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Conservation farming as a strategy to enhance food security in Ward 17, Mutoko District

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DECLARATION

I Blessing Kakunguwo declare that this research project is my own work and has not been copied from any source without the acknowledgement of the source.

Signed……

DEDICATIONS

This research is dedicated to my father Mr. A Kapfudza, my mother Mrs. D Kapfudza, my younger brother Tafadzwa, my two sisters Mazvita and Fadzai Kakunguwo for their love, prayers and moral support in making my dream a reality. I will always love and cherish your love and support.

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LIST OF ACRONYMS

AIDS	Acquired Immune Deficiency Syndrome
AREX	Agricultural Extension Service
COMTEC	Community Technology Trust
FAO	Food and Agriculture Organization
FGD	Focused Group Discussion
HIV	Human Immunodeficiency Virus
Kg	kilogram
NGO	Non-Governmental Organization
SPSS	Statistical Package for Social Sciences
US$	United States Dollar
ZIMVAC	Zimbabwe Vulnerability Assessment Committee

ABSTRACT

Conservation farming is a strategy that has been adopted by the global world in a bid to enhance food security. This study was aimed at assessing the sustainability of conservation farming as a strategy to enhance food security in Nyahunure (Ward 17) community, Mutoko District. The main objectives of the study were to assess the major contributions made by conservation farming to increase food security, to examine the challenges being faced in implementing conservation farming and to identify the level of food security of Ward 17. Both qualitative and quantitative research methods were used to gather information. Data was collected using household questionnaires, interview guides and focused group discussions. The target population was farmers practicing conservation farming technology and a sample of thirty households was selected using simple random sampling technique from two hundred households. The data was analyzed using Statistical Package for Social Sciences (SPSS) version 20 and Microsoft excel. The data was presented in form of tables, pie charts and bar graphs. The research findings were that the adoption levels of the technology is still low and this emanates from labour intensiveness, weak targeting criteria by implementers and lack of adequate knowledge on the conservation farming technology. The study concludes that conservation farming is offering a platform for ward 17 to improve on their food security evidenced by improved number of meals taken per day, assets owned by households, surplus produced and yield improvements.

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CHAPTER ONE: INTRODUCTION

1.1 Introduction

This study focused on conservation farming as a strategy to enhance food security in Ward 17 of Mutoko District. This chapter focused on background of the study, statement of the problem, significance of the study, aim, objectives of the study, delimitation of the study area, definition of terms and organization of the study.

1.2 Background of the study

Agriculture is the backbone of the Zimbabwean economies and it is a source of livelihood and provides food security to many rural communities. Rukuni, Tawonezvi, Eicher, Matondi and Hungwe (2004) note that nearly 80% of the population in Sub-Saharan countries live in rural areas with 70% of this rural population being directly dependent on agriculture for their livelihood. Despite agriculture being a major source of livelihood some communal farmers are facing food shortages.

FAO (2010) notes that worldwide around 925 million people are chronically hungry due to extreme hunger while up to 2 billion people lack food security. This problem of food insecurity has become more intensely pronounced in recent years with the threat posed by recent trends such as rainfall scarcity, low public and private investment in agriculture, shortage and high prices of inputs, as well as declining soil fertility. Sample (2007) blames conventional farming as the major contributor of land degradation and he goes on to estimate that 40% of the world's land is degraded and if this continues by 2025 Africa will only be able to feed 25% of its population. Therefore conventional farming methods in Africa have left soil depleted with lower yields and at the same time with the dangers emanating from climate change food production is being threatened further.

Nhira, Mapika and Rankhumise (2008) argue that in Sub Saharan Africa low productivity is mostly attributed to inappropriate land use and poor soil and water management than of natural conditions. Woodring, Braul, Kenea, Ruwona (2011) also concur with Nhira et al (2008) that in

many communal areas of Zimbabwe lack of proper soil, land and crop management techniques are the real concerns affecting the area since this is leading to massive soil degradation which in the long run is reducing levels of agriculture produce.

In order for maximum production to be enhanced soils need to be in excellent condition through fertilizer application. In Zimbabwe economic fluctuations has resulted in fertilizer costs to increase from US$ 280 to US$ 520 per ton from 2005 to 2008 therefore majority of the farmers cannot afford to purchase fertilizers (Chenga, 2010). Woodring et al (2011) notes that given the scenario that farmer's farm degraded soils, yields are pitifully low. In this situation farmer often abandon their crop growing season judging it not worthy of weeding. To compensate for declining yields families also plant larger areas than they can manage.

Therefore with farmers faced with low production from their fields they try to expand cropping areas to compensate rather than intensifying their lands to meet the basic household food requirements. Thierfelder and Wall (2010) note that extensive cropping will lead to land degradation because farmers are forced to move into marginal and fragile environments. In turn soil degradation decreases average yields thereby compromising the state of food security.

In Zimbabwe most rural communities are languishing in absolute poverty yet the agricultural systems being promoted have unacceptably high environmental, economic, and social costs (Bolwig and Gibbon, 2007). In Zimbabwe evidence shows that crop yields continue to decline over the past years despite the large area being planted every year (Rukuni et al, 2004).

Marongwe, Nyagumbo, Kwazira, Kassam and Friedrich (2012) note that resulting low yield levels in the smallholder farming sector impact on food security at national level since smallholder farmers produce over 60 percent of national maize production. The conservation technology therefore is essential so as to increase and sustain productivity whilst maintaining focus on increasing yields per unit area.

Given the following conditions for example low productivity as a result of declining soil fertility, unpredictable and erratic rainfall patterns, increased temperature extremes as a result of climate change, land degradation due to unsustainable farming methods which include burning of crops residues this results in poor production thereby compromising state of food security.

Conservation farming practices have the potential of providing strategies for mitigating poor production linked to the above mentioned factors and also working as an adaptive mechanism to cope with climate change. Pimbert, Tran-Tranh, Deleage, Reinert, Trehet and Bennett (2006) emphasize that a sustainable food production should be associated with people's health and well-being and conservation farming is such a type of production.

Conservation farming can be devised as a technique that can address underlying crop management problems facing farmers in Zimbabwe (Gukurume, Nhodo and Dube, 2010). When the technology is fully practiced to a higher standard it can significantly boost production and improve food security in a way that leads to sustainable development.

1.3 Statement of the problem

There is continuously declining crop yields in Zimbabwe for the past decades despite large areas that are being planted each year. The declining soil fertility, shortages of key agricultural inputs, changing climatic patterns and lack of well adapted technologies have ultimately contributed to low yields. The downward trend in farming has left many households facing food insecurity. Many people now depend on the government and donors for food aid and in the instances when the help does not come many starve. In an effort to reverse these negative trends of productivity and food security, conservation farming is one of the farming technologies being promoted. Although conservation farming has been promoted in Zimbabwe the total area under conservation farming has remained low yet the technique is said to sustainably increase yields. Therefore this research seeks to assess the sustainability of conservation farming as a strategy to enhance food security.

1.4 Significance of the study

Results from this study will offer an opportunity for all farmers in Zimbabwe to appreciate the benefits of undertaking conservation farming and also highlighting the limitations of this strategy. The study also helps farmers to identify components which are lacking for those involved in conservation farming technique so that they can employ corrective measures to make conservation farming work for them to attain food security.

This research will widen the researcher's understanding on conservation farming as a sustainable agriculture technology method that can be used to increase productivity and at the same time preserving and conserving the environment. After undertaking the study the manual will be of reference to other academics who will work on improving food security using this sustainable agriculture technology.

The study can be of interest to the government of Zimbabwe, Non-Governmental Organizations and the private sector which can be used as a manual on the contributions made by conservation farming to achieve some of the Millennium Developmental Goals for example of eradicating poverty and extreme hunger and achieving environmental sustainability.

The findings will act as baseline information to current stakeholders who are working on improving food security using the conservation strategy to be alert on challenges faced in implementing the technology and design appropriate intervention that will help increase the adoption rates of conservation farming technology among farmers in similar ecologies in Africa.

1.5 Aim

- To assess the sustainability of conservation farming as a strategy to enhance food security in Ward 17, Mutoko District.

1.6 Objectives

- To identify the level of food security in Ward 17.
- To assess the major contributions made by conservation farming to increase food security.
- To examine the challenges being faced in implementing the conservation farming technology.

1.7 Research questions

- What is the level of food security in Ward 17?
- What are the contributions being made by conservation farming to increase food security?

- What are the challenges being faced in implementing the conservation farming technology?

1.8 Definition of terms

Conservation farming: means or ways of farming that conserve natural resources of soil and water resulting in improved and sustainable production (Lowe, 2011).

Food security: whereby all people at all times have access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and health life (FAO, 2007).

Food insecurity: when people are undernourished as a result of the physical unavailability of food, their lack of social or economic access to adequate food and inadequate food use (FAO 2010).

Household: group of people, often a family, who live together (Rogers, 2003).

Adoption: the decision by a farmer to use a particular technology (Nyanga, 2012).

1.9 Limitations of the study

The conservation farming strategy in the studied area was implemented in 2008-2009 farming season so the full impacts of the projects are not yet fully established since the full benefits start to accrue after five to seven years. However, the project assessed the significance of the sustainability that has been enhanced by conservation farming to enhance food security in Ward 17 of Mutoko District.

1.10 Organization of the study

The first chapter focused on the introductory of the research project where the background that led to this research was explained, statement of the problem, significance of the study, aim, objectives, research questions and limitations were explained. Chapter two focused on review of related literature from various authorities and identifies the existing gap within the study. Chapter three focused on the research methodology, the research design, data analysis procedures, sample size, sampling procedure and ethical considerations were explained. Chapter

four focused on presentation and analysis of data; the research findings are organized, interpreted, discussed and presented using various illustrations. Chapter five focused on the summary of the findings, conclusions and recommendations of research findings.

1.11 Summary

This chapter looked at the background of the study, statement of the problem, objectives, aim, significance, limitations and organization of the study were outlined. The next chapter reviews related literature and identifies the existing gap within the study. Reviewing literature provided a link between this study and the existing knowledge in the same field so that concepts of the study were clarified and defined.

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

The chapter glanced at critiquing the existing literature from documents written by different authorities on the sustainability of conservation farming to enhance food security. The literature was reviewed to find out the similarities, differences and gaps existing from the information. The review is important as it serves the purpose of providing the framework on which to develop a research and it forms the basis of the current research. In order to make the review manageable the research topic was broken into subheadings. The literature covers both empirical studies done by other researchers as well as the theoretical literature from various information sources.

2.2 Principles of conservation farming

Marongwe, Kwazira, Jenrich, Thierfelder, Kassam (2011) note that conservation farming technology seeks to remove unsustainable parts from the conventional agriculture system tillage that is residue removal and mono cropping, thereby addressing most of the practices that restricted yield increases. Lowe (2011) notes that conservation farming is constituted by three essential components which are minimum disturbance of soil, rotation of crops and permanent soil cover.

The key principle is to move the soil as little as possible. The soil is only disturbed where the seeds are to be placed. Chiputwa, Langyintuo and Wall (2011) note that soil is formed in layers and if we disturb these layers by ploughing we damage the structure of the soil which makes rainwater to infiltrate into the soil as natural drainage is disrupted. Nhira et al (2008) notes that ploughing also destroys organic matter in the soil and this soil organic matter is acted upon by microorganisms to form humus which is a stable compound which stores nutrients and water in the soil. Soils with poor organic matter are less capable of storing nutrients and become less fertile.

The second principle of conservation farming is mulching. Mulching means the spreading of crop residues and other dead plant material on the field (Lowe 2011). The principle aims to maintain a permanent soil cover in the form of organic materials to at least 30%. It reduces

evaporation due to protection of soil from direct sunlight and so conserves soil moisture in the soil. Mulching helps reduce direct raindrop impact and so reduces soil erosion by minimizing soil water and runoff.

Mixing and rotation of crops is the third principle of conservation farming. Sample (2007) notes that crop rotation is the growing of crops from different families in sequence. Chiputwa et al (2011) defines crop mixture as the growing of two or more crops in proximity to promote symbiotic interaction between them. Mixing and rotation of crops help to control weeds and diseases and pest by breaking their life cycles through the introduction of a new crop.

From the reviewed literature it can be noted that conservation farming is based on the persistent use of three principles which are; minimum soil disturbance, permanent residue soil cover and diversified crop rotation. Marongwe et al (2011) indicates that despite these views little researches have been done on the applicability of these principles. Therefore the researcher attempted to establish how Ward 17 community farmers are following conservation farming principles and to what extent.

2.3 Benefits of conservation farming

Farmers will get maximum gains if they practice all the conservation farming principles. Conservation farming has the potential to improve food security and nutritional status of households. Weathereon, cited by Chenga (2010) observed that in Tanzania, the productivity of farmers who had been using conservation techniques for 10 years increased tremendously over the past decade. When the farmer began, he was harvesting 3 bags of maize per acre. Two years later, three became five, and at the end of the decade, the man was reaping twenty five bags from his dark fertile soils. Higher yields will provide more food for the family to eat directly and any surplus can be sold and the cash used to buy other dietary requirements.

Rotation and mixture of crops will enable households to benefit from a mixed diet. Crop mixture and rotations will act as a safety net if one crop fails (Twomlow, Urolov, Jenrich and Oldrieve 2008). This denotes that crop rotation and mixing of crops reduce the risk of crop failure in cases

of drought and disease outbreak. Mixing different crops helps to increase nutrients in the soils and nitrogen is added to the soil if legumes are included in the rotations or interactions.

Conservation farming helps to reduce runoff and soil erosion. Sample (2007) indicates that mould board ploughs mostly used by small holder farmers were identified as the primary cause of soil erosion. Woodring et al (2011) estimated soil loss from tillage sequence of mould board ploughing and cultivating to be 54 tons per hectare per year and that a risk of accelerating erosion exists on cultivated land from the moment natural and surface litter is removed. Conservation farming will counteract erosion since it does not expose soil to wind and water erosion. Chiputwa et al (2011) notes that minimum tillage gradually increases organic matter content of the soil due to reduced erosion thereby increasing yields and the amount of crop residue added to the soil surface in the long term. Minimum soil disturbance reduces time, cost and energy for land preparation thereby increases profitability (Tshuma, Maphosa, Ncube, Dube, Zenzo and Dube, 2012).

