	9.1	40.0
Relative	16.5	0.0	40.0	17.9	7.1	9.1	20.0
Ag. cooperative	13.4	0.0	5.0	32.1	21.4	0.0	0.0
Tobacco outgrower company	13.4	5.3	0.0	35.7	7.1	9.1	0.0
Money lender (Katapila)	5.2	5.3	0.0	3.6	14.3	9.1	0.0
Formal bank	2.1	5.3	0.0	3.6	0.0	0.0	0.0
Religious institution	2.1	0.0	5.0	0.0	7.1	0.0	0.0

Source: Survey (2017)

Table 40: Percentage of villages with warehouse and by storage types

	All	Lilongwe		Mchinji		Salima	
		TV	CV	TV	CV	TV	CV
Village warehouse	3.9	0.0	0.0	4.9	18.2	5.0	0.0
Storage types used:							
Chitandala in house	81.4	94.7	85.0	71.4	57.1	100.0	100.0
Traditional Nkhokwe	19.6	10.5	45.0	14.3	7.1	9.1	40.0
Improved Nkhokwe	16.5	0.0	40.0	17.9	7.1	9.1	20.0

Source: Survey (2017)

4.2.3 Adoption of New Agricultural Technologies

In this section, the typical attitudes of groundnut, soybean and maize farmers towards the introduction of new technologies, and the kinds of innovations introduced in recent memory are discussed. Figure 14 depicts the attitude of farmers toward technology adoption, and it shows that introduction of new technologies tends to receive favorable acceptance although at different paces. For the overall sample, 83.7% of villages reported a *Quick* pace of adoption as opposed to *Slow* (16.3%). Geographically, more than 50% of villages across all districts indicated a *Quick* adoption pace. However, while more than 75% of villages in Lilongwe and Mchinji reported so, less than 75% indicated that in Salima.

Agricultural innovations introduced in villages in recent memory are catalogued by district and village type in Table 41. It is evident that while some differences exist between the innovations for TVs and CVs, there are commonalities both within and across districts. Four innovations common to all village categories (highlighted in green) across districts include *planting in double rows*, *Sasakawa method of planting,* and *use of new or hybrid varieties* of seeds. The Sasakawa technology pertains to maize production and involves closer ridge spacing (75 cm apart) and use of a single seed 25 cm apart (Denning et al. 2009). *Planting in lines or rows* is common to all but CVs in Lilongwe.

