Conservation Farming Unit

CONSERVATION FARMING & CLIMATE SMART AGRICULTURE

CSAZ OUTCOMES SURVEY REPORT

2017/2018 AGRICULTURE SEASON.

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Key Outcomes survey findings for Year 2 of the CSAZ Programme - 2017/18 Farming season.

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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 of 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 16 out of the 35 districts and in all the four areas of CFU operations in Zambia. The sample size was 983 (505 adopting and 478 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 and gender of household head)***
  - Basin farmers' average yield 60.5% (Female headed HH reached 87.3% above the yield of conventional female headed households and Male reaching a margin of 52.6% above the yield of conventional male headed households),
  - ADP ripping adopters' yield was 93.0% (109.0% Female headed HH, and 90.1 Male headed HH),
  - For Year 2, Mechanising adopters are performing better than conventional tractor farmers by 111.9%
- ***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 surpass hand hoe ridging farmers by 91.6% (Females = >300% and Males 64.3%),
  - ADP ripping adopters are 87.0% above (Females 85.8%),
  - Mechanised ripping farmers' production was beaten by that of conventional tractor farmers by a margin of 18.9%, there were no female headed households for comparison.
- ***Outcome Indicator 2.3: Margin of difference between the proportion of time spent by women on On-farm activities.***

- Adopting women farmers are investing 4% more time towards on-farm activities (in the previous year the figure was as high as 36.6% and hence this is a vast improvement

The main lessons learnt from this study are that:

- ✓ CSA attracted people who have a keen interest in improving their lot due to their various socio-economic experiences/ hardships, such people will invest all possible energies towards what they have come to appreciate as the best value for their efforts and time, hence women adopters investing more time towards on-farm activities than their counterparts (non-adopters).
- ✓ Output marketing remains an area needing continued exploration as it is riddled with a plethora of challenges. Well established produce buyers are also trying to cut costs and when they find especially the road infrastructure threatening to push up costs, they would naturally pull back and a blame game will not help the ordinary farmer.
- ✓ In some areas, even when faced with increased production, villagers' minds have been overshadowed by the drudgery of everyday pain and suffering cycles of poverty. They seem not to wake up to the possibilities improving their lot and continue in that state of lethargy until death.

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

- ➢ The CFU needs to ensure that CSA technologies should make adopters enjoy more of the benefits than dread the work by continuing to be innovative around access to resources that reduce strenuous physical labour such as hand hoe weeding.
- ➢ The CSAZ project should take note that engaging farmers should be an all year round activity instead of June to March (ending with field days). The engagement should go beyond the post-harvest realities; initial storage before shelling, shelling, grain protection, packaging, aggregating and marketing.
- ➢ The CSAZ should seek ways of engaging proactively with state and private players towards permissive market infrastructure, this is a priority.
- ➢ There is need for the project to open farmers' minds to the possibility of improving their quality of life While the project has mainly focused on the production part of the value chain where farmers have more income due to high yields attained through improved farming technologies, there is need to encourage farmers to interpret the benefits gained by improving their livelihoods and indeed their homesteads

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 Programme (CSAZ), provides trainings to an outreach of over 250,000 farmers annually across four (4) of the CFU's areas of operation, namely: Central, Eastern, Western and Southern regions. 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. 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 were also conducted in 2017. Now in 2018 as this study was underway, a similar (third year training) started for the 2017/2018 season with Period 1 and Period 2 already conducted and Period 3 commencing around mid-October 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 1 and 2 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 that were between adopters and non-adopters of the CF technology as far as productivity, yield and food security were concerned.

The CFU's CSAZ Theory of Change (ToC) outlines how training farmers leads to adoption and other higher indicators such as yield increase and food security. The Outcomes (Post-Harvest) Survey focuses on tracking progress in the higher end Logframe indicators of production, yield, and time usage by comparing adopting and non-adopting farming households. The project is guided by at least three themes in its theory 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 households adopt CSA technologies, then they will achieve improved livelihoods and food security compared to those that have not adopted.***

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 (MT), Conservation Tillage (CT) and Conservation Farming (CF), and that they do this over time 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 as opposed to overall digging with a hoe, or ridging), Animal Draught Power (ADP-Ripping as opposed to ADP ploughing) and Mechanisation (Tractor Ripping as opposed to Tractor 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 farmers trained in 2017 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 2017/18 cropping season. Nevertheless, 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.

- ✓ 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.
- ✓ 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 2017 CSAZ trained farmers who had adopted the CA technology (harvested in 2018) 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 16 randomly selected districts - Mkushi, Mpongwe, Chibombo, Mumbwa, Itezhi-tezhi, Kaoma, Namwala, Choma, Pemba, Monze, Kafue, Chongwe, Nyimba, Lundazi, Petauke, and Chadiza. In addition, only Field Officers (FOs), Farmer Coordinators (FCs) and farmers from the sampled districts were eligible to participate in the survey.

1.5 CHALLENGES

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 to follow some farmers to their fields or call back at a later time.

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 farms are far from the village because of lack of agriculture land within the vicinity as well as keeping animals like goats that tend to eat their crops. Plans were made to later on drive to such fields so that measurements could be taken. 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) especially for tractor tillage. 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.

2.0 STUDY METHODS

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 (FGDs) and open-ended discussions with Farmer Coordinators (FCs) were used. A third tool was the Key informant interview that was administered to District Agriculture Coordinators (DACOs) and Camp Extension Officers (CEOs), both from the Ministry of Agriculture. Qualitative methods were conducted by the RM-M&E 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 2017/2018 farming season. The sampled adopting farmers came from the lists of adopters from the 2017/2018 season and was equally spread across all sampled districts. These were farmers who were trained by the CFU under CSAZ in the 2017/2018 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 out in each of the four CSAZ regions particularly in the sampled districts for the Outcomes Survey 2017/2018. FGDs were administered to a group of female farmers 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 previous seasons, challenges experienced in crop production and ensuring household food security, challenges experienced in accessing of inputs and marketing of 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 Extension Officers (CEO), 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

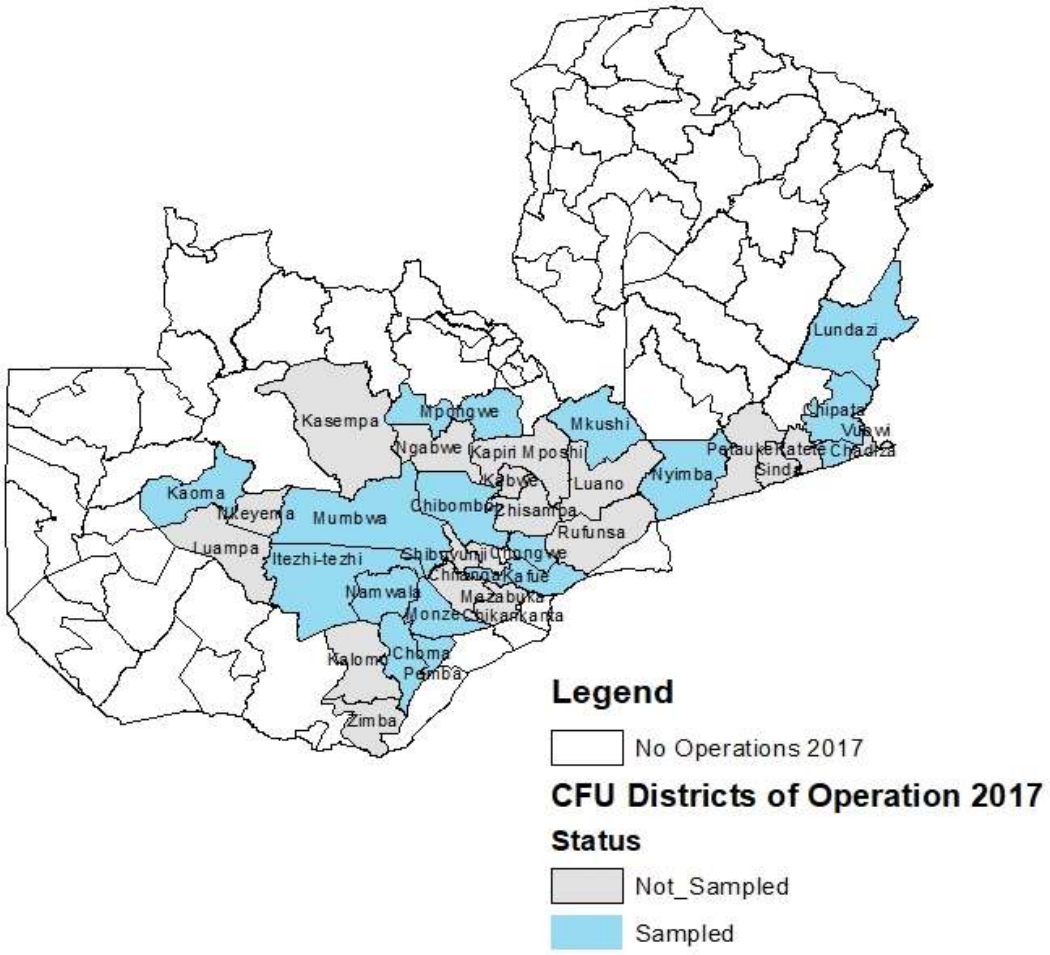
All the CFU regions were taken as part of the sources of data. Sampling was three-tiered: Purposive sampling of 16 out of the 35 districts within these regions was done in order to ensure a geographical spread of data points and information. From each sampled district, a random sample of Field Officers (FOs) and Farmer Coordinators (FCs) was then 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 2017. 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. The non-adopting households here were those strictly not to have any plot under CA as these would have made them adopters, albeit partial adopters. 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

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 1: Sampled Districts



As is shown in Figure 2 above, the Outcomes Survey was carried out in all four CFU CSAZ regions.

