Conservation Farming Unit

CONSERVATION FARMING & CLIMATE SMART AGRICULTURE

CSAZ OUTCOMES SURVEY REPORT

2016/2017 SEASON

BY THE CFU

RM-M&E DEPARTMENT

This report presents key Outcomes survey findings for Year 1 upon the implementation of the CSAZ Programme by the Conservation Farming Unit under

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ACRONYMS

ADP	Animal Draught Power
CA	Conservation Agriculture
CAPI	Computer Assisted Personal Interview
CF	Conservation Farming
CFU	Conservation Farming Unit
CEO	Camp Extension Officer
CSA	Climate Smart Agriculture
CSAZ	Climate Smart Agriculture Zambia
CSPro	Census and Survey Processing System
CT	Conservation Tillage
DACO	District Agriculture Coordinator
DFID	Department for International Development
FC	Farmer Coordinator
FGD	Focus Group Discussion
FISP	Farmer Input Support Programme
FO	Field Officer
FRA	Food Reserve Agency
HH	Household
MRM	Monitoring and Results Measurement
MS	Microsoft
MT	Minimum Tillage
SFO	Senior Field Officer (CFU officer in CFU Regions under the Regional Manager)
SPSS	Statistical Package for the Social Sciences
ToC	Theory of Change
TSP	Tillage Service Provider

EXECUTIVE SUMMARY

The Conservation Farming Unit (CFU), under the sponsorship of the British Government's Department for International Development (DFID), launched a 5-year Climate Smart Agriculture Zambia (CSAZ) in July 2016. The programmes seeks to improve food security to over a million people by providing trainings to an outreach of over 200,000 farmers annually across four the CFU's areas of operations; Central, Eastern, Western and Southern regions. The project is guided by at least three theories of change. The first is that if farmers are well trained in Climate Smart Agriculture (CSA) technologies, then they will adopt the technologies. The second is that if the private sector (agro-dealers and tractor owners and suppliers) are well mobilized, CSA technology adopters will realize even smooth and increased benefits of adoption. The third, the main theory covered by this study, is that if farmers adopt CSA technologies, then they will achieve improved livelihoods and food security.

An internal Outcomes survey was conducted by the CFU's M&E department. The study used a survey methodology to establish values for the following key project outcomes:

- Outcome Indicator 2.1: Margin of difference between the average yield of adopters and that of conventional farmers (Disaggregated by tillage type)
- Outcome Indicator 2.2: Margin of difference between the average production of adopters and that of conventional farmers (Disaggregated by tillage type)
- Outcome Indicator 2.3: Margin of difference between the proportion of time spent by women on On-farm activities.

The survey was carried out across 18 out of the 35 districts and in all the four areas of CFU operations in Zambia. The sample size was 419 adopting and 390 non-adopting farmers each representing a unique household. The survey came up with the following conclusions:

- ***Outcome Indicator 2.1: Margin of difference between the average yield of adopters and that of conventional farmers (Disaggregated by tillage type)***
  - **51% in favour of Basin adopters was the margin of difference between** the average yield of Basin adopters and that of hand-hoe ridgers/ diggers,
  - ADP ripping adopters' yield was **19% higher** than that of ADP ploughing conventional farmers.
  - For Year 1, Mechanising adopters' yield was in fact **9% lower** than that of mechanising non-adopters.
- ***Outcome Indicator 2.2: Margin of difference between the average production of adopters and that of conventional farmers (Disaggregated by tillage type)***
  - Hand hoe basin adopters are likely to harvest **7% more** than comparable conventional hand hoe farmers.
  - ADP ripping adopters are more likely to harvest **38% more** maize than the ADP ploughing conventional farmers.
  - Mechanised ripping farmers are likely to harvest **28% more** maize produce than conventional tractor ploughing farmers.

- ***Outcome Indicator 2.3: Margin of difference between the proportion of time spent by women on On-farm activities.***
  - **Contrary to expectations** that adoption would free up time for women adopters and allow them to use that freed up time on other off-farm (both in pursuit of other livelihoods and for leisure and relaxation) activities, for CSAZ Year 1, **women adopters actually used up to 36.6% more of their time** on on-farm activities than they did before adoption.

Two main lessons learnt from this study are that:

- Holistic programming dictates that focussing only on the production side of food security may not always lead to exploitation of the full benefits of CSA.
- Operating in silos and thereby ignoring the influence of other significant promoters of CSA may in fact threaten adoption patterns and limit the impact of CSA technologies

Key recommendations that should be seriously considered by the CFU as we are now in the second year are as follows:

- The CFU should continue to create face-to-face opportunities through existing platforms and activities between private sector buyers, agro suppliers, third party service providers, and farmers working with the programme.
- Households working with the CSAZ also need to be advised to safe guard their household food security requirements and be encouraged to invest in better storage equipment like the PICS bags so as to ensure the quality and quantity of their stored food stocks;
- CFU presence in the villages should not be left only and largely in the hands of the Farmer Coordinators but as much as possible, Field Officers should complement the work of FCs particularly in the more remote areas away from the proximity and comfort of urban and peri-urban locations.
- There is need for an active policy advocacy on the part of the CSAZ in order to influence both harmonisation and standardisation of CSA practices.
- There also is need for an active policy advocacy on the part of the CSAZ in order to influence both early disbursement of FISP inputs, timely and realistic gazetting of viable producer prices, as well as decentralisation of FRA collection points to the advantage of small scale producers who should then be encouraged to pool their produce to make the establishment of a collection point economically sensible.

1.0 INTRODUCTION

This section gives a background to the Conservation Farming Unit (CFU) and the Department for International Development (DFID)'s sponsored Climate Smart Agriculture Zambia Programme (CSAZ). It details the Theory of Change (ToC) as related to the Outcomes (Post-Harvest) and gives the study objectives. The last part discusses the delimitations and challenges faced during the survey itself.

1.1 BACKGROUND OF THE CSAZ AND CFU

The Conservation Farming Unit (CFU), a not-for-profit organization being sponsored by the British Government's Department for International Development (DFID), under its Climate Smart Agriculture Zambia (CSAZ), provides trainings to an outreach of over 240,000 farmers annually across four (4) CFU operation regions namely: Central, Eastern, Western and Southern. The program is currently covering a total of 35 Zambian districts with 82 Field Officers (FOs) and 11 Senior Field Officers (SFOs) across the four regions. Each FO trains and/or oversees training of about 2,970 farmers on average three times annually. While these farmers are expected to be unique individuals, there has not been a deliberate policy stopping farmers from repeating trainings as it was felt that they would always have a genuine reason for being present in the same session as the one they attended before. The majority of trainees of CFU are small-scale farmers in the rural areas of Zambia. These trained farmers are in turn expected to practice one form or another of minimum tillage as they have been trained. The previous of such types of trainings were conducted during the 2016 round of trainings in preparations for the 2016/2017 season namely:

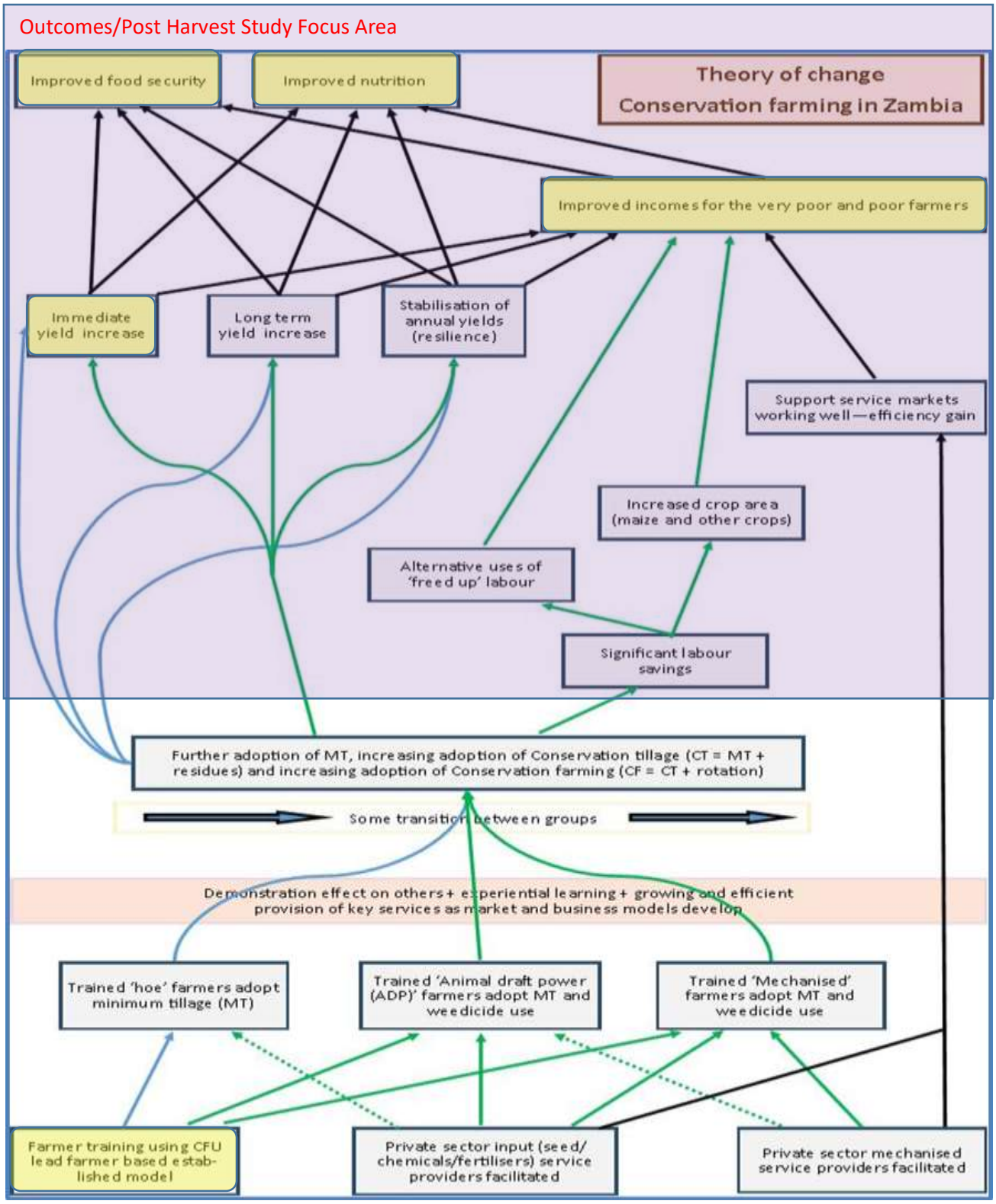
- ✓ Period 1-Land Preparation (with three sessions similar in content, to cater for more than the 30 farmers expected in one training session),
- ✓ Period 2-Nutrient application and seeding (three sessions as above),
- ✓ Period 3-Weed management (again with three sessions).

The same set of trainings have started for the 2017/2018 season with Period 1 already conducted and Period 2 commencing around mid-August in all districts.

The core purpose of the technical training is to promote the CF practices to interested farmers across operational areas. Ideally a farmer needs to attend all three periods in order for them to gain the complete set of skills needed for full adoption. However, a farmer who goes on to attend at least period one and two and then practices (for year 1) minimum tillage would qualify to be called an adopter. An Adoption survey was conducted to assess how many of the trained farmers had adopted the different forms of CF and if not, why not for those who might not have adopted. This survey (Post-Harvest) sought to find out what if any, differences there were between adopters and non-adopters of the CF technology as far as productivity, yield and food security were concerned.

1.2 CSAZ THEORY OF CHANGE

Figure 1: CSAZ Theory of Change



The CFU's CSAZ Theory of Change (ToC) above outlines how training farmers leads to adoption and other higher indicators like yield increase and food security. The highlighted sections of the ToC were the subject matter for this Outcomes (Post-Harvest) Survey. The project is guided by at least three theories of change. The first is that if farmers are well trained in Climate Smart Agriculture (CSA) technologies, then they will adopt the technologies. The second is that if the private sector (agro-dealers and tractor owners and suppliers) are well mobilized, CSA technology adopters will realize even smooth and increased benefits of adoption. The third, the main theory covered by this study, is that if farmers adopt CSA technologies, then they will achieve improved livelihoods and food security.

The ToC breaks down the different categories of adopters and how these categories interact with each other. It follows from the ToC that trained farmers adopt the different levels of the technology (Minimum Tillage, Conservation Tillage and Conservation Farming) and over time adopt further by progressively moving from MT to CT and from CT to CF. For any of these levels, three (3) main type of tillage methods can be employed namely Hand-Hoe (Basins, overall digging with a hoe, or ridging), Animal Draught Power (ADP-Ripping or ploughing) and Mechanisation (Tractor Ripping or ploughing). In the survey, questions were raised in such a way as to already categorise both adopters and non-adopters into the three tillage types for each of comparisons so that like and like were paired together. The survey also tried to establish to some extent whether farmers have progressed from Minimum Tillage (MT) to Conservation Tillage (CT) and to Conservation Farming (CF) by asking what tillage method they employed on the same field in question during the previous season and what type of crops were grown (to check for crop rotation).