The principle of mulching can allow for growth of organisms within the soil structure, suppression of weed growth and provides protection to crops against extreme temperatures due to shade effect (Hobbs, Sayre and Gupta, 2008). The growth will break down the mulch that is left on the soil surface and the breaking down of this mulch will produce a high organic matter level which will act as a fertilizer for the soil surface. Nhira et al (2008) notes that increased soil and organic matter and crop residues would reduce soil erosion and water evaporation from the soil surface. This denotes that conservation farming increases the efficiency at which precipitation is used for crop production.

Conservation farming saves on inputs and demands smaller application of inputs on plants yet higher yields are obtained. Sample (2007) notes that precision application of inputs of fertilizers ensures that there is no wastage since they are spot placed where the crops need them. Therefore conservation farming saves on inputs since a smaller area can be cultivated for years for the same or extra yields.

In line with the above argument, conservation farming reduces production cost since inexpensive equipment is needed for reduced tillage options and the wear and tear on equipment decreases

too because the area tilled is smaller than in conventional ploughing. Over time weeding requires less time as weeds are reduced in number each year (Gukurume et al 2010).

Conservation farming can be a panacea to rural farmers who face resource constraints for example labour and draught power. Given the right macro-economic environment and favourable incentives and effective extension services, farmers who are resource constrained find conservation farming as a viable alternative to their conventional cropping systems (Musara, Chimvuramahwe and Borerwe, 2012). Therefore the techniques can proffer solutions to households who are facing food insecurity challenges.

From the literature review it can be deduced that conservation farming principles such as applying soil cover, combining cereal-legume crops and applying organic and inorganic fertilizes help to build soil fertility therefore this will increase yields and ultimately food security will be enhanced. However this research is focused on the effectiveness of conservation farming as a strategy to enhance food security.

2.4 Factors affecting the implementation of conservation farming

Nyanga (2012) notes that implementation is an act of putting a decision or plan into effect. The act of putting a decision into effect is seen as a linear sequence of stages starting by the knowledge stage in which a farmer gets information and knowledge about an innovation, followed by a persuasion phase in which a farmer forms an attitude towards the innovation (Rogers, 2003). After persuasion, Nyanga (2012) indicates that adoption stage follows which is an assessment stage in which a decision is made to adopt or not to adopt. Mwaseba, Kaarhus, Johnsen, Mvena and Mattee (2006) articulate that implementation is the fourth stage in which there is a clear behavioral change by using the new innovation. The implementation stage may involve adapting or reinventing the innovation to suit the local conditions (Nyanga, 2012).

The final stage is the confirmation stage where farmers may either decide to continue if they are satisfied with the outcomes of implementation or abandon the innovation if not satisfied (Mwaseba et al, 2006). Therefore the essence of farmers in adopting the conservation farming strategy would be to increase farm productivity and profitability whilst preserving the environment for future generations.

To attain success in soil conservation implementation, Rogers (2003) argues that it is to learn the state of mind of farmers concerning perception, attitude, acceptance and adoption. According to Harford and Breton (2009), farmers are expected to have perceptions of the problems, and have a positive attitude towards solving them, and then they would step by step accept the methods that they think could solve the problems and adopt after they have been sufficiently used. Implementation of soil conservation measures thus come about after farmers have passed through these three states of mind. Derpsch (2005) indicates that in Africa the rate of adoption of the conservation farming technology is still low.

The conservation farming is labour intensive in the early years of implementing the strategy and full benefits of the technology will be accrued after five to seven years (Kassam, 2010). According to Musara et al (2012) operations such as planting and weeding have high labour demands, with which farmers find themselves unable to cope. Clover (2003) notes that the HIV and AIDS pandemic has put communal farmers under pressure in terms of labour and draught power constraints. The pandemic has left households with limited labour force and at the same time draught power remains a challenge in many communal rural set ups.

Nhira et al (2008) argues that many farmers only temporarily implement conservation farming as long as a project is running, but soon abandon the practice once the project is terminated. This type of implementation is weak and unstable, as the farmers might discontinue use of a technology any time when such assistance or incentive programs come to an end. On the other hand, some stakeholders abandon certain areas without farmers being well versed with the technology. Some factors that contribute to abandonment include lack of quick positive results and avoiding duplication of effort as other promoters had targeted same areas (Vanclay, 2011).

Failure to have adequate trainings and good rapports has effect on the adoption of the conservation farming strategy (Harford and Breton, 2009). Conservation farming trainings determines whether farmers can adopt the technology or not and are the most essential source of information to households practicing the technology.

Hobbs et al (2008) argues that overcoming the mindset of farmers in relation to changing the traditional ways of farming especially in systems where tillage is considered essential and serves various purposes can be very challenging. For example for many years farmers have been taught

that ploughing is essential for crop production because it makes the soil soft and enables roots to penetrate easily, when in fact the opposite is true.

The time delays in the realization of the full benefits of conservation farming due to problems sometimes encountered during the earlier years can discourage farmers expecting immediate benefits from the new technologies (Derpsch, 2005). As a result, most farmers will depend and continue with their traditional practices in most parts of the field even after being introduced to conservation farming.

Nyanga (2012) pointed out that farmers tend to be conscious about uncertainties that may arise from both the physical environment from a new technology. Farmers in such a situation may feel more comfortable to continue with current practices despite noticing a decline in soil productivity. Farmers opt to continue using the conventional farming strategy as they regard such behaviour as risk to their production.

There are wide ranges of socio-economic factors have shown to influence implementation and continued use of soil conservation technologies at household level. Kalinda (2011) summarized these factors as personal characteristics of land operators, characteristics of the farm enterprise, access to information system and structural condition of the society in which the farm enterprise is operated.

Ownership of property or assets affects the adoption process of conservation tillage practices. Land ownership is the key factor to all conservation tillage practices. In many parts of the region, communal ownership is still dominant. The several land tenure systems existing in the various parts of the region, greatly affect the adoption of conservation farming practices. Gladwin (2002) notes that land ownership challenges has got a bearing on women more than men as in most communities since women do not have ownership of any property due to cultural norms that restrict women to have control and title deeds to land. Therefore this challenge reflects that farmers may be denounce the conservation farming which advocates for investing in the soil for a sustainable production since households can be chased away at any time.

From the reviewed literature it can be noted that concerns over low agricultural productivity in various regions has led to the adoption and implementation of the concept of conservation

agriculture with the aim of improving food security in a sustainable manner. However the research's concern was focused on issues of adoption and implementation levels of this sustainable farming technique after its launch in 2008-2009 farming season in Ward 17.

2. 5 Recommendations on effectively implementing conservation farming

Hobbs et al (2008) argues that accelerated adoption can be achieved through instituting participatory approaches in the earlier years, involving all stakeholders and carefully monitoring the situation to remove negative outcomes. Stakeholders promoting conservation farming need to describe the benefits, principles and practices of the technology to all farmers. Even if an organization may target specific groups in the community, such as vulnerable households it is important that the technology is introduced to every farmer in the introductory meeting. Friedrich, Kassam and Taher (2009) argue that failure to incorporate all framers at early stages of the project implementation may hold back adoption by the wider community later.

Since conservation farming is based upon establishing an organic layer and producing its own fertilizer this may take time to produce that layer therefore a producer may take several years to fully attain better yields from the method (Lowe, 2011). Therefore off farm income generating activities need to be promoted to mitigate risk adverse disposition of small holders' farmers regarding the conservation farming technology.

Rogers (2003) postulates that information access is central in the process of innovation adoption. This is also coupled with good rapport whereby having a good trainer, agricultural extension staff or lead farmer. Having good rapport and providing farmers with practical and useful answers that assist them in their daily operations is important in enhancing adoption of new innovations (Vanclay, 2011). Therefore it can be noted that adequate extension services provide an important link between the technology and farmers and ultimately sustains conservation agriculture adoption. Nyanga (2012) elucidates that if farmers learn how conservation farming can solve some of their problems they are more willing to adopt the technologies.

Gladwin (2002) argues that there can be a 20% increase in production in crops such as maize if governments and development projects could adopt policies to reach African women farmers with ownership issues, productive inputs and opportunities. Gender mainstreaming has led to

development policy makers becoming more aware of the crucial contributions of women farmers to agricultural production, food and nutrition security and economic development than before therefore this will accelerate the adoption process

Future conservation agriculture promotions should explore innovative ways that address the high labor requirements associated with the technology. Mazvimavi, Ndlovu, An and Murendo (2012) note that there is need for mechanizing some of the operations such as basin preparation and weed control.

From the reviewed literature it can be depicted that a mixture of factors are reducing the adoption and contributions that can be made by conservation farming to enhance food security. However the researcher seeks to link factors affecting adoption levels and constraints being faced by households to implement all conservation farming principles. These recommendations will be of relevance to all stakeholders involved in the technology to enable the goals of conservation farming to be realized that of increasing productivity whilst conserving the environment.

2.6 Conceptual framework for food security strategy

The researcher used a conceptual framework to link conservation farming and food security. The framework shows risks that need to be tackled to achieve the three desired programme outcomes which ultimately lead to food security. The framework assumes that food availability is as a result of the use of natural resources sustainably. Food access will be realized when households have the ability to secure food in the market place or from other sources and this will be as a result of household purchasing power. Food utilization incorporates issues of food safety, quality and diversity. The framework conceptualizes three food risks that need to be tackled to escape food insecurity that is natural shocks, economic and social risks.

The framework demonstrates how factors interact overtime resulting from acute insecurity to guaranteed access, availability and utilization for all individuals. However the framework does not show the influence of government in enhancing food security. Figure 2.1 on the next page clearly illustrates the conceptual framework that was used to link conservation farming and food security.

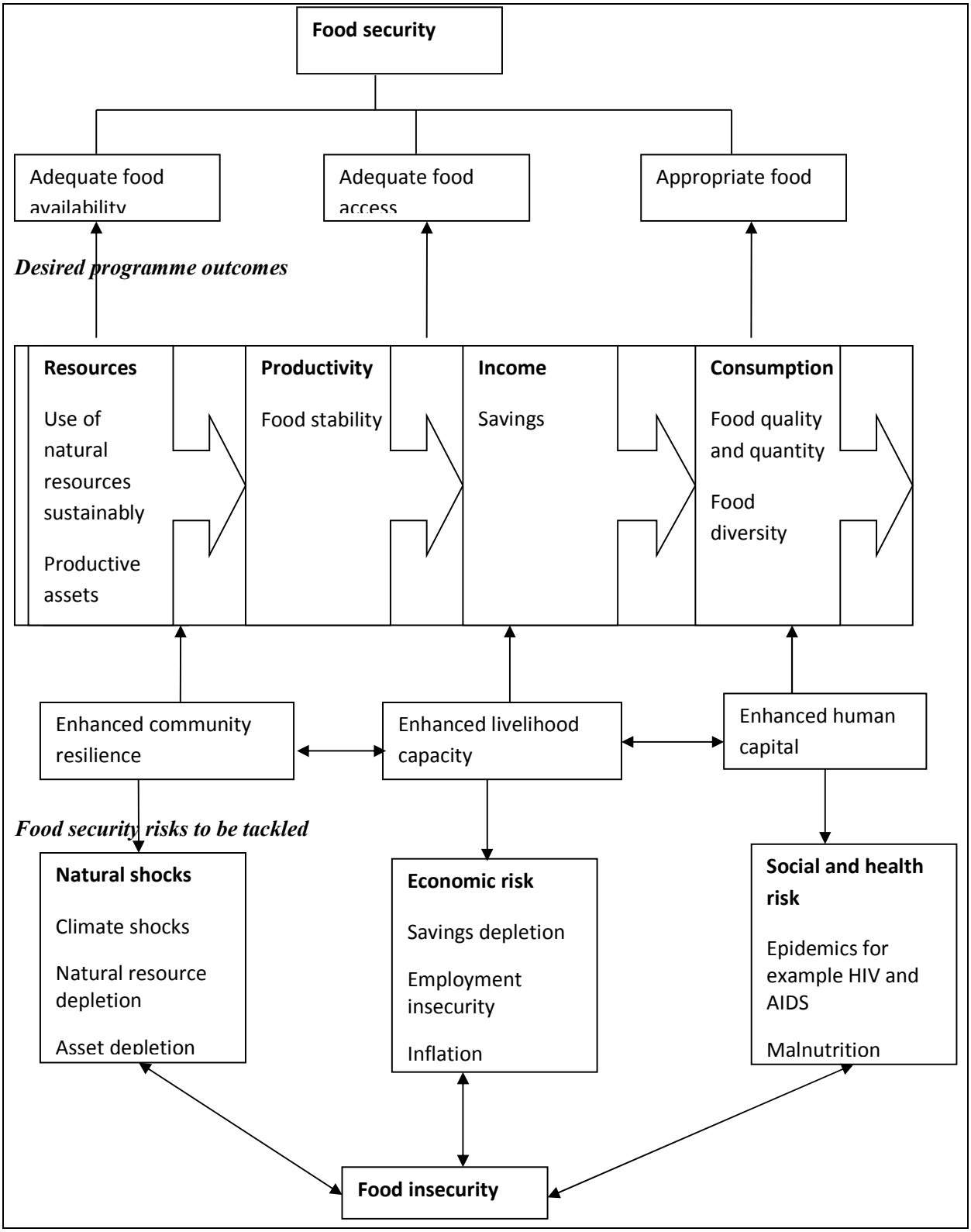

Fig 2.1: Conceptual framework: Adapted from Webb and Rogers (2003)

The researcher's definition of food security adapted from FAO (2007) emphasizes the phrase "at all times." This relates to expectations and uncertainty. Without viable expectations of availability, access and utilization at all times, a household is subject to deep-seated uncertainty that affects all of its investment. Poor households typically make economically rational decisions in the face of a wide variety of risks.

Davis (2008) contends that food supply can be affected by natural shocks for example climatic fluctuations, soil fertility depletion or the loss of a household's productive assets. Declining soil fertility in Sub Saharan Africa is attributed to the expansion of cultivated areas to compensate for declining yields and the lack of well-adapted agricultural technologies (Chiputwa et al, 2011). Therefore conservation farming can be a solution to problems related to soil infertility and food availability thereby this can sustain productivity whilst maintaining focus on increasing yields.

Webb and Rogers (2003) note that market access can be affected by economic risks for example market disruption during crises, inflation, conflicts and wars, loss of coping options or the collapse of safety net institutions that once protected people with low incomes. When such events occurs poor households are the most affected. Conservation farming counter that since it uses fewer inputs therefore this can reduce stress that can be as a result of economic risks.

Food utilization is often affected by social and health risks for example epidemic diseases such as HIV and AIDS, lack of appropriate nutrition knowledge and social discrimination in communities (FAO, 2007). Lack of appropriate nutritional knowledge has impacted at different households and this can be evidenced by the presence of malnutrition diseases such as kwashiorkor. However, conservation farming can give solutions to such challenges for example the inclusion of leguminous crops will offer protein and adds to balanced diet opportunities to many households.

