Conservation Farming Unit

CONSERVATION FARMING & CLIMATE SMART AGRICULTURE

DFID CSAZ ADOPTION SURVEY REPORT

2018/2019

By the CFU RM, M&E Team




This report presents key Adoption Survey findings for Year 3 upon the implementation of the CSAZ Programme by the Conservation Farming Unit under DFID in June 2016. This report covers the 2018/2019 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
GRZ	Government of the Republic of Zambia
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) program in July of 2016. The program seeks to improve food security to over a million people by providing trainings to an outreach of over 200,000 farmers annually across four of the CFU's areas of operations: Central, Eastern, Western and Southern regions. The project is guided by at least three theories of change. The first is that if farmers are well trained in Climate Smart Agriculture (CSA) technologies, **then** they will adopt the technologies. The second is that if the private sector (agro-dealers and tractor owners and suppliers) are well mobilized and activated, 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 2018 trainings, adopted the content of the CSA technology trainings. The survey was carried out across 15 of the 36 districts and in all the four areas of CFU operations in Zambia. The sample size was **1254** trained farmers each representing a unique household whose member was trained in 2018.

The survey established the values of Logframe indicators as follows:

- ✓ **Output indicator 1.1:** The total number of unique farmers trained in 2018 came to **268,692** farmers (surpassing the annual target of 216,000 by 24%). Of these, 135,689 (50.5%) were males and 133,003 (49.5%) were females.
- ✓ **Output indicator 1.2:** After training, 92.9% of farmers trained were in the "Good" CSA Knowledge category in P1, whilst 75.5% and 87.9% of the farmers trained were in the "Good" CSA Knowledge category in P2 and P3 respectively, the average being **85.4% (of whom 33.3% were females).** This was a great improvement from an average of 39.6% pre-test knowledge level.
- ✓ **Output indicator 2.1:** Total number of adopters during the period under review was **143,482** coming out of 103,264 adopting households. The CSAZ Logframe had set a milestone of 45,000 to be completely new adopters. The actual achievement was in fact **61,939 (of whom 30,670 were women)** new adopters and thus reaching 37.6% above the target. A total of **79,647 (of whom 39,425 were women)** farmers (against a global target of 52,600 farmers) have continued using MT from one season to the next. This is an achievement of 51.4% above the set target.
- ✓ **Output indicator 2.2:** Area of land under MT was **147,844** surpassing the set milestone of 85,210 Ha by 73.5%. Area of land under CT however went above the set milestone of 51,100 Ha by reaching **63,025** Ha (23.3% above target) although maintenance of soil cover continues to trouble farmers due to reasons explained in this report. As this is now the third year, people are expected to practice crop rotation (CF) and the annual target was set at 25,500 Ha but this target was surpassed as area of land under CF reached **44,698** Ha i.e. 75.3% above set target.
- ✓ **Output Indicator 2.**3: Number of farmers using ADP and Mechanised tillage (disaggregated by draught power). A total of **19,272** households used animals for ripping against a set annual target of 12,100. As for Mechanised, a total of **2,570** farmers used tractors for ripping. The 2018/19 milestone was set at 13,600 households using mechanised ripping services representing a very ambitious target that was set without consideration of climatic and economic factors, a target that should seriously be revised in subsequent years.
- ✓ **Output indicator 2.4:** A total of **60,638** (30,009 women) farmers who were trained in 2018, used herbicides and this was slightly below the set milestone of 63,440 that was planned for Year 3.

This study helps to highlight several lessons that the CFU should use to improve programming during year 4. The following are some of the lessons learnt:

- ✓ The longer the CSAZ operates and trains farmers in an area, the higher the proportion of adopters
- ✓ While crop rotation is apparently very high, this practice is still being influenced by several other factors such as inputs availability and markets for outputs in addition to the CSAZ teaching for enhancement of soil fertility. So attributing achievement to CSAZ should be carefully done.
- ✓ It will be wrong to assume that farmers are not adopting due to lack of inputs. Available evidence actually shows that most farmers in fact actually purchase own inputs. Hence the reasons for not adoption should exclude shortage of inputs.
- ✓ Residual perceptions and myths surrounding herbicide usage and its effect on the soil and human health still persists and needs to be eradicated.

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

1. It is recommended that serious thoughts be given to milestones that are unattainable in light of actual events on the ground with specific reference to the milestone that focuses on the Number of farmers using mechanized tillage.
2. Herbicide usage continue to be a challenge and a variety of reasons are given. There is need to engage input markets and negotiate pricing models that are friendly (such as private partners being assured of economies of scale through ready markets availed by the CSAZ).
3. Where herbicide usage is hindered by mythical perceptions, **innovative** of demythologizing herbicide usage should be employed as it appears that current repetitions of safety may not be quite effective.
4. Annual Logframe targets for mechanization continue to be missed. Missing targets cannot be business as usual. The causes must be investigated and the investigation must also consider whether or not these targets were set realistically and if not realistic, then there is need to negotiate for an adjustment of the milestones.

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 36 Zambian districts. The project has 82 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. The majority of trainees of the CFU are small-scale farmers in the rural areas of Zambia. These trained farmers are in turn expected to practice one form or another of minimum tillage as they have been trained. The previous of such types of trainings were conducted during the 2018 round of trainings in preparation for the 2018/2019 season namely:

- ✓ Period 1-Land Preparation (with three sessions similar in content, to cater for about 25 to 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).

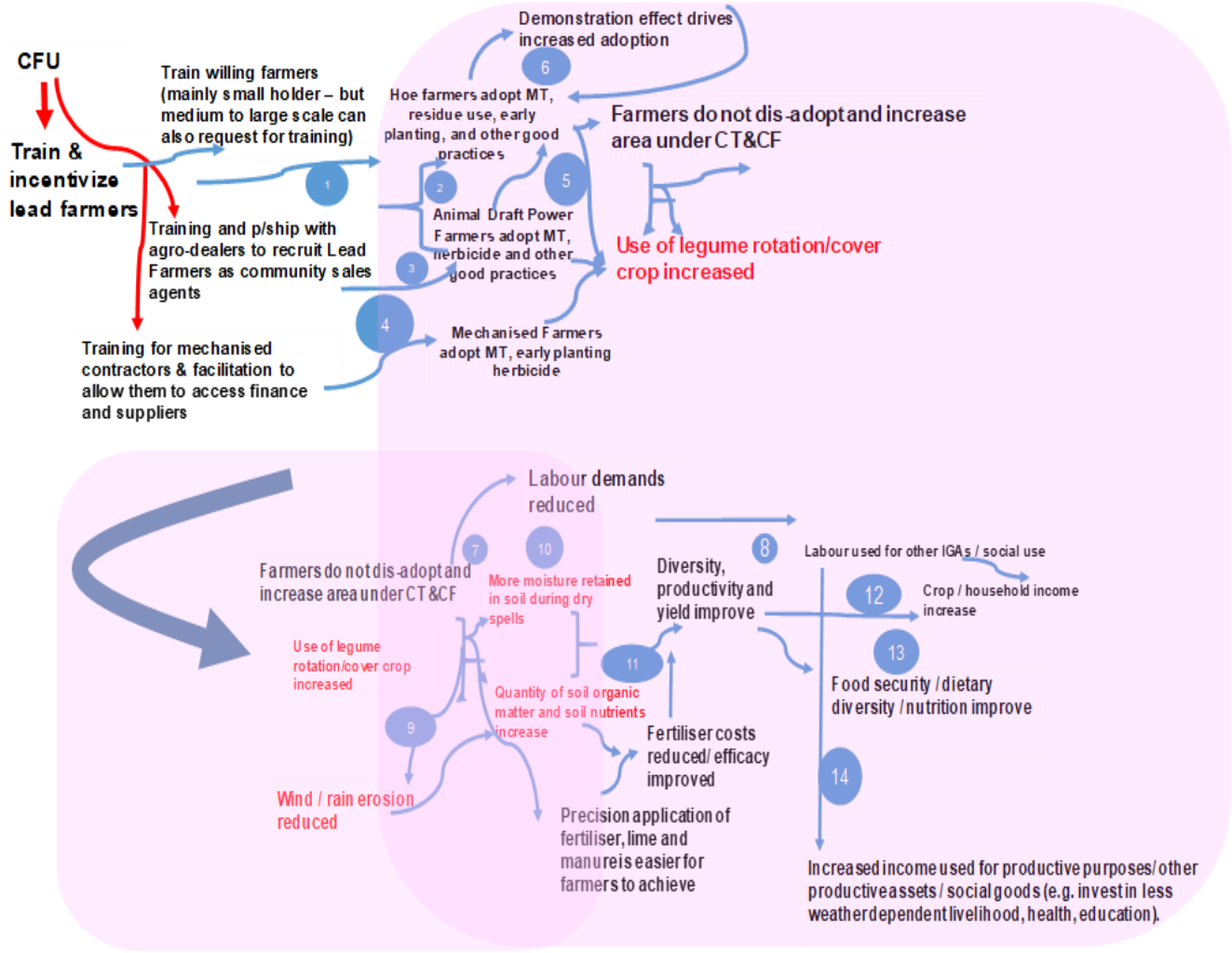
The core purpose of these trainings was to ensure that the farmer would move on to adopt the CF technology. Ideally a farmer needs to attend all three periods in order for them to gain the complete set of skills needed for full adoption. However, a farmer who goes on to attend at least period one and two and then practices (for year 1) minimum tillage (MT) would qualify to be called a Category 1 adopter i.e. Minimum Tillage – MT. Category 2 Adopters are those farmers that went on to use a combination of minimum tillage and the accrued compost of crop residues i.e. Conservation Tillage – CT. And Category 3 adopters are those farmers, now that we are in year 3 of the project, that went ahead and practiced CT as well as crop rotation i.e. Conservation Farming – CF. The survey sought to find out if and how many of those trained farmers had adopted the Climate Smart technology (disaggregating them by the categories defined above) and if not, why not. While these farmers are expected to be unique individuals, there has not been a deliberate policy stopping farmers from repeating trainings as it was felt that they would always have a genuine reason for being present in the same session as the one they attended before. None the less, the study also sought to find out reasons why some individual farmers choose to repeat trainings.

The survey also sought to get a feel of sustainability of adoption in areas where the CFU has exited, where adopting farmers were expected to sustain that adoption in the absence of the CFU. This was done by conducting Focus Group Discussions (FGDs) in exited areas. A further detailed study is expected to be commissioned and give more attention to this issue.

1.2 CSAZ THEORY OF CHANGE

The CFU's CSAZ Theory of Change (ToC) below outlines how training of 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 initially adopt the technology using Hand Hoe, Animal Draft Power (ADP) or tractors and over time adopt further by progressively moving from Minimum Tillage to Conservation Tillage and then to Conservation Farming. 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.

Figure 1: CSAZ Theory of Change



The survey also sought to establish 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).

1.3 STUDY OBJECTIVES

The main objective of this survey was to '***Establish the proportion of 2018 trained farmers that adopted the technology of Conservation Tillage (CT) and Conservation Farming (CF).'***

The specific objectives were as follows:

1. To determine the tillage methods used for each category of farmers.
2. To establish the average hectares cultivated per household under each of the following categories:
   a) Minimum Tillage b) Conservation Tillage c) Conservation Farming
3. To establish the number of CFU trained farmers disaggregated by gender and disability 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 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 2018/19 season.