1.3 STUDY OBJECTIVES

The main objective of this survey was to 'Establish the extent to which 2016 trained farmers who have adopted the technology of Conservation Farming (CF) have improved productivity and in turn become more food secure and acquired additional income as a result of increased on-farm produce (yields)'. This was accomplished by comparing productivity between comparable conventional farmers and CF adopters. Even though CF is being practiced by a wide range of farmers (small to medium, and large commercial farmers), the focus was on small scale farmers (cropping on less than 5ha) during the 2016/17 cropping season. Never the less, farmers cropping on larger tracks of land were also incorporated. Socio-economic aspects of farmers were also incorporated into the survey.

The specific objectives were as follows:

- ✓ Establish the composition of the households from which farmers come.
- ✓ Determine the assets owned by the farmers and the source of income.

- ✓ Establish average maize quantities harvested per household under each of the flowing categories of famers:
  - ➢ Hand-Hoe Tillage
  - ➢ ADP Tillage
  - ➢ Mechanized (Tractor Tillage)
- ✓ Using maize as a proxy, compare production and yields between comparable conventional and CA tillage types (i.e. Hoe conventional tillage to Basins, Animal drawn ploughing to animal ripping, and tractor ploughing to tractor ripping).
- ✓ For new adopters, make an attempt to establish the magnitude of change in months of food security across the years.
- ✓ Assess expenditure patterns of the same categories of households.
- ✓ Compute food consumption scores for the same categories of households as a proxy for nutrition and well-being.

1.4 DELIMITATIONS

The targeted respondents for this survey were the 2016/2017 CSAZ trained farmers who had adopted the CA technology and their neighbouring (comparable) non-adopters of similar socio-economic status across all the four (4) regions of the CSAZ programme as named above. In these 4 regions and out of a total of 35 districts, the survey was carried out only in 18 randomly selected districts - Luano, Mkushi, Kapiri Mposhi, Chibombo, Kafue, Petauke, Lundazi, Katete, Nyimba, Choma, Pemba, Namwala, Zimba, Mazabuka, Chikankata, Kaoma, Nkeyema and Mumbwa. In addition, only Field Officers (FOs), Farmer Coordinators (FCs) and farmers from the sampled districts were eligible to participate in the survey. Senior Field Officers (SFOs) doubled as enumerators and team leaders. This was mainly for capacity building leading to sustainability of the exercise as the CFU will not afford to continue hiring enumerators for the whole duration of the project.

1.5 CHALLENGES

As will be expected for any study, the Outcomes Study faced several challenges. It however suffices to note that none of the challenges encountered had any significant impact on the results of the survey. The first challenge faced was that of accessibility of individual farmers due to harvesting activities as well as social events occurring just around the survey period. This was a household survey and hence it was planned in such a way that interviews would take place within the homestead of the respondents. The enumerators had been forewarned and hence they expected this. FOs came in handy with motor bikes for call-backs wherever the farmer had gone too far to be located. Replacements were only made as a last resort.

The second challenge was that in some cases fields that required measuring were too far away from the homesteads where the interviews were being conducted. This was common where farmers live in villages (community) and farm were far from the village because of lack of agriculture land as well as keeping animals like goats that tend to eat their crops. Again, FOs' motorbikes were used to transport enumerators to the fields for field measurement. Only 50% of the total sampled respondents had their fields measured. The third challenge faced was lack of exact comparable tillage methods within the same locality (finding a pair of an adopter and a non-adopter within a similar geographical location). The survey design was such that for each adopter there be a non-adopter with similar tillage methods and the same socio-economic standing. Sometimes adopters who used tractors for ripping had no non-adopters who used tractors for ploughing. This was because a tractor from one area would be organized to go and rip for CF farmers in another area which had no tractors. So, there would be no mechanised conventional farmers in such an area. There was not much that the study could do about this, hence it will be noticed that the sample size for conventional mechanised farmers will be low.

The fourth, but not the least of challenges, was that of farmers with ploughed fields posing as adopters and claiming that those same ploughed fields had been ripped the previous season either because they thought they were going to receive inputs from the CFU or because the Farmer Coordinator (FC) included them on the sampling frame to push his/her numbers up. Such farmers were probed further for the truth and the information confirmed from neighbors (in some cases) and the FC. Where the truth was not clear, the FC was asked to provide other adopters to replace the 'questionable' adopters within the village or from the next village within his/her area of operation. Where an FC did not provide other adopters, nearby FCs were picked and their farmers interviewed instead.

2.0 STUDY METHODS

This survey was conducted in all four (4) regions of the CSAZ project (namely Central, Eastern, Western and Southern) in specific randomly sampled districts within these regions. The overarching methodological framework was sample survey and the data collection tool was a structured questionnaire in Computer Tablets using CSPro software. Qualitative methodologies such as Focus Group Discussions (FGD) and open-ended discussions with Farmer Coordinators (FCs). A third tool was the Key informant interview that was administered to District Agriculture Coordinator and Camp both from the Ministry of Agriculture. Qualitative methods were conducted by the MRM team. The survey findings were analysed using the Statistical Package for Social Sciences (SPSS) before exporting data to MS Excel for graphing and tables.

2.1 STUDY TOOLS

The tools used in this study were:

- Structured computer based questionnaire
- Focus Group Discussions and Open-Ended Discussions
- Key informant Interviews

2.1.1 Structured Computer Based Questionnaire

The structured questionnaire, administered by the enumerators, was a systematic compilation of questions whose specific purpose was to determine the actual adoption practices, crop yield outcomes, assets acquired as a result of uptake of climate smart agriculture, general living conditions and standard and food security to mention a few, by farmers in the 2016/2017 farming season. The sampled adopting farmers came from the lists of adopters from the 2016/2017 season and was proportionately spread across all sampled areas taking into consideration the size of the areas and the number of districts in each region. These were farmers who were trained by the CFU under CSAZ in the 2016/2017 season and subsequently adopted minimum tillage and climate smart agriculture. There was no need to sample untrained farmers as there was no list, however, conventional famers with similar socio-economic status within the same villages/ areas were interviewed keeping in mind that most factors would be held constant from one farmer to the other such as soil properties and rainfall received. Furthermore, the questionnaire incorporated aspects of household composition and size in order to establish how many people in the household contribute to field agricultural activities as well people living with disabilities therein.

2.1.2 Focus Group Discussions and Open-Ended Discussions

Focus Group Discussions (FGDs) were carried in each of the four CSAZ regions particularly in the sampled districts for the Outcomes Survey 2016/2017. FGDs were administered to a group of farmers who were set to be a balance of males, females and people living with disabilities, following a prepared guide in order to capture perceptions regarding various topics in line with the implementation of CSAZ. These discussions sought to bring out perceptions such as the yield differences of farmers from the two previous seasons, with the second season being one in which CF has been taken up, challenges experienced in crop production and ensuring household food security, challenges experienced in marketing of inputs and produce and the overall addition (in value and livelihoods) that CF has brought about through the CFU and other organisations, the impact of climate smart agriculture (CSA) on women and people with disabilities as well as challenges to their uptake of CSA.

2.1.3 Key informant Interviews

Key Informant Interviews (KII) were administered to District Agricultural Coordinators (DACOs), Senior Agricultural Officers (SAO), Camp Officers (CO) and in rare instances, Block Officers (BO), all of whom fall under the Ministry of Agriculture in Zambia. The KII were designed to capture the perceptions of key extension staff in the districts concerning the uptake and impact minimum tillage, the presence of other organisations promoting climate smart agriculture activities and their ways of conveying the messages of minimum tillage to farmers, challenges facing field crop production under the different tillage types namely, i) basins ii) ADP ripping iii) Tractor ripping and marketing of produce. Critical factors promoting the marketing of field crops were also looked into. Furthermore, the total district production of maize under CA and maize not under CA as well as the prevailing prices of various crop inputs, produce and their availability within the district were captured in order to have a feel of the disparities across districts and regions.

2.2 SAMPLING

All the CFU regions were taken as part of the sources of data. Sampling was three-tiered: Random sampling of 18 out of the 35 districts within these regions was done in order for the survey to have an unbiased spread of information. From each sampled district, a random sample of Field Officers (FOs) and Farmer Coordinators (FCs) was first done before finally carrying out a further random sampling of farmers under each sampled FC. The sampled farmers all came from the register of unique farmers from sampled FCs' areas that had adopted the CSAZ technology as trained by the CFU in 2016. Non-adopters were identified through the sampled adopters and the qualification was that they should be practicing a comparable and opposite non-CSAZ technology while also being within the same geographical area as the sampled farmers.

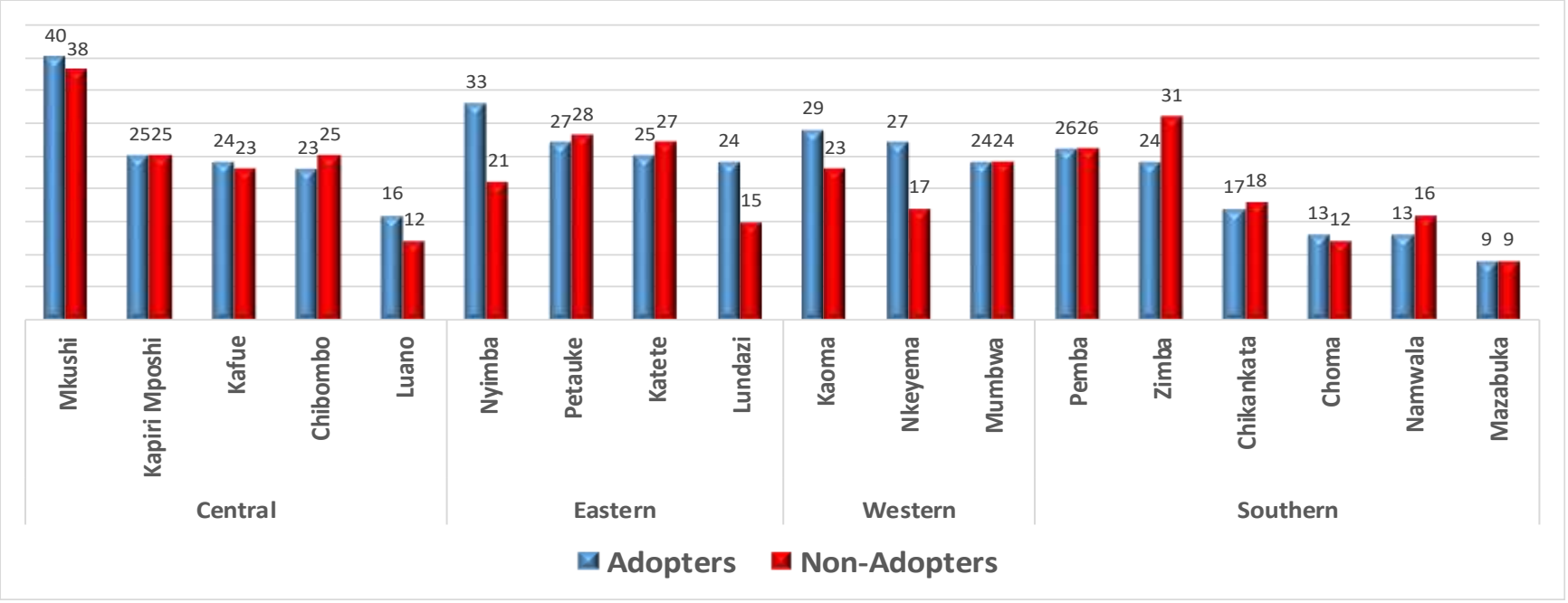
Thus, an adopter who used ADP ripping would be compared with a household practicing conventional animal ploughing while a basin adopter would be compared with a farmer who used hoe ridging or overall digging and is in the same geographical area.

2.2.1 Geographical Sampling

As earlier mentioned, sampling was done randomly at all levels in the different areas. It was decided that the study would take place in all the four CSAZ areas (CFU Regions) so as to assure representatives by capturing any variations introduced by ecological and human resource factors.

Region and District Level Sampling

Figure 2: Sample sizes (Regions and Districts)



As is shown in Figure 2 above, the Outcomes Survey was carried out in all four CFU CSAZ regions. The second column shows the randomly sampled districts and then the third and fourth columns show total sample sizes randomly drawn from geographical area. Total sample size was 809 households.

2.3 DATA MANAGEMENT

Data was collected by 12 enumerators and 10 Senior field officers who were engaged for the purpose. Before actual data collection, the Senior Field officers and the enumerators underwent an intensive four-day training workshop which included field trial runs and testing of the survey tool to be administered. Trial runs were carried out in Kafue area of Central Region. All enumerators recruited were computer literate, possessing beyond a Grade 12 certificate and have previous knowledge of the CSPro application from data entry exercises carried out by the CFU.

The actual data collection was done using Computer Assisted Personal Interviewing (CAPI) software on Lenovo Tablets and therefore all information obtained was electronic. The interviews were designed using CSPro 7.0 Software which ensured that data obtained was of the highest possible quality at that level. Quality assurance rules were built within the CAPI software and this included skipping to the next section if question is non-applicable to the respondent, asking for data to be re-entered where contradictions were noticed, ensuring that the number of individual HH groupings (such as Under-5s, above 60s, etc.) reported does not exceed the total number of people in a household, districts that are within the correct region etc.