Households become food insecure when they are unable to mitigate negative impacts of food availability, access or utilization (Gukurume et al, 2010). Such households balance their uses of private and community resources including soil, water and vegetation in an attempt to meet immediate consumption needs while reducing the risk of future shocks. They often face disincentives to longer-term investment in the productive base. In this context unsustainable

farming practices such as conventional farming methods put farmers at risk of food insecurity since repeated tillage will undermine soil fertility (Nhira et al, 2008).

At this point three aspects need to be addressed to enhance food security and these are to enhance household resilience, enhance livelihood capacity and enhance human capital in a sustainable manner. Improved food supply and access through encouraging higher-productivity sustainable agriculture is a critical input to achieve the goal of enhancing food security. Lowe (2011) notes that dissemination of agriculture technologies such as conservation farming can help to tackle risk associated with food insecurity.

From this conceptual framework it can be seen that conservation farming can fit in this framework in addressing food security issues at household levels. However this research is going to focus on the food security levels of ward 17 using different indicators such as number of meals per day, state and improvements of food security and any surpluses recorded in the previous harvest using this sustainable farming technology.

2.7 Summary

This chapter reviewed literature on food security and the sustainability of conservation farming. The chapter further linked the research objectives with existing literature and exposing areas where gaps exist and the gap to be filled by this research. The next chapter will be focusing on research methodology and research design.

CHAPTER 3: RESEARCH DESIGN AND METHODOLOGY

3.1 Introduction

Research methodology refers to the philosophy or the general principle which guides a research study (Dawson, 2009).The chapter discussed the research design that was used to carry out the study, the sampling techniques, and research instruments for data collection in the community, delimitation of the study area, ethical considerations and how the data was to be analyzed to bring out the significance and interpretations from the data.

3.2 Description of the study area

The research was carried out in Nyahunure (Ward 17 in its administrative terms) located in Mutoko district of Mashonaland East Province. The area is located in the north eastern part of Zimbabwe and it is approximately 160 kilometers from Harare. Using the agro ecological zone the area falls in Natural Region three (ZIMVAC, 2012), however majority of the places in the district are now having natural region four characteristics. The absolute location of Mutoko is 17°24¹0¹¹ South, 32°13¹0¹¹ East. The area is characterized by soils that are commonly sand in texture, acidic with low fertility and require careful full management if desired productivity levels are to be achieved on a sustainable basis. The area is characterized by low erratic rainfall of up to 650 mm per annum. The crop growing period is short therefore early planting is crucial to achieve optimum yields. Temperatures are high with all months having a high mean monthly temperature greater than 18 degrees with daily mean temperature greater than 20 degrees during the farming season. The high temperatures increases evapotranspiration rates and this in seasonality of rainfall makes the area vulnerable to prolonged droughts. The area is mainly characterized of small scale communal farmers who rely on crop production to earn a living. Crops like maize, sugar beans, peas, groundnuts, round nuts and tomatoes suit well in the area. Due to increase in human population most farmlands are being fragmented therefore this is reducing farming space per households. Therefore farming techniques that boost production and yet leaving the lands in their natural state are now required in the ward to improve their outcomes.

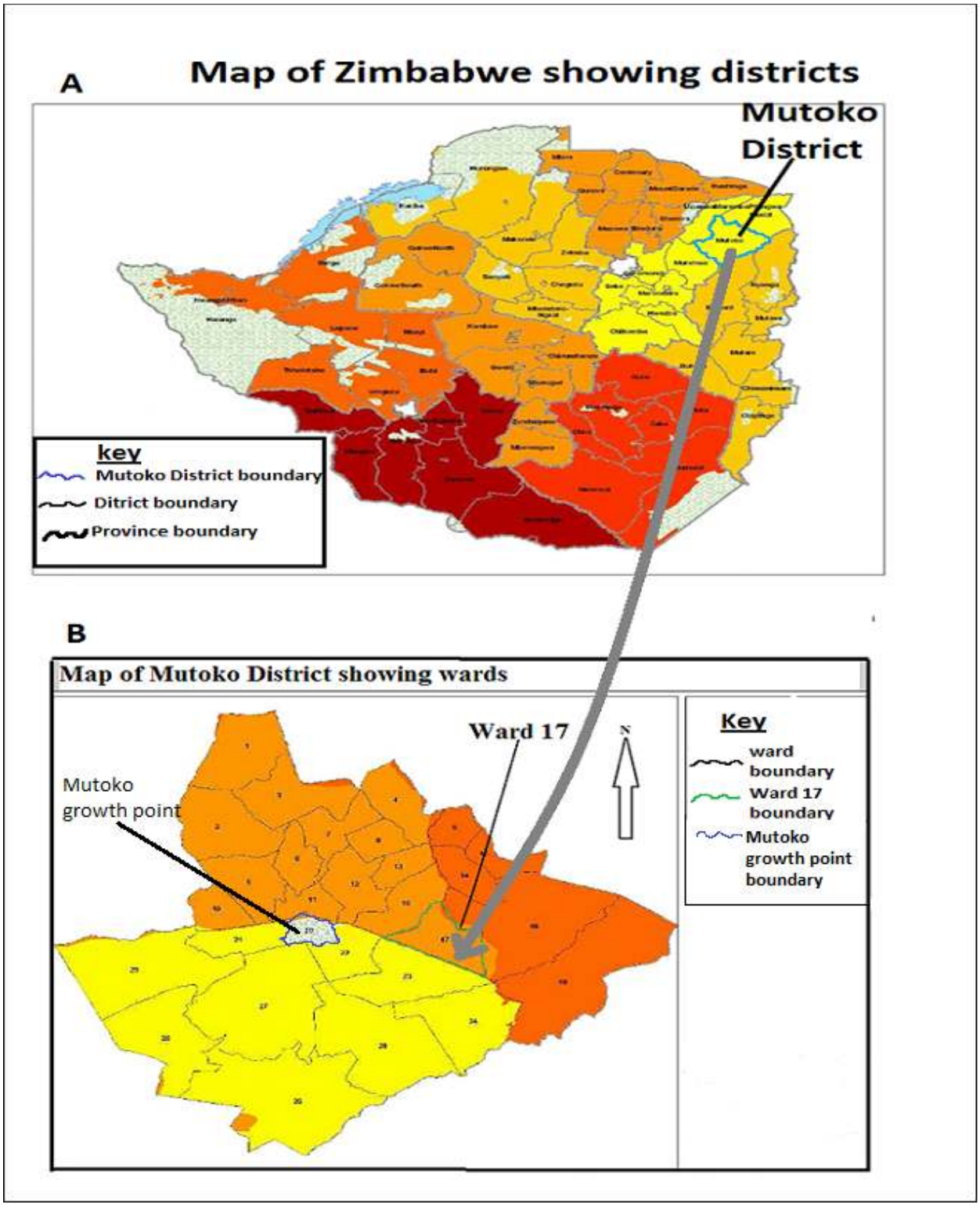

Fig 3.1 Zimbabwe map showing (A) districts and (B) Ward 17 of Mutoko District: Source: ZIMVAC 2012 with own modifications

3.3 Target population

A population is a group of individual persons, objects, or items from which samples are taken for measurement, for example, a population of farmers, women or households (Saunders, 2003). In this study the population comprised of two hundred farmers, Ward 17 councilor, representatives from AREX office, and COMTEC officials. All respondents were drawn from Nyahunure Ward.

3.4 Sampling methods

A sample is a subgroup of a population (Gilbert, 2008). Probability and non-probability sampling methods were used during this research. On non-probability sampling, purposive sampling was used to identify the target population. Purposive sampling is sampling with a purpose in mind and its main goal is to focus on particular characteristics of a population that are of interest, which will best enable the researcher to answer the research questions (Sanders, Philip and Thornhill, 2003). The researcher only focused his research to farmers practicing conservation farming so as to obtain their opinions concerning the technology. This was done with the help of the Ward councilor, COMTEC AREX officers.

The research made use of probability sampling. The use of probability sampling ensures that each member of the target population will have an equal chance of being selected for investigation since it makes use of random selection (Gilbert, 2008). Therefore ten villages were chosen at random and lists of households practicing conservation farming were obtained from COMTEC who are currently operating in the Ward as well as from the Ward councilor. Each name of household was assigned a number and simple random sampling was done using a computer. These ten villages consisted of two hundred households who are practicing the technique yearly. The researcher then sampled fifteen percent of the Ward beneficiaries which is thirty households. Simple random sampling method was favoured by the researcher since every beneficiary was having an equal chance of being selected thus curtail bias. Four focused group discussions were held with households practicing conservation farming. Three interviews were conducted with the ward councilor, AREX official and COMTEC official.

3.5 Research design

Saunders (2003) notes that the research needs a design or a structure before data collection or analysis can commence. He argues that the function of a research design is to ensure that the evidence obtained enables the researcher to answer the initial research question as clearly as possible in a logical structure. Crouch and Housden (2003) also concur with Saunders (2003) that research design is a tool plan showing how research data is gathered.

In this research a case study approach was used. Gilbert (2008) defines a case study as a method of study in-depth rather than in breadth. It is a comprehensive study of a social unit, be that unit a person, a group, social institution, district or a community. Case studies enable one to understand fully the behavior pattern of the concerned unit thus deepening our perceptions of the concerned unit and give a clear insight into life.

The researcher made use of both quantitative and qualitative designs which was aimed at obtaining reliable, valid and logical conclusions on the sustainability of conservation farming to enhance food security. The use of qualitative and quantitative research paradigms enables reliable and valid research results (Lancaster, 2005).

The qualitative information helped the researcher to understand people's experiences, perceptions and attitudes towards the research topic. The qualitative approach explores attitudes, behaviors and experiences through such methods as questionnaires and focus groups (Dawson, 2009). Qualitative design was used to collect information pertaining to views and opinions from farmers practicing conservation farming technology through interviews and focus group discussions.

Quantitative research is mainly concerned with experimentation, objectivity and accurate measurement of variables and its data is empirical (Lancaster, 2005). Quantitative data mainly focuses on the quantifiable data and in terms of numbers and measures that can be analyzed statistically. Quantitative design was used to quantify the amounts of yields on different crops and make comparisons before and after the introduction of conservation farming. Relationship between the independent and dependent variables was studied in detail therefore the researcher was more objective of the findings.

3.6 Data collection procedures

The researcher asked for permission from the Local Authorities and from the Geography Department. The researcher was given a support letter as evidence that he has been granted the permission to carry out the interviews. This was done to assist the researcher from being disrupted by the local residents and other political figures in Nyahunure Ward. Questionnaires and interview guides were prepared well before the day of data collection.

The researcher then selected a sample from the study population that was to participate in the interviews and those who were to fill in the questionnaires. From the ten villages that were chosen at random the researcher assigned a number to households and a simple random using a computer was done. The key informant approach was used to interview COMTEC officials who are operating in Nyahunure Ward and AREX officials as well as the Ward councilor.

The researcher then visited the area where the participants were located and asked for permission from the ward councilor to start the interview or to distribute the questionnaires. Instructions on how to fill the questionnaire were highlighted immediately before answering the questions.

The researcher then proceeded to make appointment with the farmers. The focused group discussions were done after the meeting. Four focused groups were formed each consisting of ten to twelve farmers. The researcher facilitated in these focused group discussions and there was an assistant who recorded the main points that were being discussed.

3. 7 Research methods

Lancaster (2005) notes that research methodology is associated with determining the research approach to data collection. The research instruments which were used for this study included questionnaires and interviews guides. The instruments were used in order to capture the desired information and consequently to produce valid results.

3.7.1 The questionnaire

A questionnaire is a data collection instrument or document which contains questions to solicit appropriate information which needs to be analyzed (Rugg and Petre, 2007). Self-administration of the questionnaires took place mainly to the respondents who did not understand English and

those who were illiterate. Questionnaires are simple and effective tools for collecting information from a large study population which were the farmers. The questionnaires were given to households practicing conservation farming any time from the2008-2009 farming season to respond to the questions. The researcher used closed questionnaires due to its advantage of gathering quantifiable data for example on amounts of outputs harvested and amounts of fertilizers being applied before and after conservation farming. Open ended questions were used due to their advantage of allowing the respondent to express an opinion without being influenced by the researcher unlike the closed ended questions which limit the respondent to the set of alternatives being influenced by the researcher (Rugg and Petre, 2007). Using the open ended questions the respondents were able to discuss challenges they are encountering using the conservation technique and gave recommendations on how to improve the strategy.

However the questionnaires were time consuming as much of the time was spent on interpreting the questions for the respondents who were facing difficulties in understanding English. Some of the terms used in conservation farming are difficult to understand they need to be interpreted to vernacular language for example mulching, spot application and minimum soil disturbance.

3.7.2 Interview guide

The interview technique is a direct method of obtaining information which helps the researcher to pursue in-depth information around the topic (Chiromo, 2006). Structured interview schedules were administered to NGOs officials, Ward councilor and AREX officer so that the researcher would not deviate from his objectives. The purpose of key informant interviews was to collect information from these community experts, with their particular knowledge and understanding. These experts provided insight on the nature of problems and gave recommendations for solutions to enable the sustainability of conservation farming to be of relevance to the community.

3.7.3 Focused group discussion guide

A focus group consist of a small group of individuals usually numbering between six to twelve people who meet together to express their views about a particular topic defined by the researcher (Gilbert, 2008). Therefore focus groups are a combination of respondents from different interest groups. The focused group discussions were conducted to farmers practicing

conservation farming in the ward. A total of four focused group discussions each consisting of ten to twelve members were held. A research assistant was employed who captured and recorded all information during the discussions to enable accurate data. Focused group discussions represent a qualitative research method that is directly interactive and sensitive to farmers who are practicing this sustainable farming technique. Therefore, it gave the researcher knowledge and dimensions and experiences of farmers who have adopted this sustainable agriculture technique in relation to their food security. The researcher received a wide range of responses during the discussion and the participants were able to remember issues they might otherwise have forgotten and not clearly answered in interviews. Focus group discussions were carried out with participants to understand the deeper issues surrounding food security in the community, principles of conservation farming, challenges associated in adopting conservation farming technique. Focused group discussions also motivated farmers to develop their own views on a subject and to discuss their knowledge about the topic.

However, some participants were uncomfortable in group setting and nervous about speaking in front of others, but the researcher motivated them to speak freely and emphasized on confidentiality of discussed issues.