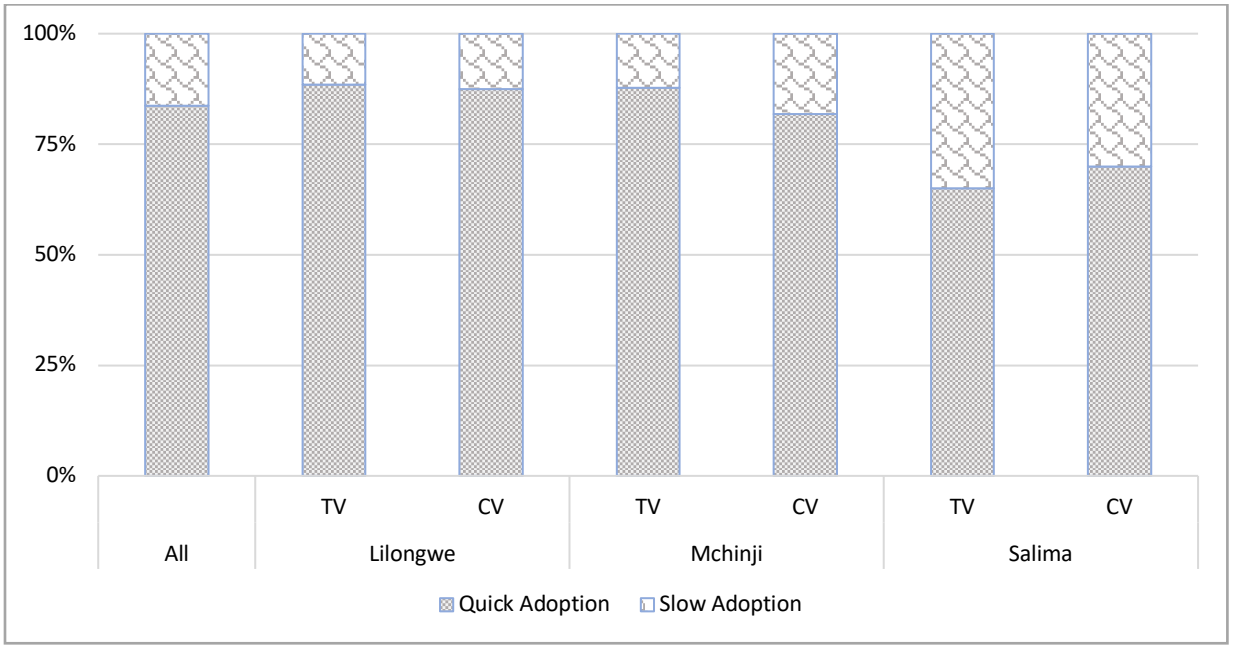


Figure 14: Percentage of villages rating attitudes towards adoption of new technologies

Table 41: Agricultural innovations introduced in recent memory

	Treated Village (TV)	Control Village (CV)
Lilongwe	• **Planting in double rows** • **Planting in lines or rows** • Planting in pits • **Sasakawa method of planting** • **Use of new or hybrid varieties** • Use of inoculants • Application of agro-chemicals • Compost making • Diversification into high-value crops • **Conservation agriculture** • Formation of farmer groups • Use of basal dressing	• **Planting in double rows** • **Sasakawa method of planting** • **Use of new or hybrid varieties** • Seed spacing • Compost making • Irrigated farming • Formation of farmer groups
Mchinji	• **Planting in double rows** • **Planting in lines or rows** • Planting in pits • **Sasakawa method of planting** • **Use of new or hybrid varieties** • Use of inoculants • Application of agro-chemicals • Compost making • Diversification into high-value crops • **Conservation agriculture** • Planting without ridges • Seed spacing • Use of Mandela Corks in drying groundnut • Residue incorporation • Use of PICS bags • Irrigated farming • Agro-forestry	• **Planting in double rows** • **Planting in lines or rows** • Planting in pits • **Sasakawa method of planting** • **Use of new or hybrid varieties** • Use of inoculants • Application of agro-chemicals • **Conservation agriculture** • Residue incorporation • Irrigated farming • Formation of farmer groups • Application of manure • Green Belt Initiative
Salima	• **Planting in double rows** • **Planting in lines or rows** • **Sasakawa method of planting** • **Use of new or hybrid varieties** • Application of agro-chemicals • Compost making • **Conservation agriculture** • Formation of farmer groups • Crop rotation • Planting without ridges • Early planting • Use of flat-top ridges	• **Planting in double rows** • **Planting in lines or rows** • **Sasakawa method of planting** • **Use of new or hybrid varieties** • **Conservation agriculture**

Note: Green denotes common to all village categories in all three districts; Blue denotes common to all but CVs in Lilongwe. Source: Survey (2017).

4.2.4 Migration and Sources of Employment

In this part of the report we focus on migration into and out of survey villages, the timing and work expectations of migrants, as well as sources of employment available in villages. Tables 42 and 43 summarize information on village out- and in-migration, respectively. For 65.2% of villages, people move out mostly between *May to November* (76%), which is the dry season in Malawi, and between *December and April* (20.7%) (see Table 42). Migrants for 77.6% of villages head to *Neighboring Countries* such as Mozambique, Zambia and South Africa, and others relocate to *Neighboring districts* (62.9%) and *Surrounding villages and towns* (19%). The major economic driver for such movements is *Farming* (66.4%), followed by *Casual labor jobs* (30.2) and *Others* (3.4%) e.g. shop keeping.

From Table 43, just 27% of villages receive migrants, and again this occurs mostly in the dry season - *May to November* (50%) and the major season - *December to April* (43.8%). Migrants for 22.9% of villages come in from *Neighboring districts*, for 10.1%, from *Surrounding villages/towns*, and for 1.1%, from *Neighboring countries*. Thus, while more villages in our data have migrants heading overseas to *Neighboring countries*, fewer receive migrants from these other countries. Again, *Farming* is the major (58.3%) economic draw for migrants coming into survey villages, followed by *Casual labor jobs* (39.6%) and then *Others* (2.1%) e.g. commodity purchase.