The analysis tool used, SPSS, allowed for robust data management and analysis as it makes use of syntaxes in order to scrutinize the datasets obtained. SPSS enables us to generate different variables and perspectives from which to approach data analysis. Microsoft Excel was also incorporated into the data analysis for enhanced visuals and graphic presentation of survey findings.

3.0 SURVEY FINDINGS

This section focuses on the actual results obtained from the survey. It highlights the composition of the households (HH) from the farmers trained and subsequently adopted climate smart agriculture in the year during the 2016/2017 season as well as comparable farmers who did not adopt climate smart agriculture, the sex of the household head (HH head) and disabled persons within those households. This section also focuses on the access to draught power that farmers have, various forms of service provision and general nutritional diversity in households. Main sources of income, main expenditure points, various crop sales and attendance of CFU trainings and field days are also part of the results generated from the survey. The size of field plots cultivated by both farmers practicing CF and those not practising CF was determined by measurement around the field plots using GPS devices. Therefore, this report will present the number and size of plots that a household has converted to and produced from CF in comparison with households that have non-converted plots and their corresponding yields. Asset ownership focused on several components of both household and farm implements that are owned regardless of whether or not they are directly related to and appropriate for CF practices. First however, focus will be put on secondary data on the CSAZ outputs to date so as to give readers an insight into the training of farmers during the 2016 (Year 1 of the project) training period.

3.1 Trainings and Adoption Overview

3.1.1: Trained Farmers 2016/17

Due to challenges associated with data capturing and management systems that were not yet in place, it was a bit difficult to establish a very accurate number of unique farmers trained during year 1 as some farmers repeated training and some would only attend one period. However, the Table 1 below represents the official tally of unique farmers trained under the CSAZ during year 1.

Table 1: Farmers Trained under the CSAZ in Year 1

Log Frame Output Indicator 2.1 – number of farmers trained in climate smart agriculture practices		
2017 Target	**Achieved**	**% of target achieved**
150 000	137 336	92%

3.1.2 Adoption Overview

Prior to the post-harvest survey, an adoption survey had been conducted and produced a couple of findings. The survey established of those that took up a CSA minimum tillage technology in the 2016/17 season, **21.9%** of the trained farmers who adopted CSA had not used the technology before the 2016/17 season while **78.1%** where continuing adopters who had used a CSA technology prior to the 2016/17 season. All in all, (both new and old

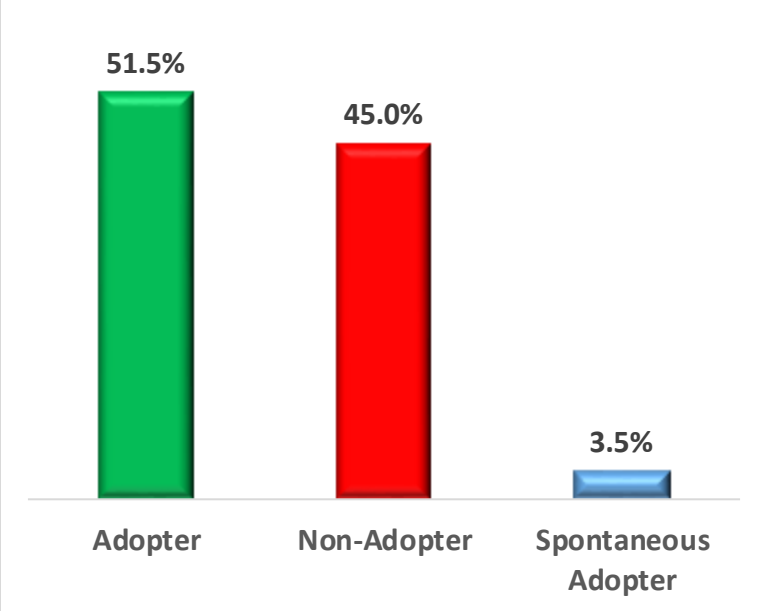
adopters), the survey showed that **66.6%** of the trained farmers adopted minimum tillage during the 2016/17 cropping season. All in all, the adoption survey established the following:

- ✓ **20,305** is the number of new farmers who have adopted CF MT CSA during year against a target of 20,000 farmers.
- ✓ **10,405** is the total Hectarage put under CF (but computed from Mechanised tillage only). This is against a year one target of 8,940 hectares.
- ✓ **11,383** is the number of new adopters using ADP and mechanised tillage services in the 2016/17 season against a target of 8,500 farmers.
- ✓ **7,391** is the number of new adopters who used herbicides for weed control purposes against a year 1 target of 13,390 farmers

3.2 Profiling Sampled Farmers.

3.2.1. Adopters and Non-Adopters.

Figure 3: Proportion of Adopters and non-Adopters

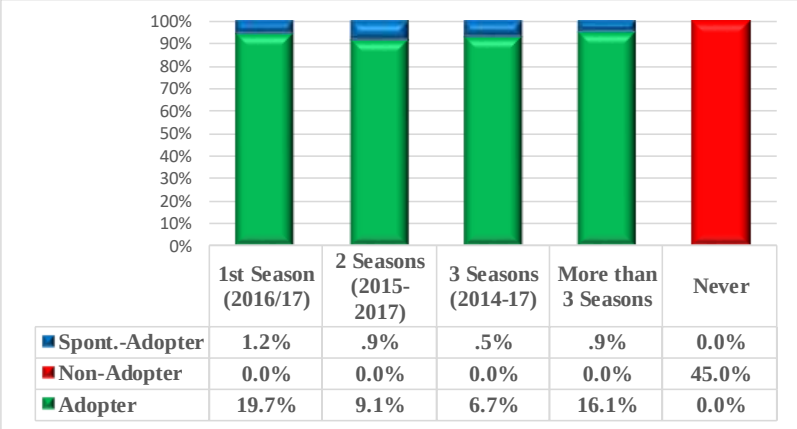


Even though the study was targeted at adopters and non-adopters (initial analysis showing that these were comprised of 419 adopting households and 390 non-adopting households), a third class emerged at data analysis, that of spontaneous adopters. Figure 3 shows that 417 (51.5%) were adopters, 3.5% were spontaneous adopters, and 45.5% of the respondents were non-adopters. The intention was to have as many adopters as non-adopters so as to enable the survey, when carrying out comparisons of the two groups, to be as representative as possible in reflecting an accurate picture of what happened after farmers used the various technologies in the 2016/2017 agricultural season. However, due to the challenges already discussed in Section 1 above, it was not possible to get as many non-adopters as adopters within the same geographically comparable locations and hence the difference noted in figure 3.

3.2.2 For How Long Has a Household Been Practicing CSA?

It was important for the survey to find out the duration of practicing CSA since indeed the CFU has been championing this technology for a considerable number of years and the sampling had not really been biased towards those that had practiced for a specified number of seasons. Figure 4 below shows the results.

Figure 4: Duration of continuous Practicing CSA



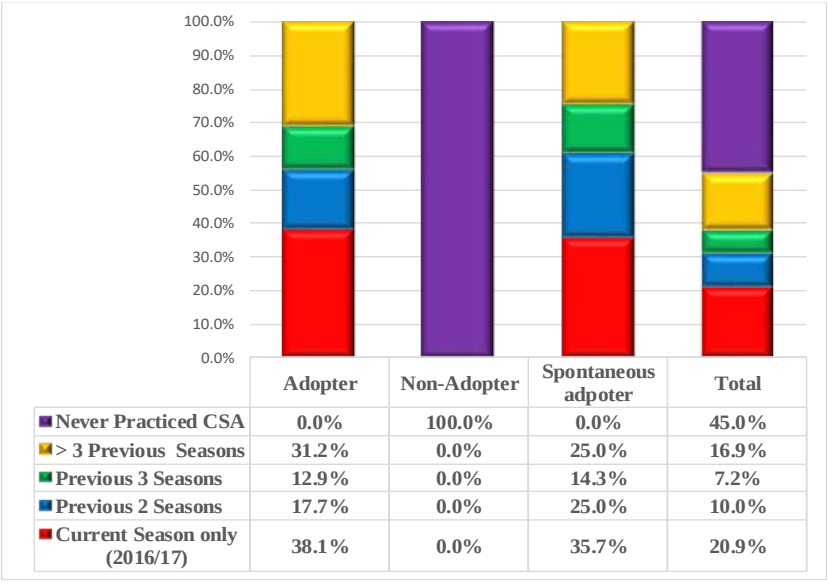
	1st Season (2016/17)	2 Seasons (2015-2017)	3 Seasons (2014-17)	More than 3 Seasons	Never
Spont.-Adopter	1.2%	.9%	.5%	.9%	0.0%
Non-Adopter	0.0%	0.0%	0.0%	0.0%	45.0%
Adopter	19.7%	9.1%	6.7%	16.1%	0.0%

Out of the 809 respondents, 45% had never practiced any CSA technology at all while the rest (55%) had used the technology ranging from just one season (current season) to more than three consecutive seasons. The majority of the adopters were in fact first time adopters, that is those using the technology for the first time under the new funding (CSAZ). The second largest group was that of "Old" adopters who had used the technologies for more than three seasons. Notice the "spontaneous adopters" forming a tiny minority on top of each adoption bar. The section below presents the same information viewed from another perspective.

3.2.3 Investigating Consecutive/Sustained Adoption.

The teaching around CSA technologies is that their benefits are incremental and peak around the third or fourth season of continuous adoption as there would have been enough nutrient trapping in the same basin or rip-line as well as from effects of rotation, and also sufficient moisture preservation through Saved crop residue effects on the soil's water holding capacity. The survey therefore established the year when a household member was first trained (if trained at all) and how many consecutive seasons the household has (if at all) practiced a CSA technology. Figure 5 shows the total sample had over 24.1% adopters and spontaneous adopters who have been practicing CSA for at least three seasons. As was true from the adoption survey, only 20.9% of the sample were taking up CSA for the first time.

Figure 5: Continuity of adoption among farmers

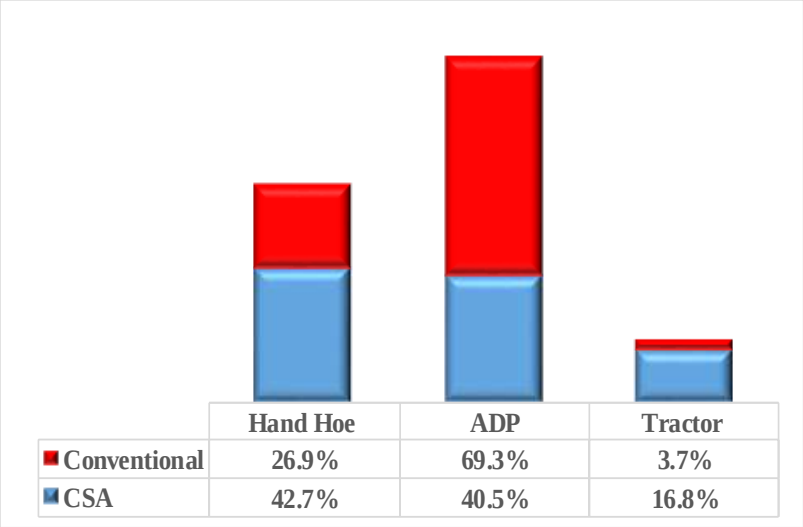


	Adopter	Non-Adopter	Spontaneous adpoter	Total
Never Practiced CSA	0.0%	100.0%	0.0%	45.0%
> 3 Previous Seasons	31.2%	0.0%	25.0%	16.9%
Previous 3 Seasons	12.9%	0.0%	14.3%	7.2%
Previous 2 Seasons	17.7%	0.0%	25.0%	10.0%
Current Season only (2016/17)	38.1%	0.0%	35.7%	20.9%

3.2.4. Main Tillage Type among Adopters/Non-Adopters

Respondents were asked which tillage method they mainly used during the 2016/17 season in spite of their adoption status. It was realised that being an adopter does not mean that **all** household plots are now under minimum tillage. The response rate was 88.0% (n=712), with 363 being adopters and 349 being non-adopters.

Figure 6: Main Tillage Methods used



	Hand Hoe	ADP	Tractor
Conventional	26.9%	69.3%	3.7%
CSA	42.7%	40.5%	16.8%

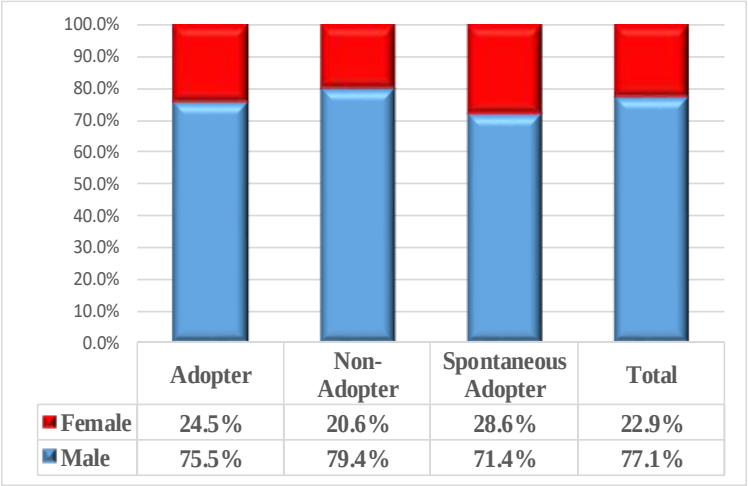
From these, Figure 6 shows that among adopters, the most popular method being used is basin tillage (42.7%) even though minimum tillage uptake using animal draft power is not really lagging behind, standing at 40.5% of the responding adopters. The plough remains the most popular tillage methods among conventional farmers, 69.3% and in CFU operational areas the likelihood of conventional farmers taking up tractor usage is very low, 3.7%.

