Conservation Farming Unit

CONSERVATION FARMING & CLIMATE SMART AGRICULTURE

DFID CSAZ ADOPTION SURVEY REPORT

2017/2018

By the CFU RM, M&E Team

This report presents key Adoption Survey findings for Year 2 upon the implementation of the CSAZ Programme by the Conservation Farming Unit under DFID in June 2016. This report covers the 2017/2018 CFU training period and farming season.

ACRONYMS

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

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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 mobilised, CSA technology adopters will realise even smooth and increased benefits of adoption. The third (not covered by this study) is that if farmers adopt CSA technologies, then they will achieve improved livelihoods and food security.

An internal survey was conducted by the CFU's M&E department. The study used a survey methodology to establish the proportion of farmers who, after the 2017 trainings, adopted the content of the CSA technology trainings. The survey was carried out across 17 out of the 31 districts and in all the four areas of CFU operations in Zambia. The sample size was 702 trained farmers each representing a unique household whose member was trained in 2017. Because two of the farmers had faulty data in some of the variables, much of the analysis was however done only on 700 sampled farmers.

The survey established the value of Logframe indicators as follows:

- ✓ **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 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 this 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 is 65.1% achievement.

This study helps to highlight several lessons that the CFU should use to improve programming during year 3. The following are some of the lessons:

- ✓ Farmers that feel respected and known by the FC and FO allocated to them tend to be more motivated to take up and religiously implement CSA principles so as not to betray the trust and confidence invested in them by their FC/ FO.
- ✓ If the participation of Ministry of Agriculture officials at lower, grassroots levels (rather than only focussing on higher ministry officials) was to be increased, then there is a possibility that increase could ensure the sustainability of CA as a viable technology.
- ✓ Enticing farmers with seed packs for adoption is not sustainable and may as well be a strong factor explaining dis-adoption once support is pulled out.

Key recommendations that should be seriously considered by the CFU as we prepare for the third year are as follows:

1. Encourage farmers to attend all three training sessions as a couple so that there is no conflict within the household as to which tillage practice should be used because of a lack of full understanding by one party. FCs should be encouraged to have stronger relationship with famers so as to be able to tell who has skipped a session and where possible visit such farmers and encourage and advise them to attend similar sessions elsewhere.
2. Showcasing the benefits of minimum tillage, particularly during a non-stable season such as the current one, and having this imprinted among fellow villagers should have been taken more seriously. Conducting field days to showcase benefits of any minimum tillage using **an already tried, tested, and proven** local adopter should be the last option. Field days for any theme should be carefully planned to take place at **relatively new farmers**, whose plots really do not have much history of good performance so as to become more awe inspiring and convincing that indeed adopting is beneficial.
3. ADP as a business should be deliberately promoted as a way of scaling up ripping services in communities where farmers in fact have resources but are using them to rip only for themselves. At the same time, the CFU should investigate the ability and willingness to pay among farmers without ADP.
4. Weed management trainings should seriously emphasise that weeds are inevitable regardless of tillage method, but more apparent (visible) in plots were MT has been used as a tillage method of choice. Under conventional tillage methods there is an observed a first weeding "advantage" by ploughing in the weeds. Emphasis on weed control using herbicides should not be overdone and made to sound as if the traditional manual hand hoe weeding is not effective as it is a known fact that farmers are resource constrained. Hand hoe weeding for MT resource constrained farmers should be promoted, emphasised, and regarded as normal so as to curb the currently rampant practice of reverting to conventional tillage and conventional ridging as a weed control measure
5. There is need for stronger collaboration between the CFU and the Ministry of Agriculture. While collaboration is already there, it appears that Ministry of Agriculture grassroots staff are overwhelmed by multiple and concurrent demands for their services and thereby reducing their sustained involvement in CSA efforts. Wherever and whenever possible, this later fact should be highlighted to Ministry of Agriculture higher offices.

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) specific to adoption and gives the study objectives.

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 200,000 farmers annually across four (4) CFU operation regions namely; Central, Eastern, Western and Southern. This covers a total of 31 Zambian districts. The project has 81 Field Officers (FOs) and 11 Senior Field Officers (SFOs) across the four regions. Each FO trains and/or oversees training of about 2,700 farmers 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 they one they attended before. None the less, the study sought to find out reasons why individual farmers repeated trainings. 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 2017 round of trainings in preparations for the 2017/2018 season namely:

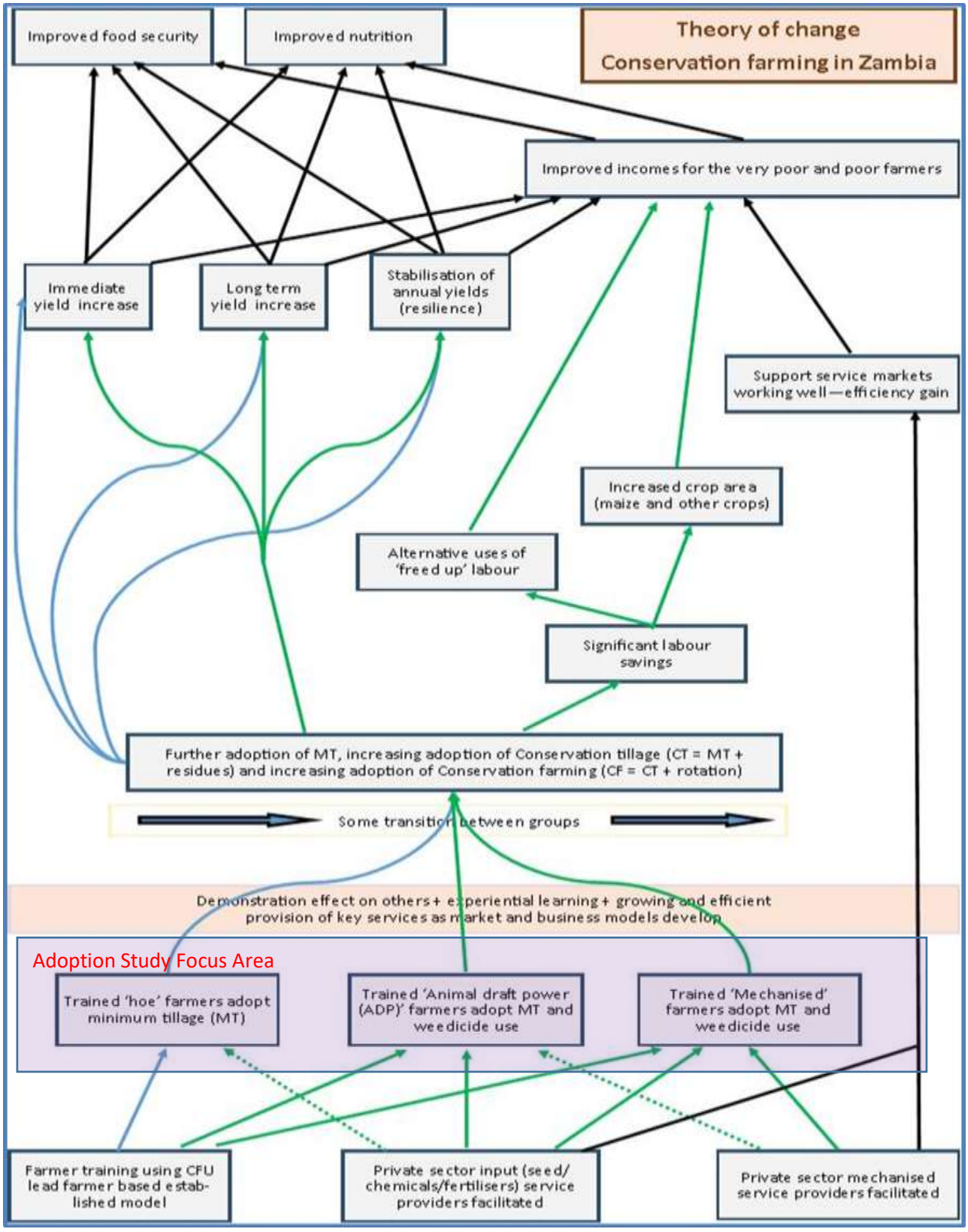
- ✓ Period 1-Land Preparation (with three sessions similar in content, to cater for more than the 30 farmers expected in one training session),
- ✓ Period 2-Nutrient application, liming and seeding (three sessions as above),
- ✓ Period 3-Weed management (again with three sessions).

The core purpose of these trainings was to ensure that the farmer would move on to adopt the CF technology. 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 category 1. Category 2 Adopters are those, now that we are in year 2 of the project, farmers that went on to use a combination of minimum tillage and the accrued compost of crop residues. The survey sought to find out if and how many of those trained farmers had adopted the CF technology (disaggregating them by the two categories) and if not, why not.

1.2 CSAZ THEORY OF CHANGE

The CFU's CSAZ Theory of Change (ToC) below outlines how training farmers leads to adoption and other higher indicators like yield increase. The highlighted sections of the ToC were the subject matter for this Adoption Survey. 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 or from CT to CF. In the survey, questions were raised in such a way as to bring out those differences and see which category is 'housing' most of the adopters under the programme. The survey also tried to establish to some extent whether farmers have progressed from Minimum Tillage (MT) to Conservation Tillage (CT) and ventured towards 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).

Figure 1: CSAZ Theory of Change



1.3 STUDY OBJECTIVES

The main objective of this survey was to '***Establish the proportion of 2017 trained farmers that adopted the technology of Conservation Farming (CF) and Conservation Tillage (CT).'***

The specific objectives were as follows:

1. To determine the tillage methods used for each categorization of farmers.
2. To establish the average number of hectares cultivated per household under each of the flowing categories:
   a) Minimum Tillage
   b) Conservation Tillage
3. To establish the number of CFU trained farmers who have adopted climate smart agriculture at its different levels as defined by the CFU (see 2 above).
4. To determine when farmers prepared their land and when farmers planted their crops with regard to the time frame recommended for conservation agricultural practices in Zambia.
5. To establish the number of CFU trained farmers who have used herbicides as a form of weed management during the 2017/18 season.

1.4 DELIMITATIONS

The targeted respondents for this survey were the 2017/2018 CSAZ trained farmers across all the four (4) regions of the CSAZ programme as named above. In these 4 regions and out of a total of 31 districts, the survey was carried out in seventeen (17) randomly selected districts - Luano, Mkushi, Kapiri Mposhi, Mpongwe, Kabwe, Rufunsa, Nyimba, Petauke, Sinda, Chipata, Mazabuka, Monze, Kalomo, Namwala, Kaoma, Shibuyunji and Mumbwa. In addition, only Field Officers (FOs), Farmer Coordinators (FCs) and farmers from the sampled districts were eligible for being part of the survey.

1.5 CHALLENGES

As will be expected for any study, the Adoption Study faced several challenges. It however suffices to note that none of the challenges encountered had any significant impact on the survey results. The first challenge faced was that of accessibility of individual farmers due to it being the rainy season. 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. Some roads were impassable by vehicles and enumerators had to walk some distances to get to the farmers' homesteads. In some cases, the field officers would help transport enumerators with motorbikes. Other enumerators had to hire bicycles to get to the farmers. Fortunately, the enumerators as well as the drivers of hired vehicles had been forewarned and hence they had both protective wear and plans to come out of the mud if vehicles were to get stuck. The second

challenge was not finding some farmers at their homesteads. Prior to and slightly into the survey, there was a long dry spell and rains only resumed when the survey was running. So this was the time that farmers had to apply fertilizer and/or weed. Others who had abandoned their fields or whose fields had dried up took advantage of the rains to plant other food crops like sweet potatoes and cowpeas. This made it difficult to find farmers at their homesteads. In some cases, farmers were called because they were already aware of the survey but in instances were fields were far from the homesteads, those farmers were replaced with someone else within the villages. And where one FC could not give sufficient numbers of trained farmers, another FC was selected. The same challenge was faced especially that the replacement farmers had not been aware of the survey.

The third and final challenge was that of poor mobilization by a few field officers and farmer coordinators such that the numbers of farmers were not adequate per area. This again led to farmer replacements which had its own challenges as mentioned above.

2.0 STUDY METHODS

This survey was conducted in all four (4) regions of the CSAZ project (namely Central, Eastern, Western and Southern) in specific randomly sampled districts within these regions. The overarching methodological framework was sample survey and the data collection tool was a structured questionnaire in Computer Tablets using CSPro software. Qualitative methodologies such as Focus Group Discussions (FGD) and open ended discussions with Farmer Coordinators (FCs), as well as field observations of the crop status at the time of the survey were done. Qualitative methods were conducted by the MRM team. Key Informant Interviews were also conducted with Disctrict Agricultural Coordinators and CFU Regional Staff. Rain Data was also obtained from CFU Field Officers. Qualitative data was first captured using Computer Assisted Interviewing Software called CSPro and then 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, and Field observations

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 practices/ adoption taken up by farmers after-training in the 2017/18 farming season. The fact that the sample was generated from a database of farmers who were trained by the CFU under CSAZ in the 2017/18 season meant that the resultant adoption pattern can be attributed to the trainings during 2017 as well as to prior trainings. Furthermore, the questionnaire incorporated aspects of gender and disability in

households (HHs) in order to establish the extent to which women and people living with disability within the household own land and make decisions regarding the land they own in cases where they do. Such decisions would include (but not limited to) what tillage method to use, as well as what crops to grow. Another aspect of gender was with regard to the sex of the trainer and opinions on whether this would have had a different impact on the training or on the farmers had the trainer been of the opposite sex. Assets owned and inputs accessed were also areas of interest covered by the questionnaire. The questionnaire is attached as Annex 1.

2.1.2 Focus Group Discussions and Open-Ended Discussions

The FGDs were administered to a group of farmers 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 how much of what was trained by FCs during the 2017/18 season was actually put into practice by the farmers. Farmer Coordinators (FCs) were also engaged in open-ended discussions in order to establish and have a feel of issues surrounding adoption.