The sources of employment in sampled villages are presented in Table 44. The three major sources include *Farming* (88.8%), *Petty trading* (70.2%), and *Casual labor jobs* (54.5%). Others include *Salaried work* (7.9%), *Bicycle taxi* (5.1%), *Masonry/welding* (3.4%), *Money lending* (1.7%) and *House/room rentals* (0.6%).

Table 42: Percentage of villages by out-migration

	All	Lilongwe		Mchinji		Salima	
		TV	CV	TV	CV	TV	CV
Migrate out	65.2	75.4	66.7	58.5	59.1	65.0	40.0
When migrants move out:							
May to November	76.7	93.5	100.0	45.8	53.9	69.2	75.0
December to April	20.7	6.5	0.0	54.2	38.5	15.4	25.0
Other	2.6	0.0	0.0	0.0	7.7	15.4	0.0
Where migrants go:							
Neighboring countries	77.6	89.1	100.0	70.8	53.9	61.5	25.0
Neighboring districts	62.9	73.9	50.0	50.0	53.9	61.5	100.0
Surrounding villages/towns	19.0	2.2	0.0	41.7	53.9	30.8	0.0
Work migrants go in for:							
Farming (as tenants)	66.4	80.4	75.0	83.3	46.2	7.7	25.0
Casual labor jobs	30.2	19.6	25.0	16.7	46.1	76.9	50.0
Other	3.4	0.0	0.0	0.0	7.7	15.4	25.0

Source: Survey (2017)

Table 43: Percentage of villages by in-migration

	All	Lilongwe		Mchinji		Salima	
		TV	CV	TV	CV	TV	CV
Migrate in	27.0	16.4	12.5	39.0	36.4	45.0	20.0
When migrants move in:							
May to November	50.0	80.0	100.0	25.0	25.0	66.7	50.0
December to April	43.8	10.0	0.0	68.8	62.5	33.3	50.0
Other	6.2	10.0	0.0	6.2	12.5	0.0	0.0
Where migrants come from:							
Neighboring districts	22.9	11.5	8.3	35.7	31.8	40.0	20.0
Surrounding villages/ towns	10.1	6.6	8.3	9.5	13.6	25.0	0.0
Neighboring countries	1.1	1.6	0.0	2.4	0.0	0.0	0.0
Work migrants come in for:							
Farming (as tenants)	58.3	90.0	100.0	31.3	75.0	44.4	50.0
Casual labor jobs	39.6	10.0	0.0	68.7	25.0	44.4	50.0
Other	2.1	0.0	0.0	0.0	0.0	11.2	0.0

Source: Survey (2017)

Table 44: Source of employment

	All	Lilongwe		Mchinji		Salima	
		TV	CV	TV	CV	TV	CV
Farming	88.8	98.4	100.0	92.7	86.4	55.0	60.0
Petty trading	70.2	77.1	75.0	56.1	72.7	75.0	60.0
Casual labor jobs	54.5	50.8	58.3	65.9	40.9	55.0	50.0
Salaried work	7.9	11.5	0.0	2.4	4.6	20.0	10.0
Bicycle taxi	5.1	0.0	0.0	0.0	9.1	15.0	40.0
Masonry/welding	3.4	1.6	0.0	4.9	4.6	10.0	0.0
Money lending	1.7	0.0	0.0	2.4	4.6	5.0	0.0
House/room rental	0.6	1.6	0.0	0.0	0.0	0.0	0.0

Note: Numbers are percentages, based on the entire sample. (Source: Survey, 2017)

4.3 Village-Level Matching

Common support between Treated and Control Villages (TVs and CVs) is important for comparison of village-level outcomes between the two groups. This Section examines common support based on observable village level characteristics through propensity score (PS) matching.

We generate the predicted probability of a village being treated by estimating a logit model, and then implement two matching estimators – nearest neighbor (nn) with replacement, and radius with a pre-defined caliper width, i.e., the maximum permitted difference between the PS of a TV and that of a matched CV. We defined the caliper width, c, as $c = a\sqrt{(\sigma_{TV}^2 + \sigma_{CV}^2)/2}$, where a is a measure of the desired level of bias removal due to village-level dissimilarities; σ_j^2 is the variance of the propensity score for the jth treatment group (Cochran and Rubin 1973; Austin 2011). For nn matching, common support was assessed assuming 1 nn and then 5 nns. For radius matching, caliper widths of 0.046 (aims at 99% bias removal) and 0.093 (aims at 96%) were used.