3.3 Household Characteristics and Demographics.

This was a survey aimed at investigating socio-economic indicators of yield, production, and proxy indicators of household wellbeing. It is therefore proper to look at issues of household size, gender and marital status of the head of household, as well as disability within household.

3.3.1 Gender and Marital Status of Household head.

Figure 7: Gender of HH Head



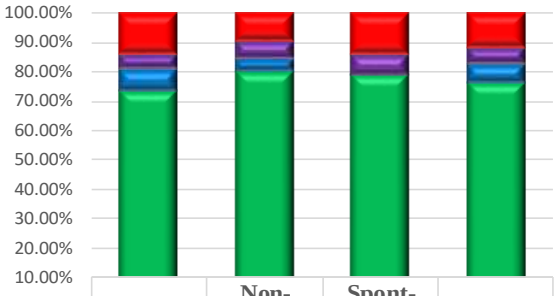
	Adopter	Non-Adopter	Spontaneous Adopter	Total
Female	24.5%	20.6%	28.6%	22.9%
Male	75.5%	79.4%	71.4%	77.1%

From Figure 7, out of a sample size of 712 responsive interviewees, most households were male headed (77.1%) with only 22.9% of the HHs being headed by females. Comparing adopters and non-adopters however, females HH heads were slightly more amongst adopters (24.5%) than amongst non-adopters (20.6%). Spontaneous adopters had the highest number of female headed HHs at 28.6%. However, the pattern remains the same across farmer status. It cannot therefore be

said that the likelihood of a male headed HH to adopt CF is high because even amongst non-adopters, most HH are male headed.

Figure 8 shows that overall, the most dominant marital status of HH head was married-monogamous. Amongst adopters, 70.5% of HH heads were married monogamously followed by widowed at 14.1%. The least were singles/never married who were at 2.7% of the total sample. Widowed HH heads (12.1%) were almost twice as many as married-polygamous HH heads (6.1%). There were no married-polygamous HH heads amongst spontaneous adopters who also happened to be dominated by married-monogamous HH heads.

Figure 8: Marital Status of HH Head

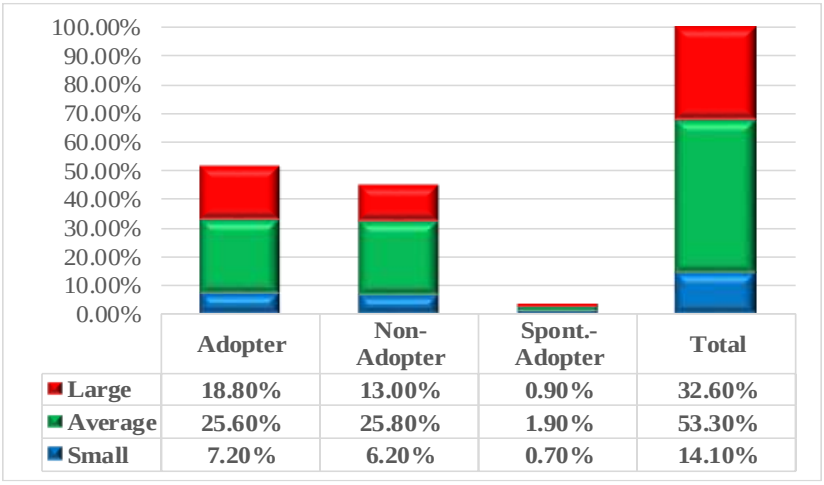


	Adopter	Non-Adopter	Spont-Adopter	Total
Widowed	14.10%	9.60%	14.30%	12.10%
Divorced/Separated	4.80%	6.30%	7.10%	5.60%
Married-Polygamous	7.90%	4.40%	0.00%	6.10%
Married-Monogamous	70.50%	76.90%	75.00%	73.50%
Single/Never married	2.60%	2.70%	3.60%	2.70%

3.3.2 Household Size and Labour Availability.

Household size has a bearing both on household labour as well as household food consumption and general economy. Figure 9 below shows that among the respondents, adopters are more likely to have larger families (18.8% of total respondents) than non-adopters (13.0%). Of course this should not be taken to represent any causality, but rather that people with larger family seem to be attracted to the promises of what CSA can offer more than people with relatively smaller family sizes. This immediately brings us to the issue of size labour force within households, again disaggregated by adoption status.

Figure 9: HH Size Category

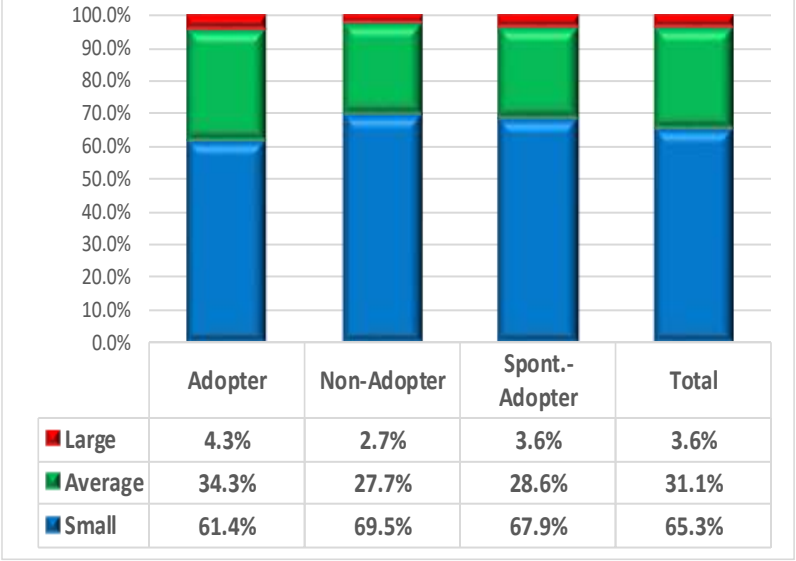


	Adopter	Non-Adopter	Spont.-Adopter	Total
Large	18.80%	13.00%	0.90%	32.60%
Average	25.60%	25.80%	1.90%	53.30%
Small	7.20%	6.20%	0.70%	14.10%

The main issue is whether HH labour size could have a bearing in being an adopter or not. First, we look at availability of labour from household members that could be categorised as being in the working age bracket (18 -59 years old).

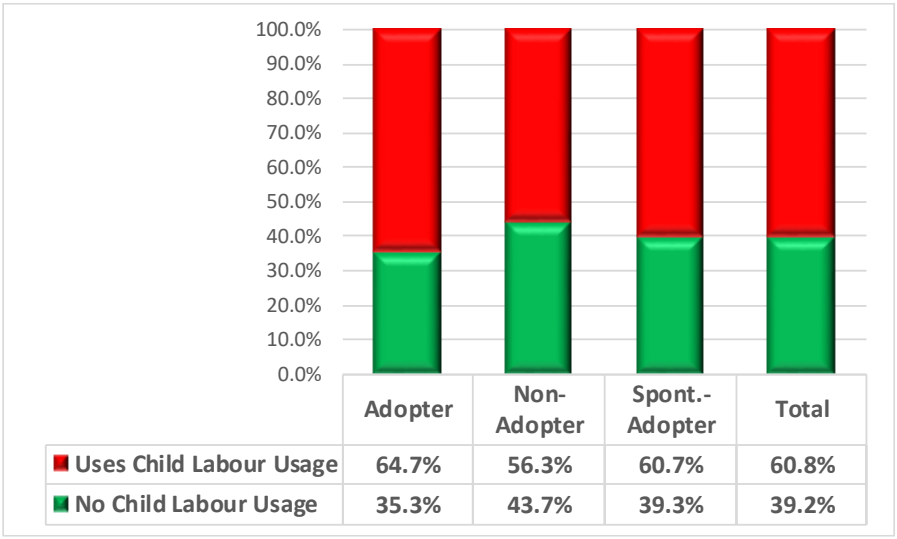
Figure 10 shows that there might not really be a discernible pattern. In general, most households tend to have a "small" labour force (18 - 59 year olds) available for agriculture labour. And this explains why there is a tendency to rely on child labour, particularly among adopters whom we have noted to also higher probability of having larger household sizes. Figure 11 provides a look into the use of child labour among households. Of course, traditionally, the concept of "Child labour" is regarded as foreign as households follow the old adage of "catch them young". Most villagers pointed out that it is unheard of that a child, especially of the age between 9 and 17 years old does not get involved in household field/ agricultural activities even early morning before going to school.

Figure 10: Size of available Working age labour force in Households.



	Adopter	Non-Adopter	Spont.-Adopter	Total
Large	4.3%	2.7%	3.6%	3.6%
Average	34.3%	27.7%	28.6%	31.1%
Small	61.4%	69.5%	67.9%	65.3%

Figure 11: The extent to which Households uses child labour.



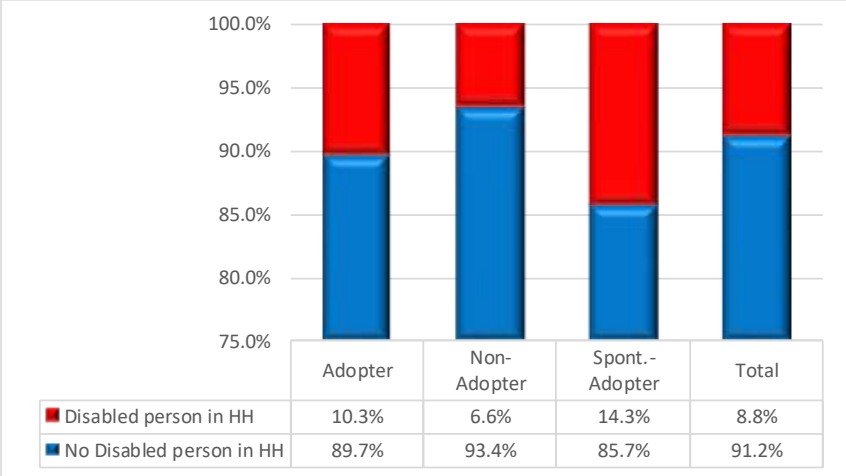
	Adopter	Non-Adopter	Spont.-Adopter	Total
Uses Child Labour Usage	64.7%	56.3%	60.7%	60.8%
No Child Labour Usage	35.3%	43.7%	39.3%	39.2%

As shown in Figure 11 adopters are more likely to be using child labour than non-adopters. Never the less, the use of child labour is generally high (60.8%) among all surveyed households such that it may not raise a real distinguishing point.

3.3.3 Disability within Households.

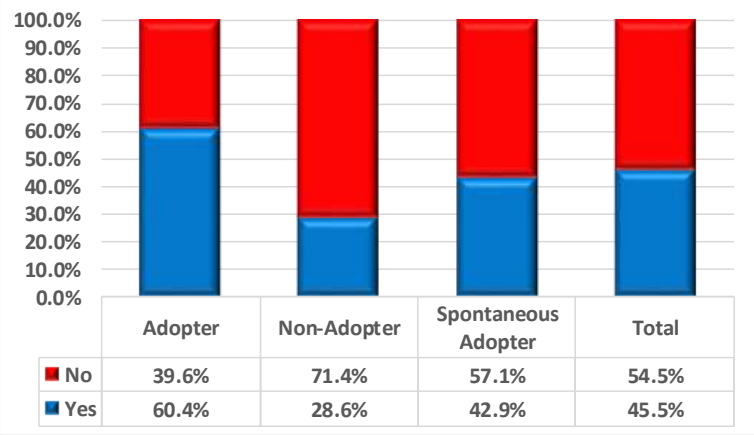
Disability, just like gender, is a key issue in CSAZ activities. The survey sought to establish and confirm what the trainings had noted (see Adoption Report, May 2017). Even though CSAZ trainings are attended by quite an insignificant number of disabled persons, disability is apparently quite common within households. Comparisons between adopters and non-adopters suggest that there is a greater probability that there could be at least one disabled person among adopters than among non-adopters. The likelihood is even higher among spontaneous adopters. This is important as adopters will do well to avail the envisaged benefits of CSA to disabled household members who would obviously greatly need them.

Figure 12: Presence of disability in Households.



3.3.4 Provision of Support Services to Farmers

Figure 13: Did farmer receive any advice on improved/ recommended cropping practices prior to the cropping season



Support services to farmers is broad and ranges from free inputs or farm implements from a formal organisation or government, cash/in-kind credit for purchase of inputs or farm implements, to any advice on improved/recommended cropping practices prior to the cropping season. All sampled households were asked questions relating to support services. The responses were mainly negative to all questions except that of advice on cropping practices. Figure 13 shows that advice on cropping practices was most common among adopters than for any other farmers. The most mentioned agent providing such extension was obviously the CFU (37.8% of responses) as this survey was conducted in CFU operation areas.