2.1.3 Field Observations

Actual observations of the crops in farmers' fields at the time of the survey were made where the farmer had not yet harvested the respective crop that was under CF. Enumerators were trained to make a judgement of whether the crop would be categorised as a "write off", "Fair" or "Good".

2.2 SAMPLING

All the CFU regions were taken as part of the sources of data. Sampling was three-tiered: Random sampling of 17 out of the 31 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 trained by the CFU in 2017 and were proportionately spread across all sampled areas taking into consideration the size of the areas and the number of trained unique farmers. There was no need to sample untrained farmers as this survey was establishing adoption levels rather than answering the question "Does CF work"?

2.2.1 Geographical Sampling

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

Region and District Level Sampling

Table 1: Sample sizes (Regions and Districts)

Region	District	Total Sample
Central	Kapiri Mposhi	30
	Luano	30
	Mkushi	47
	Mpongwe	53
	Rufunsa	24
	Kabwe	37
	Total	221
Eastern	Chipata	49
	Nyimba	49
	Petauke	68
	Sinda	56
	Total	222
Western	Kaoma	40
	Mumbwa	37
	Shibuyunji	40
	Total	117
Southern	Kalomo	35
	Mazabuka	32
	Monze	26
	Namwala	49
	Total	142

As is shown in Table 1 above, the Adoption Survey was carried out in all four CFU CSAZ regions. The second column shows the randomly sampled districts and then the third column shows total sample sizes randomly drawn from geographical area. This was done in order to enable the survey to be as representative as possible in reflecting an accurate picture of what happened after farmers were trained by the CFU in the 2017/18 agricultural season.

2.2.2 Field Officer Level and Farmer Coordinators.

From each district, it was also essential that we randomly sample field officers and the respective farmer coordinators (FCs) under them (for the same reason as given above when sampling districts).

Table 2: Sample Sizes (Field Officers)

Region	Field Officer	Sampled Farmers
Central	Benjamin Ngoma	31
	Bruce Phiri	24
	Chongo Chikwamba	39
	Grace Mpolokoso	47
	John Mbewe	43
	Ruth Phiri	37
	Total	221
Eastern	Ackson Banda	51
	Bwalya Kangwa	49
	Hezron Ngulube	67
	Rosemary Banda	55
	Total	222
Western	Andrew Kayengo	40
	Hanu Habeenzu	40
	Sam Chinyemba	37
	Total	117
Southern	Actress Musumali	26
	Ephraim Sianduba	49
	Miyanza Lisulo	35
	Obrean Sinkala	32
	Total	142

Table 2 above shows how the sampled farmers were distributed among the different randomly sampled Field Officers (FOs) in the various randomly sampled districts of the regions. Once the FOs were chosen, a list of Farmer Coordinators (FCs) under them was drawn and then also randomly sampled.

2.3 DATA MANAGEMENT

Data was collected by 12 enumerators who were engaged for the purpose. These had already been trained in similar surveys and hence they were familiar with how to carry out the survey. Nevertheless, before actual data collection, the enumerators underwent an intensive three-day training workshop which included field trial run and testing of the survey tool. Trial run were carried out in Chongwe area of Central Region.

The actual data collection was done using Computer Assisted Personal Interviewing (CAPI) software on Lenovo Tablets and therefore all information obtained was electronic. The interviews were designed using CSPro 7.0 Software which ensured that data obtained was of the highest possible quality at that level. Quality assurance rules were built within the CAPI software and this included skipping to the next section if question is non-applicable to the respondent.

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 in the year during the 2017/18 season, the sex of the household head (HH head), as well as the sex of the trained person, and any disabled persons within those households. Farmers were categorised into three groups representing year of first training. The section also focusses on household labour size, the number of HH members receiving the same training, and the ages of trained farmers. The size of plots cultivated by farmers practicing CF, as already noted above, was also established as well as whether the farmers retained and used crop residue (category 2 adopters). Asset ownership focused on the availability of animal draft power from oxen and donkeys as well as the farm implements that are appropriate to the CF practices. It will be determined if some oxen owners also provided ADP tillage services to farmers.

The section will also discuss issues related to the timely delivery of and access to inputs. The report will also discuss whether farmers planted with the first available planting rains when those occurred for their respective areas. We also examine the uptake of herbicides to control weeds on the part of those farmers who attended training. The frequency of weeding is also explained in this section. Field day attendance by farmers was also analysed.

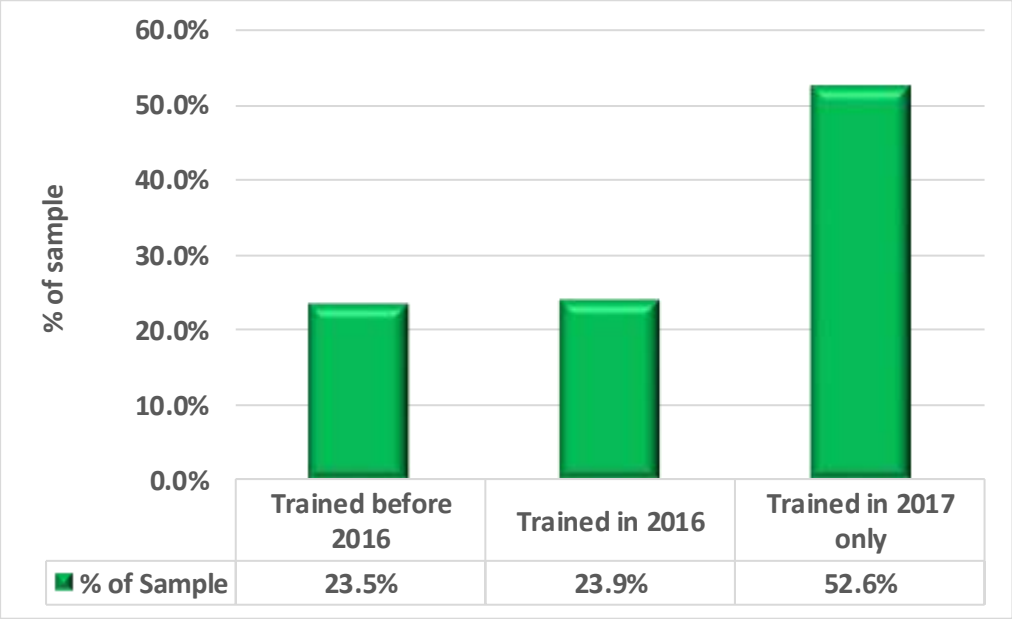
First however, focus will be put on secondary data on the CSAZ outputs to date so as to give readers an insight into the training of farmers during the 2017 (Year 2 of the project) training period.

3.1 Demographics

3.1.1 Farmer Trainee Sub-category.

Figure 2 below shows training categories of farmers in line with when they were first trained in CSA under the CFU. Upon launching of the CSAZ programme in July 2016, it was agreed that the CFU would move into new areas not covered in previous years under CAP I and CAP II. These areas were new in two regards – 1) Completely new areas in new districts of operation and 2) New areas but within old districts of operation. The survey deliberately sampled over 50% of the respondents to come from completely new farmers. It was also a deliberate effort to target at least a quarter of the sample to be from Old trainees. This is why the majority (52.6%) of farmers sampled were first trained in 2017. Figure 2 also shows that there was a rise in number of new trainees in 2016 and a further rise in 2017. The latter rise in numbers of farmers attending trainings (P1, P2 and P3) can be attributed to the fact that in Year 2 there was an increase in the number of FCs from 1690 to 2760 in order to bring it up to the full complement as cited in the CFU CSAZ log frame. These FCs were all selected in new areas of operation. In addition, old FCs were also required to expand and have at least one new village in which they carried out trainings.

Figure 2: Farmer Trainee Category



3.1.2 Gender of Household Head.

Data shows that out of the 500 respondents who were heads of households, 79.8% of households are headed by males and 20.2% are headed by females – one in five households is headed by a woman. This mirrors existing gender relationships within the rural Zambian context. Adoption patterns and trends by gender are established in Section 4.4.1 below.

3.1.3 Household Labour Size

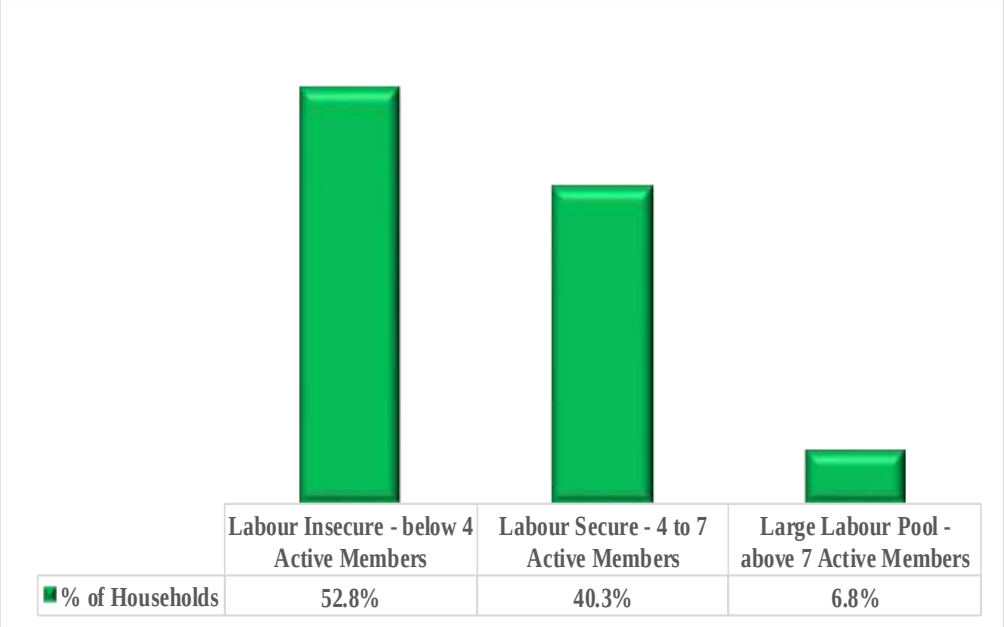
Labour restrictions combined with a lack of resources means that some farm families might not be able (assuming they want to) to convert CF MT to more plots until later on when the benefits of labour and inputs savings are realised and ploughed back into outsourced labour. However, labour constraints affect farming households irrespective of the tillage practices they are doing and not just CF adopters or those wishing to adopt and /or expand their holdings under CF. The categories regarding labour restriction categories are outlined in the bullet points below.

- ✓ Labour insecure if they have less than four labour active members;
- ✓ Labour secure if they have four to seven labour active members; and
- ✓ Large labour pool if they have more than seven labour active members

Labour security here is defined as the ability to potentially have labour available even if one labour active person should fall sick during the time when labour is demanded. As can be seen below in Figure 3**,** up to 52.8% of the

trained farmers' households are labour insecure while only 47.1% are household labour secure. Farming households with acute labour constraints might need to hire in labour to carryout key farming operations during the course of the season.

Figure 3: HH Labour Security

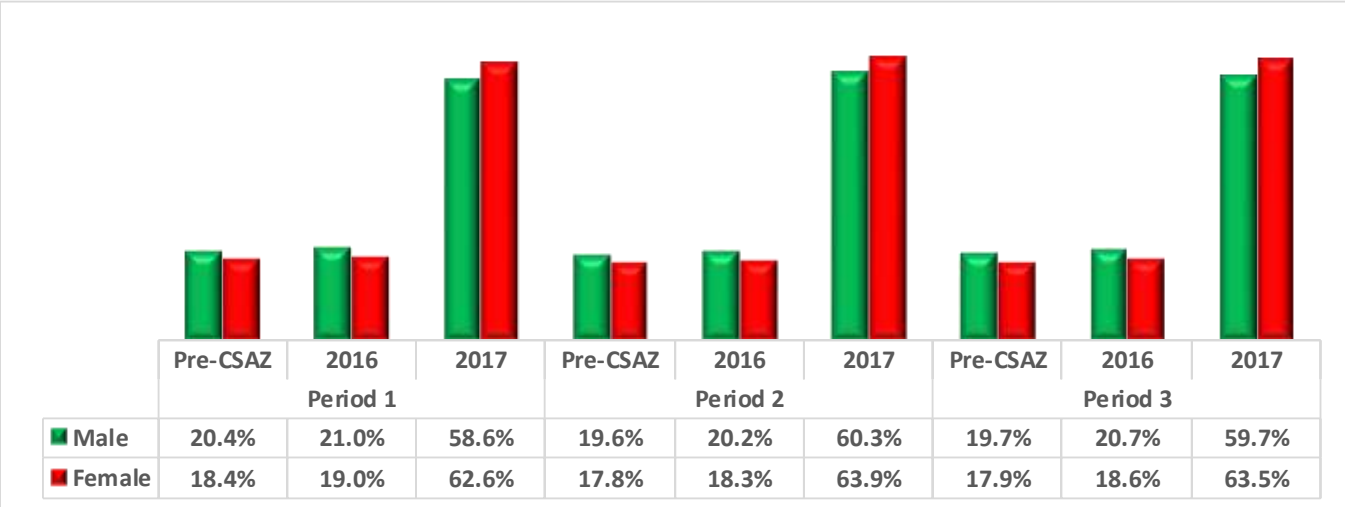


3.1.4 Training Attendance.

This subsection briefly profiles the sampled respondents' training attendance during the 2017 CSAZ trainings. Figure 4 shows that the type of farmers attending trainings increases by around 1% between pre-CSAZ and its Year 1 (2016) and sharply increased by over 38% Year 2. This shows that the trainings are attracting new trainees bearing testimony to the fact that CSAZ trainings are very much in demand particularly among people that have not yet been trained and especially that the program moved to new areas.