3.7.4 Observations

Observations were made by the research in order to cross-check some of the issues pointed out by the respondents in interviews and questionnaires. An observation guide was used to assist the researcher on the aspects of relevance to the study. None-participant observations were made in the area under study to identify areas of concern or success with regards to food security and conservation farming.

The instrument is suitable for the research because; data collected is quality and non-numerical behavior, observation is less reactive neither is it restrictive and non-artificial and thus the observer is able to study long enough, observe trends and be able to tell the difference between chance of occurrence and accustomed happenings (Lancaster, 2005).

However, a non-participant observation has its own limitations. Relationships at times may become intimate and the observer can be lost in his objectives.

3.8 Data sources

The research made use of primary and secondary data sources. Chiromo (2006) defines primary data sources as data that is captured at the point at which it is generated. Therefore this type of data is the one captured for the first time with as specific purpose in mind. The researcher used interview guides, focused group discussions and questionnaires to collect raw data from the sampled respondents.

Secondary data is essentially second hand information in as much as it is not new data collected specifically and primarily for the research of the research being conducted (Lancaster, 2005). This denotes that secondary data is data that is collected and processed by others for a purpose other than the study at hand. Data pertaining to sustainability of conservation farming and food security was sourced from different reports, journals and text books. Some of the secondary data were attained from councilor's minutes and reports, COMTEC and AREX reports.

3.9 Ethical considerations

Research ethics refer to the principles of right and wrong that guides the researcher when conducting their research (Chiromo, 2006). The researcher considered the research values of informed consent, voluntary participation, confidentiality and protection of respondents from any possible harm that could arise from participating in the study. The respondents were requested to participate in the study on a voluntary basis and refusal from participating was permitted. The respondents were promised to be provided with feedback about the findings of the study. These ethics governed the researcher not to indulge in unethical practices unknowingly.

3.10 Pilot testing and validation of research instruments

The questionnaires and interviews were administered in one selected village before the actual data collection. This was done to check the validity and reliability of these instruments. The pilot testing also helped to correct, improve and rephrase some of the questions which were not fully understood by the respondents.

3.11 Data analysis procedures

Data analysis is whereby the researcher sorts to understand collected data and thus helps to answer the research question (Rugg and Petre, 2007). This helped the researcher to explore variables, process data into valuable information and be able to report more accurately.

Quantitative data from questionnaires were analyzed using Statistical Package for Social Sciences (SPSS) version 20 and responses were coded using numbers according to the respondents' answers. For example on education levels; primary, secondary and tertiary were coded as I, 2 and 3 respectively. For open-ended questions all ideas were listed first, and then tallied to indicate how the respondents gave the same response. All data from questionnaires were coded in SPSS for all the questions before the data was edited and then it was presented as bar graphs, tables and charts using Microsoft Excel. Combinations of deductive and inductive reasoning techniques were also employed in analyzing the data. The use of the combination of both these techniques helped to overcome the weakness of either technique and combine the strength of both to come up with a conclusive discussion of facts

Qualitative data were analyzed thematically. The following steps were taken to analyze qualitative data from interviews and focused group discussions: transcripts were coded using the participants' own words and phrases and without pre-conceived classification.

3.12 Limitation of the study

The researcher faced challenges in making appointments with the key informants since most of the times there were busy. However the research managed to book appointments for the interview from the key informants.

Some questions from questionnaires relating to crop yields were not responded to. This was overcome by assisting households with estimations of their yields after given the number of bags they harvested.

3.13 Summary

The chapter focused on the research methodology. The ways in which data was collected, the research instruments, ethical considerations, delimitation of the area, target population and the

sampling methods used were discussed. The researcher engaged the qualitative and quantitative data collection methods as a way of triangulating the information to be reliable, valid and logical to the research findings. The next chapter will deliver data presentation and analysis of the research findings.

CHAPTER 4: DATA PRESENTATION, ANALYSIS AND DISCUSSION

4.1 Introduction

This chapter focused on the presentation, analysis and discussions of results of the study. To enable clear interpretations data was presented using different techniques which includes pie charts, statistics, tables and bar graphs. The findings obtained were linked to the research questions and objectives of this research study. Conclusions were also being manipulated from these outcomes.

4.2 Demographic characteristics of the sampled households

This section highlights the demographic characteristics of the respondents that were useful in determining project outcomes. These include sex, age, marital status, level of education and household size.

4.2.1 Sex of the respondents

Sex of respondents was important in assessing the sustainability of conservation farming to enhance food security. This is because male and female farmers respond differently to food security issues and their vulnerability level is also different. The diagram below shows sex of the respondents.

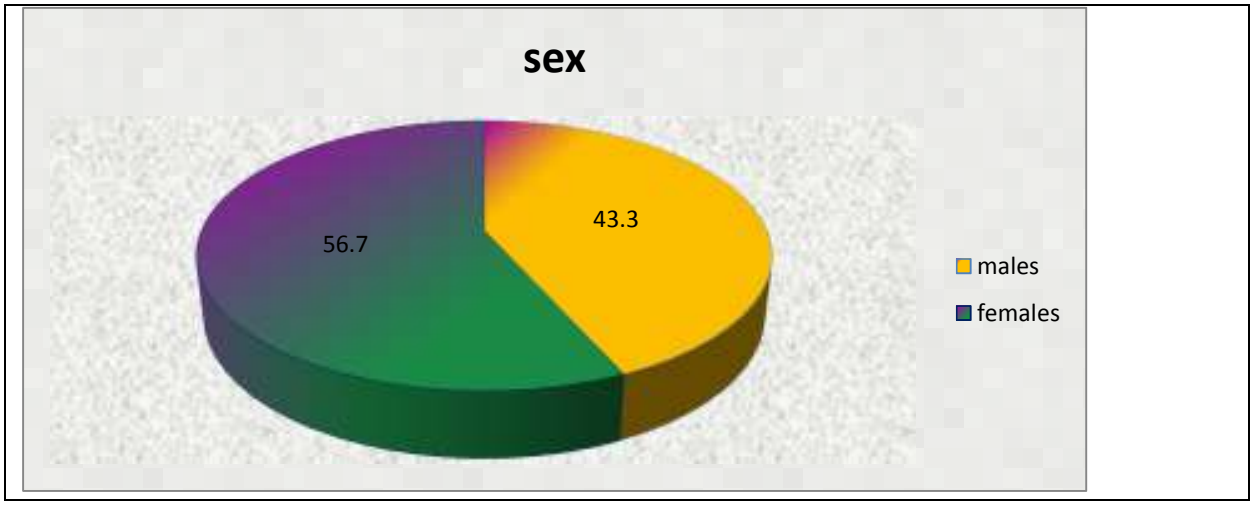

Figure 4.1: Sex of the respondents (Source: Primary data source)

From Figure 4.1 it can be depicted that women constitute about 56.7% of the farmers practicing the conservation farming technology in an effort to enhance food security. This is line with a

research carried out by Todaro and Smith (2009) who note that women are more likely to participate in community projects than their male counter parts. From the focused group discussions it was indicated that majority of the males work in Harare and Mutoko Centre as a diversifying strategy to improve their households' livelihoods. The ward councilor also pointed that some males denounce the project since they associate it as more labour intensive than the conventional farming method. Therefore these issues can explain male's low levels of 43.3% participation in the programme. From the interview conducted with the COMTEC official conservation farming method in their context has essentially targeted vulnerable households who are victims of food insecurity and consequently women have tended to be the main farmers who were selected in the programme.

4.2.2 Age group of the respondents

The adoption of conservation farming is attributed to the age of the farmer as shown below.

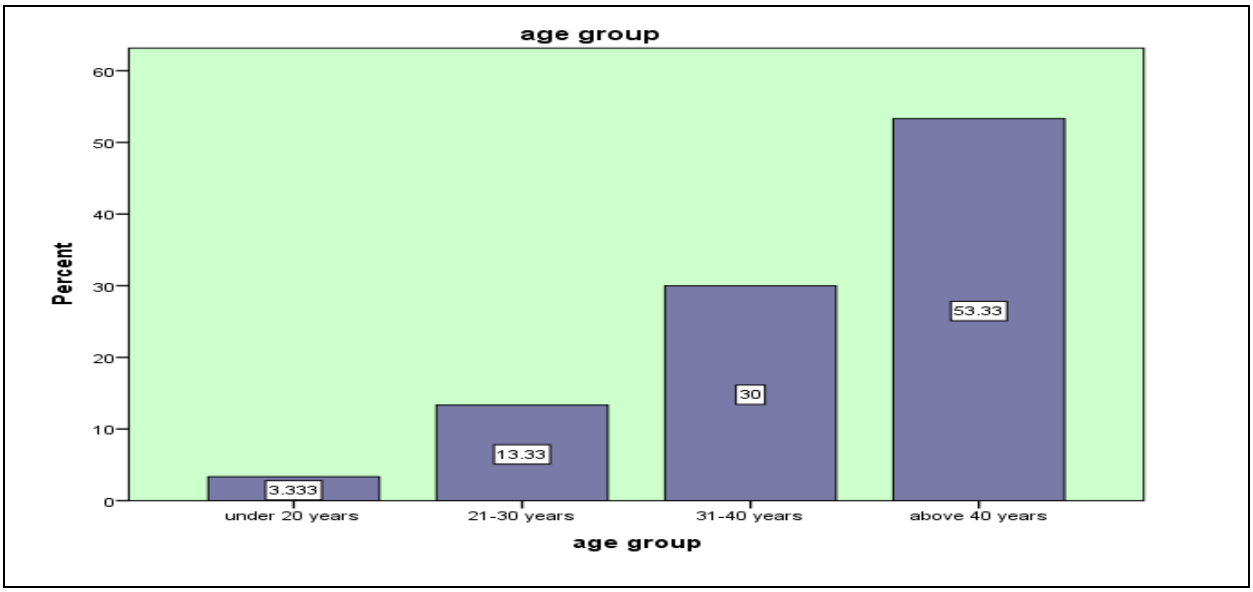

Figure 4.2: Age group of the respondents (Source: Primary data source)

From Figure 4.2, majority of the households who are practicing the conservation strategy are above 40 years with a total of 53%. This is attributed to the targeting process of households by NGOs which includes the elderly as part of the vulnerable group. The AREX officer noted that with age comes experience since the elderly people are fully aware of the negative externalities that have resulted from the conventional farming methods. This is in line with a research done by Chiputwa et al (2011) in Shamva who noted that older farmers are more cognitive of soil

degradation in their fields hence are more receptive and keen to try new technologies that counteract negative trends.

However a research conducted by Musara et al (2012) in Shamva opposes the findings where he noted that younger farmers tend to be more willing to adopt new agricultural technologies than their older counterparts. With increase in age farmers tend to be risk adverse and may avoid innovations in an attempt to avoid risk associated with the initiative. To counter that argument from the focused group discussions held participants were sharing the view that youths have little appreciation in conservation farming since they are being involved in other activities such as informal trading and brick molding as livelihood strategies. Therefore from these various data instruments age contribute to the adoption of this sustainable agriculture production.

4.2.3 Marital status of the respondents

The marital status of farmers is of relevance when analyzing the adoption of conservation farming technology. The marital status plays a role in determining farmer's decision to adopt new strategies that will enhance food security to their households. It can be noted that the single, divorced and widowed farmers may face difficulties in accessing large hectares of lands than married farmers because of the customary laws which oppressed them. The marital status of the respondents is shown on the diagram below.

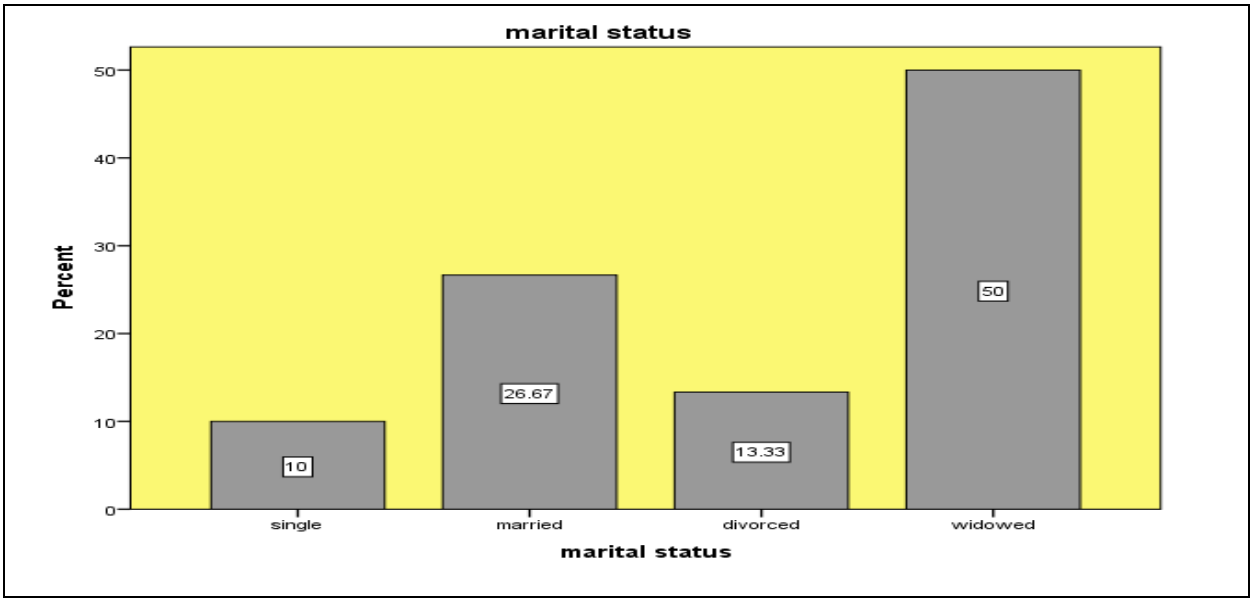

Figure 4.3: Marital status of the respondents (Source: Primary data source)

From the sampled population it was noted that 50 % of the households surveyed where widowed, 10% and 13.7% were single and divorced respectively. This implies that NGOs normally assist vulnerable groups in an effort to improve their livelihoods. From the interview conducted with the COMTEC official; the widowed, divorced and the single farmers are marginalized groups and suffer from food insecurity since they do not have the means of production for example cattle, ox-drawn ploughs and financial capital to purchase artificial fertilizers. Therefore this explains why the majority of the widowed farmers are practicing the technology.

4.2.4 Level of education of the respondents

The researcher assumed that level of education has a bearing in adoption and ability to appreciate and grasp new principles. The farmer's levels of education are illustrated below.