2.3 DATA MANAGEMENT

Data was collected by 14 Research Assistants (RAs). These 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 Kabwe area of Central Region. All RAs recruited were computer literate, possessing sufficient prior experience as the CFU now has a pool of such people that have participated in previous surveys.

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 7.1 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, not allowing a Research Assistant to proceed if a question that must be answered was skipped 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 2017/2018 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. 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 2017

Table 1 below represents the official tally of unique farmers trained under the CSAZ during Year 2.

Table 1: Farmers Trained under the CSAZ in Year 2

Log Frame Output Indicator 2.1 – number of farmers trained in climate smart agriculture practices		
2017 Target	**Achieved**	**% of target achieved**
216,000 (Of which women: 45%)	259,251 (122,444 or 47.2% women)	20% above target (Women = 26% of target)

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 2017/18 season, **35,427** of the trained farmers who adopted CSA had not used the technology before the 2017/18 season while **36,115** were continuing adopters who had used a CSA technology prior to the 2017/18 season. For both new and old adopters, the survey showed that 106,293 of the trained farmers adopted minimum tillage during the 2017/18 cropping season. All in all, the adoption survey established the following:

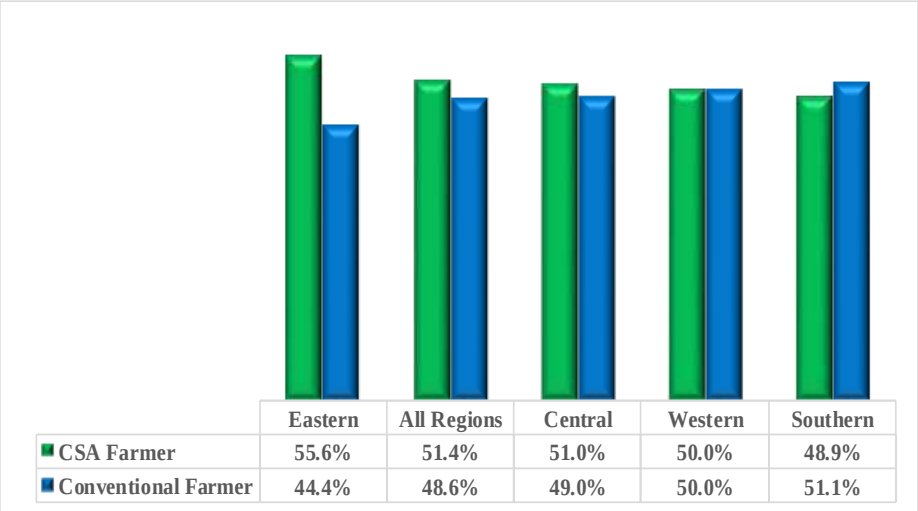
- ✓ **Output indicator 1.1:** The total number of unique farmers trained in 2017 came to **259,251** farmers (surpassing the annual target of 216,000 by 20%). Of these, 136,807 (52.8%) were males and 122,444 (47.2%) were females.

- ✓ **Output indicator 1.2:** Post training, 97.6% of farmers trained were in the "Good" CSA Knowledge category in P1, whilst 81.2% and 91.7% of the farmers trained were in the "Good" CSA Knowledge category in P2 and P3 respectively, the average being **90.3%.**
- ✓ **Output indicator 2.1:** Total number of adopters during the period under review was 106,293 households. From these, the CSAZ Logframe had set a milestone of 32,295 to be completely new adopters. The actual achievement was in fact 35,427 new adopters and thus reaching 10% above the target. A total of 36,115 farmers (against a target of 20,305) farmers have continued using MT from one season to the next. This is a phenomenal achievement of 78% above the set target. Of these sustained adopters, 51.0% (18,419) farming households were Old farmers trained before CSAZ and the rest were New farmers that were first trained in 2016.
- ✓ **Output indicator 2.2:** Area of land under MT was 106,293 Ha surpassing a set milestone of 34,160 Ha. Area of land under CT however fell below the set milestone of 20,500 Ha and only reached 12,453 Ha as maintenance of soil cover continues to trouble farmers due to reasons explained in the Adoption report.
- ✓ **Output Indicator 2.**3: Number of farmers using ADP and Mechanised tillage (disaggregated by draught power). A total of 42,198 households used own animals for ripping and 11,161 households resorted to hiring animals for ripping. The 2017/18 milestone for ADP was 4,400 households but had not specified whether or not this was hired ADP or own. As for Mechanised, a total of 3,295 farmers used tractors for ripping. The 2017/18 milestone was set at 6,500 households using mechanised ripping services.
- ✓ **Output indicator 2.4:** 44,371 farmers (representing an achievement of 129.8%) who were trained in 2017, used herbicides regardless of their adoption status therefore achieving and ultimately surpassing the set milestone for Year 2. However, if focus is placed only on adopters, the proportion of adopters using herbicides was 65.1% achievement

3.2 Profiling Sampled Farmers.

3.2.1. Adopters and Non-Adopters.

Figure 2: Proportion of Adopters and non-Adopters by Region

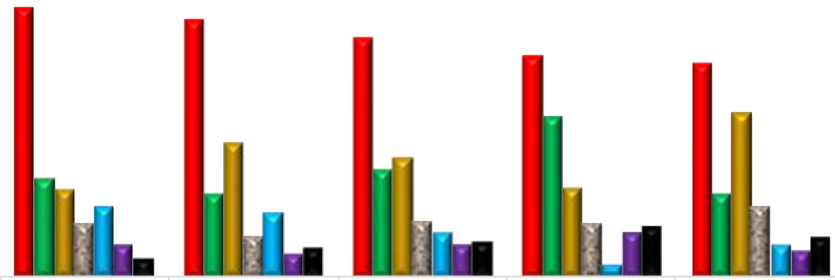


	Eastern	All Regions	Central	Western	Southern
CSA Farmer	55.6%	51.4%	51.0%	50.0%	48.9%
Conventional Farmer	44.4%	48.6%	49.0%	50.0%	51.1%

Figure 2 shows that sampling efforts to ensure that there is balance between adopting and non-adopting households were succsessful as 51.4% of the sample (in all CFU Regions) were adopting households while 48.6% were non-adopting households.

3.2.2 Investigating Consecutive/Sustained Adoption.

Figure 3: Continuity of adoption among farmers



	Southern	Central	All CFU	Western	Eastern
HH NEVER HAD A CA PLOT	43.0%	41.0%	38.3%	35.2%	34.0%
MORE THAN 3 SEASONS	15.6%	13.3%	17.0%	25.4%	13.3%
Current SEASON (2017/18)	13.9%	21.3%	18.8%	14.1%	26.1%
Current and Previous Season	8.4%	6.4%	8.6%	8.6%	11.2%
Current and Previous 2 Seasons	11.0%	10.0%	6.9%	2.0%	5.0%
HH ONCE ADOPTED BUT NOT ANY MORE	5.1%	3.6%	5.0%	7.0%	4.1%
IN-AND-OUT ADOPTER/ Not adopter last season	3.0%	4.4%	5.4%	7.8%	6.2%

The teaching around CSA technologies is that 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 investigated continuity of adoption and profiled respondents so as to later on find out whether or not production is related to continuity of adoption. Figure 3 shows that the sample was constituted of 38.3% households that had never adopted at all while 17.0% of the households were adopters that had more than three seasons of adoption. It is also important to note that 5.4% of the sample was constituted by "on-and-off" adopters.