It is also evident that in 2017, the proportion of females attending trainings is higher than that of males owing to the fact that some areas generally have a higher population of female folk than men. In addition, according to three out of four of the regional managers discussed with, women are generally more receptive to the CSA messaging whereas men take a little longer to be convinced as they will be busy with other livelihoods that bring about quick returns such as fishing, charcoal burning and in places where livestock herding is common practice, they take their livestock to the flood plains for feeding during the dry season which coincides with CFU trainings – hence the men will be absent during this time.

Figure 4: Training Attendance - Proportion of respondents



	Pre-CSAZ	2016	2017	Pre-CSAZ	2016	2017	Pre-CSAZ	2016	2017
	Period 1			Period 2			Period 3		
Male	20.4%	21.0%	58.6%	19.6%	20.2%	60.3%	19.7%	20.7%	59.7%
Female	18.4%	19.0%	62.6%	17.8%	18.3%	63.9%	17.9%	18.6%	63.5%

3.1.5 Multiple Trainees within the Household

The CFU holds that it is important to ensure that a household has more than one person trained in the CF practices as well as other technical sessions such as weed control. Both are encouraged to attend training and to subsequently support each other as they try out and eventually adopt the practices.

Figure 5: CFU Trainees within a Household

	Double Trainees - Spouses only	Single Trainee - Only One Spouse	One person with no spouse was trained	Triple Trainees - Both Spouses and at least another Household Member	A person with no spouse and another Household member trained	Double Trainees - A spouse and another Household member
% of Respondents	41.7%	31.3%	13.7%	7.3%	4.0%	2.0%

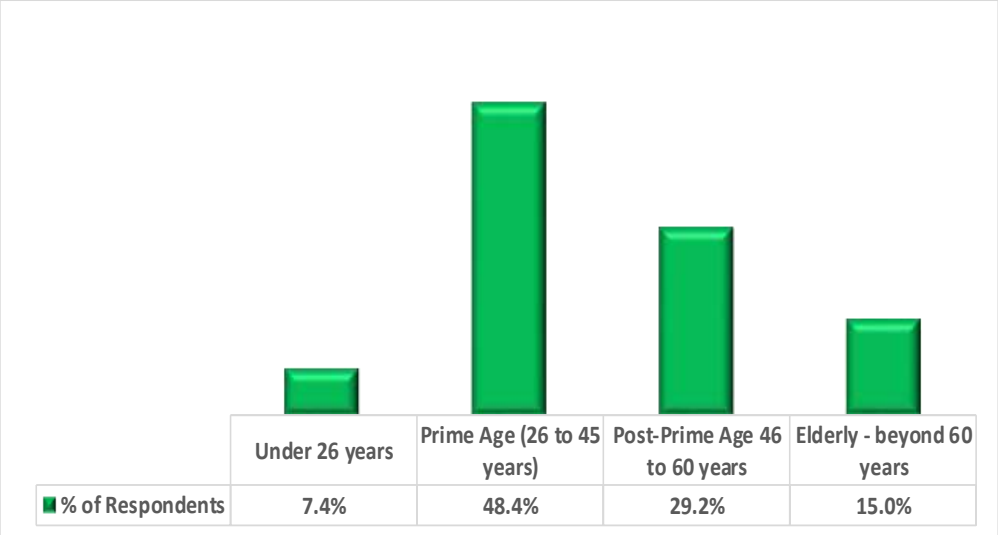
The CFU also encourages three or more persons from each farming household to attend training if they are going to be actively engaged in key farming operations over the course of the season. This all family approach also ensures that if one person is not present for whatever reason(s) during the season, then there is at least one other person capable of managing that operation.

An analysis done on the number of trainees in the household brought to light the occurrence of training of more than one person within the household – usually the respondent and an additional person or persons. Figure 5 above shows the results of the survey. It was discovered over the course of the survey that 41.7% of the households surveyed indicated double trainees comprising spouses only.

3.1.6 Age of trained farmers

Ideally, CF technology practices are passed from one generation to the next. In general, it is young to middle aged adults who attend trainings. Figure 6 therefore looks at the age categories of farmers trained by the CFU.

Figure 6: Age of Respondents



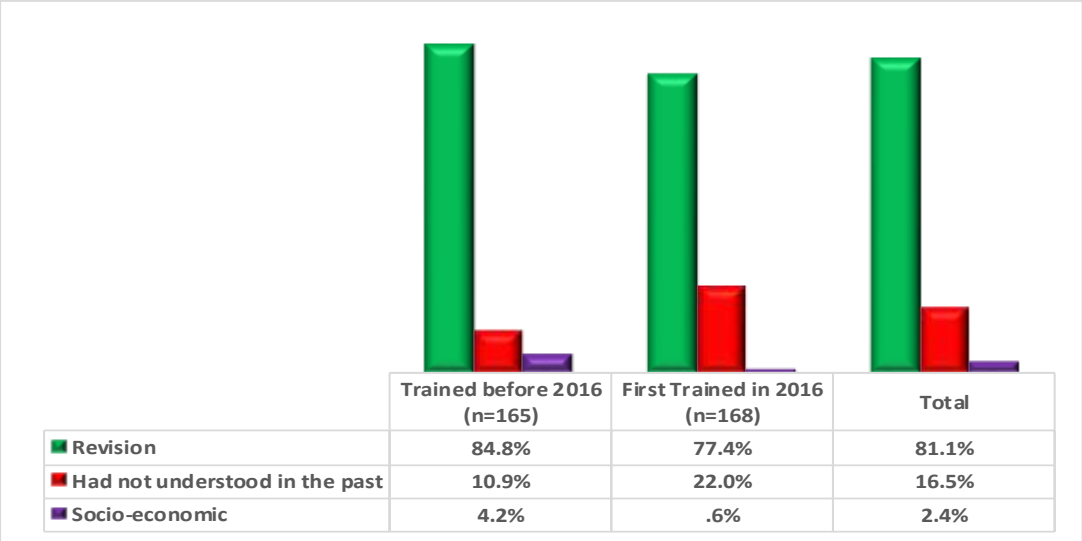
This is an expected trend and is deemed as the right population to lay the ground work for a generational crossing of farmers who will continue to carry out and expand CSAZ practices. In any society, drivers of new ways of doing things are deemed to be those between the ages of 25 and 46 years old, this is notably the age group of most rural farming communities. This group, as shown in figure 6, also appears to be supported by older and more experienced farming members within the communities who have been farming for a relatively longer time and as such, the CSA technology will hopefully become a sustainable practice over time and generations to come even in the absence of active trainings by the CFU.

3.1.7 Reason for Repeating training year after year.

It has been noted above that respondents fell into two groups, those that had already been trained by the CFU before the CSAZ project and those that were only trained by the CFU from 2016 to date (with two sub-groups; those first

trained in 2016 and those first trained only in 2017). The survey sought to establish reasons why those trained before the CSAZ as well as those trained in 2016 went on to again attend 2017 trainings.

Figure 7: Why Farmers repeated Training in 2017



	Trained before 2016 (n=165)	First Trained in 2016 (n=168)	Total
Revision	84.8%	77.4%	81.1%
Had not understood in the past	10.9%	22.0%	16.5%
Socio-economic	4.2%	.6%	2.4%

Figure 7 above shows that farmers repeatedly attend trainings mainly for revision purposes. Of course, this is more or less the same reason as "had not understood in the past" but never the less the study separated "Revision" to refer to those that had understood but chose to turn up simply for pure revision and assurance purposes. Within CFU, some had started theorising that one strong reason for repeating training was food and friends, but such socio-economic reasons are almost insignificant when compared to the more noble reasons of genuinely wanting to learn. Farmers tend to keep on attending trainings in case something new would be taught in what is deemed a changing agricultural environment especially with the recent incidences of fall army worm attacks on crops and dry spells. The basic technical message is the same with minor changes which they do not want to miss out on.

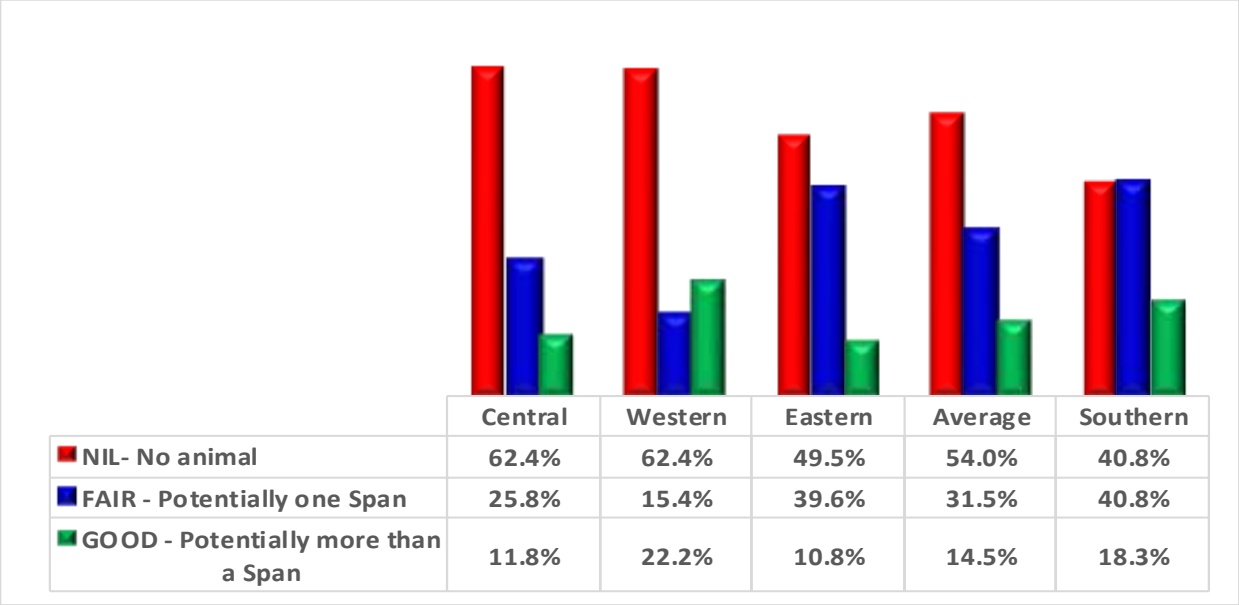
3.1.8 Potential Draft Power in Households

It is a commonly and endlessly echoed assumption that digging CF Hoe basins is more labour and time consuming. However, this comparison is almost always made against animal draft power; making it an unfair comparison for what are obvious reasons. Farmers who own animals are therefore more likely to adopt CF ADP MT for what are also obvious reasons. Farmers who have lost their animals and do not have access to other draft animals might or might not turn to hoe tillage whilst they build up their animal asset base. We therefore felt it important to try and ascertain the level of animal ownership during the survey.

As shown in Figure 8, the survey reveals that there are less farmers in Southern Region who do not own animals compared to the other three regions. This is an expected trend as the farmers in the Southern province, mainly of

Tonga and Ila origin, culturally place a high value on cattle and consider it to be a symbol of wealth and therefore draw much pride from owning many. They also have the highest potential for animal draught power represented by 59.1% followed by Eastern Region farmers who also have a fairly good potential represented by 50.4%.

Figure 8: Potential Animals for Draft Power in Households by Region



	Central	Western	Eastern	Average	Southern
NIL- No animal	62.4%	62.4%	49.5%	54.0%	40.8%
FAIR - Potentially one Span	25.8%	15.4%	39.6%	31.5%	40.8%
GOOD - Potentially more than a Span	11.8%	22.2%	10.8%	14.5%	18.3%

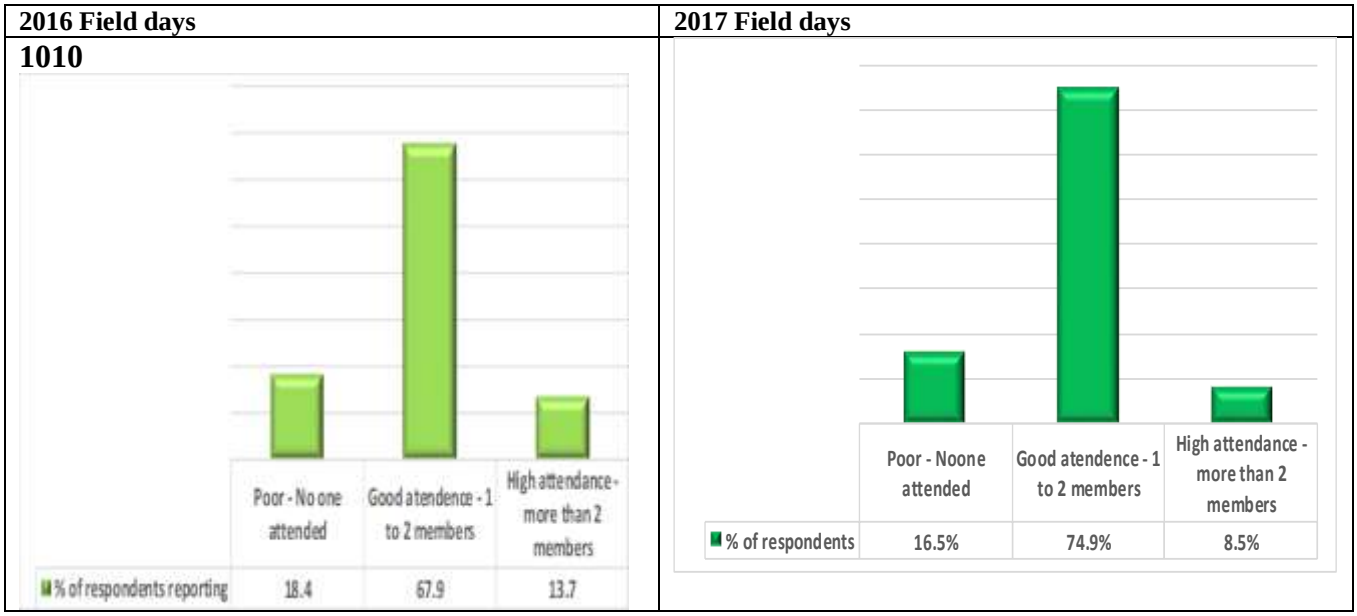
This observation, in light of the assumption that digging CF basins is more laborious and time-consuming, can be an opportunity to scale up the use of animal draft power (ADP) amongst farmers in these two regions in order to be able to fully exploit ADP tillage methods and thus push up adoption through ADP. Where potential animal draft power is relatively low, that is, in Central and Western Regions, farmers, emphasis should be placed more on basins as well as Tractor ripping.