1.4 DELIMITATIONS

The targeted respondents for this survey were the 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 36 districts, the survey was carried out in fifteen (15) randomly selected districts - Chipata, Mambwe, Katete, Nyimba, Rufunsa, Serenje, Masaiti, Mpongwe, Kasempa, Mufumbwe, Mumbwa, Chikankata, Choma, Gwembe and Chirundu/Siavonga. 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

The Adoption Study faced a few challenges but not too serious to have a negative impact on the survey results. The main challenge faced was not finding some farmers at their homesteads. This was a household survey and as such, it was planned in such a way that interviews would take place within the homesteads of the respondents. However, because this was during the peak of crop growing activities, farmers were busy in the fields either controlling weeds or doing some other farm work. In such cases, farmers were either followed to the field, or called back because they were already aware of the survey. In instances were fields were far from the homesteads, they were replaced with someone else within villages and on the training attendance list. In the end, where one FC could not give sufficient numbers of trained farmers, another nearby FC was selected and farmers trained sampled. The second challenge

was that of selected FCs not having sufficient numbers of farmers per area. This again was sorted out simply by farmer replacement from another FC.

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. Qualitative data was first captured in Computer Tablets (Computer Assisted Personal Interview - CAPI) using Census and Survey Processing System (CSPro) software version 7.3.1 and then analysed using the Statistical Package for Social Sciences (SPSS) before exporting data to MS Excel for graphing and tables. Qualitative methodologies such as Focus Group Discussions (FGDs) and open-ended discussions with Farmer Coordinators (FCs) and Field Officers (FOs) were used. Physical field observations of the crop status at the time of the survey was also done.

2.1 STUDY TOOLS

The tools used in this study were Structured computer-based questionnaire, Focus Group and Open-Ended Discussions, 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 2018/19 farming season. The fact that the sample was generated from a database of farmers who were trained by the CFU under CSAZ in the 2018/19 season meant that the resultant adoption pattern can be attributed to the trainings during 2018 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, how big a field to till 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 Focus Group Discussions (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. A total of eight Focus Group Discussions were conducted: one from each Region's current area of operation and one from each Region's exited area of operation. The FGDs from exited areas were meant to pave way for a fuller survey expected early May 2019 to establish continuity/sustainability of adoption in exited areas. The FGDs for areas of current operation

were meant to provide deeper insights into current adoption patterns. FCs and FOs were also engaged in open-ended discussions in order to establish and have a feel of issues surrounding adoption rates and challenges.

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 four CFU regions were taken as part of the sources of data. Sampling was three-tiered: Random sampling of 15 out of the 36 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 2018 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 after exposing farmers to trainings.

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 ensure representativeness by capturing any variations introduced by ecological and human resource factors.

Regional and District Level Sampling

Table 1: Sample sizes (Regions and Districts)

As is shown in Table 1, the first column indicates the CFU CSAZ regions. The second column shows the randomly sampled districts and then the third column shows total sample sizes randomly drawn from each district. The initial sample size calculation required from a population of all 2018 trained farmers was 385 based on regional training numbers. But that figure was trebled because of the vast areas that the CFU covers. This enabled 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 2018/19 agricultural season. Picking smaller samples from everywhere would not have had the same results as picking reasonable numbers from representative districts. All in all, the survey reached 1,254 unique households represented by a trained household member.

Region	District	Sample Size	Region Totals
Central	Masaiti	76	351
	Mpongwe	103	
	Serenje	91	
	Rufunsa	81	
Eastern	Mambwe	73	320
	Chipata	65	
	Katete	98	
	Nyimba	84	
Western	Mumbwa	74	274
	Mufumbwe	102	
	Kasempa	98	
Southern	Siavonga	76	309
	Gwembe	87	
	Chikankata	66	
	Choma	80	
Total		**1254**	

Field Officer and Farmer Coordinator Level

From each district, it was also essential that there was random sampling for field officers and the respective farmer coordinators (FCs) under them (for the same reason as given above when sampling districts). Table 2 shows how the sampled farmers were distributed among the different randomly sampled Field Officers (FOs) in the various randomly sampled districts across the four regions. Once the FOs were chosen, a list of Farmer Coordinators (FCs) under them was drawn and then also randomly sampled. The pool of farmers to be interviewed was the training register attendance list.

Table 2: Sample Sizes (Field Officers)

Region	District	Field Officer	Sample Size
Central	Masaiti	Cecilia Nseduluka	76
	Mpongwe	Fair Sulwe	54
		Patrick Chishimba	49
	Rufunsa	Bruce Phiri	81
	Serenje	Jason Goma	44
		John Ngala	47
Eastern	Chipata	Veronica Phiri	17
		Jessy Mvula	46
	Katete	Anock Mvula	53
		Clementina Kombe	45
	Mambwe	Pascalinah Muntanga	75
	Nyimba	Bwalya Kangwa	84
Western	Kasempa	Evans Simangolwa	55
		Marvel Mwiinga	43
	Mufumbwe	Chombe Musowe	57
		Nawa Mubita	45
	Mumbwa	Matimba Siabwanda	37
		Beatrice Munyimba	37
Southern	Chikankata	Bright Nakoonje	66
	Choma	Passmore Handongwe	80
	Gwembe	Catrite Apuleni	87
	Siavonga	Handson Kumwenda	76
Total			**1254**

2.3 DATA MANAGEMENT

Data was collected by 14 enumerators who were engaged for the purpose. These had already been trained in similar surveys and hence were very familiar with how to carry out the survey. Nevertheless, before actual data collection, the enumerators underwent an intensive two-day training workshop which included field trial run and testing of the survey tool. Trial runs were carried out in Chipata district in Eastern Region. Again, real CFU trained farmers were interviewed in the trial runs.

The actual data collection was done using Computer Assisted Personal Interviewing (CAPI) software on Huawei Tablets and therefore all information obtained was electronic. The interviews were designed using CSPro 7.1.3 Software which ensured that data obtained was of the highest possible quality at that level. Quality assurance rules were also built into the CAPI software and this included logic like skipping to the next section if a question was non-applicable to the respondent or not allowing an interviewer to proceed if a response was not entered where it was required.

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 one to generate different variables and perspectives from which to approach data analysis. Microsoft Excel was also incorporated into the data analysis process for enhanced visuals and graphic presentation of survey findings.

3.0 SURVEY FINDINGS

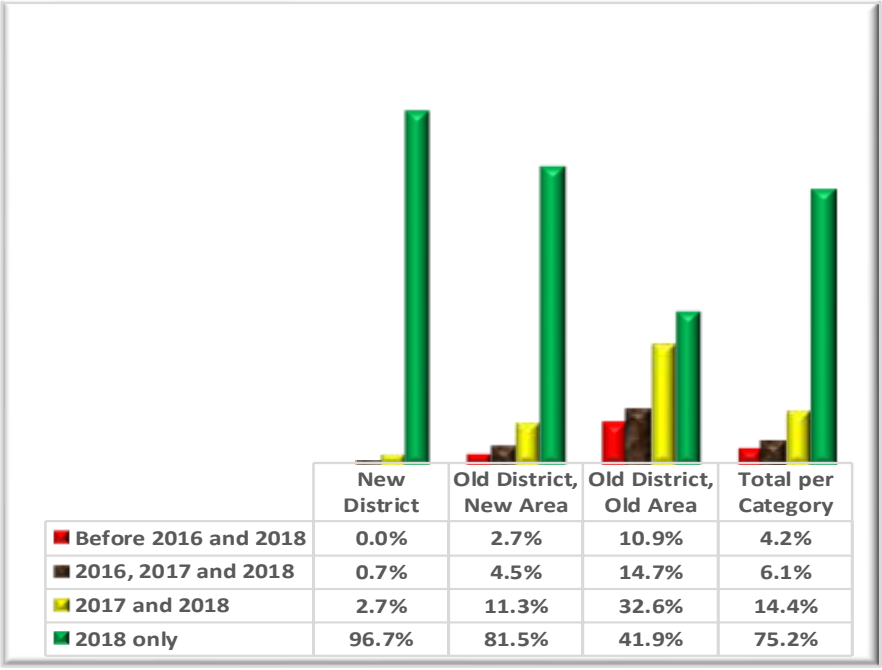
This section focuses on the demographic results obtained from the survey. It highlights the composition of the sampled households (HHs) of the farmers trained in the year during the 2018/19 season, the sex of the household head (HH head) as well as the sex of the trained person, and any disabled persons within those households. Farmers were categorised into four groups depending on which years they attended trainings by the CFU as well as when they were first trained by the CFU. The section also focusses on household labour size, the number of HH members receiving the same training, reasons for repeating trainings and the ages of trained farmers. 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. 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 2018 (Year 3 of the project) training period.

3.1 Demographics

3.1.1 Farmer Trainee Sub-category.

Figure 2: Farmer Trainee Category



	New District	Old District, New Area	Old District, Old Area	Total per Category
Before 2016 and 2018	0.0%	2.7%	10.9%	4.2%
2016, 2017 and 2018	0.7%	4.5%	14.7%	6.1%
2017 and 2018	2.7%	11.3%	32.6%	14.4%
2018 only	96.7%	81.5%	41.9%	75.2%

Figure 2 shows training categories of farmers in line with when they were trained in CSA by the CFU i.e. in which years did they attend those trainings. Upon launching of the CSAZ programme in July 2016, it was agreed that the CFU would later on move into new areas not covered in previous years under CAP I and CAP II. In 2018, there was a shift into new areas. The areas visited were categorised as – 1) Completely new areas in new districts of operation, 2) New areas but within old districts of operation and 3) Old Areas in Old Districts. Out of the sampled 15 districts, the survey deliberately chose to sample 7 new districts, 2 old districts with new areas, 4 old districts with old areas and 2 districts with a combination of new area and old area to make the total of 15 districts. The New Districts include all the areas the project moved into in 2018 and the Old District New Areas and Old District Old Areas include the ones where the CSAZ started from after CAPII ended.

As can be seen from Figure 2 above, the majority of the sampled farmers (75.2%) were trained for the very first time in 2018 followed by those who were trained in 2017 and repeated trainings in 2018 at 14%. Even the old areas in the old districts the majority of the farmers were trained in 2017 and 2018. 53 respondents out of 1,254 (4.2%) were trained in the old program before the CSAZ started and repeated trainings in 2018. Because 53 is so small compared to 1,254, it can be assumed that these are generally farmers who moved from the old closed areas to new areas of operation but who however, could not be stopped from attending trainings again. The data also showed that farmers tend to repeat trainings year after year. Reasons for that are discussed under training attendance in section 3.1.5 below.

3.1.2 Gender of Household Head.

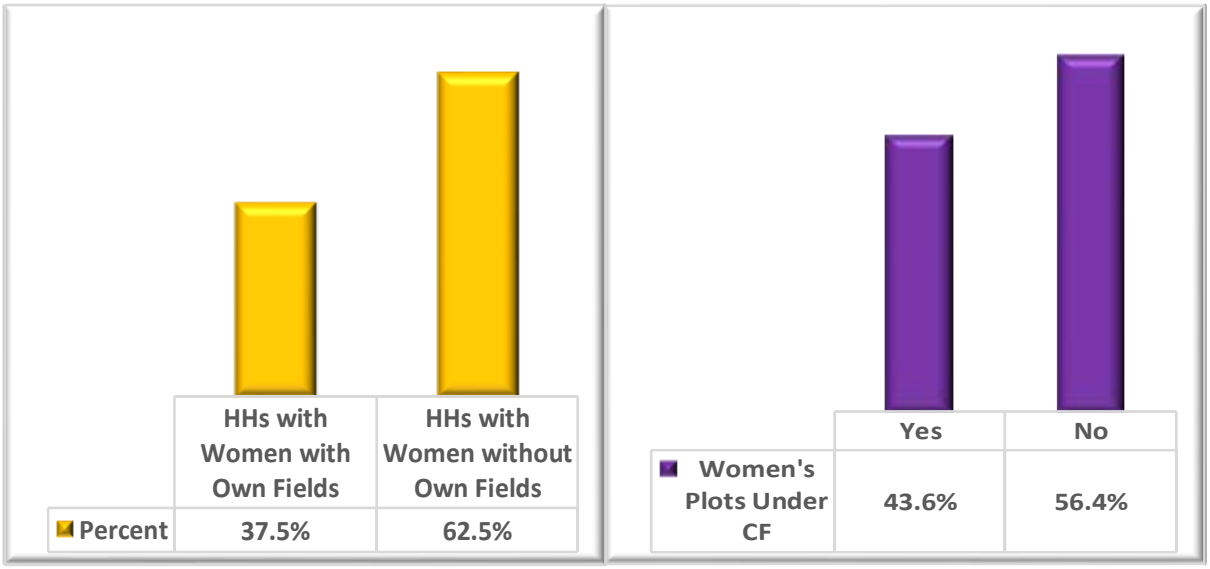
Data shows that out of the 1,188 households that gave an indication of the gender of HH head, 83.7% of those household heads were males and 16.3% were females – that is to say about one in every six households is headed

by a woman. This mirrors existing HH gender headships within the rural Zambian context. Adoption patterns and trends by gender are established in Section 4.4.1 below following the issue of gender of HH head.