3.3.5 Farming as a business.

It would be expected that farmers are not really expected to practice CSA just for the sake of availing themselves with home grown food reserves but to also be able to sell surplus produce and earn income for other day to day expenses since most of the households targeted depend mainly on rain-fed crop husbandry. So households were asked about whether or not they received information about commodity prices either during production or during the harvesting period. Farmers where subsequently asked whether someone linked them to any commodity market(s) where they could sell their produce. The responses, shown in the figures below, were not impressive.

Figure 14: Did HH Receive Information On Commodity Prices?

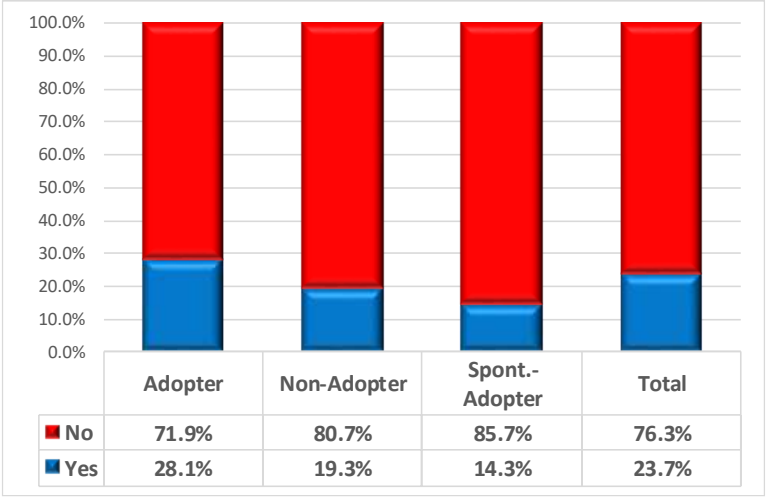
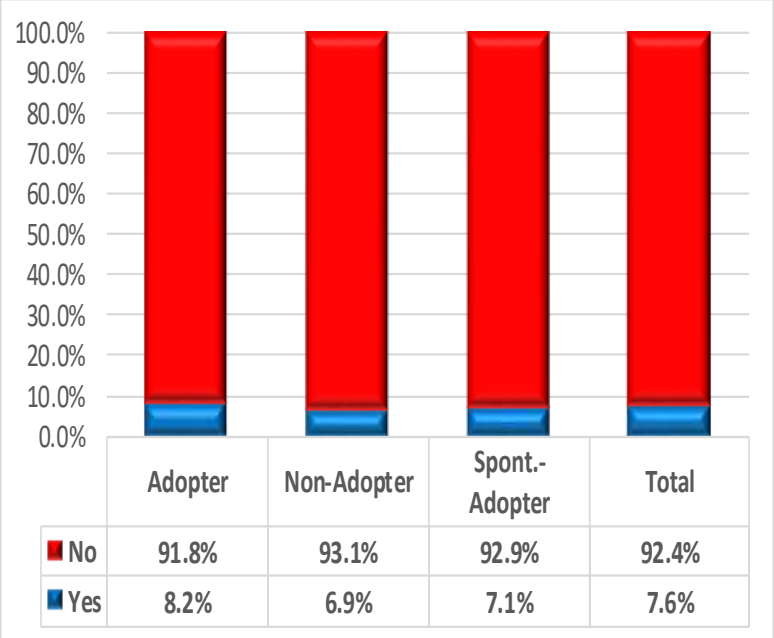


Figure 14 shows that the majority of farmers (76.3%) did not receive any information concerning commodity prices and hence produced without any clue as to the likely market value of their produce and equally reached the time of trading without adequate information about commodity prices.

The situation could have been mitigated if some post-crop-production agency had taken the role of linking farmers to viable markets for their various products. Unfortunately, this again did not take place. Figure 15 presents an even grimmer picture. As high as 92.4% of the farmers reported that no one had linked them to any buyer of their produce. Farmers had to find through their own channels who was buying what and what was the price. This was across the households divide, not favouring any type of farmers (adopters and non-adopters alike).

Figure 15: Did HH Receive Information On Commodity Prices?



4. INDEPTH ANALYSIS

The section will now discuss issues related to production and yield. This is the section where indicator values for the two Logframe outcome indicators will be discussed. The report will also venture into a discussion of impact related issues; household dietary diversity, the sources of cereal consumed in the household as a measure of food security, as well as farmer living conditions and amenities. All these will help to estimate agriculture dependent households' well-being. The overarching issue here is to establish whether there are, as yet, any noticeable differences between adopters and non-adopters at the end of Year 1 of the CSAZ Project.

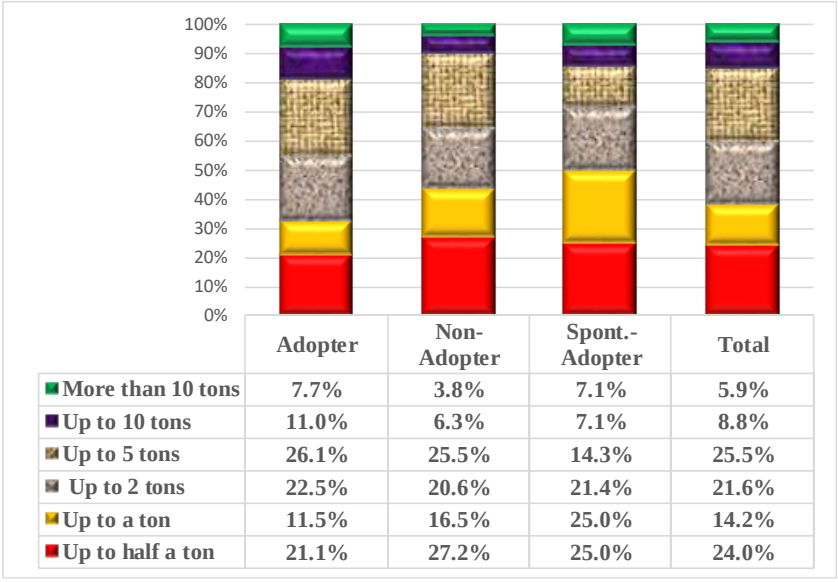
4.1 Production

While data for all crops produced by farmers was collected to investigate diversity in crop production, only maize was used as a proxy to gauge production and yield. This section will first discuss the findings on households' production and yield before computing the respective Logframe indicators.

4.1.1 Production

Total households' production ranged from zero to well above 30 tons. As shown in Figure 16, while households producing above 10 tons of maize are not among the majority this season, it is notable that that level of production is more likely among adopters (7.7%) than among non-adopters (3.8%). Corollary, households whose maize production is below a ton (up to half a ton) are more likely to be found among non-adopters (27.2%) than among adopters (21.1%). The majority of producers (47.1%) are producing ranging from above one ton to 5 tons. In this bracket lies 48.6% of the adopters and 46.1% non-adopters.

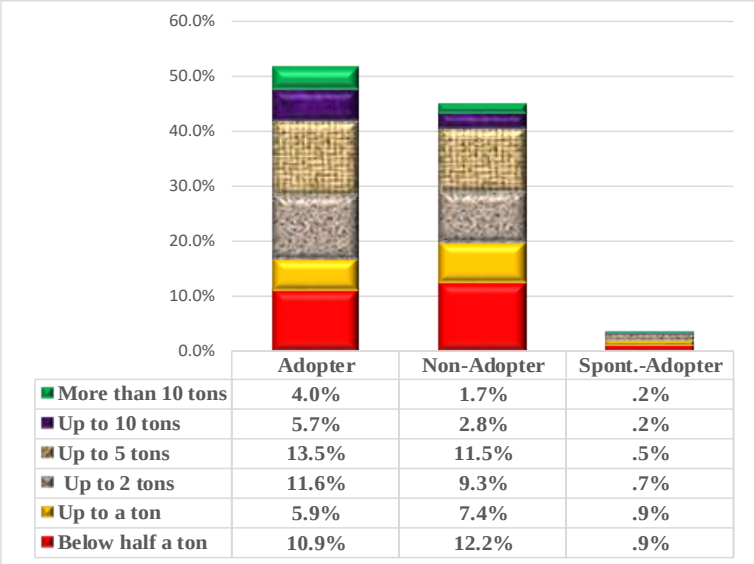
Figure 16: Production Levels within Groups.



	Adopter	Non-Adopter	Spont.-Adopter	Total
More than 10 tons	7.7%	3.8%	7.1%	5.9%
Up to 10 tons	11.0%	6.3%	7.1%	8.8%
Up to 5 tons	26.1%	25.5%	14.3%	25.5%
Up to 2 tons	22.5%	20.6%	21.4%	21.6%
Up to a ton	11.5%	16.5%	25.0%	14.2%
Up to half a ton	21.1%	27.2%	25.0%	24.0%

Even as a proportion of the whole sample adopters produced well ahead of non-adopters. Figure 17 shows that 4.0% are adopters that are more likely to produce above 10 tons compared to only 1.7%. It is clear from Figure 17 that adoption is highly related to improved production.

Figure 17: Production Levels – Comparisons Across Groups



	Adopter	Non-Adopter	Spont.-Adopter
More than 10 tons	4.0%	1.7%	.2%
Up to 10 tons	5.7%	2.8%	.2%
Up to 5 tons	13.5%	11.5%	.5%
Up to 2 tons	11.6%	9.3%	.7%
Up to a ton	5.9%	7.4%	.9%
Below half a ton	10.9%	12.2%	.9%

But perhaps there is need to conduct a test for significance. The main question here is whether or not adoption status is related to improved productivity.

To investigate this question, we used a Chi-Square test where the null hypothesis was that Adoption status and productivity have no relationship at all while the alternate hypothesis was that these two are indeed related.

The Chi-Score statistic, as shown in Table 2, is 16.574, 5 degrees of freedom, and the p-Value is 0.005. We are testing at the 5% level of significance (alpha = 0.05). Now, 0.005 is less than the alpha value. Our result is statistically significant and we will fail retain our null hypothesis which says that there is no association between adoption status and production level. In fact, being an adopter leads to improved production and hence there is more reason to promote CSA if the goal of achieving food security among farming households is to be realised.

Table 2: Chi-Test - Is there a relationship between adoption status and production level?

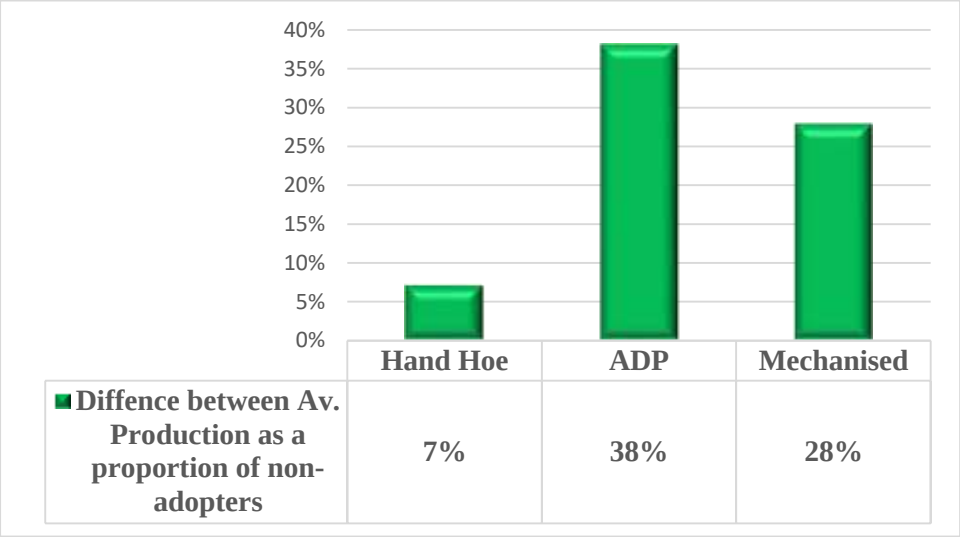
	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	16.574[a]	5	.005
Likelihood Ratio	16.844	5	.005
Linear-by-Linear Association	12.962	1	.000
N of Valid Cases	781		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 21.44.

4.1.2 Outcome Indicator 2.2: Margin of difference between the average production of adopters and that of conventional farmers (Disaggregated by tillage type)

The above discussion has shown that being adopter **does** lead to increased production. It is important therefore to establish the indicator values for the relevant Outcome Indicator. Figure 18 shows the results.

Figure 18: Margin of Difference - Production



In terms of what households have actually harvested/ brought home for use (consumption or trading), the margin of difference is highest among farmers using animal draft power, ADP ripping adopters are more likely to harvest 38% more than the average maize harvest of ADP ploughing non adopters. Hand hoe adopters are comparably the lowest as they are only likely to harvest 7% more than comparable conventional hand hoe farmers. Mechanised ripping farmers are likely to harvest 28% more maize produce than conventional tractor ploughing farmers.

4.2 Yield

To deal with the issue of unreliable land area sizes that are usually reported by households, the survey took GPS area measurements of a household's "best" maize field; one that the household held to be their typical field (both among adopters and non-adopters). Care was made to ensure that basin adopters' field would be compared hand-hoe ridging non-adopters' field while ADP ripped field (adopters) would also be compared with ADP ploughed field (non-adopters), the same for mechanisation. As is necessary for such a test, outliers were removed.