3.1.9 Field Days Attendance

The survey also asked farmers concerning field day attendance by members from the respondents' households. It was hoped that, at least for first year trainees, if they have not yet adopted, their resolve to adopt in subsequent years would be strengthened if they attended field days and witnessed first-hand the results of the trainings as others put into practice the same trainings that they had attended but decided for whatever reason(s) not to try out what they had learned during training sessions.

A field day is hoped to help '*doubting Thomases'* who would be waiting to see the performance of other trainees and hence could be very useful to strengthen their resolve to take up CF technologies in subsequent years. Figure 9 shows that 83.5% (and that was 1.8% more than 2016 attendees) of the households whose members were trained in 2017 (June to September) had also turned up for field days of February to April 2017. Again, it is hoped and will be tracked how many of those who did attend field days, went on to adopt.

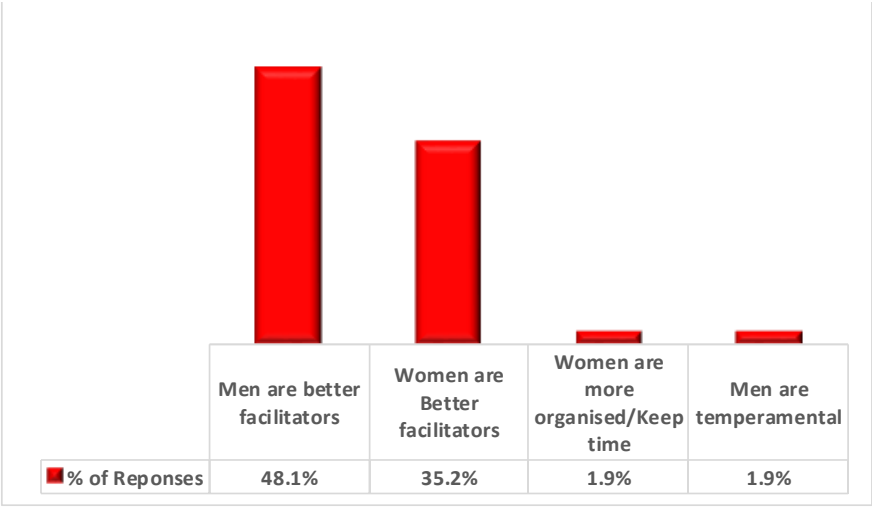
Figure 9: Field Days Attendance (2016 vs 2017)



3.1.10 Does Gender of the trainer Matter?

Among CSAZ's 2700 farmer coordinators (the people mainly in charge of training of farmers and hence driving adoption at local levels), 18% are females. As we try to understand the adoption numbers and what possible barriers there could be, it was important to find out from the trainees whether the gender of the trainer makes a difference from the perspective of the trainee and thereby possibly affect adoption. Just like in year 1, the majority of respondents (90.5%) held that the trainer's sex **really does not make a difference** and only 9.5% (N=702) of the respondents hold that gender of the trainee does make a difference. The survey nevertheless sought to find out the reasons offered by these minority respondents. Figure 10 shows an analysis of the opinions of these respondents. Out of those who said that the sex of the trainer was an important aspect, 48.1% noted that men are better facilitators.

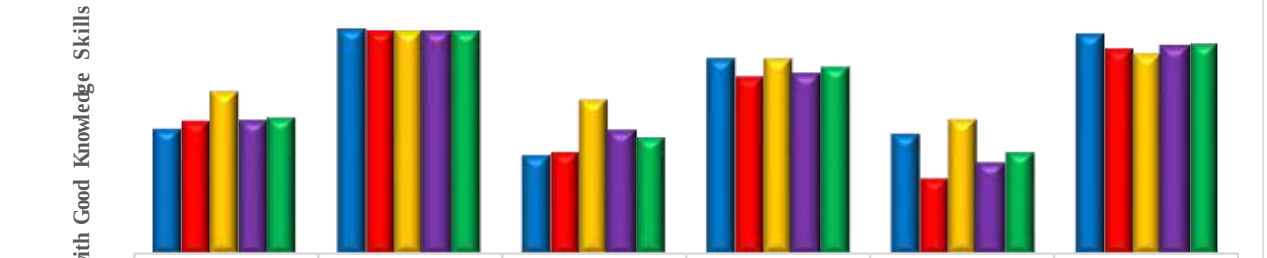
Figure 10: Reasons for Why it would make a difference if trainer were of another sex



3.2.9 Level of CSA Knowledge among 2017 Trained farmers – Post Training Vs Pre-Training.

The CSAZ theory of change is founded on the premise that training leads to increased knowledge of technologies and this is related to whether one will eventually adopt or not. Knowledge acquisition levels is in fact indicator 1.2 in the CSAZ Logframe (Proportion of trained farmers in the "Good" CSA Knowledge category post training).

Figure 11: Proportion of Trained farmers scoring at least "Good" - Post Test.



	P1		P2		P3	
	Pre-Test	Post-Test	Pre-Test	Post-Test	Pre-Test	Post-Test
Central	54.3%	98.1%	42.7%	85.4%	52.7%	96.4%
Eastern	58.3%	97.7%	44.4%	77.6%	33.0%	89.9%
Western	71.0%	97.3%	67.4%	85.6%	59.0%	87.2%
Southern	57.8%	96.9%	53.7%	78.8%	39.0%	90.7%
Total	59.4%	97.6%	51.2%	81.5%	44.4%	91.7%

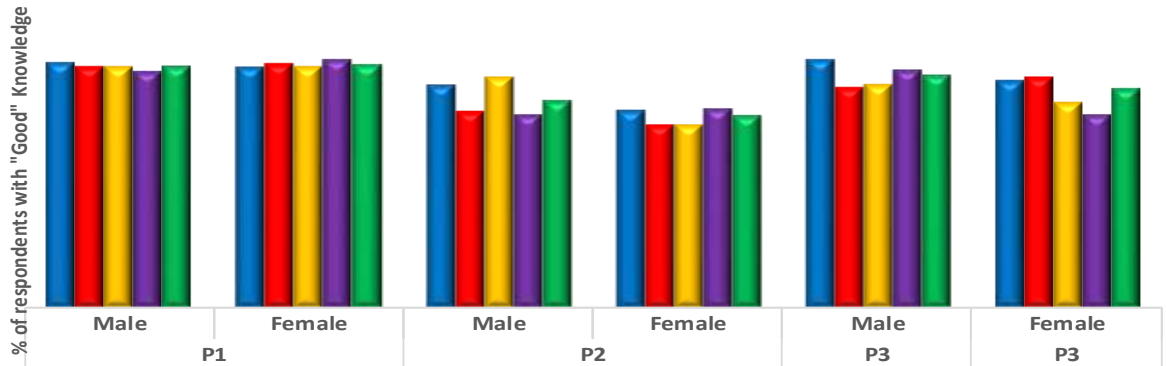
From the graph above where proportion of farmers scoring at least 'Good' is disaggregated by regions, Western region seems to have been doing better than all the other three regions in the **pre-test** in all the training periods. This could be because all the three districts sampled in Western Region have had CFU's presence for a longer time compared to some newer districts sampled in the other three regions like Mpongwe in Central, Nyimba in Eastern and Namwala in Southern which are all 2017 areas. Even if some farmers were trained in 2017 for the first time, there could have been some spill over effects within districts in Western region as opposed to totally new districts like Mpongwe. It is therefore expected that Western region farmers appeared to be more knowledgeable even before the 2017 training sessions.

Overall, there is a major improvement in knowledge after training farmers as clearly shown in the graph from an average of 51.7% (pre-Test) to 90.3% (post-Test). This improvement is recorded in all three periods to varying degrees from region to region except for P1 where they were more or less at the same level by Post-test time. Of the three periods, P3 or Weed Management, showed the most significant improvement registering an increment of about 47.3% above the pre-test knowledge level followed by P1 or Land Preparation with 38.2% and lastly 30.2% for P2 or Plant Nutrition and seeding. This could be explained by the fact that weed management is probably the biggest challenge that farmers face even before they plant making farmers more interested in that component than the other two. This has nothing to do with numbers attending P3, it has everything to do with farmers' knowledge increment because they are more interested in that topic. In the CFU's quarterly report, P3 was the least attended period after consolidating all regional data (See CSAZ Q3 Report, Pg. 6). P2 has the least change in knowledge because any

farmer, adopter or non-adopter, knows about fertilizer application and seeding, the basics are the same with some differences only in timing of application and perhaps quantities which is linked to resource availability. But P2 is not a new subject to some farmers. From this it can be deduced that the most important periods in CFU trainings are P1 and P3. This does not, however, take away the significance of P2.

It would be interesting to disaggregate this by gender. Figure 12 below shows post-training knowledge by gender proportions.

Figure 12: Proportion of Male & Female Trainees with Good knowledge



	Male	Female	Male	Female	Male	Female
	P1		P2		P3	P3
Central	99.1%	96.9%	89.8%	80.0%	100.0%	91.5%
Eastern	97.4%	98.3%	79.0%	73.6%	89.1%	92.9%
Western	97.1%	97.5%	92.9%	73.5%	89.8%	82.8%
Southern	95.6%	100.0%	78.0%	80.6%	96.0%	78.1%
Total	97.4%	97.9%	83.6%	77.3%	93.5%	87.9%

This is not a comparison between pre-test and post-test like above but a comparison between male and female farmers post-training. As can be seen from the graph, generally male farmers are likely to be more knowledgeable after training compared to female farmers albeit by a small margin (83.6% compared to 77.3% for P2 and 93.5% compared to 87.9%) except in P1 where female farmers were seen to have slightly beaten their male counterparts (97.9% for females compared to 97.4% for males). The differences are not huge showing that knowledge change is not dependent on gender of trainee as long as they are equally committed and the trainer is the same.

4.0 UNDERSTANDING ADOPTION

Since this is the second year of the CSAZ, adoption of the CSA technology will now be placed into two categories; Category 1 (MT) adoption will be defined by any minimum **tillage practice used to carry out land preparation** and Category 2 (CT) will be defined by a combination of MT and the retention and actual use of crop residue for the purpose of moisture retention, erosion control and improving soil fertility. It is however important to note that the Conservation Farming Minimum Tillage practice is what really defines and separates an adopter from all conventional farmers and conventional farming practices. Adoption starts with and is maintained through minimal to zero soil disturbance.

This section will focus on trainee categories and the proportion of trainees in specific categories that are in the two adoption categories. Reasons for non-adoption will then be immediately tabled. Data from FGDs and FC interviews will throw light into reason for non-adoption. The section would then proceed to profile the adopters by considering pertinent factors such as gender of HH head, HH labour size, HH ownership of draft power, etc. Other factors such as timeliness in accessing inputs, source of inputs, timeliness in planting, weed management and herbicide usage will also be considered.

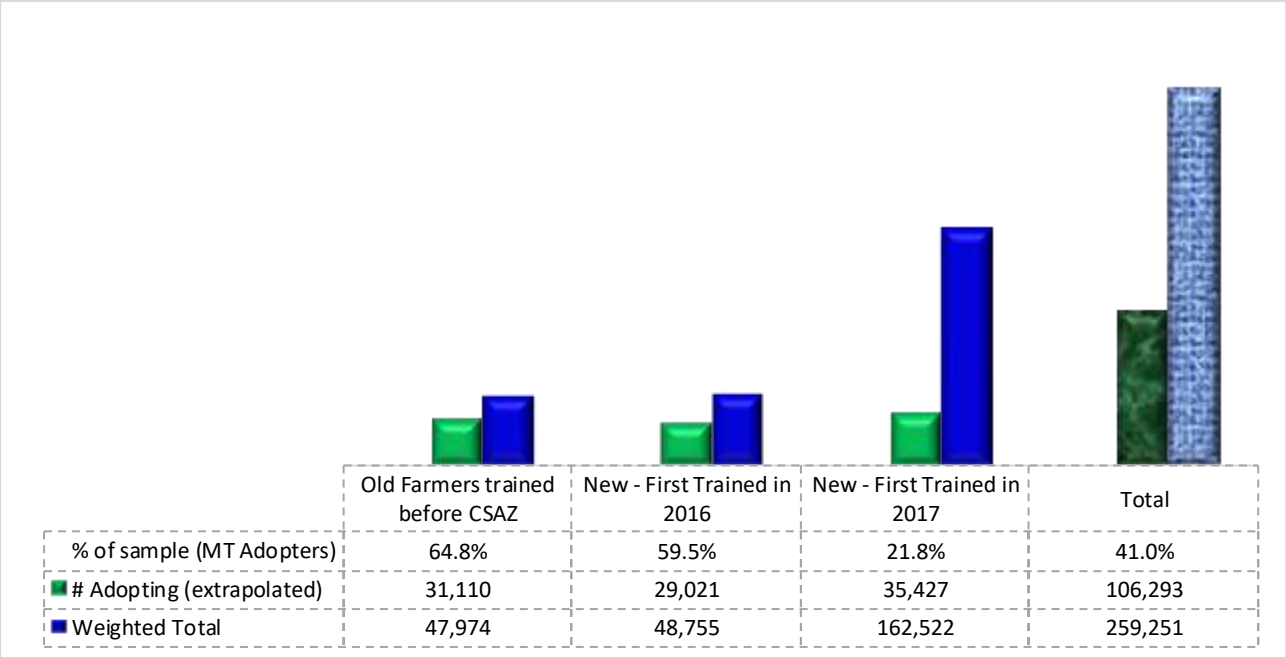
4.1 Adopters of a CSA technology.

