Conservation Farming Unit

CONSERVATION FARMING & CLIMATE SMART AGRICULTURE

CSAZ OUTCOMES SURVEY REPORT

2018/2019 AGRICULTURE SEASON.

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Key Outcomes survey findings for Year 3 of the CSAZ Programme - 2018/19 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
FO	Field Officer
FRA	Food Reserve Agency
HH	Household
M&E	Monitoring ad Evaluation
MS	Microsoft
MT	Minimum Tillage
RM	Results Measurement
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 programme seeks to improve food security to over a million people by providing trainings to an outreach of over 200,000 farmers annually across the four CFU operational areas; 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, which is 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 20 out of the 39 districts and four respective operational regions of the CFU in Zambia. The sample size was 118 adopting and 114 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 52.3% (Female headed HH reached 78.4% above the yield of conventional female headed households and Male reaching a margin of 47.5.6% above the yield of conventional male headed households),
  - ADP ripping adopters' yield was 110.8% (18.3% Female headed HH, and 119.1% Male headed HH),
  - For Year 3, Mechanising adopters are still performing better than conventional tractor farmers by 188.0% (No tractor Female headed adopting HH to compare with).
- ***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 surpassed hand hoe ridgers by 35.2% (Females = 49.6% and Males 33.8%),
  - ADP ripping adopters are 154.5% above ADP ploughing farmers (Females 10.9% and Males 164.2%),
  - Mechanised ripping farmers' production was beaten by that of conventional tractor farmers by a margin of 3.9% reducing from 18.9% the season before. 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 4% and hence there has not been any improvement.
  - Adopting women spend this much time mainly because the farm operations have, for the first time in their farming history, actually started to become more profitable and therefore more interesting, worth more time to be spending as well as the fact that in the new teaching (which they have voluntarily embraced)

land husbandry starts way earlier than the traditional conventional practices where land preparation starts only with the first rains or thereabout.

- Other indicators of interest:
  - Cereal sufficiency (a proxy for food security) – although results showed that this is more likely among adopters than among non-adopters, *there was no significant difference between adopters and non-adopters in terms of cereal sufficiency*.
  - Dietary diversity - In terms of food consumption score, it was interesting to see that a larger proportion of female headed HHs was actually more likely to be in the acceptable range compared to, not only non-adopting female headed HHs but actually non-adopting male headed HHs. And as has been the trend, adopting male headed HHs where above the rest.

Two main lessons learnt from this study are that:

- ☑ Tractor farmers for comparisons still pose a challenge. This means that there is a good opportunity for the program to expand in terms of hectarage. It means we still have room to improve even with the farmers we are already dealing with.
- ☑ Although there is no significant difference between adopters and non-adopters in cereal sufficiency, adopters have more food variety item under food consumption scores.

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

- ✓ The CFU should continue pushing the Tillage Service Provision (TSP) initiatives so that more farmers can have access to tractors for ripping services because they easily translate into higher hectarage.

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 260,000 farmers annually across four (4) CFU operation regions namely: Central, Eastern, Western and Southern. The program is currently covering a total of 39 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 2018 round of trainings in preparations for the 2018/2019 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).

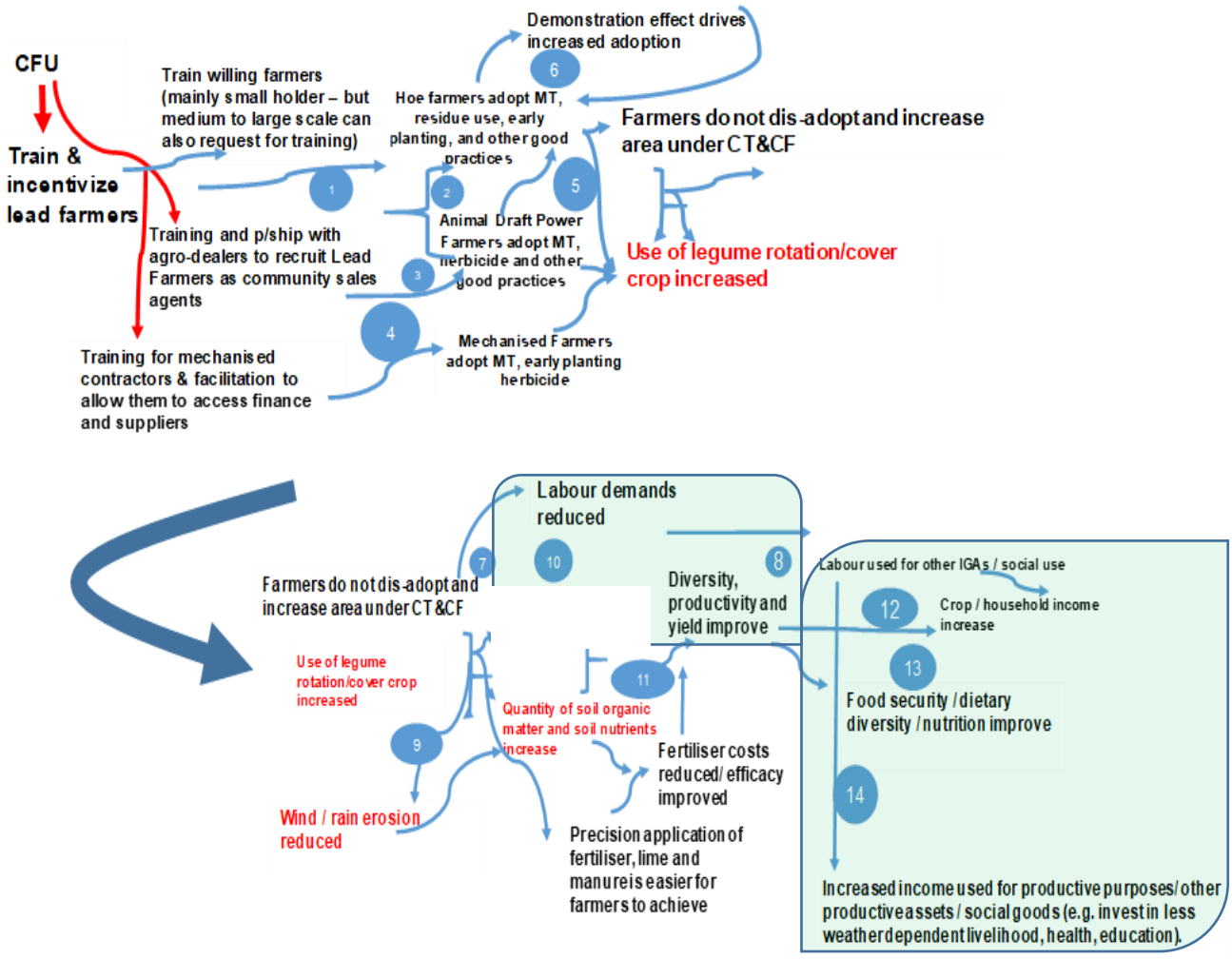
The same set of trainings have started for the 2019/2020 season with Period 1 already conducted and Period 2 having commenced around mid-August in all districts.

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 2018 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 2018/19 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 2018/2019 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 39 districts, the survey was carried out only in 20 randomly selected districts - Masaiti, Mpongwe, Serenje, Kapiri, Mumbwa, Itezhi-tezhi, Kaoma, Namwala, Kalomo, Pemba, Monze, Mazabuka, Gwembe, Siavonga/ Chirundu, Sinazongwe, Chama, Lundazi, Katete, Sinda and Vubwi. 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. 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 farms were far from the village because of lack of agriculture land 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). The survey design was such that for each adopter there be a non-adopter with comparable 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

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. 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 2018/2019 farming season. The sampled adopting farmers came from the lists of adopters from the 2018/2019 season and was equally spread across all sampled districts. These were farmers who were trained by the CFU under CSAZ in the 2018/2019 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.

2.2 SAMPLING

All the CFU regions were taken as part of the sources of data. Sampling was three-tiered: Random sampling of 20 out of the 39 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 representativeness by capturing any variations introduced by ecological and human resource factors.

Region and District Level Sampling

Table 1: Sampled Districts

REGION	DISTRICT	ADOPTER	NON-ADOPTER
Central	Serenje	20	21
	Mpongwe	25	17
	Masaiti	25	21
	Kapiri Mposhi	13	22
	Total	**83**	**81**
Eastern	Chama	16	13
	Katete	12	14
	Lundazi	13	12
	Sinda	16	7
	Vubwi	6	6
	Total	**63**	**52**
Western	Itezhi-tezhi	21	20
	Kaoma	30	20
	Mumbwa	39	39
	Total	**90**	**79**
Southern	Monze	24	23
	Mazabuka	26	27
	Kalomo	17	24
	Namwala	24	15
	Gwembe	13	12
	Siavonga/Chirundu	14	13
	Total	**118**	**114**

As is shown in Table 1 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 680 households.

2.3 DATA MANAGEMENT

Data was collected by 12 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 Kafue 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 Huawei 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 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) among the farmers trained and subsequently adopted climate smart agriculture in the year during the 2018/2019 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 2018 (Year 3 of the project) training period.

3.1 Trainings and Adoption Overview

3.1.1: Trained Farmers 2018/19

Table 2 below represents the official tally of unique farmers trained under the CSAZ during Year 3.