4.2.1 Hand Hoe Practices.

An independent ***t* test** was then conducted to determine if a difference existed between the mean maize yield of basin adopters and that of hand hoe ridgers (non-adopters). Results show that the two groups do in fact significantly differ. There was a statistically significant difference the mean maize yield of basin adopters (n=58, m=1.739, sd=1.505) and hand-hoe ridgers (n=30, m=0.948, sd=0.833); $t_{85.51}$=3.172, p=0.002). The effect size is tending towards being in fact large (above moderate), up to 10 % (η^2=0.1047) of the variance in the mean is explained by adoption status. The 95% confidence interval was 0.295 to 1.287. The study therefore rejects the claim that there is no difference between the mean yield of basin adopters and that of conventional hand hoe ridgers because in fact there is. Tables 3 shows the results.

Table 3: Basin adopters and Hand Hoe ridgers, is there a difference in yields.

Group Statistics

Adopter or non-adopter		N	Mean	Std. Deviation	Std. Error Mean
Maize Yield in 2016/17	Adopter	58	1.73852	1.504674	.197573
	Non-Adopter	30	.94760	.833369	.152152

η^2=0.1047

Independent Samples Test

		Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Interval of the Lower	Interval of the Upper
Maize Yield in 2016/17 Season	Equal variances assumed	13.550	.000	2.670	86	.009	.790922	.296203	.202091	1.379754
	Equal variances not assumed			3.172	85.529	.002	.790922	.249370	.295152	1.286693

4.2.2 ADP Practices.

Once more, just as in the case of hand-hoe practices, results for ADP practices show that the two groups do in fact significantly differ. There was a statistically significant difference the mean maize yield of ADP ripping adopters (n=37, m=3.064, sd=0.694) and ADP ploughing conventional farmers (n=32, m=2.582, sd=0.602); t_{67}=3.041, p=0.003). The effect size is also tending towards being large (above moderate), up to 12.13% (η^2=0.1213) of the variance in the mean is explained by adoption status. The 95% confidence interval was 0.165 to 0.797. The study therefore rejects the claim that there is no difference between the mean yield of ADP rippers adopters and that of conventional ADP ploughing farmers because in fact there is. Tables 4 shows the results.

Table 4: ADP Ripping Adopters and ADP Ploughing, is there a difference in yields?

Group Statistics

Adopter or non-adopter		N	Mean	Std. Deviation	Std. Error Mean
Maize Yield in 2016/17	Adopter	37	3.0635	.69840	.11482
	Non-Adopter	32	2.5821	.60219	.10645

η^2=0.1213

Independent Samples Test

		Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Interval of the Lower	Interval of the Upper
Maize Yield in 2016/17 Season	Equal variances assumed	1.563	.216	3.041	67	.003	.48135	.15828	.16543	.79727
	Equal variances not assumed			3.074	67.000	.003	.48135	.15657	.16883	.79387

4.2.3 Mechanisation Practices.

While the rule of the thumb is that each group should have at least 6 subjects, (ideally more), since inferences for the population will be more tenuous with too few subjects, this analysis risked and still ran a *t* test for mechanisation

practices that had fewer comparators among the tractor-ripping adopters and conventional tractor ploughing non-adopters. The defence here was that obtaining improved results for small samples is the T-test's claim to fame: once the sample size reaches 40 or so, the t-test is not substantially different from the z-tests researchers had been applying throughout the 19th century.

Having taken the risk and used a sample size as small as 8 households for conventional tractor ploughing, results for Mechanised minimum practices show that the two groups do not significantly differ. There was not statistically significant difference between the mean maize yield of Mechanised ripping adopters (n=19, m=2.376, sd=2.122) and Mechanised ploughing conventional farmers (n=8, m=2.617, sd=3.303); t_{25}=*-0.227*, p=0.822). The effect size is indeed small, only 0.2% (η^2=0.0021) of the variance in the mean is explained by adoption status. The 95% confidence interval was -2.418 to 1.938. The study therefore fails to reject the claim that there is no difference between the mean yield of Mechanised ripping adopters and that of conventional Mechanised ploughing non-adopters. Tables 5 shows the results.

Table 5: Tractor Ripping Adopters and Tractor Ploughing, is there a difference in yields?

Group Statistics

Adopter or non-adopter		N	Mean	Std. Deviation	Std. Error Mean
Maize Yield in 2016/17	Adopter	19	2.3757	2.12170	.48675
	Non-Adopter	8	2.6158	3.30293	1.16776

η^2=0.0021

Independent Samples Test

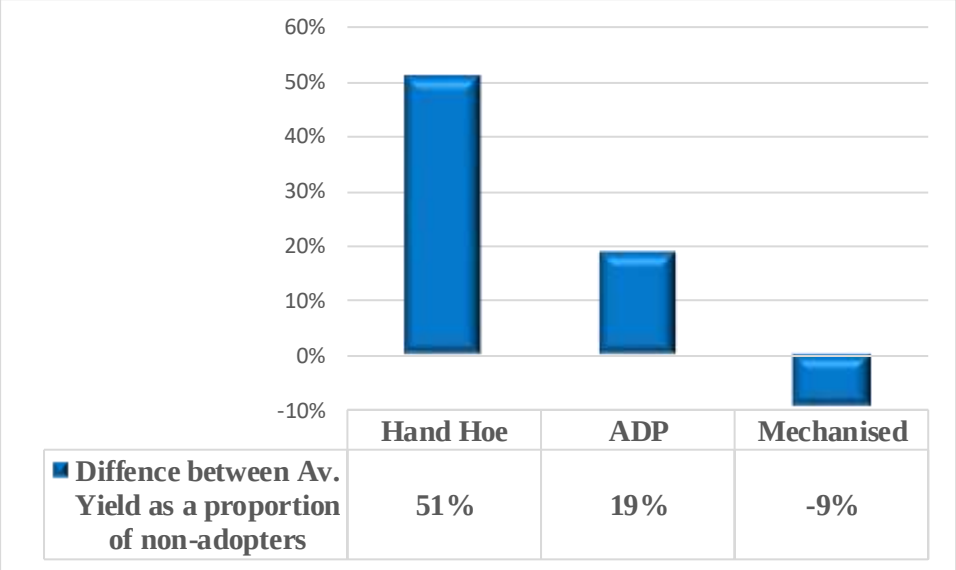
		Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Interval of the Lower	Interval of the Upper
Maize Yield in 2016/17 Season	Equal variances assumed	.968	.335	-.227	25	.822	-.24004	1.05751	-2.41803	1.93795
	Equal variances not assumed			-.190	9.532	.853	-.24004	1.26515	-3.07784	2.59776

4.2.4 Outcome Indicator 2.1: Margin of difference between the average yield of adopters and that of conventional farmers (Disaggregated by tillage type)

Consistent with the results above, the margin of difference between the average yield, as shown in Figure 19, shows a diminishing trend from Hand hoe practices through ADP to mechanisation. While Basin farmers' average yield is as high as 51% compared to that of hand-hoe ridgers/ diggers, there is a tendency for that comparison to dwindle

as we move on to the other technologies. Curiously, results from mechanisation even show that adopters' yield is more likely to be even 9% lower than that of non-adopters. This is not really strange any more since the tests for significance in the discussion above has already shown that there is no significant difference between the yield of mechanised rippers and mechanised non-adopters.

Figure 19: Margin of Difference - Yield



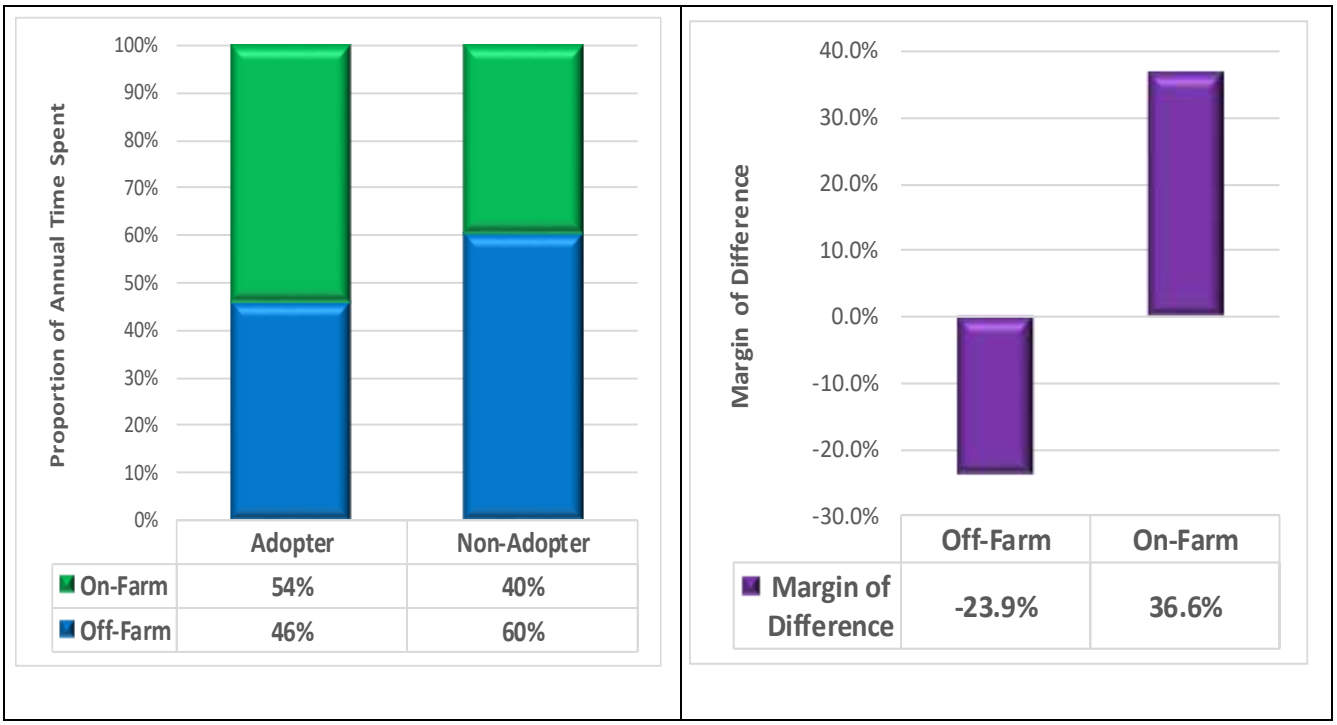
Even though this is somewhat unnerving, there is need to carry out more investigations as to why this (result from Figure 19) was the case for the first year of CSAZ. Discussions during FGDs (and this need to be further verified by more evidence) suggest that CSA benefits are more prominent in drier, low-rainfall conditions (that tend to benefit from the soil moisture retention properties of CSA) than when there is a lot of rainfall (that leads to soil erosion and leaching) as was the case during the 2016/17 agriculture season. Indeed, various scientific studies tend to show decreased yields in high rainfall areas but it is not clear whether indeed this was the case for the 2016/17 season and why this is more prominent among mechanised farmers.

4.2.5. Outcome Indicator 2.3: Margin of difference between the proportion of time spent on On-farm activities

This is notably a qualitative indicator. The indicator is computed by establishing how much time adopters and non-adopters spent on On-farm activities for a defined set of activities (land preparation, weeding, and harvesting for On-Farm activities compared to social events, village meetings, and pursuit of other local livelihood options for Off-farm activities). The adopter's on-farm time is then subtracted from the non-adopters' on-farm time and expressed as a proportion of the non-adopters' time. As this was the first year of the survey, it was sufficient to focus only on one group (the adopters) and ask them the proportion of time spent on these activities before adoption compared to after adoption. This would then be used as a basis for comparison during subsequent years. FGD Data

in Figure 20 shows that contrary to the expectation that adoption would lead to time savings (on-farm) and re-investing that saved time to livelihoods diversification and improvements in other qualitative aspects of life (leisure, resting, etc.), women adopters actually spent more time on On-farm activities than they did before adoption.

Figure 20: Margin of difference in time spent by women on On-farm activities



Evidence has it that for Year 1, adoption has led to to a 36.6% increase in the time spend on On-farm activities. Women have taken away as much as 23.9% of their time from Off-farm activities and invested it in On-farm activities. These Off-farm activities are, from a general perspective, considered essential for human development include (but not limited to) the following:

- ✓ Social events (Lwiindi ceremony; dancing ***vimbuza***; playing instruments; village concerts and weddings; visiting relatives and friends; village meeting; and practicing and improving knitting skills.
- ✓ Livelihoods diversification (Crushing stones for sell, cutting brooms for sale; cutting grass for roofing, making stones for bathing for selling) so as not to solely rely on crop husbandry (which in turn also relies on the sufficient rainfall and favourable weather patterns).
- ✓ Women related roles (Taking care of HH and Maintaining house floors (Smearing clay)

It appears then that:

- ✓ Before adopting CSA technologies, farmers had more time on their hands for off-farm activities mainly because there was not much in the fields.
- ✓ On-farm time increased after adopting CSA technologies partially because farmers observed higher production under CSA and hence decided to put in more time there.
- ✓ Crop diversification encouraged by CSA also lead to more time demanded by on-farm activities.