The first point for discussion is a focus on adoption. What proportion of households took up a CSA promoted technology in the current year 2 season? Figure 13 below presents a picture of minimum tillage adoption, as well as focussing on the trainee category. This answers to the CSAZ Logframe indicator 2.1; *Number of farmers sustainably adopting CF practices following attendance at CFU training. (disaggregated by New/Old)* and efforts shall also be made to disaggregate this by gender of HH Head. To sustainably adopt is to be an adopter of a minimum tillage in this current (2017/18) season as well as in the previous (2016/17) season. Second year adoption here should be classified into two categories; Category 1 (MT) adopter is any farmer who has prepared their land using any minimum tillage method (basin or ripping) and during the same season did not revert to any total soil disturbance (use of a ridger or a plough). Category 2 (CT) adopter is a Category 1 sustained adopter who maintained some soil cover (kept crop residue) well into the current season.

4.1.1 Category 1 (MT) Adopters

First we focus on establishing the number of Category 1 adopters this season before further establishing how many of these have sustainably adopted this season. This is in order to bring out the disaggregation required by the Logframe indicators. The last bars in Figure 13 give a weighted adoption rate as 41.0% (or 106,293 households). This represents households that opted to put at least one plot under any minimum tillage technology out of all the 259,251 tranees.

Figure 13: Proportion of Category 1 (Minimum Tillage) Adopters by trainee category



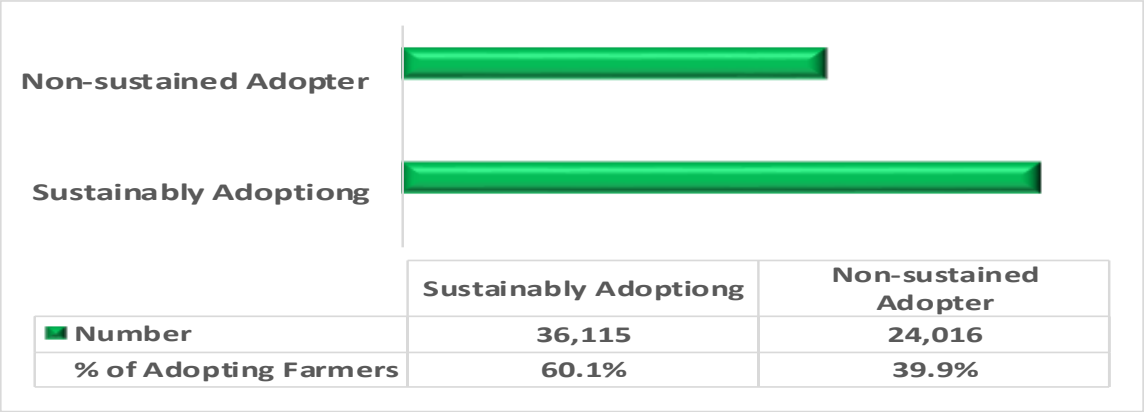
	Old Farmers trained before CSAZ	New - First Trained in 2016	New - First Trained in 2017	Total
% of sample (MT Adopters)	64.8%	59.5%	21.8%	41.0%
# Adopting (extrapolated)	31,110	29,021	35,427	106,293
Weighted Total	47,974	48,755	162,522	259,251

It can be observed that during the second year (2017) there was heavy emphasis on reaching farmers in new villages (villages where trainings were previously not being conducted) and hence 62.7% of the 259,251 farmers trained in 2017 were in this category. This helped the CSAZ reach and go beyond its Logframe target of having 32,295 hitherto untrained (under CSAZ) farmers adopting minimum tillage during the 2017/18 season. It should also be noted that similar trainings being conducted by other organisations (who then stopped trainings before the CSAZ moved in) had mixed effect on adoption rates. In Vubwi for example, a previous agent was training and then giving farmers starter packs (seeds and fertiliser) as an incentive to adoption. But when the CSAZ took over, farmers still expected free inputs and were disappointed and dropped the practice. This was not the same effect in Nyimba where CASU was training. Farmers merely appreciated the thoroughness of the CSAZ training and went on to adopt (even though to the CSAZ these are registered as being trained by the CFU for the first time). All these dynamics drove adoption by new farmers to 35,427 or **10% above the annual target of 32,295 farmers.**

Figure 13 above does not however provide an indication of the number of people that have continued to use minimum tillage from one year to another. This is also a milestone under the same output indicator 2.1 stated above. For this, further analysis had to be done. It has to be noted that this kind of analysis should only be done on those adopters that were trained before CSAZ as well as adopters trained for the first time in 2016. Figure 14 shows the result. From Figure 13 we noted that 31,110 farmers that were first trained before the CSAZ (and attended the 2017 training all the same) adopted and 29,021 farmers that were first trained in 2016 also adopted. This makes a total of 60,131 households (farmers) adopting MT in 2017/18 season (excluding the completely new adopters that were first

trained in 2017). Figure 14 is an analysis of those that had also used MT in the previous season (2016/17) and also in the current season (making them continuous adopters – sustainably adopting).

Figure 14: Old Farmers Continuing to use MT – Sustained adoption.



The 2018 milestone for farmers sustainably adopting was set at 20,305 farmers, **this was surpassed by 78%** as achievement of 36,115 was made**.** Now, survey data also shows that 51.0% (18,419) of the sustained adopters are from those that were first trained before the CSAZ and the rest were from those first trained in 2016. It was of interest to establish whether being a sustained adopter was independent from the gender of the head of household. Table 3 is a Chi-Square table investing this. Data showed that 40.0% of the male headed households were sustained adopters while 35.6% of the female headed households were sustained adopters.

Table 3: Chi-Square Test - Sustained Adoption is independent from Gender of HH Head

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	.882[a]	1	.348

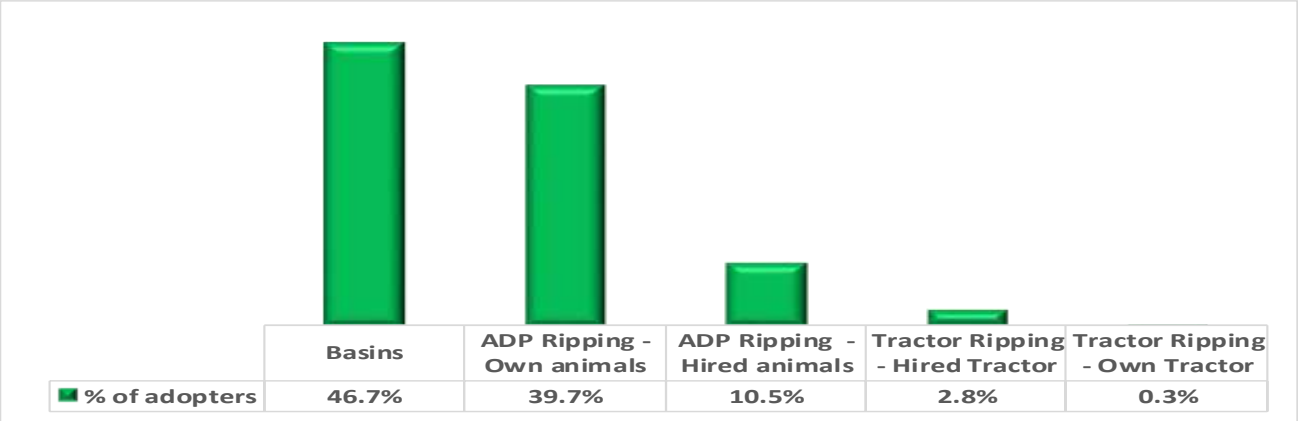
The Null hypothesis was that being a sustained adopter is independent of the gender HH head. The Chi-square statistic here is 0.882, 1 degree of freedom, and the p-Value is 0.348. We are testing at the 5% level of significance (alpha = 0.05). Now, 0.348 is larger than the alpha value. We therefore FAIL to reject the Null hypothesis. ***There is NO evidence to suggest an association between being a sustained adopter and whether or not the head of household is male or female.***

Tillage Methods Used by Category 1 Adopters.

It is important for the CFU to take stock of the very tillage methods that were being used during this season by adopting households. Figure 15 shows an analysis of adopters by tillage method. This also answers to ***Output Indicator 2.3: Number of farmers using ADP and Mechanised tillage (disaggregated by draught power).*** Since 106,293 households adopted, figures in Figure 15 can then be used to show how many households used which tillage method. A total of 42,198 households used own animals for ripping and 11,161 households resorted to hiring animals for ripping. As for Mechanised, a total of 3,295 farmers used tractors for ripping. Note that the earlier survey under

the TSP/E-Voucher Rapid appraisal used different figures as it was not meant to be rigorous in sampling methodology.

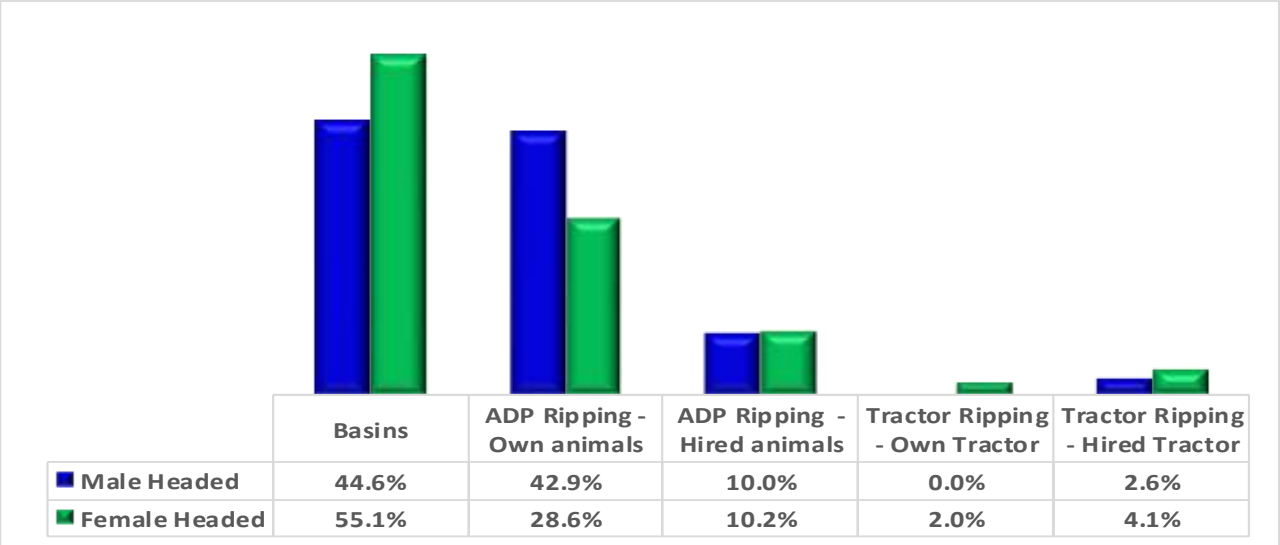
Figure 15: Tillage Methods Used by adopters



	Basins	ADP Ripping - Own animals	ADP Ripping - Hired animals	Tractor Ripping - Hired Tractor	Tractor Ripping - Own Tractor
% of adopters	46.7%	39.7%	10.5%	2.8%	0.3%

Animal draft power ripping is the most popular tillage method employed by farmers during this season (50.2% - combining those that use own animals and those that used hired animals). A look at the gender of household head however shows that female headed households are more likely to use basin tillage while male headed counterparts are more likely to use own animal draft power (Figure 15).

Figure 16: Tillage Methods employed by adopters (by gender of HH Head)



	Basins	ADP Ripping - Own animals	ADP Ripping - Hired animals	Tractor Ripping - Own Tractor	Tractor Ripping - Hired Tractor
Male Headed	44.6%	42.9%	10.0%	0.0%	2.6%
Female Headed	55.1%	28.6%	10.2%	2.0%	4.1%

4.1.2 Category 2 (CT) Adopters – Soil cover (keeping crop residue on plots)

Focus now moves towards those farmers that deliberately kept crop residues for the purpose of soil cover as taught during the CSAZ trainings of 2016 going back. There is no need to focus on farmers that were trained in 2017 since training took place AFTER farmers had harvested and hence may not have been equipped with the knowledge that

they should retain some crop residue for soil cover. The computations for the number of CT farmers here should be understood to be focussing only on those MT adopting farmers trained in 2016 or before (totalling 60,131 farmers).