Table 2: Farmers Trained under the CSAZ in Year 3

Log Frame Output Indicator 2.1 – number of farmers trained in climate smart agriculture practices		
2019 Target	**Achieved**	**% of target achieved**
216 000	268,692	124.4%

3.1.2 Adoption Overview

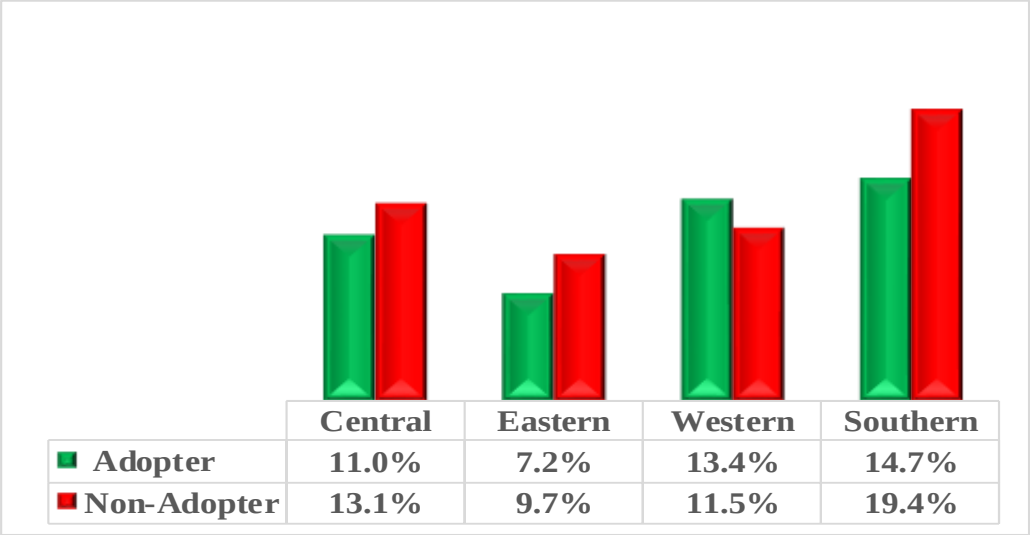
Prior to the post-harvest survey, an adoption survey had been conducted and produced a couple of findings. The survey established of those that took up a CSA minimum tillage technology in the 2018/19 season, **23.1%** of the trained farmers who adopted CSA had not used the technology before the 2018/19 season while **29.6%** where continuing adopters who had used a CSA technology prior to the 2018/19 season. All in all, (both new and old adopters), the survey showed that **66.6%** of the trained farmers adopted minimum tillage during the 2018/19 cropping season. All in all, the adoption survey established the following:

- ✓ **61,939** is the number of new farmers who have adopted CF MT CSA during year against a target of **45000** farmers.
- ✓ **44,698** is the total Hectarage put under CF. This is against a year two target of **25,500** hectares.
- ✓ **19,272** is the number of households using ADP tillage services while **2,570** farmers acquired mechanised tillage services in the 2018/19 season against a target of **12,100** and **13,600** respectively.
- ✓ **60,638** s the number of new adopters who used herbicides for weed control purposes against a year 3 target of **63,440** farmers

3.2 Profiling Sampled Farmers.

3.2.1. Adopters and Non-Adopters.

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



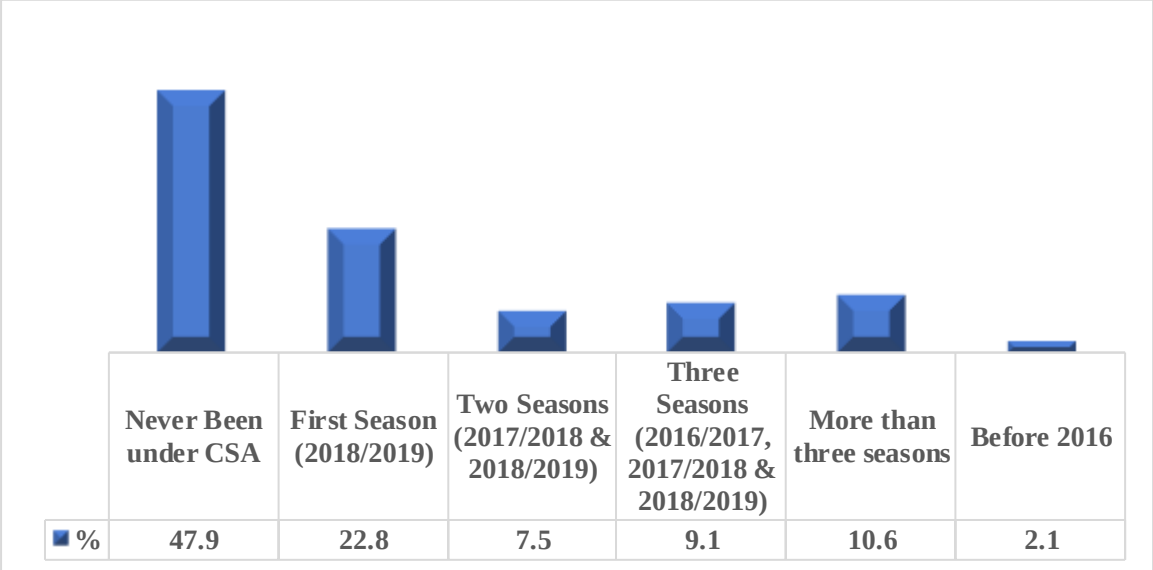
	Central	Eastern	Western	Southern
Adopter	11.0%	7.2%	13.4%	14.7%
Non-Adopter	13.1%	9.7%	11.5%	19.4%

Figure 2 gives a visual representation of how sampled respondents were spread across regions according to their adoption status.

3.2.2 For How Long Has a Household Been Practicing CSA?

3.2.3 Investigating Consecutive/Sustained Adoption

Figure 3: Continuity of adoption among farmers



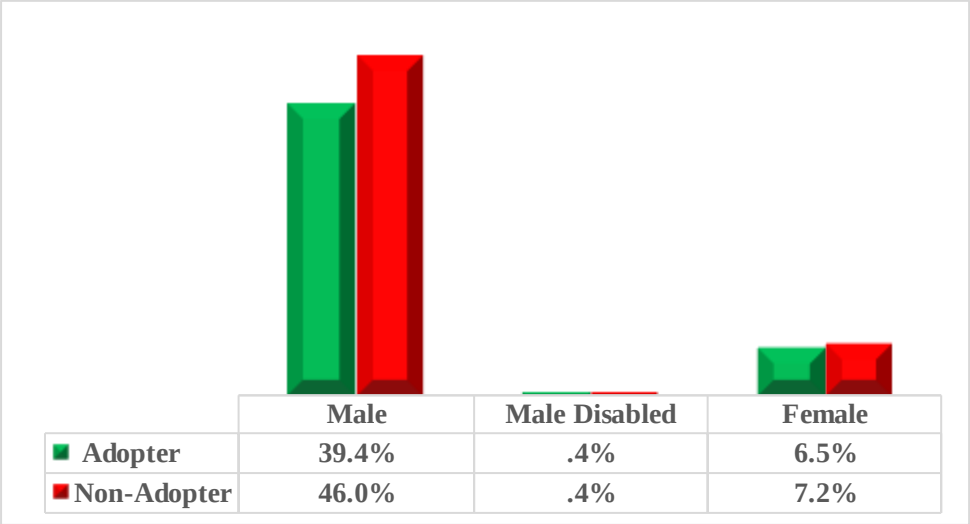
The teaching around CSA technologies is that benefits are incremental and peak around the third or fourth season of continuous adoption as there would have been enough nutrient trapping in the same basin or rip-line as well as from effects of rotation, and also sufficient moisture preservation through saved crop residue effects on the soil's water holding capacity. The survey sample was constituted of mostly first season 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, Marital Status, and Disability within Household

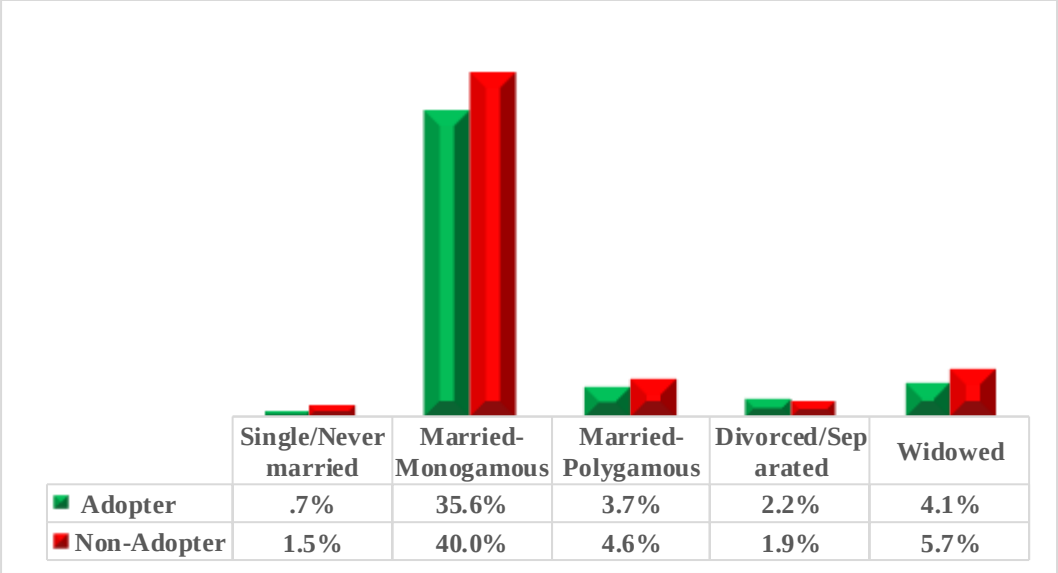
Figure 4: Gender of HH Head



	Male	Male Disabled	Female
Adopter	39.4%	.4%	6.5%
Non-Adopter	46.0%	.4%	7.2%

From Figure 4, out of a sample size of 635 responsive interviewees, most households were male headed (86.2%) of which 0.8% were disabled male household heads. The survey showed no record of any female disabled household heads.