Table 4.1 Educational levels of the respondents

Educational level	Frequency	Percent
Primary	17	56.7
secondary	11	36.7
Tertiary	2	6.7
Total	30	100.0

Source: Primary data source

Table 4.1 indicates that 56.7% the sampled population at least attained primary education. This higher percentage affected to the questionnaires since some could not understand some terms that had been asked thereby the researcher had to translate those into vernacular language. However the researcher noted that on the output levels in some instances those with primary education where performing better to those who had secondary and tertiary education. The COMTEC official responded to that view whereby he noted that the organization does not consider level of education of farmers since these farmers were supposed to work as groups and a lead farmer was chosen thus helping each other. Therefore from the evidence gathered there is no relationship between educational levels and production.

Educational levels have a bearing in the adoption levels. From the questionnaire it was noted that those with primary education tended to adopt the technology faster than those with secondary and tertiary education. The AREX officer commented that those with primary education mostly have to rely on crop cultivation and have less alternative diversified strategies to improve their livelihoods. A research carried out by Musara et al (2012) in Madziva supports the researcher's findings where he notes that educated people tend to shun agriculture for white color jobs in Madziva and surrounding areas therefore with more years in schooling probability of participation tends to decrease in crop cultivation. Therefore this clearly illustrates that educational levels has an impact on adoption levels.

4.2.5 Distribution of farmers practicing conservation farming in relation to their household size.

Household size was important to analyze since this will determine the amount of food required by the family per year.

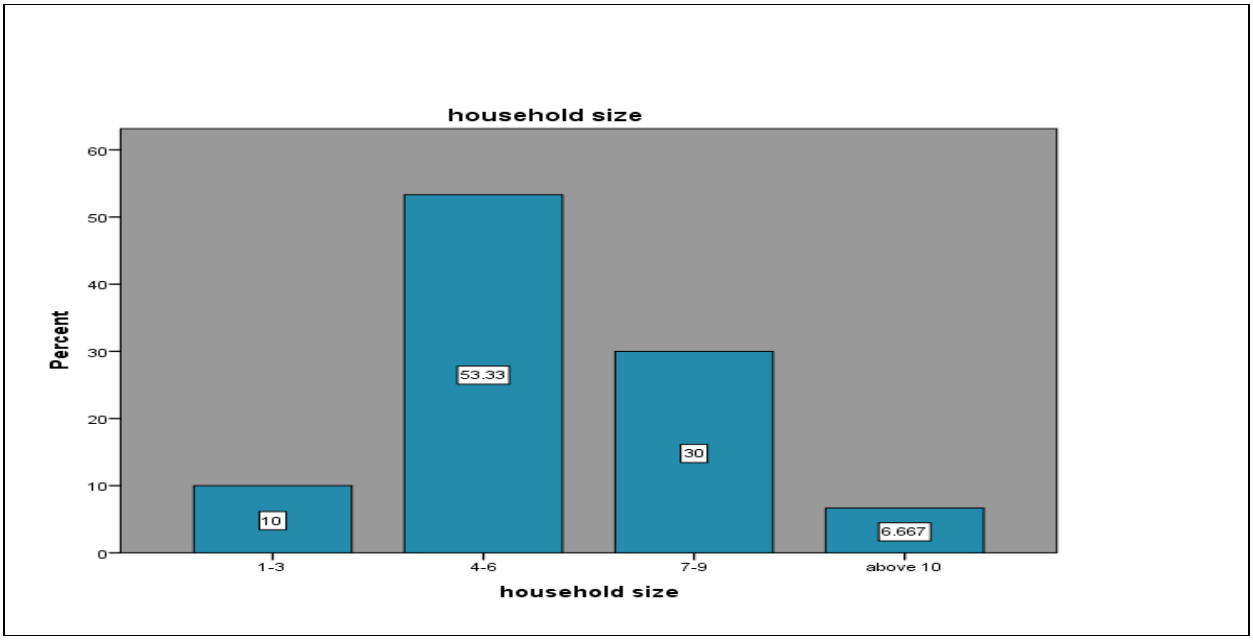

Figure 4.4: Household size of the respondents (Source: primary data source)

Figure 4.5 illustrates that those households with 4 to 6 dependents have the highest adoption level with a total of 53.3% as well as households with 7 to 9 dependents with a total of 30% adoption level. From the focused group discussions it was noted that farmers with larger families are likely to adapt the technology since chances of labour shortages during peak times are low.

The evidence shows that households with small size of 1 to 3 are less likely to adopt the technology and largest households of more than 10 members with 6.7% respondents are less likely to be seen in communal areas due to limited lands. This is in line with a research carried by Chiputwa et al (2011) who contends that farmers with larger families are more likely to be better resource endowed and hence more likely to try new technologies that will contribute to their food security levels. Therefore from these different evidences household size has a bearing on adoption of conservation farming levels.

4.3 Level of food security in ward 17

In this study different proxy indicators were used to identify the level of food security in Ward 17. These include assessing the state of food security before and after conservation farming was introduced, assessing the availability of grains from the 2011-2012 harvest as well as assessing the number of meals taken per day before and after the technology.

4.3.1 State of food security before adopting conservation farming

Figure 4.5 below shows the state of food security in Ward 17 before adopting the conservation strategy.

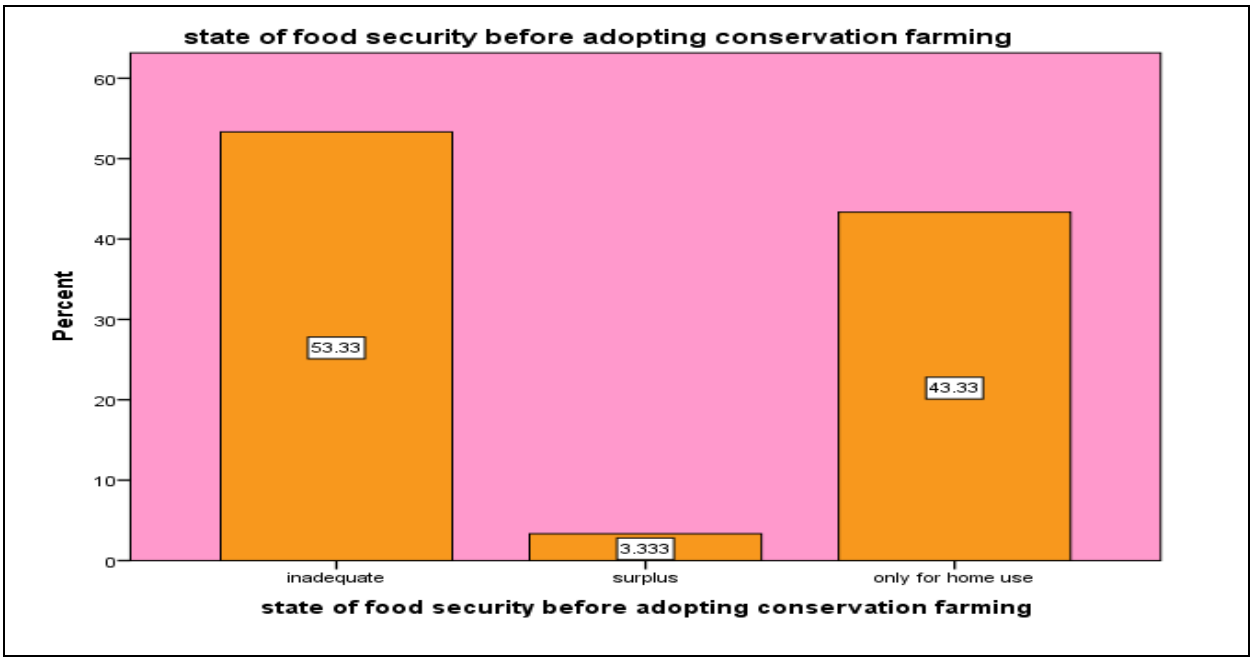

Figure 4.5: State of food security before adopting conservation farming (Source: Primary data)

From the diagram it can be clearly seen that using the conventional farming method more than half of the sampled population were having inadequate food. A total of 3.3% households were having surpluses and 43.3% were having food for their home consumption only. From the focused group discussions reduced yields under conventional farming were attributed to late planting since majority of the farmers pointed out that they faced constraints in ploughing since they have limited draught power therefore they depend on hiring from fellow farmers who are better off. Given such a scenario with short rainy season being experienced this resulted in low yields therefore food insecurity was a result. This may explain why households have opted for trying new technologies that counteract challenges posed by short rainfall season.

4.3.2 Any improvements on food security as a result of conservation farming

Some changes have been noted after the introduction of conservation farming to households as shown from the figure below.

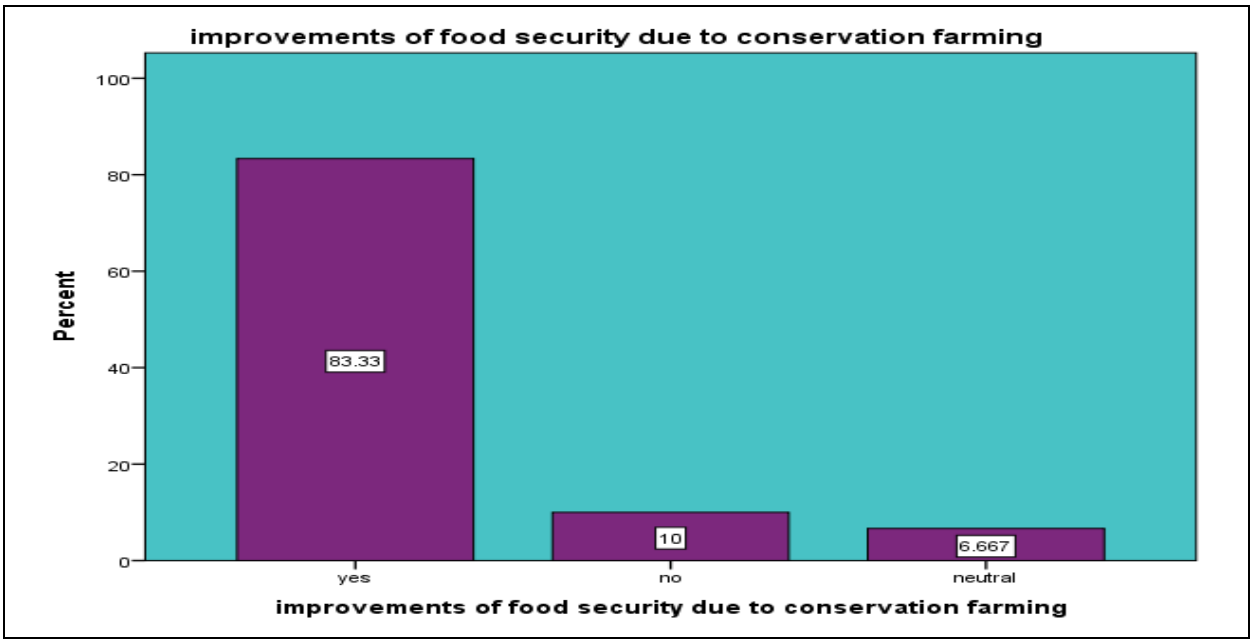

Figure 4.6: Improvements of household food security as result of conservation farming (Source: Primary data)

From Figure 4.6 it can be noted that 83.3% of the households indicated that there are some improvements on their food security as a result of conservation farming. 6.7% of the households indicated that the technology did not change their state and a total of 10% noted that the technology failed to improve their state it actually worsened the situation. The ZIMVAC (2012)

report highlighted that Mashonaland East has the least number at 10% of the projected to have the lowest proportion food insecure households. This low food insecurity percentage can be as a result of the conservation farming technology which is being encouraged to farmers.

4.3.3 Any surpluses recorded from the previous harvest

Farmers have witnessed some improvements in their state of food security as illustrated below.

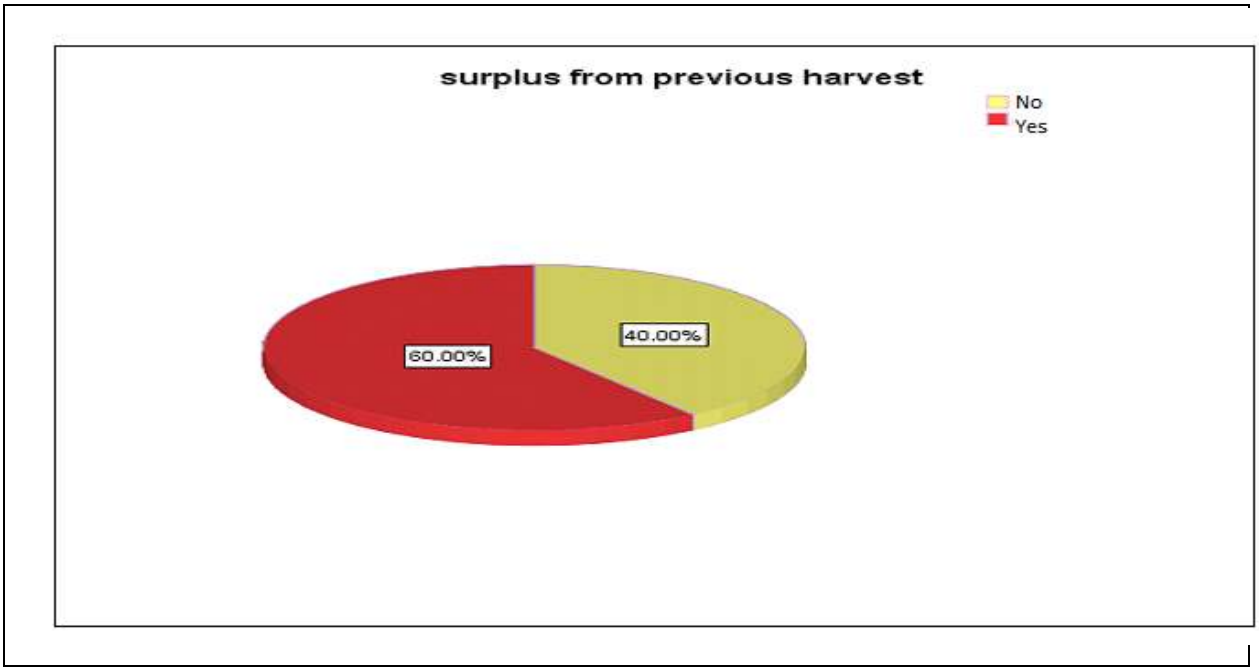

Figure 4.7: Availability of surplus from previous harvests as a result of conservation farming (Source: Primary data)

From Figure 4.7 it can be deduced that 60% of the sampled households had some surpluses from the 2011-2012 harvest whilst 40% were not having any surplus from the same harvest. From the focused group discussions held farmers who have attained surplus are now able to sell their produce. The income which is generated from the sales enhances the access dimension of food security as households are now able to buy food items that they would not have grown in their fields.