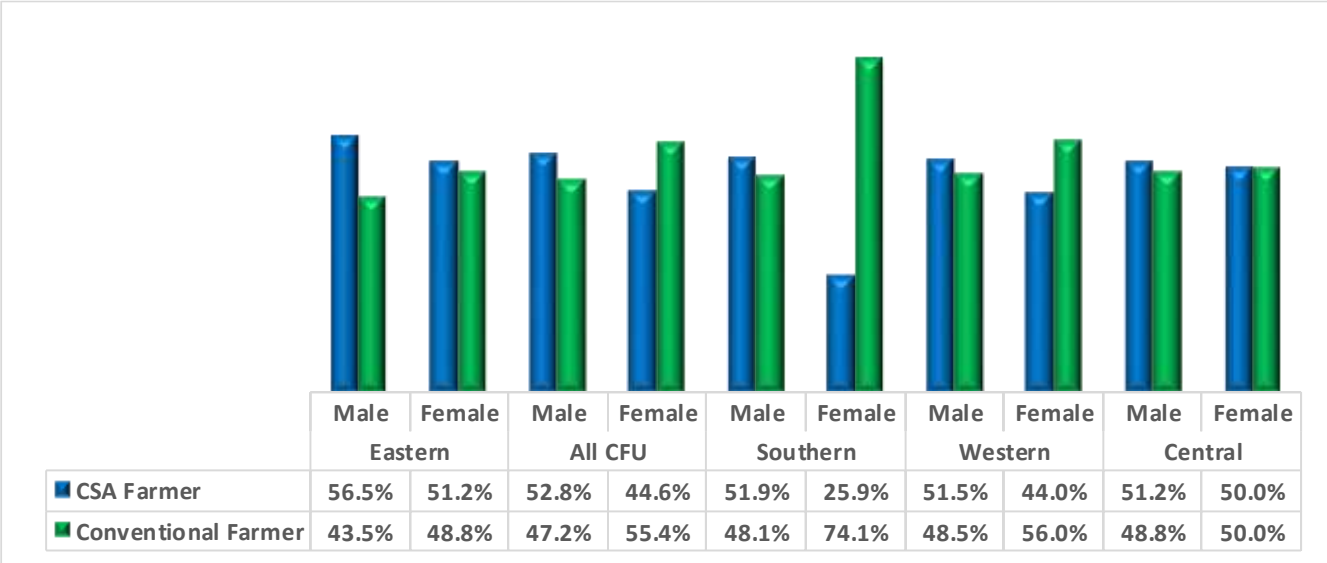
3.3 Household Characteristics and Demographics.

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 Age of Household head.

Results of the findings show that out of a sample size of 983 households, most households were male headed (83.1%) with only 16.9% of the HHs being headed by females. Comparing adopters and non-adopters, female HH heads that went on to become adopters were also less (44.6% of female headed households) than non-adopters (55.4% of female headed households). Adoption viewed in relation to the gender head of household (globally) suffers a set-back in Southern Region where only 25.9% of the sampled female headed households there are adopters while the rest (74.1%) are conventional farmers (See Figure 4 below).

Figure 4: Gender and Adoption Status of HH Head

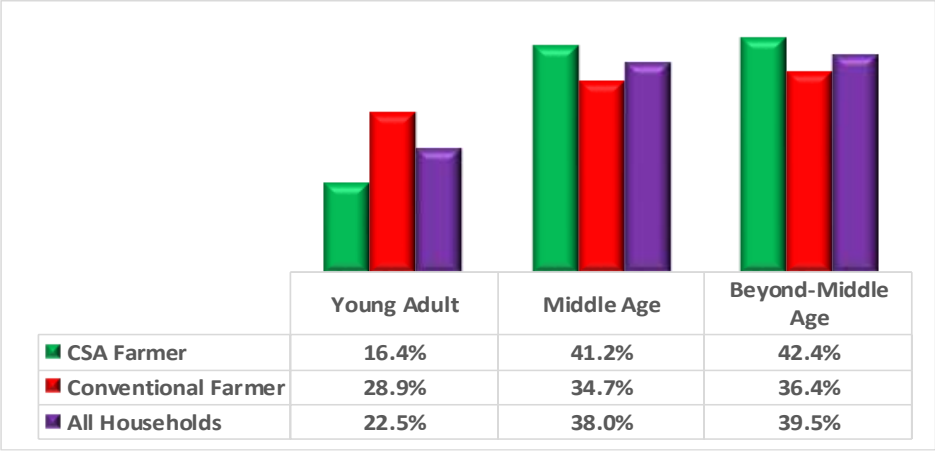


	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
	Eastern		All CFU		Southern		Western		Central	
CSA Farmer	56.5%	51.2%	52.8%	44.6%	51.9%	25.9%	51.5%	44.0%	51.2%	50.0%
Conventional Farmer	43.5%	48.8%	47.2%	55.4%	48.1%	74.1%	48.5%	56.0%	48.8%	50.0%

Figure 4 also shows that from the sample, the highest female headed adopting households are most likely to be found in Eastern Region (51.2% of all female headed households) and the lowest in Southern Region (25.9%). Even though the study did not focus on inter-Regional differences, one can still surmise that the comparatively higher participation by women in the Eastern Region in CFU trainings compared to men is carried through even to levels of adoption while the opposite is true in Southern Region (the proportion of women attending trainings in Eastern has traditionally been above 50% while in Southern it has been below 49%).

Just as the gender of HH head, various studies in poverty analysis have shown that there is an extent to which age of household head may determine household productivity status. Later on we will test the hypothesis that as Age of HH head increases, production levels also increase. The socio-economic thinking here is that the older HH head makes better production decisions and is better resourced and efficient in the use of resources than the younger HH Head.

Figure 5: Age of HH Head



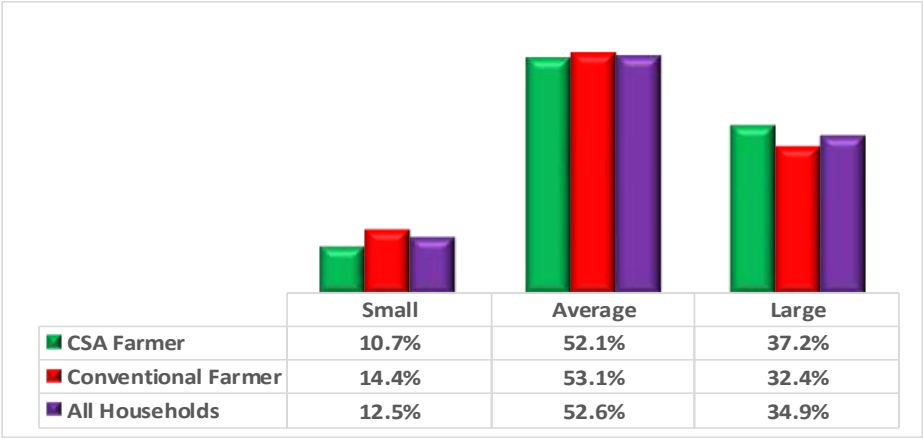
	Young Adult	Middle Age	Beyond-Middle Age
CSA Farmer	16.4%	41.2%	42.4%
Conventional Farmer	28.9%	34.7%	36.4%
All Households	22.5%	38.0%	39.5%

Figure 5 shows that overall, the most dominant age of HH head was beyond middle age (above 50 years) and that young adult (18 – 35 years old) HH heads are on average only 22.5% of the population of farming households in the Regions.

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. Even though larger HH sizes may imply more labour availability, it also means more mouths to feed, more school children to send to school (… more resources required) and hence larger households tend to end up being poorer. We will use this variable later for computations of HH food security.

Figure 6: HH Size Category by Adopter Status



	Small	Average	Large
CSA Farmer	10.7%	52.1%	37.2%
Conventional Farmer	14.4%	53.1%	32.4%
All Households	12.5%	52.6%	34.9%

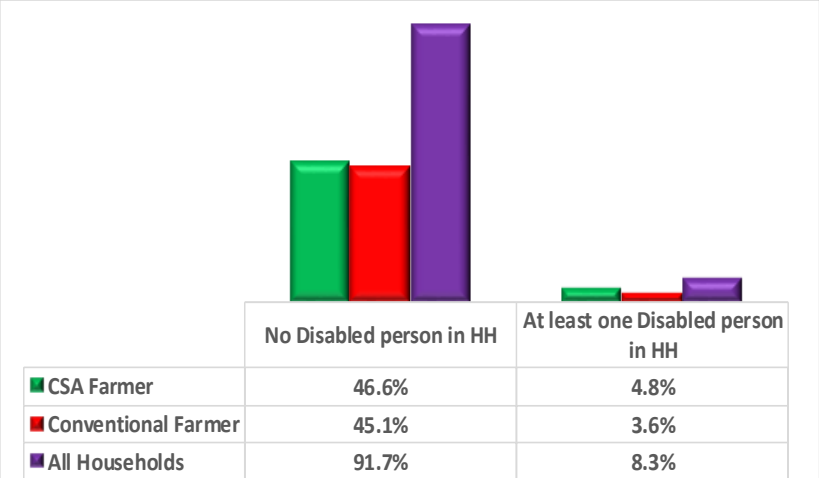
Figure 6 shows that among farming households, small household sizes are uncommon (12.5%) and that the majority of the households are just around the average household size (4 to 7 members) even though in this category one is more likely to find more households (53.1%) among conventional farmers than among adopting households.