Figure 5: Marital Status of HH Head



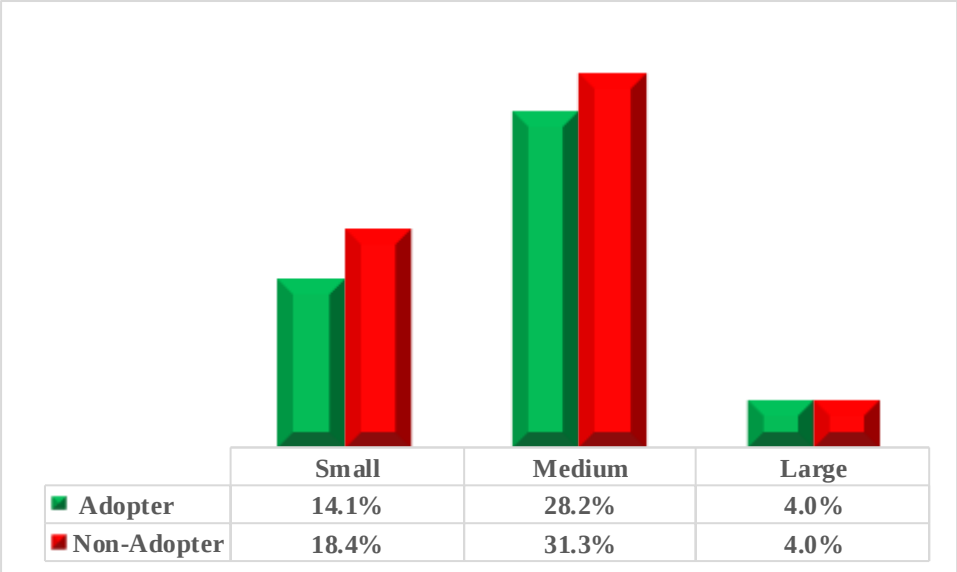
	Single/Never married	Married-Monogamous	Married-Polygamous	Divorced/Separated	Widowed
Adopter	.7%	35.6%	3.7%	2.2%	4.1%
Non-Adopter	1.5%	40.0%	4.6%	1.9%	5.7%

Figure 5 shows that overall, the most dominant marital status of HH head was monogamously married followed by households headed by individuals who have been widowed (9.8%).

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 7 below shows that the largest proportion of households for both adopters and non-adopters falls within the medium range which comprises approximately a total of 6 – 12 household members. With the exception of the 'large' family category, Figure 6 also presents evidence that non-adopters are in higher proportions for both small and medium family sizes.

Figure 6: HH Size Category by Adopter Status

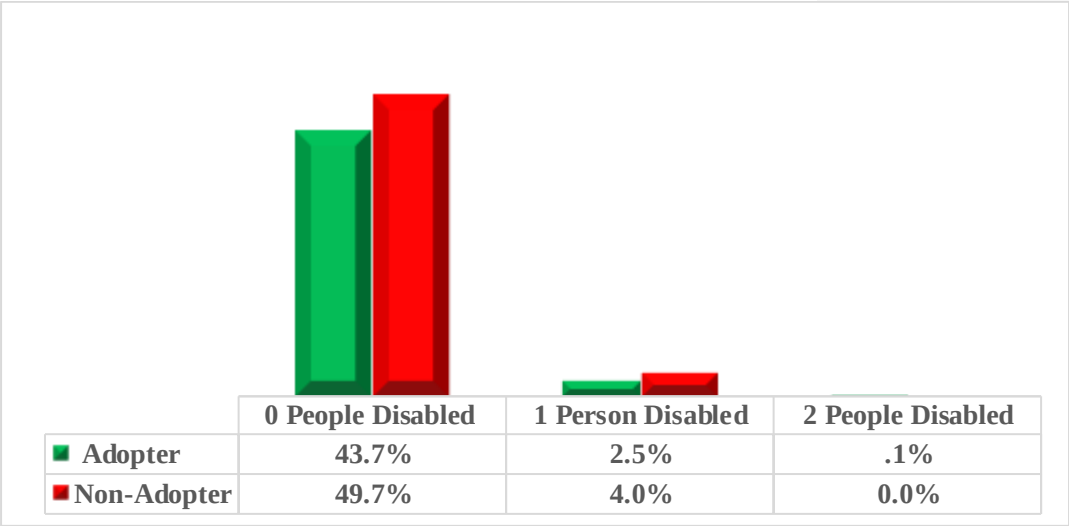


	Small	Medium	Large
Adopter	14.1%	28.2%	4.0%
Non-Adopter	18.4%	31.3%	4.0%

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, April 2019). The number of people living with disabilities within households is relatively low. Figure 7 shows the distribution with the sampled households. It would be interesting in other studies to investigate the likelihood of adoption among households where there is at least one person who is disabled ("Does the presence of a disabled HH member have any hindrance towards the propensity to adopt?").

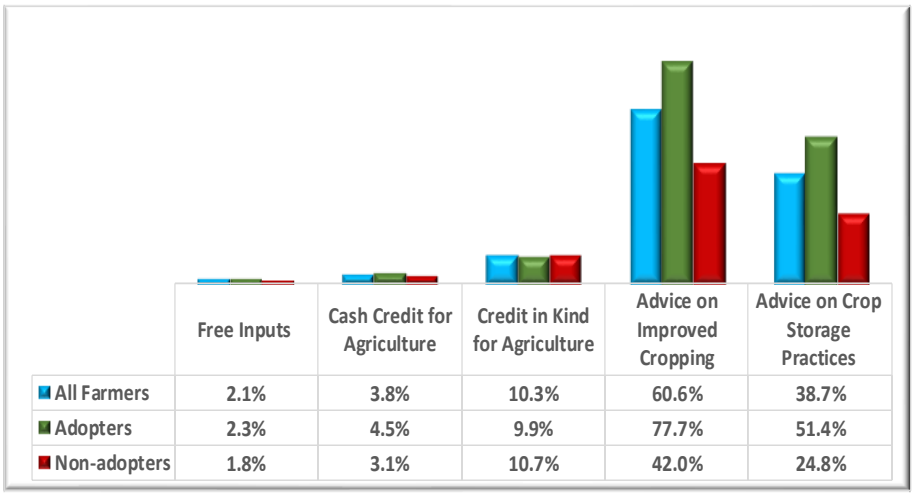
Figure 7: Presence of disability in Households.



	0 People Disabled	1 Person Disabled	2 People Disabled
Adopter	43.7%	2.5%	.1%
Non-Adopter	49.7%	4.0%	0.0%

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
All Farmers	2.1%	3.8%	10.3%	60.6%	38.7%
Adopters	2.3%	4.5%	9.9%	77.7%	51.4%
Non-adopters	1.8%	3.1%	10.7%	42.0%	24.8%

Any form of support given to a farmer prior to the cropping season, be it free inputs or farmer implements on loan or even advice on cropping practices comprises Support Services. All sampled households were asked if and what type of support services they received and from which organisations. This information was then disaggregated by Adoption Status. The responses are shown in Figure 8 above. Although the comparison farmers were picked from same villages, adopters are more likely to receive support except for credit in kind where non-adopters are more likely to be above adopters albeit by a small margin. It can be concluded that adopting households have become smarter/ more inclined to seeking and receiving beneficial information than their conventional counterparts. Whether this has translated into increased productivity and yield is a subject of further analysis in Section 4 of this report.

Prevention of post-harvest losses is key if farmers are to maintain hard-earned harvest. For those who said they had received advise on post-harvest technologies, the results show which particular technologies farmers actually took up after being enlightened.

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

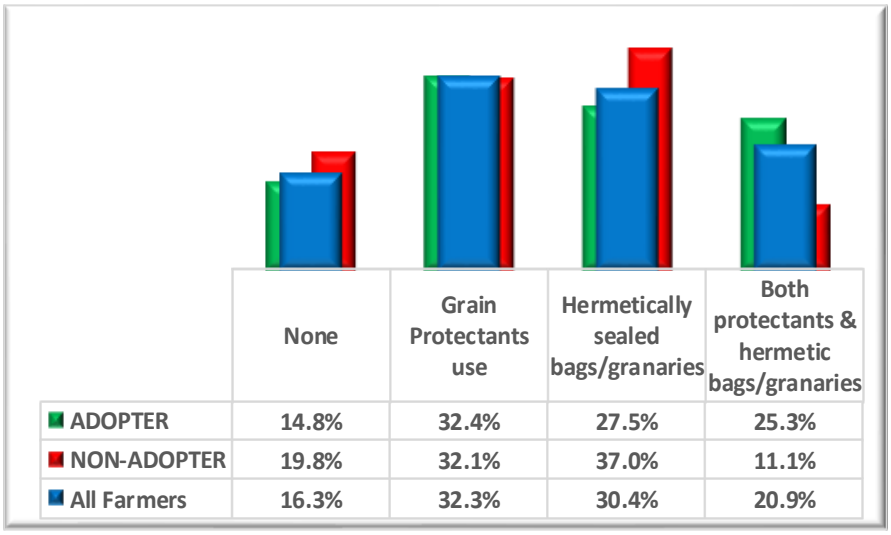


Figure 9 shows that within groups, the likelihood of receiving advice and not using it is relatively low, and is comparatively even lower among adopting farmers. Almost 20% of non-adopters will not use any grain protecting methods despite knowing about it. Adopters are just as likely to use grain protectants as non-adopters which is the number one choice when all farmers are put together. The next favourite method is hermetic bags and/or granaries (30.4%) and lastly a combination of all three methods. It is clear that farmers have choices and have developed preferences.

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. In fact, it is the wish of every farmer to produce enough for home consumption and for selling. If a HH intends to produce or just happens to produce enough for selling, it is important to know in advance where they would sell the surplus. Therefore, households were asked whether someone linked them to any commodity market(s) where they could sell their produce.

Figure 10: Did Anyone Link you to any Output Market?