4.3.4 Meals taken per day before and after adopting conservation farming

This proxy indicator was adopted whereby comparisons were made on the number of meals consumed per day across the two farming systems. This indicator dwells on the researcher's definition of food security which emphasize on access to safe and nutritious food at all times.

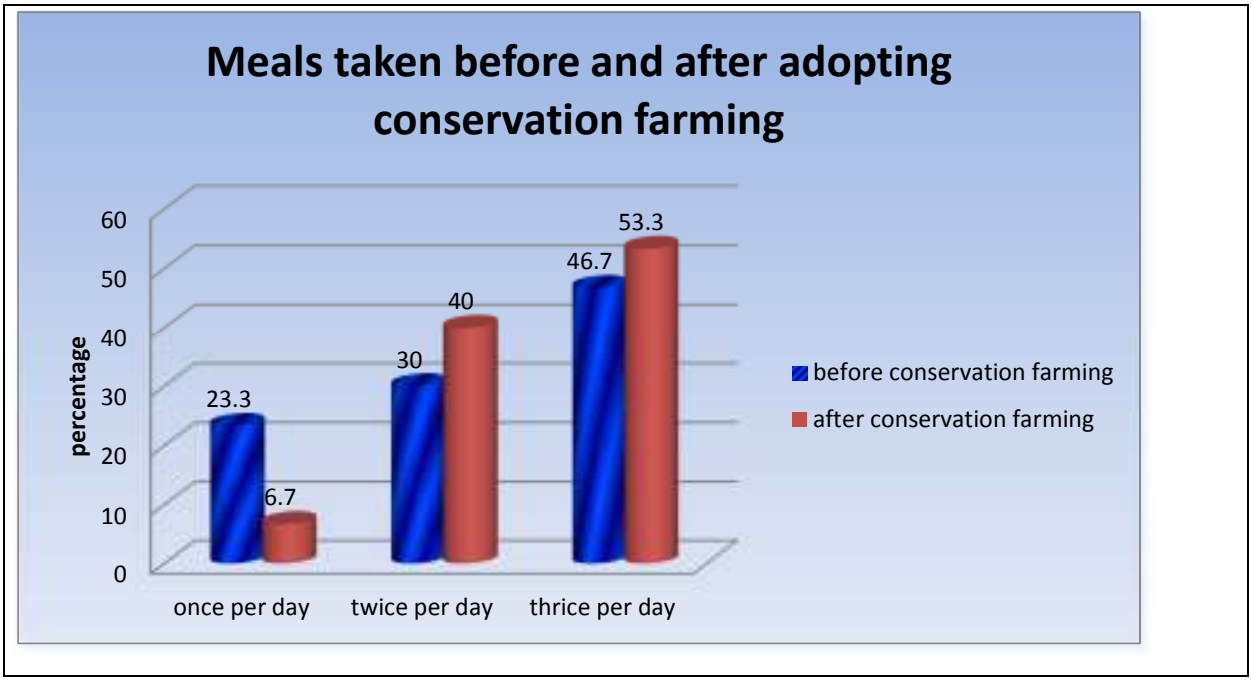

Figure 4.8: Number of meals taken per day before and after adopting conservation farming (Source: Primary data)

Before the introduction of conservation farming it can be depicted that 23.3% of the sampled households were taking one meal per day and after implementing the technology there has been a drastic improvements where only 6.7% were taking one meal per day. After the introduction of the technology 53.3% of the sampled households were capable of affording to take three meals per day which is the Zimbabwean standard and that reflects an improvement from the 46.7% which was previously offered by conventional farming. The research findings tally with a research carried by Tsuma et al (2012) in the Mangwe District whereby the findings noted that 55% of the conservation farming households could have an average of three meals per day whereas 45% of the conventional farming households indicated that they could take three meals per day.

4.4 Contributions made by conservation farming to enhance food security

This section analyzed the contributions being made by conservation farming to enhance food security in Ward 17. Data was presented and analyzed noting on the changes that have been brought by conservation farming to improve food security in the Ward.

4.4.1 Maize outputs harvested before and after adopting conservation farming

Contributions of conservation to in maize production has an impact on food security levels therefore outputs were presented using the two farming systems and the results were as shown below.

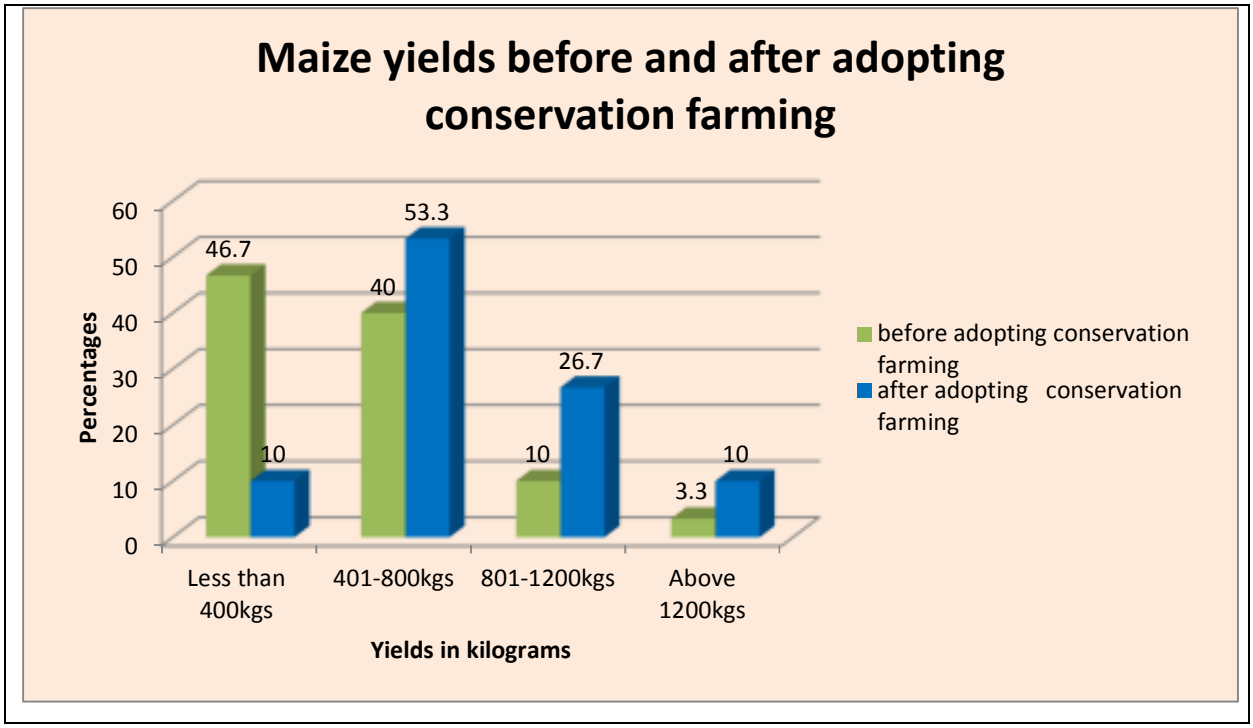

Figure 4.9: Maize yields before and after adopting conservation farming (Source: Primary data)

From Figure 4.9 above it can be depicted that yields in maize have improved but are still much low. There has been a drastic improvement in the maize yields for example 46.7% of the farmers using the conventional farming method produced less than 400kgs and after implementing conservation farming only 10% are still producing the same yields in their fields. 53.3% of the farmers are now producing 401-800kgs of maize. The COMTEC official highlighted that low

production that are still experienced are due to the fact that the technology require five to seven years for full benefits to be attained that means farmers will be in a position to produce more than 800kgs in their fields . This is also complemented by a research by Mazvimazi et al (2012) who noted that in Zimbabwe conservation farming plots tended to produce higher yields as exemplified by the 2008-2009 season where an average maize yielded 1,546kgs per hectare as compared to 970kgs per hectare under conventional farming in the 2002-2003 season. Given the FAO (2007) estimations that an average family of four to six members consumes between 600-800kgs of maize per annum then from the data analysis it can be seen that with the conservation farming technique majority of the farmers can be seen that they are food secure.

4.4.2 Groundnuts outputs harvested before and after adopting conservation farming

Groundnuts offer an opportunity for farmers to improve on their nutrition hence comparisons were made on the changes that have been brought by conservation farming in Ward 17.

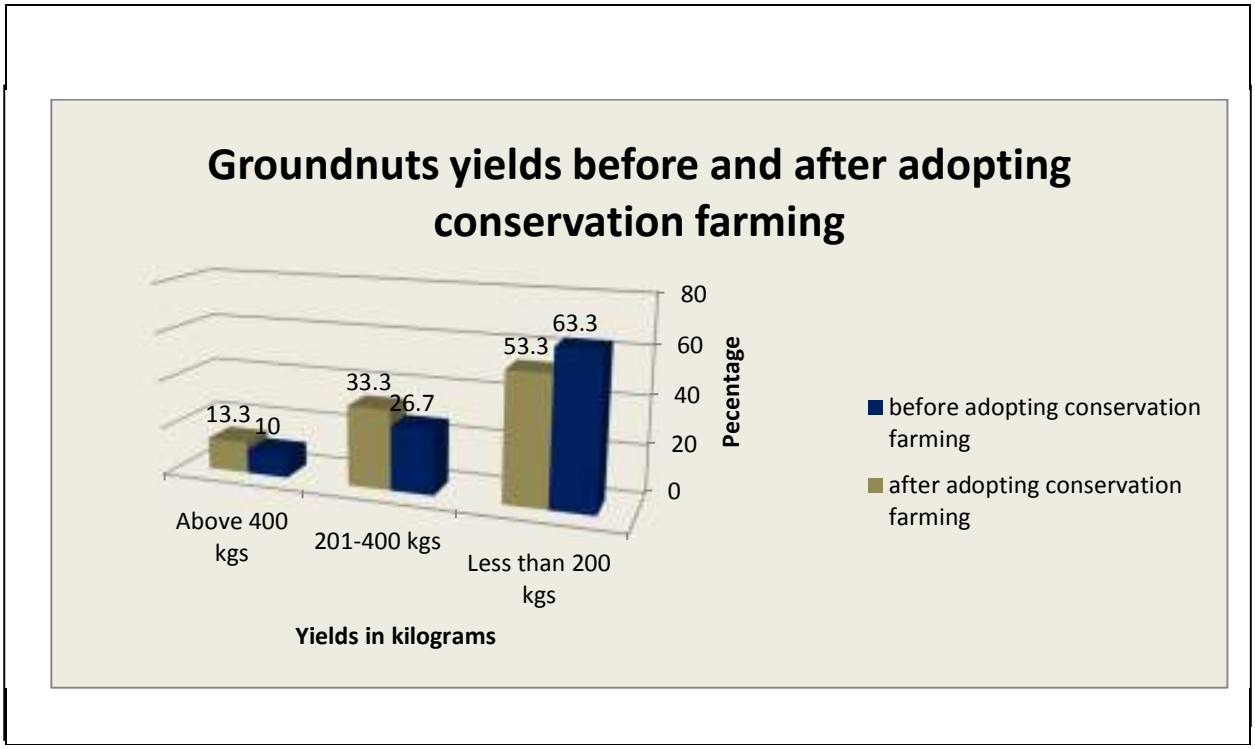

Fig 4.10: Groundnuts yields before and after adopting conservation farming (Source: Primary data)

From Figure 4.10 it can be depicted that changes brought by conservation farming technology is still low. There was an improvement from 26.7% to 33.3% on households who produced 201-400kgs and this percentage change is still low. The Ward councilor noted that most farmers tend to grow maize since it is the staple food and grow these other crops as secondary options. However from the focused group discussions farmers highlighted that they mainly grow groundnuts for sell. Hence farmers can be able to buy other food stuffs to supplement their diet therefore this shows an element of food security component as a result of increased yields in groundnuts yields.

4.4.3 Cowpeas or sugar beans outputs harvested before and after adopting conservation farming

Conservation farming has an impact on cowpeas or sugar beans output as illustrated below.

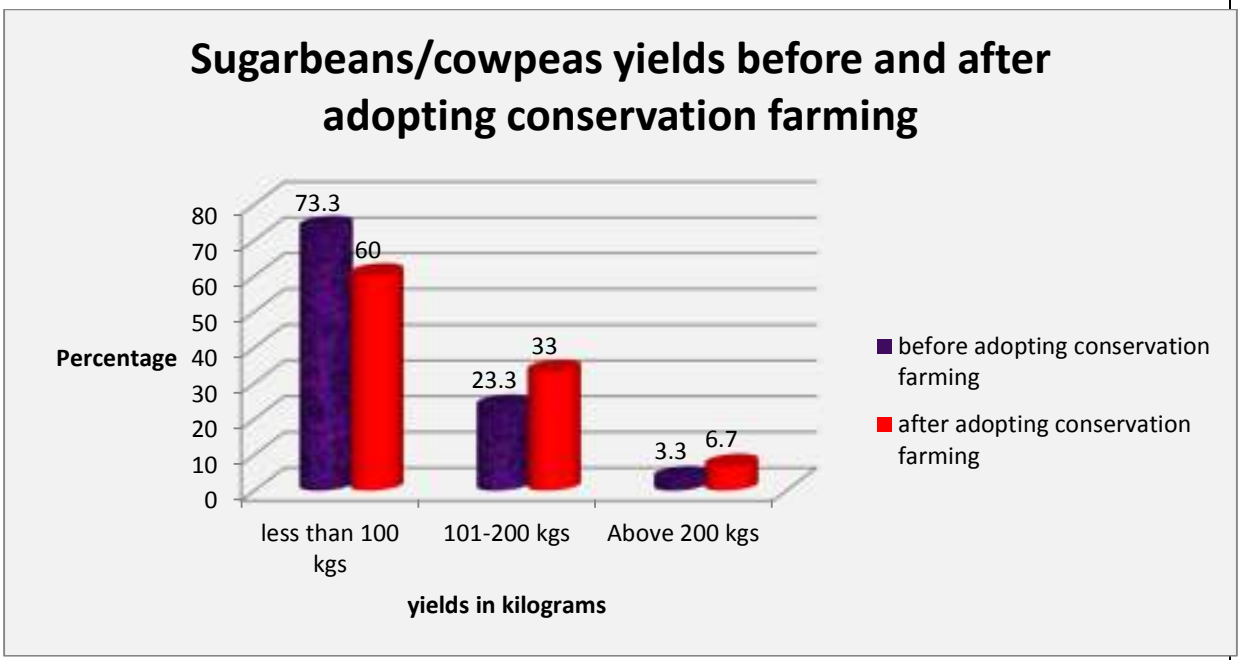

Figure 4.11: Sugar beans or cowpeas yields before and after adopting conservation farming (Source: Primary data)

From Figure 4.11 the change that has been brought by conservation to improve food security is very little. 73.3% farmers harvested less than 100kgs and after the conservation farming there

was only a 13.3% reduction to the farmers who still produced that same amount. The AREX officer explained on little percentage changes that were noted in these legume fields were due to lack of seeds. However from the focused group discussions farmers noted that these legume crops are helping to increase nutrition in their diet.