3.1.2.1 Women in Agriculture

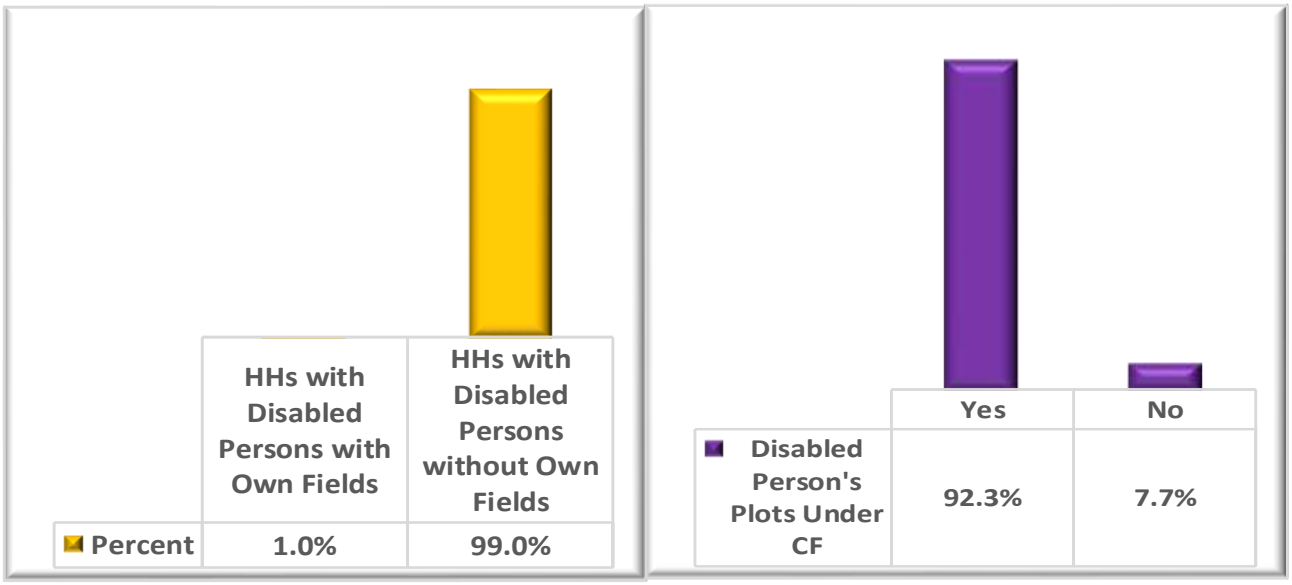
Here we focused on sampled persons that were women and reported to have had cultivated pieces of land directly under themselves. Results showed that out of 470 HHs which had women present in them, only 37.5% of those women have their own fields, the majority depend on family-owned fields. And of the 37.5% of the women with their own fields, only 43,6% are likely to use CF on those fields. This percentage of women with fields under CF translates to 16% of all HHs trained have women with own fields under CF.

Figure 3: Women with Own Plots under CF



3.1.2.2 Disabled Persons in Agriculture

Figure 4: HHs with Disabled Persons with Own



We also focused on disabled persons within sampled households that were reported to be cultivating pieces of land directly under themselves. Only 1% of the total sample was the proportion of HHs with disabled people owning plots. This was only 13HHs and out the 13, 12 (92.3%) put those plots under CF.

3.1.3 Household Labour Size

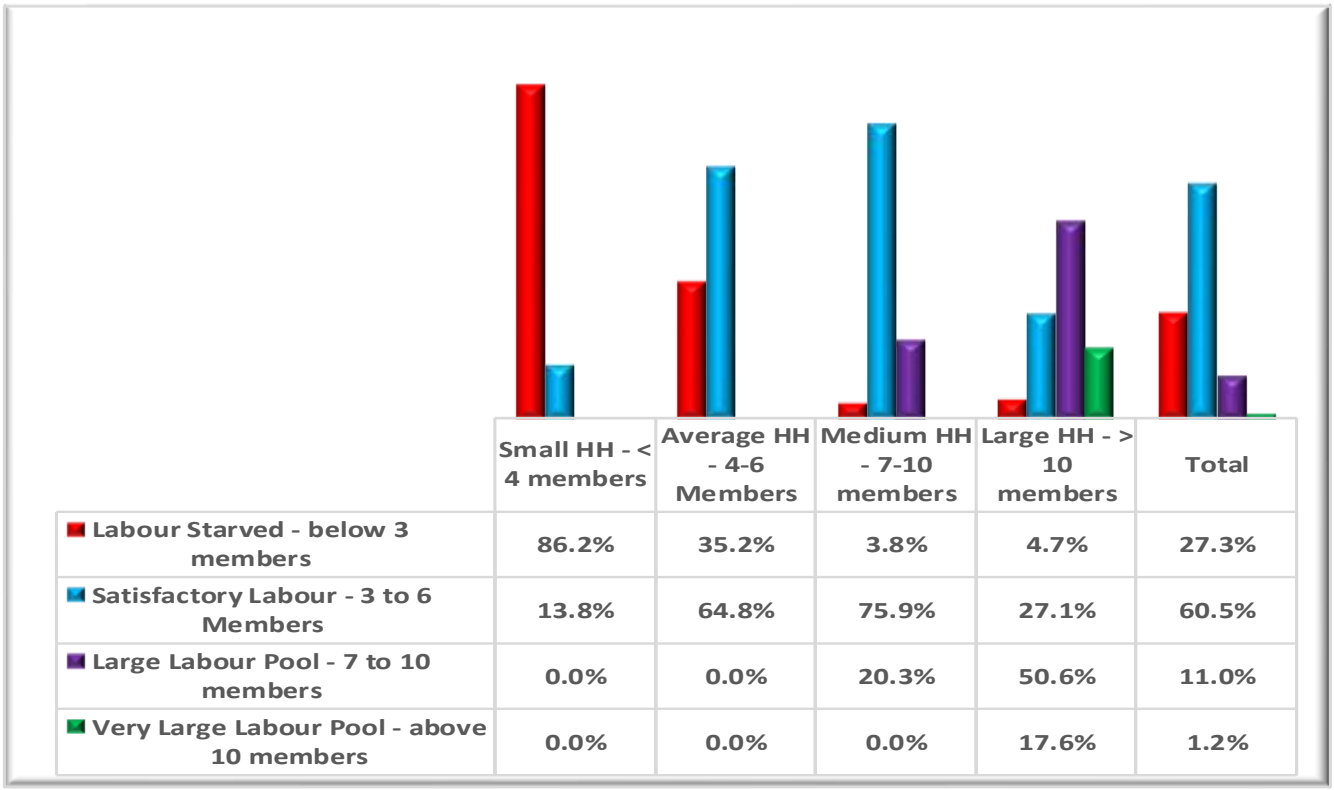
Labour restrictions combined with a lack of resources means that some farming families might not be able (assuming they want to) to convert more plots to CF MT until later on when the benefits of labour and input savings are realised and ploughed back into outsourced labour. This is because, before trying it out, farmers have a perception that CF is labour intensive but once they have converted, that story changes. However, labour constraints affect all 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 are outlined in the bullet points below:

- ✓ Labour Starved if they have less than three labour active members;
- ✓ Satisfactory Labour if they have three to six labour active members;
- ✓ Large Labour Pool if they have seven to ten labour active members and
- ✓ Very Large Labour Pool if they have more than ten 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 5**,** the majority of large HHs (above 10 members) have a large to very large labour pool (68.2%) and very few of them are labour starved obviously because they are many. Large HH which are labour starved would be those with a lot of young children,

the elderly, sick or disabled persons. The majority of small HHs (below 3 members) as expected are labour starved. The in-betweens (average and medium HHs) have satisfactory labour with 64.8% and 75.9% respectively.

Figure 5: HH Labour Security



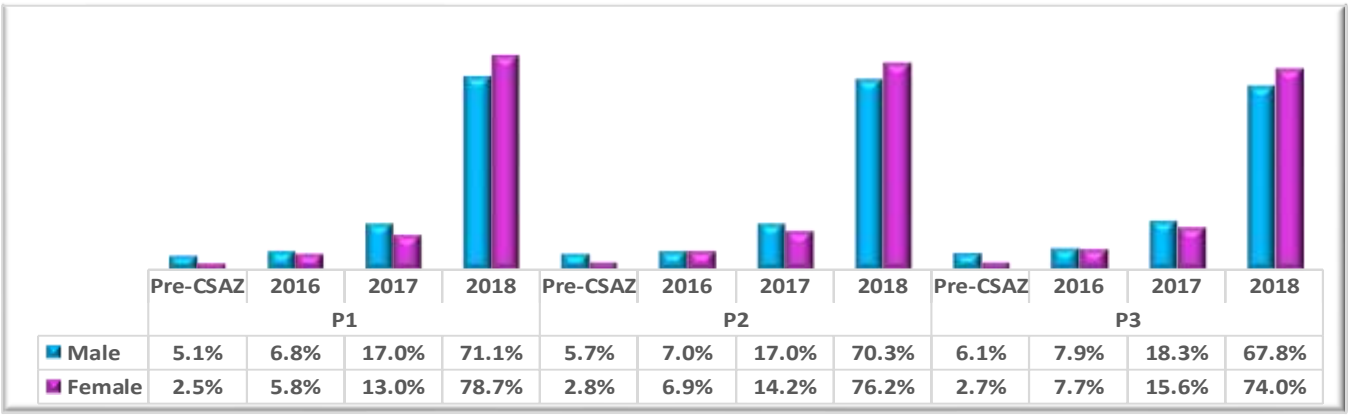
	Small HH - < 4 members	Average HH - 4-6 Members	Medium HH - 7-10 members	Large HH - > 10 members	Total
Labour Starved - below 3 members	86.2%	35.2%	3.8%	4.7%	27.3%
Satisfactory Labour - 3 to 6 Members	13.8%	64.8%	75.9%	27.1%	60.5%
Large Labour Pool - 7 to 10 members	0.0%	0.0%	20.3%	50.6%	11.0%
Very Large Labour Pool - above 10 members	0.0%	0.0%	0.0%	17.6%	1.2%

Overall, most of the trained farmers' households have satisfactory labour (60.5%). Still, over a fourth are labour starved and only 1.2% have at least large labour pools and all from large HHs as expected. This means that, ***if labour was the only constraint, only 27.3% can fail to convert to CF***. However, this can still be overcome by farming households which are labour starved hiring labour to carry out key farming operations during the course of the season – assuming resources for hiring labour are available.

3.1.4 Training Attendance.

This subsection briefly profiles the sampled respondents' training history. They were asked when was the very first time they received training from the CFU in Climate Smart Agriculture. This was an important question because the intention of moving into new areas was to train new farmers. Figure 6 shows that in all three periods there were more farmers being trained for the very first time with an average of 73% attending for the first time in each period. This shows that the trainings indeed targeted 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.