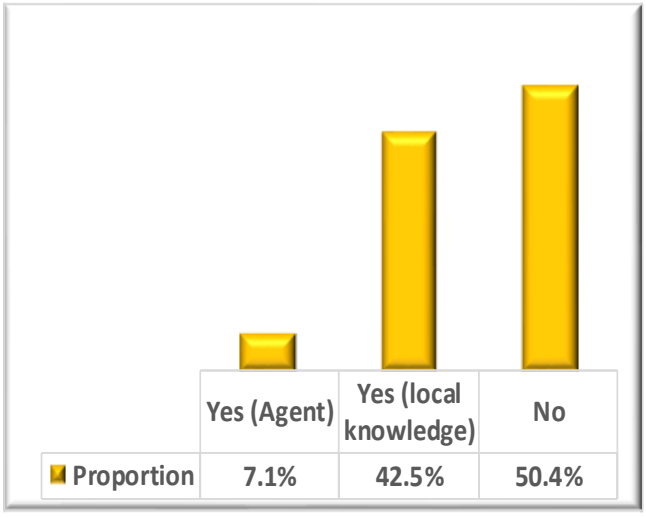
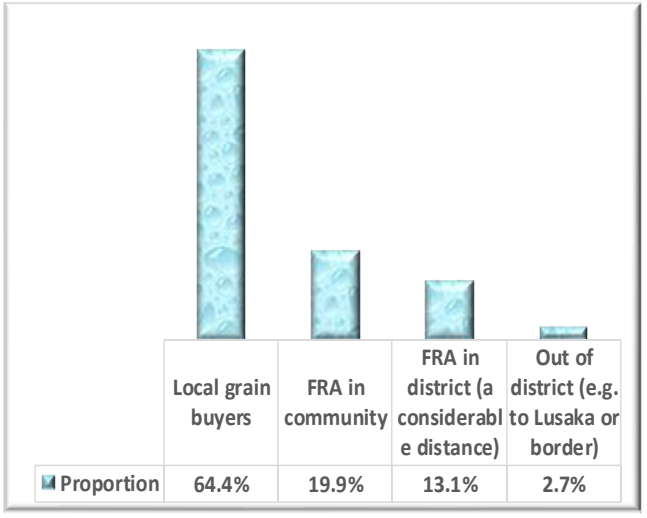


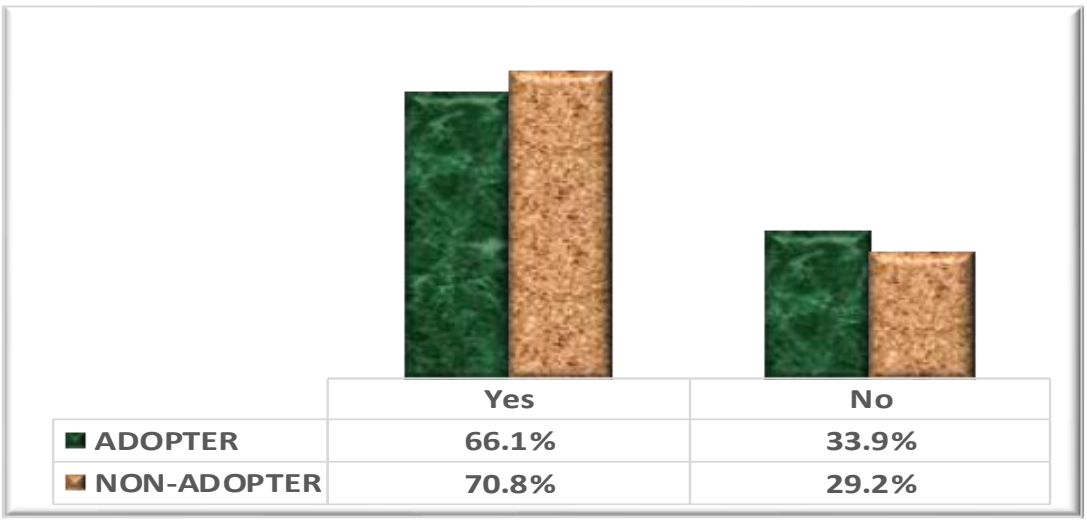
Figure 11: Where is this Market?



From Figure 10 above, less than half of all farmers interviewed had known about output markets where they could their produce. 50.4% had no market linkages by deliberate/intentional action of an agent for their products. They had no market information either because they had no intention to sell and hence did not bother to actively look for an output market or production is not output market driven. However, this does not mean they had absolutely no idea where they were going to take their surplus produce, some always know the Food Reserve Agency (FRA) and local buyers always buy their produce even though they may not know the prices at that time. These are the biggest two markets that farmers were aware of at the time of production with a few (2.7% of the 49.6% who had market information) being linked to some out of the district markets like Lusaka, Kasumbalesa, etc (Fig11).

Farmers were also asked about whether or not they received information about commodity prices either during production or during the harvesting period. Having information about where one can sell their produce is different from knowing the prevailing prices. In fact, price is probably the biggest determinant of which of the available markets a farmer will sell to considering other costs like transportation.

Figure 12: Did This Household Receive Information on Community Prices Before Selling Crops?



The results in figure 12 above show that more non-adopters were aware of prices than adopters and that almost 34% of adopters are more likely to produce without knowledge of prices compared to 29.2% of non-adopters. This only suggests that availability of price information is independent of whether one is an adopter or not.

4. INDEPTH ANALYSIS

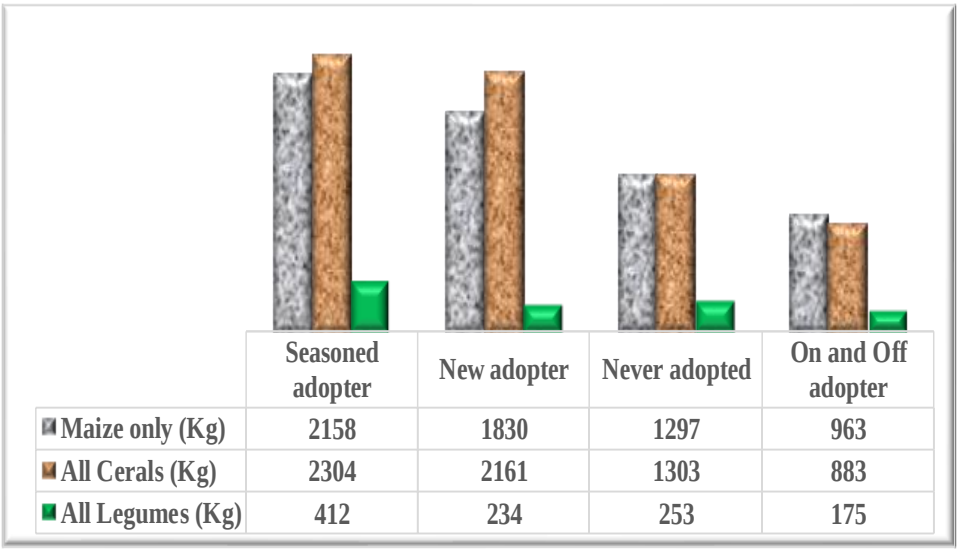
Section 4 will now discuss issues related to production and yield. This is the section where indicator values for the two Logframe outcome indicators will be discussed. The report will also venture into a discussion of impact related issues; household dietary diversity as well as cereal consumed in the household as a measure of food security. All these will help to estimate agriculture dependent households' well-being. The overarching issue here is to establish whether there are any noticeable differences between adopters and non-adopters at the end of Year 3 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 and legumes 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 13: Average Production Levels (Kgs) - by Crop Type and Adopter Status



	Seasoned adopter	New adopter	Never adopted	On and Off adopter
Maize only (Kg)	2158	1830	1297	963
All Cerals (Kg)	2304	2161	1303	883
All Legumes (Kg)	412	234	253	175

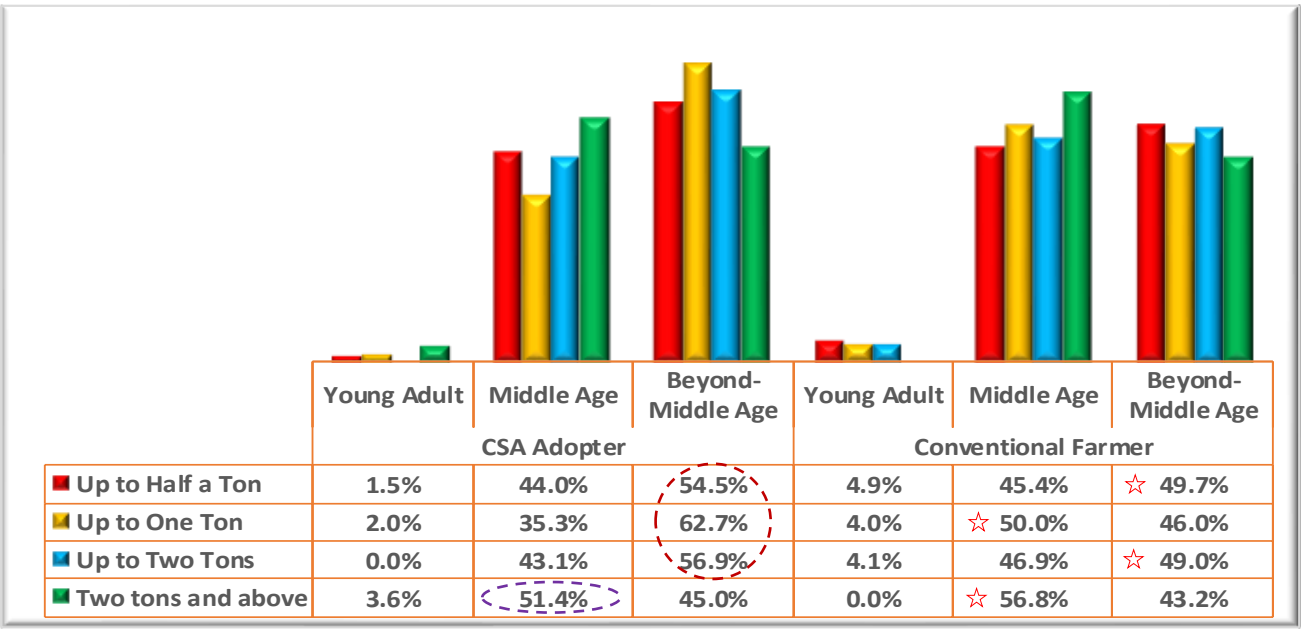
Total households' cereal production ranged from zero to well above ten tons except for the On and Off Adopters who never reached 10 tons. As shown in Figure 13, there is a steady rise in production levels from non-adopters to seasoned adopters. This is well expected and documented by literature on Conservation 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 13 that adoption is highly related to improved production.