Table 45 summarizes the number of TVs that have similar CV matches for each scenario of the matching algorithm. Common supports for 1 nn and 0.046 caliper width are depicted in Figures 15 and 16, respectively. In Table 45, both nn scenarios result in 100 TVs and 56 CVs on common support. However, using the tighter caliper width of 0.046 resulted in 99 TVs 56 CVs on common support. Easing up the caliper bound to 0.093 gave the same result as the two nn scenarios, i.e. 100 TVs vs 56 TVs.

The implication of the matching results is that based on observable variables, comparison of village-level baseline outcomes alone would warrant using 99 or 100 TVs and all 56 CVs. However, the results, have no bearing on farmer-level outcomes as village fixed effects and other observable attributes would be introduced when matching treated with control households.

Table 45: The number of TVs with CV Matches

	Nearest Neighbor				Radius			
	1 nn		5 nn		Caliper = 0.046		Caliper = 0.093	
	Off Support	On Support	Off Support	On Support	Off Support	On Support	Off Support	On Support
TV	22	100	22	100	23	99	22	100
CV	0	56	0	56	0	56	0	56
Total	22	156	22	156	23	125	22	156

Source: Survey, 2017

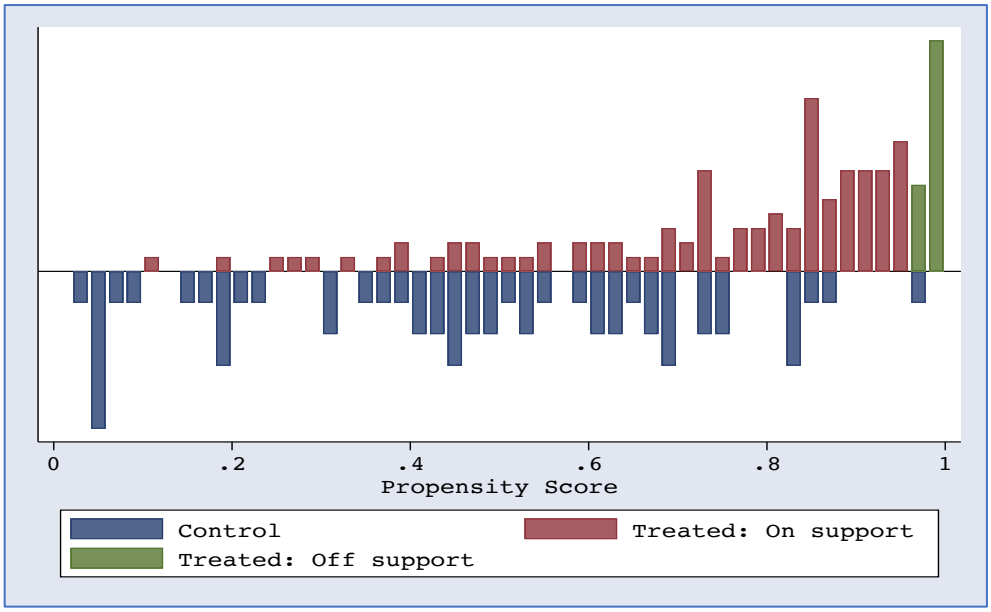


Figure 15: Common support between TVs and CVs: 1 nn

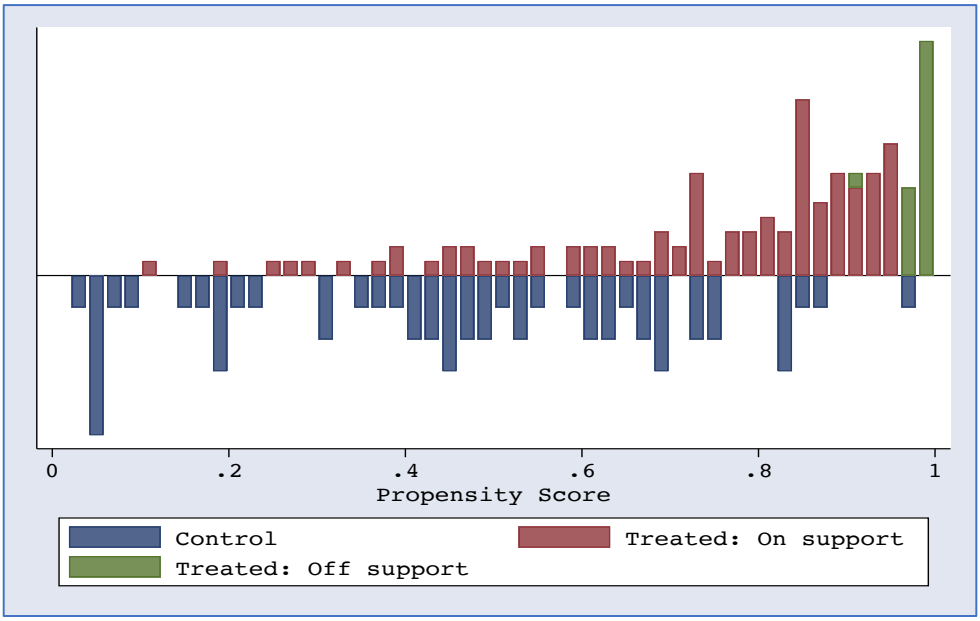


Figure 16: Common support between TVs and CVs: Caliper = 0.046

5. SUMMARY

A key component of the USAID-funded Malawi Agricultural Diversification Activity (AgDiv) is to disseminate research-based Good Agricultural Practices to households working with anchor farms. An anchor farm is a business model where a large commercial farm serves as a hub of best farming practices and is part of a network of surrounding smallholder farmers (referred to as outgrowers or ingrowers). The main goal is to help smallholders increase farm productivity and incomes so as to improve living standards. Outgrower farmers are members of village-based organizations, who receive assistance from an anchor farm and cultivate their own plots. Ingrowers, are similar to outgrowers, but in addition they cultivate plots allocated to them within the anchor farm.

To understand the current situation, a baseline survey was conducted in three Districts in the Central Region of Malawi, namely Lilongwe, Mchinji and Salima. Data was collected from random samples of farm households producing groundnut and/or soybeans as well as from their corresponding village leaders. This report presents a descriptive analysis of the baseline data, which was collected between August 2017 and April 2018.