- ✓ A key issue cited for increase On-farm time is that of weeds. Weeds were always overwhelming and weeding took a long time to finish a round because farmers were not using herbicides. This took away time for off-farm activities.
- ✓ On-farm time also increased after adopting CSA technologies because CFU is strict with weed management and the practice introduced big space between rows which must be freed from weeds (mostly manually in the absence of resources for herbicides).
- ✓ A good number of women said the workload on farms could have reduced if most men have been always cooperating in the smaller on-farm activities, it appears men are not always helpful. Some men go drinking while women start early land preparation. If the work was shared it could have meant more time for women to do other things

When this unexpected effect of CSAZ was brought to the attention of CFU technical/programming department, several responses/explanations were given:

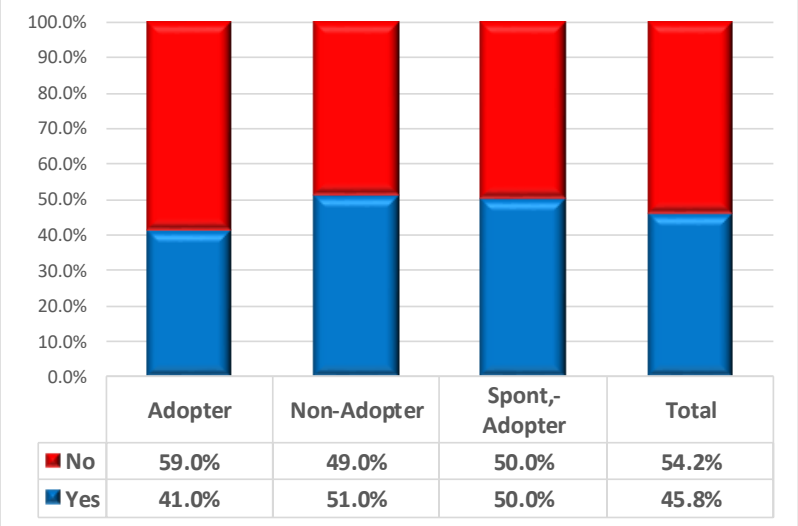
- ✓ The first two to three years of adoption are rife with challenges (such as those cited by the women).
- ✓ These will gradually decrease and real and incomparable time and economic benefits will eventually be noticed.

It will be very important for to keep on monitoring this parameter over the years to see if indeed these observations will be corroborated.

4.3 Has Adoption Led to improved Well-being (Quality of Life)

4.3.1 Cereal Sufficiency

Figure 21: Was there a month (June 2016-May 2017) that HH could not afford sufficient cereals?



	Adopter	Non-Adopter	Spont,-Adopter	Total
No	59.0%	49.0%	50.0%	54.2%
Yes	41.0%	51.0%	50.0%	45.8%

Here, we seek to establish whether there is a difference between adopters and non-adopters in their respective access to cereals for own/domestic consumption. So respondents were each asked whether a month (June 2016-May 2017) that the HH could not afford sufficient cereals (responses being yes there was, or, no we had sufficient cereals every month within the reference period). Figure 21 provides the responses provided by the respective respondents. While 54.2% of the respondents reported not facing cereal shortages, it appears cereal **sufficiency** is more likely among adopters (59.0%) than among non-adopters (49.0%). The reverse is also true; shortage of cereal among households is more likely among non-adopters

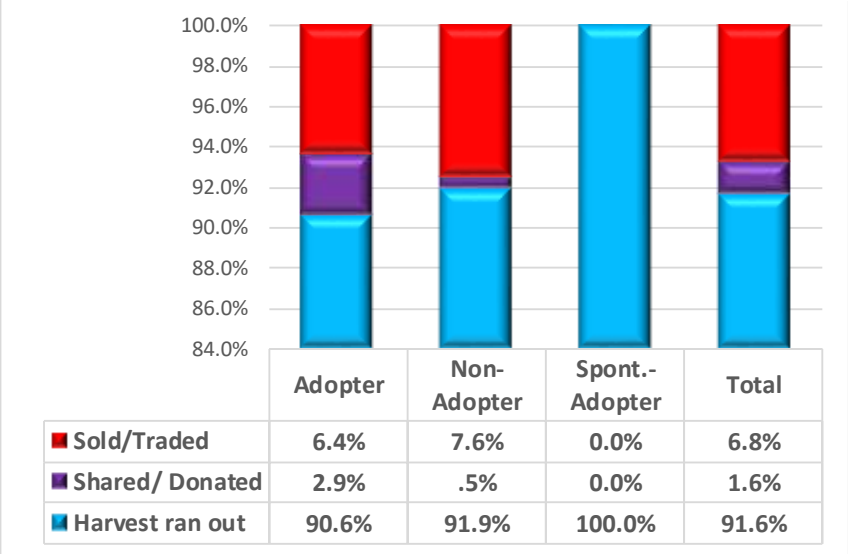
(51.0%) than among non-adopters (41.0%). This is an interesting observation and warrants further statistical analysis through Chi-Square.

Table 6: Cereal Sufficiency: Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	7.958[a]	2	.019
Likelihood Ratio	7.968	2	.019
Linear-by-Linear Association	6.971	1	.008
N of Valid Cases	808		

Table 6 shows the results of the Chi-square test. The Chi-Score statistic here is computed to be 7.958, 2 degrees of freedom, and the p-Value is 0.019. We are testing at the 5% level of significance (alpha = 0.05). Now, 0.019 is less than the alpha value. Our result is therefore statistically significant and we will fail retain our null hypothesis which says that there is no association between adoption status and cereal sufficiency. ***In fact, the conclusion is that adopters are more likely to be cereal sufficient than non-adopters.***

Figure 22:Reasons proffered for being cereal deficient

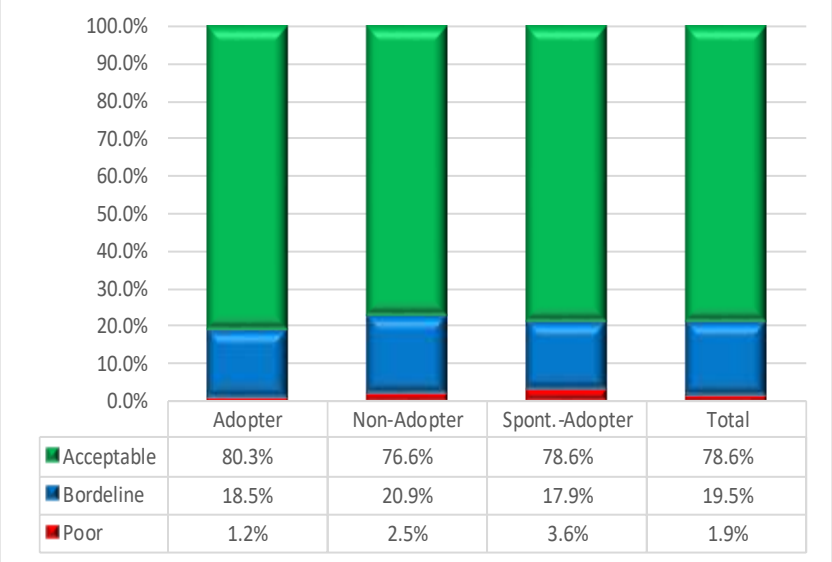


Major reasons proffered for cereal deficiency (as shown in Figure 22) are very similar across groups and cannot therefore be ascribed to one particular group. The predominant reason is that a household's previous harvest simply ran out and they could not afford accessing cereal from other sources. It is not clear whether the households sold/traded their cereal (and thereby became cereal deficient) as distress sales or as a miscalculation of cereal requirements soon after harvest as households also try to access other commodities using proceeds from their cereal (cash or barter). But as already noted above, farmers are not pre-equipped with market intelligence and tend to sell in ignorance or at the spur of the moment of specific/urgent financial needs. This needs to be further investigated but for now, it suffices to also note that some households (and CSA households in particular) may in fact need to be made aware how to determine the amount of cereals to put aside for their families instead of trading invaluable food stocks.

4.3.2 Food Security: Dietary Diversity/ Food Consumption Scores.

While there is no single way to measure food security and the concept itself being rather elusive, this study has relied on an indicator called the Food Consumption Score (FCS) that has been developed as a proxy. This is an index based on dietary diversity (DD), food frequency, and relative nutritional importance of different food groups. Dietary diversity relates to nutrient adequacy (coverage of basic needs in terms of macro and micro nutrients) and to diet variety/balance, which are two of the main components of diet quality. At the household level, DD is correlated to the energy adequacy of intakes, i.e. to the ability of the household to cover basic energy needs of its members. FCS is calculated over a reference time period of 7 days and based on a list of 8 food groups. Different weights, ranging from 0.5 to 4, are applied to the food groups according to their nutrient density. The consumption frequencies are summed for each food group (with an upper limit of 7). FCS is then computed by multiplying frequencies and weights for each food group and summing values over the 8 groups (theoretically ranging from 0 to 112) and categorised as 'Poor' (FCS ranging from 0 to 21), 'Borderline (FCS above 21 and up to 35) or 'Acceptable' (FCS above 35). The survey sought to establish a benchmark FCS for future referencing. It was of interest to find out whether there is any difference between adopters and non-adopters in terms of the proportion of households within a FCS category.

Figure 23: Comparisons of Food Consumption Scores (within Group)



	Adopter	Non-Adopter	Spont.-Adopter	Total
Acceptable	80.3%	76.6%	78.6%	78.6%
Bordeline	18.5%	20.9%	17.9%	19.5%
Poor	1.2%	2.5%	3.6%	1.9%

Even though percentage wise, adopters are more likely be within the "Acceptable" food consumption score (sufficient dietary diversity) standing at 80.3% with non-adopters lagging behind at 76.6%, a more robust statistical Chi-Square test does not allow us to conclude that adoption is linked to dietary diversity. Figure 23 shows a surface analysis of the comparison between adopters and non-adopters.

Table 7 presents a deeper analysis of the issue. The Chi-Score statistic here is 3.119, 4 degrees of freedom, and the p-Value is 0.538. We are testing at the 5% level of significance (alpha = 0.05). Now, since 0.538 is greater than the alpha value, our result is not statistically significant and we will retain our null hypothesis which says that there is

no association between adoption status and dietary diversity, ***being an adopter in itself does not really affect one's dietary diversity.*** Even if a Chi-Square test is done to test whether at least there is an association between adoption status and being within borderline or poor FCS category, the result remains the same, there is no association at all at the present moment.

Table 7: Is FCS Related to Adoption Status

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	3.119	4	.538
Likelihood Ratio	3.089	4	.543
Linear-by-Linear Association	1.943	1	.163
N of Valid Cases	809		

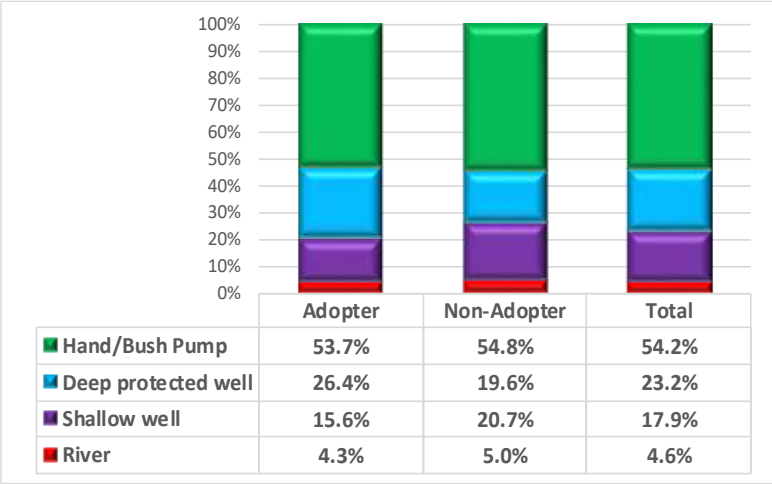
Since we have data for the duration a household has practiced CSA, an attempt was also made to test whether duration of practice could be related to the FCS category but once more, the results showed that there is no relationship. It therefore appears that there is more to the explanation of a household's FCS category than just adoption.

4.3.3 Basic Household Assets Ownership.

The CSA is anticipated to lead to improved wellbeing of Zambian farming families who depend on field-scale, rain-fed agriculture. One domain where such improvements could be noticed should be in their basic living conditions. To that end, two general areas were considered, *viz*, ownership of basic domestic assets, and water and sanitation access.