Figure 6: Training Attendance - Proportion of respondents



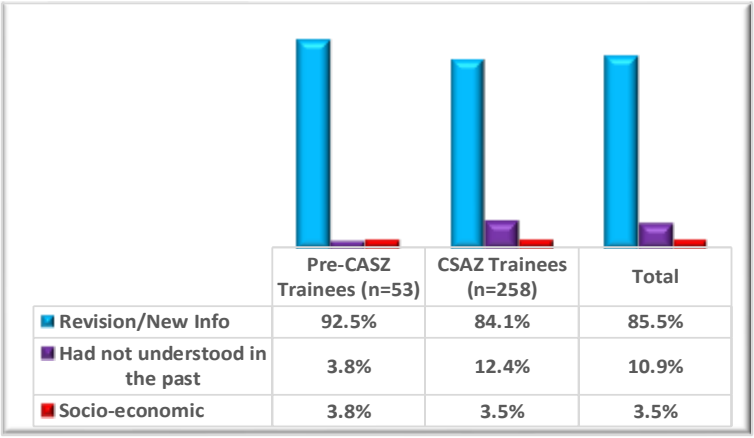
	Pre-CSAZ	2016	2017	2018	Pre-CSAZ	2016	2017	2018	Pre-CSAZ	2016	2017	2018
	P1				P2				P3			
Male	5.1%	6.8%	17.0%	71.1%	5.7%	7.0%	17.0%	70.3%	6.1%	7.9%	18.3%	67.8%
Female	2.5%	5.8%	13.0%	78.7%	2.8%	6.9%	14.2%	76.2%	2.7%	7.7%	15.6%	74.0%

Although the figure above shows that more females attended trainings for the very first time in 2018 compared to men, the 2018 training data shows that there were almost as many males trained as there were females but, and true to what the figure above is showing, a larger proportion of females were trained for the first time in 2018 compared to males. However, it is also evident that the proportion of trained females sampled and interviewed was higher (52.2%) compared to that of males (47.8%). Also, at the time of the survey, some men were represented by women because generally, if one spouse will be home, it will be the woman as men are busy with other livelihoods that bring about quick returns.

3.1.5 Reason for Repeating training year after year.

Following when respondents were first trained by the CFU in Figure 6 above, respondents can be put into two groups, those that had already been trained by the CFU before the CSAZ project (Pre-CSAZ) and those that were only trained by the CFU in the CSAZ program (2016 to 2018). Apart from those trained for the very first time in 2018, the survey sought to establish reasons why those trained before the CSAZ as well as those trained in 2016 and 2017 went on to attend trainings again in 2018.

Figure 7: Why Farmers repeated Training in 2018



	Pre-CASZ Trainees (n=53)	CSAZ Trainees (n=258)	Total
Revision/New Info	92.5%	84.1%	85.5%
Had not understood in the past	3.8%	12.4%	10.9%
Socio-economic	3.8%	3.5%	3.5%

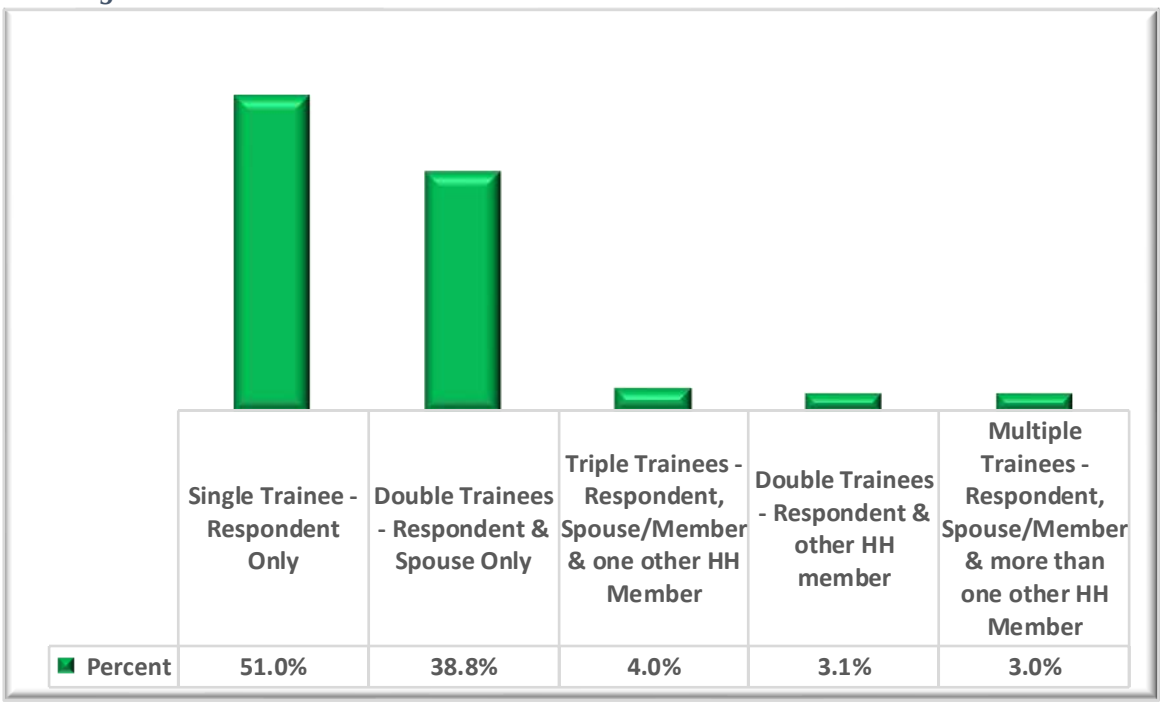
Figure 7 shows that farmers repeatedly attend trainings mainly for revision purposes. Of course, this is more or less the same reason as "had not understood in the past" but never the less the study separated "Revision" to refer to those that had understood but chose to turn up simply for pure revision and assurance purposes. Within the 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 comes up especially with the ever-changing agricultural environment for climate change and the recent incidences of fall army worm attacks on crops. The basic technical message is the same with minor changes which they do not want to miss out on.

3.1.6 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. Spouses are encouraged to attend trainings together and to subsequently support each other as they try out and eventually adopt the practices.

Figure 8: CFU Trainees within a Household



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 whole-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.

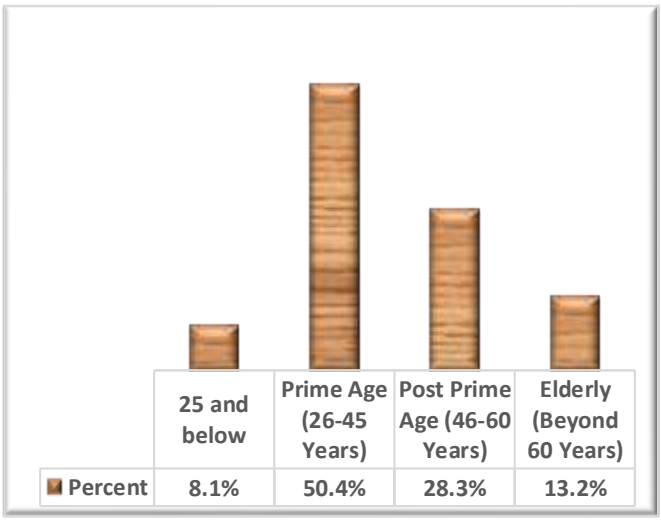
An analysis done on the number of trainees in the household brought to light the occurrence of training of more than one person within the household – usually the respondent and an additional person/people. Figure 8 above shows the results of the survey. It was discovered over the course of the survey that 38.8% of the households surveyed indicated double trainees comprising respondents and their spouses. 51% of the HHs represented at trainings are

more likely to be just themselves trained, while 3% of the trained HHs are likely come from HHs where more than 3 members were trained.

3.1.7 Age of trained farmers

Ideally, CF technology practices are passed from one generation to the next. It can be expetced for this to happen, the young to middle aged adults should be the majority attending trainings rather than the old. Figure 9 looks at the age categories of farmers trained by the CFU.

Figure 9: 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 technologies are considered to be those between the ages of 26 and 45 years old, this is notably the age group of most rural farming communities. This group, accounting for half of the farmers trained, as shown in figure 9, also appears to be supported by older and more experienced farming members within the communities who have been farming for a relatively longer time. 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.

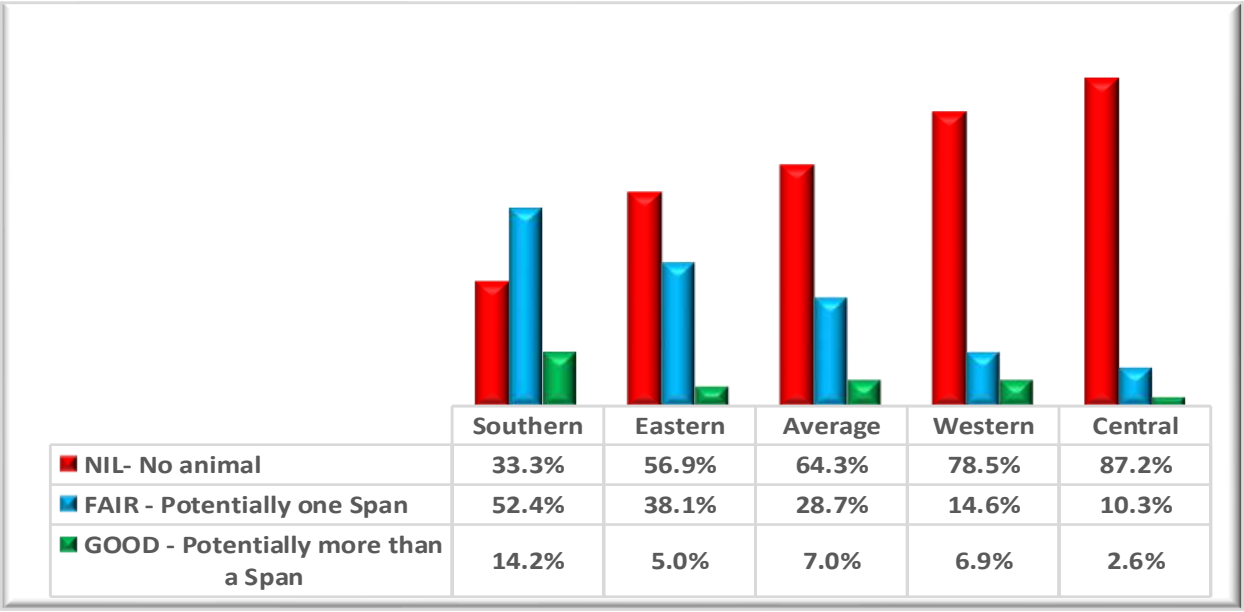
3.1.8 Potential Animal Draft Power (ADP) in Households

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 power animals might or might not turn to hoe tillage whilst they build up their animal asset base. It was therefore realised that it would be important to try and ascertain the level of animal ownership.

As shown in Figure 10, the survey reveals that Southern Region (SR) has more farmers with animals that can potentially be used as ADP (over 60%) than any other region followed by Eastern Region (ER) with 43.1%, Western Region (WR) with 21.5% and Central Region (CR) is the least with only12.9% of the HHs likely to have the potential to own ADP within the Region. The flip side is that SR is likely to have the least number of HHs with no ADP and CR is most likely going to have most of the HHs with no ADP. This is an expected tendency 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. Western region has quite a lot of Tonga speaking people but, in that region, the mechanisation strategy worked well and they mostly depend on tractors for ripping. Compared to ER though, WR had fewer HHs with potential ADP.

Figure 10: Potential Animals for Draft Power in Households by Region



	Southern	Eastern	Average	Western	Central
NIL- No animal	33.3%	56.9%	64.3%	78.5%	87.2%
FAIR - Potentially one Span	52.4%	38.1%	28.7%	14.6%	10.3%
GOOD - Potentially more than a Span	14.2%	5.0%	7.0%	6.9%	2.6%

This observation, in the 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 especially in SR and ER which are most likely to have the most potential for ADP 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, emphasis should be placed more on basins as well as Tractor ripping.