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 (that on average, only 1% of the trainees where disabled people). We notice that indeed not all disabled people can attend trainings due to the nature of each individual's disability, but there is a level to which

having a disabled person in a household imposes extra needs of care. Hence we had to assess the presence of disability in farming households.

Figure 7: Presence of disability in Households.

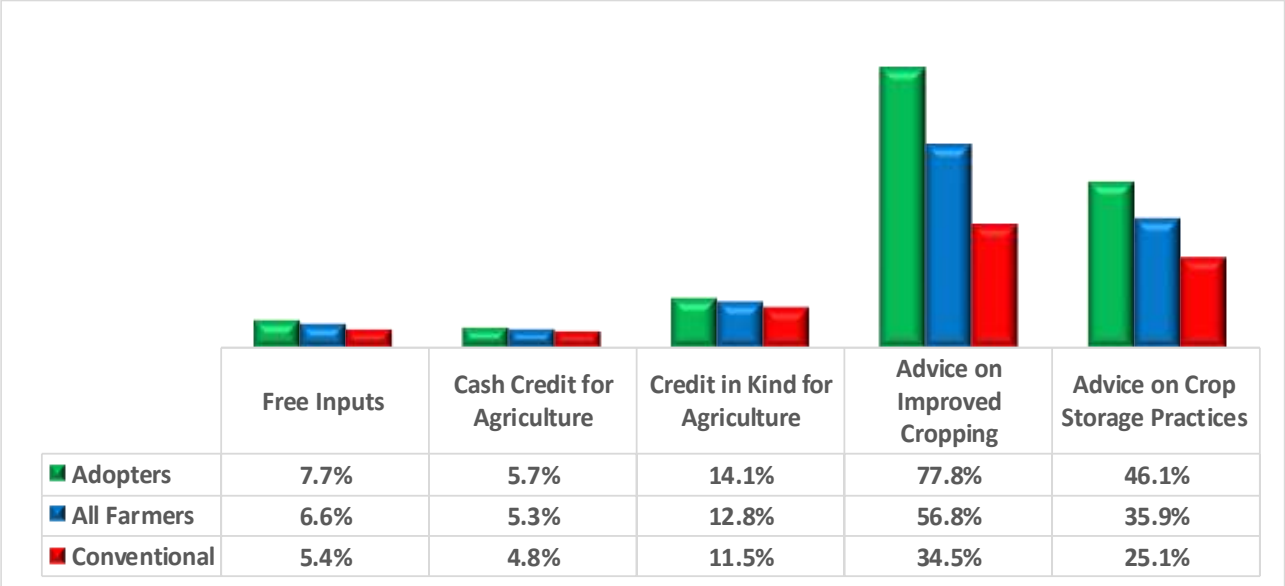


	No Disabled person in HH	At least one Disabled person in HH
CSA Farmer	46.6%	4.8%
Conventional Farmer	45.1%	3.6%
All Households	91.7%	8.3%

Figure 7 shows that even though the presence of disabled people in households is very low, it is more likely to find a disabled person living in an adopting household than in a conventional farming household. This is NOT surprising as adoption is not an aesthetic enterprise but is driven more by felt household pressures on food security and having a disabled household member may in itself propel able bodied members to desire all means possible and enhance productivity.

3.3.4 Provision of Support Services to Farmers

Figure 8: Support Services Received by Farmers (by Adoption Status)



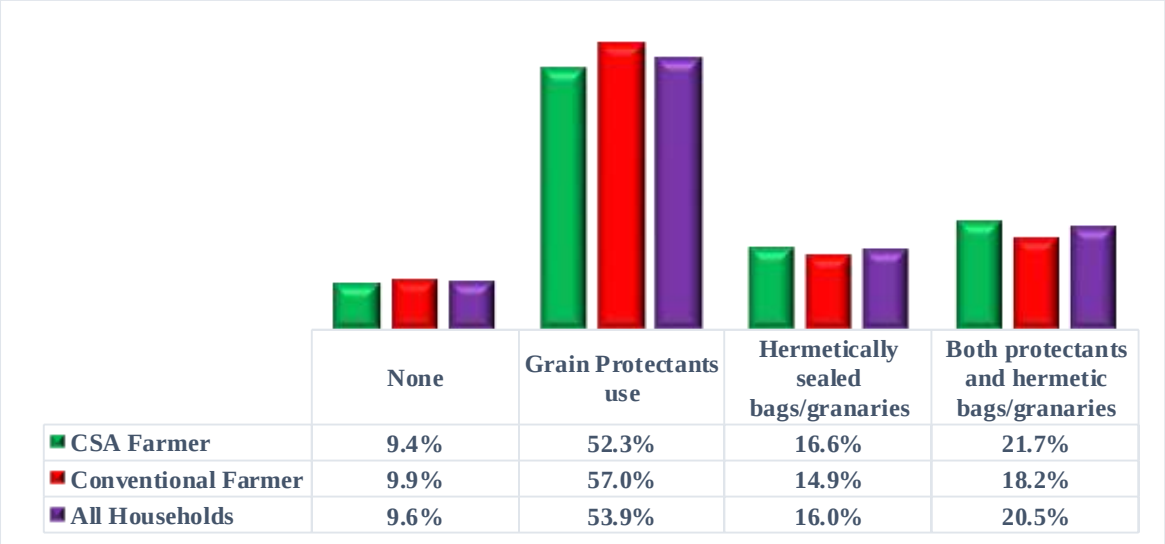
	Free Inputs	Cash Credit for Agriculture	Credit in Kind for Agriculture	Advice on Improved Cropping	Advice on Crop Storage Practices
Adopters	7.7%	5.7%	14.1%	77.8%	46.1%
All Farmers	6.6%	5.3%	12.8%	56.8%	35.9%
Conventional	5.4%	4.8%	11.5%	34.5%	25.1%

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 and post-harvest practices prior to the cropping season. All sampled households were asked questions relating to support services. The responses are shown in Figure 8. It appears that the probability of receiving any kind of service is higher for adopters than for conventional farmers even though, as

noted during the sampling procedures discussion, both types of farmers reside within the same locality. The conclusion is that Adopting households have become smarter in seeking and receiving beneficial information than their conventional counterparts. Whether this has translated to increased productivity is the subject of further analysis in section 4 of this report.

It was also of interest to check whether farmers have taken up some of the advice, particularly on the prevention of post-harvest losses. Note that this question was only raised to those that had reported receiving the specific advice.

Figure 9: Use of Post-Harvest Advice (by Adoption Status)



	None	Grain Protectants use	Hermetically sealed bags/granaries	Both protectants and hermetic bags/granaries
CSA Farmer	9.4%	52.3%	16.6%	21.7%
Conventional Farmer	9.9%	57.0%	14.9%	18.2%
All Households	9.6%	53.9%	16.0%	20.5%

Figure 9 shows that within groups, the likelihood of receiving advice and not using it is indeed low, and is comparatively even lower among adopting farmers. The advice mostly used is that of the use of grain protectants. It appears more of conventional farmers use this message (57.0% of conventional farmers that had received the message used it) than among adopters. But then, further analysis showed that 11.5% of these had in fact received this message from the CFU and hence they are either "Selective adopters" or those who once adopted and later on dis-adopted but still kept some of the messaging.

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. Therefore, 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 10: Did Anyone Assist Linking you to Output Market