Figure 17: Proportion of Category 2 Adopters

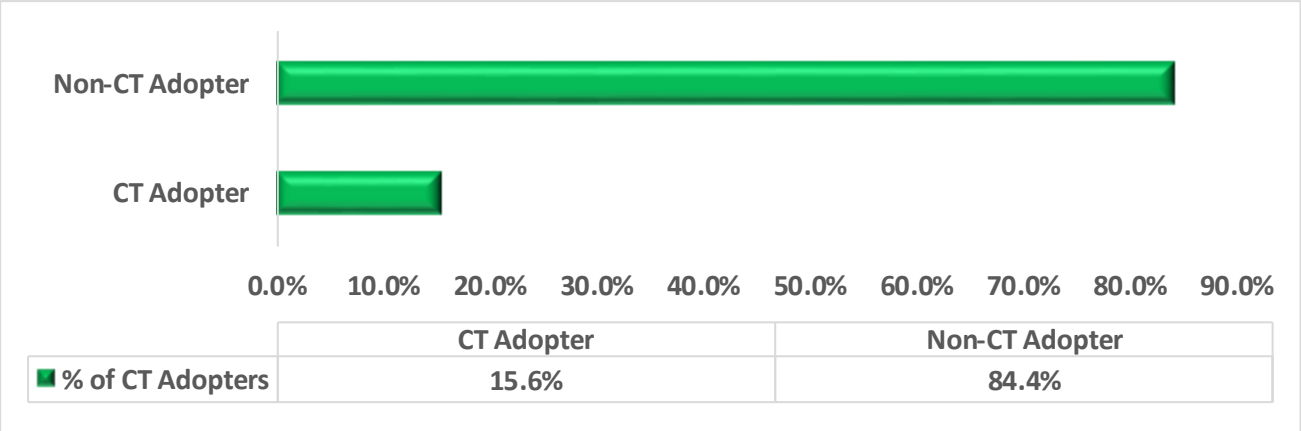


Figure 17 shows that only 15.6% of the MT adopting farmers went on to maintain crop residue. Using the 2017 farmer database, this translates to 9,363 farming households. It had been hoped that up to 20% of the MT farmers would move on to CT, hence the programme fell short of its expectation by a margin of 4.4% This is not really an impressive figure considering that before applying filters, over 80% of the farmers had actually retained crop residue for the correct reason of soil cover but this was reversed by other factors before land preparation was completed. Such factors include bush fires and deliberate burning by other community members mainly hunting for mice (quick source of protein between June and September). Bush fires could have been controlled through the use of fire guards. However, the few **fire guards that the survey team noticed were very narrow** and not really according to laid standards for fire guard width. Some villagers have sought the help of community leaders (traditional institutions such as village heads) to curb deliberate burning of residue in neighbours' plots during mice hunting – but this is the tragedy of the commons, no-one really knows who is burning whose residue, the need for scarce protein is recognised by all and sundry and far outweighs the not so commonly appreciated need for residue retention.

4.2 Area of land under MT, CT

The CSAZ requires that the area of land put under minimum tillage as well as that under conservation tillage be computed. For the third year, area of land under CF will also have to be computed as this study decided to be cautious by seeking to postpone investigating crop rotation in year two but rather wait and do this for year three. Available survey data showed that the minimum area of land was 0.01 hectares and the maximum was 15 hectares under MT. It became convenient to use the statistical averages in coming up with values for the Logframe indicators. First to be computed was the average area of land that category one adopters (MT) had. The modal land area under MT was 1 hectare (mean was 1.1045 Ha) and hence if a total of 106,293 farmers adopted MT, then the total area under MT was around 106,293 hectares surpassing the Logframe milestone of 34,160 hectares.

Secondly, using the same method, the data was also used to compute average land area under CT by Category 2 adopters. Figure 17 above has shown that 9,363 farming households come under CT adopters. Now, available data show that the minimum area of land under CT was 0.13Ha and the maximum was 15Ha. The mean (1.33Ha) was slightly different from the mode (1.0Ha) and in this case we preferred to use the mean in computing the total area of land under CT. Since 9,363 farming households come under CT adopters, total area of land under CT was therefore 12,453 hectares against a target of 20,500 hectares, registering a 60.7% achievement.

4.3 Reasons for Non-adoption.

Focus Group Discussion and Key Informant Interviews gave several important insights into reasons for non-adoption. The first reason was the issue of weed management and herbicide usage. Some farmers who have not adopted have given weed pressure as the reason for not adopting. Such farmers include those that initially prepared their land using one of the minimum tillage methods but then later when the rains came, became too frightened with weeds such that they simply moved in with a plough or a ridger and achieved 100% soil disturbance. There is a myth that CF actually promotes weeds and that if a farmer uses conventional tillage methods, the weeds would not be as much as those in a CA plot. Farmers also noted that herbicides are too expensive for them to afford and without herbicide they cannot practice CF because of the same weed pressure. The price of post emergence herbicides particularly was just too high for most farmers. Most farmers fear minimum tillage because it requires that weeds are controlled before planting whereas conventional tillage methods all hide the weeds underneath making fields look cleaner.

In addition to the above, herbicides have been received with mixed feeling with some people thinking that they poison their soils. Others think that herbicides are hazardous to both animals and humans and they would rather not use them. This stems from lack of knowledge and the CFU should keep on addressing this through with continuous training.

The second most frequent reason for not adopting is lack of resources for acquiring CF equipment such as rippers, sprayers and even animals for ripping even though farmers can hire ripping services. Some have requested for tractor ripping services and when the tractors were not available they did not resort to hiring ADP services despite it being cheaper and more readily available in their localities. There seems to be a belief that hiring tillage services should be confined to tractor ripping and if tractors are not available on time, then the use of conventional tillage becomes the only land preparation route. Of course the CFU should become more militant in promoting ADP ripping as it is more readily available rather than continue complaining about the difficulty faced by farmers in securing tractor loans.

The third and probably the biggest challenge was farmer's attitude and/or mind-set towards CA. Some farmers do not have genuine reasons for not adopting and they look for reasons here and there to justify their lack of adoption.

These are the farmers who are just adamant and have fear of change who do not want to accept other agriculture technologies, finding and giving excuses such as labour intensity for not adopting. Several key informants said CF requires consistent and timely preparation for the season, each task having a time period and that some farmers were simply lazy and could not manage the challenge of timeous execution of their agricultural activities. No matter how much they see the benefits, they will just not change. The Mpongwe SAO was positive that the only reason some farmers are practicing CA is because they believe there are incentives without which most farmers do not adopt.

Inconsistency in technology delivery was another factor that could be affecting adoption where different stakeholders give conflicting messages to farmers even though recently the CFU has collaborated quite extensively with other agriculture stakeholders as well as the Ministry of Agriculture to ensure the message going to the farmers was consistent. Some NGOs give farmers incentives such as seeds and fertilizer so as to encourage adoption. In Vubwi district, the CFU moved in to replace an NGO that had exited and farmers ended up not adopting when they realised that the CFU was not giving any incentives that were given by their predecessor.

Finally, the 2017/18 season can bring confusion to farmers. The teaching by the CSAZ has been to plant early, **with the first effective rains**. Now this season, some Maize fields that were planted with first rains had started drying up even though those under conventional tillage are visibly more affected. Crops planted later during the season seem to be doing better in spite of the tillage method and this has started raising doubts among adopters who had experimented with a few plots to see if MT works and they were saying that in the next season they may as well go back to their traditional technologies. Never the less, the difference between CA crops and conventional tillage crops cannot really be ignored as it is visible. . The CA crops managed to pull through this difficult year and the results are there to show in the field. In whatever situations the differences between CA and Conventional tillage are visible in terms of cob sizes for maize and kernel filling for Soya beans.

4.4 Further Investigating Adoption

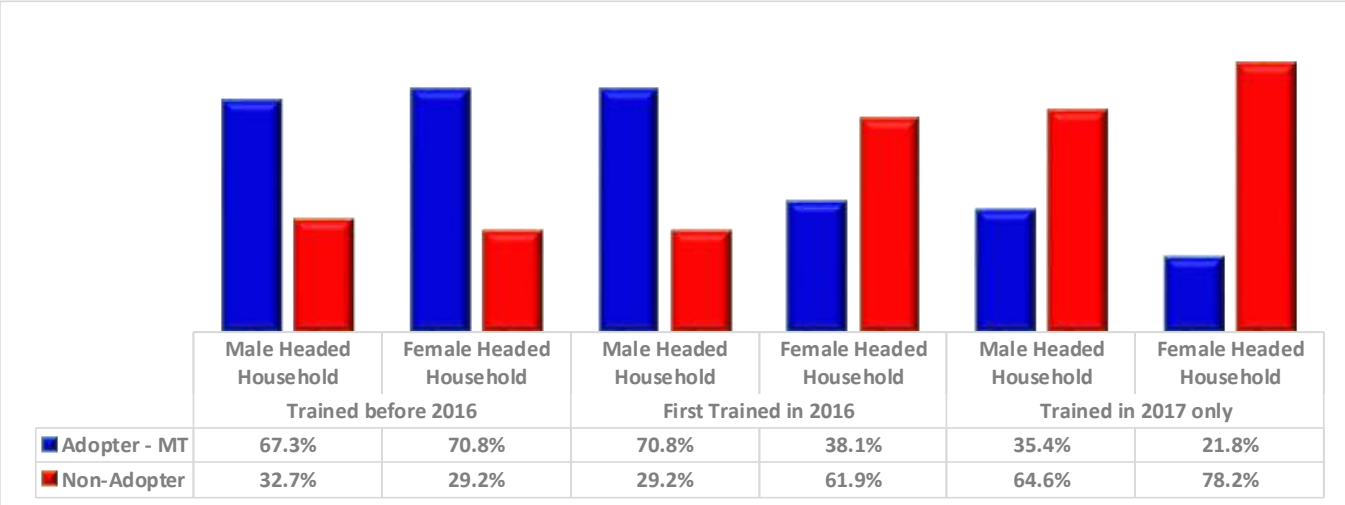
Here we focus on some possible variables that we could expect to be associated with adoption status. In this study, we focus on gender of HH head, total training sessions/seasons attended to date, ownership of draft power, and knowledge level of potential adopters. For the benefit of readers with not much background in statistics, more emphasis will be put on the first association, Sex of HH head.

4.4.1 Adoption and Gender of HH head

The gender of the HH in relation to adoption of CSA is an interesting consideration. With the expectation of a HH head in rural Zambian households to be male, the reality however, is that there are HH heads that are female for one reason or another, in most cases such women being widows or their husbands being incapable of running household affairs due to prolonged absence, ailments or have to live with a disability.

Generally, the likelihood of a first year (trained in 2017 only) household to adopt MT is lower than for those households who have attended trainings more than once regardless of whether the households are male or female headed. Male headed HHs only seem to do better than female headed HHs when they are trained once or twice but over time females are seemingly better. However, to prove this case, it is necessary that a chi-square test is run. From the graph we can also conclude that adoption is likely to increase the more trainings a farmer attends regardless of the gender of head of HH but this will also need a chi-square test.

Figure 18: Gender of HH Head and Adopting MT



Percentages depicted in Figure 18 show that over time, with more seasons of training, the proportion of female headed households adopting (as a proportion of female headed households) is more likely to overtake the proporportion of male headed households (67.3% for male headed compared to 70.8% for female headed).

To find out whether adoption status is dependent on the gender of the head of household, a Chi-square test was run and Table 4 shows the results.

Table 4: Chi-Square Test - Adoption is independent from Gender of HH Head

Chi-Square Tests (H_0: Adoption Status and Gender of HH Head are independent)					
	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	8.068[a]	1	.005		
N of Valid Cases	499				

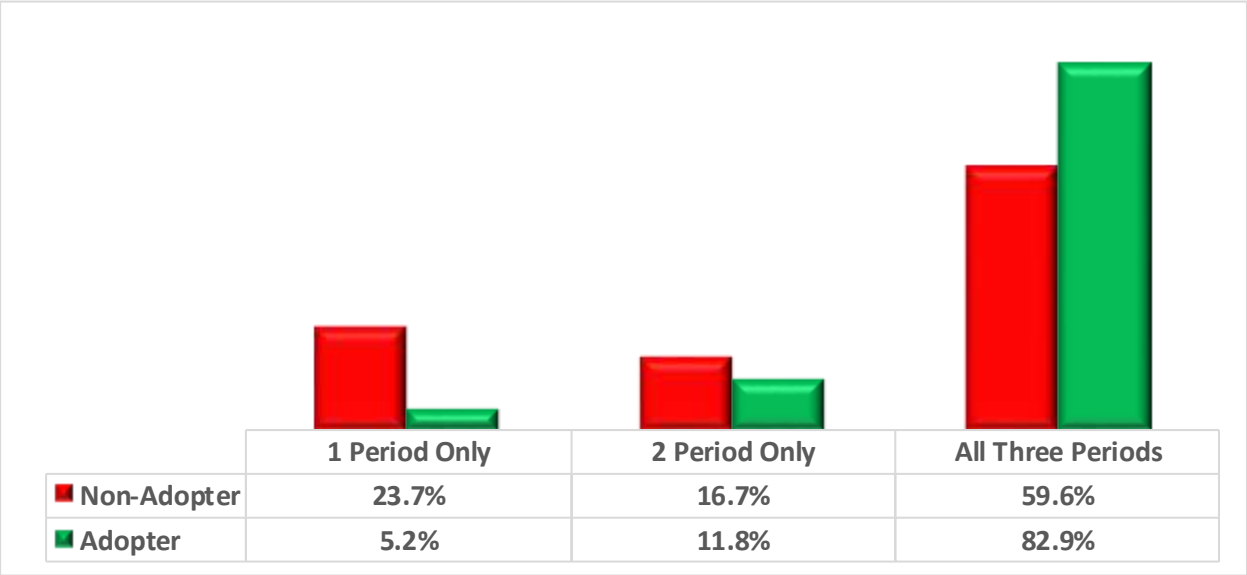
The Null hypothesis was that adoption status is independent of the gender HH head. The Chi-Score statistic here is 8.068, 1 degree of freedom, and the p-Value is 0.005. We are testing at the 5% level of significance (alpha = 0.05). Now, 0.005 is less than the alpha value and we will reject our null hypothesis which says that there is no association between the adoption patterns and gender of the HH head, **available evidence suggests that adoption is dependent on gender of HH head**. It appears that if a household is female headed, the household's socio-economic conditions

tend to incline the family to opt for CA technologies as a way of boosting food security. But this is however generally affected by the type of MT method chosen, female headed households, as already noted, tend to be inclined to adopt basin minimum tillage while male headed households are inclined towards ADP ripping. This later pattern is also because in general, male households have the cattle for draught power.