However, is it clear that new Adopters did **not** produce more legumes than those that have never adopted. This could be due to land area allocated to the legumes, which is why yield analysis is very important as it does not regard the area allocated to a particular crop being used to compare between the groups. Yield is discussed in Section 4.2.

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 14 below shows the results from a cross tabulation of HH Head category and total cereal production.

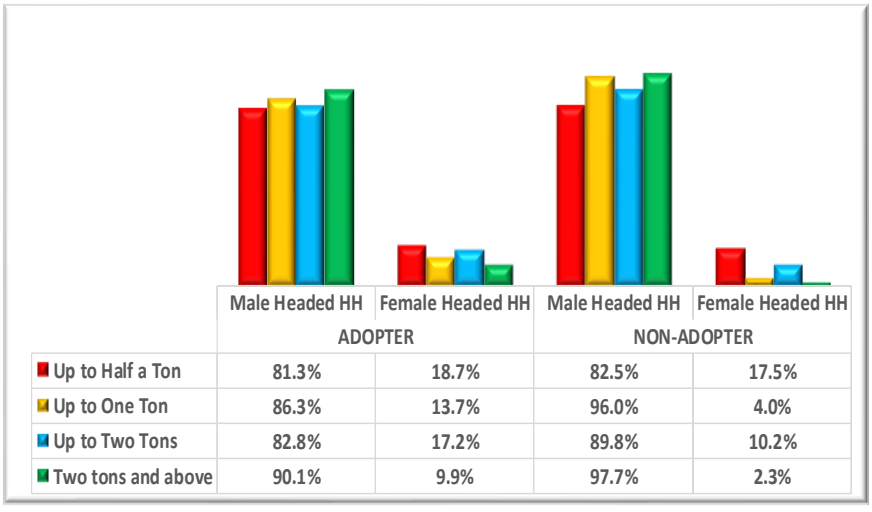
Figure 14: Household Head Age and Total Cereal Production



	CSA Adopter			Conventional Farmer		
	Young Adult	Middle Age	Beyond-Middle Age	Young Adult	Middle Age	Beyond-Middle Age
Up to Half a Ton	1.5%	44.0%	54.5%	4.9%	45.4%	☆ 49.7%
Up to One Ton	2.0%	35.3%	62.7%	4.0%	☆ 50.0%	46.0%
Up to Two Tons	0.0%	43.1%	56.9%	4.1%	46.9%	☆ 49.0%
Two tons and above	3.6%	51.4%	45.0%	0.0%	☆ 56.8%	43.2%

Figure 14 shows that for adopters, HHs with Heads in the Beyond Middle Age (46+ years olds) are likely to produce more than the other two categories except under the "Two tons and above" level where the Middle Age (26 to 45 years old) produced more. For the non-adopters, there was no clear pattern. It can be concluded that generally age of HH Head has a bearing towards production; improving as the head of the HH grow older.

Figure 15: Total Cereal Production by Gender and Adoption



	ADOPTER		NON-ADOPTER	
	Male Headed HH	Female Headed HH	Male Headed HH	Female Headed HH
Up to Half a Ton	81.3%	18.7%	82.5%	17.5%
Up to One Ton	86.3%	13.7%	96.0%	4.0%
Up to Two Tons	82.8%	17.2%	89.8%	10.2%
Two tons and above	90.1%	9.9%	97.7%	2.3%

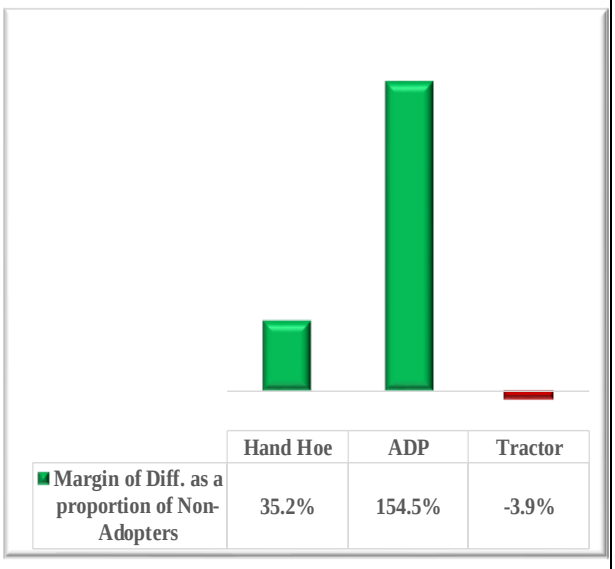
Figure 15 compares the same results but taking into consideration the gender of the head of household. Male headed HHs produced more than female headed HHs among both production techniques but the margin of difference between adopting male headed and adopting female headed HHs was comparatively lessor that that for conventional male and female farmers.

4.1.3 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 an adopter **is associated with** increased production. It is important therefore to establish the indicator values for the relevant Outcome Indicator. Figures 16 and 17 show the results. Note that for indicator values, data used was from farmers whose fields were actually measured during the survey (this was in accordance with the 2017 Annual review that noted the need for measurements).

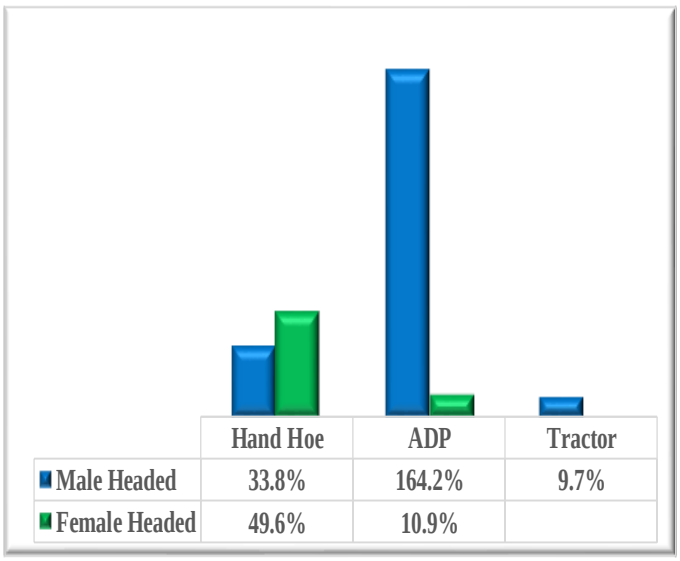
Figure 16 confirms the issue already noted; that adoption is highly related to improved production. It however appears that conventional Tractor tillage farmers are producing 3.9% more than adopters dropping from a difference of 18.9% more in the previous season (2017/2018). This balance in favour of Conventional farmers is however now made clearer from a consideration of the socio-economic status of conventional tractor farmers versus their CSAZ adopter counterparts. In most circumstances, tractor ripping adopters are economically less resource-endowed and usually rely on the services of hired TSPs to rip their land and are also basically less equipped in several other ways. The point to 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. This is indeed a good start and given time, resources, and more exposure, it is not farfetched to imagine that these so called less privileged would soon ascend and make greater impact in terms of contributing to the food reserves of the communities and country.

Figure 16: Margin of Difference – Production



	Hand Hoe	ADP	Tractor
Margin of Diff. as a proportion of Non-Adopters	35.2%	154.5%	-3.9%

Figure 17: Gendered Margin of Difference - Production



	Hand Hoe	ADP	Tractor
Male Headed	33.8%	164.2%	9.7%
Female Headed	49.6%	10.9%	

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 ADP users where adopting farmers are likely to produce way more than 160% than their conventional ADP male-headed households counterparts. Last season the adopting hand hoe farmers showed a likelihood to produce over 300% more than their hand hoe non-adopting counterparts. The reduction can be attributed to a bad season where some farmers had zero harvest. For this analysis, however, farmers with zero produce were not considered as that would have affected the mean yields.

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 taken to ensure that basin adopters' fields would be compared with hand-hoe ridging non-adopters' fields while ADP ripped fields (adopters) would also be compared with ADP ploughed fields (non-adopters), and the same for tractor users. 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 and gender)

Figure 18 shows the general marginal 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

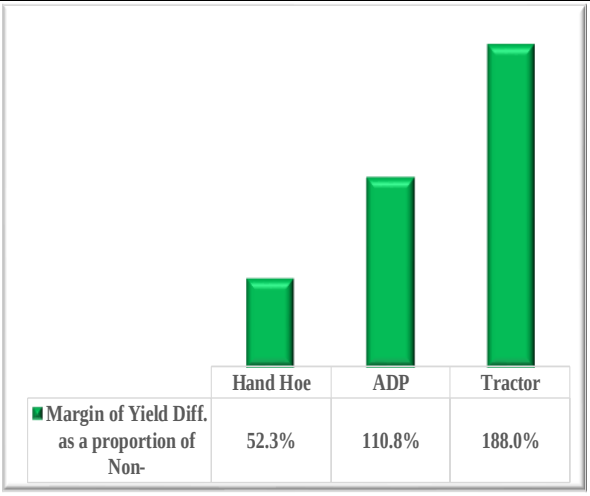
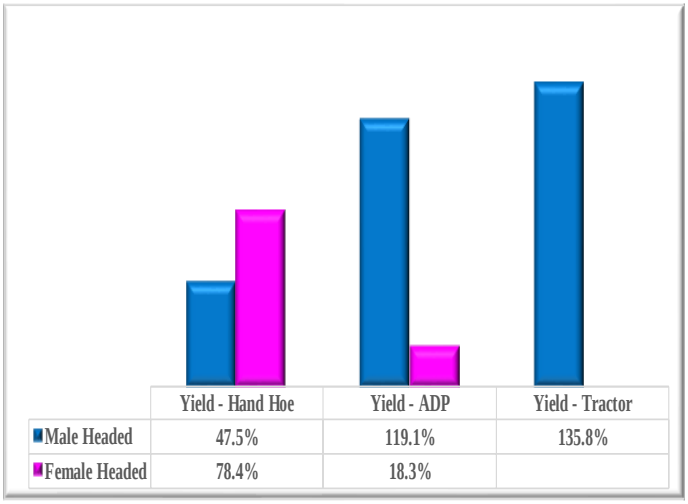


Figure 19: Gendered Margin of Difference – Yield



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 yield adopting 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 further statistical analysis. Even though the above discussion suffices, we went further to test for significance in the differences between mean yields. First, we tested 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 **is equal to** that of a corresponding conventional technology; H_1 = The Mean yields are **not** equal). We used the Independent *t*-Test.