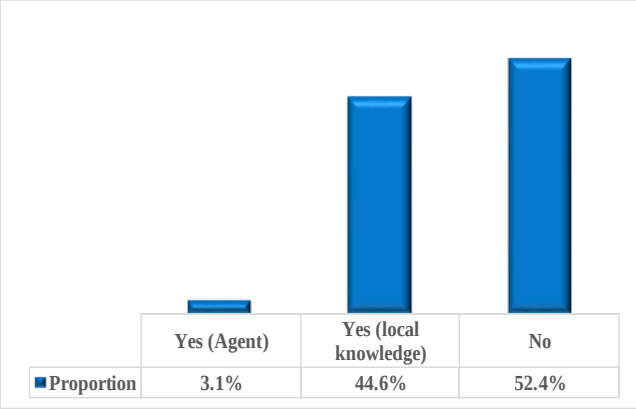


Figure 11: Where is this Market

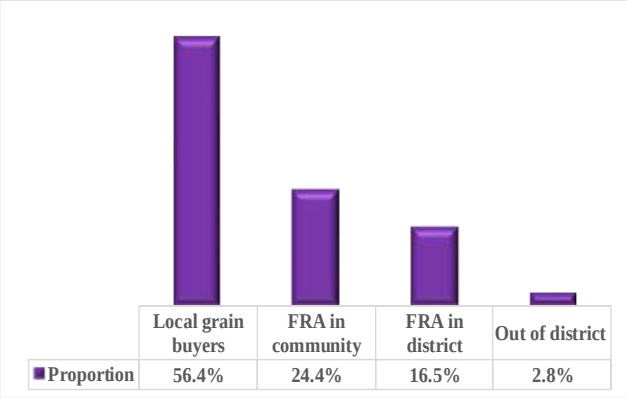
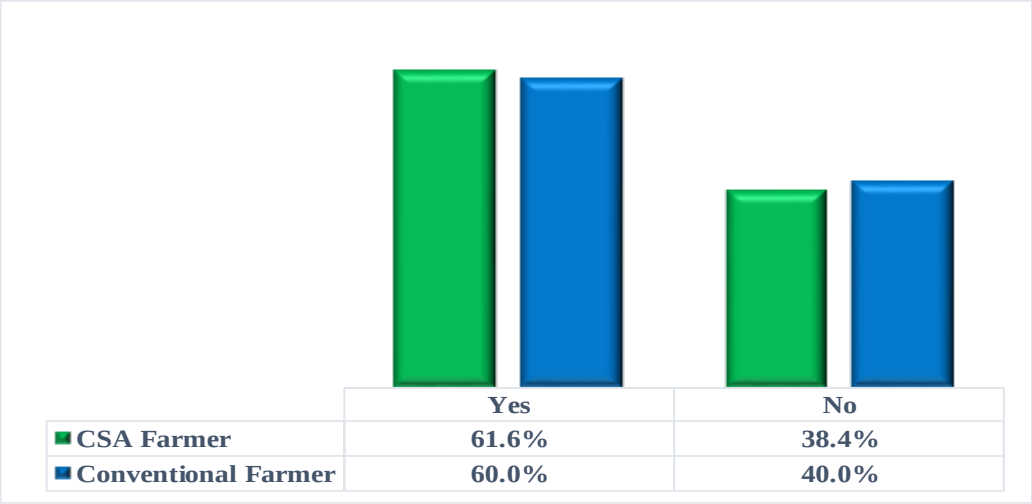


Figure 10 shows that only a tiny minority (3.1%) of the respondents were linked to an output market through some deliberate/intentional action of an agent. The awareness of an output market by a good number of crop sellers was merely through local shared market intelligence (from neighbours). Unfortunately, over 52% of community members were not even aware of the existence of any market for produce either because they had no intention to sell and hence did not bother to look for an output market or production is not output market driven. Figure 12 illustrates the actual output market for those that knew of a Market. It turns out that the main driver behind produce marketing are what has deregotorily been called "briefcase business" buyers (or "Middle-men"). Local grain buyers provide a ready market to over 56% of the target population of CSAZ farmers. Rarely would one find government buyers (FRA) within the community as these tend to seek the comforts of district towns leaving farmers with the burden of transportation costs. Where farmers reported "FRA in community", these were almost always farmers close to the main district town (farmers around Mumbwa, Chongwe, Mpongwe, etc).

Figure 12: Local Grain Buyers Serving Communities

Figure 13 shows that 38 – 40% of the crop sellers blindly go to the market to trade their crops without knowledge of prices. These are mostly driven by urgent need for cash for day to day use and sometimes emergency use such that they would end up selling at any price they find on that day. Again, Figure 13 also shows that there is not much difference in the price knowledge between adopters and conventional farmers. This only suggests that the source of price information is independent of whether one is an adopter or not.

Figure 13: Received Information on Commodity Prices Before Selling?



	Yes	No
CSA Farmer	61.6%	38.4%
Conventional Farmer	60.0%	40.0%

4. INDEPTH ANALYSIS

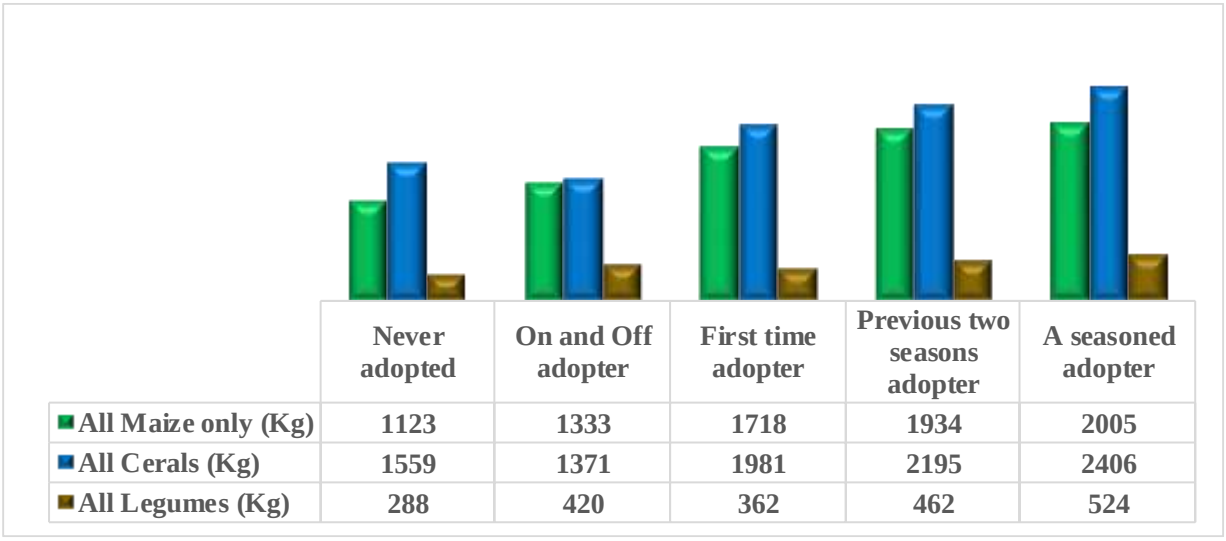
The section will now discuss issues related to production and yield. This is the section where indicator values for the two Logframe outcome indicators will be discussed. The report will also venture into a discussion of impact related issues; household dietary diversity, cereal consumed in the household as a measure of food security, as well as farmer asset base. 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 2 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, even though an attempt was nevertheless made to consider other cereals in section 4.1.1 below. This section will first discuss the findings on households' production and yield before computing the respective Logframe indicators.

4.1.1 General View on Production

Figure 14: Average Production Levels (Kgs) - by Crop Type and Adopter Status



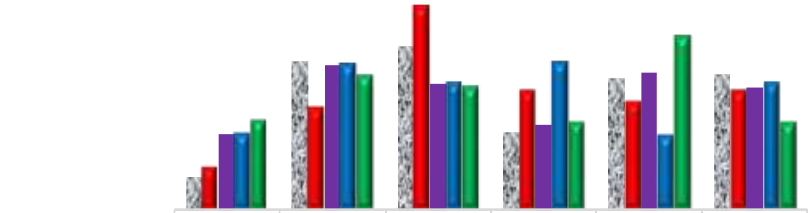
	Never adopted	On and Off adopter	First time adopter	Previous two seasons adopter	A seasoned adopter
All Maize only (Kg)	1123	1333	1718	1934	2005
All Cerals (Kg)	1559	1371	1981	2195	2406
All Legumes (Kg)	288	420	362	462	524

Total households' cereal production ranged from zero to well above ten tons. As shown in Figure 14, there is a steady rise in production levels from non-adopters to seasoned adopters. This is well expected and documented by literature on Conservation Agriculture. It is also worth noting that even legume production also follows the same incremental pattern as adopters are exposed to the teachings promoting legumes for the sake of crop rotation. It is clear from Figure 14 that adoption is highly related to improved production.

4.1.2 Age of HH Head and Production Levels.

In section 3.3.1 we wondered whether as age of HH head increases, production levels would also increase. We will briefly investigate this. Figure 15 below shows the results from a cross tabulation of HH Head category and total cereal production.