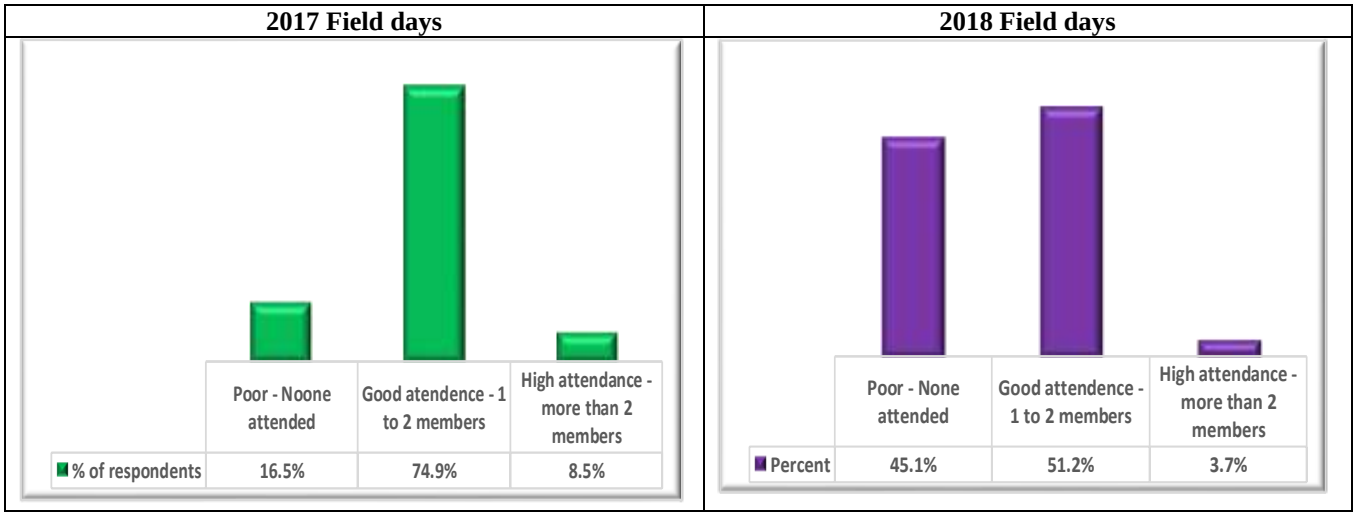
3.1.9 Field Days Attendance

Respondents were also asked about field day attendance by themselves and/or other members from their households. It is 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 those training sessions.

A field day is expected to help those who would be waiting to see the performance of other trainees that went on to adopt. Field days are also events from where potential trainees for upcoming training sessions are found. Figure 11 shows that 54.9% of the households whose members were trained in 2018 (June to September) had also turned up for field days of February to April 2018 (prior to being trained). The reduction in the figure when compared to 83.5% in 2017 is because in new areas, field days had not yet started taking place as there were no adopters yet and

the first activity in those areas were the trainings themselves. It will however be interesting to compare these attendance figures with the 2019 ones during the next Adoption Study. Note however, that by the time of the study, field days were still underway and fuller picture could have been captured had the survey been conducted after March 2019.

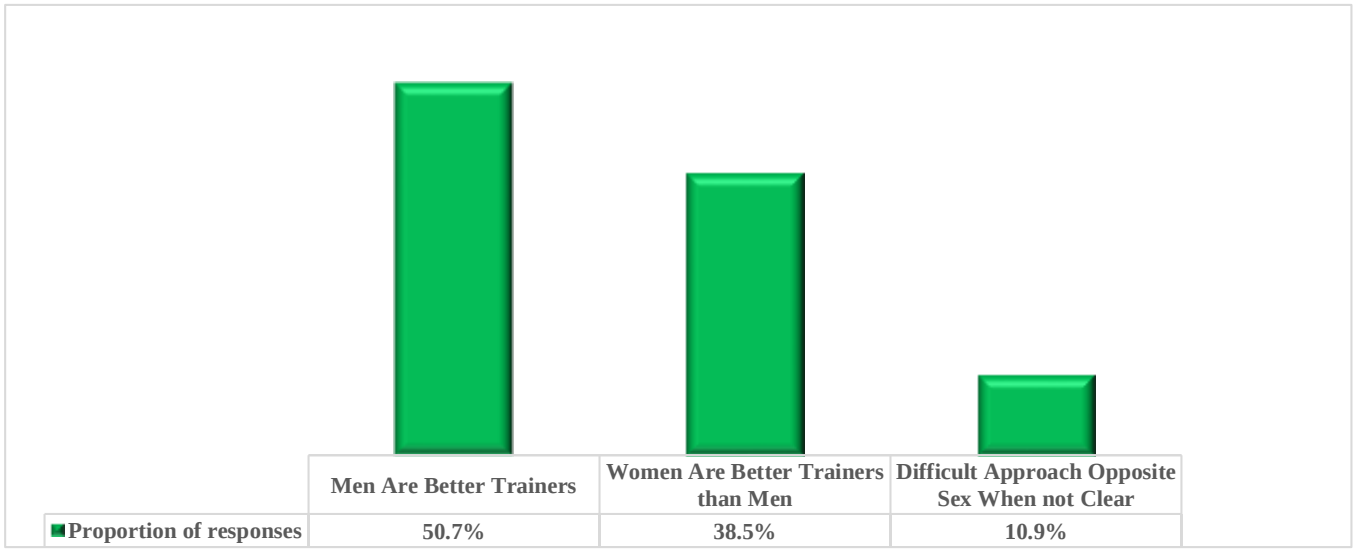
Figure 11: Field Days Attendance (2017 vs 2018)



3.1.10 Does Gender of the trainer Matter?

Among CSAZ's farmer coordinators (the people mainly in charge of training of farmers and hence driving adoption at local levels), 20% 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.

Figure 12: Reasons for Why it would make a difference if trainer were of

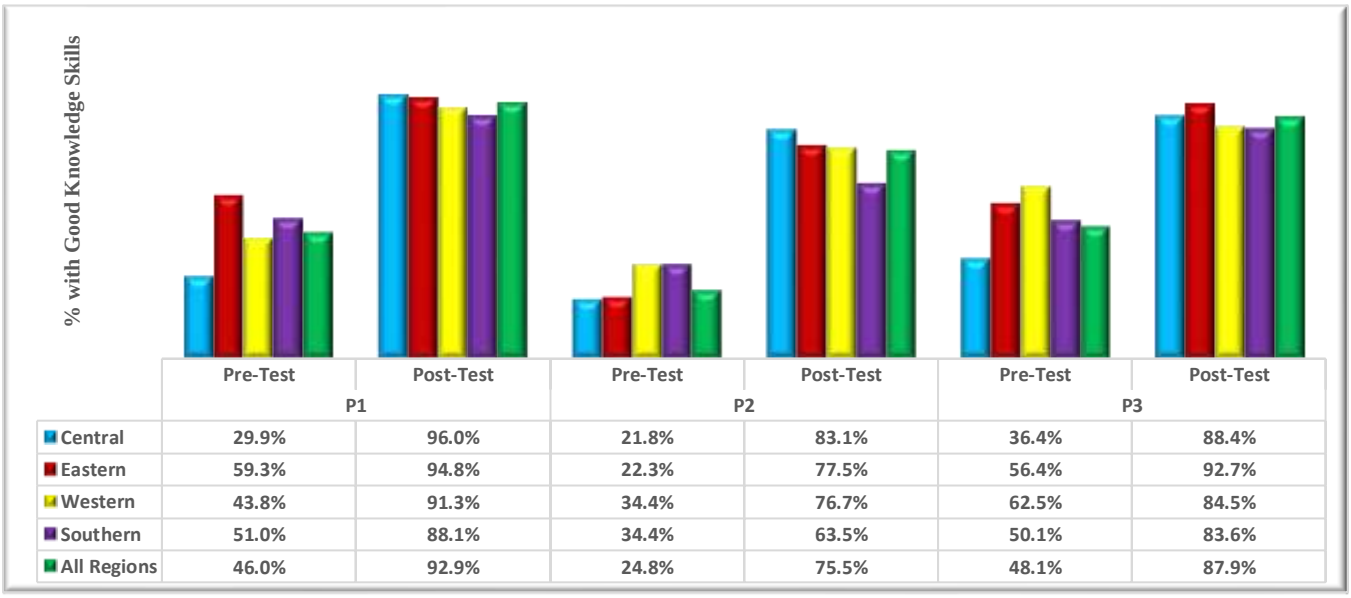


Just like in year 1 and 2, the majority of respondents (91.9%) held that the trainer's sex **really does not make a difference** and only 8.1% (N=1254) of the respondents hold that gender of the trainee does make a difference. The survey nevertheless sought to find out the reasons offered by these minority respondents. Figure 12 shows an analysis of the opinions of these respondents. Out of those who said that the sex of the trainer was an important aspect, 50.7% noted that men are better facilitators while 38.5% actually believe that women are better trainers, the other 10.9% felt that being trained by a person of the same sex is important as it would be difficult to approach a trainer of the opposite sex on a one to one basis should the trainee find the need for further clarifications outside the session.

3.1.11 Level of CSA Knowledge among 2018 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 Log-frame (Proportion of trained farmers in the "Good" CSA Knowledge category post training).

Figure 13: 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	29.9%	96.0%	21.8%	83.1%	36.4%	88.4%
Eastern	59.3%	94.8%	22.3%	77.5%	56.4%	92.7%
Western	43.8%	91.3%	34.4%	76.7%	62.5%	84.5%
Southern	51.0%	88.1%	34.4%	63.5%	50.1%	83.6%
All Regions	46.0%	92.9%	24.8%	75.5%	48.1%	87.9%

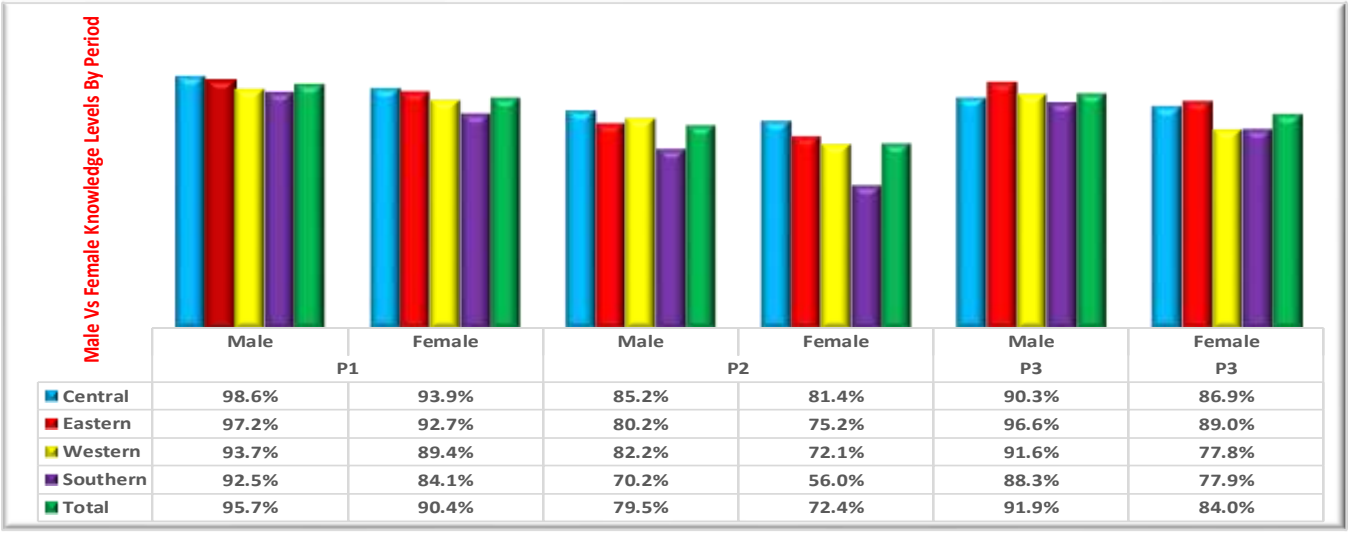
From the graph above where proportion of farmers scoring at least 'Good' is disaggregated by training periods, farmers are most likely to be more knowledgeable in Period Three (P3) and least knowledgeable in P2 before training. Post training, farmers are more likely to be more knowledgeable in P1 followed by P3 and lastly P2. However, although farmers are more likely to have the least knowledge in P2 both pre- and post-training, it recorded the highest positive increment in knowledge and P3 which initially had the highest knowledge recorded the least positive increment in knowledge. P3 has the least change in knowledge because it also recorded the highest pre-training. So generally speaking, farmers are more likely to be more knowledgeable in P1 and P3 than P2 after training. This could be attributed to the fact that perhaps P1 is the easiest to grasp for farmers than P2, and P3 has been shown over and over to arouse the most interest in both adopters and non-adopters because of 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.