Hand Hoe Practices.

An independent ***t*-Test** was therefore conducted to determine if a difference existed between the mean maize yield of basin adopters and that of hand hoe ridgers (non-adopters). Table 3 shows the results.

On Levene's Test for Equality of Variances, we note that the significance level is below 0.05, it is 0.000, hence the assumption of equal variances is upheld and we read our t-test values from the bottom line. The results show that there was a statistically significant difference between the mean maize yield of Basin adopters (n=91, m=2.2226, sd=2.05275) and hand hoe conventional farmers (n=84, m=1.49060, sd=1.46104); t_{95}=2.734, p=0.007). The study therefore rejects the claim (null hypothesis) 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.

Table 3: Basin Adopters and Hand Hoe Ridgers – Is the observed difference in yields statistically significant?

Group Statistics

RESPONDENT OR HH STATUS		N	Mean	Std. Deviation	Std. Error Mean
Maize Yield in 2019	ADOPTER	91	2.2226	2.05275	.21519
	NON-ADOPTER	84	1.4906	1.46104	.15941

Independent Samples Test

		Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Maize Yield in 2019	Equal variances assumed	13.432	.000	2.698	173	.008	.73208	.27135	.19649	1.26767
	Equal variances not assumed			2.734	162.742	.007	.73208	.26780	.20327	1.26090

ADP Practices.

Just as in the case of hand-hoe practices, results for ADP practices show that the difference between the means is significant. Table 4 shows the results. From the 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.

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

Group Statistics

RESPONDENT OR HH STATUS		N	Mean	Std. Deviation	Std. Error Mean
Maize Yield in 2019	ADOPTER	164	1.9447	2.00385	.15647
	NON-ADOPTER	233	.9165	1.14514	.07502

Independent Samples Test

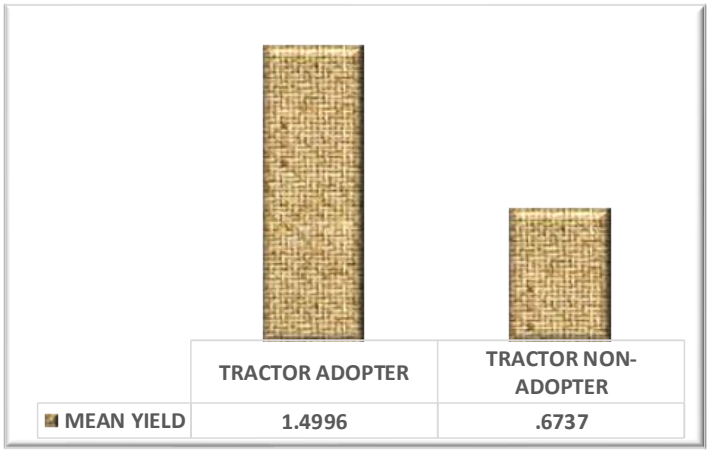
		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Maize Yield in 2019	Equal variances assumed	48.428	.000	6.475	395	.000	1.02824	.15880	.71604	1.34044
	Equal variances not assumed			5.925	237.723	.000	1.02824	.17353	.68639	1.37009

The results show that the there was a statistically significant difference between the mean maize yield of ADP ripping adopters (n=164, m=1.9447, sd=2.00385) and ADP ploughing conventional farmers (n=233, m=0.9165, sd=1.14514); t95=5.925, p=0.000). 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.

Mechanisation Practices.

Test around Mechanization (Tractor tillage types) continue to be dogged by sample sizes just as observed during the previous two seasons. We only managed to get 5 non-adopting 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.

Figure 20: Maize Mean Yields – Tractor Farmers



Looking at the means for tractor adopters and non-adopters in Figure 20, it is clear that tractor ripping has a higher mean than tractor conventional farming. This is in line with the above analysis on margins of difference in yields in figure 18. However, although this shows that there is a difference, it is important to subject this to a statistical test that will show whether the differnce is significant or not. Now with sample sizes of 52 for tractor adopters and 5 for tractor non-adopters, the assumptions of an ordinary parametric t-Test will cause distortions like was seen the last two years. And among all the statictical tests available, the Mann-Whitney U Test is the most appropriate test for this. Table 5 below shows the results.

Table 5: Tractor Ripping and Tractor Ploughing– Is the observed difference in yields statistically significant?

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.	Decision
1	The distribution of Maize Yield in 2019 is the same across categories of A10 RESPONDENT OR HH STATUS.	Independent-Samples Mann-Whitney U Test	.000	Reject the null hypothesis.

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

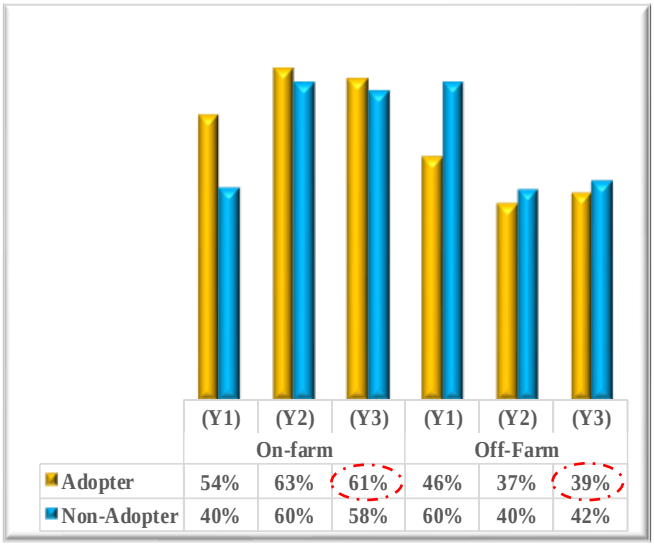
Table 5 shows the non-parametric Mann-Whitney U Test for the null hypothesis "The Distribution of Maize Yields in 2019 is the same across categories i.e. Tractor Adopters and Non-Adopters." Results from the test suggest that we must reject the null hypothesis. There is in fact a difference between the two means. This is in line with findings from research and the previous Outcomes Reports which suggest on average, the mean yield from tractor ripping is different from mean yield of tractor ploughing. We already know from Figure 18 that ripping produces a higher yield, and this is also confirmed by results from the CFU's Trial Plots.

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

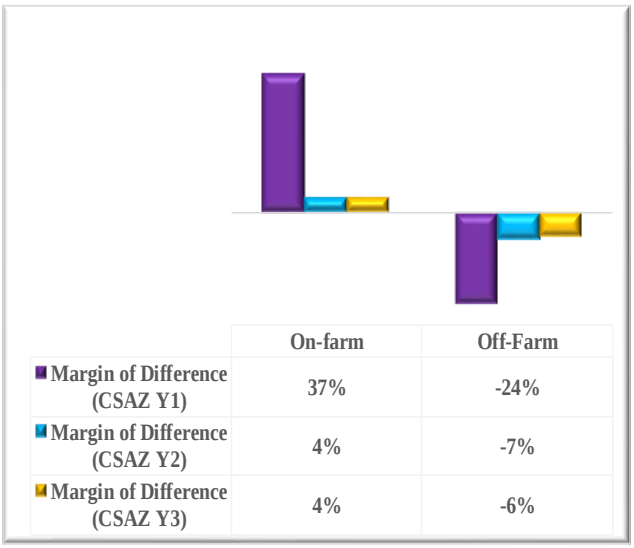
4.3.1. Outcome Indicator 2.3: Margin of difference between the proportion of time spent on On-farm activities

This is notably a qualitative indicator. It is a challenging 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-adopter's** time. As was the case in Years One and Two, Adopters are still dedicating comparatively more time towards On-farm activities than conventional farmers. The explanation is still the same as the previous years – 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 21, evidence has it that for Year 3, adoption has not led to any difference (4% for years two and three) but there was a significant reduction between years one and two from 36.6% more than Conventional farmers in Year 1 of CSAZ to just 4% in CSAZ Year 2 and 3. It can only be anticipated that Year 4 may see adopters spending LESS rather than MORE time towards On-farm activities than in the previous years. From all this over the 3 year-period, however, it is clear that adoption has led to time savings except that the saved time is **reinvested** in more fields which may translate to more income and food security. Unless that changes, it is difficult to think that adopters and non-adopters will spend the same amount of time on On-Farm activities.