Figure 15: Household Head and Total Cereal Production



	CSA Adopter			Conventional Farmer		
	Young Adult	Middle Age	Beyond-Middle Age	Young Adult	Middle Age	Beyond-Middle Age
Up to Half a Ton	9.8%	43.1%	47.1%	22.8%	38.0%	39.2%
Up to One Ton	12.2%	29.3%	58.5%	34.5%	31.0%	34.5%
Up to Two Tons	21.8%	41.8%	36.4%	24.4%	40.0%	35.6%
Up to Five Tons	21.8%	41.8%	36.4%	42.4%	21.2%	36.4%
Above Five Tons	25.8%	38.7%	35.5%	25.0%	50.0%	25.0%

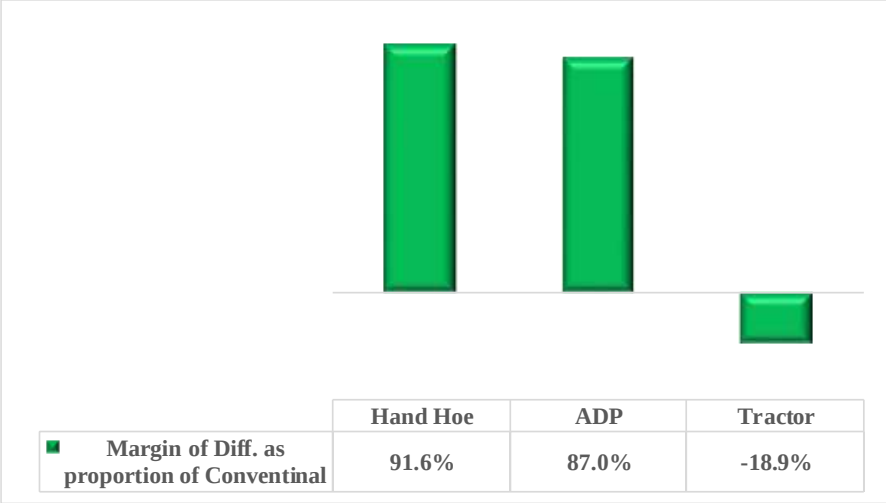
Even though a Chi-square test for the relationship between production levels and age of HH Head was not conclusive, an inspection of Figure 15 shows that for adopters HH Heads in the prime age (middle age of 36 to 50 year olds) production levels of two tons and above are higher than any of the other two groups. The majority of low producers (up to only a ton) are however among the most elderly household heads. For conventional farmers, this pattern is repeated at production levels of up to two tons and above 5 tons. We can surmise that indeed age of HH Head has a bearing towards production; peaking as one reaches prime age and dropping as the HH Heads becomes an elderly head.

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 suggested that being adopter **does** lead to increased production. It is important therefore to establish the indicator values for the relevant Outcome Indicator. Figure 15 shows the results. Note that for indicator values, preference was given to farmers whose fields were actually measured during the survey (this was in accordance with the 2017 Annual review that noted the need for measurements).

Figure 16 confirms the issue already noted; that adoption is highly related to improved production. It however appears that conventional Tractor tillage farmers are producing 18.9% more than adopters. This however is now clear from the socio-economic status of conventional tractor farmers versus their adopter counterparts. In most circumstances, adopters are economically less empowered and rely on the services of TSPs to rip their land and are basically less equipped in several other ways. The point to still note is that adoption is seemingly heralding a breaking of barriers as less privileged members of society are making inroads towards usage of resources considered to be for the wealthier members of the same community around the Zambian farming terrain.

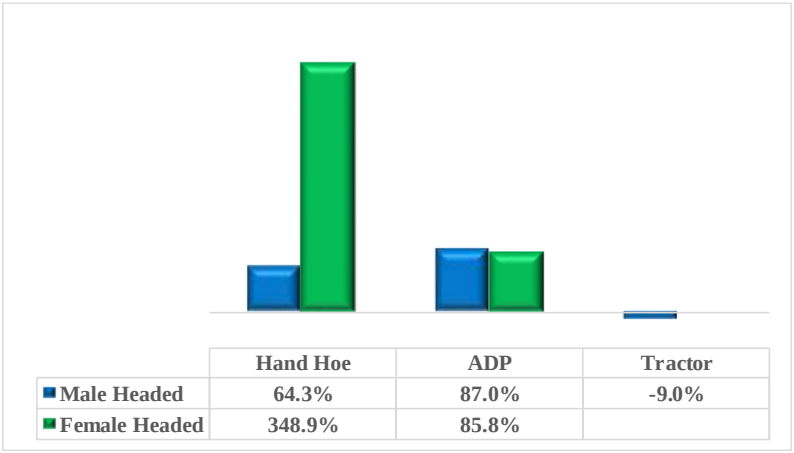
Figure 16: Margin of Difference - Production



This is indeed a good start and given time and more exposure, it is not farfetched to imagine that these so called less privileged would soon ascend higher and make greater impact in terms of contributing to the food reserves of the communities and country.

The 2017 Annual Review also requested that indicator values be disaggregated by gender of household head. Such an analysis is shown in Figure 17. There was no female headed households among conventional tractor ploughing farmers hence there is no comparison there. While both hand hoe and ADP confirm the fact that adoption leads to increased productivity, note the huge margin of difference between female headed hand hoe users where basin farmers are likely to produce way above 300% more than their conventional hand hoe counterparts.

Figure 17: Gendered Margin of Difference - Production



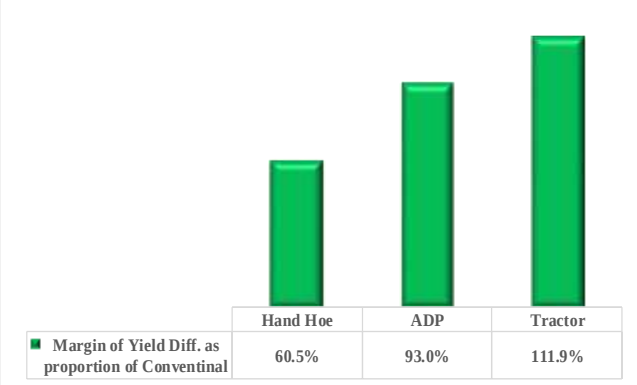
4.2 Yield

As already noted above, 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' fields would be compared hand-hoe ridging non-adopters' fields 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 Outcome Indicator 2.1: Margin of difference between the average yield of adopters and that of conventional farmers (Disaggregated by tillage type)

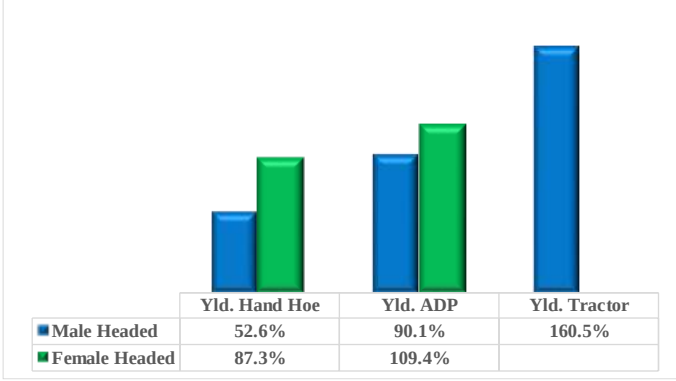
Figure 18 show the general margin differences between the yield of adopters and non-adopters. Again, this was subjected to a gender lens and Figure 19 shows the margins from a gender perspective.

Figure 18: Margin of Difference - Yield



	Hand Hoe	ADP	Tractor
Margin of Yield Diff. as proportion of Conventinal	60.5%	93.0%	111.9%

Figure 19: Gendered Margin of Difference - Yield



	Yld. Hand Hoe	Yld. ADP	Yld. Tractor
Male Headed	52.6%	90.1%	160.5%
Female Headed	87.3%	109.4%	

Even though production among Tractor users was in favour of conventional farmers (they produced more than adopters), as shown in Figure 18, yield data shows that in fact, tractor ripping is a more efficient technology that is likely to produce yields above 100% higher than tractor ploughing. Figure 19 corroborates these findings from a gender perspective by showing that, in addition to what is already known, a female headed household that adopts any CSAZ technology is highly likely to achieve results that are, by comparison, way above those of their female counterparts using the respective conventional package. Note again that the sample did not provide female headed households that could give us a comparison for tractor ripping and ploughing.

Since yield is such a sensitive issue, there was need to conduct further tests to verify if the first line conclusion was correct. The question we now turn to is whether or not the noticed differences in yield are significant and attributable to differences in technology used.

4.2.1 Statistical Difference in the Difference between the Means

This subsection will carry out further statistical tests on the data concerning the differences between mean yields and may be skipped from reading by readers not really interested in this subject. Even though the above discussion suffices, we went further to test for significance in the differences between mean yields. First we will test the hypothesis that there is no statistically significant difference between the mean yield from each CSAZ technology and its comparative conventional technology (H_o = The mean yield of a particular CSAZ technology does not differ from that of a corresponding conventional technology; H_1 = The Mean yields are different). We will use the Independent *t*-Test. Where we conclude that indeed the mean yields are significantly different; we will proceed to measure the effect size; the strength of the difference between the means. We will measure effect size using **Cohen's**

d (or the appropriate modification[1]). Cohen suggested that d=0.2 be considered a **'small'** effect size, 0.5 represents a **'medium'** effect size and 0.8 a **'large'** effect size. This means that if two groups' means don't differ by 0.2 standard deviations or more, the difference is trivial, even if it is statistically significant.

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 in the mean maize yield of basin adopters. Tables 3 shows the results.

Table 2: Basin adopters and Hand Hoe ridgers – Is the observed difference in yields statistically significant?

Group Statistics

Survey Status Recoded		N	Mean	Std. Deviation	Std. Error Mean
Maize Yield in 2018	CSA Farmer	64	2.1524	1.95820	.24477
	Conventional Farmer	33	1.3408	1.28367	.22346

Effect size
Cohen's d = 0.507857.
Hedges' g = 0.470797.