Two study populations were defined. The first is constituted by farmers who cultivate groundnut and/or soybean in the Lilongwe, Mchinji and Salima Districts within the Central Region of Malawi. The second population comprises village heads/leaders of all the villages included in the farm survey. A random sample was drawn from Treated Villages (i.e. those having farmers affiliated with Exagris and Horizon Farms anchor farms) and from Control Villages (similar to the treated but outside the area of influence of the anchor farms). The household (HH) level survey includes Treated (T) and Control (C) farmers where the latter do not work with an anchor farm. Control farmers consist of two sub-groups, Neighbor Control (C1) who live in treated villages and Pure Control (C2) who live in control villages. Following standard procedures to determine sample size, a total of 2,598 farms were interviewed (1300 T, 650 C1, 648 C2) distributed across 179 villages (123 treated, 56 controls).

Two main surveys were conducted, one for individual farmers and the other for village leaders. The farmer questionnaire focused on the HH structure, farming activities, institutional support to the farm, and resilience-related questions. The village questionnaire sought information about demographics, agricultural practices and challenges, and availability of key resources and infrastructure. The data was collected using tablets along with the World Bank's Computer-Assisted Personal Interviewing (CAPI) Platform (Survey Solutions). The target respondent at the HH level was the farm manager and in village interviews the village head.

The data shows that 310 treated farmers were assigned anchor farm plots in 2016/17 and 346 in seasons prior to 2016/17. A total of 1,500 farmers, including T1, C1 and C2 farmers, received PICS bags in 2016/17 in Lilongwe and Mchinji (none in Salima) and, as would be expected, the numbers are considerably higher for the T1 group followed by the C1 group. The total number of farmers receiving inoculants is much smaller at 99, and again the largest

figure is for the T1 group. A total of 404 farmers in the sample received a salary in 2016/17 from Exagris or Horizon Farms.

The average farmer interviewed: is 42 years old; has 5.4 years of schooling; 52.4% are women; 87.1% are Christians; worked 96.6 days on the farm during the main season in 2016/17; and has 5.3 persons in the HH. The average dependency ratio is 1.1. Household income from work outside the farm in the previous 12 months averaged MWK 36,956. The total number of HHs reporting outside income is 1,370 (52.7%).