Figure 21: Margin of difference in time spent by women on On-farm activities



	(Y1)	(Y2)	(Y3)	(Y1)	(Y2)	(Y3)
	On-farm			Off-Farm		
Adopter	54%	63%	61%	46%	37%	39%
Non-Adopter	40%	60%	58%	60%	40%	42%

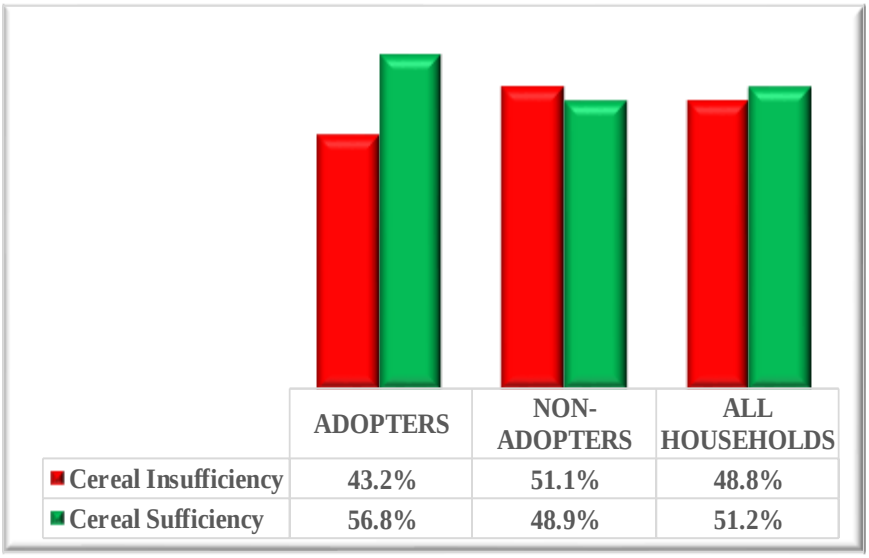


	On-farm	Off-Farm
Margin of Difference (CSAZ Y1)	37%	-24%
Margin of Difference (CSAZ Y2)	4%	-7%
Margin of Difference (CSAZ Y3)	4%	-6%

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

4.3.1 Cereal Sufficiency – 2018 Harvest

Figure 22: Was there a month (June 2018-May 2019) that the HH could not afford sufficient cereals?

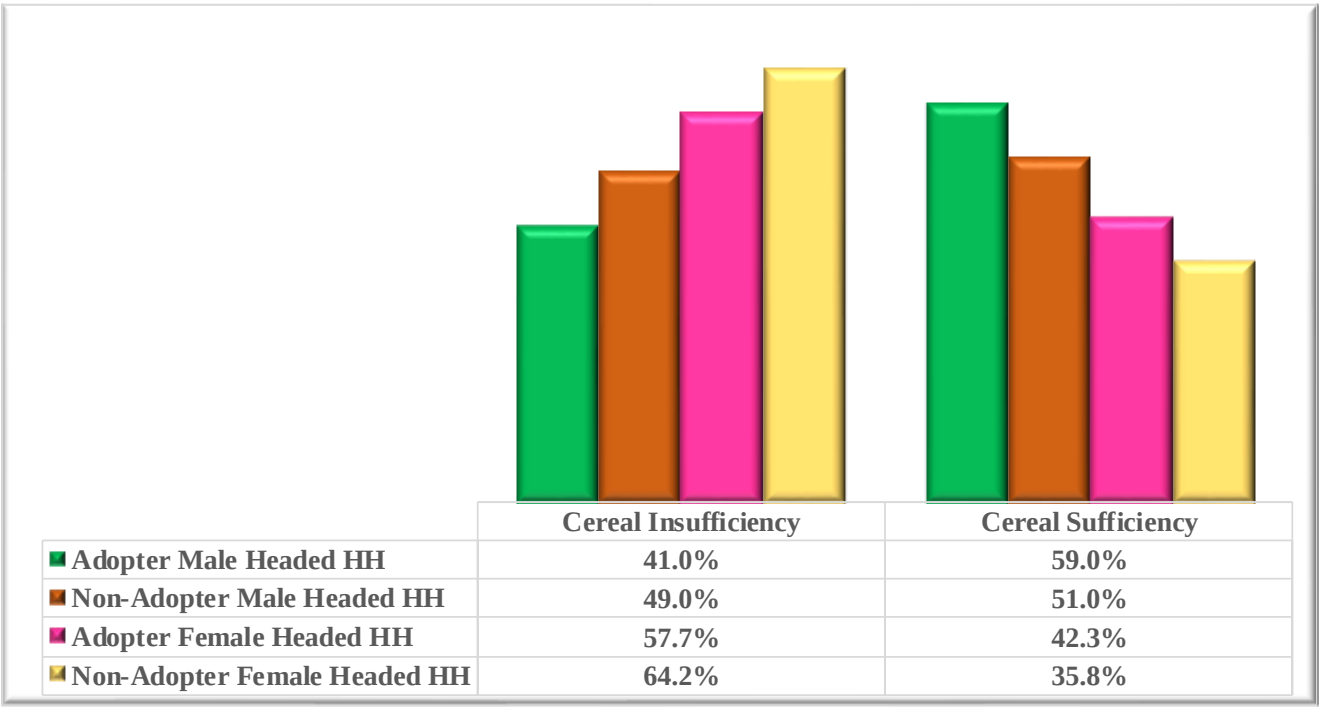


	ADOPTERS	NON-ADOPTERS	ALL HOUSEHOLDS
Cereal Insufficiency	43.2%	51.1%	48.8%
Cereal Sufficiency	56.8%	48.9%	51.2%

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 2018-May 2019) that the HH could not afford sufficient cereals (responses being yes there was a period when we had no food, or, no we had sufficient cereals every month within the reference period). Figure 22 provides the responses from the respective respondents. It was found that 51.2% of the respondents reported not facing cereal shortages. However, results show that cereal **sufficiency** is more likely among adopters (56.8%) than among non-adopters (48.9%). The reverse is also true; shortage of cereal among households is more likely among non-adopters (51.1%) than among adopters (43.2%). There is a decline in the proportion of HHs who had sufficient cereal the previous year due to the bad season experienced.

As with other variables, it was important to see this cereal sufficiency through a gender lens: are male headed HHs more cereal sufficient among adoption status or not? It is clear that male headed HH are better than female headed HHs in terms of cereal sufficiency. This pattern is consistent across adoption status. So, in general, adopting female headed HHs are more likely to be cereal sufficient than their non-adopting counterparts as shown in figure 23 below.

Fig 23: Was there a month (Jun '18-May '19) HH could not afford sufficient cereals (by Gender of HH Head)?



	Cereal Insufficiency	Cereal Sufficiency
Adopter Male Headed HH	41.0%	59.0%
Non-Adopter Male Headed HH	49.0%	51.0%
Adopter Female Headed HH	57.7%	42.3%
Non-Adopter Female Headed HH	64.2%	35.8%

From the two figures above (22 and 23), care should be taken that this result is not obtained by chance, hence further statistical analysis through Chi-Square became important. Table 6 presents the results.

Table 6: Cereal Sufficiency: Chi-Square Tests

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	3.540[a]	1	.060		
Continuity Correction[b]	3.230	1	.072		
Likelihood Ratio	3.550	1	.060		
Fisher's Exact Test				.064	.036
Linear-by-Linear Association	3.535	1	.060		
N of Valid Cases	680				

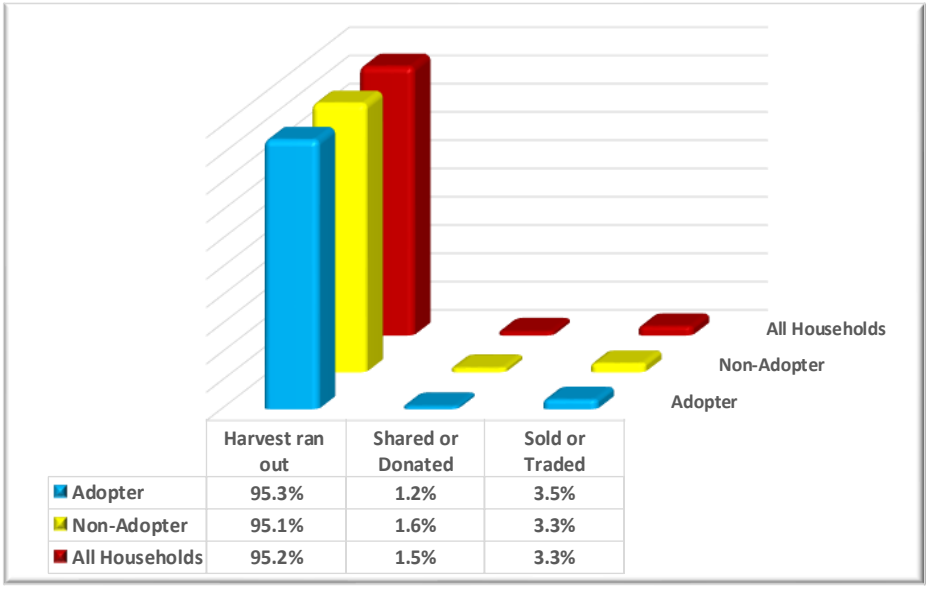
a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 97.16.

b. Computed only for a 2x2 table

Table 5 shows the results of the Chi-square test. The Chi-Score statistic here is computed to be 3.54, 1 degree of freedom, and the p-Value is 0.06. We are testing at the 5% level of significance (alpha = 0.05). Now, 0.06 is greater than the alpha value. Our result is therefore not statistically significant and we will fail to reject our null hypothesis which says that there is no association between adoption status and cereal sufficiency. ***Therefore, the conclusion is that there is no significant difference between adopters and non-adopters in terms of cereal sufficiency.*** Note that the opposite was found to be true in the 2017 Outcomes report. The shift in the result could be due to the long dry spells experienced in 2018 which could have affected the results.

Households that ran out of food in certain months were asked what led to the cereal shortage and their responses are presented in figure 24 below.