4.4.4 Conservation farming principles and their contributions to improve food security

For each principle the researcher noted the challenges faced with implementing the technique as well as asking for the benefits to those who were applying that given principle.

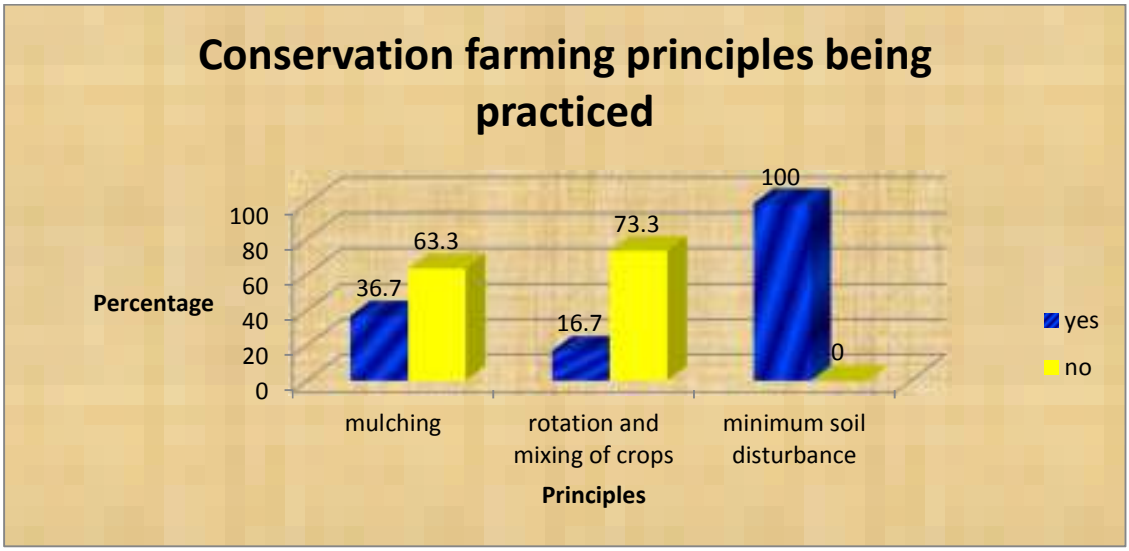

Fig 4.12: Conservation farming principles being practiced (Source: Primary data)

4.4.4.1 Mulching and minimum burning of crop residues principle

From Figure 4.12 it can be deduced that 36.7% of the sampled population were practicing the principle. Farmers noted that mulching is helping to reduce raindrop impact therefore erosion is reduced. The AREX officer noted that erosion is associated with the loss of topsoil hence reduced yields. Using the mulching principle consequences resulting from soil erosion are reduced therefore yields can be increased. Farmers also noted that mulching is helping to keep weeds down therefore this reduces competition for moisture and nutrients between plants and

weeds therefore there is successful establishment of plant growth therefore this will help to maximize yields.

From Figure 4.12 it can be noted that 63.3% of the farmers are not practicing the principle. From the focused group discussions, farmers pointed out different reasons for failing to apply the principle. Some noted that crop residues act as food to livestock after harvesting therefore crop residues are difficult to use for mulching. A research carried out by Mazvimavi et al (2012) in Zimbabwe indicated that during the 2008 to 2009 cropping season 40% of the interviewed farmers did not mulch and they pointed out that their fear was that mulch would be destroyed by animals and termites. The COMTEC officer noted that the benefits associated with mulching may take much longer time to be realized.

4.4.4.2 Mixing and crop rotation principle

From Figure 4.12, 73.3% of the households sampled were not practicing the crop rotation principle. The AREX officer highlighted that most farmers rely on maize since it is their staple food. From the focused group discussions farmers noted that shortage of groundnuts and legume seeds draws them back from practicing crop rotation However from the 16.7% who were practicing the principle noted that crop rotation and mixing of crops is ensuring diversity of diet which is helping to ensure nutrition to their households. The AREX officer noted that mixing crops with legumes provided cover therefore reduces erosion and ensuring better nutrients through nitrogen fixing. This shows that conservation farming is contributing to food security since an improved nutrition is a proxy indicator of food security.

4.4.4.3 Minimum soil disturbance principle

From Figure 4.12 it can be seen that all the farmers have adopted the main conservation farming principle which is minimum soil disturbance. The COMTEC official explained that the 100% uptake was due to the fact that basins were dug during the dry season and often in groups. Twomlow et al (2008) asserts that farmers tend to disassemble technology packages and adopt what they perceive as the most relevant components followed by additional components in time. Therefore the minimum soil disturbance principle has proved to be the most relevant component in conservation farming in order to increase food security. From the focused group discussions

the minimum soil disturbance is helping to reduce ploughing cost therefore farmers can maximize profits using hoes. The AREX officer noted that with minimum soil disturbance there is little compaction and erosion is also minimized. Therefore the principle is contributing to increase yields and ultimately this will improve food security.

However a critical analysis was made by the researcher given a 100% adoption rate of the minimum soil disturbance principle yet the farmers complain and associate the technology as a backbreaking programme. This is a misnomer due to the conflicting issues highlighted therefore sustainability of the programme after closure of the implementer's project is questionable. A research by Gukurume et al (2010) in Chivi district concluded that many households were simply pretending to fully embrace the strategy because they have seen certain incentives associated with engaging to NGOs.

4.5 Factors affecting the implementation of conservation farming

This section analyzed the factors that are affecting the implementation of conservation farming. Changes are going to be seen from the yearly percentage uptake of the technology since it was introduced in 2008 to 2009 farming seasons and explanations will be given.

4.5.1 Period when household started to implement conservation farming

The period when household started to implement conservation farming was important to analyze so as to make comparisons on whether farmers are increasing or decreasing on adoption of the technology.

Table 4.2 When household start to implement conservation farming

Farming season	Frequency	Percent
2008-2009	8	26.7
2009-2010	13	43.3
2010-2011	5	16.7
2011-2012	4	13.3
Total	30	100

Source: Primary data source

From Table 4.2 above it can be deduced that adoption of conservation farming increased at first that is from 26.7% up to 43.3% and after that it started to decline in the third farming season to 16.7% and in the 2011 to 2012 farming season the uptake declined to 13.3%. The COMTEC official explained on the trends whereby he explained that at first farmers were still new to the concept. However the adoption levels started to decline since farmers were complaining on the labour constraints associated with the technology and lack of knowledge on conservation farming principles.

4.5.2 Challenges faced in implementing the conservation farming technology

The implementation of conservation farming is influenced by different factors as shown from the diagram below.

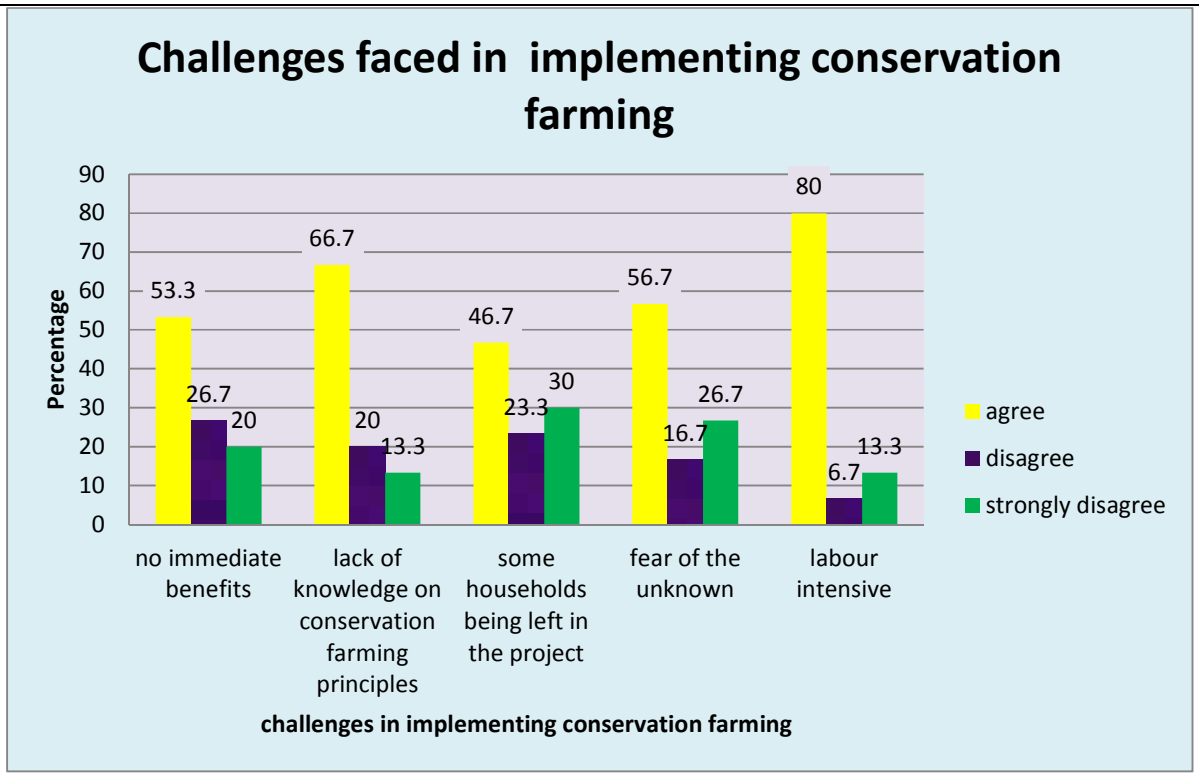

Figure 4.13: Challenges faced in implementing conservation farming (Source: Primary data)

From Figure 4.13 it can be depicted that from the sampled farmers 80% highlighted that the technology is labour intensive and families with small household size are unlikely to adopt the

technology. In the respondents profile households with a family size of 1 to 3 face constraints in adopting the technology. The labour intensity issue was observed whereby farmers were labeling the technology "dhiga ufe" meaning dig and die. Given such perceptions this has negative repercussions on some households to adopt the technology. The COMTEC official acknowledged that in the first years of adopting the technology it is strenuous since farmers have to invest a lot of labour in digging basins, searching for organic fertilizers, mulching and weeding but with time it saves labour. In the focused group discussions women viewed the technology as increasing their workload and from the respondents profile it can be noted that women are participating more than males in the conservation farming and constitute 56% of the adopters. Gukurume et al (2010) also compliments with the researcher's findings that most development projects instead of ameliorating poverty have increased women's workloads. The AREX officer concluded that considering the cost and benefit of such a labourious technology some farmers will resort to the conventional farming methods.

From Figure 4.13 about 66.7% of the farmers highlighted that lack of knowledge on conservation farming principles hinders some farmers fail to adopt the technology. The ward councilor noted that there is inadequate support from the government and NGOs covering majority of the people. In the focused group discussions the farmers noted that without adequate knowledge, conservation farming techniques are complex so without having such services this may hinder the adoption levels. This can be explained from the respondent's profile whereby 56.7% of the sampled population only attended primary education therefore given such a scenario without intervention the farmers face constraints in understanding the principles and benefits that result from conservation farming. The COMTEC official noted that lack of resources hinders them to cover majority of the farmers therefore this is negatively affecting the adoption level. The AREX officer argued that the number of extension visits by agriculture or field officers has a bearing on the adoption levels since the personnel will be exposing new information and explaining some concepts hence the farmers will take the risk of trying this technology but he indicated that lack of resources also hinders them to cover many areas.

From Figure 4.13 it can be noted that 56.7 % of the farmers noted that some households do not adopt the technology due to fear of the future. In the focused group discussions households noted that some farmers fear that if they use conservation farming and produce more on their farmland,

the chief might then take over the plot since majority of farmers do not own the land. Farmers who have adopted the technology noted that they opted for the technology as an experiment however there are some who fear that the technology may reduce their current food production. Therefore those farmers tend to be risk adverse and may avoid innovations in an attempt to avoid risk associated with the initiative.

From Figure 4.13 it can be deduced that 53.3% of the farmers noted that there were no immediate benefits associated with the technology. Farmers stated that the first year of conservation tilling of the permanent basins and the extensive weeding is a challenge yet production of crops does not increase greatly during the first year. The COMTEC official noted that establishing organic layer takes time to accumulate therefore farmers take five to seven years to fully attain maximum benefits from the technology. Therefore since farmers are irrational some will not be patient enough to adopt the technology.

From Figure 4.13 it can be seen that 46.7% of the sampled households noted that some farmers were left in the project thereby this hinder them from adopting the technology labeling it to be of specific farmers. These households started to practice conservation farming after being selected by NGOs. The COMTEC official noted that it was for them to be blamed since they targeted vulnerable groups as depicted from the demographic characteristics section. However the official noted that demonstration plots can be used and lead farmers can be used as they will be relating their experience to community members. A research by Musara et al (2012) in Madziva counter those perceptions whereby the researcher articulated that if some social groups are excluded at the early stages, it may hold back adoption by the wider community later. Therefore this has left a gap to other similar organizations who may want to apply the technology to other regions to incorporate all farmers since targeting has often excluded better resource endowed farmers, who could be better positioned to maximize on conservation agriculture practices to improve food security whilst preserving the environment.

From the focused group discussions and interview guides there are some factors which also affect adoption levels of conservation farming. The farmers noted that some households only adopt the technology due to incentives being offered by NGOs. For instance farmers were given loans to purchase inputs and in the field show laptops, scorch carts and ploughs were given to the

best farmers. The AREX officer noted that if those benefits were removed many households may resort to their traditional farming practice. The ward councilor referenced that many farmers who were being sponsored and given incentives by a certain NGO are no longer practicing the technology since the organization migrated to another ward.