4.4.2 Number of Training Sessions Attended by trainees

Here we raise the question whether or not the number of CSAZ training sessions attended by a farmer affects adoption status. It would appear it is rather obvious that the more sessions one attends, the more the interest they have in the technologies and hence the more likely they are to eventually adopt. However, this needs to be systematically tested. Figure 19 shows that more non-adopters (23.7%) than adopters (5.2%) attended one module only while more adopters (82.9%) than non-adopters (59.6%) attended all the three modules. It appears therefore **that the more modules one is exposed to, the more one is likely to adopt minimum-tillage.**

Figure 19: Adoption status and Number of Modules attended.



The above position is also confirmed by a Chi-Square test as presented in Table 5 below.

Table 5: Chi-Square Tests – Is adoption independent of number of CA training sessions attended.

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	51.995[a]	2	.000

The Null hypothesis was that adoption status is independent of the number of sessions attended by the household representative. The Chi-Score statistic here is 51.995, 2 degrees of freedom, and the p-Value is 0.000. We are testing at the 5% level of significance (alpha = 0.05). Now, 0.000 is less than the alpha value and we will reject our null

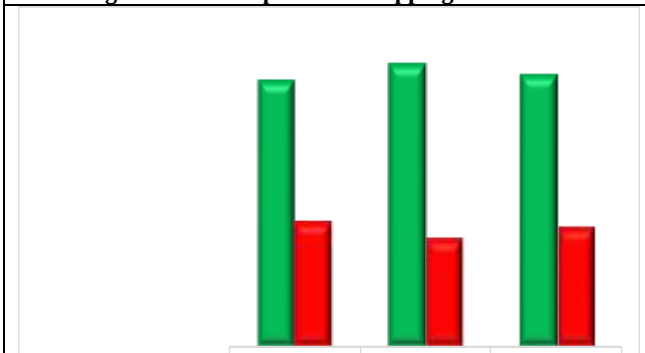
hypothesis which says that there is no association between the adoption status and knowledge level of the HH representative, **available evidence suggests that adoption is in fact dependent on the number of sessions attended by the household representative**. One has, however, to be very cautious about this observation. What if attending all sessions already belies a propensity to adopting instead of adopting because one has attended all sessions? Do people adopt because they attended all three sessions or they attend all three sessions because they are already inclined (even before adoption) towards adopting. Despite this puzzle, the fact still remains, adopting and attending CSAZ sessions are dependent on each other as it would be difficult to conceptualise adopting without **sufficient** exposure to the principles of minimum tillage.

4.4.3 HH Ownership of Potential Animals - relationship to ripping.

Next, we investigate the possible relationship between availability of draft power within the HH and whether this is related to ripping for themselves as well as for others (as ADP Tillage service providers). Households with animal draft power were asked whether or not they used their animals to rip for themselves as well as for others. Figure 20 below shows the results for both scenarios. The percentages should however not be taken to suggest the levels of adoption since, as shall be noted later, due to some circumstances such as too much weeds, some people ended up carrying out total soil conversion thereby reversing the concept of minimum tillage.

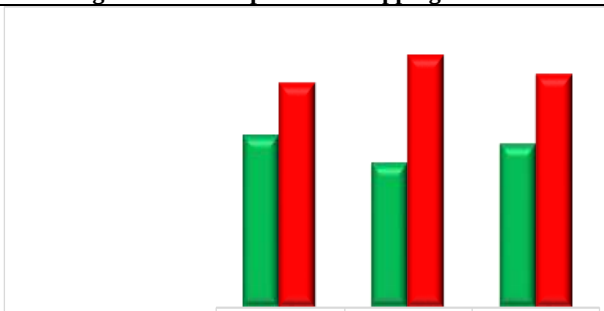
Figure 9: Ownership of draft power and ripping

a. Having Animal draft power and ripping for self



	FAIR - Potentially one Span	GOOD - Potentially more than a Span	Total
Yes ripped for self	68.3%	72.5%	69.7%
No did not rip for self	31.7%	27.5%	30.3%

b. Having Animal draft power and ripping for Others



	FAIR - Potentially one Span	GOOD - Potentially more than a Span	Total
Yes ripped for others	43.4%	36.3%	41.2%
No Did not rip for others	56.6%	63.7%	58.8%

The more draft power a household has available, the more they likely to rip for themselves (av.69.7% of those ripping own fields). Yet this is not true for the likelihood of ripping for others, the likelihood to rip for others is still low (av.41.2%) even when a household has several span of oxen (36.3%). While the CSAZ have made inroads towards promoting ripping using animal draft power, there still remains a reluctance to provide ripping services for others (as a business). This is probably because in the past, emphasis has been that where ripping is done for others, tractors should be hired. Only recently have the CSAZ began putting emphasis on ADP ripping for others. More

still needs to be done to encourage ADP ripping (ADP-TSPs) for others as this is the best way to ensure sustainability of the practice and adoption of ADP ripping on a wider scale.

4.4.4 Knowledge Level and Adoption.

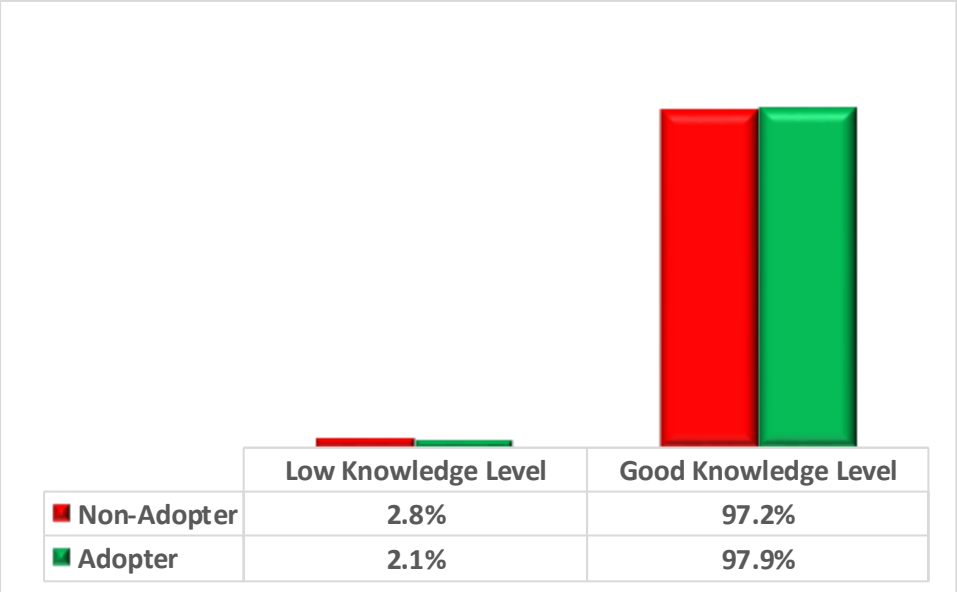
Finally, we investigate the possible relationship between knowledge level and adoption. It is important to note that not all the three knowledge tests were administered to all the 702 sampled participants but only to those that either attended the three training modules or indicated that they absented themselves from any of the modules because they felt they already knew the contents of the respective module. If a respondent missed any module for reasons beyond their control, such participants were excluded from this test. In the end, this came to a total of 69.1% of the sample and this number was considered sufficient for us to draw conclusions concerning the association between knowledge levels and adoption.

Table 6: Chi-Square Test - Adoption is independent from Level of Knowledge of HH representative

	Value	Df	Asymp. Sig. (2-sided)
Pearson Chi-Square	.277[a]	1	.598

The Null hypothesis was that adoption status is independent of the level of CSAZ knowledge held by the HH representative interviewed. The Chi-Score statistic here is 0.277, 1 degree of freedom, and the p-Value is 0.598. We are testing at the 5% level of significance (alpha = 0.05). Now, 0.598 is larger than the alpha value and we **FAIL** to reject our null hypothesis which says that there is no association between the adoption patterns and gender of the HH head. ***There is NO evidence to suggest an association between being an adopter and the knowledge level.*** There are several non-adopters with very high knowledge levels, just like there are several adopters with very high knowledge levels (see figure 21). It appears that knowledge alone does not really explain adoption, one may give all the correct answers to the principles of adoption and still NOT become an adopter. The reverse should not however be taken to be true, a person completely ignorant of the principles of MT cannot be assumed to possibly adopt.

Figure 21: Adoption Status and Knowledge Levels

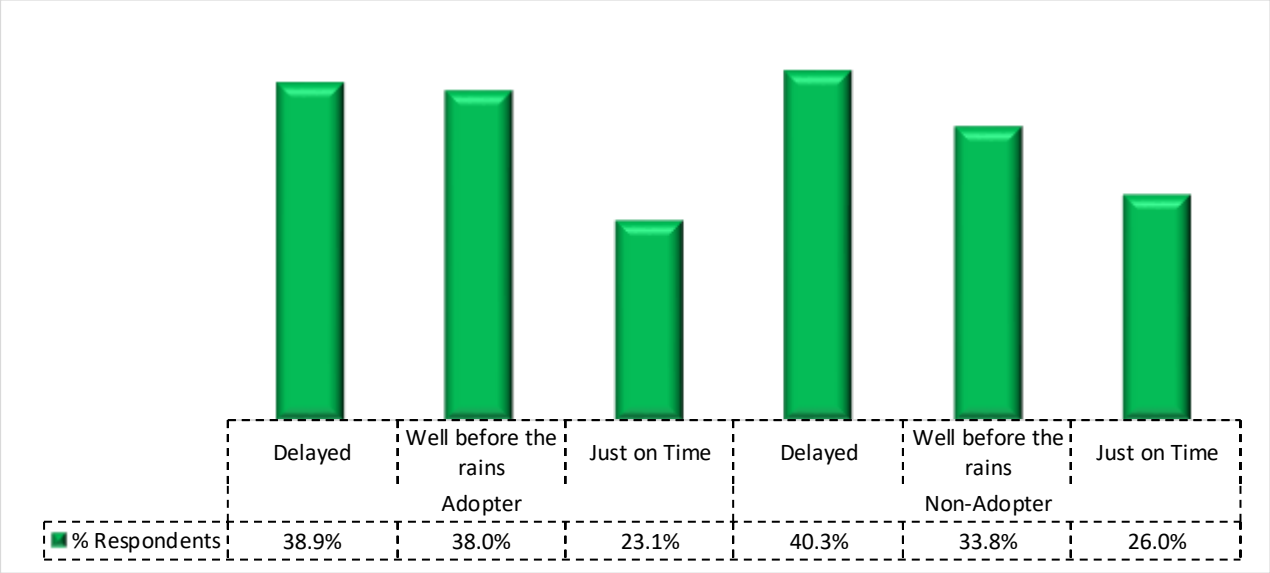


4.5 Other Adoption Considerations

4.5.1 Timeliness in Accessing Inputs.

The CSAZ encourages to maximize gains by being ready to plant with the first effective rains. The survey sought to find out when farmers accessed inputs from whichever source and focus here will be put on certified maize seed and the main issue was an effort to find difference between adopters and non-adopters. As seen in Figure 22, there is not much difference in the time that adopters and non-adopters access inputs. While a 61.1% of the adopters are within an acceptable timeframe (Just on time or sometime before the rains), 59.8% of the non-adopters are also within this time range. Again, 38.9% of the adopters compared to 40.3% of the non-adopters are in the "Delayed" category. Reasons given for the delay in accessing inputs are the same for both adopters and non-adopters: resource constraints due to late payments for produce delivered to FRA and waiting for FISP inputs.

Figure 22: Timeliness in Accessing Inputs



4.5.2 Sources of Inputs and Inputs Markets

Figure 23 shows the sources of different inputs acquired for the season 2017/18, whether through purchases, retaining previous harvest or from government. The bulk of the inputs, shown by both the number of inputs as well as the number of respondents (percentage), were acquired through purchases either locally or outside district except for retained maize seed. Around 84.4% of respondents who use herbicides are likely to purchase while only 6.5% of them would acquire herbicides through the government e-voucher under FISP. Other items that the bulk of the farmers are likely to purchase were Maize certified seed (71.0%), basal dressing fertilizer (65.3%) and top dressing fertilizer (57.8%). Fewer farmers also obtained these through FISP. Generally, most farmers obtain legumes either by purchasing or by retaining previous harvests in roughly equal numbers. The data shows that farmers are unlikely to get legumes using the e-voucher because of limited stock or unavailability of the seed through the suppliers and agro-dealers and not all agro-dealers are on the FISP program. Some farmers said they retained legume seed because they were more expensive to buy with a 20kg bag of soya-beans going for as much as ZMW450. Most farmers (54.5%) retained groundnut seed because this legume performs quite well even when recycled.

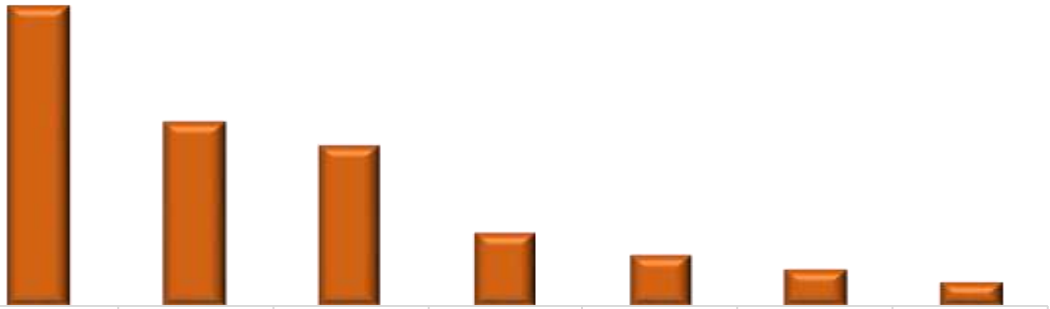
Figure 23: Sources of Inputs

	Purchases	From previous harvested produce	Goverment (FISP)
Herbicides	84.4%	0.0%	6.5%
Maize Certified Seed	71.0%	0.0%	7.7%
Basal Fertiliser	65.3%	.7%	27.1%
Top Dressing	57.8%	0.0%	32.6%
Soya Beans	42.1%	42.1%	0.0%
Ground Nuts	36.4%	54.5%	0.0%
Maize (Harvested seed non-OPV)	0.0%	96.1%	0.0%

The results also show that, apart from fertilizers, FISP accounts for very few farmers getting inputs using the e-voucher. This is understandable considering that FISP inputs are usually late (as late as mid-January to February for many famers). So although a significant number of respondents indicated that lack of adoption is attributed to late or non-accessibility of FISP, the results show that in fact most of them are likely to acquire their inputs through purchasing using own resources.