In terms of water and sanitation, it appears that there are agencies that have successfully managed to even the ground and remove any noticeable differences between adopters and adopters. As shown in Figure 24, an investigation into to the households' water sources did not yield much differences. It appears that water interventions by other agencies have done very well as most households are accessing domestic water from either a bush pump or from a deep protected well

Figure 24: Access to Clean Water

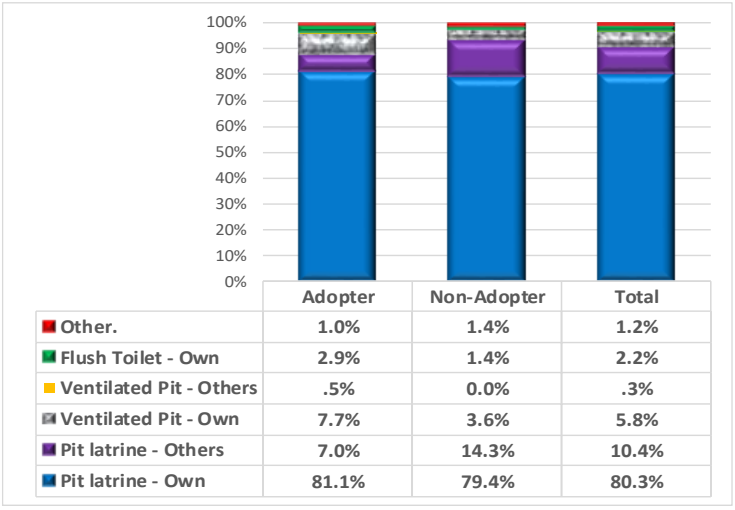


	Adopter	Non-Adopter	Total
Hand/Bush Pump	53.7%	54.8%	54.2%
Deep protected well	26.4%	19.6%	23.2%
Shallow well	15.6%	20.7%	17.9%
River	4.3%	5.0%	4.6%

Even a Chi-Square test could not dispute the fact that ***there is no difference between an adopter and a non-adopter in terms of accessing clean water sources***.

Even though a Chi-Square test for household access to sanitation facilities seems to suggest that adopters are more likely to have more hygienic sanitation preferences, that result is more likely to have been influenced by ownership of the sanitation facility than by the use. Figure 25 shows that the majority of households in each adoption strata mainly uses a pit latrine of their own, even though more non-adopters tend to use one that is now owned by the household.

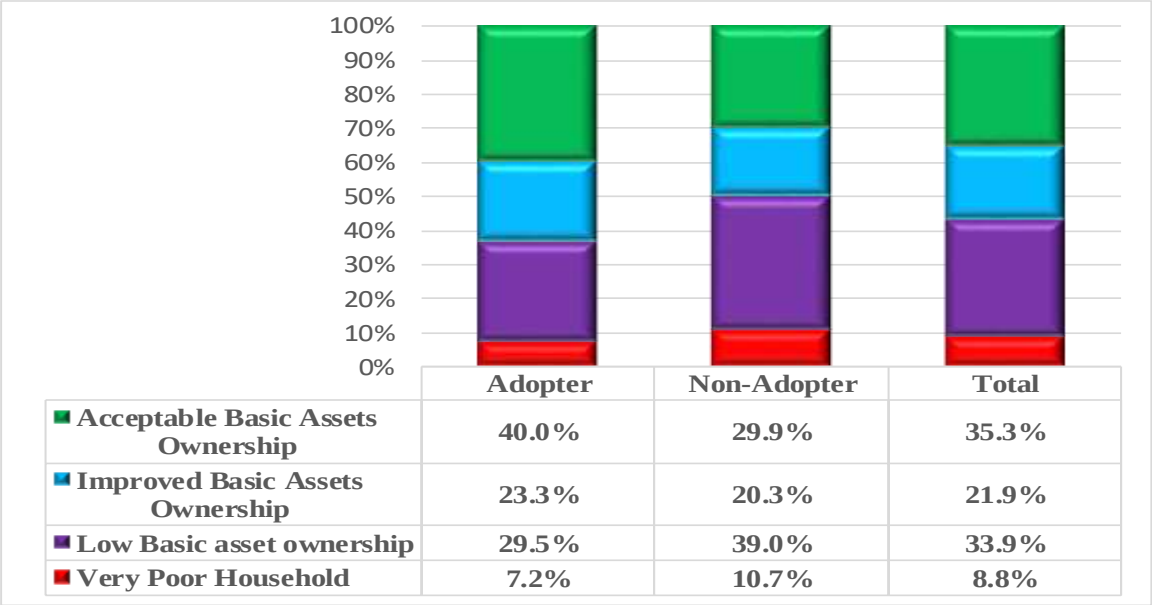
Figure 25: Sanitation Facility Used by Household



	Adopter	Non-Adopter	Total
Other.	1.0%	1.4%	1.2%
Flush Toilet - Own	2.9%	1.4%	2.2%
Ventilated Pit - Others	.5%	0.0%	.3%
Ventilated Pit - Own	7.7%	3.6%	5.8%
Pit latrine - Others	7.0%	14.3%	10.4%
Pit latrine - Own	81.1%	79.4%	80.3%

The main difference in terms of living conditions was mainly noticed in ownership of basic household assets. The survey investigated the living conditions to establish whether or not adopters have better living conditions than non-adopters. Five basic assets (an iron/asbestos roofed house, a bed with a mattress, some basic household furniture, a basic entertainment sets; TV or radio, and at least one Cell phone in the Household) were considered and a household with none of these 5 was considered to be having a very poor living style, those with at most two of these assets were simply taken as being in the category of "Low basic assets ownership", those with 3 of the assets were considered as having an "Improved basic assets ownership" and those with 4 or 5 assets were the best category and considered as having the "Acceptable basic assets ownership". Figure 26 shows that results are that Adopters are doing better than non-adopters in terms of basic living conditions as 40.0% of the adopters are in the "Acceptable Basic Assets Ownership" category while only 29.9% of the non-adopters are in that category. To make sure of this, a Chi-Square test for significance of this result was also carried out.

Figure 26: Household ownership of Basic domestic assets



	Adopter	Non-Adopter	Total
Acceptable Basic Assets Ownership	40.0%	29.9%	35.3%
Improved Basic Assets Ownership	23.3%	20.3%	21.9%
Low Basic asset ownership	29.5%	39.0%	33.9%
Very Poor Household	7.2%	10.7%	8.8%

Table 8 shows the results. The Chi-Score statistic here is 14.287, 3 degrees of freedom, and the p-Value is 0.003. We are testing at the 5% level of significance (alpha = 0.05). Now, 0.003 is less than the alpha value. Our result is statistically significant and we will fail retain our null hypothesis which says that there is no association between is no association between adoption status and basic assets ownership. In fact, ***being an adopter predisposes one to accumulate sufficient basic assets and graduates one from being considered as being a very poor household to an improved assets holding household***.

Table 8: Chi-Test for Assets ownership

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	14.287[a]	3	.003
Likelihood Ratio	14.324	3	.002
Linear-by-Linear Association	13.528	1	.000
N of Valid Cases	781		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 32.16.

4.4 Some Other Pertinent Issues

4.4.1 Farmer Satisfaction with CFU Services.

The survey also sought to establish the perception of farmers' satisfaction with CFU services in general. This was important as these perceptions help shape adoption patterns as well as continuity of practice after the project has come to an end. The aim was to find ways of improving programming during the current CSAZ Project and for future CFU implemented projects. It was thought that farmers would be affected by social desirability and present

a very positive but untrue picture of their actual sentiments towards the CFU. However, some very constructive critical appreciation came out and is hereby worth presenting.

On the negative side, some farmers noted that the CFU could do better by considering the following:

- ✓ CFU does not find markets for adopters and yet the practices are already known to ensure that farmers get higher production.
- ✓ The majority of farmers are used to government and other development agencies certified (free) inputs. But the CFU simply trains and advices farmers without giving farmers anything (free inputs) to ensure they put what they have learnt into practice, not even subsidies for input acquisition. This makes farmers wait for the usually delayed free inputs from other agencies and this does not tally with the CSAZ advice on early planting. (In addition, the longer they wait, the more the weeds infestations).
- ✓ CFU staff (not Farmer Coordinators who are fellow villagers) are not really visible. Farmers are hungry to have direct contact with these during the duration of the project and not just left in the hands of their local FC. Farmers wanted field officers before each activity. Farmers noted that official CFU field monitoring was low and they wanted constant reminders e.g. buy fertilizer now, plant now, weed now.

There were however several positive comments and farmers wanted the CFU to take not of these as well:

- ✓ The CFU was the only organisation in that area even offering some form of solution to improve farmers' lives. CFU lessons led to higher yields from the same portion of land than before and food security. The soils were also being conserved for their children and future generations.
- ✓ The CFU is very strong on training and this is very unlike other organisations (names provided) that only bring inputs as loans without any form of training. Such organisations are making profits without really empowering farmers. Government's FISP e-Voucher is no better as the inputs always come late and (CSAZ) trained end up using recycled seed.

4.4.2 District Agricultural Coordination Officers' Key Observations.

The survey noted that one of the key partners in the promotion of CSA as well as sustainable practice of the technologies were the DACOs. It was therefore important to extract some key observations from this group of stakeholders. Key observations that came from the DACOs that the CFU should consider in future programming were as follows:

- ✓ There should be a lot of stakeholder engagement as some agencies are sometimes conveying a different (technically) messages. Such divergent messaging includes teachings to the effect that herbicides/pesticides/ chemical fertilizers are bad for the soils; digging of basins should be on top of a ridge; and farming in "God's Way" does not always emphasise on the correct basin dimensions.
- ✓ While the DACOs are trying to find ways of harmonising CSA approaches within districts, all promoters should also see out each other and come to an agreement.
- ✓ By and large, the uptake of CSA is low mainly because there is low utilization of ADP services for ripping' low levels of mechanization as the few available tractors are either too expensive for small

holder farmers or are availed late after the bigger conventional farmers (and these pay very well) have released them; basin tillage is labour intensive and is only being practiced on smaller plots and mostly by poorer farmers who cannot afford ripping.

- ✓ The impact of CSA on the few adopters remains low because they were not following the **full package** of the technology. Giving incentives to farmers was a wrong way of empowering them because once the incentives stopped, they also stopped implementing.
- ✓ Marketing of produce (and related value chain, post production issues) should be a strong component of programming. Middle-men are ripping off farmers as they offer immediate cash incentives while government buyers are late in advising the prices (albeit initially lower prices than that of the middle-man).
- ✓ Government buying points are also not sufficiently decentralised to allow farmers to easily sell produce without incurring great transportation costs.

5. CONCLUSIONS, LESSONS LEARNT, AND RECOMMENDATIONS

This was the first Post-Harvest/ Outcomes survey under the CSAZ project and several pertinent issues could be drawn from the findings.

5.1 CONCLUSIONS

This subsection focusses on drawing out conclusions that can furnish us with values for Outcome indicators as per the CSAZ Logical framework. The major conclusion from this study is that CSA provides farmers with an opportunity to improve agricultural livelihoods as well as wellbeing. With reference to the Outcome indicators in the CSAZ Lofgrame, from survey findings we can conclude that:

- ***Outcome Indicator 2.1: Margin of difference between the average yield of adopters and that of conventional farmers (Disaggregated by tillage type)***
  - Basin farmers' average yield was 51% **higher** than that of hand-hoe ridgers/ diggers,
  - ADP ripping adopters' yield was 19% **higher** than that of ADP ploughing conventional farmers.
  - For Year 1, Mechanising adopters was in fact 9% **lower** than that of mechanising non-adopters.
- ***Outcome Indicator 2.2: Margin of difference between the average production of adopters and that of conventional farmers (Disaggregated by tillage type)***
  - Hand hoe basin adopters are likely to harvest 7% more than comparable conventional hand hoe farmers.
  - ADP ripping adopters are more likely to harvest 38% more maize than the ADP ploughing conventional farmers.
  - Mechanised ripping farmers are likely to harvest 28% more maize produce than conventional tractor ploughing farmers.
- ***Outcome Indicator 2.3: Margin of difference between the proportion of time spent by women on On-farm activities.***
  - Contrary to expectations that adoption would free up time for women adopters and allow them to use that freed up time on other off-farm (both in pursuit of other livelihoods and for leisure and relaxation) activities, women adopters actually use up to 36.6% more of their time on on-farm activities than they did before adoption.
- Other indicators of interest:
  - Cereal sufficiency (a proxy for food security) is more likely among adopters than among non-adopters. The reverse is also true; shortage of cereal among households is more likely among non-adopters than among non-adopters
  - However, being an adopter in itself does not really affect one's dietary diversity.
  - Being an adopter predisposes one to accumulate sufficient basic assets and graduates one from being considered as being a very poor household to an improved assets holding household.
  - There is however, no difference between an adopter and a non-adopter in terms of accessing clean water sources.

5.2 LESSONS LEARNT

Two major lessons clearly emerge from what has been observed this study. These are:

- Holistic programming dictates that focussing only on the production side of food security may not always lead to exploitation of the full benefits of CSA.
- Operating in silos and thereby ignoring the influence of other significant promoters of CSA may in fact threaten adoption patterns and limit the impact of CSA technologies

5.3 RECOMMENDATIONS

The survey findings led us to the following recommendations:

- Since literature is awash with evidence to the fact that CSA does improve yields/production, the CSAZ/CFU should urgently find innovative ways of improving market intelligence for marketing of excess produce while at the same time advising households not to excessively sell their cereals and undermine household food security.
- CFU presence in the villages should not be left only and largely in the hands of the Farmer Coordinators but as much as possible, Field Officers should complement the work of FCs particularly in the more remote areas away from the proximity and comfort of urban and peri-urban locations.
- There is need for an active policy advocacy on the part of the CSAZ in order to influence both harmonisation and standardisation of CSA practices.
- There also is need for an active policy advocacy on the part of the CSAZ in order to influence both early disbursement of FISP inputs, timely and realistic gazetting of viable producer prices, as well as decentralisation of FRA collection points to the advantage of small scale producers who should then be encouraged to pool their produce to make the establishment of a collection point economically sensible.