CR had the most improvement in all three periods followed by ER, WR and lastly SR. Overall, there is a major improvement in knowledge after training farmers in all three periods as clearly shown in the graph. **Output indicator 1.2:** Post training, 92.9% of farmers trained were in the "Good" CSA Knowledge category in P1, whilst 75.5% and 87.9% of the farmers trained were in the "Good" CSA Knowledge category in P2 and P3 respectively, the average being **85.4% (of whom 33.3% were females).**

In the CFU's quarterly report, P3 was the least attended period with 191,054 unique farmers after consolidating all regional data (See CSAZ Q3 Report -October to December 2018, Pg. 6) while P1 was the most attended with 217,088 unique farmers. Figure 14 below shows post-training knowledge by gender proportions.

Figure 14: Proportion of Male & Female Trainees with Good knowledge Post Test



	Male P1	Female P1	Male P2	Female P2	Male P3	Female P3
Central	98.6%	93.9%	85.2%	81.4%	90.3%	86.9%
Eastern	97.2%	92.7%	80.2%	75.2%	96.6%	89.0%
Western	93.7%	89.4%	82.2%	72.1%	91.6%	77.8%
Southern	92.5%	84.1%	70.2%	56.0%	88.3%	77.9%
Total	95.7%	90.4%	79.5%	72.4%	91.9%	84.0%

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 of 5.3%, 7.2% and 7.9% for P1, P2 and P3 respectively. Overall, males are 6.8% more knowledgeable than their female counterparts. 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 third year of the CSAZ, adoption of the CSA technology will now be placed into three categories: Category 1 (MT) adoption will be defined by any minimum **tillage practice used to carry out land preparation**, 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, and Category 3 (CF) will be defined by a combination of CT and crop rotation. 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 reasons for non-adoption. The section will 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.

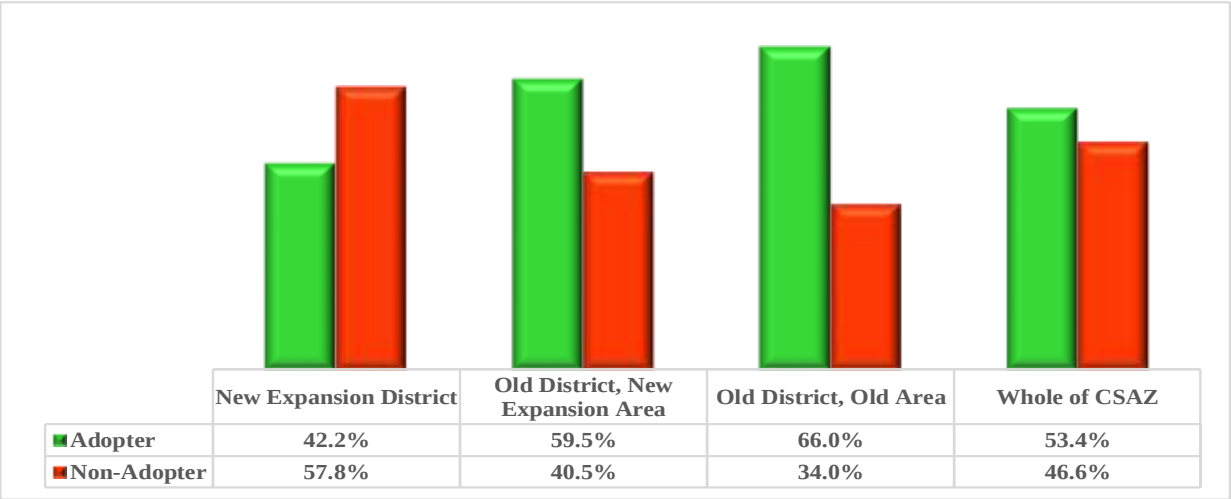
The first point for discussion is a focus on adoption. What proportion of households took up a CSA promoted technology in the current year 3 season? Figure 15 below presents a picture of minimum tillage adoption, as well as focussing on the trainee category. This answers to the CSAZ Logframe indicator 2.1; ***Number of farmers sustainably adopting CF practices following attendance at CFU training. (disaggregated by New/Old)***. 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 practice in this current (2018/19) season as well as in the previous (2017/18) season. This requires us to distinguish between two categories of adopters: Category 1 (MT) adopter is a farmer/household that prepared their land using any minimum tillage (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. Category 3 (CF) adopter is a Category 2 adopter that proceeded to rotate crops (cereal followed by legume or vice versa). So, to compute the second category we only use figures from the first category while the third category figures depend on the second category farmers.

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 by new and sustained

adopters as indicated in the respective Logframe indicator. Figure 15 gives a weighted adoption rate as 53.4% (or 103,264) households which is an increase from the 2017/18 season adoption rate which stood at 41.0% households.

Figure 15: Proportion of Adopters and Non-Adopters (by area type)



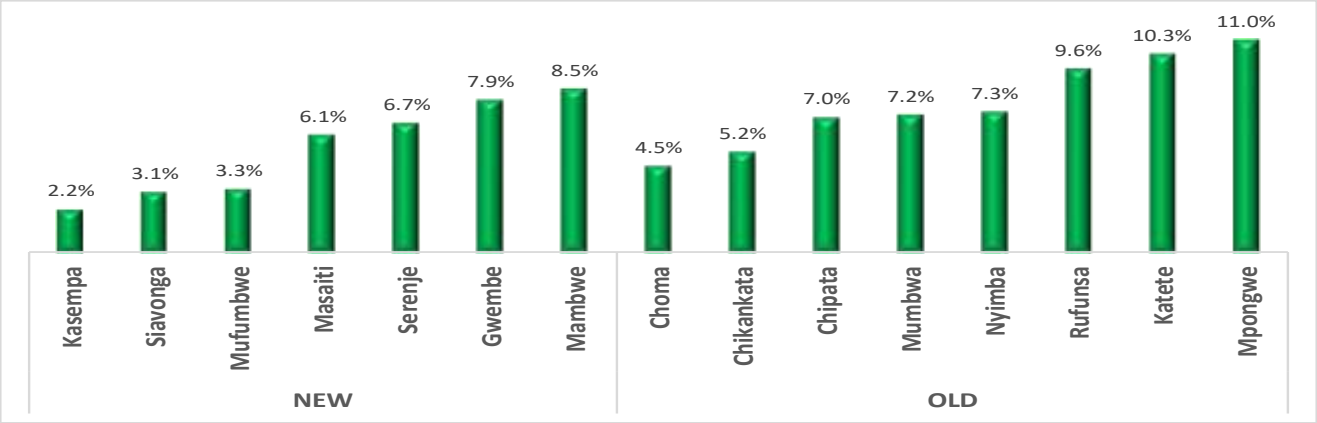
	New Expansion District	Old District, New Expansion Area	Old District, Old Area	Whole of CSAZ
Adopter	42.2%	59.5%	66.0%	53.4%
Non-Adopter	57.8%	40.5%	34.0%	46.6%

The survey, as is indicated in earlier chapters as well as in Figure 15, was carried out in three area types specifically:

- New expansion district (completely new)
- Old District with operations in a new expansion area and
- Old district with operations continued in an old expansion area.

It is seen from Figure 15 that the ***longer the CFU operates and trains farmers in an area, the higher the proportion of adopters.*** But this of course follows the economic law of diminishing returns as Figure 16 below depicts more or less the same picture.

Figure 16: Percent Contribution of Adopters by Districts

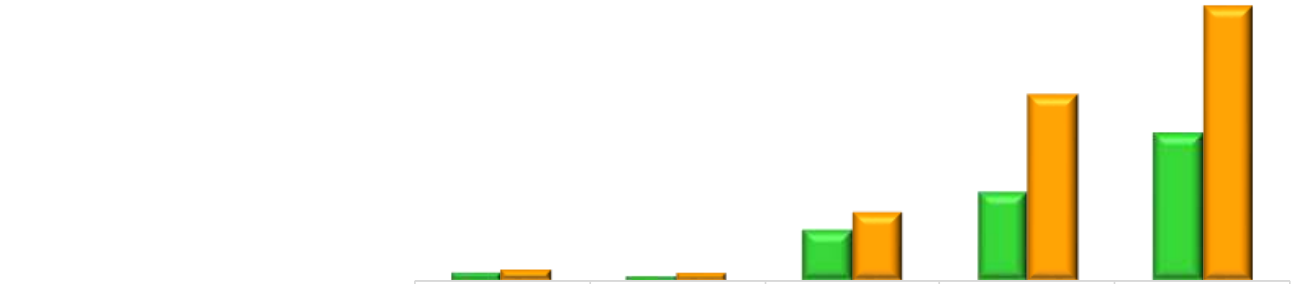


There are new districts that are nearly hopeless in terms of adoption just as there are old districts that have also

reached the peak of adoption and are starting to yield less than expected. The CSAZ can decide, for example to use 7% as the threshold below which it is not economically viable to continue training farmers. This would mean districts such as Kasempa, Siavonga, Mufumbwe, Masaiti and Serenje should be dropped in the coming season. Among the Old districts, this would also mean that Choma and Chikankata also may have to be dropped. Note that Mambwe is a special case; what in fact happened was that FOs and FCs in Chipata had long since moved into Mambwe before 2018 training sessions but was reporting Mambwe under Chipata, just as FCs in Monze/Choma had moved into Gwembe but reported trainees as coming under Monze/Choma. This explains the comparatively high adoption rates in these New areas.

Output Indicator 2.1: Number of farmers sustainably adopting CF practices

Figure 17: Household Adopters by Respondents' Trainee Category



	Before CSAZ - Old Trainee	In 2016 - Attending for the 3rd time	In 2017 - Attending for the 2nd time	In 2018 - Attending for the 1st time	All Households
# HHs Adopting within Category	6,121	3,373	36,122	61,939	103,264
Total HH in Category as per training dataset (N)	8,015	5,093	48,615	131,550	193,273

Out of the 131,550 households that were trained **for the first time** in 2018, 47.1% (61,939) adopted CSA. In relation to the **Logframe Indicator 2.1, adoption by new farmers is 61,939 and therefore surpassed the annual target of 45,000 farmers by 37.6%.** This does not however provide an indication of the number of people that have continued to use minimum tillage from one year to another (sustained adopters). 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, second and third time in 2018, 2017 and 2016 respectively. Further analysis of data shows that a total of **79,647 farmers sustainably adopted**. This implies that whereas the milestone for Output Indicator 2.1 sustained adopters was 52,600 farmers, actual achievement was 51.4% above annual target.

It was of interest to establish whether being a sustained adopter was dependent on the gender of the head of household. Table 3 is a Chi-Square table investigating this.