On average, the HH has 1.9 plots of land covering 1.1 ha including rented land. The area cultivated is almost the same as the total land area. The most commonly grown crop is maize with 98% of the whole sample doing so. Groundnut ranks second (71.1%) followed by soybeans (49.5%). The next most commonly grown crops are Beans/cowpea (8.9%) and Tobacco (6%). The percentage of farmers cultivating both groundnut and soybean is 37.5%. Farms that cultivated the dominant crops did so on an average area (yield) of 0.39 ha (912 kgs/ha) for groundnut, 0.37 ha (923 kgs/ha) for soybeans, and 0.52 ha (1,673 kgs/ha) for maize. The average area devoted to other crops is 0.49 ha. A total of 1,211 farmers cultivated in the 2016 dry season and maize was again the most common crop with (89.5%), while groundnut and soybeans were produced by a very small share of farmers. Most of those that cultivated, reported using watering can/bucket (98.4%) and a few, treadle pump (1.6%). The most common source of irrigation water is wells (93.2%).

The average VTP for all crops is MWK 269,653, with cash costs of production (i.e. expenses on hired labor and purchased inputs and excludes non-cash costs such as the opportunity costs of family labor, free inputs and own seeds) equal to MWK 54,954. The average gross margins or GM (VTP *less* cash costs) per farm is MWK 202,575 and MWK 225,264 per hectare. A total of 51.9% of the sample reports livestock rearing in the past 12 months preceding the survey with an average GM of only MWK 1,541.

A total of 36.5% of all farmers in the sample reported having received extension in the 12 months preceding the survey and the dominant source is NGO/private (52.3%) followed by the Government (50.8%). The data reveals that 36.1% of all farmers in the sample reported having borrowed money in the past 12 months and the most common credit source is microfinance followed by neighbor. Forty-seven percent of farmers source their inputs from the local market, while 42.5% rely on Agro-input dealers.

A total of 93.4% of the sample reports that their dwelling is owned. The most common source of drinking water is borehole (65.8%) followed by well (32.2%). As far as toilet facilities, 71.9% of the HHs reported having a traditional toilet with roof. The most common food group consumed in the seven days preceding the survey is maize and condiments (6.9 and 6.7 times, respectively) followed by vegetables (5.3 times). Groundnut and soybean/soy product have the same average consumption frequency (3.6). In terms of eating fewer meals than usual because there was no food, 21.5% of the HHs experienced this during the week preceding the survey, 11.8% in the preceding month, and 16.5% in the preceding year. A substantial majority of HHs (63%) reported having no food to eat at home at some point in the 5 years preceding the survey. In terms of the last time a HH member(s) went to sleep

hungry, 55.6% reported that experience in the 5 years preceding the survey, and 11% in the preceding week.

Respondents were asked to compare the amount of money holdings/savings held by the HH at the time of the survey and 69.8%, 77.2%, 77.9% and 76.3%, reported lower amounts at the time of the survey compared to previous past month, 6 months, 12 months and 1 year, respectively. The average food expenditure per week for all the sample is MWK 2,525, and that for Non-food expenditure per quarter is MWK 34,967. Information on savings and borrowing practices of the HH in the month preceding the survey indicates that 24.5% of HHs saved, 19.9% used savings to meet expenses, 22.1% borrowed money or food, and 23.4% skipped expenses on needed items.

Concerning whether the HH was affected negatively in the past 12 months prior to the survey by a number of different events the category with the highest response rate is crop diseases/pest (62.3%) followed by heavy rains at (18.7%) and livestock diseases (11.2%). When asked if the HH received early warning regarding environmental or weather-related shocks and most cases none was received. When asked if the HH was affected negatively in the past 12 months by non-environmental/non-weather-related sources the top response is high cost of farm inputs (60.6%), followed by low prices for crops (56.0%). The most frequently cited coping strategies used by HHs in the preceding 12 months, is the sale of crops stored for future consumption (53.7%), followed by credit (29.3%), and the use of HH savings (24.0%). The dominant answers obtained concerning perception of current climatic effects compared to the past 10 years are: Temperature-70.6% answered Higher; Rainfall-51.4% responded Higher; Floods-39.2% responded Lower; Drought-39.6% indicated Lower; and Landslides-55.9% replied the Same.