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Maize Yield in 2018	Equal variances assumed	2.764	.100	2.152	95	.034	.81162	.37720	.06278	1.56047
	Equal variances not assumed			2.449	89.450	.016	.81162	.33143	.15312	1.47013

On Levene's Test for Equality of Variances, we note that the significance level is above 0.05, it is 0.1, hence the assumption of equal variances is not upheld and we read our t-test values from the top line. The results show that there was a statistically significant difference between the mean maize yield of Basin adopters (n=64, m=2.152, sd=1.958) and ADP ploughing conventional farmers (n=33, m=1.340, sd=1.283); t95=2.152, p=0.034). The study therefore rejects the (null hypothesis) claim that there is no difference between the mean yield of Basin adopters and that of conventional hand-hoe diggers/ridgers. Available evidence suggests that on average, Basin adopter's yields are different (and significantly higher) from those of hand-hoe diggers/ridgers. Effect size is medium (0.5) and this tallies with what we have already observed from Figure 17 above that the margin of difference is 60.5%.

ADP Practices.

Just as in the case of hand-hoe practices, results for ADP practices show that the difference between the means is significant. Tables 4 shows the results. Levene's Test for Equality of Variances, we note that the significance level is lower than 0.05, it is 0.000 (significant) hence the assumption of equal variances is upheld and we read our t-test values from the bottom line. The results show that the there was a statistically significant difference between the

[1] Cohen's *d* is the appropriate effect size measure if two groups have similar standard deviations and are of similar size. Glass' *delta*, which uses only the standard deviation of the control group, is an alternative measure if each group has a different standard deviation. Hedges' *g*, which provides a measure of effect size weighted according to the relative size of each sample, is an alternative where there are different sample sizes.

mean maize yield of ADP ripping adopters (n=144, m=2.402, sd=2.041.694) and ADP ploughing conventional farmers (n=153, m=1.245, sd=1.111); t218=6.108, p=0.000).

Table 3: ADP Ripping Adopters and ADP Ploughing – Is the observed difference in yields statistically significant?

Group Statistics

Survey Status Recoded		N	Mean	Std. Deviation	Std. Error Mean
Maize Yield in 2018	CSA Farmer	144	2.4021	2.04143	.17012
	Conventional Farmer	153	1.2445	1.11085	.08981

Effect size	
Cohen's d	0.704396.
Hedges' g	0.710305.

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Maize Yield in 2018	Equal variances assumed	16.586	.000	6.118	295	.000	1.15759	.18922	.78520	1.52998
	Equal variances not assumed			6.018	217.889	.000	1.15759	.19237	.77845	1.53673

The study therefore rejects the claim that there is no difference between the mean yield of ADP ripping adopters and that of conventional ADP ploughing non-adopters. Available evidence suggests on average, adopters yield is different (and significantly higher) from those of non-adopters. The magnitude of the difference (effect size) is approaching 0.8 and can therefore be considered as being large (0.5) and again this tallies in with what we have already noted that the margin of difference is 93% (Figure 17 above).

Mechanisation Practices.

Test around Mechanization (Tractor tillage types) continue to be dogged by sample sizes just as observed during the previous season. We only managed to get 4 households willing to participate in the survey and that were also in close proximity (hence ensuring comparability both geographically and all other considerations). This was perhaps mainly because most Tractor ploughing were comparatively affluent and tended to have accumulated larger pieces of land (farms) and settled in areas removed from the ordinary households targeted mostly by the CSAZ. A good number of the tractor ripping farmers in fact do not own the tractors but hire them during land preparation and hence are observed to be people of comparatively lower socio-economic status that somehow managed to access resources for hiring. Now with sample size of 11 and 4 the assumptions of an ordinary parametric t-Test will cause distortions like was seen last year. Table 5 shows both the parametric t-Test results and (in a coloured inserted table) the non-parametric Mann-Whitney U Test for the same question null hypothesis. We will rely on the non-parametric test and therefore reject the null hypothesis. There is in fact a difference between the two means. Available evidence suggests on average, the mean yield from tractor ripping is different from mean yield of tractor ploughing. We already know from Figure 17 that ripping produces a higher yield and this is confirmed by results from the CFU's Trial Plots.

Table 4: Tractor Ripping Adopters and Tractor Ploughing– Is the observed difference in yields statistically significant?

Group Statistics

Survey Status Recoded		N	Mean	Std. Deviation	Std. Error Mean
Comparator's Maize Yield in 2018	CSA Farmer	11	1.8915	1.43864	.43377
	Conventional Farmer	4	.8310	.37546	.18773

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.	Decision
1	The distribution of Comparator's Maize Yield in 2018 is the same across categories of Survey Status Recoded.	Independent-Samples Mann-Whitney U Test	.000	Reject the null hypothesis.

Asymptotic significances are displayed. The significance level is .05.

Independent Samples Test

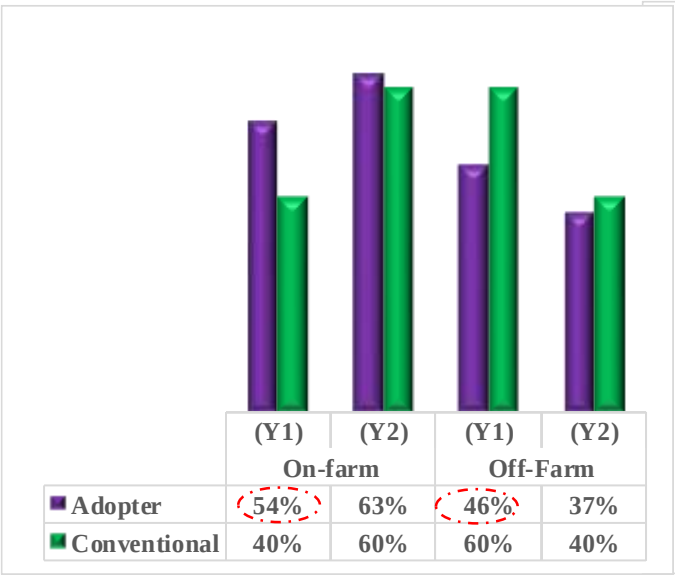
		Equality of		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Interval of the Lower	Interval of the Upper
Comparator's Maize Yield in 2018	Equal variances assumed	3.716	.076	1.425	13	.178	1.06048	.74421	-.54727	2.66824
	Equal variances not assumed			2.244	12.621	.043	1.06048	.47265	.03626	2.08470

4.3 Proportion of Time Spent by Women and Disabled - On-farm Activities.

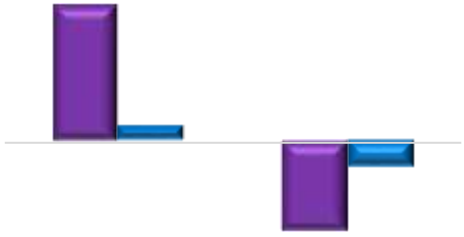
4.3.1. Outcome Indicator 2.3: Margin of difference between the proportion of time spent on On-farm activities

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 Off-farm livelihoods and social events; village meetings, and pursuit of other local livelihood options. The adopter's mean on-farm time is then subtracted from the non-adopters' mean on-farm time and expressed as a proportion of the **non-adopters'** time.

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



	(Y1)	(Y2)	(Y1)	(Y2)
	On-farm		Off-Farm	
Adopter	54%	63%	46%	37%
Conventional	40%	60%	60%	40%



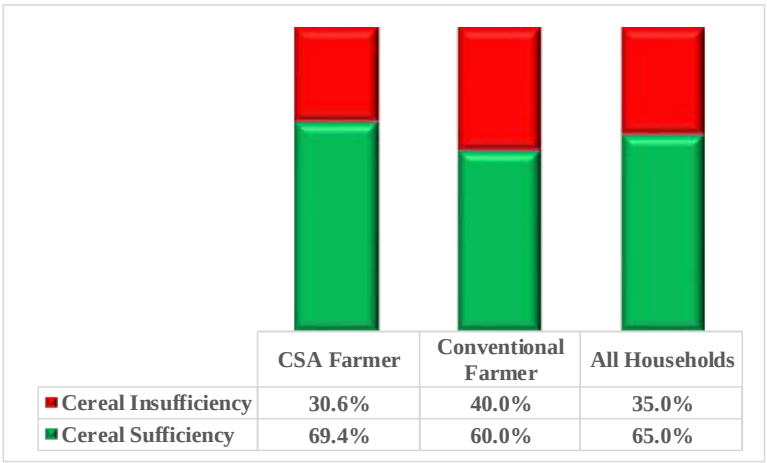
	On-farm	Off-Farm
Margin of Difference (CSAZ Y1)	37%	-24%
Margin of Difference (CSAZ Y2)	4%	-7%

As was the case in Year One, Adopters are still dedicating comparatively more time towards On-farm activities than conventional farmers. The explanation is still the same as the previous year; that adopters have found it more enriching to pursue a more rewarding livelihood option by subsequently putting more land to conservation agriculture than pursuing options experienced as less rewarding. However, as seen in Figure 20, evidence has it that for Year 2, adoption has led to comparatively reduced margin of difference from 36.6% more than Conventional farmers in Year 1 of CSAZ to just 4% in CSAZ Year 2. It can therefore be anticipated that Year 3 will even see adopters now spending LESS time towards On-farm activities than conventional farmers, this is the anticipated narrative for CSA; that it would eventually lead to time savings.