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

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	2.527[a]	1	.112
N of Valid Cases	1187		

The Null hypothesis was that being a sustained adopter is independent of the gender HH head. The Chi-square statistic here is 2.527, 1 degree of freedom, and the p-Value is 0.112. We are testing at the 5% level of significance (alpha = 0.05). Now, 0.112 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.

Output Indicator 2.3: Number of farmers using ADP and Mechanised tillage

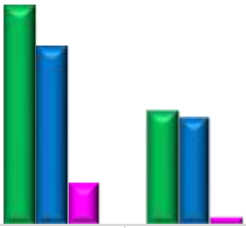
It is important for the CFU to take stock of the very tillage methods that were being used during this season by adopting households. This also answers to ***Output Indicator 2.3: Number of farmers using ADP and Mechanised tillage (disaggregated by draught power).*** It noted above that 103, 264 households adopted. Results show that a total of 47,055 (5.1% are female headed while 40.4% are male headed) households used ADP. Note that the indicator wording is "Number of farmers" and not "Households" and this makes it difficult to decide which figures to use. In order not to give an impression of over achievement, we have decided to use households and not individual farmers. Again, the indicator is not clear on whether or not those that purely used own ADP should be counted. Only a target of 12,100 households was set for ADP and if own animals are considered, then the achievement would be way above the milestone. However, those that hired or partially hired (own plus shared) still surpass the target of 12,100 households as they reached a total of 19,272 households. This study proposes to use the value of 19,272 households as the ***number of farmers using ADP and Mechanised tillage***.

For Mechanised ripping, 2,570 (all male headed) households used tractor ripping tillage method. This is below the expected milestone of 13,600. For consistency's sake, "households" will still be used even though the Logframe indicator uses "farmers" (even though using farmers would still give us a low achievement of 3,570 farmers). How at all it was expected that Mechanised ripping would reach higher numbers than ADP remains an indication that the milestone was unrealistically sent and needs to be revised. Some of the reasons explaining low achievement in this domain are:

- ✓ Poor rainfall leading to people not willing to invest in more expensive tillage methods;

- ✓ Hash micro-economic conditions leading to tractor owners not able to maintain tractors in good conditions for ripping
- ✓ A huge swing away from Mechanised tillage and reliance on ADP as this was the more economically viable option for those that opted to use rippers.

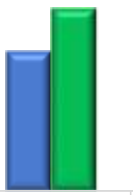
Figure 18: Number of Farmers using Specific Tillage Methods (also comparison across gender)



	Basins users	ADP Ripping - Own animals	ADP Ripping - Hired animals	ADP Ripping - Shared animals	Tractor Ripping - Own Tractor	Tractor Ripping - Hired Tractor	Tractor Ripping - Shared Tractor
# ALL Type of Adopters	53,639	27,783	11,884	7,387	321	1,927	321
# Male Headed	43,682	26,177	10,118	5,460	321	1,927	321
#Female Headed	9,957	1,606	1,767	1,927	-	-	-

It is of interest to look at gender usage by focussing on tillage type within each gender category. Figure 18 below makes it clear that when compared across categories, within gender categories however, female headed households are more likely to use Basins (65.3% of all female headed households) than any other tillage method while 50.4% male headed households are not likely to use basins but rely on other tillage methods ranging from ADP ripping to tractor ripping. Tractor ripping, this season, is apparently the prerogative for male headed HHs. It is clear from this that agricultural asset ownership is still heavily tilted in favour of male headed households and if Basin digging is indeed laborious, then there is need for other development agencies to promote access to higher assets by female headed households.

Figure 19: Tillage Methods employed by adopters (within gender of HH Head)



	Basins	ADP Ripping - Own animals	ADP Ripping - Hired animals	ADP Ripping - Shared animals	Tractor Ripping - Own Tractor	Tractor Ripping - Hired Tractor	Tractor Ripping - Shared Tractor
Male-Headed HH	49.6%	29.7%	11.5%	6.2%	0.4%	2.2%	0.4%
Female-Headed HH	65.3%	10.5%	11.6%	12.6%	0.0%	0.0%	0.0%

4.1.2 Category 2 (CT and CF) Adopters – Soil cover and Crop Rotation

Focus now moves towards those farmers that deliberately kept crop residues for the purpose of soil cover as taught during the CSAZ trainings of 2017 going back. There is no need to focus on farmers that were trained in 2018 since training took place AFTER farmers had harvested and hence these are not expected to have retained some crop residue for a deliberate purpose of soil cover. The computations for the number of CT farmers here should be understood to be focussing only on those MT **sustained adopting farmers trained in 2017** or before (totalling 79,647 farmers). Results show that 79.1% of the MT sustained adopters went on to keep crop residue (practice CT), bringing the total of CT farmers to 63,025.

Turning to CF, again the computation considers only those farmers that would have used CT (63,025) and went on to take up crop rotation. Results show that 37.2% of the CT adopters went on to practice crop rotation (practice CF), bringing the total of CF farmers to 23,432. This data will be used to compute Output Indicator 2.2: Area of land under MT, CT and CF (section 4.2 below).

4.2 Area of land under MT, CT

Output Indicator 2.2: Area of land under MT, CT, CF

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 under MT was 0.01 hectares and the maximum was 9 hectares. 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 0.5 hectares, mean was 1.0304Ha and hence if a total of 143,482 farmers adopted MT, then the total area under MT (based on the mean) was around 147,844 hectares. This achievement would surpass the Logframe milestone of 85,210 hectares by 73.5%.

Secondly, using the same method, the data was also used to compute average land area under CT by Category 2 adopters. As stated above 63,025 farming households come under CT adopters. Now, available data show that the median was 1.000 Ha hence the total area of land under CT was therefore 63,025 hectares against a target of 51,100 hectares, surpassing the target Hectarage by 23.3%.

Finally, again using the same method, it has been stated above has shown that 23,432 farming households used CF. Available data show that the minimum area of land under CT was 0.10Ha and the maximum was 10Ha. The majority of farmers put 0.5 Ha under CF and therefore total area of land under CF was 44,698 hectares against a target of 25,500 hectares, surpassing the target CF Hectarage by 75.3%. It should be however emphasised here that crop

rotation is still being influenced by several other factors such as inputs availability and markets for outputs in addition to the CSAZ teaching for enhancement of soil fertility. So attributing achievement to CSAZ should be carefully done.

4.3 Reasons for Non-adoption.

Focus Group Discussions 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 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.

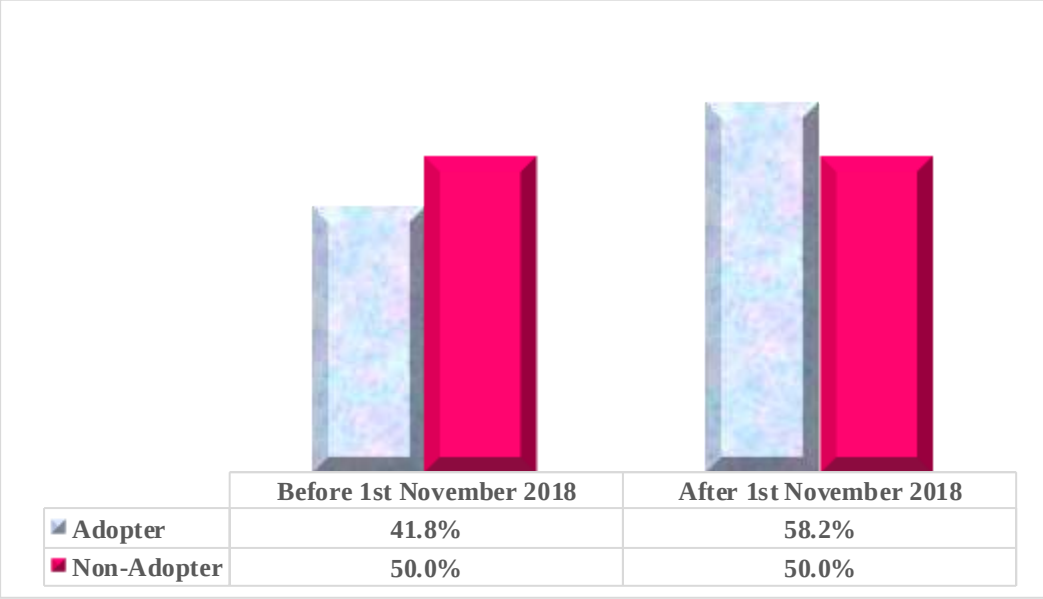
4.3 Other Adoption Considerations

4.3.1 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 differences between adopters and non-adopters. As seen in Figure 20, there

is not much difference in the time that adopters and non-adopters access inputs. While 41.8% of the adopters are within an acceptable timeframe (Just on time or sometime before the rains), even more non-adopters, 8.2% more than adopters are also within this time range. Again, 58.2% of the adopters compared to 50.0% of the non-adopters are in the category of having secured their inputs after 1st November 2018. Reasons given for the delay in accessing inputs are the same for both adopters and non-adopters: The season has been economically bad and all farmers faced resource constraints and this was aggravated by late payments for produce delivered to FRA. On the other hand, farmers were also waiting for FISP inputs.

Figure 20: Timeliness in Accessing Inputs



	Before 1st November 2018	After 1st November 2018
Adopter	41.8%	58.2%
Non-Adopter	50.0%	50.0%

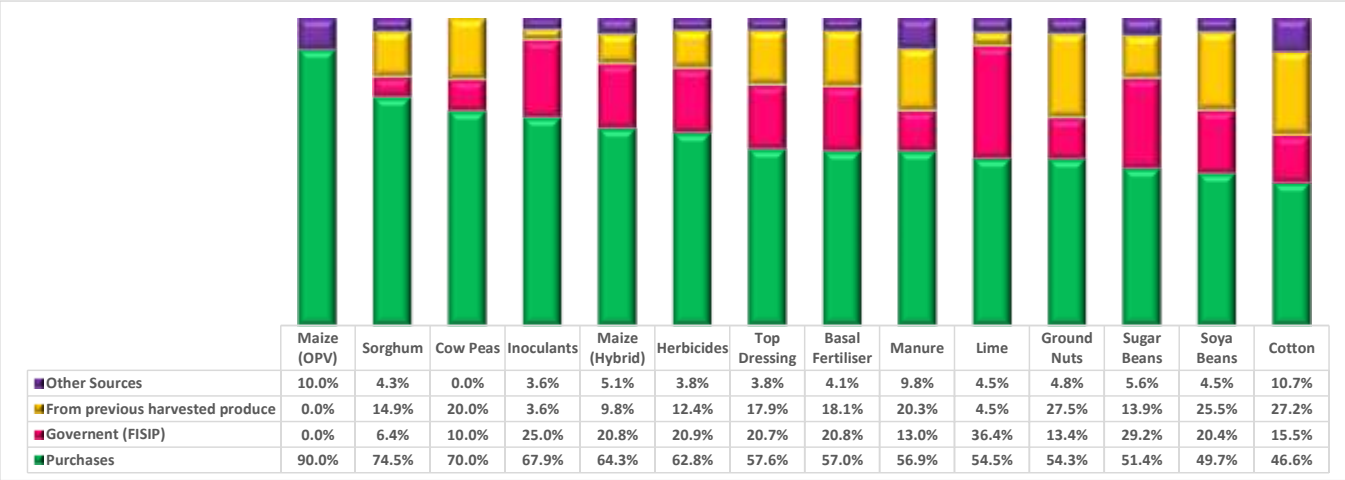
4.3.2 Sources of Inputs and Inputs Markets

Figure 21 shows the sources of different inputs acquired for the season 2018/19. The bulk of the inputs, shown by both the type of inputs as well as the proportion of respondents (percentage), were acquired through purchases either locally or outside the district. The majority of respondents (90.0%) purchase Maize (Open-Pollinated Varieties) with a lower proportion of 64.3% purchasing the hybrid maize seed. This however comes a s surprise since OPV maize by its very nature is expected to be retained after harvest and kept as seed for the next harvest. This suggests that either farmers have not really understood what OPV is (assuming they actually purchased OPV) OR they in fact never purchased OPV and that this is actually hybrid maize seed. This needs to be further investigated.