Turning to the village-level data, the average number of residents per village is 401 with an overall land area averaging 92 ha. In terms of proximity to the relevant district and regional capitals, the average distance is 44.9 km and 92.7 km, respectively. The average village is 10.8 km away from the closest town. All three major religions in Africa are practiced in the sampled villages, with Christianity being the most common (99%), followed by African traditional religion (62.4%), and then Islam (27.5%). Clearly, in many villages more than one religion is practiced.

Only 15.2% of the villages report having potable water. The primary source of energy for lighting, cooking, processing and other uses is firewood (97%), then battery/torch (90.5%), candle (26.4%), grass (11.8%), electricity (8.4%) and paraffin/kerosene (1.1%). In terms of health facilities, 87.6% of the villages have none whereas 5.1% reported having traditional healing centers, 4.5% a hospital and 3.9% a clinic. Regarding educational facilities, 39.9% of the villages have a primary school while only 5.6% have a secondary school. Landline telephone and Television/cable services are available in very few villages (0.6% and 11.8%, respectively). Overall, most villages have dirt road with maintenance (68.5%) as the main access route followed by dirt road with no maintenance (23.6%) and then paved/black top road (7.9%). The predominant mode of transportation is bicycle (98.3%) while there is also reliance on motor cycle/scooter (30.9%), ox-cart (30.3%), and truck/bus (20.8%).

Several land access/tenure arrangements are found and the most common is inheritance (62.4%), followed by allocation by local leaders (60.7%), leasehold/rent (56.2%), and family allocation (44.9%). Land purchases, borrowing without charge and illegal "squatting" are observed in less than 10% of the villages. The Rental rate per acre per season is MWK 12,198 while the average Purchase value per acre is MWK 263,812. As would be expected, Crop farming accounts for most of the land used (98.9%). Other uses include forestry/woodlot (17.3%), public infrastructure (11.2%) and business/trading (8.9%), recreation (5.6%) and grazing (4.5%).

A majority of villages (87.6%) has some form of extension service primarily through public agricultural extension (80.9%) from the Government of Malawi. A significant share of villages receives agricultural information from anchor farms/NGOs (40.5%), electronic media (34.8%), lead farmers (34.8%), neighboring/other farmers (34.3%), and farmer field days/school (10.1%). Facilities to purchase inputs (e.g. seeds, agro-chemicals, implements) are only available in only 9% of the villages and in 85% of the villages the only way to get input is from the neighboring villages/towns. The average distance from a village to the closest point to purchase inputs is about 9.8 km.

Credit is locally available in 54.5% of the villages and in those villages 81.4% of the credit comes from microfinance sources, about 29% through neighbors, 16.5% through relatives, 13.4% through Agricultural cooperatives, and 13.4% through Tobacco outgrower companies (e.g. Limbe leaf, Alliance one, Japan Tobacco International). Other less popular (<10%) sources include money lenders, formal banks, and religious institutions. Less than 4% of the villages report having warehouses for farmers to store their products. Village leaders indicate that groundnut, soybean and maize farmers tend be receptive to the introduction of new technologies with 83.7% reporting a quick innovation take-up. Four innovations with considerable acceptance across most villages are planting in double rows, Sasakawa method of planting, and use of new or hybrid seed varieties.

The last issue examined has to do with migration and sources of employment. In most villages (65.2%), people tend to move out from May to November (76%), and between December and April (20.7%). Migrants for 77.6% of villages go to neighboring countries (e.g. Mozambique, Zambia, South Africa), and others relocate to neighboring districts (62.9%) and surrounding villages and towns (19%). The major economic driver for such movements is farming, followed by casual jobs.

Less than 3 in 10 villages receive migrants also during May to November (50%) and December to April (43.8%), primarily from neighboring districts. Thus, while more villages in our data have migrants heading to neighboring countries, fewer receive migrants from these other countries. Again, farming is the major (58.3%) economic draw for migrants coming into surveyed villages, followed by casual labor (39.6%). The major sources of employment are farming (88.8%), petty trading (70.2%), and casual labor (54.5%). Less important are salaried work (7.9%), bicycle taxi (5.1%), masonry/welding (3.4%), money lending (1.7%) and house/room rentals (0.6%).

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APPENDIX

APPENDIX A: Household Questionnaire

APPENDIX B: Household Dataset 1_2019

APPENDIX C: Village Questionnaire

APPENDIX D: Village Dataset 1_2019