One of the requirements on the log-frame is to report on in-community agents and although this report does not touch on how many they are out there, it helps us see that they exist and how much farmers are relying on them. The list of inputs that farmers purchased and reported was quite varied but for the sake of this study, 4 inputs have been reported on. The item of interest here is the in-community agents

Figure 24: Inputs Markets



	Agro-Dealers Within District	Left over or Retained	Purchased from In-Community agent	Free Local (NGO/FISIP)	Free from Relative/Friend	Purchased from Outside District	Free Outside community (NGO/FISIP)
% of occurances	36.2%	22.1%	19.4%	8.8%	6.2%	4.4%	2.9%

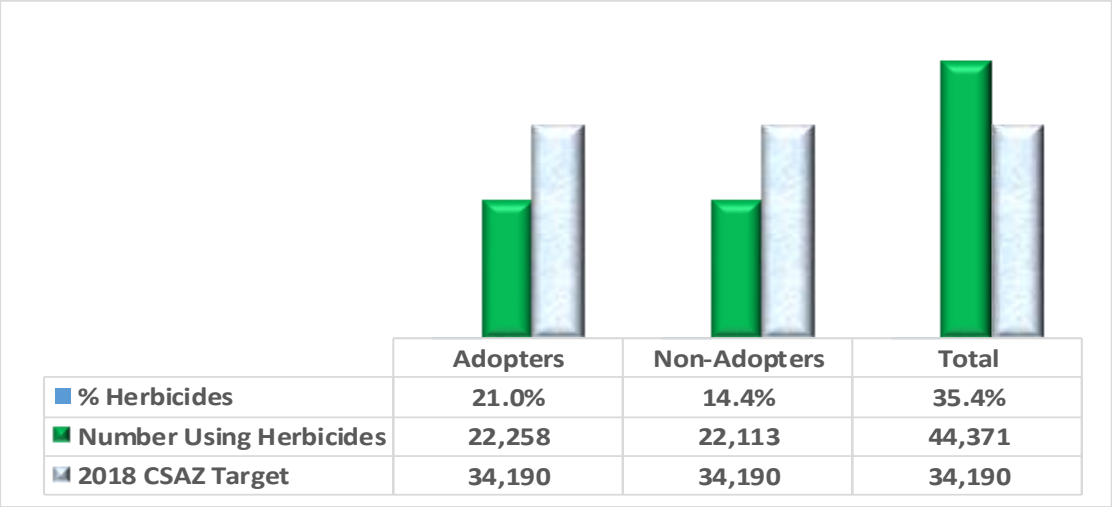
The study sought to find out where respondents obtained inputs from and Figure 24 reveals that 36.2% which represents the largest proportion of farmers, accessed inputs from agro-dealers within the district or the main town. Farmers, regardless of the distance, travel to the main town area of the district to make purchases. For some, because they have simply become accustomed to it and have done so since time immemorial whilst for others, they find it cheaper to do so due to the fact that in-community agents comparatively hike prices to more than what the average farmer would have budgeted for/ can afford. Regardless of these hikes, some farmers still prefer to make purchases from in-community agents as this cut down on their transport costs, in some instances, quite significantly as can be seen above with around 19.4% engaging in this kind of input source. Around 22.1% of respondents represents inputs that were accessed during the previous season which are retained for use in the current season. It is here where most FISP inputs would appear (because they are received late and kept for the next season).

4.5.3 Weed Management through Herbicide.

In every district of operation, the challenges that potential adopters always face is the control of weeds. If not effectively controlled, weed infestation always discourages farmers from real adoption of the technology. In this survey alone, a lot of farmers in fact had adopted MT at land preparation but then because of weed challenges, they later on moved in and just ploughed their already ripped (or basin) plots and became non-adopters. In trying to control weeds, the CFU introduced herbicide trainings towards the beginning of the season so that farmers have information on weed control before they are overwhelmed by weeds. The CFU places a lot of importance on this such that weed management is a training topic on its own. In this period of trainings however, other methods of weed control are also discussed because sometimes it is appropriate to combine the different methods and farmers like to have choices. They can if they wish use herbicides or not.

The CSAZ Logframe was hoping that by the second year (the season of 2017/18) over 34,190 farming households would be using herbicides. It remains to be clarified whether these 34,190 should be interpreted as being MT adopters or just any of the trained farmers regardless of their adoption status. Figure 25 shows that if the indicator is taken to mean adopters only, then the 2018 milestone has not been achieved as only 22,258 farmers (65.1% achievement) who adopted used herbicides. However, if the target is applied to the people trained by the CSAZ in 2017, then the target has been surpassed since 44,371 farmers (129.8%) in fact used herbicides.

Figure 25: Proportion of farmers using Herbicides



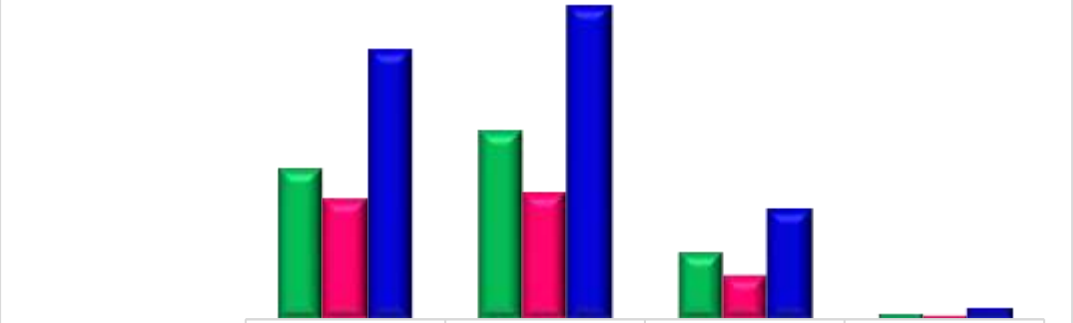
	Adopters	Non-Adopters	Total
% Herbicides	21.0%	14.4%	35.4%
Number Using Herbicides	22,258	22,113	44,371
2018 CSAZ Target	34,190	34,190	34,190

4.5.4 Farmers' Perception of Crop Health.

The current season has not been one of the best in terms of rainfall distribution. Rains started early in October and then there came a period of long dry spell up until early February.

On the day of a household interview, farmers were accordingly asked to give an honest assessment of what they judged was the current condition of the main crop in the various plots. Research assistants would also observe the crop under discussion and both (farmer and researcher) used four descriptions to categorise the crop; Good, Fair, Poor, or Write-off. Figure 26 below show a comparison of crop status during the time of the survey (by adoption status). If this is a reliable measure of crop condition, then the crops of adopters are apparently better (in each perception category) than that of non-adopters. Indeed, this was also attested during FGDs, crops grown in basins and rip-lines were reported to be of better health than crops grown using conventional tillage methods.

Figure 26: Perceptions of general crop condition (by adoption status).



	Good	Fair	Poor	Written-off
Adopter	21.3%	26.8%	9.5%	.9%
Non-Adopter	16.8%	17.7%	6.3%	.7%
Total	38.1%	44.5%	15.7%	1.6%

5.0 CONCLUSIONS, LESSONS LEARNT, AND RECOMMENDATIONS.

5.1 Conclusions

This subsection focusses on drawing out conclusions that can furnish us with values for indicators to with adoption. With reference to the output indicators in the CSAZ Lofgrame, from survey findings we can conclude that:

- ✓ **Output indicator 1.1:** (Number of farmers trained in climate smart agriculture practices (disaggregated by gender). The total number of unique farmers trained in 2017 came to **259,251** farmers (surpassing the annual target of 250,000 by 104%). Of these, 136,807 (52.8%) were males and 122,444 (47.2%) were females.
- ✓ **Output indicator 1.2:** (Proportion of trained farmers in the "Good" CSA Knowledge category post training) 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:** (Number of farmers sustainably adopting CF practices following attendance at CFU training. (disaggregated by New/Old) 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 and thus reaching a 110% level of achievement. 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 178% against 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, CT) Area of land under MT was 106,293 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 this report.
- ✓ **Output indicator 2.4:** 44,371 farmers (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 in placed only on adopters, the number of adopters using herbicides is 22,258 and this would be a 65.1% achievement.

5.2 Lessons Learnt

Five major lessons clearly emerge from what has been observed among adopters. These are:

- ✓ Farmers that feel respected and known by the FC and FO allocated to them tend to be more motivated to take up and religiously implement CSA principles so as not to betray the trust and confidence invested in them by their FC/ FO.
- ✓ The benefits of CA over conventional tillage towards plant health are clearly visible to farmers even before harvest (and this season has shown many farmers that tillage method makes a difference).
- ✓ Leaving farmers to transition from MT to CT on their own will not see the project reaching targets easily, there is need for more deliberate and innovative support in averting the inevitable current loss of retained residue.
- ✓ If the participation of Ministry of Agriculture officials at lower, grassroots levels (rather than only focussing on higher ministry officials) were to be increases, then there is a possibility that increase this could ensure the sustainability of CA as a viable technology.
- ✓ Enticing farmers with seed packs for adoption is not sustainable and may as well be a strong factor explaining dis-adoption once support is pulled out.

5.3 Recommendations

In the light of what has been observed above, this season's adoption study wishes to make the following recommendations:

1. Work with the already existing small number of adopters to strengthen them in the CSA technology so that they become proper examples to non-believers.
2. Encourage farmers to attend all three training sessions as a couple so that there is no conflict within the household as to which tillage practice should be used because of a lack of full understanding by one party. FCs should be encouraged to have stronger relationship with farmers so as to be able to tell who has skipped a session and where possible visit such farmers and encourage and advise them to attend similar sessions elsewhere.
3. Showcasing the benefits of minimum tillage, particularly during a non-stable season such as the current one, and having this imprinted among fellow villagers should continue to be emphasised. Conducting field days to showcase benefits of any minimum tillage using **an already tried, tested, and proven** local adopter should be the last option. Field days for any theme should be carefully planned to take place at **relatively new farmers**, whose plots really do not have much history of good performance so as to become more awe inspiring and convincing that indeed adopting is beneficial.
4. ADP as a business should be deliberately promoted as a way of scaling up ripping services in communities where farmers in fact have resources but are using them to rip only for themselves. At the same time, the CFU should investigate the ability and willingness to pay among farmers without ADP.
5. Emphasis on the use of glyphosate as the first weeding should continue being done as well as farmer testimonies on how to control the first weeds should be done during trainings, field days and using media. Usually, reversing minimum tillage methods is a reaction to weed infestations in plots where land preparation had been done far earlier (at the correct time)
6. Weed management trainings should seriously emphasise that weeds are inevitable. Weed control should not be left only to the use of herbicides as it is a known fact that farmers are resource constrained, hand hoe weeding for MT resource constrained farmers should be destigmatized, emphasised, and regarded as normal so as to curb the currently rampant practice of reverting to conventional tillage and conventional ridging as a weed control measure.

7. Period one trainings should continue to emphasise the motive for CFU trainings; that of equipping farmers with technical skills of how to derive benefits from employing CSA while at the same time categorically informing farmers that the CFU will NOT give any additional incentives/handouts. This will prevent the often mentioned crisis of expectations as a reason for not adopting by new farmers that come for training hoping that participation in trainings is some entry point for subsequent benefits in the form of starter packs.
8. Perennially blaming the FISP for late disbursement of inputs and using this as a reason for lack of adoption should be nipped. The CFU needs to come up with a strong message for season preparedness and planning so farmers can be helped on how to plan, budget and procure inputs early and be ready for the season.
9. There is need for more innovation and creativity on the part of field staff (SFOs, FOs and FCs) as adoption can be scaled up if field staff were to be more engaging with farmers at a person to person level for the sake of extension support. FCs and FOs should take pride in getting to know farmers at a more person to person level than just leaving it to group level interactions. FOs should get to know farmers directly and not only end at knowing FCs and a few already outstanding adopters.
10. We, as the CFU, should sit and agree with other organisations to speak the same language when we are preaching and teaching CA on the ground.
11. The CFU should find innovative ways of promoting sustained residue retention as the current scenario will not see many farmers transitioning from MT to CT, there are just too many factors militating against crop residue retention for soil cover. Land under CT is part of the CSAZ initiative and should not be left to chance. Experimenting with green mulch not attractive to livestock should be considered as a serious option in the face of a plethora of factors militating against residue retention.
12. There is need for stronger collaboration between the CFU and the Ministry of Agriculture. While collaboration is already there, it appears that Ministry of Agriculture grassroots staff are overwhelmed by multiple and concurrent demands for their services and thereby reducing their sustained involvement in CSA efforts. Wherever and whenever possible, this later fact should be highlighted to Ministry of Agriculture higher offices. CFU's approach is a more intensified package that must be broadly shared for the benefits of farmers. This collaboration will help with sustainability in future should the CFU leave an area so that the Ministry can easily pick it up. It also helps with uniformity in terms of information dissemination to farmers so that the message is harmonised. Government field staff will also benefit from CFU especially now that CFU officers are plant doctors. The CFU should work hand in hand with the agricultural officers and camp extension officers for them to achieve the goals and objectives of CSA.