4.5.3 Productive assets owned by households

Assets owned by households were essential to investigate since these help to determine poverty and wealth levels of the household.

Table 4.3 showing assets owned by households

Number of assets owned by household	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
% of cattle owned	63.3	6.7	10	10	6.7	-	3.3	-	-	-	-
% of donkeys owned	86.7	3.3	6.7	3.3	-	-	-	-	-	-	-
% of mould board ploughs owned	56.7	30	10	3.3	-	-	-	-	-	-	-
% of hoes owned	-	-	-	3.3	13.3	23.3	26.7	16.7	10	3.3	3.3

Source: Primary data source

From table 4.3 above it can be depicted that majority of the households do not own draught assets that are mainly used in conventional farming whereby 63.3% do not have cattle and 86.7% do not own donkeys and 56.7% do not own mould ploughs. However from the table above it can be seen that all the farmers sampled own more than three hoes. From the given statistics it can be

seen that majority of the farmers are poor therefore minimum soil tillage techniques can offer opportunities for farmers to improve their food security. A research carried out by ZIMVAC (2012) observed that about 70% of sampled farmers in Zimbabwe who had less than one draught power animal produced less than 200kgs of cereals whilst 41% of the households who had six or more animals produced more than 1000kgs.

In the focused group discussions women were complaining that there are some cultural practices that still harm women for example ownership rights whereby women are regarded as property therefore a property cannot own property The COMTEC official indicated that if women get more control over land, this will increase their control over their personal life and possibility to plan ahead and this may increase their adoption levels to the conservation technology. This was well supported by FAO (2007) which estimates that if women are given the same access to resources and opportunities as men yields on their farmers would increase by 20-30%. This increase in output improves food security by 12 to 17% reduction in hungry people.

4.6. Conclusion

The chapter presented data presentation, analysis and discussions on the sustainability of conservation farming to enhance food security. In particular demographic characteristics, food security levels of Ward 17, contributions made by conservation farming to enhance food security and factors affecting adoption levels of conservation farming were examined. The next chapter focused on the summary, conclusions and recommendations of the overall research findings.

CHAPTER FIVE: SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

This chapter gave a summary of the research findings, conclusions and recommendations were deduced from the research findings.

5.2 Summary

The study was aimed at assessing the sustainability of conservation farming in enhancing food security in Ward 17 of Mutoko District. The objectives were to identify the level of food security in Ward 17, to assess the contributions made by conservation farming to increase food security and to examine the level of adoption of conservation farming.

Literature review reflected that conservation farming is based on three principles and implementing these will enable farmers to attain maximum yields that will help to improve food security. Different authorities argue that farmers are irrational and there are mixed reasons that might result in some farmers failing to adopt the technology. Literature also showed that there are benefits that are associated with conservation farming for example reduced erosion, mixed diet and improvements in soil fertility hence all these factors help to increase food security.

The findings reviewed that the level of food security has improved in Ward 17. Before implementing conservation farming food was insecure and after the adoption of the technology improvements were seen for example as illustrated on figure 4.7. The number of meals taken by a family increased after implementing the technology as shown in figure 4.8.

The research also reviewed on the contributions being made by conservation farming to enhance food security. The findings indicate that maize yields improved after adopting the conservation farming technology as clearly shown on figure 4.9. However the research also observed that little improvements were depicted in the groundnuts, sugar beans and cowpeas harvest as shown in figure 4.10 and 4.11 respectively.

From the findings it can be noted that application of the conservation farming principles is helping to increase food security in the ward. Use of minimum soil disturbance is helping to

reduce ploughing cost therefore this helped to maximize profits. The mixing and rotation of crops is helping to improve household's diet. The mulching principle is helping to reduce soil erosion therefore improvement in land quality and fertility which will enable better yields to be attained. However there are challenges emanating from application of these principles which has resulted in some farmers failing to enjoy full conservation farming benefits. Farmers complained that the minimum soil disturbance principle is labour intensive. The mulching principle is difficult to apply since residues act as food stoves for animals. In the crop rotation principle failure to acquire adequate seeds has drawn back farmers in implementing the strategy. Therefore this has left a gap which needs to be filled by further studies on improving the applicability of these principles so that farmers can fully benefit from the conservation farming technology.

There is a mixture of factors affecting the adoption levels of conservation farming technology. From table 4.2 it can be seen that the adoption levels at first were increasing but the trend seems to be declining in time. Majority of the farmers complained that the technology is backbreaking project since farmers have to invest in labour, digging basins, weeding and looking for manure is strenuous. Some households noted that the targeting being done by NGOs has left some households who want to adopt the conservation farming technology. From the findings it was noted that inadequate extension service has resulted in the adoption levels to be low.

5.3 Conclusions

The research was a case study research design on the contributions being made by conservation farming to enhance food security. From the findings it can be concluded that conservation farming has a positive impact on increasing food security levels despite the fact that some empirical studies showed that it is ineffective. From the findings it can be deduced that conservation farming is not a magic bullet to food security but is offering a platform to reduce insecurity challenges.

From the findings it can be concluded that conservation farming is contributing to increase food security in the Ward. This can be deduced from improvements in crop yields, number of meals eaten by households per day and surpluses attained.

From the research findings it can be concluded that the conservation farming technology faced adoption challenges emanating from labour intensive of the technique, limited benefits associated with the technology in the short run, weak targeting criteria by implementers, fear of uncertainties and risk associated with new technologies to farmers.

5.4 Recommendations

The researcher makes some recommendations on improving the sustainability of conservation farming so that it can fully enhance food security. These recommendations need to be taken into consideration to enable the goals of conservation farming to be realized that of increasing productivity whilst conserving the environment.

- There is need for conservation farming designers to improve on alternatives of the hoe system since farmers were complaining on labour intensiveness of the technology. Therefore use of improved alternatives will enable the technology to work for all members for example use of rippers. This better equipment should be also affordable to all farmers.
- It is important to strengthen the role of AGRITEX to implement and promote improved cropping technologies to farmers. NGO promotions of conservation agriculture are not permanent; therefore, this practice can only be sustained through involvement of the national extension service. Institutionalization of the technology promotions through AGRITEX will significantly contribute to sustained conservation agriculture adoption.
- The government should design strategies that link farmers to input markets such as agro-dealers and distributing relief inputs through local retail outlets is likely to play an important role in sustained conservation farming gains. This will include the use of vouchers to purchase seed and fertilizers that are generally a challenge to enable all farmers to grow diversified crops.
- Farmers need to be well organized into groups and followed closely by extension workers so as to assist in some of the principles that are technical in nature.
- Extension officers and field officers need to disseminate exact information relating to challenges during the first years of the conservation farming since this is important in reducing the drop-out rate.

- The government needs to address challenges that are emanating from access to land ownership especially to females so as to increase sustainable production of crops emanating from this group.
- There is need to promote winter cropping which would necessarily be supported by irrigation systems to reduce transitory hunger which is experienced from November to February. Introduction of irrigation could also offset the low precipitation and short growing season, which have restricted farming to the wet season therefore this would enable all-year round conservation farming crop production therefore this will increase food security.
- In the selection criteria done by NGOs it is important to include both resource endowed and vulnerable households in the promotion of conservation farming. Targeting vulnerable farmers has excluded some farmers therefore such exclusion has limited the technology transfer to diverse resource groups within the communities.
- NGOs implementing the conservation farming to various communities need to be patient since adoption requires understanding and careful explanations to convince farmers to adapt to this alien farming method therefore they should increase their time frame in implementing the strategy.

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APPENDIX 1
Questionnaire No…….

Household Questionnaire
My name is Blessing Kakunguwo a fourth year Development Studies student at Bindura University of Science Education. I am researching on the sustainability of conservation farming as a strategy to enhance food security in ward 17, Mutoko district. The information given will be treated as confidential and it is specifically going to be used for academic purposes only.

Tick or write in the appropriate box or spaces below where applicable

Section A RESPONDENTS PROFILE

1. **Sex** Male ☐ Female ☐

2. **Age group** under 20 years ☐ 21-30 years ☐ 31-40years ☐ above 40 years ☐

3. **Marital status** Single ☐ Married ☐ Divorced ☐ Widowed ☐

4. **Level of education** Primary ☐ Secondary ☐ Tertiary ☐

5. **Household size** 1-3 ☐ 4-6 ☐ 7-9 ☐ above 10 ☐

SECTION B: FOOD SECURITY INDICATORS

6. Before adopting conservation farming what was the state of your food security?

Inadequate ☐ Surplus ☐ Only for home use ☐

7. Are there any improvements on food security as a result of conservation farming in this Ward?
Yes ☐ No ☐ Neutral ☐

8. Are there any surpluses from previous harvests? Yes ☐ No ☐

9. How many meals did you eat per day before adopting conservation farming?

☐ ☐

Once a day ☐ twice per day thrice per day

10. Considering the adoption of conservation farming how many meals can now be offered per day? One per day ☐ two per day ☐ thrice per day ☐

SECTION C CONSERVATION FARMING AND FOOD SECURITY

11. Before adopting conservation farming how much did you harvest in the following crops?

a) ***maize*** Less than 400kgs ☐ 401kgs-800kgs ☐ 801kgs-1200kg ☐ above 1200kgs ☐

b) ***Groundnuts*** Less than 200kgs ☐ 201-400kgs ☐ Above 400kgs ☐

c) ***Cowpeas/sugar beans*** Less than100kgs ☐ 101-200kgs ☐ Above 200kgs ☐

12. How much have you harvested in the 2011-2012 agricultural season using the conservation farming technology:

a) ***maize*** Less than 400kgs ☐ 401kgs-800kgs ☐ 801kgs-1200kgs ☐ Above 1200kgs ☐

b) ***Groundnuts*** Less than 200kgs ☐ 201-400kgs ☐ Above 400kgs ☐

c) ***Cowpeas/ sugar beans*** Less than 100kgs ☐ 101-200kgs ☐ Above 200kgs ☐

13. What conservation principles have you practiced?

Principle	**Yes**	**No**
Minimum soil disturbance		
Mulching and minimum burning of crop residues		
Mixing and rotation of crops		

14. What changes have you noted after applying these principles?

Minimum soil disturbance

……

……..

Mulching and minimum burning of crop residues

……

……..

Mixing and rotation of crops

……

……...

15. What other benefits have you noted that are a result of conservation farming.

……

……

SECTION D CHALLENGES FACED IN IMPLEMENTING CONSERVATION FARMING AND RECOMMENDATIONS

16. When did you start implementing conservation farming?

2008-2009 season ☐ 2009-2010season ☐

2010-2011season ☐ 2011-2012season ☐

17. What issues are affecting some households fail to adopt the conservation farming technology?

Issue	**Agree**	**Disagree**	**Strongly disagree**
No immediate benefits			
Lack of knowledge on conservation principles			
Some households were left by NGOs			
Fear of the unknown			
Labour intensive			

18. What other factors affect some households fail to adopt the conservation farming strategy.

……

……

……

19. How many of the following productive assets does the household own or keep in working conditions.

Asset	**Total**
Cattle	
Donkeys	
Hoes	
Ox-drawn plough	

20. What do you think can be done to improve adoption of conservation farming to enhance food security?

……

……

……

APPENDIX 2

Interview guide for ward councilor

My name is Blessing Kakunguwo a fourth year Development Studies student at Bindura University of Science Education. I am researching on the sustainability of conservation farming as a strategy to enhance food security in ward 17, Mutoko district. The information given will be treated as confidential and it is specifically going to be used for academic purposes only. Councilor

Your responses and cooperation are greatly appreciated.

1. What was the state of food security in the Ward before the adoption of conservation farming?
2. Does conservation farming have any impact in the improving the state of food security in the Ward, if so to what extent?
3. Considering the current state of food security in the Ward would you recommend the persistence use of conservation farming in your ward?
4. What challenges are being faced in adopting conservation farming strategy?
5. What can be done to improve sustainability of conservation farming to food security?

APPENDIX 3

Interview schedule for nongovernmental organizations

My name is Blessing Kakunguwo a fourth year Development Studies student at Bindura University of Science Education. I am researching on the sustainability of conservation farming as a strategy to enhance food security in ward 17, Mutoko district. The information given will be treated as confidential and it is specifically going to be used for academic purposes only.

Your responses and cooperation are greatly appreciated.

1. Name of NGO.

2. When did you start to implement conservation farming in ward 17?

3. What is the total number of households that have adopted the strategy in the Ward?

4. What type of assistance do you provide to the households implementing conservation farming strategy?

5. In your opinion what factors are affecting the adoption of conservation farming?

6. Considering the state of food security do you think conservation farming has an impact in ward 17 and why?

7. What challenges are you facing in implementing the strategy in this Ward?

8. What do you think are possible solutions to challenges above?

APPENDIX 4

Interview guide to the Arex officer

My name is Blessing Kakunguwo a fourth year Development Studies student at Bindura University of Science Education. I am researching on the sustainability of conservation farming as a strategy to enhance food security in ward 17, Mutoko district. The information given will be treated as confidential and it is specifically going to be used for academic purposes only.

Your responses and cooperation are greatly appreciated.

1. When did you start to promote conservation farming in Ward 17?

2. Before the introduction of conservation farming what was the state of food security in the Ward?

3. What change have you recorded concerning crop yield as triggered by the adoption of conservation farming every year?

4. Does the conservation farming strategy suit the area?

5. What problems are being faced by your farmers in adopting conservation farming?

6. What do you think could be done to enhance food security through conservation farming in the Ward?

APPENDIX 5

Focused group discussions

My name is Blessing Kakunguwo, l am a student doing HBSc in Development studies at Bindura University of Science Education. The student is carrying a research on the sustainability of conservation farming to enhance food security in Ward 17 of Mutoko District and it is specifically for academic purposes. I would like to discuss a few questions with you; your opinions and feelings are very valuable and shall help the planners in the future. Your responses will remain confidential and no references will be made to your name if the findings of this work are published. You may refuse to discuss any question you are not comfortable with. Nevertheless, open discussion and sincere responses to the questions is greatly appreciated.

Questions

1. Are we aware of the conservation farming technique? If yes, can you briefly describe its principles and its advantages?
2. Before the adoption of conservation farming what was the level of food security in the area?
3. Comparing conservation farming with conventional farming, which between the two is sustainable to your area and why?
4. Identify the major challenges associated with conservation farming technique?
5. What can be done to address these challenges?

Thank you.

APPENDIX 6

Observation guide

1. What is the state of the environment due to conservation farming?
2. What are the challenges being faced in implanting conservation farming?
3. What is the state o food security in war 17?