4.3 Do Adopters have an improved Well-being (Quality of Life)

4.3.1 Cereal Sufficiency – 2017 Harvest

Figure 21: Was there a month (June 2017-May 2018) that HH could not afford sufficient cereals?



	CSA Farmer	Conventional Farmer	All Households
Cereal Insufficiency	30.6%	40.0%	35.0%
Cereal Sufficiency	69.4%	60.0%	65.0%

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 there was a month (June 2017-May 2018) 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

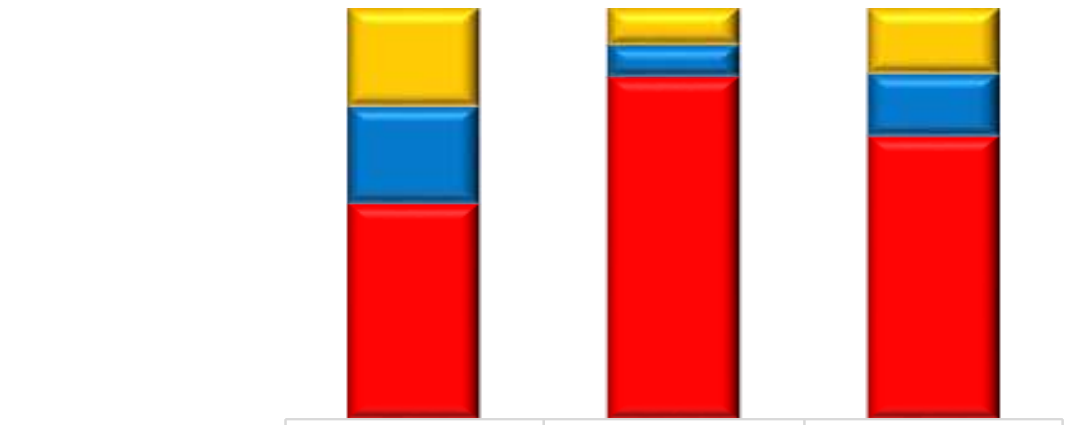
respective respondents. It was found that 65.0% of the respondents reported not facing cereal shortages. However, results show that cereal **sufficiency** is more likely among adopters (69.4%) than among non-adopters (60.0%). The reverse is also true; shortage of cereal among households is more likely among non-adopters (40.0%) than among adopters (30.6%). Care should be taken that this results is not obtained by chance, hence further statistical analysis through Chi-Square became important. Table 6 presents the results.

Table 5: Cereal Sufficiency: Chi-Square Tests

Chi-Square Tests			
	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	3.959	1	.040
Continuity Correction	3.556	1	.050
N of Valid Cases	409		

Table 6 shows the results of the Chi-square test. The Chi-Score statistic here is computed to be 3.959, 1 degree of freedom, and the p-Value is 0.04. We are testing at the 5% level of significance (alpha = 0.05). Now, 0.04 is less than the alpha value. Our result is therefore statistically significant and we will reject 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.*** Not that the same conclusion was reached at in the 2017 Outcomes report.

Figure 22:Reasons proffered for being cereal deficient – by Adoption Status



	CSA Farmer	Conventional Farmer	All Households
Sold/Traded	23.9%	9.2%	16.1%
Shared/Donated	23.9%	7.9%	15.4%
Harvest ran out	52.2%	82.9%	68.5%

Findings show that the main reason behind cereal deficiency is that a household ran out of harvested stock (68.5% of all cereal deficient households).

Figure 22 also shows that Adopters who had some cereal shortages encountered that problem because they are more likely to share cereal stocks with relatives as well as to sell more than Conventional farmers.

4.4 Some Other Pertinent Issues

4.4.1 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:

Table 6: Observations from DACOs

Critical factors challenging field crop production 2017/18 using CA Basins	Critical factors challenging field crop production 2017/18 using ADP Ripping	Critical factors challenging field crop production 2017/18 using Tractor Ripping	Critical factors affecting marketing of field crop produce 2017/18	Critical factors promoting marketing of field crop produce 2017/18

✓ ***Labour intensive*** ✓ ***Weed infestation in the first few years of implementation scares away adopters***	✓ Lack of inputs/implements-especially rippers (farmers end up removing mouldboard but this is not effective) ✓ Lack of herbicides for chemical weeding ✓ Death of animals for ADP	✓ Limited number of tractor mechanization service providers ✓ Land preparation especially in virgin land ✓ High cost of hiring	✓ Pricing of produce does not attract increased production. ✓ Poor marketing infrastructure (poor road network and distances) ✓ High transportation cost versus low commodity prices ✓ Unstandardized scales used by private buyers	✓ Crop diversification (market demand for various crop produce has led farmers to diversify) ✓ Working as cooperatives enhancing bargaining power

In some areas (such as Chongwe), there is a slight conflict between messages. Some agencies promote organic principles and discourages the use of chemical fertilizers and herbicides while MOA and the CFU actually promote the use of chemicals. DACOs were also asked on their view on how Min-Till interventions are going to continue in the absence of supporting NGOs. They were unanimous that the best way forward would be, while funded programmes are still available, for both development partners and responsible Government Ministries to push for a policy shift towards entrenching minimum tillage for optimum production and sustainable use of the land within all sectors of the agriculture value chain. This entails deliberate and targeted efforts at all levels; education systems below tertiary level, Tertiary level education systems, seed-houses and implement producers (Agro-dealers), Government departments, a heavily pro-CA input supply programme (such as the FISP and any other subsidised inputs/implements scheme for CA related items), as well as the entire scaling up of consumer output markets infrastructure to enable smooth movement of goods and services. A common message setting out the value of CA should run through all the above structures and institutions.

5. CONCLUSIONS, LESSONS LEARNT, AND RECOMMENDATIONS

This was the second 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 and gender of household head)***
  - Basin farmers' average yield 60.5% (Female headed HH reached 87.3% above the yield of conventional female headed households and Male reaching a margin of 52.6% above the yield of conventional male headed households),
  - ADP ripping adopters' yield was 93.0% (109.0% Female headed HH, and 90.1 Male headed HH),
  - For Year 2, Mechanising adopters are performing better than conventional tractor farmers by 111.9%
- ***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 beat hand hoe ridgers by 91.6% (Females = >300% and Males 64.3%),
  - ADP ripping adopters are 87.0% above (Females 85.8%),
  - Mechanised ripping farmers' production was beaten by that of conventional tractor farmers by a margin of 18.9%, there were no female headed households for comparison.
- ***Outcome Indicator 2.3: Margin of difference between the proportion of time spent by women on On-farm activities.***
  - Adopting women farmers are investing 4% more time towards on-farm activities (in the previous year the figure was as high as 36.6% and hence this is a vast improvement

5.2 LESSONS LEARNT

Three key lessons that can be drawn from this study are as follows"

- ✓ CSA attracted people who have a keen interest in improving their lot due to their various socio-economic experiences/ hardships, such people will invest all possible energies towards what they have come to appreciate as the best value for their efforts and time, hence women adopters investing more time towards on-farm activities than their counterparts (non-adopters).

- ✓ Output marketing remains an area needing continued exploration as it is riddled with a plethora of challenges. Well established produce buyers are also trying to cut costs and when they find especially the road infrastructure threatening to push up costs, they would naturally pull back and a blame game will not help the ordinary farmer.
- ✓ In some areas, even when faced with increased production, villagers' minds have been overshadowed by the drudgery of everyday pain and suffering cycles of poverty. They seem not to wake up to the possibilities of improving their lot and continue in that state of lethargy until death.

5.3 RECOMMENDATIONS

The survey findings led us to the following recommendations:

- ➢ The CFU needs to ensure that CSA technologies should make adopters enjoy more of the benefits than dread the work by continuing to be innovative around access to resources that reduce strenuous physical labour such as hand hoe weeding.
- ➢ The CSAZ project should take note that engaging farmers should be an all year round activity instead of June to March (ending with field days). The engagement should go beyond the post-harvest realities; initial storage before shelling, shelling, grain protection, packaging, aggregating and marketing.
- ➢ The CSAZ should seek ways of engaging proactively with state and private players towards permissive market infrastructure, this is a priority. Casting the net wide and far could rope in medium to small, private and public players towards a viable M4P system … no corner along the value chain should be left unexplored
- ➢ There is need for the Project to open people's minds to the possibility of improving their lives qualitatively. This may mean that the CFU should go an additional mile and seek to open the minds of simple villagers to aspire for qualitative improvement of their lives using proceeds from improved production.