Figure 24:Reasons proffered for being cereal deficient – by Adoption Status

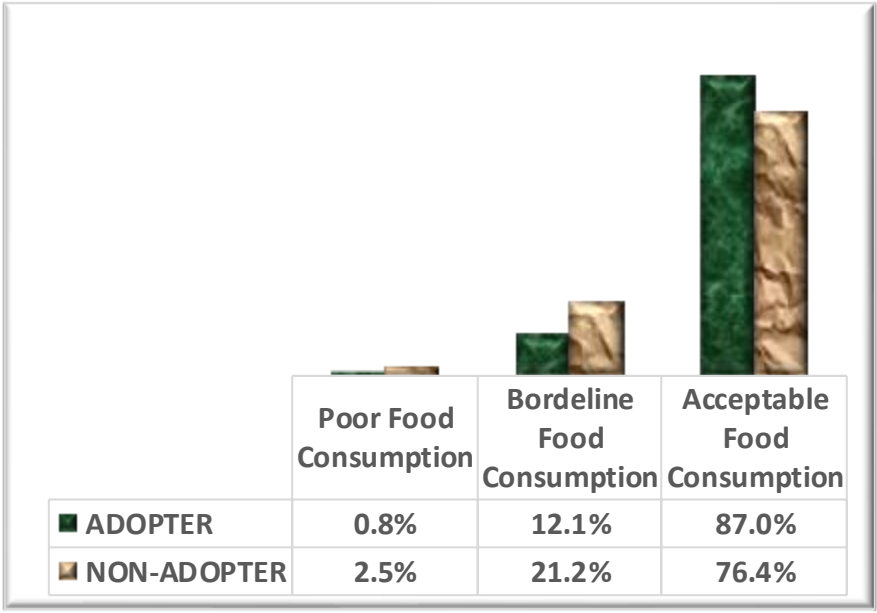


	Harvest ran out	Shared or Donated	Sold or Traded
Adopter	95.3%	1.2%	3.5%
Non-Adopter	95.1%	1.6%	3.3%
All Households	95.2%	1.5%	3.3%

Findings show that the main reason behind cereal deficiency is because households ran out of harvested stock. As high as 95.2% of all households that were cereal deficient cited their harvest running out as the reason. Figure 24 also reasserts that there was not much difference between adopting and non-adopting HHs in terms of reasons for cereal insufficiency.

4.3.1 Food Consumption Scores

Figure 25: Weekly Food Consumption Score

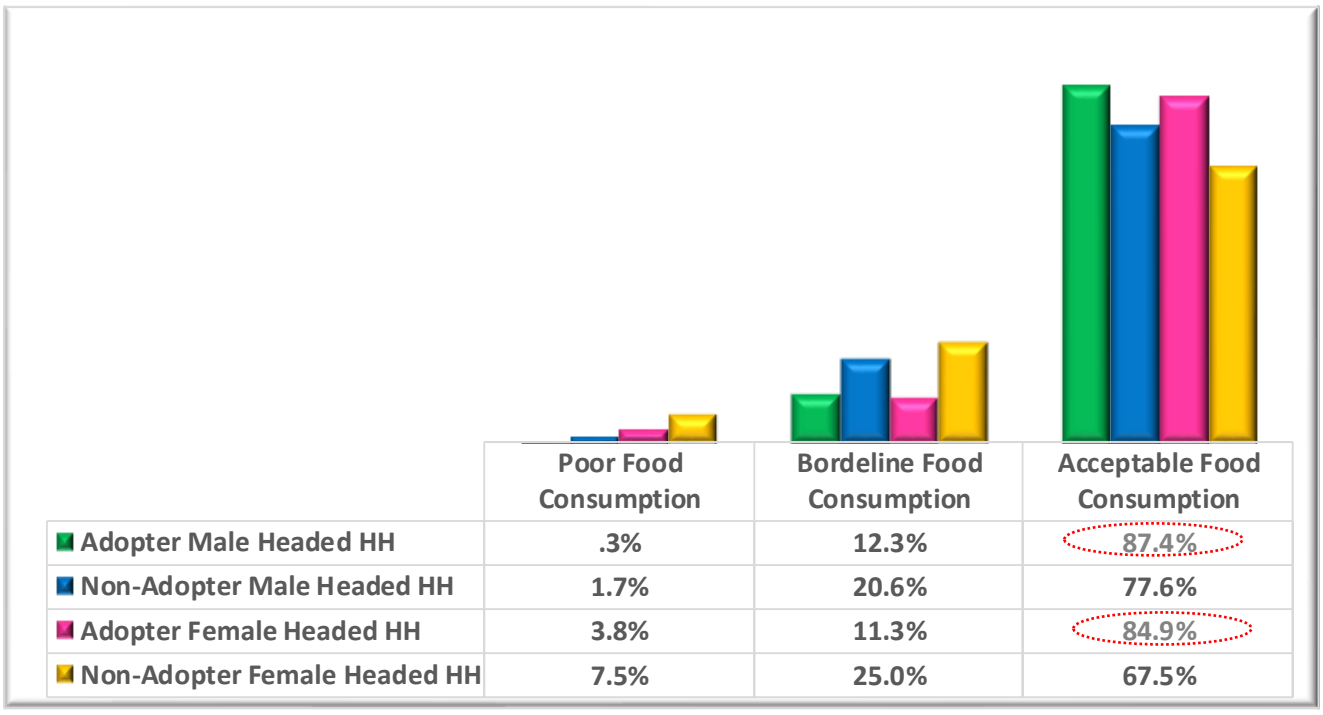


	Poor Food Consumption	Bordeline Food Consumption	Acceptable Food Consumption
ADOPTER	0.8%	12.1%	87.0%
NON-ADOPTER	2.5%	21.2%	76.4%

From a variety of food sources that form a balanced diet, including proteins, carbohydrates and fats, and fruits and vegetables, HHs were asked how many days in a week (out of 7 days) they had consumed each category of food. The results were then analysed to come up with the Food Consumption Score ranging from poor to borderline to acceptable.

Comparing adopters and non-adopters, it was found that 87% of adopting HHs are more likely to be in the acceptable food consumption range compared to 76.4% of non-adopting HHs. In the poor category, less than a percentage of adopting HHs are likely to be there compared to 2.5% of non-adopting HHs. Again, this was seen from the perspective of the gender of the head of HH as in Figure 26 below.

Figure 26: Weekly Food Consumption Score by Gender of HH Head



	Poor Food Consumption	Bordeline Food Consumption	Acceptable Food Consumption
Adopter Male Headed HH	.3%	12.3%	87.4%
Non-Adopter Male Headed HH	1.7%	20.6%	77.6%
Adopter Female Headed HH	3.8%	11.3%	84.9%
Non-Adopter Female Headed HH	7.5%	25.0%	67.5%

In terms of food consumption score, it was interesting to see that a larger proportion of female headed HHs was actually more likely to be in the acceptable range compared to, not only non-adopting female headed HHs but actually non-adopting male headed HHs. And as has been the trend, adopting male headed HHs are above conventional farming households.

Table 7: Food Consumption Score: Chi-Square Tests

Chi-Square Tests for food consumption score			
	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	14.227[a]	5	.014
N of Valid Cases	669		

A chi-square test was conducted to find out whether the differences in food consumption scores were due to the HHs adoption statuses or not. The null hypothesis was stated as: There is no difference between FCS for adopters and non-adopters. Testing at the 5% level of significance, the Chi-Score statistic for this test is computed to be 14.227, 5 degrees of freedom, and the p-Value is 0.014 which is less than the alpha value of 0.05. We therefore reject the null hypothesis and conclude that there is a significant difference in FCSs of adopters and non-adopters with adopting HHs having a better score than their counterparts as shown in Figure 26.

5. CONCLUSIONS, LESSONS LEARNT & 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 <u>average yield</u> of adopters and that of conventional farmers (Disaggregated by tillage type and gender of household head)***
  - Basin farmers' average yield 52.3% (Female headed HH reached 78.4% above the yield of conventional female headed households and Male reaching a margin of 47.5.6% above the yield of conventional male headed households),
  - ADP ripping adopters' yield was 110.8% (18.3% Female headed HH, and 119.1% Male headed HH),
  - For Year 3, Mechanising adopters are still performing better than conventional tractor farmers by 188.0% (135.8% Male headed HH, and no tractor Female headed adopting HH to compare with).
- ***Outcome Indicator 2.2: Margin of difference between the <u>average production</u> of adopters and that of conventional farmers (Disaggregated by tillage type)***
  - Hand hoe basin adopters beat hand hoe ridgers by 35.2% (Females = 49.6% and Males 33.8%),
  - ADP ripping adopters are 154.5% above (Females 10.9% and Males 164.2%),
  - Mechanised ripping farmers' production was beaten by that of conventional tractor farmers by a margin of 3.9% reducing from 18.9% the season before. 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 still 4% and hence there has not been any improvement).
- Other indicators of interest:
  - Cereal sufficiency (a proxy for food security) – although results showed that this is more likely among adopters than among non-adopters, *there was no significant difference between adopters and non-adopters in terms of cereal sufficiency*.
  - Dietary diversity - In terms of food consumption score, it was interesting to see that a larger proportion of female headed HHs was actually more likely to be in the acceptable range compared to, not only non-

adopting female headed HHs but actually non-adopting male headed HHs. And as has been the trend, adopting male headed HHs topped the charts.

5.2 LESSONS LEARNT

Some of the key lessons that can be drawn from this report include:

- ☑ Tractor farmers for comparisons still pose a challenge. This means that there is a good opportunity for the program to expand in terms of hectarage. It means we still have room to improve upon even with the farmers we are already dealing with.
- ☑ Although there is not significant difference between adopters and non-adopters in cereal sufficiency, adopters have more food item variety under food consumption scores.

5.3 RECOMMENDATIONS

The survey findings led us to the following recommendations:

- ✓ The CFU should continue pushing the Tillage Service Provision (TSP) agenda so that more farmers can have access to tractors because they easily translate into higher hectarage. The sample did not provide adopting female headed households that could give us a comparison for tractor ripping and ploughing.
- ✓ As the sampling is taking place, Field Officers must be more involved and assist to ensure that adopting female headed HHs that use tractors are provided with comparators for tractor productivity and yield.