Around 62.8% of respondents who use herbicides are likely to purchase while 20.9% of them would acquire herbicides through the government e-voucher under FISP and 12.9% having kept stock from the previous year. Other items that the bulk of the farmers are likely to purchase were basal dressing fertilizer (57.0%) and top-dressing fertilizer (57.6%). The introduction of the FISP E-Voucher has seen a larger proportion of farmers obtaining both fertilizer and legumes such as soya beans, ground nuts and cowpeas (though in smaller proportions). Generally,

most farmers obtain legumes either by purchasing or by retaining previous harvests although, as you will notice in Figure 21, about half of the numbers purchased. The limited stock or unavailability of the legume seed through the suppliers and agro-dealers made it somewhat difficult for some farmers to acquire it. Notwithstanding, not all agro-dealers are on the FISP program.

Figure 21: Sources of Inputs



	Maize (OPV)	Sorghum	Cow Peas	Inoculants	Maize (Hybrid)	Herbicides	Top Dressing	Basal Fertiliser	Manure	Lime	Ground Nuts	Sugar Beans	Soya Beans	Cotton
Other Sources	10.0%	4.3%	0.0%	3.6%	5.1%	3.8%	3.8%	4.1%	9.8%	4.5%	4.8%	5.6%	4.5%	10.7%
From previous harvested produce	0.0%	14.9%	20.0%	3.6%	9.8%	12.4%	17.9%	18.1%	20.3%	4.5%	27.5%	13.9%	25.5%	27.2%
Goverment (FISIP)	0.0%	6.4%	10.0%	25.0%	20.8%	20.9%	20.7%	20.8%	13.0%	36.4%	13.4%	29.2%	20.4%	15.5%
Purchases	90.0%	74.5%	70.0%	67.9%	64.3%	62.8%	57.6%	57.0%	56.9%	54.5%	54.3%	51.4%	49.7%	46.6%

Even though this is not an evaluation of FISP, results show that, very few farmers depend on the GRZ's FISP e-voucher as their main source of agriculture inputs. 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, 7 inputs have been reported on.

Figure 22: Inputs Markets

The item of interest here is the in-community agents. The study sought to find out where respondents obtained inputs from and Figure 22 reveals that 26.8% 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 cuts down on their transport costs, in some instances, quite significantly as can be seen above with around 15.7% engaging in this kind of input source. A relatively high proportion of inputs are retained from the previous season 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). Some of these retained inputs may also be as a result of drastic fluctuations in weather conditions that may not have allowed for their use in that particular season. A classic example of this is herbicides which can only be used when certain levels of moisture are present in one's field.

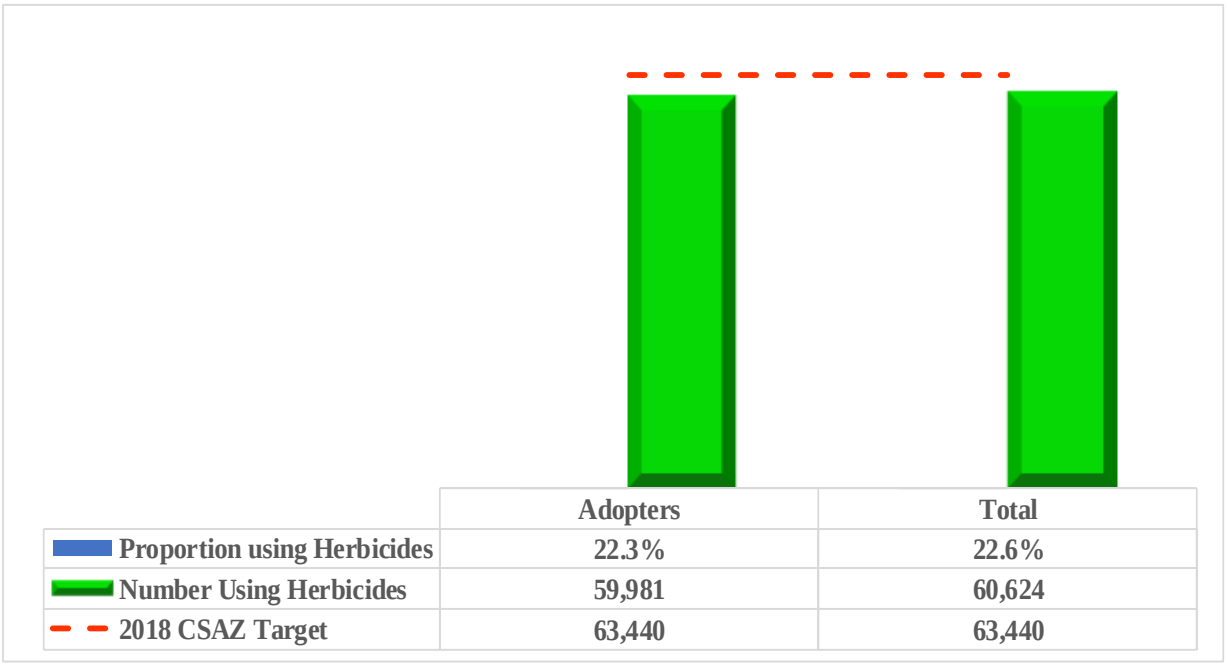
4.3.3 Weed Management through Herbicides.

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. Weed infestation is the major reason why some go on to plough (ridge) over the basins or rip-lines and thereby reversing minimum soil inversion (the very essence of CA). In this survey alone, several farmers in fact had adopted MT at land preparation but then because of weed challenges, they later on moved in and ploughed the already ripped (or basin) plots and hence 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 management 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 however, other methods of weed management are also discussed because sometimes it is appropriate to combine the different methods so that farmers have a variety of choices.

The CSAZ Logframe aimed that by the third year (the season of 2018/19) over 63,440 farming households would be using herbicides. It remains to be clarified whether these 63,440 should be interpreted as being MT adopters or just any of the trained farmers regardless of their adoption status. Figure 23 shows that if the indicator is taken to mean adopters only, then the 2018 milestone has narrowly missed as 59,981 farmers (missing target by 5.5%) who adopted used herbicides. However, when the target is applied to the people trained by the CSAZ in 2018, achievement comes to 60,638 farmers (95.6%) in fact used herbicides. Two main reason for such an achievement is that the CFU moved to new areas where market penetration by the private sector players has not yet achieved optimal levels. The other reason is that the rainfall patterns were either poor and erratic OR there was no rain at all and some herbicides would produce negative results if used under wrong climatic conditions. In addition to the two main reasons, it was also realised that farmers still have various negative perceptions about herbicides. Focus Group Discussions carried out sought to find out what exactly some of these perceptions are. For a new district such as Serenje, intercropping is a common practice and since herbicides, according to farmers there, kill all crops except maize, it is not in their best interest to manage weeds chemically. Apart from this, there is a widespread belief, which is not unique to Serenje alone but to other new districts and areas, that herbicides destroy the soil and its biodiversity.

Figure 23: Proportion of farmers using Herbicides



	Adopters	Total
Proportion using Herbicides	22.3%	22.6%
Number Using Herbicides	59,981	60,624
2018 CSAZ Target	63,440	63,440

4.4.4 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 a long period of dry spell followed until mid-April. It is evident that this has been one of the worst dry spells to have been experienced in all of the regions with Southern Region (which is already deemed as the 'driest') being hit the worst.

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. FGDs, crops grown in basins and rip-lines were reported to be of better health than crops grown using conventional tillage methods. As mentioned in earlier paragraphs, the severe dry spell that hit most areas of Southern Region particularly Chikankata, Gwembe and Siavonga saw some maize crop stressed and drying out before reaching full maturity. It is important to note that adopters were not spared from this unfortunate phenomenon.

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:** The total number of unique farmers trained in 2018 came to **268,692** farmers (surpassing the annual target of 216,000 by 24%). Of these, 135,689 (50.5%) were males and 133,003 (49.5%) were females.
- ✓ **Output indicator 1.2:** After training, 92.9% of farmers trained were in the "Good" CSA Knowledge category in P1, whilst 75.5% and 87.9% of the farmers trained were in the "Good" CSA Knowledge category in P2 and P3 respectively, the average being **85.4% (of whom 33.3% were females).** This was a great improvement from an average of 39.6% pre-test knowledge level.
- ✓ **Output indicator 2.1:** Total number of adopters during the period under review was **143,482** coming out of 103,264 adopting households. The CSAZ Logframe had set a milestone of 45,000 to be completely new adopters. The actual achievement was in fact **61,939 (of whom 30,670 were women)** new adopters and thus reaching 37.6% above the target. A total of **79,647 (of whom 39,425 were women)** farmers (against a global target of 52,600 farmers) have continued using MT from one season to the next. This is an achievement of 51.4% above the set target.
- ✓ **Output indicator 2.2:** Area of land under MT was **147,844** surpassing the set milestone of 85,210 Ha by 73.5%. Area of land under CT however went above the set milestone of 51,100 Ha by reaching **63,025** Ha (23.3% above target) although maintenance of soil cover continues to trouble farmers due to reasons explained in this report. As this is now the third year, people are expected to practice crop rotation (CF) and the annual target was set at 25,500 Ha but this target was surpassed as area of land under CF reached **44,698** Ha i.e. 75.3% above set target.
- ✓ **Output Indicator 2.**3: Number of farmers using ADP and Mechanised tillage (disaggregated by draught power). A total of **19,272** households used animals for ripping against a set annual target of 12,100. As for Mechanised, a total of **2,570** farmers used tractors for ripping. The 2018/19 milestone was set at 13,600 households using mechanised ripping services representing a very ambitious target that was set without consideration of climatic and economic factors, a target that should seriously be revised in subsequent years.
- ✓ **Output indicator 2.4:** A total of **60,638** (30,009 women) farmers who were trained in 2018, used herbicides and this was slightly below the set milestone of 63,440 that was planned for Year 3.

5.2 Lessons Learnt

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

- ✓ The longer the CSAZ operates and trains farmers in an area, the higher the proportion of adopters. But this trend soon reaches its peak before it begins to drop (diminishing marginal returns) and there is not much value for money in overstaying in the same area

- ✓ While crop rotation is apparently very high, this practice is still being influenced by several **other** factors such as inputs availability and markets for outputs in addition to the CSAZ teaching for enhancement of soil fertility. So attributing achievement to CSAZ should be carefully done.
- ✓ It will be wrong to assume that farmers are not adopting due to lack of inputs. Available evidence actually shows that most farmers in fact actually purchase own inputs. Hence the reasons for not adopting should exclude shortage of inputs.
- ✓ Residual perceptions and myths surrounding herbicide usage and its effect on the soil and human health still persists and needs to be eradicated.

5.3 Recommendations

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

1. It is recommended that serious thoughts be given to milestones that are unattainable in light of actual events on the ground with specific reference to the milestone that focuses on the Number of farmers using mechanized tillage.
2. Herbicide usage continue to be a challenge and a variety of reasons are given. There is need to engage input markets and negotiate pricing models that are friendly (such as private partners being assured of economies of scale through ready markets availed by the CSAZ).
3. Where herbicide usage is hindered by mythical perceptions, **innovative** demythologising of herbicide usage should be employed as it appears that current repetitions emphasising safety may not be quite effective.
4. Annual Logframe targets for mechanization continue to be missed. Missing targets cannot be business as usual. The causes must be investigated and the investigation must also consider whether or not these targets were set realistically and if not realistic, then there is need to negotiate for an adjustment of the milestones.
5. Next seasons' adoption study should be carried out earlier so as to give ample time for completion of report writing and lesson learning in preparation for new training sessions and other activities such as the Annual Reviews.